此文件在2026年 2月 06日收到。城市規劃委員會只會在收到所有必要的資料及文件後才正式確認收到申請的日期。

This document is received on - 6 FEB 2026. The Town Planning Board will formally acknowledge the date of receipt of the application only upon receipt of all the required information and documents.

Form No. S16-I
表格第 S16-I 號

APPLICATION FOR PERMISSION
UNDER SECTION 16 OF
THE TOWN PLANNING ORDINANCE
(CAP. 131)

根據《城市規劃條例》(第131章)
第16條遞交的許可申請

Applicable to proposals not involving or not only involving:
適用於建議不涉及或不祇涉及:

(i) Construction of "New Territories Exempted House(s)";
興建「新界豁免管制屋宇」;

(ii) Temporary use/development of land and/or building not exceeding 3 years in rural areas or Regulated Areas; and
位於鄉郊地區或受規管地區土地上及/或建築物內進行為期不超過三年的臨時用途/發展;及

(iii) Renewal of permission for temporary use or development in rural areas or Regulated Areas
位於鄉郊地區或受規管地區的臨時用途或發展的許可續期

Applicant who would like to publish the notice of application in local newspapers to meet one of the Town Planning Board's requirements of taking reasonable steps to obtain consent of or give notification to the current land owner, please refer to the following link regarding publishing the notice in the designated newspapers: https://www.tpb.gov.hk/en/plan_application/apply.html

申請人如欲在本地報章刊登申請通知,以採取城市規劃委員會就取得現行土地擁有人的同意或通知現行土地擁有人所指定的其中一項合理步驟,請瀏覽以下網址有關在指定的報章刊登通知:https://www.tpb.gov.hk/tc/plan_application/apply.html

General Note and Annotation for the Form
填寫表格的一般指引及註解

# "Current land owner" means any person whose name is registered in the Land Registry as that of an owner of the land to which the application relates, as at 6 weeks before the application is made
「現行土地擁有人」指在提出申請前六星期,其姓名或名稱已在土地註冊處註冊為該申請所關乎的土地的擁有人的人

& Please attach documentary proof 請夾附證明文件

^ Please insert number where appropriate 請在適當地方註明編號

Please fill "NA" for inapplicable item 請在不適用的項目填寫「不適用」

Please use separate sheets if the space provided is insufficient 如所提供的空間不足,請另頁說明

Please insert a「✔」at the appropriate box 請在適當的方格內上加上「✔」號

2600317 4/2 By hand

Form No. S16-I 表格第 S16-I 號

For Official Use Only 請 勿 填 寫 此 欄	Application No. 申請編號	A/TKO/134
	Date Received 收到日期	- 6 FEB 2026

1. The completed form and supporting documents (if any) should be sent to the Secretary, Town Planning Board (the Board), 15/F, North Point Government Offices, 333 Java Road, North Point, Hong Kong.
申請人須把填妥的申請表格及其他支持申請的文件 (倘有)，送交香港北角渣華道 333 號北角政府合署 15 樓城市規劃委員會(下稱「委員會」)秘書收。

2. Please read the "Guidance Notes" carefully before you fill in this form. The document can be downloaded from the Board's website at http://www.tpb.gov.hk/. It can also be obtained from the Secretariat of the Board at 15/F, North Point Government Offices, 333 Java Road, North Point, Hong Kong (Tel: 2231 4810 or 2231 4835), and the Planning Enquiry Counters of the Planning Department (Hotline: 2231 5000) (17/F, North Point Government Offices, 333 Java Road, North Point, Hong Kong and 14/F, Sha Tin Government Offices, 1 Sheung Wo Che Road, Sha Tin, New Territories).
請先細閱《申請須知》的資料單張，然後填寫此表格。該份文件可從委員會的網頁下載 (網址：http://www.tpb.gov.hk/)，亦可向委員會秘書處 (香港北角渣華道 333 號北角政府合署 15 樓 – 電話：2231 4810 或 2231 4835)及規劃署的規劃資料查詢處(熱線：2231 5000) (香港北角渣華道 333 號北角政府合署 17 樓及新界沙田上禾輋路 1 號沙田政府合署 14 樓)索取。

3. This form can be downloaded from the Board's website, and obtained from the Secretariat of the Board and the Planning Enquiry Counters of the Planning Department. The form should be typed or completed in block letters. The processing of the application may be refused if the required information or the required copies are incomplete.
此表格可從委員會的網頁下載，亦可向委員會秘書處及規劃署的規劃資料查詢處索取。申請人須以打印方式或以正楷填寫表格。如果申請人所提交的資料或文件副本不齊全，委員會可拒絕處理有關申請。

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1. Name of Applicant 申請人姓名/名稱

(□ Mr. 先生 / □ Mrs. 夫人 / □ Miss 小姐 / □ Ms. 女士 / ☑ Company 公司 / □ Organisation 機構)

HKJC Public Riding Schools Limited

2. Name of Authorised Agent (if applicable) 獲授權代理人姓名/名稱（如適用）

(□ Mr. 先生 / □ Mrs. 夫人 / □ Miss 小姐 / □ Ms. 女士 / ☑ Company 公司 / □ Organisation 機構)

Townland Consultants Limited

3. Application Site 申請地點

(a) Full address / location / demarcation district and lot number (if applicable) 詳細地址／地點／丈量約份及地段號碼（如適用）	Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories (GLA-TSK 500 (part))
(b) Site area and/or gross floor area involved 涉及的地盤面積及／或總樓面面積	☑ Site area 地盤面積 46,500 (consisting areas of the three platforms with ancillary facilities) sq.m 平方米 ☑ About 約 ☑ Gross floor area 總樓面面積 Total: 9,000 sq.m 平方米 ☑ About 約
(c) Area of Government land included (if any) 所包括的政府土地面積（倘有）	46,500 sq.m 平方米 ☑ About 約

*Domestic GFA for Ancillary Coach Duty Room for the coach staying on shift

(d) Name and number of the related statutory plan(s) 有關法定圖則的名稱及編號	Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32
(e) Land use zone(s) involved 涉及的土地用途地帶	"Open Space", "Green Belt" and "Other Specified Uses" annotated "Industrial Estate"
(f) Current use(s) 現時用途	Restored Landfill Site (If there are any Government, institution or community facilities, please illustrate on plan and specify the use and gross floor area) (如有任何政府、機構或社區設施，請在圖則上顯示，並註明用途及總樓面面積)

4. "Current Land Owner" of Application Site 申請地點的「現行土地擁有人」

The applicant 申請人 –

□ is the sole "current land owner"#& (please proceed to Part 6 and attach documentary proof of ownership).
是唯一的「現行土地擁有人」#& (請繼續填寫第 6 部分，並夾附業權證明文件)。

□ is one of the "current land owners"# & (please attach documentary proof of ownership).
是其中一名「現行土地擁有人」#& (請夾附業權證明文件)。

□ is not a "current land owner"#.
並不是「現行土地擁有人」#。

☑ The application site is entirely on Government land (please proceed to Part 6).
申請地點完全位於政府土地上（請繼續填寫第 6 部分）。

5. Statement on Owner's Consent/Notification
就土地擁有人的同意/通知土地擁有人的陳述

(a) According to the record(s) of the Land Registry as at .... (DD/MM/YYYY), this application involves a total of .... "current land owner(s) "#.
根據土地註冊處截至 .... 年 .... 月 .... 日的記錄，這宗申請共牽涉 .... 名「現行土地擁有人」#。

(b) The applicant 申請人 – N/A

□ has obtained consent(s) of .... "current land owner(s)"#.
已取得 .... 名「現行土地擁有人」#的同意。

Details of consent of "current land owner(s)"# obtained 取得「現行土地擁有人」#同意的詳情		
No. of 'Current Land Owner(s)' 「現行土地擁有人」數目	Lot number/address of premises as shown in the record of the Land Registry where consent(s) has/have been obtained 根據土地註冊處記錄已獲得同意的地段號碼/處所地址	Date of consent obtained (DD/MM/YYYY) 取得同意的日期 (日/月/年)

(Please use separate sheets if the space of any box above is insufficient. 如上列任何方格的空間不足，請另頁說明)

□ has notified .... "current land owner(s)"#
已通知 .... 名「現行土地擁有人」#。

Details of the "current land owner(s)"# notified 已獲通知「現行土地擁有人」#的詳細資料		
No. of 'Current Land Owner(s)' 「現行土地擁有人」數目	Lot number/address of premises as shown in the record of the Land Registry where notification(s) has/have been given 根據土地註冊處記錄已發出通知的地段號碼／處所地址	Date of notification given (DD/MM/YYYY) 通知日期(日/月/年)
	N/A	

(Please use separate sheets if the space of any box above is insufficient. 如上列任何方格的空間不足，請另頁說明)

□ has taken reasonable steps to obtain consent of or give notification to owner(s):
已採取合理步驟以取得土地擁有人的同意或向該人發給通知。詳情如下：

Reasonable Steps to Obtain Consent of Owner(s) 取得土地擁有人的同意所採取的合理步驟

□ sent request for consent to the "current land owner(s)" on __________________ (DD/MM/YYYY)#&
於__________________(日/月/年)向每一名「現行土地擁有人」#郵遞要求同意書&

Reasonable Steps to Give Notification to Owner(s) 向土地擁有人發出通知所採取的合理步驟

□ published notices in local newspapers on __________________ (DD/MM/YYYY)&
於__________________(日/月/年)在指定報章就申請刊登一次通知&

□ posted notice in a prominent position on or near application site/premises on __________________ (DD/MM/YYYY)&
於__________________(日/月/年)在申請地點／申請處所或附近的顯明位置貼出關於該申請的通知&

□ sent notice to relevant owners' corporation(s)/owners' committee(s)/mutual aid committee(s)/management office(s) or rural committee on __________________ (DD/MM/YYYY)&
於__________________(日/月/年)把通知寄往相關的業主立案法團/業主委員會/互助委員會或管理處，或有關的鄉事委員會&

Others 其他

□ others (please specify)
其他（請指明）

Note: May insert more than one「✔」.
Information should be provided on the basis of each and every lot (if applicable) and premises (if any) in respect of the application.

註: 可在多於一個方格內加上「✔」號
申請人須就申請涉及的每一地段（倘適用）及處所（倘有）分別提供資料

6. Type(s) of Application 申請類別

□ Type (i) 第(i)類 Change of use within existing building or part thereof 更改現有建築物或其部分內的用途

□ Type (ii) 第(ii)類 Diversion of stream / excavation of land / filling of land / filling of pond as required under Notes of Statutory Plan(s) 根據法定圖則《註釋》內所要求的河道改道／挖土／填土／填塘工程

□ Type (iii) 第(iii)類 Public utility installation / Utility installation for private project 公用事業設施裝置/私人發展計劃的公用設施裝置

□ Type (iv) 第(iv)類 Minor relaxation of stated development restriction(s) as provided under Notes of Statutory Plan(s) 略為放寬於法定圖則《註釋》內列明的發展限制

☑ Type (v) 第(v)類 Use / development other than (i) to (iii) above 上述的(i)至(iii)項以外的用途／發展

Note 1: May insert more than one「✓」.
註 1： 可在多於一個方格內加上「✓」號
Note 2: For Development involving columbarium use, please complete the table in the Appendix.
註 2： 如發展涉及靈灰安置所用途，請填妥於附件的表格。

(i) For Type (i) application 供第(i)類申請

(a) Total floor area involved 涉及的總樓面面積	sq.m 平方米		
(b) Proposed use(s)/development 擬議用途/發展	N/A (If there are any Government, institution or community facilities, please illustrate on plan and specify the use and gross floor area) (如有任何政府、機構或社區設施，請在圖則上顯示，並註明用途及總樓面面積)		
(c) Number of storeys involved 涉及層數		Number of units involved 涉及單位數目	
(d) Proposed floor area 擬議樓面面積	Domestic part 住用部分 .... sq.m 平方米 □About 約		
	Non-domestic part 非住用部分.................... sq.m 平方米 □About 約		
	Total 總計 .... sq.m 平方米 □About 約		

(e) Proposed uses of different floors (if applicable) 不同樓層的擬議用途(如適用) (Please use separate sheets if the space provided is insufficient) (如所提供的空間不足，請另頁說明)	Floor(s) 樓層	Current use(s) 現時用途	Proposed use(s) 擬議用途

(ii) For Type (ii) application 供第(ii)類申請

(a) Operation involved 涉及工程	□ Diversion of stream 河道改道 □ Filling of pond 填塘 Area of filling 填塘面積 .... sq.m 平方米 □About 約 Depth of filling 填塘深度 .... m 米 □About 約 □ Filling of land 填土 Area of filling 填土面積 .... sq.m 平方米 □About 約 Depth of filling 填土厚度 .... m 米 □About 約 □ Excavation of land 挖土 Area of excavation 挖土面積 .... sq.m 平方米 □About 約 Depth of excavation 挖土深度 .... m 米 □About 約 (Please indicate on site plan the boundary of concerned land/pond(s), and particulars of stream diversion, the extent of filling of land/pond(s) and/or excavation of land) (請用圖則顯示有關土地／池塘界線，以及河道改道、填塘、填土及／或挖土的細節及/或範圍))
(b) Intended use/development 有意進行的用途／發展	N/A

(iii) For Type (iii) application 供第(iii)類申請

(a) Nature and scale 性質及規模

□ Public utility installation 公用事業設施裝置

□ Utility installation for private project 私人發展計劃的公用設施裝置

Please specify the type and number of utility to be provided as well as the dimensions of each building/structure, where appropriate
請註明有關裝置的性質及數量，包括每座建築物/構築物(倘有)的長度、高度和闊度

Name/type of installation 裝置名稱／種類	Number of provision 數量	Dimension of each installation /building/structure (m) (LxWxH) 每個裝置／建築物／構築物的尺寸 (米) (長 x 闊 x 高)

(Please illustrate on plan the layout of the installation 請用圖則顯示裝置的布局)

(iv) For Type (iv) application 供第(iv)類申請

(a) Please specify the proposed minor relaxation of stated development restriction(s) and **also fill in the proposed use/development and development particulars in part (v) below** –
請列明擬議略為放寬的發展限制**並填妥於第(v)部分的擬議用途/發展及發展細節** –

N/A

□	Plot ratio restriction 地積比率限制	From 由 ………………… to 至 …………………
□	Gross floor area restriction 總樓面面積限制	From 由 …………sq. m 平方米 to 至 …………sq. m 平方米
□	Site coverage restriction 上蓋面積限制	From 由 ……………..% to 至 ………………… %
□	Building height restriction 建築物高度限制	From 由 ………………m 米 to 至 ………………… m 米 From 由 ……………… mPD 米 (主水平基準上) to 至 ………………mPD 米 (主水平基準上) From 由 ……………… storeys 層 to 至 ……………… storeys 層
□	Non-building area restriction 非建築用地限制	From 由 ………………m to 至 …………………m
□	Others (please specify) 其他（請註明）	………………………………………………

(v) For Type (v) application 供第(v)類申請

(a) Proposed use(s)/development 擬議用途/發展	Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities (Please illustrate the details of the proposal on a layout plan 請用平面圖說明建議詳情)

(b) Development Schedule 發展細節表

Proposed gross floor area (GFA) 擬議總樓面面積	9,000 sq.m 平方米	☑About 約
Proposed plot ratio 擬議地積比率	N/A	□About 約
Proposed site coverage 擬議上蓋面積	20.9%	☑About 約
Proposed no. of blocks 擬議座數	17	
Proposed no. of storeys of each block 每座建築物的擬議層數	1 storeys 層 □ include 包括……storeys of ~~basements 層地庫~~ ~~□ exclude 不包括~~……storeys of basements 層地庫	
Proposed building height of each block 每座建築物的擬議高度	Lower Platform About 11.5 to 18.5 mPD(主水平基準上) About 4.8m to 7.0m米 Middle Platform About 46.3 to 48.2 mPD(主水平基準上) About 6.0m to 7.7 m米 Upper Platform About 144.8 to 148.1 mPD(主水平基準上) About 5.0m to 7.7 m米	

Part 6 (Cont'd) 第 6 部分 (續)

☑ Domestic part 住用部分

GFA 總樓面面積 ....200*.............. sq. m 平方米 ☑About 約

number of Units 單位數目 ~~..........................~~

average unit size 單位平均面積 ~~.....................sq. m 平方米~~ □About 約

estimated number of residents 估計住客數目 ....

*Coach Duty Room for the coach staying on shifts only

☑ Non-domestic part 非住用部分 GFA 總樓面面積

□ eating place 食肆 .... sq. m 平方米 □About 約

□ hotel 酒店 .... sq. m 平方米 □About 約

(please specify the number of rooms 請註明房間數目) ....

□ office 辦公室 .... sq. m 平方米 □About 約

□ shop and services 商店及服務行業 .... sq. m 平方米 □About 約

□ Government, institution or community facilities 政府、機構或社區設施

(please specify the use(s) and concerned land area(s)/GFA(s) 請註明用途及有關的地面面積／總樓面面積)

....

....

....

☑ other(s) 其他

(please specify the use(s) and concerned land area(s)/GFA(s) 請註明用途及有關的地面面積／總樓面面積)

Public Riding School with ancillary facilities:..........

Approx. 8,800 sq.m.....................................

....

□ Open space 休憩用地 (please specify land area(s) 請註明地面面積)

□ private open space 私人休憩用地 .... sq. m 平方米 □ Not less than 不少於

□ public open space 公眾休憩用地 .... sq. m 平方米 □ Not less than 不少於

(c) Use(s) of different floors (if applicable) 各樓層的用途 (如適用)

[Block number] [座數]	[Floor(s)] [層數]	[Proposed use(s)] [擬議用途]

Please refer to Table 4.1 of the Supplementary Planning Statement

(d) Proposed use(s) of uncovered area (if any) 露天地方（倘有）的擬議用途

Lower Platform: ancillary parking, Pony Viewing Area, ancillary E&M

Middle Platform: Arena, Wash Box, Lungeing Pen, Horse Walker, Spelling Yard, ancillary Parking, ancillary E&M

Upper Platform: Arenas, Wash Box, Lungeing Pen, Horse Walker, Spelling Yard, ancillary parking, ancillary E&M

Ancillary Utility Trench

....

7. Anticipated Completion Time of the Development Proposal
擬議發展計劃的預計完成時間

Anticipated completion time (in month and year) of the development proposal (by phase (if any)) (e.g. June 2023)
擬議發展計劃預期完成的年份及月份 (分期 (倘有)) (例：2023 年 6 月)
(Separate anticipated completion times (in month and year) should be provided for the proposed public open space and Government, institution or community facilities (if any))
(申請人須就擬議的公眾休憩用地及政府、機構或社區設施 (倘有) 提供個別擬議完成的年份及月份)

2030

8. Vehicular Access Arrangement of the Development Proposal
擬議發展計劃的行車通道安排

Any vehicular access to the site/subject building? 是否有車路通往地盤／有關建築物？	Yes 是	☑ There is an existing access. (please indicate the street name, where appropriate) 有一條現有車路。(請註明車路名稱(如適用)) Junction of Chun Yat Street and Chun Sing Street; Existing Access Road within TKOL II/III ☐ There is a proposed access. (please illustrate on plan and specify the width) 有一條擬議車路。（請在圖則顯示，並註明車路的闊度）
	No 否	☐
Any provision of parking space for the proposed use(s)? 是否有為擬議用途提供停車位？	Yes 是	☑ (Please specify type(s) and number(s) and illustrate on plan) 請註明種類及數目並於圖則上顯示) Private Car Parking Spaces 私家車車位 58 Motorcycle Parking Spaces 電單車車位 4 Light Goods Vehicle Parking Spaces 輕型貨車泊車位 Medium Goods Vehicle Parking Spaces 中型貨車泊車位 Heavy Goods Vehicle Parking Spaces 重型貨車泊車位 Others (Please Specify) 其他 (請列明) Accessible Car Parking Space; Golf Cart Parking Space 8; 14 Coach Parking Space; Shuttle Parking Space 2; 3
	No 否	☐ *Please refer to Appendix 3 Traffic Impact Assessment of the Supplementary Planning Statement for the plans.
Any provision of loading/unloading space for the proposed use(s)? 是否有為擬議用途提供上落客貨車位？	Yes 是	☑ (Please specify type(s) and number(s) and illustrate on plan) 請註明種類及數目並於圖則上顯示) Taxi Spaces 的士車位 Coach Spaces 旅遊巴車位 Light Goods Vehicle Spaces 輕型貨車車位 Medium Goods Vehicle Spaces 中型貨車車位 Heavy Goods Vehicle Spaces 重型貨車車位 Others (Please Specify) 其他 (請列明) L/UL space for for operational need for horse 2 L/UL space for hay/beddings delivery 2 L/UL space for For Refuse Collection Vehicle 2 General Lay-by 1
	No 否	☐ *Please refer to Appendix 3 Traffic Impact Assessment of the Supplementary Planning Statement for the plans.

9. Impacts of Development Proposal 擬議發展計劃的影響

If necessary, please use separate sheets to indicate the proposed measures to minimise possible adverse impacts or give justifications/reasons for not providing such measures.
如需要的話，請另頁註明可盡量減少可能出現不良影響的措施，否則請提供理據/理由。

Does the development proposal involve alteration of existing building? 擬議發展計劃是否包括現有建築物的改動?	Yes 是	☐ Please provide details 請提供詳情 …………………………………… …………………………………… …………………………………… …………………………………… ……………………………………
	No 否	☑
Does the development proposal involve the operation on the right? 擬議發展是否涉及右列的工程? (Note: where Type (ii) application is the subject of application, please skip this section. 註: 如申請涉及第(ii)類申請，請跳至下一條問題。)	Yes 是	☑ (Please indicate on site plan the boundary of concerned land/pond(s), and particulars of stream diversion, the extent of filling of land/pond(s) and/or excavation of land) (請用地盤平面圖顯示有關土地／池塘界線，以及河道改道、填塘、填土及／或挖土的細節及/或範圍) ☐ Diversion of stream 河道改道 ☐ Filling of pond 填塘 Area of filling 填塘面積 ……………… sq.m 平方米 ☐About 約 Depth of filling 填塘深度 ……………… m 米 ☐About 約 ☑ Filling of land 填土 Area of filling 填土面積 ..5,300........ sq.m 平方米 ☑About 約 Depth of filling 填土厚度 ....1........... m 米 ☑About 約 ☑ Excavation of land 挖土 Area of excavation 挖土面積..27,400..... sq.m 平方米 ☑About 約 Depth of excavation 挖土深度 ....0.5..........m 米 ☑About 約
	No 否	☐ *Areas and Depth of Filling and Excavation of Land is indicative only and is subject to detail design.
Would the development proposal cause any adverse impacts? 擬議發展計劃會否造成不良影響？	On environment 對環境	Yes 會 ☐ No 不會 ☑
	On traffic 對交通	Yes 會 ☐ No 不會 ☑
	On water supply 對供水	Yes 會 ☐ No 不會 ☑
	On drainage 對排水	Yes 會 ☐ No 不會 ☑
	On slopes 對斜坡	Yes 會 ☐ No 不會 ☑
	Affected by slopes 受斜坡影響	Yes 會 ☑ No 不會 ☐
	Landscape Impact 構成景觀影響	Yes 會 ☐ No 不會 ☑
	Tree Felling 砍伐樹木	Yes 會 ☑ No 不會 ☐
	Visual Impact 構成視覺影響	Yes 會 ☐ No 不會 ☑
	Others (Please Specify) 其他 (請列明) Traffic, Sewerage	Yes 會 ☐ No 不會 ☑
	Please state measure(s) to minimise the impact(s). For tree felling, please state the number, diameter at breast height and species of the affected trees (if possible) 請註明盡量減少影響的措施。如涉及砍伐樹木，請說明受影響樹木的數目、及胸高度的樹幹直徑及品種(倘可) Please refer to the Supplementary Planning Statement.	

10. Justifications 理由

The applicant is invited to provide justifications in support of the application. Use separate sheets if necessary.
現請申請人提供申請理由及支持其申請的資料。如有需要，請另頁說明。

Please refer to the Supplementary Planning Statement.

11. Declaration 聲明

I hereby declare that the particulars given in this application are correct and true to the best of my knowledge and belief.
本人謹此聲明，本人就這宗申請提交的資料，據本人所知及所信，均屬真實無誤。

I hereby grant a permission to the Board to copy all the materials submitted in this application and/or to upload such materials to the Board's website for browsing and downloading by the public free-of-charge at the Board's discretion. 本人現准許委員會酌情將本人就此申請所提交的所有資料複製及/或上載至委員會網站，供公眾免費瀏覽或下載。

Signature 簽署 ………………………………………… □ Applicant 申請人 / ☑ Authorised Agent 獲授權代理人

LAU, VINCENT CHI KING ………………………………………… Director ……………………………………………

Name in Block Letters 姓名（請以正楷填寫） Position (if applicable) 職位 （如適用）

Professional Qualification(s) 專業資格 ☑ Member 會員 / □ Fellow of 資深會員
☑ HKIP 香港規劃師學會 / □ HKIA 香港建築師學會 /
□ HKIS 香港測量師學會 / □ HKIE 香港工程師學會 /
□ HKILA 香港園境師學會/ □ HKIUD 香港城市設計學會
☑ RPP 註冊專業規劃師 (RPP No. 378)
Others 其他 ….MRTPI…………………………………………………………

on behalf of 代表 Townland Consultants Limited ……………………………………………………………

☑ Company 公司 / □ Organisation Name and Chop (if applicable) 機構名稱及蓋章（如適用）

Date 日期 04/02/2026 …………………………………………………… (DD/MM/YYYY 日/月/年)

Remark 備註

The materials submitted in this application and the Board's decision on the application would be disclosed to the public. Such materials would also be uploaded to the Board's website for browsing and free downloading by the public where the Board considers appropriate.
委員會會向公眾披露申請人所遞交的申請資料和委員會對申請所作的決定。在委員會認為合適的情況下，有關申請資料亦會上載至委員會網頁供公眾免費瀏覽及下載。

Warning 警告

Any person who knowingly or wilfully makes any statement or furnish any information in connection with this application, which is false in any material particular, shall be liable to an offence under the Crimes Ordinance.
任何人在明知或故意的情況下，就這宗申請提出在任何要項上是虛假的陳述或資料，即屬違反《刑事罪行條例》。

Statement on Personal Data 個人資料的聲明

1. The personal data submitted to the Board in this application will be used by the Secretary of the Board and Government departments for the following purposes:
   委員會就這宗申請所收到的個人資料會交給委員會秘書及政府部門，以根據《城市規劃條例》及相關的城市規劃委員會規劃指引的規定作以下用途：
   (a) the processing of this application which includes making available the name of the applicant for public inspection when making available this application for public inspection; and
   處理這宗申請，包括公布這宗申請供公眾查閱，同時公布申請人的姓名供公眾查閱；以及
   (b) facilitating communication between the applicant and the Secretary of the Board/Government departments.
   方便申請人與委員會秘書及政府部門之間進行聯絡。

2. The personal data provided by the applicant in this application may also be disclosed to other persons for the purposes mentioned in paragraph 1 above.
   申請人就這宗申請提供的個人資料，或亦會向其他人士披露，以作上述第 1 段提及的用途。

3. An applicant has a right of access and correction with respect to his/her personal data as provided under the Personal Data (Privacy) Ordinance (Cap. 486). Request for personal data access and correction should be addressed to the Secretary of the Board at 15/F, North Point Government Offices, 333 Java Road, North Point, Hong Kong.
   根據《個人資料(私隱)條例》(第 486 章)的規定，申請人有權查閱及更正其個人資料。如欲查閱及更正個人資料，應向委員會秘書提出有關要求，其地址為香港北角渣華道 333 號北角政府合署 15 樓。

For Developments involving Columbarium Use, please also complete the following:
如發展涉及靈灰安置所用途，請另外填妥以下資料:

Ash interment capacity 骨灰安放容量@

Maximum number of sets of ashes that may be interred in the niches
在龕位內最多可安放骨灰的數量

Maximum number of sets of ashes that may be interred other than in niches
在非龕位的範圍內最多可安放骨灰的數量

Total number of niches 龕位總數

Total number of single niches
單人龕位總數

Number of single niches (sold and occupied)
單人龕位數目 (已售並佔用)

Number of single niches (sold but unoccupied)
單人龕位數目 (已售但未佔用)

Number of single niches (residual for sale)
單人龕位數目 (待售)

Total number of double niches
雙人龕位總數

Number of double niches (sold and fully occupied)
雙人龕位數目 (已售並全部佔用)

Number of double niches (sold and partially occupied)
雙人龕位數目 (已售並部分佔用)

N/A

Number of double niches (sold but unoccupied)
雙人龕位數目 (已售但未佔用)

Number of double niches (residual for sale)
雙人龕位數目 (待售)

Total no. of niches other than single or double niches (please specify type)
除單人及雙人龕位外的其他龕位總數 (請列明類別)

Number. of niches (sold and fully occupied)
龕位數目 (已售並全部佔用)

Number of niches (sold and partially occupied)
龕位數目 (已售並部分佔用)

Number of niches (sold but unoccupied)
龕位數目 (已售但未佔用)

Number of niches (residual for sale)
龕位數目 (待售)

Proposed operating hours 擬議營運時間

@ Ash interment capacity in relation to a columbarium means –
就靈灰安置所而言，骨灰安放容量指：

- the maximum number of containers of ashes that may be interred in each niche in the columbarium;
  每個龕位內可安放的骨灰容器的最高數目;
- the maximum number of sets of ashes that may be interred other than in niches in any area in the columbarium; and
  在該靈灰安置所並非龕位的範圍內，總共最多可安放多少份骨灰；以及
- the total number of sets of ashes that may be interred in the columbarium.
  在該骨灰安置所內，總共最多可安放多少份骨灰。

Gist of Application 申請摘要

(Please provide details in both English and Chinese as far as possible. This part will be circulated to relevant consultees, uploaded to the Town Planning Board's Website for browsing and free downloading by the public and available at the Planning Enquiry Counters of the Planning Department for general information.)
(請盡量以英文及中文填寫。此部分將會發送予相關諮詢人士、上載至城市規劃委員會網頁供公眾免費瀏覽及下載及於規劃署規劃資料查詢處供一般參閱。)

Application No. 申請編號	(For Official Use Only) (請勿填寫此欄)
Location/address 位置／地址	Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories (GLA-TSK 500 (part)) 新界丈量約份第233約政府土地將軍澳發展區第105區的將軍澳第二／三期已修復堆填區 (GLA-TSK 500 (部分))
Site area 地盤面積	46,500 (consisting areas of the three platforms with ancillary facilities) sq. m 平方米 ☑About 約 46,500 (包含三個平台及附屬設施的範圍) (includes Government land of 包括政府土地 46,500 sq. m 平方米 ☑ About 約)
Plan 圖則	Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 將軍澳分區計劃大綱核准圖編號S/TKO/32
Zoning 地帶	"Open Space", "Green Belt" and "Other Specified Uses" annotated "Industrial Estate" 「休憩用地」、「綠化地帶」及「其他指定用途」註明「工業邨」
Applied use/ development 申請用途/發展	Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities 擬議康體文娛場所 (公眾騎術學校)及附屬設施

(i) Gross floor area and/or plot ratio 總樓面面積及／或地積比率		sq.m 平方米	Plot Ratio 地積比率
	Domestic 住用	200 ☑ About 約 □ Not more than 不多於	□About 約 □Not more than 不多於
	Non-domestic 非住用	8,800 ☑ About 約 □ Not more than 不多於	□About 約 □Not more than 不多於
(ii) No. of blocks 幢數	Domestic 住用	2	
	Non-domestic 非住用	15	
	Composite 綜合用途		

(iii)	Building height/No. of storeys 建築物高度／層數	Domestic 住用 (In respect to Coach Duty Room at Lower Platform only)	Approx. 4.8 m 米 ☐ (Not more than 不多於)
			Approx.16.7 - 18.5 mPD 米(主水平基準上) ☐ (Not more than 不多於)
			Proposed 1 Storeys(s) 層 ☐ (Not more than 不多於) ~~(☐Include 包括/☐ Exclude 不包括~~ ~~☐ Carport 停車間~~ ~~☐ Basement 地庫~~ ~~☐ Refuge Floor 防火層~~ ~~☐ Podium 平台)~~
		Non-domestic 非住用	Lower Platform 低層平台Approx. 約 6.0 to 7.0 Middle Platform 中層平台Approx. 約 6.0 to 7.7 Upper Platform 高層平台Approx. 約 5.0 to 7.7 m 米 ☐ (Not more than 不多於)
			Lower Platform 低層平台: Approx. 約 11.5 to 15.9 mPD 米(主水平基準上) Middle Platform 中層平台: Approx. 約 46.3 to 48.2 mPD 米(主水平基準上) Upper Platform 高層平台: Approx. 約 144.8 to 148.1mPD 米(主水平基準上)
			Proposed 1 Storeys(s) 層 ☐ (Not more than 不多於) ~~(☐Include 包括/☐ Exclude 不包括~~ ~~☐ Carport 停車間~~ ~~☐ Basement 地庫~~ ~~☐ Refuge Floor 防火層~~ ~~☐ Podium 平台)~~
		Composite 綜合用途	~~m 米~~ ~~☐ (Not more than 不多於)~~
			~~mPD 米(主水平基準上)~~ ~~☐ (Not more than 不多於)~~
			~~Storeys(s) 層~~ ~~☐ (Not more than 不多於)~~ ~~(☐Include 包括/☐ Exclude 不包括~~ ~~☐ Carport 停車間~~ ~~☐ Basement 地庫~~ ~~☐ Refuge Floor 防火層~~ ~~☐ Podium 平台)~~
(iv)	Site coverage 上蓋面積	20.9%	☑ About 約
(v)	No. of units 單位數目		
(vi)	Open space 休憩用地	Private 私人	~~sq.m 平方米 ☐ Not less than 不少於~~
		Public 公眾	~~sq.m 平方米 ☐ Not less than 不少於~~

(vii) No. of parking spaces and loading / unloading spaces 停車位及上落客貨車位數目	Total no. of vehicle parking spaces 停車位總數	89
	Private Car Parking Spaces 私家車車位	58
	Motorcycle Parking Spaces 電單車車位	4
	Light Goods Vehicle Parking Spaces 輕型貨車泊車位	
	Medium Goods Vehicle Parking Spaces 中型貨車泊車位	
	Heavy Goods Vehicle Parking Spaces 重型貨車泊車位	
	Others (Please Specify) 其他 (請列明)	
	Accessible Car Parking Space; Golf Cart Parking Space	8; 14
	Coach Parking Space; Shuttle Parking Space	2; 3
	Total no. of vehicle loading/unloading bays/lay-bys 上落客貨車位／停車處總數	6 / 1
	Taxi Spaces 的士車位	
	Coach Spaces 旅遊巴車位	
	Light Goods Vehicle Spaces 輕型貨車車位	
	Medium Goods Vehicle Spaces 中型貨車位	
	Heavy Goods Vehicle Spaces 重型貨車車位	
	Others (Please Specify) 其他 (請列明)	
	L/UL space for for operational need for horses; L/UL space for hay/beddings delivery	2; 2
	L/UL space for Refuse Collection Vehicle; General Lay-by	2; 1

Submitted Plans, Drawings and Documents 提交的圖則、繪圖及文件

	Chinese 中文	English 英文
Plans and Drawings 圖則及繪圖		
Master layout plan(s)/Layout plan(s) 總綱發展藍圖／布局設計圖	□	☑
Block plan(s) 樓宇位置圖	□	□
Floor plan(s) 樓宇平面圖	□	□
Sectional plan(s) 截視圖	□	☑
Elevation(s) 立視圖	□	□
Photomontage(s) showing the proposed development 顯示擬議發展的合成照片	□	☑
Master landscape plan(s)/Landscape plan(s) 園境設計總圖／園境設計圖	□	☑
Others (please specify) 其他（請註明）	□	☑
Artist Impression		
Reports 報告書		
Planning Statement/Justifications 規劃綱領/理據	□	☑
Environmental assessment (noise, air and/or water pollutions) 環境評估（噪音、空氣及／或水的污染）	□	☑
Traffic impact assessment (on vehicles) 就車輛的交通影響評估	□	☑
Traffic impact assessment (on pedestrians) 就行人的交通影響評估	□	☑
Visual impact assessment 視覺影響評估	□	☑
Landscape impact assessment 景觀影響評估	□	□
Tree Survey 樹木調查	□	☑
Geotechnical impact assessment 土力影響評估	□	□
Drainage impact assessment 排水影響評估	□	☑
Sewerage impact assessment 排污影響評估	□	☑
Risk Assessment 風險評估	□	□
Others (please specify) 其他（請註明）	□	□
Landscape Master Plan and Tree Preservation and Removal Proposal; Water Supply Study		
Geotechnical Planning Review Report		

Note: May insert more than one「✔」. 註：可在多於一個方格內加上「✔」號

Note: The information in the Gist of Application above is provided by the applicant for easy reference of the general public. Under no circumstances will the Town Planning Board accept any liabilities for the use of the information nor any inaccuracies or discrepancies of the information provided. In case of doubt, reference should always be made to the submission of the applicant.

註： 上述申請摘要的資料是由申請人提供以方便市民大眾參考。對於所載資料在使用上的問題及文義上的歧異，城市規劃委員會概不負責。若有任何疑問，應查閱申請人提交的文件。

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SECTION 16 PLANNING APPLICATION TOWN PLANNING ORDINANCE (CAP. 131)

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

- Supplementary Planning Statement -

Volume 1 of 3

TOWNLAND CONSULTANTS LIMITED

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

SECTION 16 PLANNING APPLICATION

Supplementary Planning Statement

Applicant	HKJC Public Riding Schools Limited
Planning Consultant, Visual Impact Specialist & Submitting Agent	Townland Consultants Limited
Architect	Wong Tung & Partners Limited
Landscape Architect	Otherland Limited
Traffic Consultant	MVA Hong Kong Limited
Environmental, Infrastructural and Geotechnical Consultant	Ove Arup & Partners Hong Kong Limited
Water Supply Consultant	P&T (M&E) Limited

File Reference: HKJC/TKOL/2

For and on behalf of Townland Consultants Limited

Approved by : ____________________

Position : Director

Date : 4 February 2025

4 February 2026

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Appendix 9 Geotechnical Planning Review Report

EXECUTIVE SUMMARY

This Section 16 Planning Application is submitted on behalf of the HKJC Public Riding Schools Limited (the "**Applicant**") to seek permission from the Town Planning Board ("**TPB**"/ the "**BOARD**") for the development of Public Riding School with ancillary facilities (e.g. utility trench) (collectively as "**PRS**") at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories ("**TKOL II/III**").

Public Riding Schools in Hong Kong are equestrian facilities available to the general public that provide horse riding and equestrian related programmes to the community. These schools offer affordable, accessible riding lessons and programmes that inspire interest in horse riding and horse care to individuals of all ages and skill levels to the sport.

Environmental Protection Department ("**EPD**") has long been supportive of the development of restored landfills into popular and well utilised recreational and sports facilities and of suitable proposals from organizations or groups to develop self-funded recreational facilities and operate the facilities on a non-profit-making and self-financing basis on restored landfills with the support/consent of relevant policy bureau and departments. Given the growth of community riding, the Applicant is propelled by public demand to consider the after-use of the three relatively flat platforms within TKOL II/III, considered as an ideal location with relatively flat areas to carry out equestrian sports in a safe manner, as Hong Kong's fourth Public Riding School in furtherance of equestrian sport in Hong Kong. The PRS aligns with the Government's policy objectives in fostering more community participation through wider visibility and popularity of horse riding, supporting the development of equestrian sports, and culminating Hong Kong as a centre for international sports events.

The Application Site comprises of the three (3) relatively flat platforms and the land required for the provision of ancillary utility trench connecting to the platforms to accommodate proposed essential utilities in supporting the operation of PRS. Access between the platforms will be provided via the shared use of the existing access road, which is currently used by the EPD for aftercare works at the restored landfill.

The Application Site is predominately zoned "Open Space" ("**O**") on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 ("**Approved OZP**"), whilst a strip of area at the north is zoned "Green Belt" ("**GB**") and a minor portion abutting Chun Sing Street is zoned "Other Specified Uses" annotated "Industrial Estate" ("**OU(Industrial Estate**)" on the Approved OZP. The PRS with ancillary facilities ('Horse Riding School' subsumed under 'Place of Recreation, Sports or Culture' use) is a Column 2 use under the "O" , "GB" and "OU(Industrial Estate)" zones that may be permitted with or without conditions on Application under S16 of the Town Planning Ordinance ("**TPO**"). There is no plot ratio ("**PR**"), building height ("**BH**"), site coverage ("**SC**") and Gross Floor Area ("**GFA**") restrictions imposed within the "O", "GB" and "OU(Industrial Estate)" zones of the Approved OZP. While a portion of the TKOL II/III falls within the Clear Water Bay Country Park, the Application Site will not involve any areas falling within the Country Park Boundary.

The PRS, is a single-storey building development with a proposed total GFA of approx. 9,000m^2 and a proposed building height of approx. 4.8 to 7.7m, is a time-honoured movement and is justified on the following grounds:

- The PRS is fully in line with Government's policies to promote sports culture and enhance community well-being. Furthermore, it builds upon the established precedent of successfully developing restored landfills into vibrant public recreational facilities;
- The three (3) platforms are suitable for the development of the PRS in meeting the operational needs of the PRS while acceptable from a technical perspective in respect to development at the restored TKOL II/III;
- The PRS is in line with the Planning Intention in providing low-density and low-impact recreational facilities for public enjoyment and is compatible with the surrounding area;
- The PRS will address the growing public demand for equine facilities and improve their geographical distribution across the territory. It will provide cutting-edge amenities to nurture future industry talent and promote equestrian sports to the wider community;
- The PRS will enable equine facilities and programmes to be more accessible to visitors and the general public, including individuals who may not be familiar with horses or animal welfare; and
- No significant adverse visual, traffic, environmental, infrastructural, water supplies and geotechnical impacts are anticipated.

Based on the above justifications and as detailed in this Supplementary Planning Statement, we respectfully request the Board to give favourable consideration to this Application.

行政摘要

（內文如有差異，以英文版本為準）

根據城市規劃條例第十六條，我司代表香港賽馬會公眾騎術學校有限公司（下稱「**申請人**」）向城市規劃委員會（下稱「**城規會**」）呈交規劃申請書，要求批准於新界丈量約份第 233 約政府土地將軍澳第 105 區的將軍澳第二／三期已修復堆填區內(合稱「**申請地盤**」／「**地盤**」）發展公眾騎術學校及附屬設施（例如設施坑道）（合稱「**公眾騎術學校**」）。

香港的公眾騎術學校是向市民大眾開放的馬術設施，為社區提供騎馬及馬術相關課程。這些學校為不同年齡及技術水平的公眾人士提供可負擔和方便接觸的騎術訓練和活動，以培養公眾對騎馬及馬匹護理的興趣，並推廣馬術運動。

環境保護署（下稱「**環保署**」）一直支持將已修復的堆填區發展為廣受歡迎且使用率高的康樂及體育設施，並支持各組織或團體在相關政策局及部門的支持下，於已修復堆填區自資發展康樂設施及以非牟利和自負盈虧的形式營運設施。由於社區馬術活動日益增長並在公眾需求的推動下，申請人建議於將軍澳第二／三期堆填區內三個較平坦的平台發展馬術設施作堆填區修復後的用途。由於該區域地勢較為平坦並具備安全進行馬術運動的條件，所以適合作香港第四所公眾騎術學校和繼續推動本港馬術運動發展。公眾騎術學校符合政府多項政策方針，包括透過提升馬術運動的知名度和普及程度促進廣泛社區參與、支持馬術運動發展、以及推動香港成爲國際體育賽事中心。

申請地盤由三個較平坦的平台及其附屬設施坑道組成，該附屬設施坑道將連接不同平台，並用於容納支持公眾騎術學校的運作的擬議必要設施。平台之間將透過與環保署共用的現有通道連接，現時該通道由環保署用作已修復堆填區的後期修護工作。

申請地盤於《將軍澳分區計劃大綱核准圖編號 S/TKO/32》（下稱「**核准圖**」）上主要劃為「休憩用地」地帶，北面一帶則劃為「綠化地帶」及毗鄰駿昇街的一小部分地段劃為「其他指定用途」註明「工業邨」。公眾騎術學校及附屬設施 （「騎術學校」歸於「康體文娛場所」用途）屬「休憩用地」地帶、「綠化地帶」和「其他指定用途」註明「工業邨」地帶的第二欄用途，須先向城規會申請，可能在有附帶條件或無附帶條件下獲准。核准圖上的「休憩用地」地帶、「綠化地帶」及「其他指定用途」註明「工業邨」地帶均沒有訂明任何地積比率、建築物高度、上蓋面積及總樓面面積限制。雖然將軍澳第二／三期堆填區部分範圍位於清水灣郊野公園內，但申請地盤並不涉及任何郊野公園範圍內的土地。

公眾騎術學校為單層式建築，其總樓面面積和建築物高度分別為約 9,000 平方米和 4.8 至 7.7 米，是一項歷久彌新的發展及具備以下充分理據的支持：

- 公眾騎術學校完全符合政府推動體育文化及提升社會福祉政策。此外，公眾騎術學校更延續既往成功先例，把已修復堆填區發展為充滿活力的公眾康樂設施；
- 該三個平台均滿足公眾騎術學校發展的運作需求，亦在技術層面上符合於已修復的將軍澳第二/三期堆填區進行發展的標準；
- 公眾騎術學校符合提供低密度及低影響的文娛康樂設施供公眾享用的規劃意向，並與周邊環境相容；
- 公眾騎術學校將回應公眾對馬術設施日益增長的需求，並改善全港公眾騎術學校設施的地理分佈。公眾騎術學校將提供先進的馬術設施，為馬術行業培育人才，同時向更廣泛的公眾推廣馬術運動；
- 公眾騎術學校將讓訪客及公眾更容易接觸馬術設施及課程，惠及包括可能不熟悉馬匹或動物福利的人士；及
- 公眾騎術學校將不會造成負面視覺、交通、環境、基礎建設、水質和岩土影響。

基於上述支持理據及此補充規劃文件內的詳述資料，懇請城規會委員對是項申請作出正面的考慮。

Reference: HKJC/TKOL/2/AGNES/01
Date: 4 February 2026

TO THE TOWN PLANNING BOARD:

SECTION 16 PLANNING APPLICATION
TOWN PLANNING ORDINANCE (CHAPTER 131)

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

- SUPPLEMENTARY PLANNING STATEMENT -

1 INTRODUCTION

1.1 Purpose of the Application

1.1.1 Townland Consultants Limited (“**TOWNLAND**”) has been commissioned by the HKJC Public Riding Schools Limited (the “**Applicant**”) to prepare and submit this Section 16 (“**S16**”) Planning Application to seek permission from the Town Planning Board (“**TPB**”/ the “**BOARD**”) for the development of a Public Riding School with ancillary facilities (e.g. utility trench) (collectively as “**PRS**”) at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories (GLA TSK-500 (Part)) ("**TKOL II/III**").

1.1.2 EPD has long been supportive of the development of restored landfills into popular and well utilised recreational and sports facilities and of suitable proposals from organizations or groups to develop self-funded recreational facilities and operate the facilities on a non-profit-making and self-financing basis on restored landfills with the support/consent of relevant policy bureau and departments, as demonstrated in successful precedents at the restored TKO Stage I Landfill, Jordan Valley, Ngau Chi Wan, Sai Tso Wan, Gin Drinkers Bay, and Shuen Wan Landfills (***Annex 1*** refers).

1.1.3 Building on these successful precedents, the Applicant has identified and expressed interest to EPD in developing the three relatively flat platforms deemed technically feasible and safe for recreational use into Hong Kong’s fourth PRS. In view that the Applicant has been registered as a charitable organization with Inland Revenue Department and Culture, Sports and Tourism Bureau (“**CSTB**”) has provided its in-principle support, EPD has accepted the Applicant’s expression of interest to explore the possibility of developing a PRS at the restored TKOL II/III.

1.1.4 Riding on the growth of equestrian sports since the 2008 Beijing Olympics and rising demand for equestrian facilities, the Applicant aims to further equestrian sports by developing Hong Kong’s fourth PRS at TKOL II/III. Located in New Territories East, the PRS will support the Applicant’s commitment in making equestrian sports accessible to all by achieving a balanced geographical distribution of equine facilities across the city, enhancing their riding experiences and enjoyment. The PRS also aligns with the Government’s policy objectives in fostering more public participation in the community through wider visibility and popularity of horse riding, supporting equestrian as an elite sport, and maintaining Hong Kong as a centre for major international sports events. It will become the largest PRS in Hong Kong with advanced facilities for the public to enjoy equestrian sport.

1.1.5 This Supplementary Planning Statement ("**SPS**") provides relevant information on the Application to facilitate the BOARD's consideration including justifications on planning, design and technical grounds.

2 SITE CONTEXT

2.1 The Application Site

2.1.1 Upon the closure of the landfill in 1994, TKOL II/III, a total area of approx. 40 ha, was allocated to Environmental Protection Department ("**EPD**") for the implementation of comprehensive restoration works, which were completed in January 1999. It is now in the aftercare period undertaken by EPD's restoration contractor. Aftercare works include the operation and maintenance of the landfill gas and leachate management systems, maintenance of the capping system and the carrying out of regular environmental monitoring and audit for the restored landfill. EPD intends to extend the temporary Government Land Allocation ("**GLA**") (GLA-TSK 500) expiring in 2028 for another 25 years until 2053 to allow for continued monitoring of the aftercare works[1], subject to the renewal of by the Lands Department. The PRS will be operated by the Applicant, while EPD will remain the management department of TKOL II/III.

2.1.2 The Application Site, approx. 46,500m^2, is located within TKOL II/III in TKO Area 105. The Proposed PRS will be located on three (3) relatively flat platforms (Lower Platform (excluding EPD Facilities Area) (approx. +6.0mPD), Middle Platform (approx. +40.0mPD), and Upper Platform (approx. +140.0mPD)). The Application Site also includes the land required for the provision of ancillary utility trench connecting to the three (3) platforms (***Figure 2.1*** refers). Access between the three platforms will be provided via shared use of an existing access road currently used by the EPD for aftercare works at the restored landfill.

2.1.3 The Applicant conducted a Feasibility Study that concludes the Application Site is suitable for PRS development due to the relatively flat terrain, which align with critical operational requirements for horse welfare and rider safety, as well in the context of ongoing aftercare works of TKOL II/III involving monitoring facilities in non-platform areas (***Annex 2*** refers). The non-platform areas are mostly slopes formed by waste buried underneath. Afteruse development on waste slopes have to overcome challenging constraints and technical difficulties, such as restriction on load-bearing capacity, slippage possibility, ground settlement and conflict with the landfill facilities underneath as well as environmental monitoring works being carried out by EPD. Potential after-use of these site portions will therefore all depend on the mitigation of the risk factors and safety issues as described above.

2.1.4 The platforms have a site level difference of approx. 134m. The areas outside the Application Site consist primarily of topographical slopes equipped with landfill restoration facilities to maintain the aftercare works for TKOL II/III.

2.2 Surrounding Land Uses

2.2.1 Generally, TKOL II/III is predominantly surrounded by densely vegetated areas, except area to the west where various existing and planned high-rise residential developments, industrial buildings/ data centres are located. Various bus stops and Green Minibus stops are along Wan Po Road and Wan O Road (***Figure 2.2*** refers).

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[1] SKDC(M) Paper No. 2/26: "Tseung Kwan O Restored Landfill – Extension of Temporary Government Land Allocation", Sai Kung District Council, 6 January 2026, https://www.districtcouncils.gov.hk/sk/doc/2024_2027/en/dc_meetings_doc/31277/SK_2026_002_TC.pdf

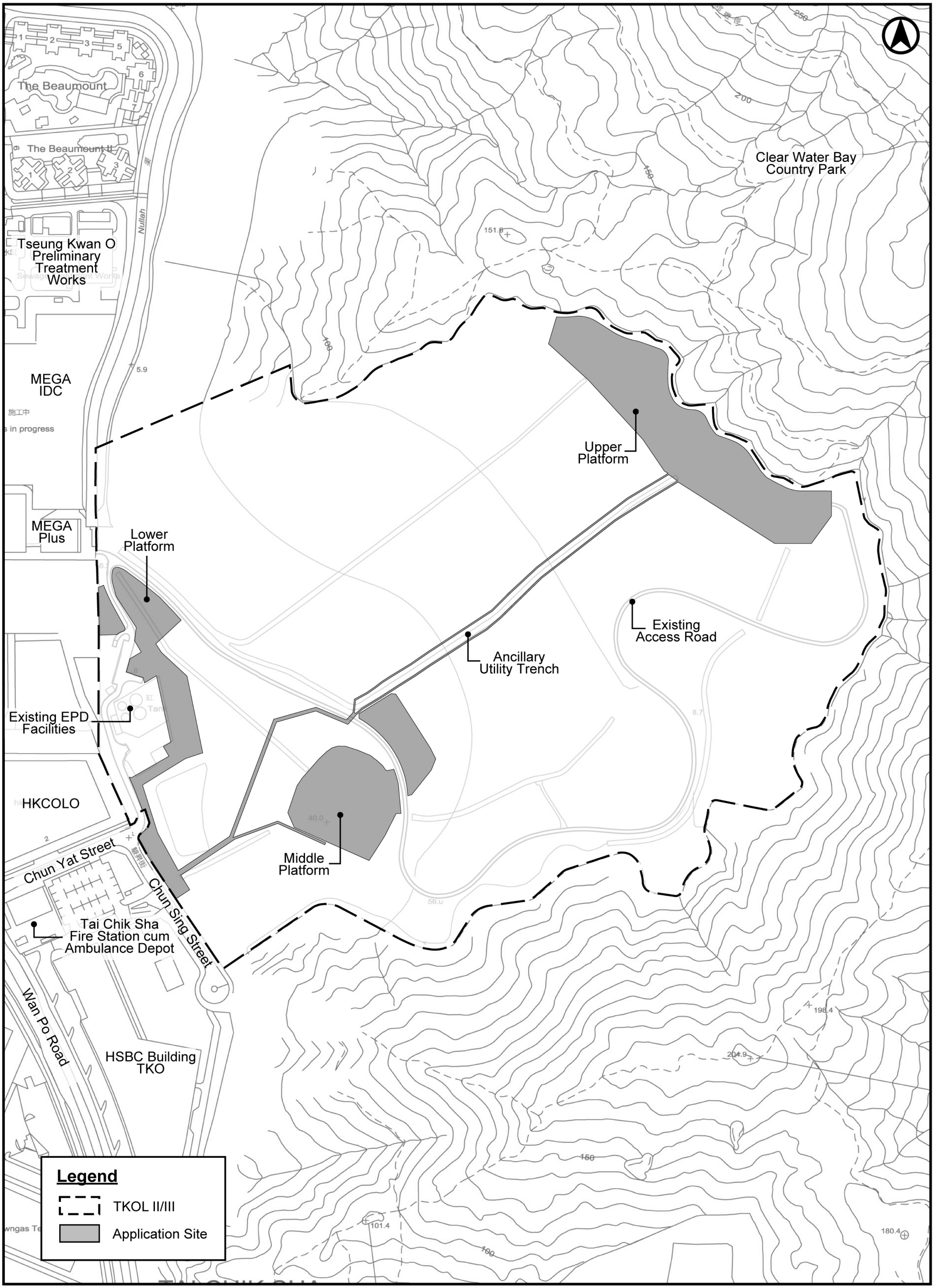
- To the immediate north of the Application Site is a densely vegetated area with hilly terrain. The CWBCP is located to the immediate northeast and east of the Application Site, including Miu Tsai Tun and High Junk Peak.
- To the immediate south of the Application Site is the foothill of Tai Chik Sha with dense vegetation. South East New Territories Landfill is located to the further south of the Application Site.
- To the southwest of the Application Site is Tseung Kwan O Industrial Estate (Tseung Kwan O InnoPark), a cluster of industrial buildings for heavy industries, light commercial manufacturing and the technology development of IT related services. Buildings to the immediate southwest include HSBC Building TKO, Tai Chik Sha Fire Station cum Ambulance Depot, and HKCOLO Building.
- To the immediate west of the Application Site are MEGA Plus Data Centre and MEGA IDC Data Centre, and a GIC Site reserved for a Communications Tower.
- To the further west of the Application Site across Wan Po Road is LOHAS Park, a large-scale comprehensive residential/ commercial development and supporting community facilities. LOHAS Park MTR Station and The LOHAS Shopping Centre is located within the comprehensive development. A planned Joint-user Government Building with Laboratory Facilities is located opposite to LOHAS Park on Wan O Road.
- To the immediate northwest of the Application Site consists of Tseung Kwan O Preliminary Treatment Works, Shrewsbury International School Hong Kong, and a cluster of high-rise residential developments, namely Manor Hill and The Beaumount and The Beaumount II.

2.3 Accessibility

2.3.1 The Application Site is accessible via existing footpaths at Chun Yat Street and Chun Sing Street. A proposed cautionary pedestrian crossing will be provided at the entrance of the TKOL II/III across Chun Yat Street, which will connect the existing eastern footpath of Chun Sing Street thereby linking to the footpath outside HKCOLO at Chun Yat Street, Wan Po Road, and the wider TKO area (***Appendix 3*** refers).

2.3.2 The Application Site benefits from comprehensive public transport connectivity, including the LOHAS Park MTR Station located approx. 1,300m away and accessible via a 20-minute walk from the Application Site. As of January 2026, the area is well-served by approx. 20 franchised bus routes and four (4) Green Minibus ("**GMB**") routes operating in the vicinity. The nearest bus stop and GMB stop (at Chun Yat Street near Wan Po Road) are situated within a convenient approx. 350m walking distance (approx. a 5-minute walk) from the Application Site (***Appendix 3*** refers). To further enhance accessibility to the Application Site, a new bus stop is proposed at Chun Sing Street, offering a walking distance of less than 120m (approx. a 2-minute walk) to the Application Site (***Appendix 3*** refers).

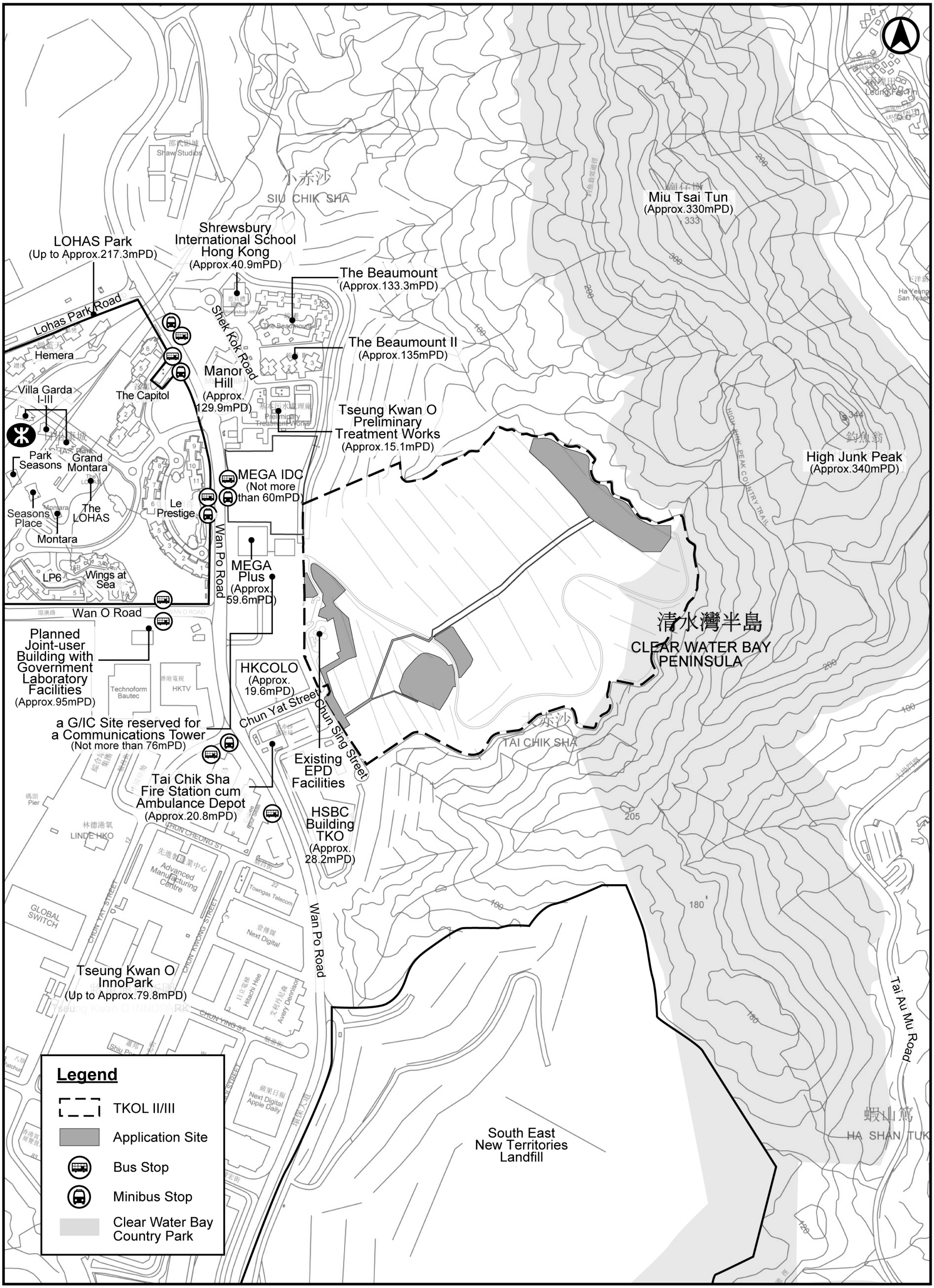
2.3.3 Overall, the Application Site is considered to have good accessibility via public transport in view of the comprehensive coverage of the public transport services and the available different choices on transport modes.


The Beaumount
The Beaumount II
Tseung Kwan O Preliminary Treatment Works
Nullah
MEGA IDC
施工中
s in progress
MEGA Plus
Lower Platform
Existing EPD Facilities
HKCOLO
Chun Yat Street
Chun Sing Street
Tai Chik Sha Fire Station cum Ambulance Depot
Wan Po Road
HSBC Building TKO
Middle Platform
Ancillary Utility Trench
Upper Platform
Existing Access Road
Clear Water Bay Country Park
250
200
150
100
151.6
5.9
40.0
8.7
56.0
198.4
204.9
101.4
180.4
Legend
TKOL II/III
Application Site

HKJC/TKOL/2

FIGURE 2.1 SITE LOCATION PLAN

SCALE 1 : 5,000


Legend
TKOL II/III
Application Site
Bus Stop
Minibus Stop
Clear Water Bay Country Park
LOHAS Park (Up to Approx.217.3mPD)
Lohas Park Road
Hemera
Villa Garda I-III
The Capitol
Park Seasons
Grand Montara
The LOHAS
Seasons Place
Montara
Le Prestige
LP6
Wings at Sea
Shrewsbury International School Hong Kong (Approx.40.9mPD)
Shek Kok Road
Manor Hill (Approx. 129.9mPD)
The Beaumount (Approx.133.3mPD)
The Beaumount II (Approx.135mPD)
Tseung Kwan O Preliminary Treatment Works (Approx.15.1mPD)
MEGA IDC (Not more than 60mPD)
MEGA Plus (Approx. 59.6mPD)
Wan Po Road
Wan O Road
Planned Joint-user Building with Government Laboratory Facilities (Approx.95mPD)
Technoform Bautec
HKTV
HKCOLO (Approx. 19.6mPD)
Chun Yat Street
Chun Sing Street
a G/IC Site reserved for a Communications Tower (Not more than 76mPD)
Tai Chik Sha Fire Station cum Ambulance Depot (Approx.20.8mPD)
Existing EPD Facilities
HSBC Building TKO (Approx. 28.2mPD)
Shaw Studios
小赤沙
SIU CHIK SHA
Miu Tsai Tun (Approx.330mPD)
333
High Junk Peak (Approx.340mPD)
344
HIGH JUNK PEAK COUNTRY TRAIL
清水灣半島
CLEAR WATER BAY PENINSULA
大赤沙
TAI CHIK SHA
LINDE HKO
Pier
CHUN CHEONG ST
Advanced Manufacturing Centre
GLOBAL SWITCH
Towngas Telecom
Next Digital
Hitachi Hee
Avery Dennison
CHUN KWONG STREET
CHUN YAT STREET
CHUN YING ST
Tseung Kwan O InnoPark (Up to Approx.79.8mPD)
Next Digital Apple Daily
South East New Territories Landfill
Tai Au Mu Road
蝦山篤
HA SHAN TUK
Leung Fai Tin
Ha Yeung San Tsuen
100
200
300
205
180
120

HKJC/TKOL/2

FIGURE 2.2 SITE LOCATION PLAN

SCALE 1 : 10,000

3 PLANNING CONTEXT

3.1 Statutory Planning Context

Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32

3.1.1 The Application Site is predominately zoned “O” (approx. 40,190m^2 or 86.4% of the Application Site Area), whilst a strip of area at the north is zoned “GB” (approx. 6,100m^2 or 13.1%) of the Application Site Area) and a minor portion abutting Chun Sing Street is zoned “Other Specified Uses” annotated “Industrial Estate” (“**OU(Industrial Estate)**”) (approx. 210m^2 or 0.5%) of the Application Site Area) on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 ("**Approved OZP**”) (***Figures 3.1 and 3.2*** refer). According to the Approved OZP, the “O” zone is intended “*primarily for the provision of outdoor open-air public space for active and/or passive recreational uses serving the needs of local residents as well as the general public*”, while the “GB” zone is intended “*primarily for defining the limits of urban and sub-urban development areas by natural features and to contain urban sprawl as well as to provide passive recreational outlets. There is a general presumption against development within this zone*”, and the “OU(Industrial Estate)” zone is intended “*primarily to provide/reserve land for the development of an industrial estate for industries to be admitted by the Hong Kong Science and Technology Parks Corporation according to the criteria set by the Corporation. Industries to be included would normally not be accommodated in conventional industrial buildings because of their specific requiremen*t”. The PRS with ancillary facilities (‘Horse Riding School’ subsumed under ‘Place of Recreation, Sports or Culture’ use) is a Column 2 use under the “O”, “GB” and “OU(Industrial Estate)” zones that may be permitted with or without conditions on Application under S16 of the TPO. There are no PR, BH, and SC restrictions imposed within the “O”, “GB” and “OU (Industrial Estate)” zones of the Approved OZP.

3.1.2 While a portion of TKOL II/III falls within the CWBCP, the Application Site does not involve any areas falling within the Country Park Boundary.

3.2 Non-Statutory Planning Context

Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030

3.2.1 Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030 (“**HK2030+**”) is a long-term planning framework that will guide Hong Kong’s planning, land and infrastructure development, and shape Hong Kong's built and natural environment beyond 2030. HK2030+ recognises the importance of enhancing liveability in a compact high-density city while promoting the health, age-friendliness, well-being, and quality living environment of Hong Kong people. There is a stronger focus on quality of life and tackling the challenge of enhancing liveability in the high-density urban context of Hong Kong.

Government Policies

3.2.2 As announced in the Chief Executive's ("**CE**") Policy Address in recent years, the Government has consistently emphasised the importance of fostering sports development with the aim of promoting sports within the community, support elite sports, maintain Hong Kong as a hub for major international sports events, enhance professionalism, and develop sports as an industry. Increasing and diversifying the provision of sports facilities in an expedited manner has been the key approach to promoting sports in the community and encouraging the public's participation in sports.

3.2.3 The Government has committed to restoring closed landfills in ensuring safety and environmental acceptability for beneficial and appropriate land uses over decades and has encouraged the development of gainful afteruses such as recreational, environmental or other community facilities at restored landfills for public's enjoyment.

3.2.4 The Culture, Sports and Tourism Bureau ("**CSTB**") is committed to promoting the development of sports in Hong Kong through promoting sports in the community, supporting elite sports, promoting Hong Kong as a centre for major international sports events, enhancing professionalism and developing sports as an industry. In addition, CSTB promotes sports in the community and in schools, increase and enhance sports and recreation facilities, as well as encourage collaboration among communities in fostering a strong sporting culture. Equestrian sports is a Tier A Sport under the Elite Vote Support Scheme ("**EVSS**").

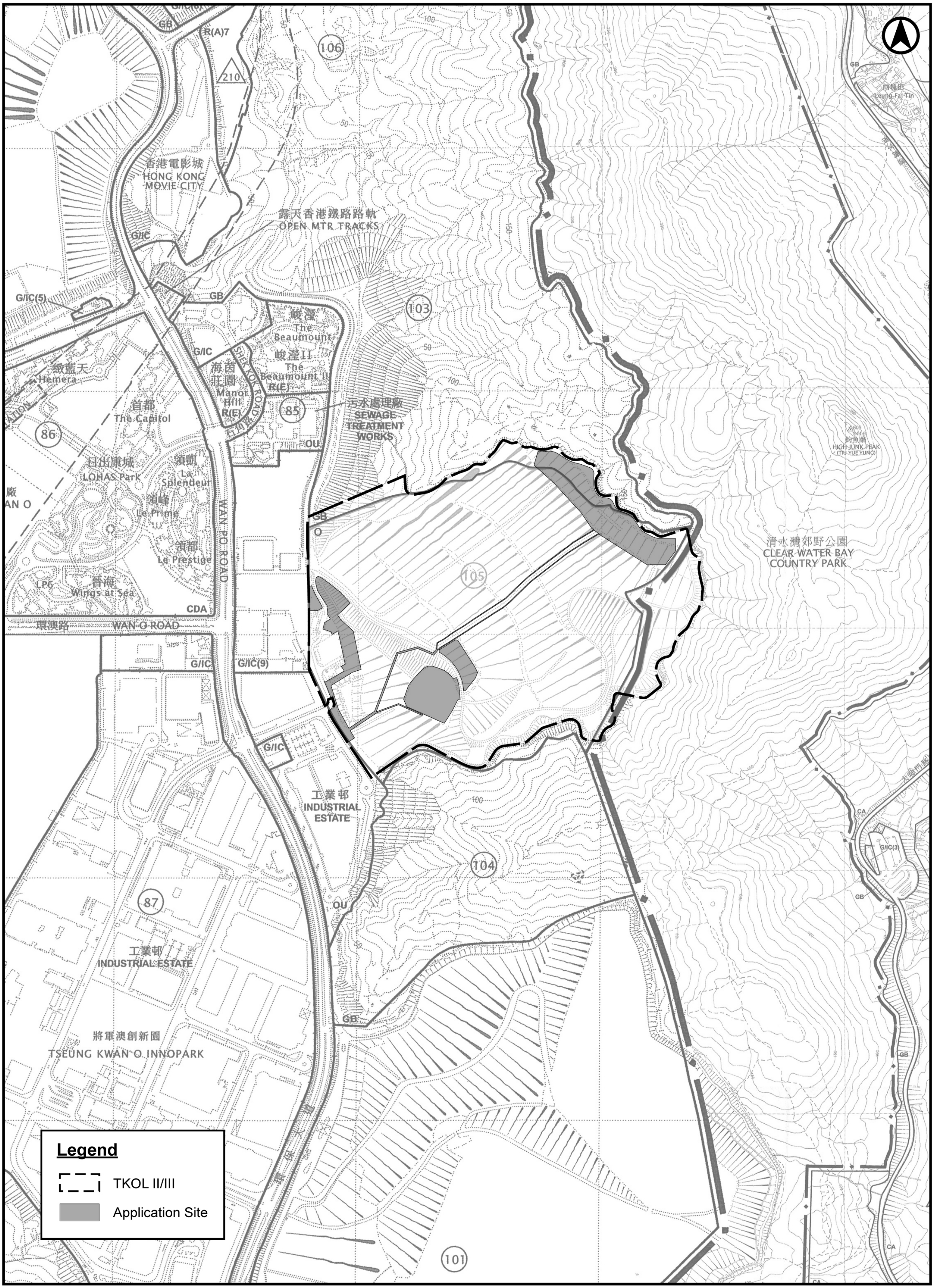
3.2.5 The Sports Commission ("**SC**") recognises the importance of promoting "Sports for All" in creating a sustainable and community-wide sporting culture for people of all age groups, and to foster High Performance Sports so that athletes can compete in major international and overseas sports events competitively, and become role models for our youth.

*Hong Kong Planning Standards and Guidelines ("**HKPSG**")*

3.2.6 Horse-riding is identified as a specialist type of recreation under Chapter 4: Recreation, Open Space and Greening of the Hong Kong Planning Standards and Guidelines ("**HKPSG**"). The HKPSG encourages participation in recreational pursuits and seeks to ensure that appropriate opportunities are available to meet the needs of the people of Hong Kong. The provision of a wide variety of recreation facilities apart from the core activities is encouraged by the Government, and such proposals would be assessed on their individual merits.

Town Planning Board Guidelines for Application for Development Within Green Belt Zone under Section 16 of the Town Planning Ordinance

3.2.7 The Town Planning Board Guidelines for Application for Development within Green Belt Zone under Section 16 of the Town Planning Ordinance ("**TPB PG-No. 10**") outlines the criteria and considerations for development within "GB" zone, in which each application within "GB" zone will be assessed on its individual merits and according to a set criteria.



R(A)7
210
106
香港電影城
HONG KONG MOVIE CITY
露天香港鐵路路軌
OPEN MTR TRACKS
G/IC
G/IC(5)
GB
103
峻瀅
The Beaumount
峻瀅II
The Beaumount II
R(E)
海茵莊園
Manor Hill
R(E)
SHEUNG NGAU ROAD
85
污水處理廠
SEWAGE TREATMENT WORKS
OU
緻藍天
Hemera
首都
The Capitol
86
日出康城
LOHAS Park
領凱
La Splendeur
領峰
Le Prime
領都
Le Prestige
LP6
香海
Wings at Sea
CDA
環澳路
WAN O ROAD
WAN PO ROAD
GB
O
105
G/IC
G/IC(9)
G/IC
工業邨
INDUSTRIAL ESTATE
104
87
工業邨
INDUSTRIAL ESTATE
OU
GB
將軍澳創新園
TSEUNG KWAN O INNOPARK
101
清水灣郊野公園
CLEAR WATER BAY COUNTRY PARK
釣魚翁
HIGH JUNK PEAK (TIU YUE YUNG)
Leung Fai Tin
G/IC(3)
GB
CA
Legend
TKOL II/III
Application Site

HKJC/TKOL/2

FIGURE 3.1 APPROVED TSEUNG KWAN O OUTLINE ZONING PLAN NO. S/TKO/32 (EXTRACT)

SCALE 1 : 10,000

OPEN SPACE

Column 1 Uses always permitted	Column 2 Uses that may be permitted with or without conditions on application to the Town Planning Board
Aviary	Cable Car Route and Terminal Building
Barbecue Spot	Eating Place
Field Study/Education/Visitor Centre	Government Refuse Collection Point
Library (on land designated "O(1)" only)	Government Use (not elsewhere specified)
Park and Garden	Holiday Camp
Pavilion	Pier
Pedestrian Area	Place of Entertainment
Place of Recreation, Sports or Culture (on land designated "O(1)" only)	Place of Recreation, Sports or Culture (not elsewhere specified)
Picnic Area	Private Club
Playground/Playing Field	Public Transport Terminus or Station
Promenade	Public Utility Installation
Public Convenience	Public Vehicle Park (excluding container vehicle)
Sitting Out Area	Religious Institution
Zoo	Service Reservoir
	Shop and Services
	Tent Camping Ground
	Utility Installation for Private Project

Planning Intention

This zone is intended primarily for the provision of outdoor open-air public space for active and/or passive recreational uses serving the needs of local residents as well as the general public.

FIGURE 3.2 STATUTORY NOTES ATTACHED TO THE APPROVED TSEUNG KWAN O OUTLINE ZONING PLAN NO. S/TKO/32 (EXTRACT)

GREEN BELT

Column 1 Uses always permitted	Column 2 Uses that may be permitted with or without conditions on application to the Town Planning Board
Agricultural Use Barbecue Spot Government Use (Police Reporting Centre only) Nature Reserve Nature Trail On-Farm Domestic Structure Picnic Area Public Convenience Tent Camping Ground Wild Animals Protection Area	Animal Boarding Establishment Broadcasting, Television and/or Film Studio Cable Car Route and Terminal Building Columbarium (within a Religious Institution or extension of existing Columbarium only) Crematorium (within a Religious Institution or extension of existing Crematorium only) Field Study/Education/Visitor Centre Flat Government Refuse Collection Point Government Use (not elsewhere specified) Helicopter Landing Pad Holiday Camp House Marine Fuelling Station Petrol Filling Station Pier Place of Recreation, Sports or Culture Public Transport Terminus or Station Public Utility Installation Public Vehicle Park (excluding container vehicle) Radar, Telecommunications Electronic Microwave Repeater, Television and/or Radio Transmitter Installation Religious Institution Residential Institution Rural Committee/Village Office School Service Reservoir Social Welfare Facility Utility Installation for Private Project Zoo

Planning Intention

The planning intention of this zone is primarily for defining the limits of urban and sub-urban development areas by natural features and to contain urban sprawl as well as to provide passive recreational outlets. There is a general presumption against development within this zone.

HKJC/TKOL/2 FIGURE 3.2 (CONT'D) STATUTORY NOTES ATTACHED TO THE APPROVED TSEUNG KWAN O OUTLINE ZONING PLAN NO. S/TKO/32 (EXTRACT)

OTHER SPECIFIED USES (cont'd)

Column 1
Uses always permitted

For "Industrial Estate" Only

Ambulance Depot
Broadcasting, Television and/or Film Studio
Cargo Handling and Forwarding Facility
Dangerous Goods Godown
Eating Place
Gas Works
Government Refuse Collection Point
Government Use (not elsewhere specified)
Industrial Use
Information Technology and Telecommunications Industries
Marine Fuelling Station
Office
Petrol Filling Station
Pier
Private Club
Public Convenience
Public Transport Terminus or Station
Public Utility Installation
Public Vehicle Park (excluding container vehicle)
Radar, Telecommunications Electronic Microwave Repeater, Television and/or Radio Transmitter Installation
Refuse Disposal Installation
Research, Design and Development Centre
Shop and Services
Social Welfare Facility (excluding those involving residential care)
Training Centre
Utility Installation for Private Project
Warehouse (excluding Dangerous Goods Godown)
Wholesale Trade

Column 2
Uses that may be permitted with or without conditions on application to the Town Planning Board

Electric Power Station
Off-course Betting Centre
Offensive Trades
Oil Depot, Oil Refinery and Petro-chemical Plant
Place of Recreation, Sports or Culture
Service Industries (not elsewhere specified)

Planning Intention

This zone is intended primarily to provide/reserve land for the development of an industrial estate for industries to be admitted by the Hong Kong Science and Technology Parks Corporation according to the criteria set by the Corporation. Industries to be included would normally not be accommodated in conventional industrial buildings because of their specific requirements.

(Please see next page)

FIGURE 3.2 (CONT'D) STATUTORY NOTES ATTACHED TO THE APPROVED TSEUNG KWAN O OUTLINE ZONING PLAN NO. S/TKO/32 (EXTRACT)

4 THE DEVELOPMENT PROPOSAL

4.1 Development Objectives

Vision of PRS

4.1.1 The Applicant intends to establish a Public Riding School in Tseung Kwan O in an ongoing effort to support equestrian development in the community through expanding public access to equestrian sports and education for the community. This will be realized through the provision of a sustainable and world-class public horse-riding school that sets new standards in terms of architecture, spatial quality, operation efficiency and green features. It will offer an immersive equestrian experience through visitor-centric amenities that integrates with the natural landscape and promotes horse welfare and safety.

PRS Activities / Experiences for Community Benefit

4.1.2 The PRS will provide an extensive range of riding lessons and equine related leisure activities as well as workshops for anyone who is interested in equestrian sports, equine care and professional equestrian development programmes to cultivate a deeper appreciation for equestrian sports and animal welfare for all level of individuals aged 6 or above. It will be professionally managed by the Applicant and will be approved by the British Horse Society ("**BHS**") under their globally recognised accreditation scheme. Key activities / experiences include (***Figure 4.1*** refers):

- **Riding Lessons:** Structured training programs for riders of all skill levels, combining traditional paddock-based instruction with innovative simulator-based lessons for enhanced learning
- **Stable Tours:** Guided behind-the-scenes tours of equestrian facilities, offering insights into daily horse care routines, feeding practices, farrier/shoeing demonstrations, and riding equipment maintenance
- **Stable Management Sessions:** Interactive educational sessions covering horse behaviour, grooming techniques, and stable operations, ideal for those interested in equine care and management
- **Equine Events:** Diverse annual horse shows and exhibitions, including dressage and showjumping events, providing thrilling experiences for participants and spectators alike
- **Open Days:** Family-friendly events featuring pony rides, mini-pony interactions, photo opportunities, stable visits, demonstration of farrier shoeing and equestrian riding
- **Riding for the Disabled:** Therapeutic riding programmes tailored to support the physical, emotional, and cognitive development of individuals with disabilities
- **Seasonal Day Camps & Pony Activities:** Seasonal day camps and themed pony activities offering immersive, hands-on equine experiences for children and families, combining education with entertainment

4.2 Development Proposal

4.2.1 The PRS is located on the three (3) relatively flat platforms within TKOL II/III, Lower Platform (approx. +6.0mPD), Middle Platform (approx. +40.0mPD) and Upper Platform (approx. +140.0mPD), connected by an existing access road currently used by EPD for aftercare activities. The existing road will be shared with the authorised vehicles of the PRS and will also serve as the Emergency Vehicular Access (not included as part of the Application Site). Furthermore, an ancillary utility trench connecting to the three (3) platforms and accommodating essential utilities services in support of the PRS operations will be provided. The Architectural Drawings and indicative Artist's Impressions of the PRS are provided in ***Appendix 1***.

Lower Platform - Reception and Hospitality Lounges

4.2.2 The 'Reception and Hospitality Lounges' at the Lower Platform (approx. +6.0mPD), located along Chun Yat Street adjacent to the existing EPD Facilities (office buildings and associated treatment plants), serves as the welcoming gateway for all entering the PRS, and consists of the Welcome Hub (main administration building), Coach Duty Room, Central Fodder Store (Supplies Storage), E&M Block, ancillary E&M, and ancillary parking.

4.2.3 Visitors can arrive on foot from Chun Yat Street, by private car, taxi or coach to carry out registration at the Welcome Hub of Lower Platform. To minimise disturbance/ interface with existing EPD Facilities, access has been rerouted to avoid the need to enter EPD Facilities access road before arriving at the Drop Off Area. In view of the ongoing aftercare works by EPD within TKOL II/III, direct vehicle and visitor access will be limited up to the Lower Platform, which will be bounded by low-profile fencing and access gates. Access between platforms will be restricted to authorized vehicles of the PRS and EPD only.

4.2.4 The Welcome Hub acts as the Main Visitor Arrival Centre, offering comfortable waiting areas, and dedicated staff assistance to guide visitors through registration, changing, and administrative processes, adopts a nature-inspired design to harmonize with the surrounding greenery.

4.2.5 Following check-in, groups gather in organised groups and board PRS operated vehicles to transverse to other parts of the PRS at different platforms, ensuring safe and streamlined movement throughout the PRS.

Pony Viewing Area as an Additional Public Planning Gain

4.2.6 As a unique offering to the PRS at TKO, a 'Pony Viewing Area' is provided at the Lower Platform to offer an opportunity for the public other than riders to be in close proximity with the ponies. The Pony Viewing Area is strategically located adjacent to the Welcome Hub for optimal accessibility, ensuring convenient access for visitors of all ages and mobility. The Pony Viewing Area will be accessible to all visitors, including those not participating in riding lessons, during the operational hours of the PRS.

Middle Platform - Pony Paddock & Pavilion I

4.2.7 The 'Pony Paddock & Pavilion I' at the Middle Platform (approx. +40.0mPD) will be mainly used for supporting the activities of the Riding for Disabled Association ("**RDA**") to support persons with disabilities, pony riding, and riding lessons for beginners. The Middle Platform is divided into two portions by the existing access road, with the Western Portion being the main area consisting of essential facilities, including The Pony Paddock & Pavilion I (administration building), Arena, Stable, Wash Box, Lungeing Pen, Horse Walker, Farrier & Veterinary Room, E&M Block, Spelling Yard, covered storage areas, ancillary E&M, and ancillary parking.

4.2.8 The Pony Paddock & Pavilion I provides an Indoor Viewing Area open to and overlooking the Arena with panoramic vistas of the surrounding mountains. To better address the needs of persons with disabilities and to improve the overall arrival experience for all visitors, weatherproof and barrier free access will be provided as appropriate.

4.2.9 Facilities aimed at improving horse welfare provided include Lungeing Pen and Horse Walker that provide controlled exercise and training spaces, and Farrier & Veterinary Room that provide dedicated spaces for hoof care, medical treatment, and routine health checks for the horses. Recognizing horses' acute sensitivity to noise and its impact on their wellbeing, the Stables at Middle Platform have been positioned at an optimal distance from the access road while leveraging the elevated topography to provide horses with calming resting area along with scenic views.

4.2.10 The Eastern Portion of the Middle Platform is separated by the existing access road and consists of an extensive Spelling Yard, providing horses with a controlled environment for free exercise, stress reduction, and enhanced physical and mental well-being.

Upper Platform - Horse Paddock & Pavilion II

4.2.11 The 'Horse Paddock & Pavilion II' at the Upper Platform (approx. +140.0mPD) accommodates majority of the PRS riding activities and consists of the Horse Paddock & Pavilion II (administration building), three (3) Arenas, three (3) Stables, Wash Box, Farrier & Veterinary Room, Lungeing Pen, Horse Walker, Staff Block, Spelling Yard, E&M Block, Judge Box, covered storage areas, covered coach's stands / spectator stands, covered refuse collection area, ancillary E&M and ancillary parking.

4.2.12 The Horse Paddock & Pavilion II provides Indoor Viewing Area open to one of the arenas and Spelling Yard, as well as panoramic vistas of the surrounding mountains and Junk Bay, enhancing their overall experience at PRS. The Stables provide a scenic and tranquil environment that allow for horses to enjoy an unrestricted view overlooking the natural landscape and bay views while resting.

4.2.13 The Upper Platform features a strategically designed layout, optimizing PRS facility placement and spatial configuration to maximize operational efficiency. Furthermore, care has been made to minimise the number of low-rise building blocks within the "GB" zone (i.e. only one (1) building block and portion of Stable falling within "GB" zone).

Provision of Ancillary Utilities

4.2.14 As there are no existing utilities provision within the Application Site, an ancillary utility trench (ranging from 1500mm to 3000mm) connecting to the three (3) platforms is proposed to accommodate various essential utilities services (i.e. water mains, electricity cables and ducts, sewage pipes, and other essential service infrastructure) to support PRS operations. The ancillary utility trench connecting the platforms will be fixed aboveground, while the connection between the Middle and Upper Platforms will be provided along an existing drainage nullah. The extent of excavation works and alignment of the ancillary utility trench will be subject to investigation and refinement during the detailed design and care will be made to ensure no conflict with EPD's aftercare operations.

4.3 Technical and Accommodation Schedules

4.3.1 The Technical and Accommodation Schedule at ***Table 4.1*** summarises the major development parameters of the PRS:

Table 4.1 Technical and Accommodation Schedules

TECHNICAL SCHEDULE OF THE PRS	
Overall Development	
Application Site Area	Approx. 46,500m^2 (consisting areas of the three platforms (43,700m^2) and associated ancillary utility trench (2,800 m^2))
Total GFA	Approx. 9,000m^2
Domestic	Approx. 200m^2*(1)
Non-domestic	Approx. 8,800m^2
Total Site Coverage	Approx. 20.9%
Domestic	Approx. 0.4%
Non-domestic	Approx. 20.5%
Building Height	
Storeys	Proposed 1 storey
Main Roof (m)*(2)	Proposed 4.8 to 7.7m
No. of Building Blocks	Proposed 17 nos.
Lower Platform – Reception and Hospitality Lounges	
Site Area	Approx.10,200m^2
GFA	
Domestic	Approx. 200m^2 *(1)
Non-domestic	Approx. 980m^2
Site Coverage	
Domestic	Approx. 0.4%
Non-domestic	Approx. 3.2%
Building Height	
Storeys	Proposed 1 storey
Main Roof (m)	Proposed 4.8m to 7.0m
Main Roof (mPD)*(2)	Proposed +11.5mPD to +18.5mPD
No. of Building Blocks	Proposed 5 nos.
Middle Platform – Pony Paddock & Pavillion I	
Site Area	Approx.12,800m^2
GFA	
Domestic	N/A
Non-domestic	Approx. 2,480m^2
Site Coverage	
Domestic	N/A
Non-domestic	Approx. 5.3%
Building Height:	
Storeys	Proposed 1 storey
Main Roof (m)	Proposed 6.0m to 7.7m
Main Roof (mPD)	Proposed. +46.3mPD to +48.2mPD
No. of Building Blocks	Proposed 4 nos.
Upper Platform – Horse Paddock & Pavilion II	
Site Area	Approx. 20,700m^2
GFA	
Domestic	N/A
Non-domestic	Approx. 5,340 m^2
Site Coverage	
Domestic	N/A
Non-domestic	Approx. 12.0%
Building Height:	
Storeys	Proposed 1 storey
Main Roof (m)	Proposed 5.0m to 7.7m
Main Roof (mPD) *(2)	Proposed +144.8mPD to +148.1mPD
No. of Building Blocks	Proposed 8 nos.

**(1) Domestic GFA for Coach Duty Room for the coach staying on shift*
**(2) The proposed buildings will be supported on varying levels of foundations on platform.*

ACCOMMODATION SCHEDULE OF THE PLATFORMS	
Lower Platform	Welcome Hub (administration building), Coach Duty Room, Central Fodder Store, E&M Block, ancillary E&M, ancillary parking*(1), Pony Viewing Area
Middle Platform	The Pony Paddock & Pavilion I (administration building (including Indoor Viewing Area), Arena, Stable, Wash Box, Lungeing Pen, Horse Walker, Farrier & Veterinary Room, E&M Block, Spelling Yard, covered storage areas, ancillary E&M, ancillary parking*(2)
Upper Platform	The Horse Paddock & Pavilion II (administration building (including Indoor Viewing Area)), Arenas, Stables, Wash Box, Farrier & Veterinary Room, Lungeing Pen, Horse Walker, Staff Block, Spelling Yard, E&M Block, Judge Box, covered storage areas, covered coach's stands / spectator stands, covered refuse collection area, ancillary E&M, ancillary parking*(2)

**(1) Car parking Space at Lower Platform are provided for visitors and staff*
**(2) Car parking Space at Middle and Upper Platform are provided for staff and operational vehicles*

4.4 Design and Community Considerations of the PRS

4.4.1 The PRS responds to public demand by creating an equine facility with a high-quality and enjoyable environment for visitors, horses and its riders. Thoughtful design features have been incorporated to ensure a safe and sustainable facility while minimizing the impacts to neighbouring residential developments, the existing woodland, and CWBCP, including:

- **International Standard of Equine Facilities and Careful Equestrian Facility Design for Equine Wellbeing:** The PRS will provide modern facilities designed to international standards for horse and rider well-being, prioritizing safety, hygiene and equine management. Veterinary care and farrier service will also be available. The Stables are strategically placed to maximize distance from access roads and EVA Driveway to ensuring a tranquil environment required for equine well-being.

- **Inviting Space for Equine Education and Appreciation:** The PRS will be a platform to promote equestrian development through a diverse range of educational activities, including riding lessons, stable tours, stable management sessions, and equine events ***Figure 4.1*** refers). Open Days will also be held with a wide range of horse-related and other recreational activities (**Section 4.1.2** refers), fostering a deeper understanding of equine sports and culture while offering public enjoyment. The 'Pony Viewing Area' acts as an introductory space providing a welcoming and cohesive arrival experience for visitors and the public who may not have yet signed up to riding lessons an opportunity to safely observe ponies up close in a secure environment.

- **Enhancing Accessibility for Persons with Disabilities:** Demonstrating a commitment to inclusivity, the PRS will offer dedicated therapeutic riding activities for persons with disabilities. The PRS will collaborate with the Riding for Disabled Association and provide accessible amenities at the Middle Platform, including weather-proof pathways and barrier-free access to create a seamless and inclusive equestrian experience.

- **Sustainable Building Design and Seamless Integration with the Surrounding Landscape:** The PRS prioritizes sustainability and landscape integration through a low-rise, low-impact design. Energy-efficient elements like operable high windows and adaptable glazing reduce consumption while connecting occupants with the natural surroundings. The layout and material selection preserve views of the CWBCP and Junk Bay, ensuring the facility harmonizes with the environment.

- **Maximizing Greenery and Respecting Natural Surroundings:** The PRS design incorporates landscaped features to enhance the visitor experience and protect the natural environment, including a Pony Viewing Area with landscape features to serve as a welcoming entrance and public space; vertical greening and plantings that blend seamlessly with the environment, minimizing visual obstruction to the north and east; and landscaped arrival gardens provide inviting, nature-connected entrances, enriching visitor experience. To protect the nearby woodland and CWBCP, trees will be strategically planted along the northern boundary of the Upper Platform to create a greening buffer that reduces potential noise or glare impacts on local wildlife.

- **Minimizing Potential Impacts to the Surrounding:** The PRS is a low-density, low-profile facility designed to minimize intrusion on its natural and residential surroundings. The stables and equine facilities are well distanced from the nearby residences (i.e. approx. 450m and 700m from the Middle and Upper Platforms to Le Prestige respectively and approx. 590m and 460m from the Middle and Upper Platforms to The Beaumount II). All equine facilities will adopt rigorous housekeeping protocols, including daily waste clearing from stalls and collection, implementing stable cleansing practices, covering waste by tarpaulin etc, to minimize any potential odour sources. On-site noise sensitive E&M equipment will be enclosed to minimize noise disturbances. A series of control measures during both construction and operational phases (e.g. quiet plant equipment, temporary noise barriers and enclosed structures for possible fixed noise sources, and restricted access to the Upper Platform (i.e. visitors and staff only)) will be implemented to minimise the disturbance to the CWBCP.

- **Lighting and Glare Mitigation:** Low-intensity and directional lighting will be used where necessary within the Application Site and access road to ensure safety while minimising potential glare impact. The angle of solar panels within the Application Site will also be adjusted to avoid glare impact to the nearby residence. Adhering to a strict protocol, interior and exterior lighting during designated/operational hours will be limited, while lighting will be turned off overnight to support equine health and reduce light spill. Lighting along the access road will be designed to minimize glare and light spill to in compliance with relevant ordinances / guidelines and to prevent disruption to nearby residences and the adjacent CWBCP, for example, the incorporation of glare shields (***Appendix 5*** refers).

- **Addressing Concerns on Landfill Gas Hazard:** Protective and precautionary measures will be implemented per relevant guidelines/regulations (e.g. routine monitoring for all excavations, manholes, chambers etc.) during construction phase. Similarly, during the operational phase of the PRS, passive control systems, gas detection systems, and effective site management will be employed, while maintenance staff in confined spaces shall adhere to entry safety procedures as stipulated relevant regulation (***Appendix 5*** refers).

4.5 Proposed Operational Arrangement

4.5.1 In line with existing PRS developments, the Proposed PRS will tentatively operate from 7:00AM to 12:00PM & 2:00PM to 9:00PM during the weekdays, and from 7:00AM to 12:00PM & 2:00PM to 6:00PM during the weekend, with some adjustments to operating hours during periods of hot weather in accordance with relevant horse welfare guidelines, and with an anticipated annual attendance of over 40,000 visitors across various offerings. While the Pony Viewing Area is accessible to all visitors, including those not participating in riding lessons, the PRS facilities will only be accessible to those with scheduled lessons and/or pre-registered for prescribed programmes due to security/safety concerns (for visitors and horses). Enrolment of Riding Lessons and other activities / experiences will follow existing established enrolment procedures (i.e. online application and assigned on a first-come-first-served basis, to a class of an appropriate level, which will be decided by the PRS according to their horse riding experiences, once places are available).

4.5.2 Rate and charges for the Proposed PRS will reference that of the existing three (3) PRS currently operated by the Applicant e.g. Group Lessons as of January 2026 ranging from $355 per 45mins (Pony) to $435 per hour (horse)), subject to future reviews having regard to operational sustainability.

4.6 Conceptual Landscape Design

4.6.1 The landscape design for the PRS aims to support equestrian functions while seamlessly blending the development with the context of the TKOL II/III area and the adjacent Clear Water Bay Country Park (CWBCP). This landscape approach ensures architectural and environmental cohesion, avoiding an out-of-context appearance. The Conceptual Landscape Master Plan and Tree Preservation and Removal Proposal are provided in ***Appendix 2***.

4.6.2 The following proposals are considered in the landscape design, to:

- Strategically incorporate native trees and shrubs species within the Application Site to improve visual and physical comfort for both riders/visitors and horses, while promoting ecological connectivity with the surrounding natural environment.
- An extensive landscape treatment, including tree plantings, will be provided along the northern boundary of the Upper Platform to serve as a greening buffer to the existing woodland and CWBCP to the northeast.
- Enhance the public/riders' experience through intuitive and clear way-finding signage to guide seamless circulation across the PRS, creating a cohesive recreational journey while improving accessibility for all users.
- Incorporate amenity plantings throughout the PRS where practicable, including ornamental trees, flowering shrubs, and creeping plants. These soft landscape treatments will visually soften architectural edges and hard structural lines. A thoughtful blend of native and ornamental species, combined with season planting strategies, will create year-round visual interest while reinforcing the unique character of the PRS.

4.6.3 The construction and implementation of the PRS and the Utility Trench will inevitably result in impact to existing trees. All **62** nos. of trees, which are on land with gradient variations or with poor form/ health/structural conditions and not suitable for transplantation, are proposed to be felled. No Old and Valuable Trees ("**OVT**") are found within the Application Site.

4.6.4 To compensate the proposed tree felling within the Application Site, **62** nos. of compensatory trees are proposed, achieving a compensatory ratio of at least 1:1 in terms of quantity. To provide greening effects and provide visual enhancement for the landscape areas, a matrix of native and ornamental species is proposed.

4.7 Access Arrangements and Internal Transport Arrangement

4.7.1 An existing vehicular access at the intersection of Chun Yat Street and Chun Sing Street would serve the PRS as well as existing EPD Facilities (***Appendix 3*** refers).

4.7.2 At present, there are no proper crossing facilities at Chun Yat Street near main entrance of the Proposed PRS. To enhance pedestrian accessibility to the Proposed PRS, a cautionary pedestrian crossing across Chun Yat Street is proposed.

4.7.3 There are three existing bus route nos. A28 (CTB), 290X (KMB), and 797 (CTB) running along MTR LOHAS Park Station, Chun Yat Street and Chun Sing Street. A new stop at Chun Sing Street is proposed for these routes to serve the visitors of the Proposed PRS to and from the MTR LOHAS Park Station. The proposed crossing facilities will enable the visitors to and from the Proposed PRS to access the new bus stop at Chun Sing Street conveniently.

4.7.4 Within TKOL II/III, restricted access between the three platforms will be made via shared use of the existing restricted access road currently used by EPD. The existing access road will undergo upgrading and widening works by EPD to facilitate operation and aftercare of TKOL II/III by EPD which will enable two-way traffic operations, while meeting a minimum width of 6m necessary for Emergency Vehicular Access ("**EVA**"). The widened access road will ensure seamless connectivity between the three platforms, improving accessibility for students, persons with disabilities, and visitors. The completion of the widening works of the access road by EPD is expected to be completed in 2027.

4.7.5 The existing access road will remain restricted to authorized vehicles only. Dedicated PRS-operated vehicles will be responsible for the transfer of visitors between platforms. As such, low traffic volume is anticipated. The Applicant will maintain close liaison with EPD on the usage arrangements of the access road to ensure no conflict arise between EPD and the PRS operations.

4.7.6 As there are no relevant internal transport facilities recommendations stipulated in the HKPSG, reference was made to the existing provision at Tuen Mun PRS. In comparison with the internal transport facilities at the Tuen Mun PRS, the Proposed PRS in TKO will provide more private car parking spaces to enhance public convenience. Parking provisions for coaches, shuttles, and motorcycles have also been incorporated at the Lower Platform. Furthermore, cycle parking spaces are proposed near the end of the cycle track at Chun Yat Street for visitors arriving by bicycles. Overall, a variety of parking provisions are provided to serve the Proposed PRS in TKO. The details of the proposed internal transport provision is detailed in ***Table 4.2*** below and in ***Appendix 3***.

Table 4.2 Internal Transport Provisions

INTERNAL TRANSPORT PROVISION			
Parking Space	**Location**	**Proposed Provision**	
		By Platform	**Total**
Total no. of Car Parking Space (Visitor/Staff/Maintenance)	Lower Platform	50*(2)	58*(1)
	Middle Platform	3*(3)	
	Upper Platform	5*(3)	
Total no. of Accessible Car Parking Space	Lower Platform	4*(2)	8
	Middle Platform	2*(3)	
	Upper Platform	2*(3)	
Total no. of Motorcycle Parking Space	Lower Platform	4	4*(4)
	Middle Platform	-	
	Upper Platform	-	
Total no. of Golf Cart Parking Space	Lower Platform	7	14*(5)
	Middle Platform	3	
	Upper Platform	4	
Total no. of Coach Parking Space	Lower Platform	2	2*(6)
	Middle Platform	-	
	Upper Platform	-	
Total no. of Shuttle Parking Space	Lower Platform	3	3*(7)
	Middle Platform	-	
	Upper Platform	-	
General Lay-by	Lower Platform	1	1
	Middle Platform	-	
	Upper Platform	-	
Total no. of L/UL Bays	Lower Platform	2	6
	Middle Platform	3	
	Upper Platform	1	

**(1) The number of car parking spaces is made with reference to the existing provision under Tuen Mun Public Riding School*

**(2) A total of 32 nos. of car parking space are provided at Lower Platform for visitors (i.e. 28 nos. of car parking space and 4 nos. of accessible car parking space) and a total of 22 nos. of car parking spaces are provided for staff use at Lower Platform*

**(3) Car parking space at Middle and Upper Platforms are provided for staff and operational vehicles*

**(4) The 4 nos. of motorcycle parking spaces at Lower Platform are for visitors.*

**(5) The 14 nos. of Golf Cart Parking are provided for staff transportation between the three (3) Platforms.*

**(6) Coach parking is provided for tour groups only. Each coach parking space can serve a Group Size of 40 visitors.*

**(7) In line with existing practice, no external shuttle bus service will be provided. The shuttle parking spaces provided within the PRS is dedicated for the internal shuttle service to facilitate the transfer of visitors between the platforms. The pick-up and drop-off points will be provided outside Welcome Hub at Lower Platform.*

Remarks: It is proposed to provide 14 nos. cycle parking spaces near the end of cycle track at Chun Yat Street. The exact number and location will be further agreed with TD separately.

4.8 Development Programme

4.8.1 The PRS is anticipated to be completed in 2030 tentatively.

Public Riding School Open Day

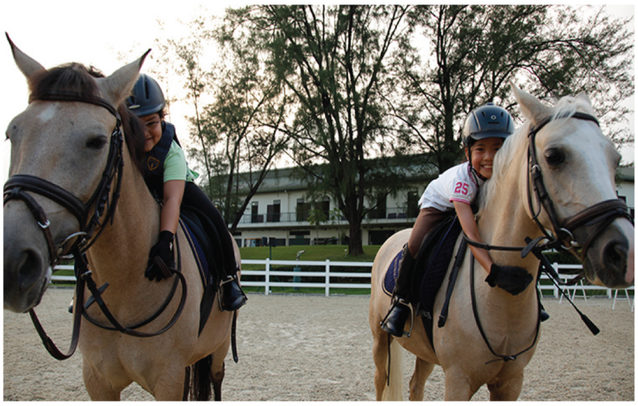
Public Riding School Open Day

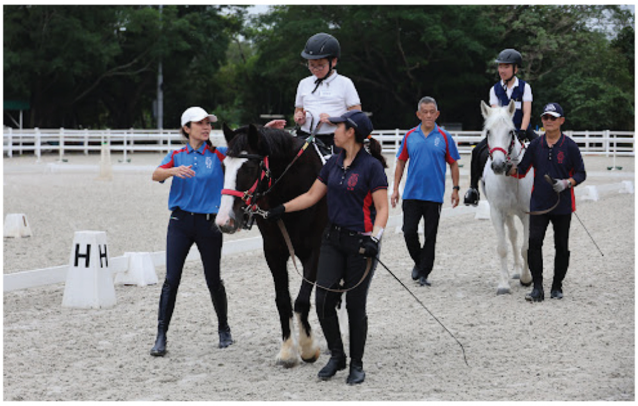
Farrier demonstration

Stable Visit

Pony Ride

Pony Ride


Pony Riding Lesson



Riding for the Disabled - Therapeutic Riding Lesson

FIGURE 4.1 TENTATIVE ACTIVITIES / EXPERIENCES WITHIN THE PROPOSED PUBLIC RIDING SCHOOL

5 PLANNING JUSTIFICATIONS

5.1 Established Precedents for Recreational Use of Restored Landfills

5.1.1 The Government has long encouraged the development of gainful afteruses such as recreational, environmental or other community facilities at restored landfills. Over the years, EPD has strived to develop restored landfills into popular and well utilised recreational and sports facilities for the public, for instance, the restored Tseung Kwan O Stage I Landfill has been developed for a cycle track cum footpath, Pet Garden and Football Training Centre, and E-Co Village (a camp site cum green education ground), which serve as a recreational outlet for public enjoyment. Similarly, Jordan Valley Landfill has been redeveloped into Jordan Valley Park, which offer radio-controlled model car racing circuit, community garden, play areas etc. Other successful examples include Ngau Chi Wan, Sai Tso Wan, Gin Drinkers Bay, and Shuen Wan Landfills, all revitalized into vibrant recreational hubs. A list of restored landfills with approved recreational afteruses is provided in ***Annex 1***.

5.1.2 A PRS in TKO (New Territories East) will support the Applicant’s commitment in making equestrian sports accessible to all by achieving a balanced geographical distribution of equine facilities across the city, thereby enhancing their riding experiences and enjoyment. Building on the successful precedents of transforming restored landfills, it presents a parallel opportunity to provide equestrian facilities, aligning with the Government’s vision of converting restored landfill into a community asset. The initiative of PRS will extend the legacy of the transformed restored landfills while maximising the opportunity for access to equestrian sports.

5.2 In Line with Government Policies

5.2.1 The PRS is in line with Government’s policies in promoting sports culture and in creating a Liveable City and an international metropolis for culture, arts, creativity, sports and events. As outlined by the Government, promoting sports in the community and supporting elite sports development is a key policy objective. The PRS with a wide range educational and interactive activities / experiences as indicated in **Section 4.1.2** above aims to promote equine culture to the wider community, transforming the equestrian landscape in Hong Kong, and provide cutting-edge equestrian facilities and training platforms to nurture riders in excelling in local and international competitions. In-principle support for the PRS has been sought from CSTB.

5.2.2 Furthermore, the PRS aligns with the HK2030+ objectives, which emphasize sustainable development, enhancing community well-being, and fostering a vibrant, inclusive city. By offering accessible sports and recreational opportunities for a wide range of people, the PRS supports the goal of creating a more inclusive, healthy, and liveable environment for Hong Kong’s future.

5.3 In Line with the Statutory Planning Intentions and Town Planning Board Guidelines for Application for Development Within Green Belt Zone under Section 16 of the Town Planning Ordinance with Minimal Impact to "Green Belt" Zone and adjoining Clear Water Bay Country Park

5.3.1 The PRS is in line with the Statutory Planning Intention of the "O" zone, providing active recreational uses to the community that is compatible to the surrounding environment. Although a small portion of the Application Site within TKOL II/III located in the "OU(Industrial Estate)" zone (approx. 210m² or 0.5% of the Application Site area), this area mainly consists of the areas between Chun Sing Street (zoned "OU(Industrial Estate)") and the "O" zone. Notwithstanding, 'Place of Recreation, Sports or Culture' is a Column 2 use under the "OU(Industrial Estate)" zone nor will it undermine the integrity of the TKO Innopark located within this zoning.

5.3.2 While a minor portion of northern strip of the Upper Platform (approx. 6,100m^2 or 13.1% of the Application Site area) falls within the fringe of the "GB" zone, this portion falls within the TKOL II/III boundary and possesses relatively low ecological value, and is lightly vegetated with minimal tree cover consisting of only 4 nos. of trees of poor health, structural condition and low anticipated survival rate after transplanting (***Annex 3*** refers). Furthermore, this strip only accounts for approx. 0.6% of the entire GB zone north of TKOL II/III. The PRS also complies with the criteria stipulated in the Town Planning Board Guidelines for Application for Development Within Green Belt Zone under Section 16 of the Town Planning Ordinance ("**TPB PG-No.10**") (***Annex 3*** refers). In this regard, the PRS will not impact the integrity of the "GB" zone and the adjoining CWBCP.

5.3.3 The PRS facilities have been strategically designed and carefully sited to minimize visual and environmental impacts on the "GB" zone. This is achieved through low-rise and low-density buildings/structures, including open-air arenas with low-profile fencing all designed to blend seamlessly with the natural surroundings. Careful consideration has been given to minimising the number of low-rise building block and/or structure within the "GB" zone, with only one (1) building block and a portion of the stable falling within "GB" zone. Compensatory native trees will be planted strategically at areas falling the "GB" zone to enhance the amenity value of the area while serving as a landscape buffer between the PRS facilities and the existing woodland. The PRS is also located with adequate separation distance from ecologically sensitive areas (i.e. CWBCP over 150m and Conservation Area over 450m). Various design considerations and mitigation measures will be adopted to minimise the impacts to the existing woodland and CWBCP, as outlined in **Section 4.4.1** and the EA at ***Appendix 5***.

5.4 Compatibility with Surrounding Land Uses

5.4.1 The PRS is well aligned with surrounding land uses in terms of scale, function, and character. As a low-rise and low-impact recreational facility, it is complementary to its surroundings and preserves the area's visual openness and natural ambience. Focused on educational and interactive equestrian offerings, it aligns with community-oriented recreational uses and enhances the overall provision of recreational opportunities within Open Space in the District. Its sensitive integration with the surrounding natural landscape, low-density and low-rise buildings with minimal footprint, and low traffic generation further reinforces its compatibility with the existing and planned uses in the vicinity.

5.5 Applicant's Commitment to Community and Sport Development and Accommodating the Increasing Demand for Equine Facilities

5.5.1 The HKJC, established in 1884, has played a major role in Hong Kong's equestrian sports development. Public Riding Schools in Hong Kong are equestrian facilities available to the general public that provide horse riding and equestrian related programmes to the community, offering affordable, accessible riding lessons and programmes that inspire interest in horse riding and horse care to individuals of all ages and skill levels to the sport.

5.5.2 Given the high demand of the equine facilities among the public, existing PRS facilities have exceeded their capacity to accommodate the growing public participation of the sport after the 2008 Olympic and Paralympic Games. The Applicant currently operates three (3) PRS developments in Tuen Mun (New Territories West), Pok Fu Lam (Southern Hong Kong Island) and Lei Yue Mun Park (Eastern Hong Kong Island). They altogether draw 70,000 visitors annually whilst lessons are at full capacity yet yielding a waiting list of more than 20,000 students. Supplementary information on existing PRS developments in Hong Kong are provided in ***Annex 4***.

5.5.3 Riding on the success and the growth of equestrian sports since the 2008 Beijing Olympics in Hong Kong and in response to the growing demand for equestrian facilities, the Applicant has been proactively searched for a suitable site to establish Hong Kong's fourth PRS in furtherance of equestrian sports in Hong Kong. The PRS in TKO will become Hong Kong's fourth PRS, not only expanding overall capacity and alleviating pressure on current facilities, but also contributing to a more even geographical distribution of PRS facilities across the territory. This strategic placement will enhance accessibility for a broader segment of the community, enabling more people from different districts to engage in horse riding and related activities, and further support the promotion of equestrian sports throughout Hong Kong.

5.6 Provision of Cutting-Edge Equine Facilities to Nurture Talents for The Equine Industry While Promoting Equestrian Sports to the Wider Community

5.6.1 The PRS will be a modern, well-equipped facility designed to make equestrian sports accessible and inclusive and aligning with the government's "Sports for All" vision. It will provide a safe environment for various equestrian activities for individuals meeting the age requirement and backgrounds to promote the sport. Stable visits to the public will also be hosted, where participants can discover more about horse's daily life and stable operations. As part of the Applicant's commitment to inclusivity and building a supportive equestrian community, the PRS will also offer riding programmes and equestrian activities specifically designed for persons with disabilities. These programmes are designed to offer proven physical and mental health benefits while promoting social integration. The existing PRS developments hosted over 70,000 visitors yearly over various activities while it is anticipated that the PRS can host more than 40,000 visitors yearly amongst all offerings.

5.7 Provision of "Pony Viewing Area" to enhanced Public Enjoyment & Experience and Recreational Value

5.7.1 A 'Pony Viewing Area' provided as a Public Planning Gain will serve as an introductory space for the public an opportunity to safely observe ponies in close proximity within a secure and controlled environment and to promote equestrian development while ensuring seamless integration with the surrounding natural environment and complementing to the PRS as an additional feature operated and managed by the Applicant. Unique to the PRS at TKO (as shown in ***Annex 4***), the Pony Viewing Area will enhance the recreational value of the PRS and encourage wider community participation in equine and outdoor activities, ultimately contributing to the promotion of equestrian development.

5.8 Consultation with Sai Kung District Council

5.8.1 Sai Kung District Council was consulted on 6 January 2026, where members unanimously expressed support for the PRS within TKOL II/III. Members recognised the benefits of the PRS in optimising land resources, promoting equestrian sports, creating job opportunities, and providing recreational facilities for nearby residents. Comments/suggestions were received in respect to accessibility, geotechnical and safety considerations, environmental considerations (including glare), and transport arrangements. Comprehensive design and technical assessments have been undertaken to confirm the acceptability of the PRS in these respects as demonstrated in this Application.

6 TECHNICAL JUSTIFICATIONS

6.1 No Adverse Traffic Impact

6.1.1 A Traffic Impact Assessment ("**TIA**") has been undertaken and provided in ***Appendix 3***. The TIA concludes that based on the traffic analysis, the PRS along with the proposed improvement works to pedestrian accessibility (i.e. proposed cautionary pedestrian crossing across Chun Sing Street) and accessibility of the PRS (i.e. proposed additional bus stop at Chun Sing Street) would generate minimal traffic during the proposed peak periods in both construction and operational phases and have minimal impact on the junction performance. All critical junctions are anticipated to be operate within capacities during both phases, and as such, the PRS is considered to be acceptable from a traffic point of view.

6.2 No Adverse Visual Impact

6.2.1 A Visual Impact Assessment ("**VIA**") has been prepared to assess the potential visual impact of the PRS to its surrounding areas and to visualise the relationship of the PRS with the surrounding context (***Appendix 4*** refers). A total of Six (6) potential Viewpoints ("**VP**s") were identified with the PRS visible at three (3) VPs. As demonstrated in the photomontages, the PRS with the implementation of mitigation measures (i.e. façade design and landscape treatments) will seamlessly blend in with the surrounding built development to the east and the natural environment with dense woodlands and vegetation to the north, south and west.

6.2.2 The VIA conducted in support of this Planning Application concludes that the no adverse visual impact arising from the PRS, taking into consideration the visual effect of the relationship with the surrounding context. The PRS is considered not incompatible with the surrounding context.

6.3 No Adverse Environmental Impact

6.3.1 An Environmental Assessment ("**EA**") has been conducted with a view to ensure the acceptability of the PRS development (***Appendix 5*** refers). With the implementation of various design and control measures including housekeeping rules in proper waste management practices to control hygiene and odour matters, proper design of lighting fixtures to minimize nuisance and continuous monitoring of landfill gas and good design measures to prevent the potential risk, the EA has showed that the proposed PRS would not result in long-term environmental impacts. Besides, to control the short-term environmental impact during the construction, mitigation measures such as dust control measures, use of noise barriers, good site management practices and regularly monitoring of landfill gas for excavation works, would be implemented to mitigate the impact to within established standards and guideline and environmental monitoring and audit will be carried out during construction phase of the project to ensure the effectiveness of the measures implemented.

6.4 No Adverse Infrastructural Impact

Sewerage

6.4.1 A Sewerage Impact Assessment ("**SIA**") (***Appendix 6*** refers) was prepared which concludes that the existing sewerage system downstream to the proposed connection point had been checked to have sufficient capacity, and the contribution from the proposed PRS to the Tseung Kwan O Preliminary Treatment Works is considered negligible. As such, no adverse sewerage impact is anticipated due to the Proposed PRS.

Drainage

6.4.2 A Drainage Impact Assessment ("**DIA**") (***Appendix 7*** refers) was prepared which assessed the drainage provisions within the Application Site and reviewed the public drainage system in the vicinity. Subject to agreement by EPD, the existing drainage infrastructure within TKOL II/III will also be utilised for stormwater discharge to the public drainage system, with sufficient capacity to cater for the increased surface runoff due to the PRS. Further, new drainage system will be designed to serve each platform and the associated facilities, subject to further study. The design standard for the drainage system of PRS will be able to accommodate a flood event, of which the design flood protection level is in accordance with the Stormwater Drainage Manual. It is concluded that no adverse drainage impact to the existing public drainage system is anticipated.

6.5 No Adverse Water Supply Impact

6.5.1 A Water Supply Study (***Appendix 8*** refers) was prepared for the PRS which concludes that the PRS is technically feasible from water supplies perspective, and no insurmountable impact will be aroused to the existing freshwater supply system and flushing water system from the PRS with the proposed waterworks connections.

6.6 No Adverse Geotechnical Impact

6.6.1 A Geotechnical Planning Review Report ("**GPRR**") was prepared for the PRS that may affect, or be affected by, natural terrain of man-made slopes or retaining wall features in accordance with GEO Advice Note for Planning Application under TPO (***Appendix 9*** refers).

6.6.2 As recommended under the Natural Terrain Hazard Study (covering the engineering geological assessment, natural terrain hazard review, natural terrain hazard assessment and hazard mitigation strategy), a No-Build Zone has been delineated at the northern portion of the Upper Platform, which will also safeguarded the PRS from potential natural terrain hazards. The Lower and Middle Platforms fall outside No-Build Zone and will not be affected by natural terrain hazard. A minor portion of the PRS at Upper Platform is located within the No-Build Zone. Mitigation measures (e.g., retaining wall), if necessary, will be further explored at a later stage. Further, two (2) boulders with potential boulder fall risk within natural terrain are recommended to remove or stabilized in-situ as precautionary measures.

6.6.3 The structures of the PRS proposed on the platforms will adopt a stepped-raft foundation to follow the elevation of the terrain and limit excavation depth to within 500mm.

6.6.4 A preliminary slope stability assessment was carried out to assess the impact of the PRS on the existing slope features. It is concluded that the stability of the existing features is considered to be satisfactory to the current standard. The planned development load at the three platforms has been limited to 40kPa to 50kPa. The preliminary slope stability assessment suggested the FoS of the existing landfill slopes are still satisfactory even with 50kPa load at all the platforms.

6.6.5 In this regard, it is concluded that the PRS is considered feasible from a geotechnical perspective.

7 CONCLUSION

7.1 This Section 16 Planning Application seeks planning permission for the PRS with ancillary facilities at TKOL II/III. The PRS is in line with Government's initiatives in further fostering equestrian sports and activating recreational activity at TKOL II/III. It has been demonstrated in this SPS that the PRS is justified on the following grounds:

- The PRS is fully in line with Government's policies to promote sports culture and enhance community well-being. Furthermore, it builds upon the established precedent of successfully developing restored landfills into vibrant public recreational facilities;
- The three (3) platforms are suitable for the development of the PRS in meeting the operational needs of the PRS while acceptable from a technical perspective in respect to development at the restored TKOL II/III;
- The PRS is in line with the Planning Intention in providing low-density and low-impact recreational facilities for public enjoyment and is compatible with the surrounding area;
- The PRS will address the growing public demand for equine facilities and improve their geographical distribution across the territory. It will provide cutting-edge amenities to nurture future industry talent and promote equestrian sports to the wider community;
- The PRS will enable equine facilities and programmes to be more accessible to visitors and the general public, including individuals who may not be familiar with horses or animal welfare; and
- No significant adverse visual, traffic, environmental, infrastructural, water supply impacts and geotechnical are anticipated.

7.2 In light of the justifications and planning merits put forth in this SPS, we sincerely request the BOARD to give favourable consideration to this Application.

Edited &
Approved by: Vincent Lau __________
Prepared by: Agnes Leung __________

Date: 4 February 2026
File Ref: HKJC/TKOL/2

Annex 1

RESTORED LANDFILLS WITH APPROVED RECREATIONAL AFTERUSE – SUMMARY INFORMATION

Annex 1 – Restored Landfills with Approved Recreational Afteruse - Summary Information

	Restored Landfill	Location	Statutory Zoning	Area (ha)	Landfill Closed	Period of Restoration Works[1]	Ongoing aftercare works within the Restored Landfill (Y/N)[2]	Approved Recreational Afteruses[3&4]	Photos
1	Jordan Valley	New Clear Water Bay Road, Jordan Valley	Currently zoned "Open Space" ("**O**") on the Approved Ngau Tau Kok and Kowloon Bay Outline Zoning Plan No. S/K13/34	11	1990	1997-1998	Y	• 5 ha of the restored landfill is designated for Jordan Valley Park, which is operated by the Government and opened to the public in 2010, which features radio-controlled model car racing circuit, horticultural education centre, community garden, children's play areas, elderly exercise corner, jogging track, etc.	Source: Environmental Protection Department
2	Ma Yau Tong Central	Tseung Kwan O Road, Lam Tin	Currently zoned "O" on the Draft Kwun Tong (South) Outline Zoning Plan No. S/K14S/27	11	1986	1997-1998	Y	• 0.1 ha of the restored landfill is designated for sitting-out area adjacent to Lam Tin Park, which is operated by the Government and opened to the public in 2011	Source: Environmental Protection Department
3	Ma Yau Tong West	Tseung Kwan O Road, Lam Tin	Currently zoned "Green Belt" ("**GB**") on the Draft Kwun Tong (South) Outline Zoning Plan No. S/K14S/27	6	1981	1997-1998	Y	• 0.1 ha of the restored landfill is designated as sitting-out area, which is operated by the Government and opened to the public in 2011	Source: Environmental Protection Department
4	Sai Tso Wan	Sin Fat Road, Lam Tin	Currently zoned "O" on the Draft Cha Kwo Ling, Yau Tong, Lei Yue Mun Outline Zoning Plan No. S/K15/28	9	1981	1997–2006	Y	• 3 ha of the restored landfill is designated for Sai Tso Wan Recreation Ground for soccer and baseball fields, which is operated by the Government and opened to the public in 2004	Source: Environmental Protection Department

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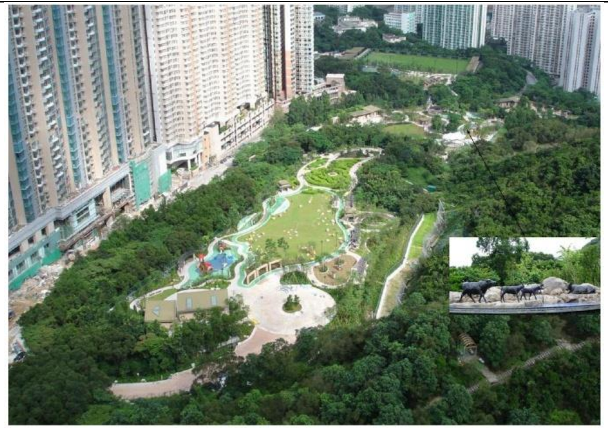
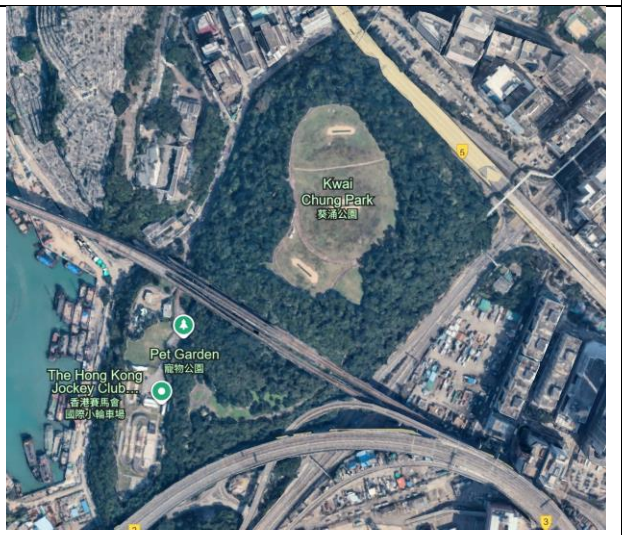
[1] Exclusion of monitoring and aftercare works by Environmental Protection Department

[2] Full restoration of a closed landfill may take at least 30 years during which building development cannot take place due to settlement problems. Source: Environmental Protection Department, " Restoration and Afteruse of Closed Landfills," Hong Kong Government. Available at: https://www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/msw_racl.html

[3] Environmental Protection Department, "Landfill Restoration and Afteruse - Summary Information," Hong Kong Government. Available at: https://www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/msw_si_lra.html

[4] Audit Commission, Report No. 70 of the Director of Audit: Chapter 1 – Management of Restored Landfills (Hong Kong: Audit Commission, 3 April, 2018). Available at: https://www.aud.gov.hk/pdf_e/e70ch01.pdf.

5	Ngau Chi Wan	Fung Shing Street, Ngau Chi Wan	Currently zoned “O” on the Approved Ngau Chi Wan Outline Zoning Plan No. S/K12/18	8	1977	1998-2000	Y	- 4 ha of the restored landfill was designated for Ngau Chi Wan Park. which is operated by the Government and opened to the public in 2010 with first phase opened in Aug 2009. Facilities include archery field, jogging trail, elderly fitness corners, children's play areas, basketball court, etc.	 Source: Environmental Protection Department
6	Siu Lang Shui	Tuen Mun	Currently zoned “GB” and “Site of Special Scientific Interest” (“**SSSI**”) on the Approved Tuen Mun Outline Zoning Plan No. S/TM/41	12	1983	1999–2000	Y	- 2.3 ha of the restored landfill is designated as a Site of Special Scientific Interest for over-wintering of butterflies	 Source: Environmental Protection Department
7	Gin Drinkers Bay	Kwai Chung	Currently zoned “O” on the Approved Kwai Chung Outline Zoning Plan No. S/KC/32	29	1979	1999 - 2000	Y	- 25.5 ha (including below BMX Park and cricket grounds) of the restored landfill was used for Kwai Chung Park, with Phase 1 (3.02 ha) opened in Dec 2025[5] - 3.92 ha of the restored landfill was used for The Hong Kong Jockey Club International BMX Park, which is operated by HKJC and opened in 2009; - 4.5 ha of the restored landfill[6] was used for temporary cricket grounds, which is operated by Hong Kong Cricket Association and opened in 2018[7]	 Kwai Chung Park 葵涌公園 Pet Garden 寵物公園 The Hong Kong Jockey Club Source: Google Earth (Photo saved at 23 Jan 2025)

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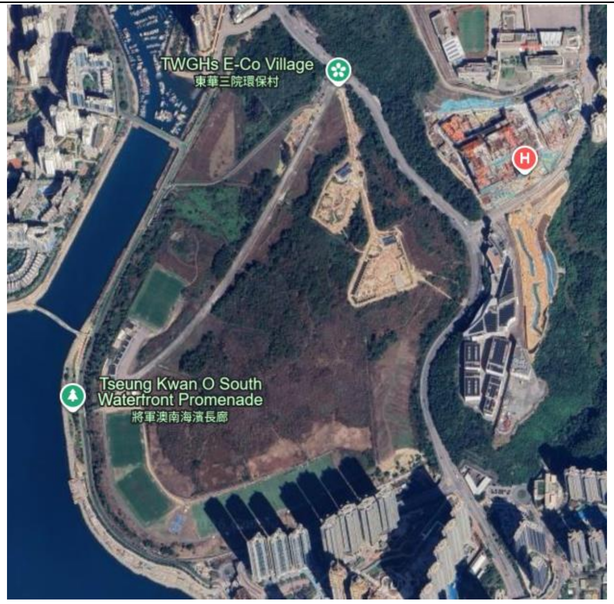
[5] Leisure and Cultural Services Department, "Kwai Chung Park" (葵涌公園), Hong Kong Government. Available at: https://www.lcsd.gov.hk/tc/parks/kcp/index.html

[6] Audit Commission, Report No. 70 of the Director of Audit: Chapter 1 – Management of Restored Landfills (Hong Kong: Audit Commission, 3 April, 2018). Available at: https://www.aud.gov.hk/pdf_e/e70ch01.pdf.

[7] Public Accounts Committee, Supplemental Report of the Public Accounts Committee on Report No. 70 of the Director of Audit: Appendix 16 (Hong Kong: Legislative Council, November 2018). Available at: https://www.legco.gov.hk/yr17-18/english/pac/reports/70a/app_16.pdf

8	Tseung Kwan O Stage I	TKO Area 77	Currently zoned "Recreation" ("**REC**") on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32	68	1995	1997-1999	Y	• A cycle track cum footpath, which is operated by the Government and opened to the public in 2012 • 1.3 ha of the restored landfill is designated for Pet Garden, which is operated by the Government and opened to public in 2023 • 12.5 ha of the restored landfill is designated for Jockey Club HKFA Football Training Centre, which is operated by Hong Kong Football Association and opened to the public in 2018 • 2 ha of the restored landfill is designated for a camp site cum green education ground (i.e. E-Co Village), which is operated by the Tung Wah Group of Hospitals and was opened in 2024	 TWGHs E-Co Village 東華三院環保村 Tseung Kwan O South Waterfront Promenade 將軍澳南海濱長廊 Source: Google Earth (Photo saved at 23 Jan 2025)
9	Tseung Kwan O Stage II/III (where the Application Site is located)	TKO Area 105	Currently zoned "O", "Other Specified Use (Industrial Estate)" ("**OU(Industrial Estate)**") and "GB" on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32	42	1994	1997-1999	Y	• Nil *N.B. 4.65 ha of the restored landfill is proposed to designate for Proposed Public Riding School with ancillary facilities, which will be operated by the HKJC Public Riding Schools Limited*	 Source: Google Earth (Photo saved at 23 Jan 2025)
10	Shuen Wan	Tng Kok Road, Tai Po	Currently zoned "Other Specified Use (Golf Course)" ("**OU(Golf Course)**") on the Approved Tai Po Outline Zoning Plan No. S/TP/32	55	1995	1996–1997	Y	• 52 ha of the restored landfill has been granted to Sha Lo Tung Development Company Limited under a non-in-situ land exchange for the development of a private golf course in 2022[8] *N.B. A temporary golf driving range was opened previously for use by the public from 1999 to 2022*	 Source: Environmental Protection Department

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[8] Lands Department, The Government of the Hong Kong Special Administrative Region, "Land Exchange Transactions. Available at: https://www.landsd.gov.hk/en/resources/land-info-stat/non-NTEH-land-transaction/land-exchange.html.

Annex 2

TECHNICAL CONSIDERATIONS OF THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105

Annex 2 - Technical Considerations of the Restored Landfill Site (TKOL II/III) in TKO Area 105

The development of a Public Riding School with ancillary facilities (collectively as "**PRS**") within the Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories ("**TKOL II/III**") presents unique opportunities for adaptive after-use of the technically feasible area within the restored landfill. Managed by the Environmental Protection Department ("**EPD**"), TKOL II/III has an ongoing waste degradation process, specific loading capacities, sloping topography, and essential restoration facilities that require careful consideration to maintain long-term safety and support the aftercare process. The Proposed PRS will utilize three (3) relatively flat platforms identified as suitable locations, incorporating design principles to promote horse welfare, rider safety, operational efficiency, and integration with the surrounding natural environment, while in compliance with EPD guidelines during construction and operation. A Utility Trench linking the three (3) platforms is also proposed to accommodate various essential utilities services in support of the PRS operations.

Existing Landfill Restoration Facilities

1. TKOL II/III consists of various landfill restoration facilities managed by EPD, including landfill gas extraction pipework, wells, infiltration cells, subsoil drainage, surface drainage, and settlement markers. These restored landfill facilities support ongoing aftercare and monitoring works by EPD to ensure the safe operations within TKOL II/II. As advised by EPD, the three (3) relatively flat platforms are suitable for recreational uses.

2. The design of PRS will maintain 2m clearance distance for aftercare works. Surface drainage, settlement markers, and infiltration cells may require specific treatments or relocation, subject to EPD approval, while subsoil drains may need loading verification or potential relocation based on assessments. The PRS is planned to avoid interference with these facilities with the intention to support both the safety of horses, riders and visitors and the routine maintenance by EPD. The three (3) identified platforms with ancillary facilities, located away from these facilities, are considered most suitable for the development of PRS, which will ensure no disruption to aftercare activities by EPD.

Landfill Gas Generation

3. There is ongoing waste degradation at TKOL II/III which is supported by an existing capping system and landfill gas management system to collect and treat generated landfill gas. The PRS will adopt gas protection measures during its construction and operational phases to maintain the integrity of these systems. The PRS located across three (3) platforms will ensure the continued functionality of the capping and gas management systems, supporting the waste degradation process while prioritizing the safety of horses, riders, visitors, and staff through a non-disruptive approach.

Sloping Topography and Level Differences

4. TKOL II/III features varied terrain, with most areas having a slope gradient of approximately 1:3 to 1:4. In view of the flatness of the platforms, the three(3) platforms are well-suited for the development of the PRS to meet the level ground requirements for the equine facilities and equines' and riders' safety concerns. The disposition arrangement and accessibility of riding facilities across these platforms are meticulously planned to enhance integration and operational efficiency of the PRS. Utilizing these platforms will minimize the need for extensive earthworks in other parts of the area of TKOL II/III, which will expedite the implementation of the PRS.

Restricted Loading Limit

5. The current landfill capping system, which consists of a geotextile polyethylene liner, a synthetic geo-composite drainage layer and the soil for vegetation, is designed primarily for environmental protection and light-duty use. The three (3) platforms allow for a higher loading capacity, ranging from 40kPa to 50kPa, subject to the endorsement of relevant Government Departments, including Civil Engineering and Development Department ("**CEDD**"). These loading capacities at the platforms will support the planned equestrian activities for the PRS. Similarly, the existing access road was also designed to accommodate vehicular use and loading. In general, a low-rise and low-density design with optimised building massing will be adopted to ensure the loading within the limits and the platform safety.

6. The structural design of the PRS will be carefully considered in the context of the layout, building massing, foundation loads, and height to in line with the characteristics of TKOL II/III. By incorporating low-rise and low-density structures, the PRS ensures compatibility with the site's conditions, promoting long-term safety and operational performance.

No-Build Zone and Safety Measures

7. TKOL II/III, adjacent to natural slopes, includes a No-Build Zone where development is restricted to preserve the natural landscape and address natural terrain hazards considerations. In general, no covered structures of the PRS located within the No-Build Zone. Landscape treatments are provided along the northern boundary of Upper Platform serving as a buffer between the facilities and the No-Build Zone while enhancing the integration with the natural surroundings. Mitigation measures (e.g., retaining wall), if necessary, will be further explored at a later stage. Further, two (2) boulders with potential boulder fall risk within natural terrain are recommended to remove or stabilized in-situ as precautionary measures.

Requirements of Necessary Precautionary Measures imposed by EPD

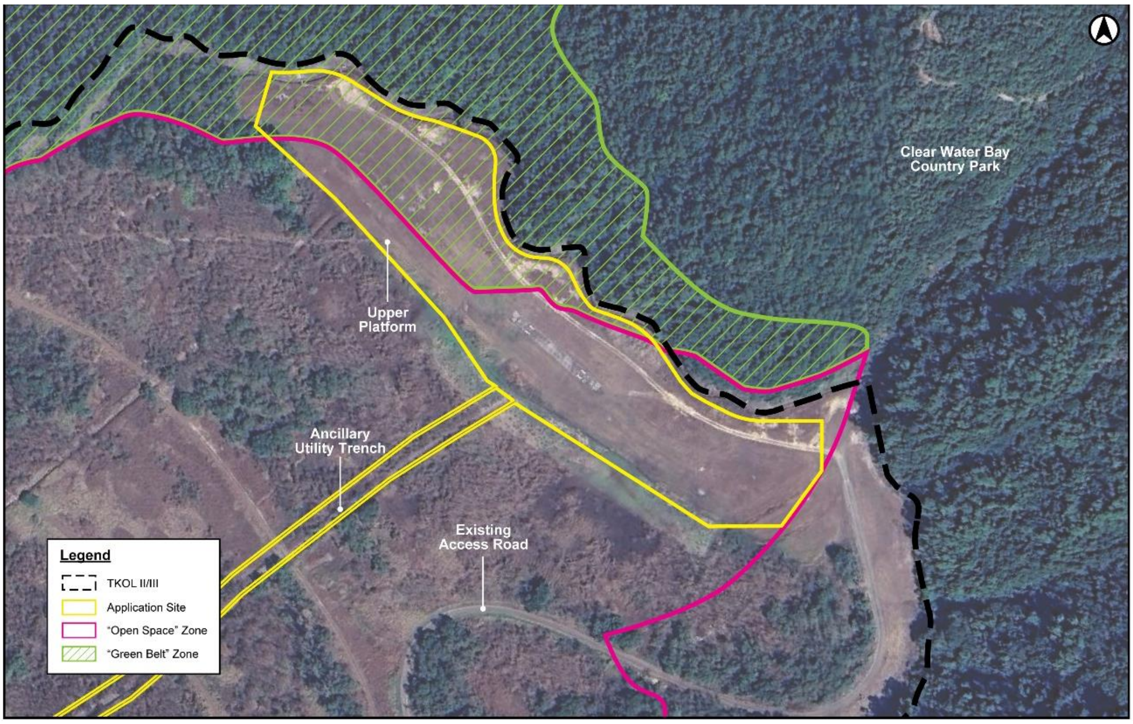
8. Certain requirements of necessary precautionary measures at landfill sites are imposed by EPD to safeguard against landfill gas hazard, including additional safety measures for forging under controlled environment, and maintain access to the existing landfill site facilities during construction. The construction and operation of the PRS at the three (3) platforms will ensure no disruption to EPD's aftercare works at TKOL II/III and full compliance with all required safety requirements.

Annex 3

AREA UNDER APPLICATION FALLING WITHIN "GB" ZONE AND ASSESSMENT OF THE PUBLIC RIDING SCHOOL AGAINST TPB PG-NO.10

Annex 3 - Area under Application falling within "GB" zone and Assessment of the Public Riding School Against TPB PG-No.10

Item A - Area *under Application falling within "GB" zone Figure*


Clear Water Bay Country Park
Upper Platform
Ancillary Utility Trench
Existing Access Road
Legend
TKOL II/III
Application Site
"Open Space" Zone
"Green Belt" Zone

Base Aerial Photo retrieved from Google Earth on 13 January 2026

Item B - Assessment of the Public Riding School Against Town Planning Board Guidelines for Application for Development Within Green Belt Zone under Section 16 of the Town Planning Ordinance

Assessment of the Development against TPB PG-No.10

TPB PG-No. 10 Criteria	Applicant's Response
(a) There is a general presumption against development (other than redevelopment) in a "GB" zone. In general the Board will only be prepared to approve applications for development in the context of requests to rezone to an appropriate use.	The PRS is located mainly within the "O" zone, with only minor portions falling within the "GB" and "OU(Industrial Estate)" zones. Notwithstanding, the PRS adopts a low-density-low-impact approach with small clustering of single-storey buildings to provide a recreational outlet for public enjoyment that not only is compatible with the surrounding context but also minimises disturbance to the surrounding environment. The PRS with ancillary facilities ('Horse Riding School' subsumed under 'Place of Recreation, Sports or Culture' use) is a Column 2 Use under the Approved OZP, which may be permitted with or without conditions on application to

	the Town Planning Board under Section 16 of the TPO.
(b) An application for new development in a "GB" zone will only be considered in exceptional circumstances and must be justified with very strong planning grounds. The scale and intensity of the proposed development including the plot ratio, site coverage and building height should be compatible with the character of surrounding areas. With the exception of New Territories Exempted Houses, a plot ratio up to 0.4 for residential development may be permitted.	The PRS adopts a low-rise-low-density design approach that is compatible with the surrounding context and only occupies a minor portion of the fringe of the "GB" zone that falls within TKOL II/III.
(c) Applications for New Territories Exempted Houses with satisfactory sewage disposal facilities and access arrangements may be approved if the application sites are in close proximity to existing villages and in keeping with the surrounding uses, and where the development is to meet the demand from indigenous villagers.	Not Applicable to the Planning Application.
(d) Redevelopment of existing residential development will generally be permitted up to the intensity of the existing development.	Not Applicable to the Planning Application.
(e) Applications for G/IC uses and public utility installations must demonstrate that the proposed development is essential and that no alternative sites are available. The plot ratio of the development site may exceed 0.4 so as to minimize the land to be allocated for G/IC uses.	Not Applicable to the Planning Application.
(f) Passive recreational uses which are compatible with the character of surrounding areas may be given sympathetic consideration.	While the PRS provides active recreational use for the community, the design intent aims to harmonise seamlessly with the adjacent natural landscape and is considered not incompatible with the surrounding context.
(g) The design and layout of any proposed development should be compatible with the surrounding area. The development should not involve extensive clearance of existing natural vegetation, affect the existing natural landscape, or cause any adverse visual impact on the surrounding environment.	The clearance of existing natural vegetation for the PRS is considered minimal, particularly within "GB" zone (see (h) below). Furthermore, according to the Ecological Impact Assessment prepared under the Environmental Assessment, the areas falling within "GB" zone are considered

	Turfgrass Land with low ecological value due to the man-made nature with low species diversity and its impact is considered to be insignificant (***Appendix 5*** refers). The Visual Impact Assessment (***Appendix 4*** refers) also concludes that no adverse visual impacts are expected as a result of the PRS.
(h) The vehicular access road and parking provision proposed should be appropriate to the scale of the development and comply with relevant standards. Access and parking should not adversely affect existing trees or other natural landscape features. Tree preservation and landscaping proposals should be provided.	The three platforms will be connected by an existing restricted access road which will undergo upgrading and widening works by EPD. Appropriate parking provision have been provided to support the PRS. With reference to the Tree Preservation and Removal Proposal in ***Appendix 2,*** there are only 4 nos. of trees located within the areas under application falling within "GB" zone. All the trees are proposed to be felled due to their poor health, structural condition, and low anticipated survival rate after transplanting. Compensatory native trees (approx. 21 nos.) will be planted strategically at areas falling the "GB" zone to enhance the amenity value of the area while serving as a landscape buffer between the PRS facilities and the existing woodland. Additional landscape buffer will also be provided at the northeastern boundary of Upper Platform, serving as a buffer between the PRS and the existing woodland as well as the fringe of CWBCP to minimize disturbance to the natural surroundings.
(i) The proposed development should not overstrain the capacity of existing and planned infrastructure such as sewerage, roads and water supply. It should not adversely affect drainage or aggravate flooding in the area.	The PRS is small in scale and no adverse infrastructural impacts are anticipated.
(j) The proposed development must comply with the development controls and restrictions of areas designated as water gathering grounds.	Not Applicable to the Planning Application.
(k) The proposed development should not overstrain the overall provision of G/IC facilities in the general area.	Not Applicable to the Planning Application.
(l) The proposed development should not be susceptible to adverse environmental effects from pollution sources nearby	The PRS will not be susceptible to adverse environmental effects. An Environmental Assessment (***Appendix 5*** refers) has been

	such as traffic noise, unless adequate mitigating measures are provided, and it should not itself be the source of pollution.	conducted which concludes the no adverse environmental impact as a result of the PRS is anticipated, with the implementation of appropriate precautionary, protective and mitigation measures.
(m)	Any proposed development on a slope or hillside should not adversely affect slope stability.	The proposed structures of the PRS provided on the relatively flat platforms are low-density and low-rise in nature, of which site formation and large-scale excavation works are not required. Geotechnical Planning Review Report (***Appendix 9*** refers) concludes that no adverse geotechnical impact is anticipated as a result of the PRS.

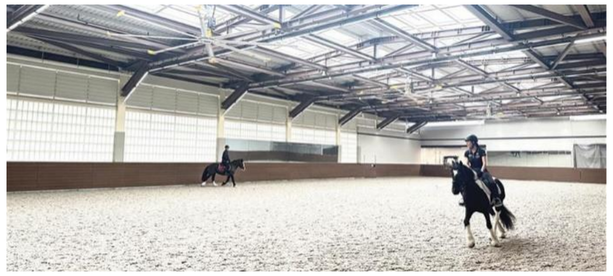
Annex 4

INFORMATION ON THE PUBLIC RIDING SCHOOLS BY THE HKJC PUBLIC RIDING SCHOOLS LIMITED

Annex 4 - Information on the Public Riding Schools by the HKJC Public Riding Schools Limited

	Proposed TKO Public Riding School*(1)	**Tuen Mun Public Riding School**	**Lei Yue Mun Public Riding School**	**Pokfulam Public Riding School**
Location	Tseung Kwan O (New Territories East)	Tuen Mun (New Territories West)	Chai Wan (Eastern District)	Pok Fu Lam (Southern District)
Year of Completion	2030 tentatively	1994	1992	1978 Redevelopment in 2022 was completed in September 2025
Indicative Area of the Public Riding School (m^2)	Approx. 46,500	40,000	4,000	4,700
Opening Hours*(2)	Weekdays: 7:00AM to 12:00PM & 2:00PM to 9:00PM Weekend: 7:00AM to 12:00PM & 2:00PM to 6:00PM	Weekdays: 8:00AM to 12:00PM & 2:00PM to 9:00PM Weekend: 8:00AM to 12:00PM & 2:00PM to 6:00PM	Weekdays: 7:30AM to 12:00PM & 2:00PM to 9:00PM (Closed on Mondays) Weekend: 7:00AM to 12:00PM & 2:00PM to 6:00PM	Weekdays: 7:00AM to 12:00PM & 2:00PM to 9:00PM Weekend: 7:00AM to 12:00PM & 2:00PM to 6:00PM
Charges (Normal Rate)	Rate and charges for riding lessons and stable visits / equine events will reference that of the existing three (3) PRSs as of January 2026, subject to future reviews having regard to operational sustainability	As of January 2026: Group Lessons: $355 per 45mins (Pony Lesson) to $435 per hour (Horse Lesson) Private Lessons (30 mins) / Semi- Private Lessons (45 mins): $255 to $490 Private Lessons (45 mins): $385 to $730 Stable Management Lessons: $175 per 45 mins to $220 per hour Pony Ride and Stable Visit: $60 per hour		
Facilities of the Public Riding School *(3) (4) (5)	Pony Viewing Area 4 nos. of Outdoor Arenas 74 nos. of Stables Spelling Yards Lungeing Pens Horse Walkers Wash Boxes Farrier & Veterinary Rooms Horse Simulator Toilet/ Changing Rooms Indoor Viewing Area at the Pavilion Ancillary Parking Central Storeroom *N.B. Please also refer to Table 4.1 Technical and Accommodation Schedules of the Supplementary Planning Statement*	3 nos. of Outdoor Arenas 95 nos. of Stables Administration Building (including Lecture Room, Toilet/ Changing Room) Spelling Yard (Sand Paddocks) Horse Walker Wash Boxes Farrier Room Spectator Stand Gallery Block (including Equine Simulator, Equine Exhibition Room) Hacking Trail Landscaped Area (Garden Area) Ancillary Parking Central Storeroom	2 nos. of Outdoor Arenas 36 nos. of Stables Administration Building (including Lecture Room, Toilet/ Changing Room, Waiting Room etc.) Wash Boxes Horse Simulator Farrier Room Covered Seating Area (Patio) Hacking Trail Ancillary Parking	1 no. of Indoor Arena 38 nos. of Stables Classrooms Toilet/ Changing Room Indoor Viewing Gallery Horse Simulator Wash Boxes Farrier Room Hacking Trail Ancillary Parking

Available Activities / Experiences	Riding Lessons Horse Simulator Lessons Pony Ride and Stable Visits Stable Management Lessons Open Days Equine Events (e.g. annual horse shows & exhibitions, dressage and show jumping events) Riding Lessons for the Disabled Seasonal Day Camp & Themed Pony Activities *N.B.* *(1) Pony Viewing Area – a unique feature allowing the public to appreciate and observe ponies in close proximity during operation hour without the need of registration* *(2) Please also refer to Section 4.1.2 of the Supplementary Planning Statement*	Riding Lessons Horse Simulator Lessons Pony Ride and Stable Visit Stable Management Lessons Open Day (Tuen Mun Public Riding School only) Equine Events (e.g. dressage and jumping events) Seasonal Day Camps (e.g. Training Camps) Themed Pony Activities (e.g. Own A Pony) Therapeutic Riding Lessons for the Persons with Disabilities		
Enrolment Procedures for Riding Lessons & Activities / Experiences	Online application and assigned on a first-come-first-served basis*(6)			
Public Access to PRS Facilities and Horses	Pony Viewing Area at the Lower Platform is open to the public free of charge during operating hours. No registration is required.	Free access to common area for viewing and enquiries		
	Registration is required for access to the riding lessons and activities/ experiences			
No. of Total Attendees per year	Anticipated over 40,000	Approx. 41,600	Approx. 16,200	Approx.18,000

Photos of Existing Facilities	N/A	 Entrance Arena Stables	 Entrance Arena Stables	 Entrance  Arena Stables

*(1) The figures indicated for the Proposed Public Riding School in Tseung Kwan O are indicative/forecast only.

*(2) The Public Riding Schools are operating with adjusted hours during periods of hot weather in accordance with relevant horse welfare guidelines.

*(3) The list of facilities of Tuen Mun Public Riding School is available at: https://corporate.hkjc.com/corporate/english/jc-news-and-activities/jc-equestrian-development/public-riding-schools/tm/tm-intro/tm-facilities.aspx

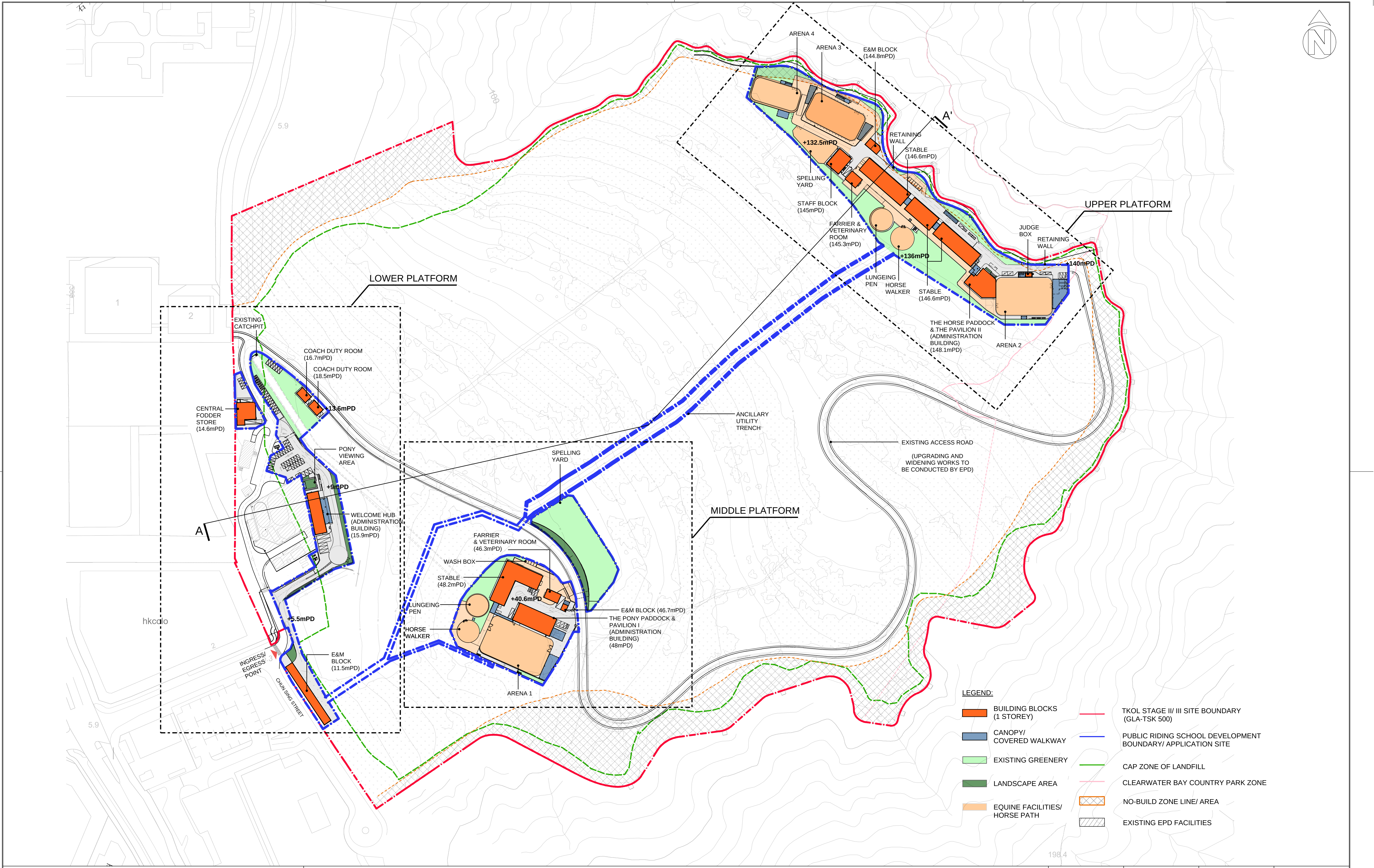
*(4) The list of facilities of Lei Yue Mun Public Riding School is available at: https://corporate.hkjc.com/corporate/english/jc-news-and-activities/jc-equestrian-development/public-riding-schools/lym/lym-intro/lym-facilities.aspx

*(5) The list of facilities of Pokfulam Public Riding School is available at: https://corporate.hkjc.com/corporate/english/jc-news-and-activities/jc-equestrian-development/public-riding-schools/pfl/pfl-intro/pfl-facilities.aspx

*(6) Riding lessons will be allocated to a class commensurate with the rider's experience. Placement will be determined by the PRS according to the participant's previous horse-riding experience and is subject to availability of places. For persons with disabilities, participants should submit their application to Riding for the Disabled Association Limited, given its professional expertise and skills.

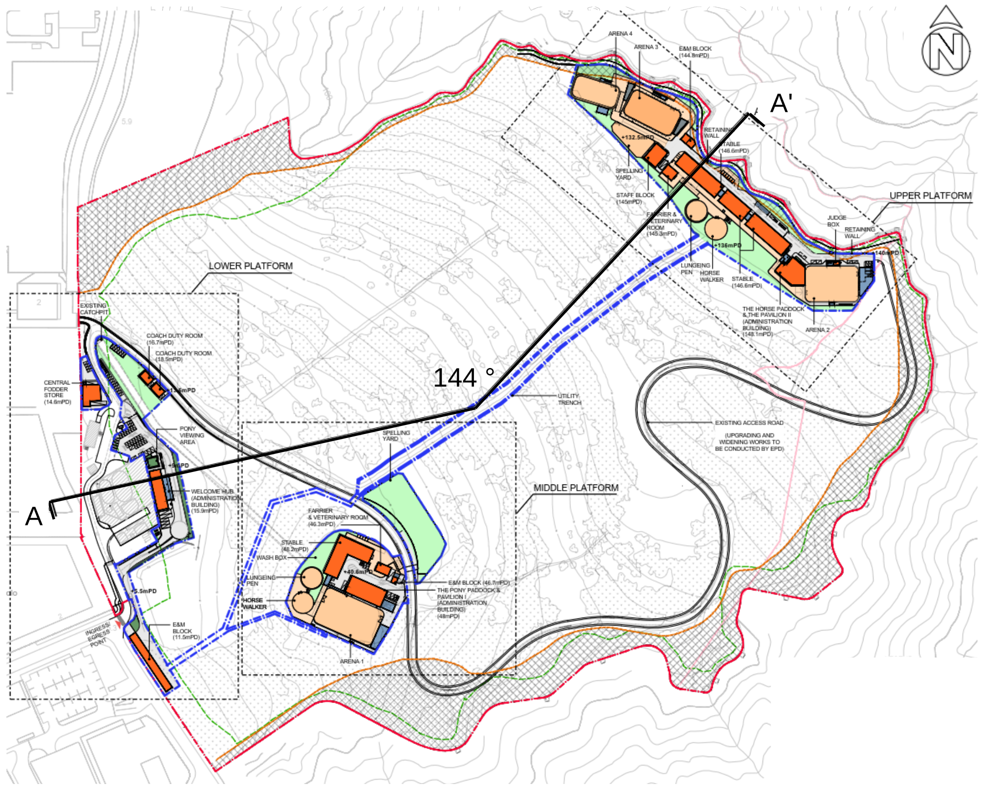
Appendix 1

CONCEPTUAL ARCHITECTURAL DRAWINGS
AND INDICATIVE ARTIST'S IMPRESSION


ARENA 4
ARENA 3
E&M BLOCK (144.8mPD)
A'
RETAINING WALL
STABLE (146.6mPD)
+132.5mPD
SPELLING YARD
STAFF BLOCK (145mPD)
FARRIER & VETERINARY ROOM (145.3mPD)
UPPER PLATFORM
JUDGE BOX
RETAINING WALL
+140mPD
+136mPD
LUNGEING PEN
HORSE WALKER
STABLE (146.6mPD)
THE HORSE PADDOCK & THE PAVILION II (ADMINISTRATION BUILDING) (148.1mPD)
ARENA 2
LOWER PLATFORM
EXISTING CATCHPIT
COACH DUTY ROOM (16.7mPD)
COACH DUTY ROOM (18.5mPD)
+13.6mPD
CENTRAL FODDER STORE (14.6mPD)
PONY VIEWING AREA
+9mPD
WELCOME HUB (ADMINISTRATION BUILDING) (15.9mPD)
A
+5.5mPD
INGRESS/ EGRESS POINT
CHUN SING STREET
E&M BLOCK (11.5mPD)
ANCILLARY UTILITY TRENCH
EXISTING ACCESS ROAD
(UPGRADING AND WIDENING WORKS TO BE CONDUCTED BY EPD)
SPELLING YARD
MIDDLE PLATFORM
FARRIER & VETERINARY ROOM (46.3mPD)
WASH BOX
STABLE (48.2mPD)
+40.6mPD
LUNGEING PEN
HORSE WALKER
E&M BLOCK (46.7mPD)
THE PONY PADDOCK & PAVILION I (ADMINISTRATION BUILDING) (48mPD)
ARENA 1
hkcolo
100
5.9
5.9
198.4
1
2
2
LEGEND:
BUILDING BLOCKS (1 STOREY)
CANOPY/ COVERED WALKWAY
EXISTING GREENERY
LANDSCAPE AREA
EQUINE FACILITIES/ HORSE PATH
TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY/ APPLICATION SITE
CAP ZONE OF LANDFILL
CLEARWATER BAY COUNTRY PARK ZONE
NO-BUILD ZONE LINE/ AREA
EXISTING EPD FACILITIES
N

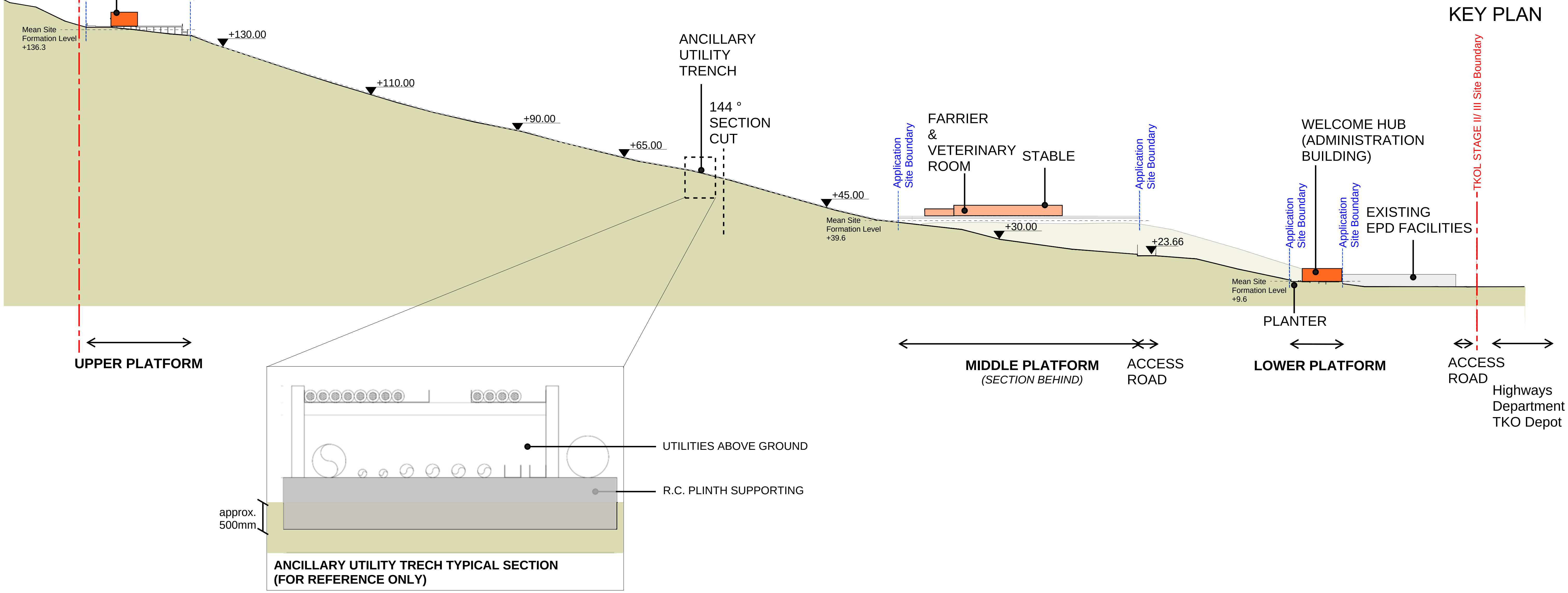
WONG TUNG 王董

Title Indicative Master Layout Plan	Checked	SKW	Drawn	RYT
	Rev	0	Date	FEB 2026
	Scale 1 : 3000		Figure Appendix 1 (Fig. 1.1)	



A'
A
144 °
UPPER PLATFORM
LOWER PLATFORM
MIDDLE PLATFORM

KEY PLAN



TKOL STAGE II/ III Site Boundary
Application Site Boundary
STABLE
Application Site Boundary
Mean Site Formation Level +136.3
+130.00
+110.00
+90.00
+65.00
ANCILLARY UTILITY TRENCH
144 ° SECTION CUT
+45.00
Mean Site Formation Level +39.6
Application Site Boundary
FARRIER & VETERINARY ROOM
STABLE
Application Site Boundary
+30.00
+23.66
WELCOME HUB (ADMINISTRATION BUILDING)
Application Site Boundary
Application Site Boundary
EXISTING EPD FACILITIES
TKOL STAGE II/ III Site Boundary
Mean Site Formation Level +9.6
PLANTER
UPPER PLATFORM
MIDDLE PLATFORM
(SECTION BEHIND)
ACCESS ROAD
LOWER PLATFORM
ACCESS ROAD
Highways Department TKO Depot
UTILITIES ABOVE GROUND
R.C. PLINTH SUPPORTING
approx. 500mm

ANCILLARY UTILITY TRECH TYPICAL SECTION
(FOR REFERENCE ONLY)

WONG TUNG 王董

Title

Site Section A' - A

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
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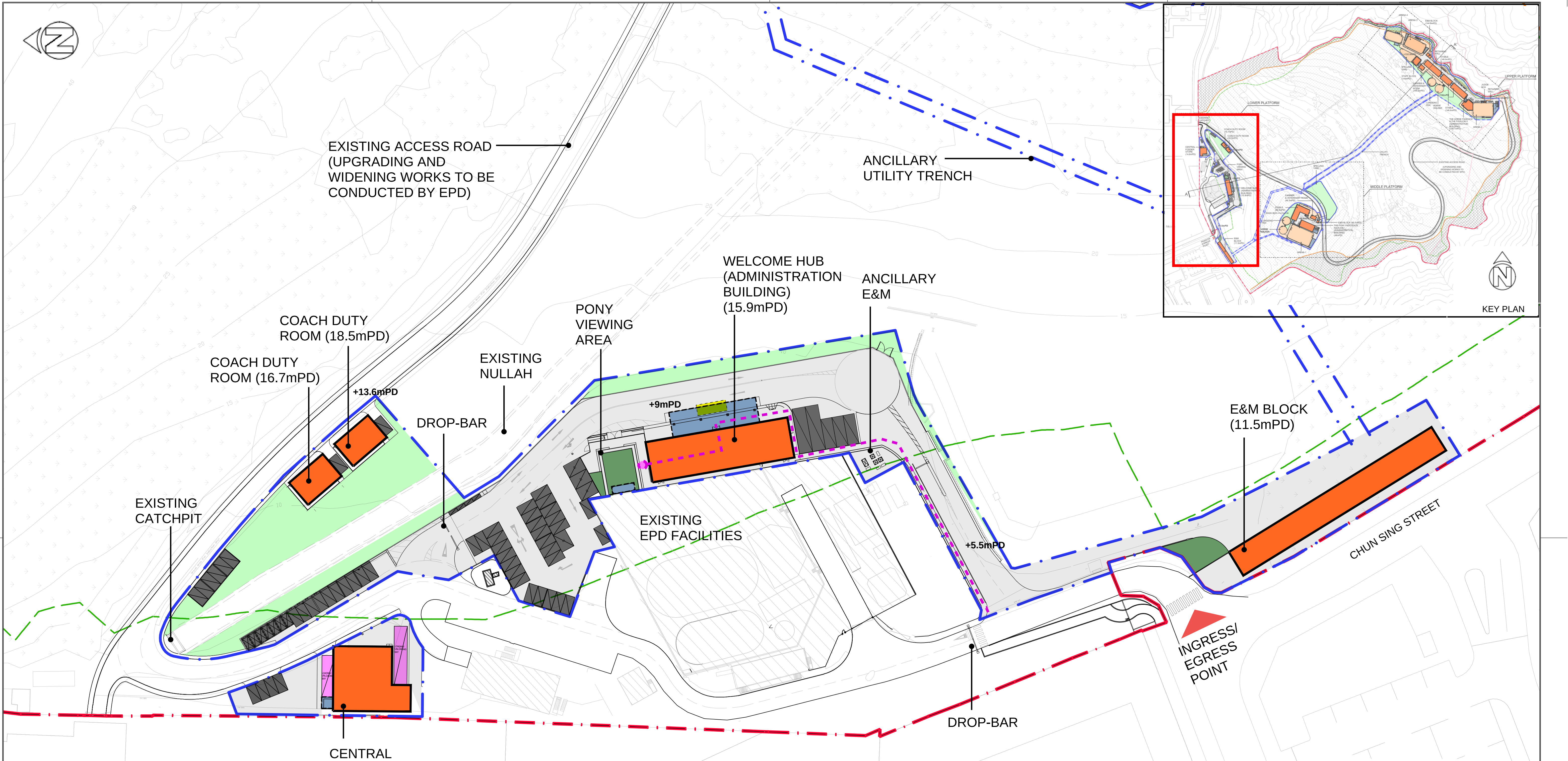
EXISTING ACCESS ROAD (UPGRADING AND WIDENING WORKS TO BE CONDUCTED BY EPD)
ANCILLARY UTILITY TRENCH
WELCOME HUB (ADMINISTRATION BUILDING) (15.9mPD)
ANCILLARY E&M
PONY VIEWING AREA
EXISTING NULLAH
COACH DUTY ROOM (18.5mPD)
COACH DUTY ROOM (16.7mPD)
+13.6mPD
+9mPD
DROP-BAR
EXISTING CATCHPIT
EXISTING EPD FACILITIES
+5.5mPD
E&M BLOCK (11.5mPD)
CHUN SING STREET
INGRESS/ EGRESS POINT
DROP-BAR
CENTRAL FODDER STORE (14.6mPD)
LOWER PLATFORM
MIDDLE PLATFORM
UPPER PLATFORM
KEY PLAN

LEGEND:

- 🟧 BUILDING BLOCKS (1 STOREY)
- 🟦 CANOPY/ COVERED WALKWAY
- 🟩 EXISTING GREENERY
- 🟩 LANDSCAPE AREA
- 🟧 EQUINE FACILITIES/ HORSE PATH
- ⬛ PARKING
- 🟪 LOADING/ UNLOADING
- 🟨 DROP-OFF
- ― TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
- ― PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY/ APPLICATION SITE
- ― CAP ZONE OF LANDFILL
- ― CLEARWATER BAY COUNTRY PARK ZONE
- ☒ NO-BUILD ZONE LINE/ AREA
- ▨ EXISTING EPD FACILITIES
- - - PROPOSED PEDESTRIAN ACCESS

WONG TUNG 王董

Title

Ground Floor Plan - Lower Platform

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Rev	0	Date	FEB 2026
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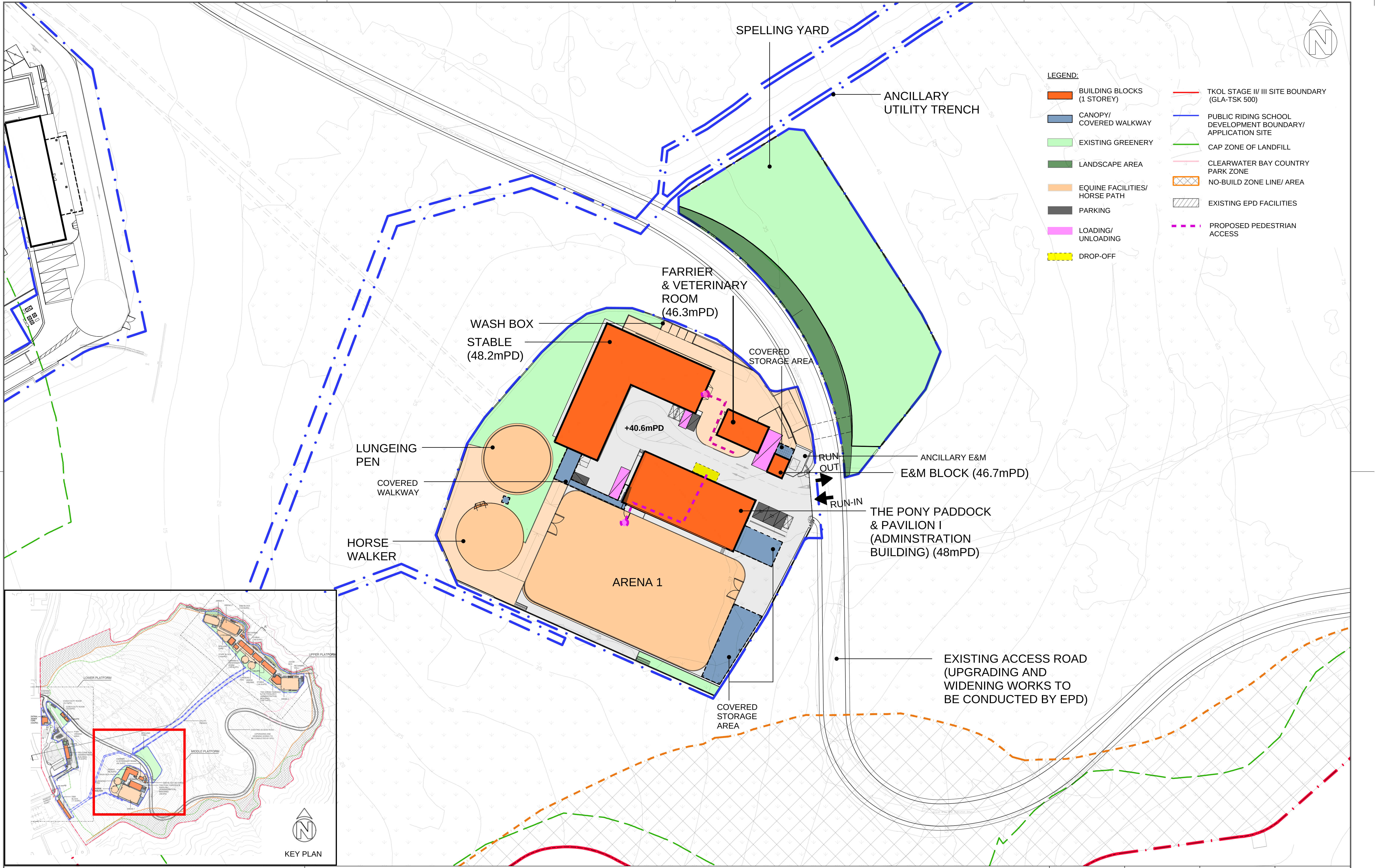
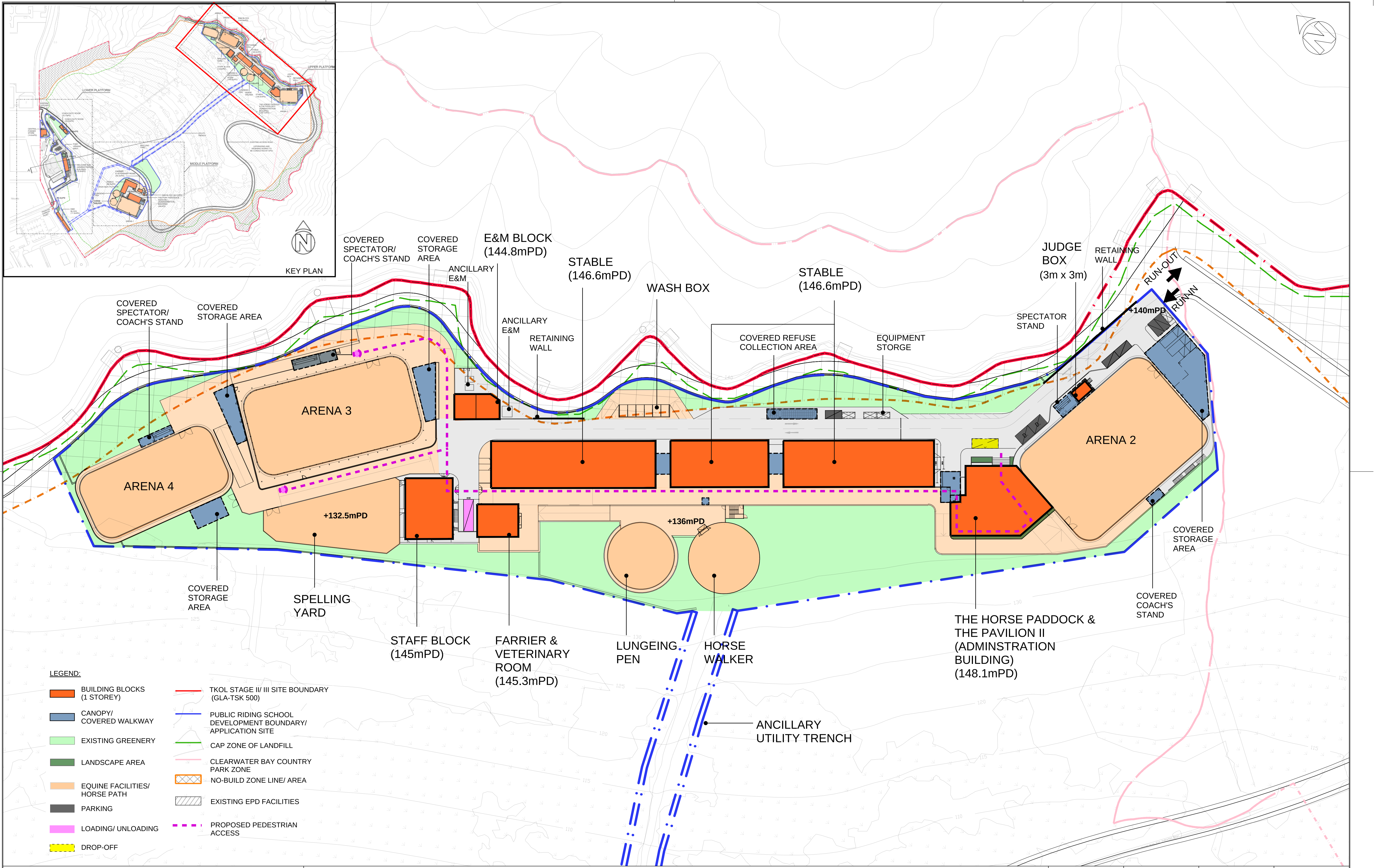

SPELLING YARD
ANCILLARY UTILITY TRENCH
LEGEND:
🟧 BUILDING BLOCKS (1 STOREY)
🟦 CANOPY/ COVERED WALKWAY
🟩 EXISTING GREENERY
🟩 LANDSCAPE AREA
🟧 EQUINE FACILITIES/ HORSE PATH
⬛ PARKING
🟪 LOADING/ UNLOADING
🟨 DROP-OFF
TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY/ APPLICATION SITE
CAP ZONE OF LANDFILL
CLEARWATER BAY COUNTRY PARK ZONE
NO-BUILD ZONE LINE/ AREA
▨ EXISTING EPD FACILITIES
PROPOSED PEDESTRIAN ACCESS
FARRIER & VETERINARY ROOM (46.3mPD)
WASH BOX
STABLE (48.2mPD)
COVERED STORAGE AREA
+40.6mPD
LUNGEING PEN
COVERED WALKWAY
RUN OUT
ANCILLARY E&M
E&M BLOCK (46.7mPD)
RUN-IN
THE PONY PADDOCK & PAVILION I (ADMINSTRATION BUILDING) (48mPD)
HORSE WALKER
ARENA 1
EXISTING ACCESS ROAD (UPGRADING AND WIDENING WORKS TO BE CONDUCTED BY EPD)
COVERED STORAGE AREA
KEY PLAN
N

WONG TUNG 王董

Title

Ground Floor Plan - Middle Platform

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale 1 : 1000		Figure Appendix 1 (Fig. 1.4)	

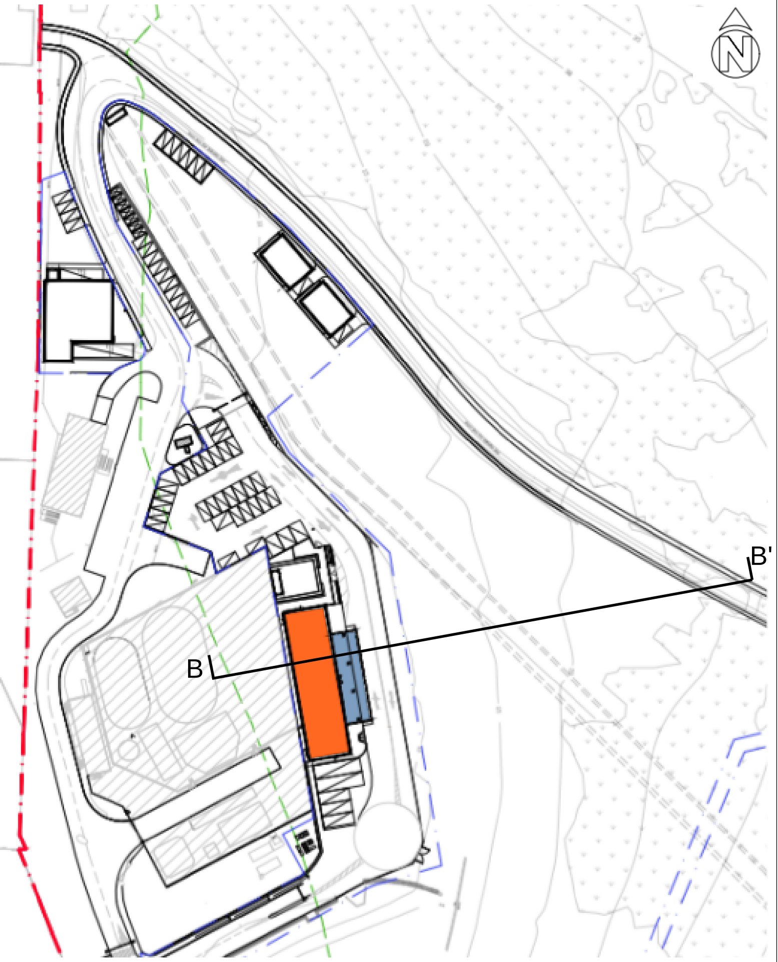

KEY PLAN
UPPER PLATFORM
MIDDLE PLATFORM
LOWER PLATFORM
COVERED SPECTATOR/ COACH'S STAND
COVERED STORAGE AREA
COVERED SPECTATOR/ COACH'S STAND
COVERED STORAGE AREA
ANCILLARY E&M
E&M BLOCK (144.8mPD)
ANCILLARY E&M
RETAINING WALL
STABLE (146.6mPD)
WASH BOX
STABLE (146.6mPD)
COVERED REFUSE COLLECTION AREA
EQUIPMENT STORGE
JUDGE BOX (3m x 3m)
RETAINING WALL
SPECTATOR STAND
RUN-OUT
RUN-IN
+140mPD
ARENA 3
ARENA 4
ARENA 2
+132.5mPD
+136mPD
COVERED STORAGE AREA
SPELLING YARD
STAFF BLOCK (145mPD)
FARRIER & VETERINARY ROOM (145.3mPD)
LUNGEING PEN
HORSE WALKER
THE HORSE PADDOCK & THE PAVILION II (ADMINSTRATION BUILDING) (148.1mPD)
COVERED STORAGE AREA
COVERED COACH'S STAND
ANCILLARY UTILITY TRENCH
LEGEND:
BUILDING BLOCKS (1 STOREY)
CANOPY/ COVERED WALKWAY
EXISTING GREENERY
LANDSCAPE AREA
EQUINE FACILITIES/ HORSE PATH
PARKING
LOADING/ UNLOADING
DROP-OFF
TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY/ APPLICATION SITE
CAP ZONE OF LANDFILL
CLEARWATER BAY COUNTRY PARK ZONE
NO-BUILD ZONE LINE/ AREA
EXISTING EPD FACILITIES
PROPOSED PEDESTRIAN ACCESS

WONG TUNG 王董

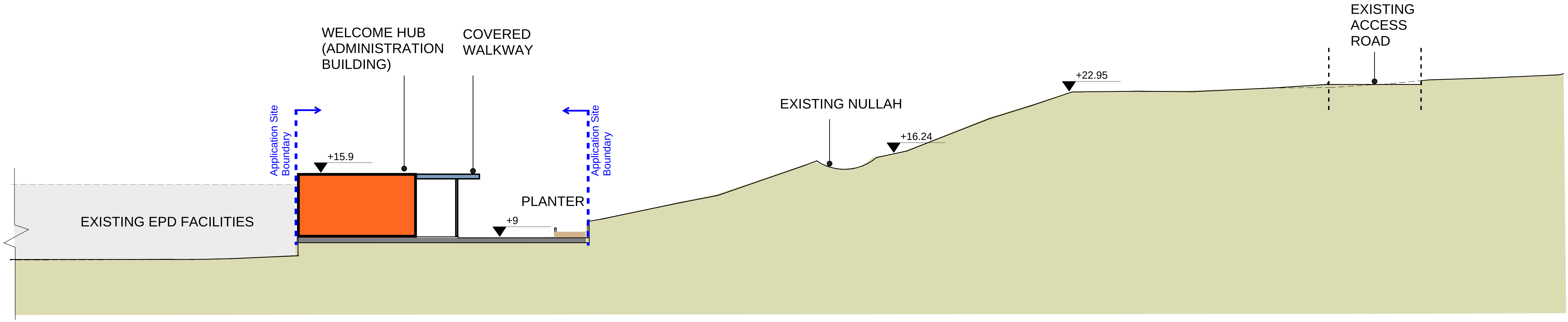
Title

Ground Floor Plan - Upper Platform

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale	1 : 1000	Figure	Appendix 1 (Fig. 1.5)



KEY PLAN


WELCOME HUB (ADMINISTRATION BUILDING)
COVERED WALKWAY
EXISTING ACCESS ROAD
+22.95
EXISTING NULLAH
+16.24
Application Site Boundary
Application Site Boundary
+15.9
PLANTER
+9
EXISTING EPD FACILITIES

Section B - B'

WONG TUNG 王董

Title

Indicative Lower Platform Section

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
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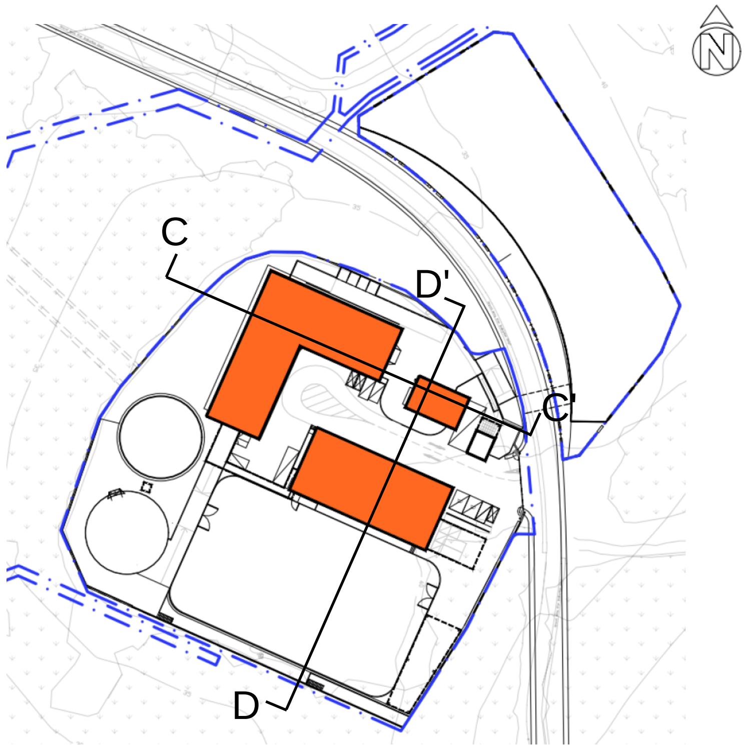
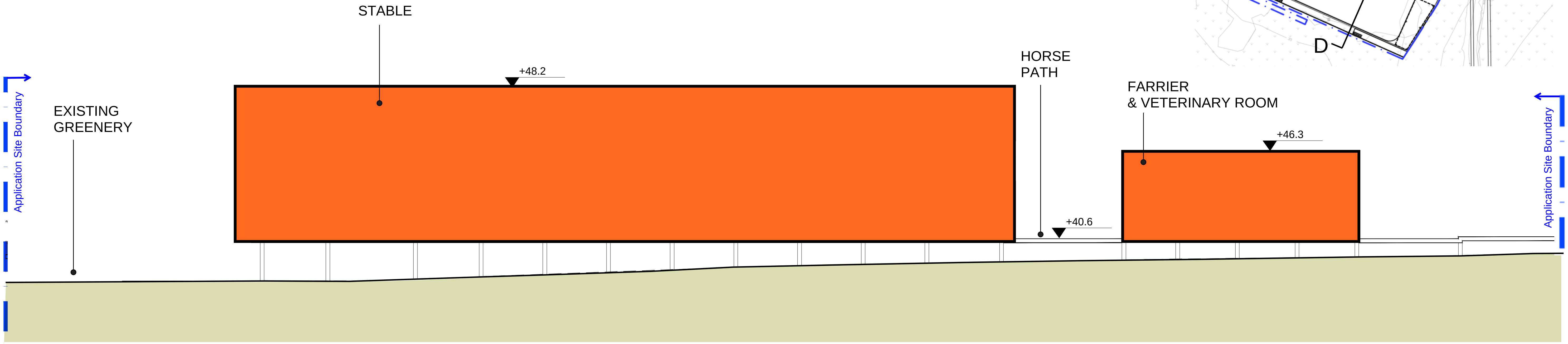
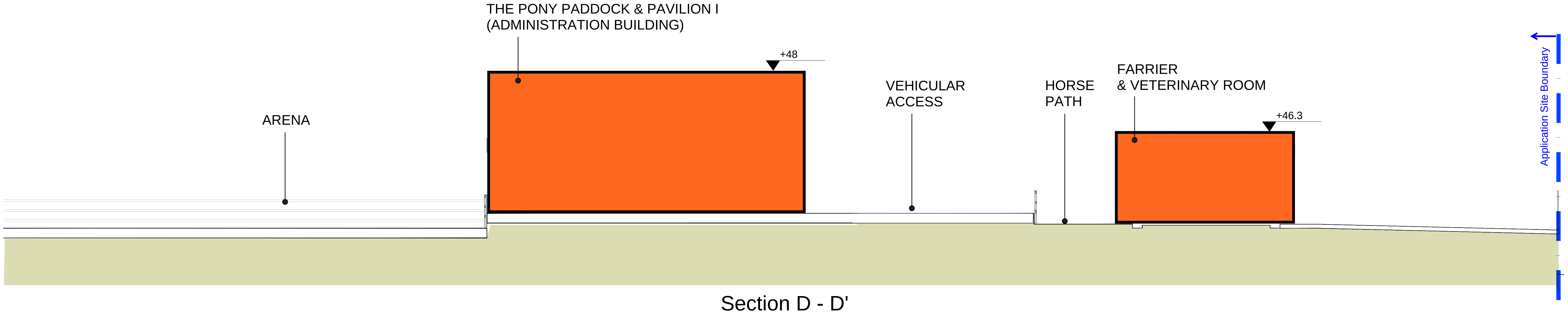



STABLE
+48.2
HORSE
PATH
FARRIER
& VETERINARY ROOM
+46.3
+40.6
EXISTING
GREENERY
Application Site Boundary
Application Site Boundary

Section C - C'


THE PONY PADDOCK & PAVILION I
(ADMINISTRATION BUILDING)
+48
ARENA
VEHICULAR
ACCESS
HORSE
PATH
FARRIER
& VETERINARY ROOM
+46.3
Application Site Boundary

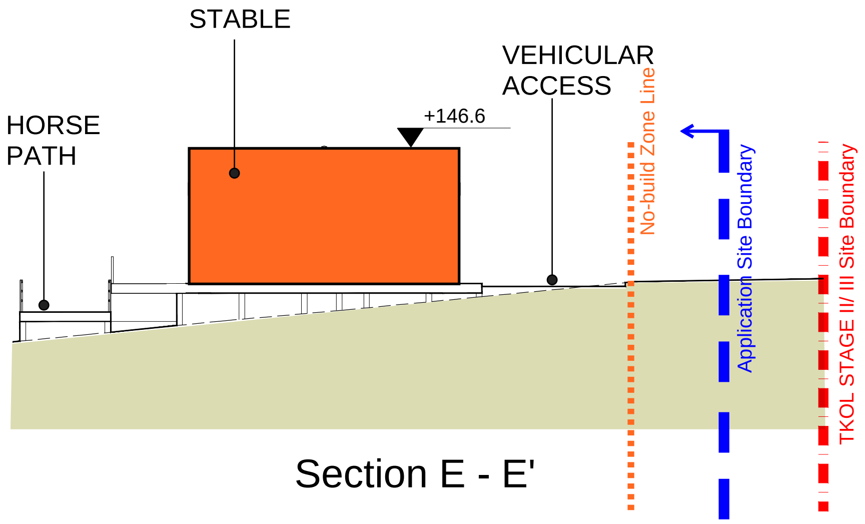
Section D - D'

WONG TUNG 王董

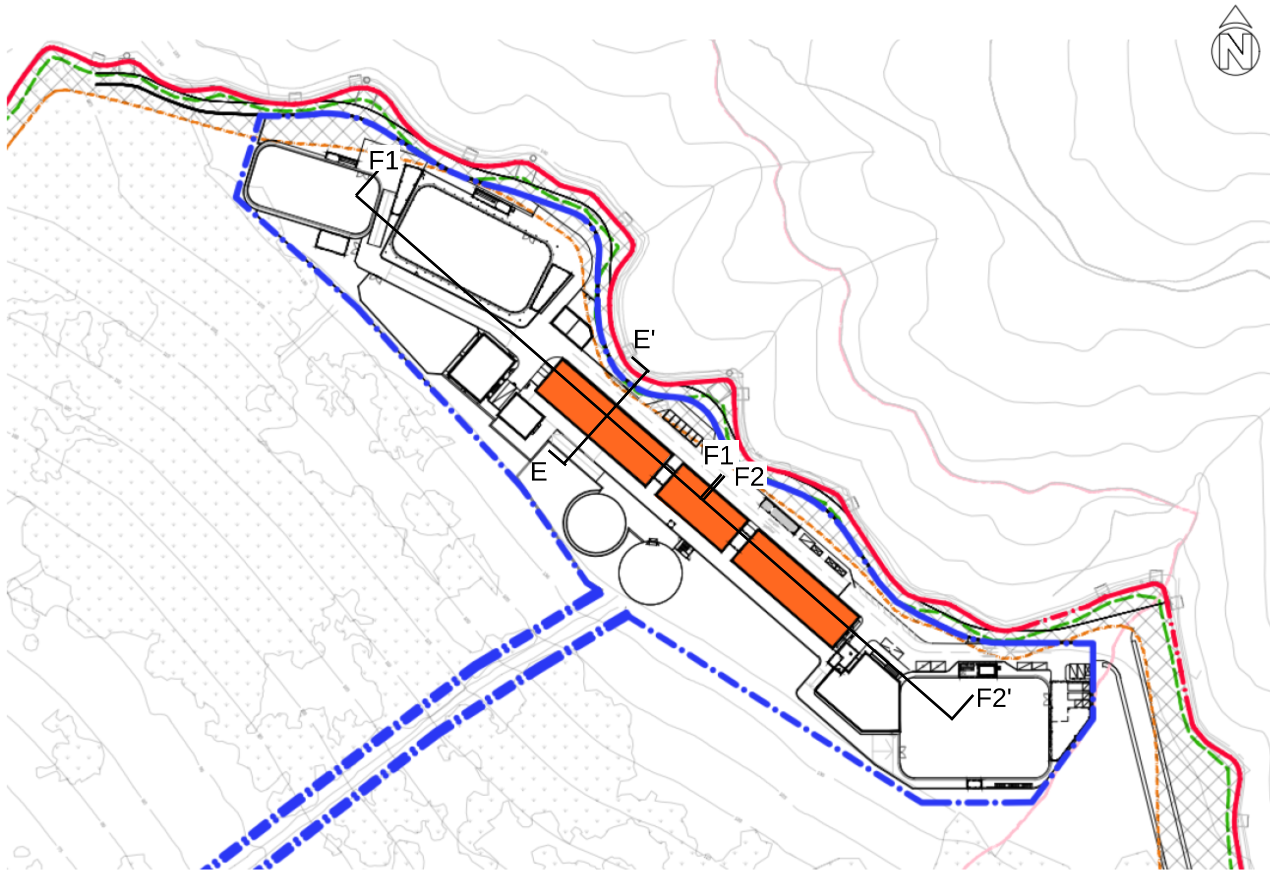
Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale 1 : 200		Figure Appendix 1 (Fig. 1.7)	

Title

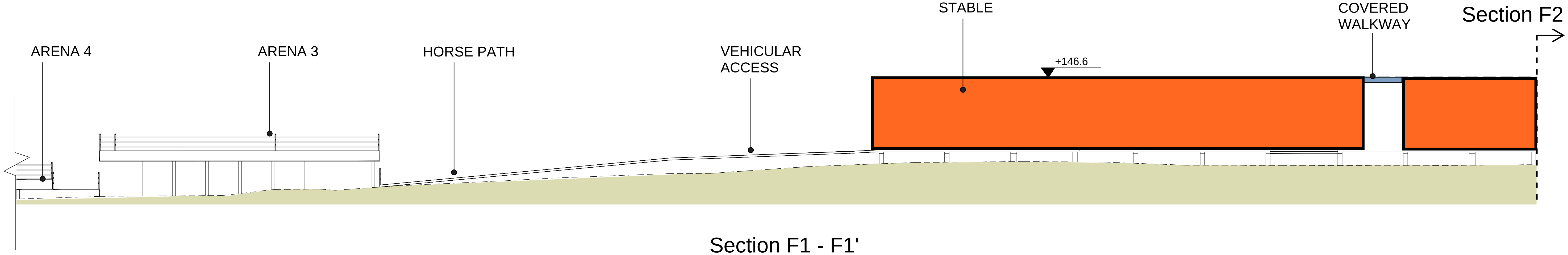
Indicative Middle Platform Section


STABLE
VEHICULAR ACCESS
HORSE PATH
+146.6
No-build Zone Line
Application Site Boundary
TKOL STAGE II/ III Site Boundary

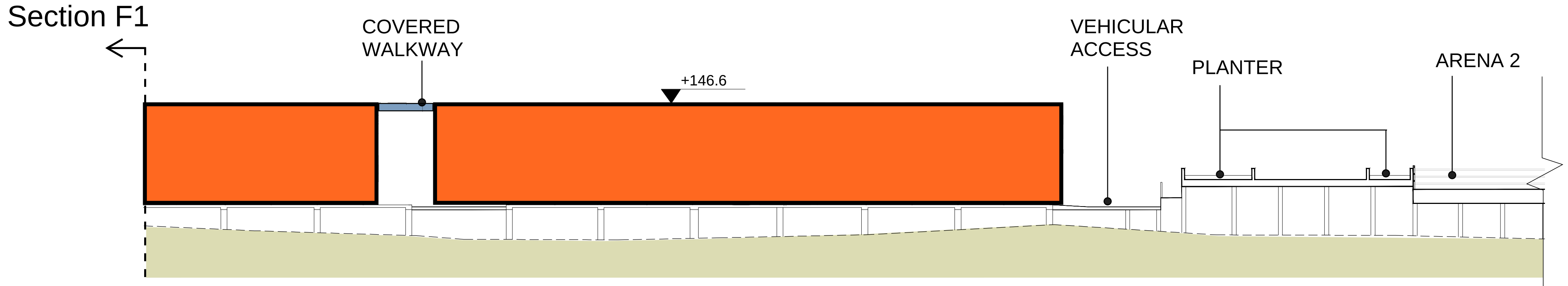
Section E - E'


F1
E'
E
F1'
F2
F2'

KEY PLAN


ARENA 4
ARENA 3
HORSE PATH
VEHICULAR ACCESS
STABLE
+146.6
COVERED WALKWAY
Section F2

Section F1 - F1'


Section F1
COVERED WALKWAY
+146.6
VEHICULAR ACCESS
PLANTER
ARENA 2

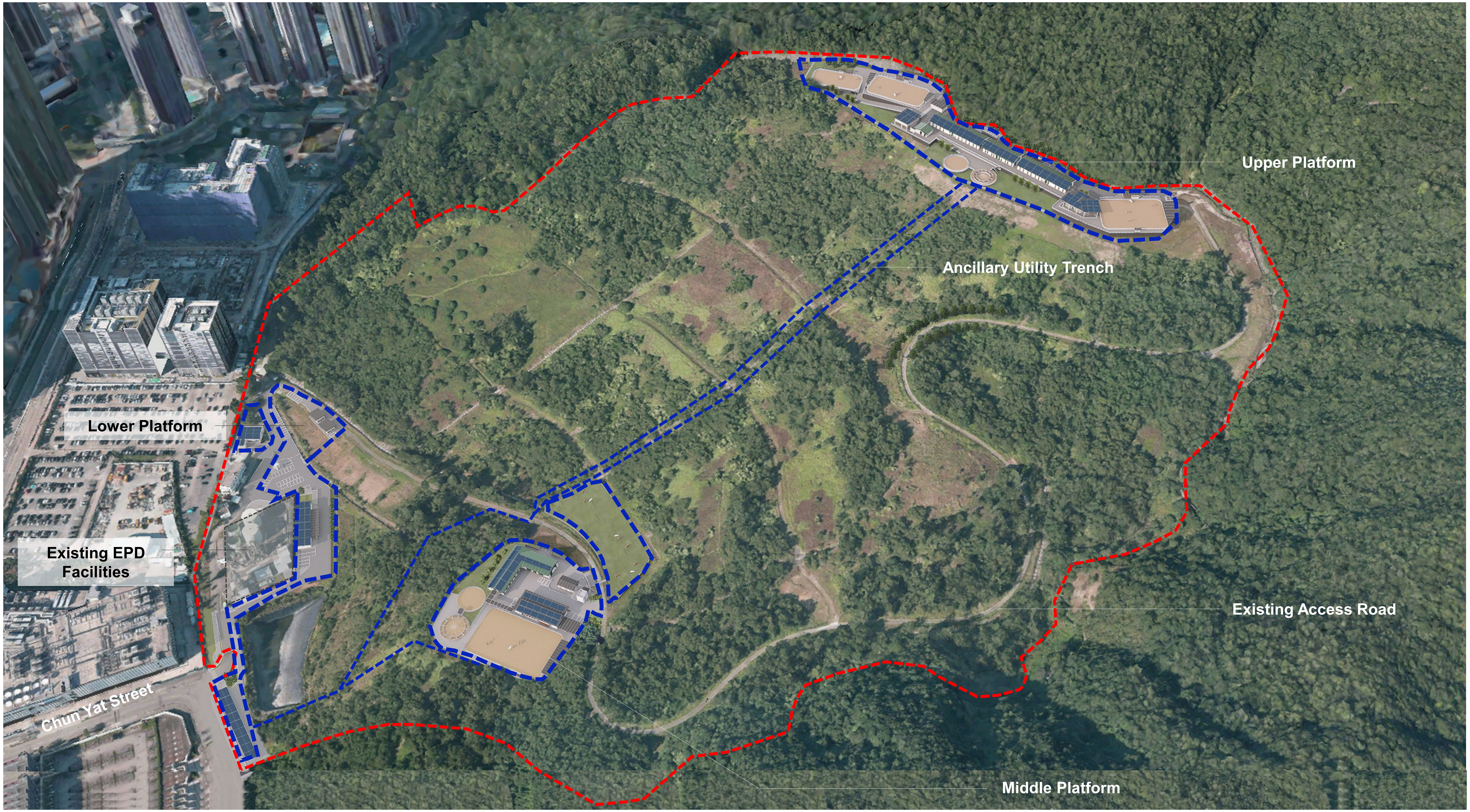
Section F2 - F2'

WONG TUNG 王董

Title

Indicative Upper Platform Section

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale	1 : 400	Figure	Appendix 1 (Fig. 1.8)


Upper Platform
Ancillary Utility Trench
Lower Platform
Existing EPD Facilities
Existing Access Road
Chun Yat Street
Middle Platform

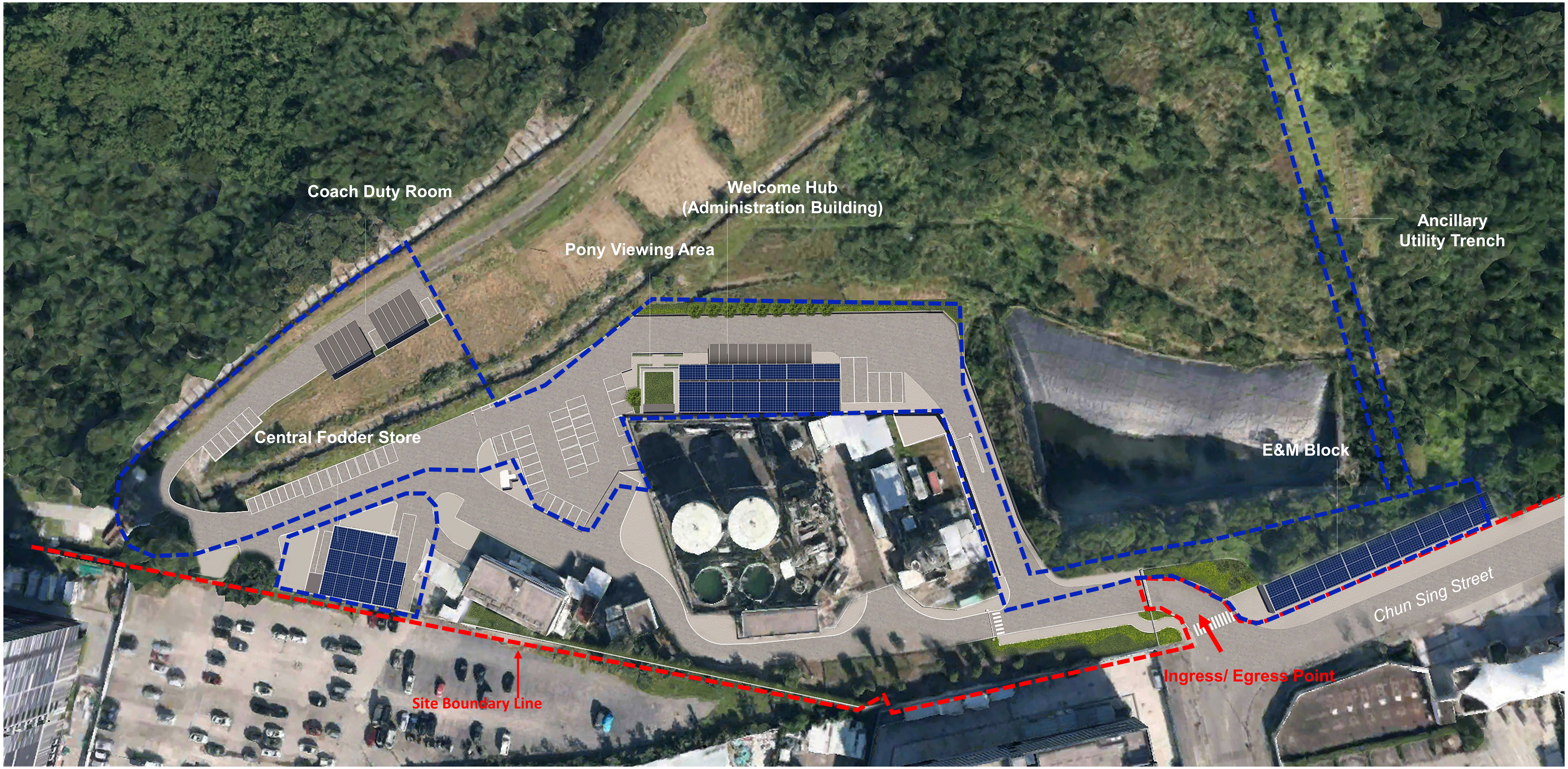
WONG TUNG 王董

Title

Supplementary Drawings - Artist's Impression (for reference only)

The Proposed Riding School

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale N/A		Figure Appendix 1 (Fig. 2.1)	

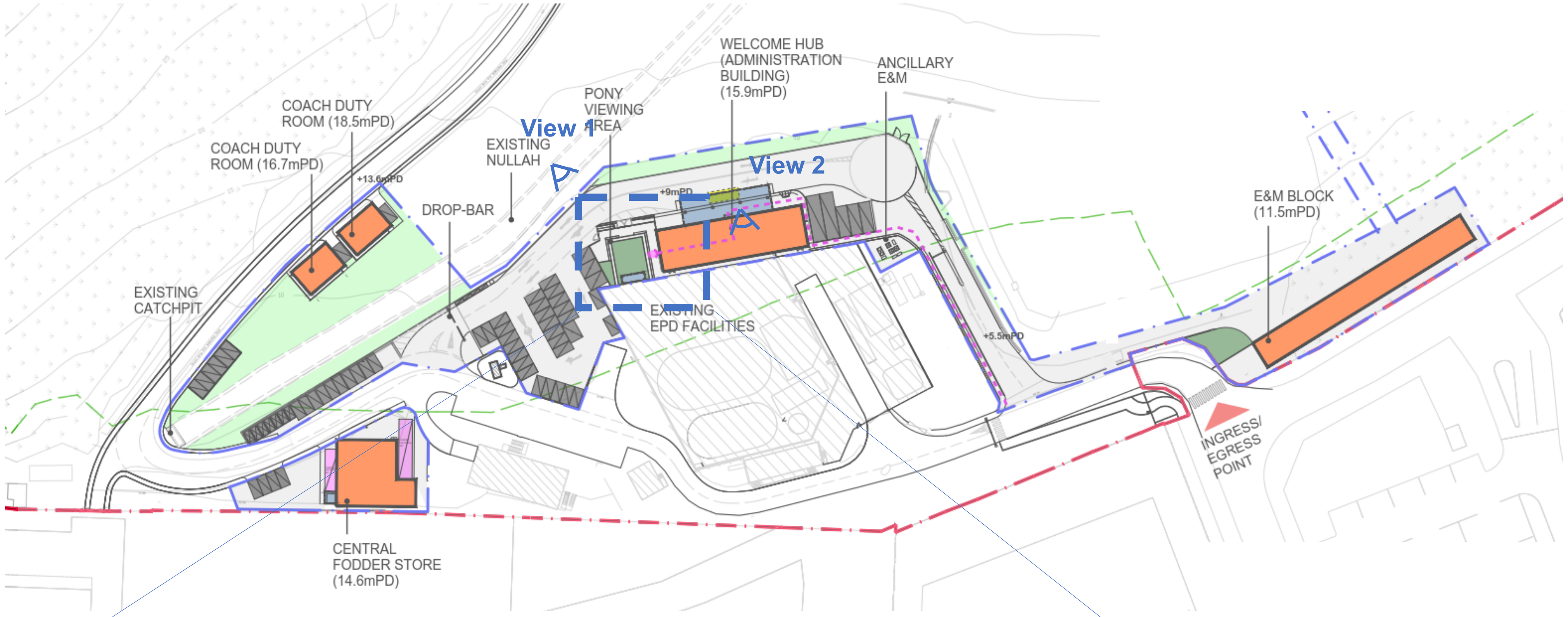

Coach Duty Room
Welcome Hub
(Administration Building)
Pony Viewing Area
Ancillary
Utility Trench
Central Fodder Store
E&M Block
Chun Sing Street
Ingress/ Egress Point
Site Boundary Line

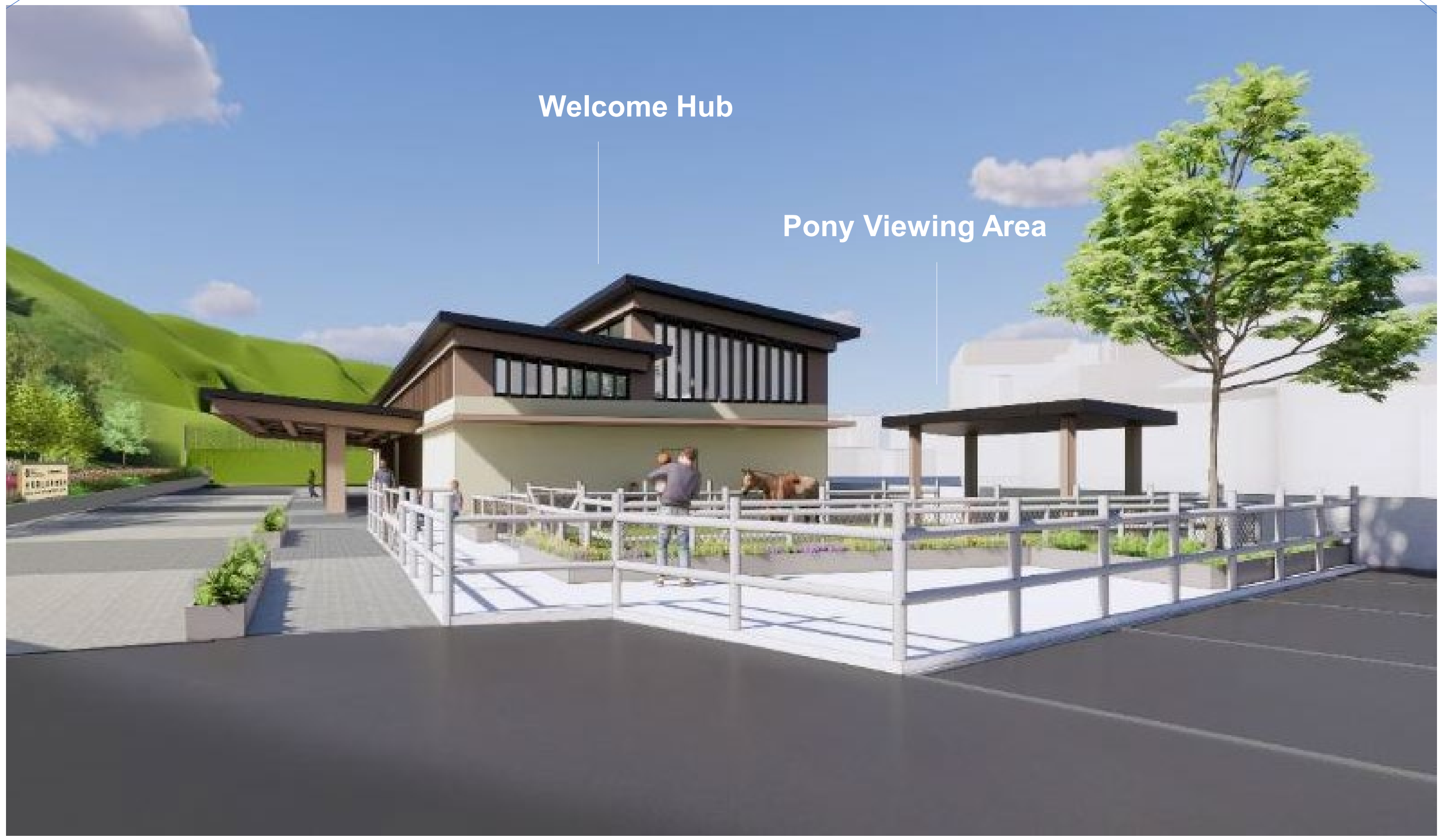
WONG TUNG 王董

Title

Supplementary Drawings - Artist's Impression (for reference only)
Lower Platform

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale N/A		Figure Appendix 1 (Fig. 2.2)	


WELCOME HUB
(ADMINISTRATION
BUILDING)
(15.9mPD)
ANCILLARY
E&M
PONY
VIEWING
AREA
View 1
View 2
COACH DUTY
ROOM (18.5mPD)
COACH DUTY
ROOM (16.7mPD)
+13.6mPD
EXISTING
NULLAH
DROP-BAR
+9mPD
EXISTING
CATCHPIT
EXISTING
EPD FACILITIES
+5.5mPD
E&M BLOCK
(11.5mPD)
INGRESS/
EGRESS
POINT
CENTRAL
FODDER STORE
(14.6mPD)


Welcome Hub
Pony Viewing Area

View 1: Pony Viewing Area

香港賽馬會
The Hong Kong Jockey Club

View 2: Welcome Hub

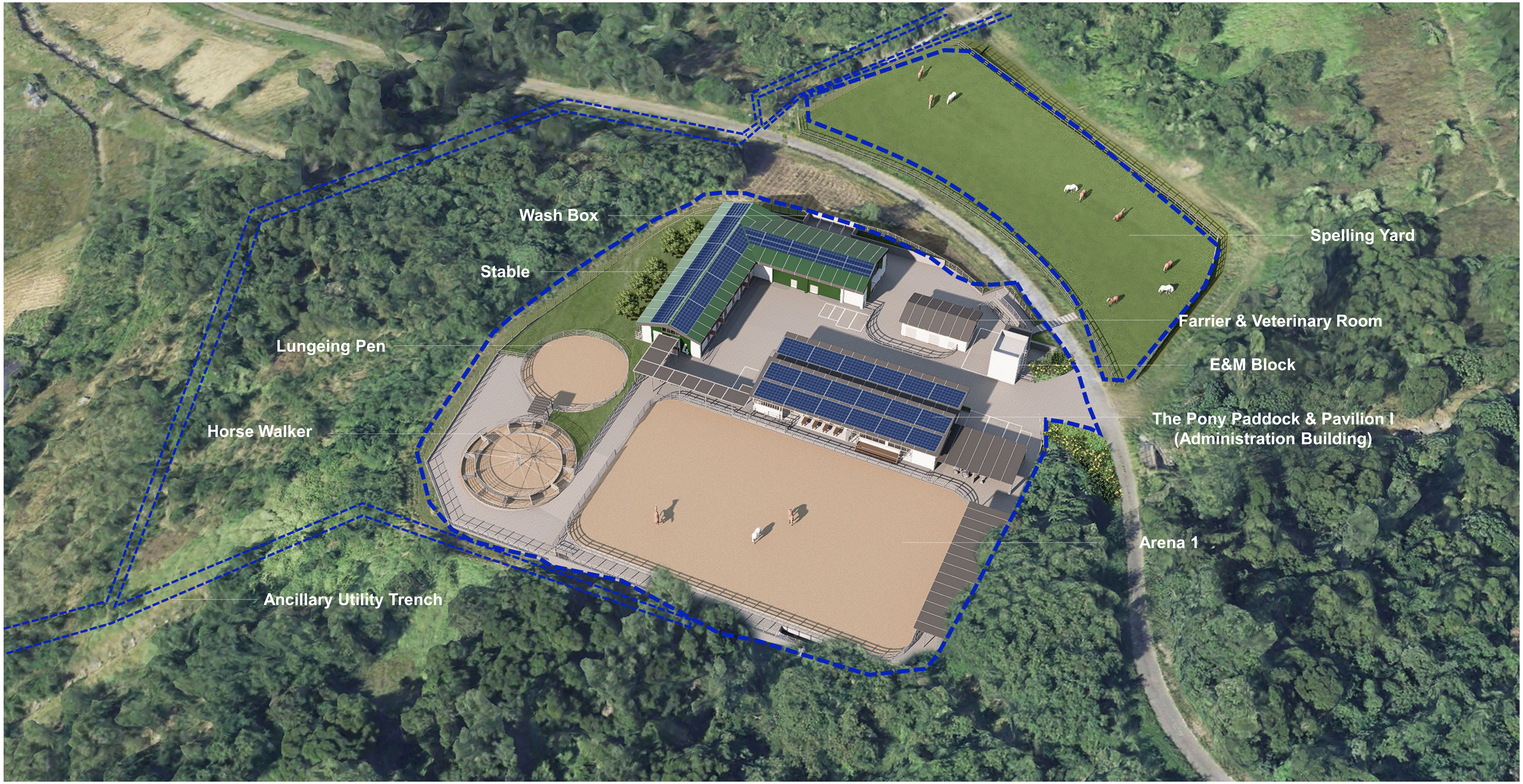
WONG TUNG 王董

Title

Supplementary Drawings - Artist's Impression (for reference only)

Lower Platform

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale N/A		Figure Appendix 1 (Fig. 2.3)	


Wash Box
Stable
Lungeing Pen
Horse Walker
Ancillary Utility Trench
Spelling Yard
Farrier & Veterinary Room
E&M Block
The Pony Paddock & Pavilion I
(Administration Building)
Arena 1

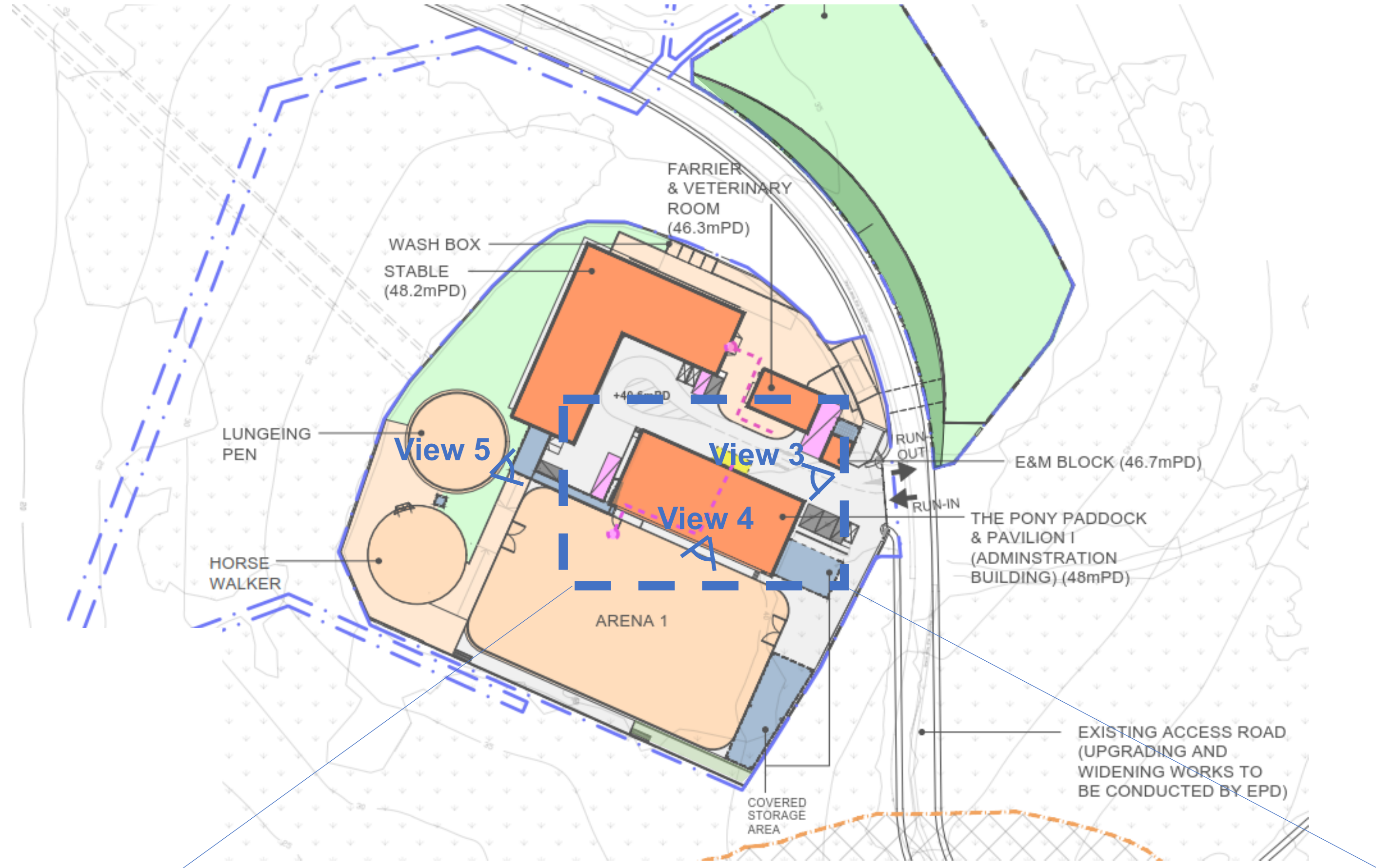
WONG TUNG 王董

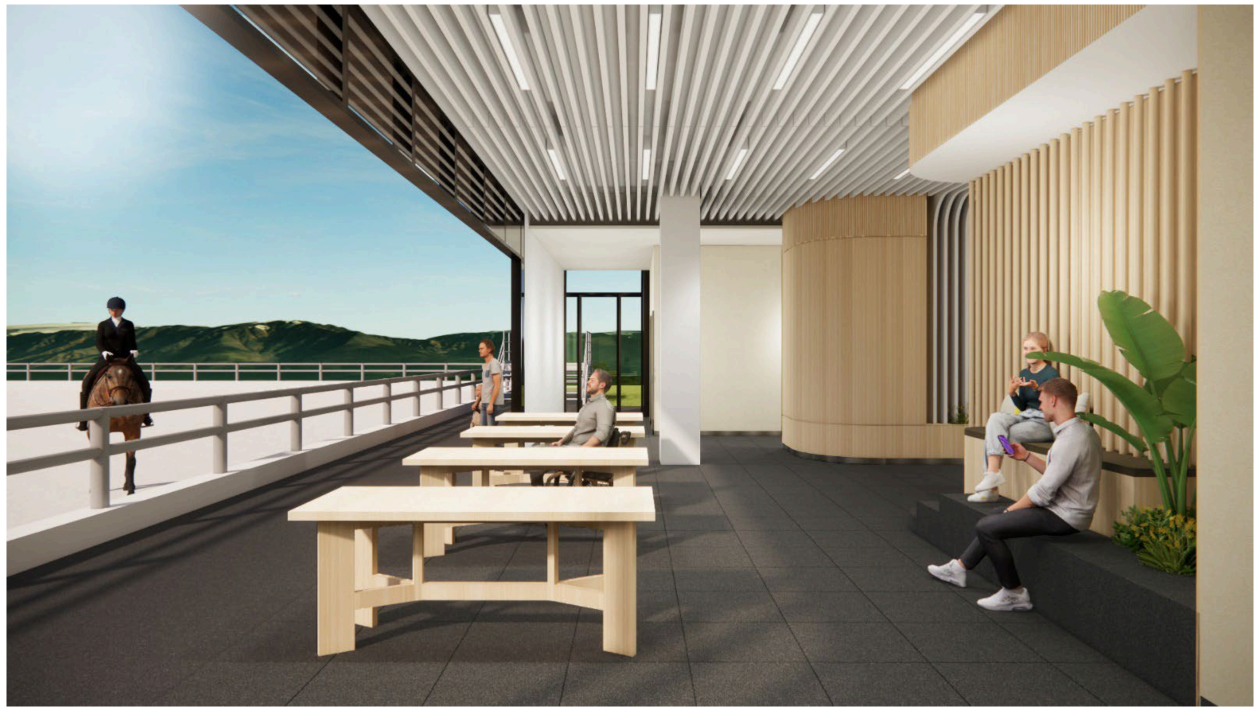
Title

Supplementary Drawings - Artist's Impression (for reference only)

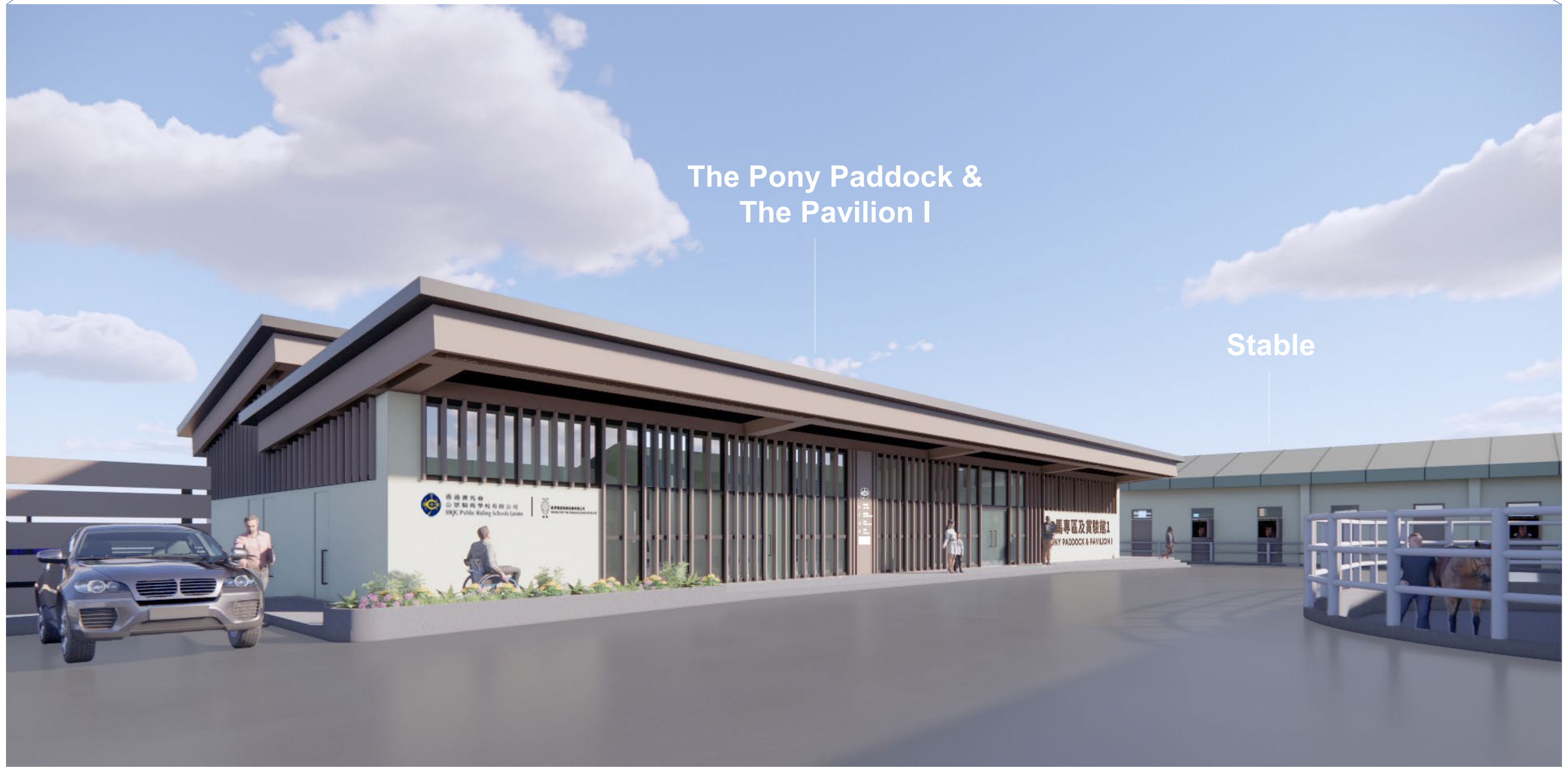
Middle Platform

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale N/A		Figure Appendix 1 (Fig. 2.4)	

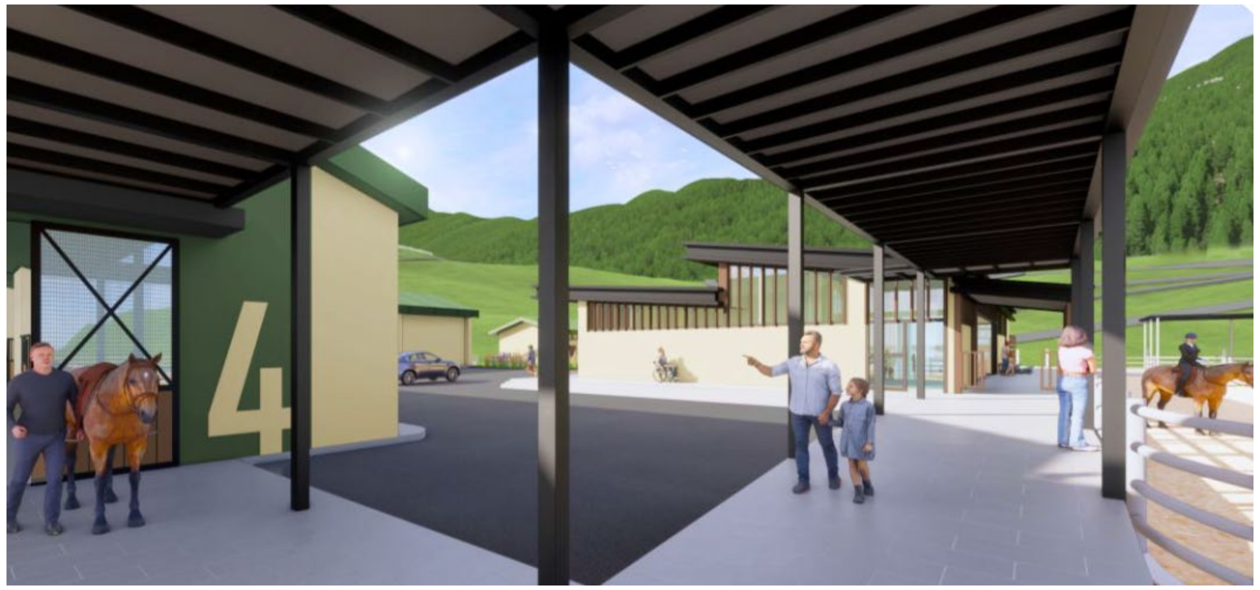

FARRIER & VETERINARY ROOM (46.3mPD)
WASH BOX
STABLE (48.2mPD)
LUNGEING PEN
View 5
View 3
View 4
RUN-OUT
RUN-IN
E&M BLOCK (46.7mPD)
THE PONY PADDOCK & PAVILION I (ADMINSTRATION BUILDING) (48mPD)
HORSE WALKER
ARENA 1
EXISTING ACCESS ROAD (UPGRADING AND WIDENING WORKS TO BE CONDUCTED BY EPD)
COVERED STORAGE AREA



View 4: The Pony Paddock & Pavilion I


The Pony Paddock &
The Pavilion I
Stable

View 3: The Pony Paddock & Pavilion I



View 5: Covered Walkway

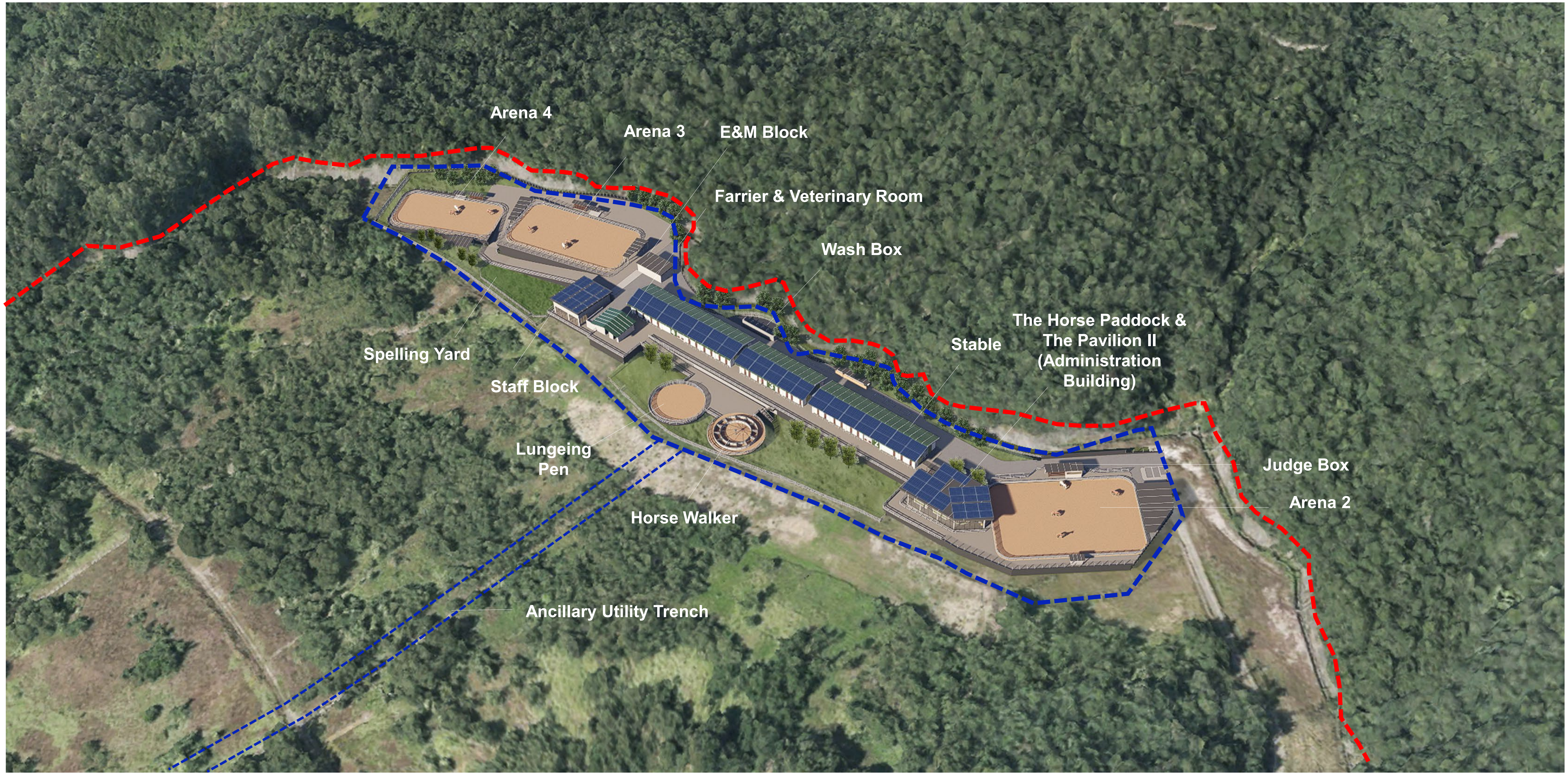
WONG TUNG 王董

Title

Supplementary Drawings - Artist’s Impression (for reference only)

Middle Platform

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale N/A		Figure Appendix 1 (Fig. 2.5)	


Arena 4
Arena 3
E&M Block
Farrier & Veterinary Room
Wash Box
The Horse Paddock &
The Pavilion II
(Administration
Building)
Stable
Spelling Yard
Staff Block
Lungeing
Pen
Horse Walker
Judge Box
Arena 2
Ancillary Utility Trench

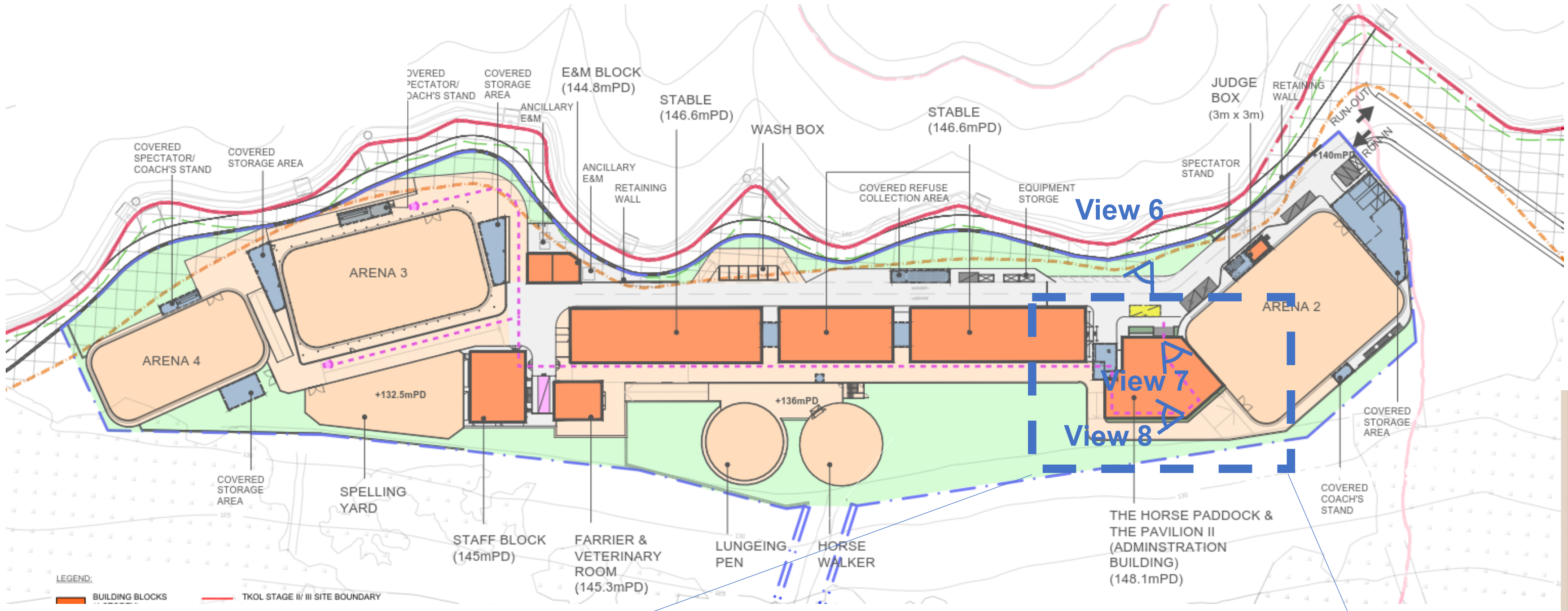
WONG TUNG 王董

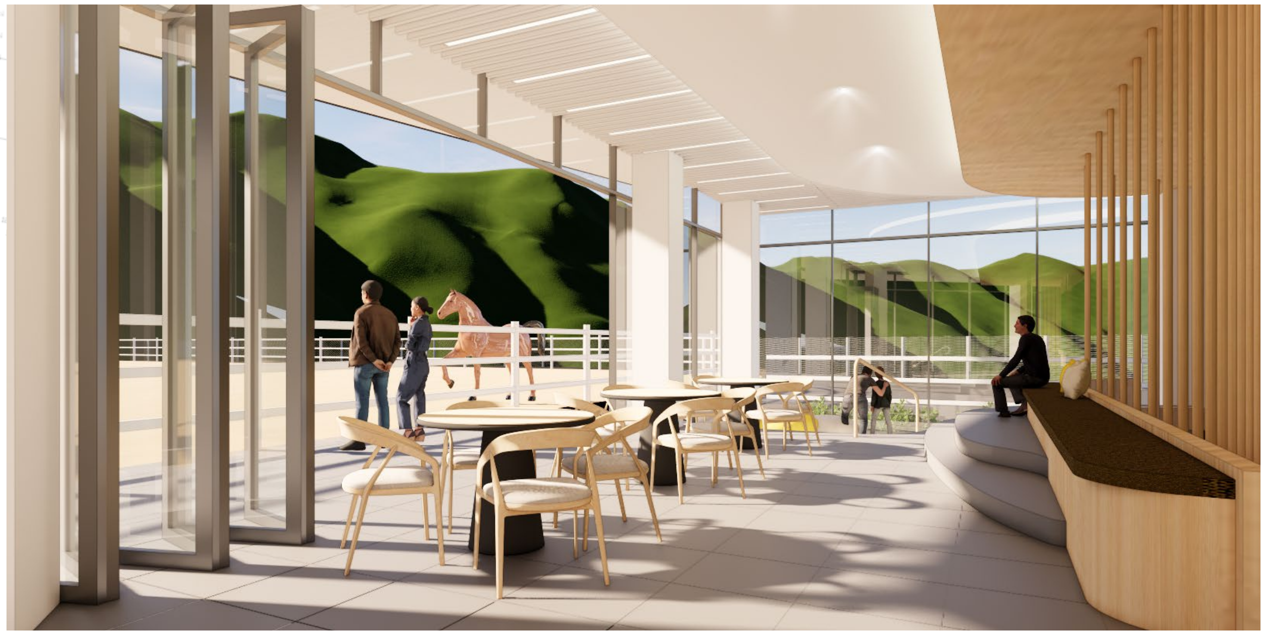
Title

Supplementary Drawings - Artist's Impression (for reference only)

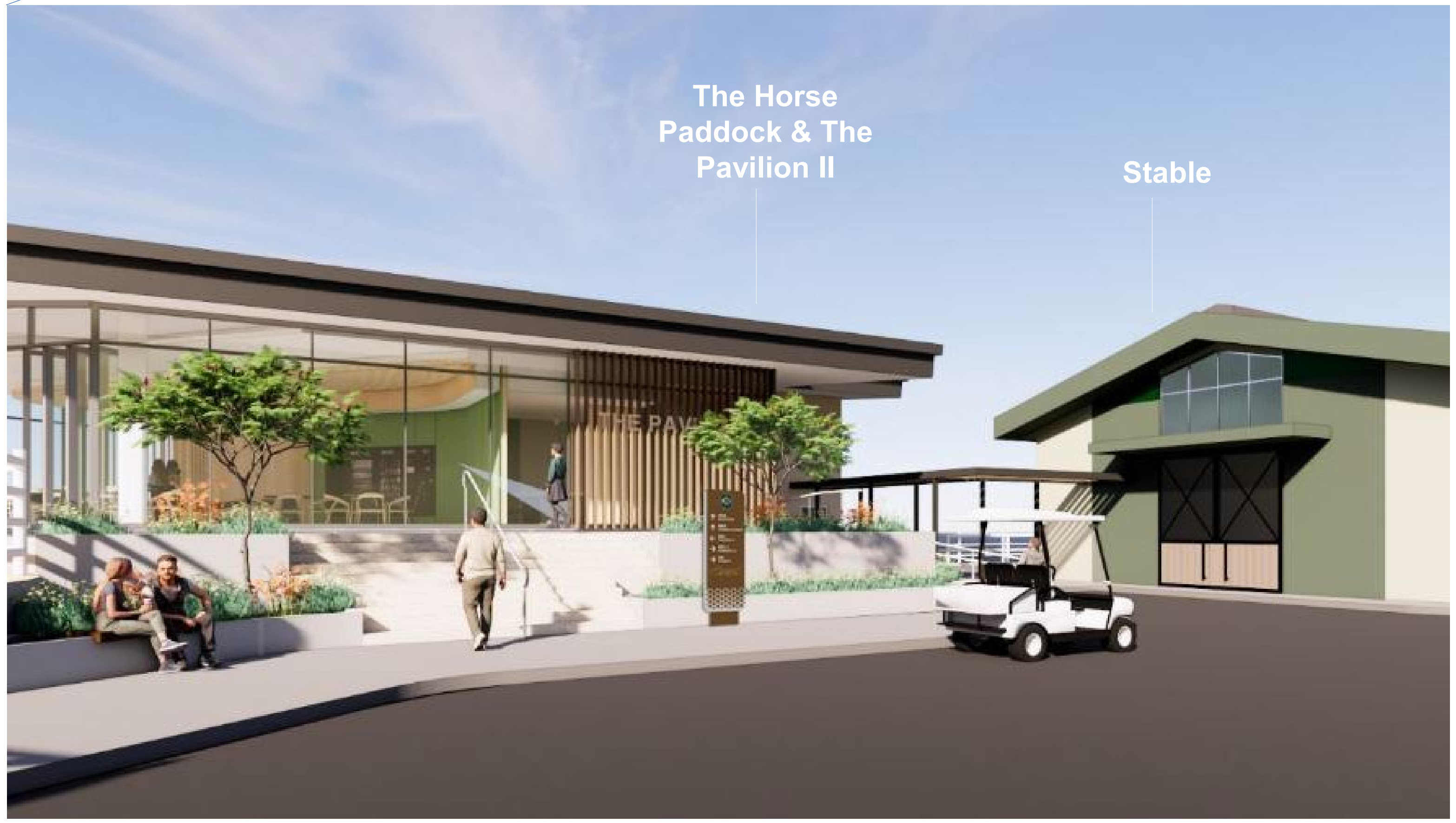
Upper Platform

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale N/A		Figure Appendix 1 (Fig. 2.6)	

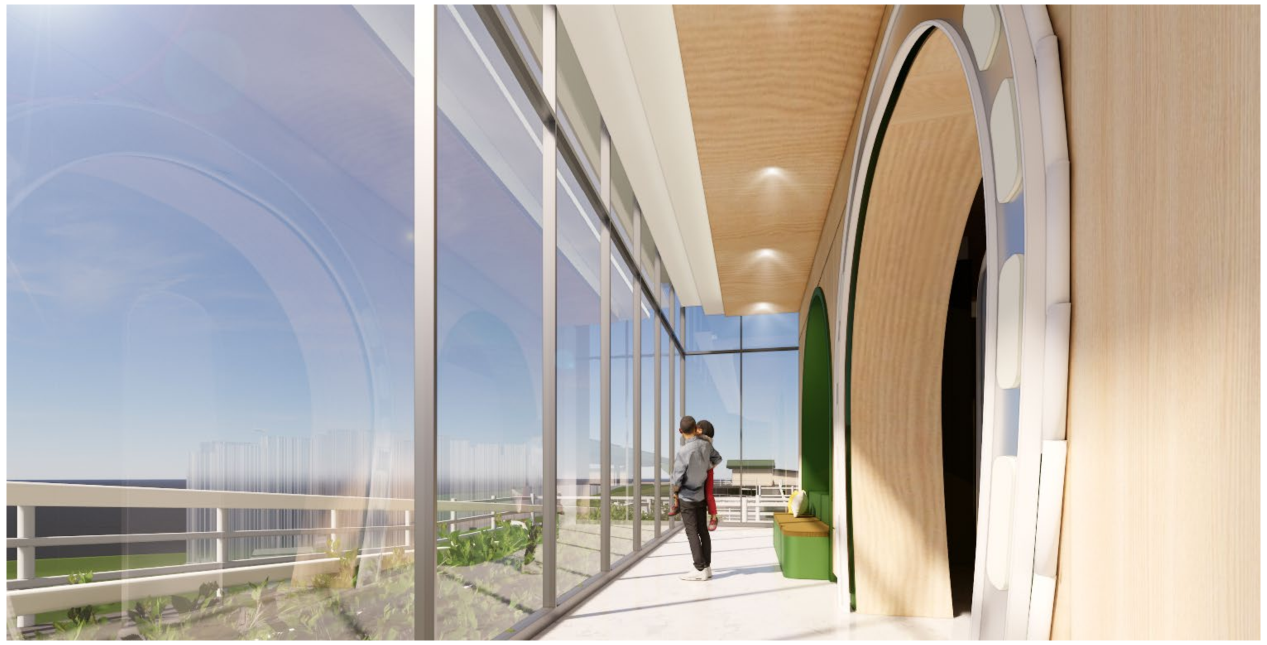

COVERED SPECTATOR/ COACH'S STAND
COVERED STORAGE AREA
VERED PECTATOR/ ACH'S STAND
COVERED STORAGE AREA
ANCILLARY E&M
E&M BLOCK (144.8mPD)
ANCILLARY E&M
RETAINING WALL
STABLE (146.6mPD)
WASH BOX
COVERED REFUSE COLLECTION AREA
STABLE (146.6mPD)
EQUIPMENT STORGE
View 6
SPECTATOR STAND
JUDGE BOX (3m x 3m)
RETAINING WALL
RUN-OUT
RUNN
+140mPD
ARENA 3
ARENA 4
ARENA 2
+132.5mPD
+136mPD
View 7
View 8
COVERED STORAGE AREA
SPELLING YARD
STAFF BLOCK (145mPD)
FARRIER & VETERINARY ROOM (145.3mPD)
LUNGEING PEN
HORSE WALKER
THE HORSE PADDOCK & THE PAVILION II (ADMINSTRATION BUILDING) (148.1mPD)
COVERED STORAGE AREA
COVERED COACH'S STAND
LEGEND:
BUILDING BLOCKS
TKOL STAGE II/ III SITE BOUNDARY



View: 7 The Horse Paddock & The Pavilion II


The Horse Paddock & The Pavilion II
Stable
THE PAV

View 6: The Horse Paddock & The Pavilion II



View 8: The Horse Paddock & The Pavilion II

WONG TUNG 王董

Title

Supplementary Drawings - Artist's Impression (for reference only)

Upper Platform

Checked	SKW	Drawn	RYT
Rev	1	Date	NOV 2025
Scale N/A		Figure Appendix 1 (Fig. 2.7)	

Appendix 2

LANDSCAPE MASTER PLAN AND TREE PRESERVATION AND REMOVAL PROPOSAL

Project Title	Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))
Report Title	Landscape Master Plan and Tree Preservation and Removal Proposal For S16 Planning Application (Rev. B)
Checked By Ms. Rose Tan Registered Landscape Architect	

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Appendix A	Tree Treatment Plan, Tree Treatment Schedule and Photographic Record for Existing Trees
Appendix B	Landscape Master Plan
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1 Background

1.1 General

1.1.1 This Landscape Master Plan and Tree Preservation and Removal Proposal is prepared in support of the Section 16 ("S16") Planning Application to allow for the development of a Public Riding School with ancillary facilities (e.g. utility trench) (collectively as the "PRS") at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories ("TKOL II/III") for the HKJC Public Riding Schools Limited (the "Applicant"). The Application Site comprises of three (3) existing platforms and land required for the provision of ancillary utility trench connecting to the three (3) platforms (collectively as the "Application Site") within TKOL II/III. The PRS aligns with the Government's policy objectives in fostering more public participation in the community through wider visibility and popularity of horse riding, supporting equestrian as an elite sport, and maintaining Hong Kong as a centre for major international sports events.

1.1.2 The Application Site is predominately zoned "Open Space" ("O") on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 ("Approved OZP"), whilst a strip of area at the north is zoned "Green Belt" ("GB") and a minor portion abutting Chun Sing Street is zoned "Other Specified Uses" annotated "Industrial Estate" ("OU(Industrial Estate)") on the Approved OZP. The PRS with ancillary facilities ('Horse Riding School' subsumed under 'Place of Recreation, Sports or Culture' use) is a Column 2 use under the "O", "GB" and "OU(Industrial Estate)" zones that may be permitted with or without conditions on Application under S16 of the Town Planning Ordinance ("TPO"). There are no plot ratio ("PR"), building height ("BH"), and site coverage ("SC") restrictions imposed on the "O", "GB" and "OU(Industrial Estate)" zones of the Approved OZP. While a portion of TKOL II/III falls within the Clear Water Bay Country Park ("CWBCP"), the Application Site does not involve any areas falling within the Country Park Boundary.

1.1.3 The PRS is located on three (3) platforms, namely the Lower Platform (i.e. Reception and Hospitality Lounges) (approx.+6.0mPD), Middle Platform (i.e. Pony Paddock & Pavilion I)(approx. +40.0mPD) and Upper Platform (i.e. Horse Paddock & Pavilion II) (approx.140.0mPD), with a proposed total GFA of approx. 9,000m^2 and a proposed building height of 4.8m to 7.7m. An ancillary utility trench connecting to the three (3) platforms is also proposed to accommodate various essential utilities services in support of the PRS operations.

1.2 Objective

1.2.1 This report has the following objective;

- Demonstrate the landscape layout for the Application Site

1.2.2 Relevant government guidelines, practice notes, references and standards on preparation of this LMP:

- Development Bureau Technical Circular (Works) No. 4/2020 – Tree Preservation; and
- Development Bureau (DEVB) Technical Circular (Works) No. 5/2020 – Registration and Preservation of Old and Valuable Trees.

2 Site Appraisal

2.1 General

2.1.1 The Environmental Protection Department ("EPD") has long been supportive of the development of restored landfills into popular and well utilised recreational and sports facilities and of suitable proposals from organizations or groups to develop self-funded recreational facilities and operate the facilities on a non-profit-making and self-financing basis on restored landfills with the support/consent of relevant policy bureau and departments. Building on the successful precedents, the Applicant has expressed to EPD in developing the three (3) relatively flat platforms deemed technical feasible and safe for recreational use into Hong Kong's fourth PRS as outlined in the Supplementary Planning Statement ("SPS").

2.1.2 The PRS will adopt an integrated design and engineering approach combining strategies as mentioned in the SPS to ensure no disruption to the ongoing waste degradation process and aftercare works and facilities of the restored landfill, in compliance to the loading capacities of the platforms, as well as ensure the safety of all riders and visitors within the PRS. Ultimately, the PRS will offer an immersive equestrian experience through visitor-centric amenities that integrates with the natural landscape and promotes horse welfare and safety.

2.1.3 Generally, TKOL II/III is predominantly surrounded by densely vegetated areas, except area to the west where various existing and planned high-rise residential developments, industrial buildings/ data centres are located. Various bus stops and Green Minibus stops are along Wan Po Road and Wan O Road.

2.1.4 The platforms have a site level difference of approx. 134m. The areas outside the Application Site consist primarily of topographical slopes equipped with landfill restoration facilities to maintain the aftercare works for TKOL II/III.

3 The Proposed Development

3.1 General

3.1.1 The PRS is located on three platforms, namely the Lower Platform (i.e. Reception and Hospitality Lounges) (approx.+6.0mPD), Middle Platform (i.e. Pony Paddock & Pavilion I)(approx. +40.0mPD) and Upper Platform (i.e. Horse Paddock & Pavilion II) (approx.140.0mPD). The platforms are connected by an ancillary utility trench to house the essential utilities service to enable PRS operation and an existing internal road currently used by EPD for aftercare and monitoring works of TKOL II/III. Please refer to the Landscape Master Plan in **Appendix B**.

3.1.2 Lower Platform sits at the southeast part of the site. Located at the lowest level and directly facing Chun Yat Street, it serves as the entrance and drop off point. The platform features Welcome Hub (administration building) and Pony Viewing Area with ancillary supporting facilities. The landscape areas mainly composed of roadside planting with ornamental species and lawn area.

3.1.3 Middle Platform enhances the arrival and recreational experience. It includes the Pony Paddock & Pavilion I (administration building (including Indoor Viewing Area), Stable, Wash Box, Arena, Lungeing Pen, Horse Walker, Farrier & Veterinary Room, Spelling Yard and ancillary supporting facilities.

3.1.4 Upper platform is located at the northeastern part of the site. It consists of the Horse Paddock & Pavilion II (administration building (including Indoor Viewing Area)), Arena, Farrier & Veterinary Workshop, Lungeing Pen, Horse Walker, Staff Block, Spelling Yard and ancillary supporting facilities.

4 Existing Landscape Resources

4.1 General

4.1.1 Tree survey was conducted on between 12nd March and 22nd September 2025 to investigate the landscape impact on existing vegetation within the Application Site and adjoining areas.

4.1.2 Any invasive trees or dead trees within the remaining GLA TSK-500 would be separately removed by EPD during routine woodland management and will not be included in this report.

4.1.3 A total of **62** nos. of surveyed trees were recorded. The tree survey schedule, tree survey plan and photographic record of existing trees are shown in **Appendix A** and are summarized below:

Table 4.1 Summary of Tree Species Composition within or close to the Application Site

	Species Name	Chinese Name	No. of Trees.
1	*Acacia confusa*	台灣相思	8
2	*Bischofia javanica*	秋楓	2
3	*Casuarina equisetifolia*	木麻黃	1
4	*Celtis sinensis*	朴樹	3
5	*Ficus microcarpa*	細葉榕	9
6	*Macaranga tanarius* var. *tomentosa*	血桐	37
7	*Mallotus paniculatus*	白楸	2
			Total : 62

4.1.4 7 nos. of tree species are identified; the dominant species is *Macaranga tanarius var. tomentosa* 血桐 (37 nos.). All of them are common woodland plantation species in Hong Kong. The general conditions of the surveyed trees are found to be poor to average.

4.1.5 There are no Old and Valuable Trees (“OVT”).

4.2 Impact of the Proposed Development

4.2.1 Impact of the Proposed Development is generally caused by the site formation works, construction of the building, removal of existing vegetation for the build element and the related construction activities, excavation works for E&M reserves and structural footings. The proposed building layout has been overlaid on Tree Survey Plans in **Appendix A** to illustrate the impact on the existing trees.

4.3 Retention of Trees

4.3.1 No trees are proposed to be retained within the Application Boundary.

4.4 Felling and Transplantation of Trees

4.4.1 For Trees that will be in conflict with the proposed works shall be proposed to be transplanted if they fulfil all the criteria below:

a. Trees have high amenity value

b. Trees with good form and health;

c. Suitable access;

d. Tree species able to be transplanted easily;

e. Trees have suitable size and;

f. Trees are young to semi-mature.

4.4.2 Within the application site, **62** nos. of existing trees will be in direct conflict with the proposed works and cannot be retained in situ.

4.4.3 The affected trees (62 nos.), including 58 nos. in Open Space and 4 nos. in Green Belt, are on sloping ground or with poor form/ health/structural condition which will not be suitable for transplantation. Therefore, they are proposed to be felled and compensated by quality trees.

4.4.6 A summary of the proposed treatment to the existing trees is listed below:

Table 4.2 Summary of Proposed Treatment for Existing Trees

Proposed Treatment	Quantity (nos.) in Open Space	Quantity (nos.) in Green Belt	Total Quantity (nos.)
To be Retained	0	0	0
To be Transplanted	0	0	0
To be Felled	58	4	62
Total Number of Trees	58	4	62

5. Landscape Design

5.1 General

5.1.1 The landscape proposals aim to respond to the site conditions, building form and function and to provide a quality landscape scheme. The main factors to be taken into consideration are:

- Response to the site context, in terms of landscape character and visual amenity;
- Response to the proposed building and its architectural style;
- Creation of a green setting by maximizing the opportunity for soft landscape; and
- Minimization of future maintenance requirements.

5.1.2 Section diagrams showing the proposed landscape treatment, particularly for the edge treatments of the development and their underlying principles are attached in **Appendix B**.

5.2 Landscape Design Concept

This Landscape Master Plan aims to create quality landscape that fulfil the functional needs of equestrian activities while embracing aesthetics and ecological harmony. The landscape layout at the three platforms will be formulated in a holistic manner to enhance the learning and training experience while establishing an active space to attract visitors, students, and equestrian enthusiasts.

5.2.1 Enhancing Sustainability

Native trees and shrubs species would be strategically incorporated to improve site biodiversity. Whilst the greenery and tree canopies at the three platforms contribute visual and physical comfort for both human and horses.

5.2.2 Enhancing Visitors Journey and Recreation

The three platforms provide sequential and immersive recreational experience for visitors. Guests arrive/ drop-off at Lower Platforms, the linear layout and edge planting create a formal and welcoming entry. They are then directed up to the Middle Platform where is concentrated with paddocks and horse stables for horse riding activities. The Upper Platform would be provided with Arenas, viewing deck etc for visitors to enjoy opened view of surrounding Clear Water Bay Country Park. Way-finding signage would be provided at each platform to guide the circulation across the access road (in separated submission). These intend to create a cohesive recreational journey.

5.2.3 Amenity Plantings within the Development

For the entire landscape area, where practicable, ornamental trees, flowering shrubs, creeping plants are proposed. These soft landscape measures will ensure the hard lines of the built form are visually softened. Planting will be selected to produce seasonal interest and will be comprised of a mixture of native and ornamental species to enhance the character of the proposed landscape area. Planting Plans showing the soft landscape treatment such as trees, shrubs and groundcovers are shown in **Appendix C**.

5.3 Recreational Facilities

5.3.1 The Application Site (three existing platforms) is primarily to provide active recreational use for equestrian sports accompanied by other supporting facilities.

Lower Platform

5.3.2 In support of the house-riding activities in the three platforms, the Lower Platform will serve as the Main Visitor Arrival Centre for all visitors, students, and staff entering the PRS, and include the Welcome Hub (main administration building), Coach Duty Room, Central Fodder Store (Supplies Storage), E&M Block, ancillary E&M, and ancillary parking.

5.3.3 As a unique offering to the PRS at TKO, a 'Pony Viewing Area' is provided at the Lower Platform to offer an opportunity for the public other than riders to be in close proximity with the ponies and to educate the public about equine care and other educational topics. The Pony Viewing Area is strategically located adjacent to the administrative building for optimal accessibility, ensuring convenient access for visitors of all ages and mobility. The Pony Viewing Area will be accessible to all visitors, including those not participating in riding lessons, during operational hours.

Middle Platform

5.3.4 The Middle Platform will be mainly used for supporting the activities of the Riding for Disabled Association ("RDA") to support persons with disabilities, pony riding, and riding lessons for beginners. The Middle Platform is divided into two portions by the existing access road, with the Western Portion being the main area consisting of essential facilities, including Pony Paddock & Pavilion I (administration building), Arena, Stable, Wash Box, Lungeing Pen, Horse Walker, Farrier & Veterinary Room, E&M Block, Covered storage areas, and ancillary parking. The Eastern Portion of the Middle Platform consists of an extensive Spelling Yard.

Upper Platform

5.3.5 The 'Horse Paddock & Pavilion II' at the Upper Platform accommodates majority of the PRS riding activities and consists of the Horse Paddock & Pavilion II (administration building), three (3) Arenas, three (3) Stables, Wash Box, Farrier & Veterinary Room, Lungeing Pen, Horse Walker, Staff Block, Spelling Yard, E&M Block, Judge Box, covered storage areas, covered coach's stands, Spectator Stand, and ancillary parking.

5.3.6 The Horse Paddock & Pavilion II provides Indoor Viewing Areas open to the Paddocks and Spelling Yad, as well as panoramic vistas of the surrounding mountains and Junk Bay, enhancing their overall experience at PRS. The Stables provide a scenic and tranquil environment that allow for horses to enjoy an unrestricted view overlooking the natural landscape and bay views while resting.

Overall

5.3.7 Recreational spaces with different functions and activities are proposed across the three platforms which will cater for the recreational and equestrian needs of the visitors. The provision of recreational facilities to be provided within the Application Site are:

Table 5.1 Proposed Recreational Facilities

Location	Proposed Scheme	
Lower Platform	Recreational Open Space:	Pony Viewing Area
	Recreational and Supporting Facilities:	Welcome Hub (administration building), Coach Duty Room, Central Fodder Store, E&M Block, Ancillary Car Park
Middle Platform	Recreational Open Space:	The Pony Paddock & Pavilion I (administration building (including Indoor Viewing Area))
	Recreational and Supporting Facilities:	Arena, Arena Storeroom, Stable*1, Wash Box, Lunging Pen, Horse Walker, Farrier & Veterinary Room, E&M Block, Spelling Yard, Ancillary Car Park
Upper Platform	Recreational Open Space:	The Horse Paddock & Pavilion II (Administration Building (including Indoor Viewing Area))
	Recreational and Supporting Facilities:	Arenas, Stables, Wash Box, Farrier & Veterinary Room, Lungeing Pen, Horse Walker, Staff Block, Spelling Yard, E&M Block, Judge Box, covered storage areas, covered coach's stands, Spectator Stand, ancillary parking

5.4 Lighting

5.4.1 All the accessible and open space areas will be provided with sufficient illumination to follow the Chartered Institution of Building Services Engineers (CIBSE) lighting guide. The lighting concept includes 3 types of lighting as follows:

5.4.2 (a) Amenity Lighting

The amenity lighting design aims to provide adequate security and safety and with high amenity value. A proprietary brand of lighting shall be selected and the style of fixtures shall aim to compliment the general landscape design concept and be consistent throughout the residential area.

5.4.3 (b) Area Lighting

Low level lighting such as wall recessed wall lighting and planter up-light shall be proposed at gardens to minimize visual intrusion of high lamp poles to residents.

5.4.4 (c) Safety Lighting

For security measures at night, minimum lux level lighting will be utilised for periods between midnight and early morning.

5.5 Soil Depth and Drainage for Planting

5.5.1 The area outside the Application Site within TKOL II/III involves monitoring facilities to maintain the aftercare works for TKOL II/III by EPD. To preserve the functionality of these landfill facilities, the soft landscaping work in general will directly adopt the existing soiling system and it is acknowledged that the planting soil is 800mm depth above the waterproof layer.

5.5.2 Under the aftercare works by EPD, tree groups have been planted throughout the TKO II/III and are now observed to be moderately established, demonstrating the existing soiling system is suitable for tree/plant growth and able to support the proposed plantation within the Application Boundary.

5.5.3 For the trees or shrubs to be planted on structure of the three platforms, to support healthy plant growth, 1200mm soil depth for tree planting and 600mm for shrub planting will be provided accompanied by additional drainage layer.

Table 5.2 Planting Medium (Soil Depth)

Planting Type	Soil Depth
Tree	As existing; or 1200mm on structure
Shrub/ climber	As existing; or 600mm on structure
Groundcover/ Turf	As existing; or 300mm on structure

Irrigation

5.5.4 The proposed irrigation system will be by tap water pipe for manual operation. Lockable water points will be provided at 40m centres covering the entire new planting areas. The proposed source of water supply is subject to final approval from the Water Services Department.

Future Maintenance

Hard Landscape Elements

5.5.5 Maintenance for hard landscape elements within the proposed landscaped areas shall be carried out by management office of the proposed development with maintenance intention as follows:

I – Routine Maintenance (Daily – Weekly)
a. Rubbish and litter removal;
b. Sweeping and cleaning; and
c. Damage inspection and repair for site furniture and light bulb replacement.

II – Annual/ Long Term Maintenance
a. Repainting;
b. Resurfacing of worn pavements;
c. Replacing worn parts site furniture, lighting fixture and other facilities; and
d. Replacement of worn landscape furniture.

Soft Landscape Element

5.5.6 For all landscaped areas, the softworks contractor will be responsible for maintenance of the planting during the establishment period allowed for in the construction contract, usually for the first year after the beginning of the operational phase. This will ensure that the soft landscape measures are in a healthy condition prior to the finished scheme being handed back to the lot owner.

5.5.7 Ultimately, the lot owners will employ maintenance staff to take care of all landscaped areas within the Site.

6 Planting Proposal

6.1 General

6.1.1 As stipulated in LAO PN No. 6/2023, the compensation ratio of felled trees shall be not less than 1:1 in terms of quantity. All compensatory trees will be planted within the Application Boundary or within the TKOL II/III. A compensatory ratio of at least 1:1 in terms of quantity in general will be achieved. To enhance the visual and environmental quality of the restored landfill and blend into the natural environment, a matrix of native and ornamental species is proposed in this compensatory proposal.

6.1.2 In order to provide quality landscape for the proposed development, soft landscape works will be the major landscape element in the landscaping proposal and should satisfy the following criteria:

- To compensate the loss of affected trees;
- To match or improve the landscape quality to the existing restored landfill;
- To minimize future maintenance; and,
- To be compatible with the hillside environment and the adjacent Clear Water Bay Country Park.

6.1.3 The proposed new tree planting schedule is listed below for reference:

Table 6.1 Proposed Planting Schedule

Botanical Name	Chinese Name	Origin	Size (mm)
Trees			
Castanopsis fissa	黧蒴錐	Native	Whips to Standard Size
Litsea glutinosa	潺槁樹	Native	Whips Size
Sapium discolor	山烏桕	Native	Whips Size
Sterculia lanceolata	假蘋婆	Native	Whips to Standard Size
Viburnum odoratissimum	珊瑚樹	Native	Whips to Standard Size
Shrub and Groundcovers			
Cenchrus ciliaris	水牛草	Exotic	Medium Size
Chloris gayana	非洲虎尾草	Exotic	Medium Size
Cuphea hyssopifolia	雪茄花	Exotic	Medium Size
Eragrostis curvula	彎葉畫眉草	Exotic	Medium Size
Miscanthus spp.	芒草	Exotic	Medium Size
Nephrolepis cordifolia	腎蕨	Exotic	Medium Size
Pennisetum alopecuroides	狼尾草	Native	Medium Size
Scaevola taccada	草海桐	Native	Medium Size
Lagurus ovatus	兔尾草	Exotic	Medium Size

62 whips to standard size trees are proposed to be planted to compensate the loss of existing trees. All the trees within the Application Boundary will be maintained by the management office of the proposed development including 17 nos. of trees in Lower Platform; 5 nos. of trees in Middle Platform and 40 nos. of trees in Upper Platform.

6.1.4 There is excavation limit of 500mm depth within the cap zone of the restored landfill. Any tree planting proposed on existing soil system within the cap zone will be limited to whip size to avoid damaging the existing underground facilities during the horticultural work. On the contrary, standard-sized trees are proposed on new planters and flat ground without immediate underground landfill facilities.

6.1.5 The overall compensatory proposal is summarized in **Table 4.4** below.

Table 4.4 Overall Compensatory Proposal

	Proposed scheme
Total number of trees to be removed	62
Number of new trees within the Application Boundary	62
Overall compensatory ratio in terms of number	1:1

7 Proposal for Tree Preservation

7.1 General

7.1.1 In this proposal, **no** surveyed tree within the Application Site will be preserved on site.

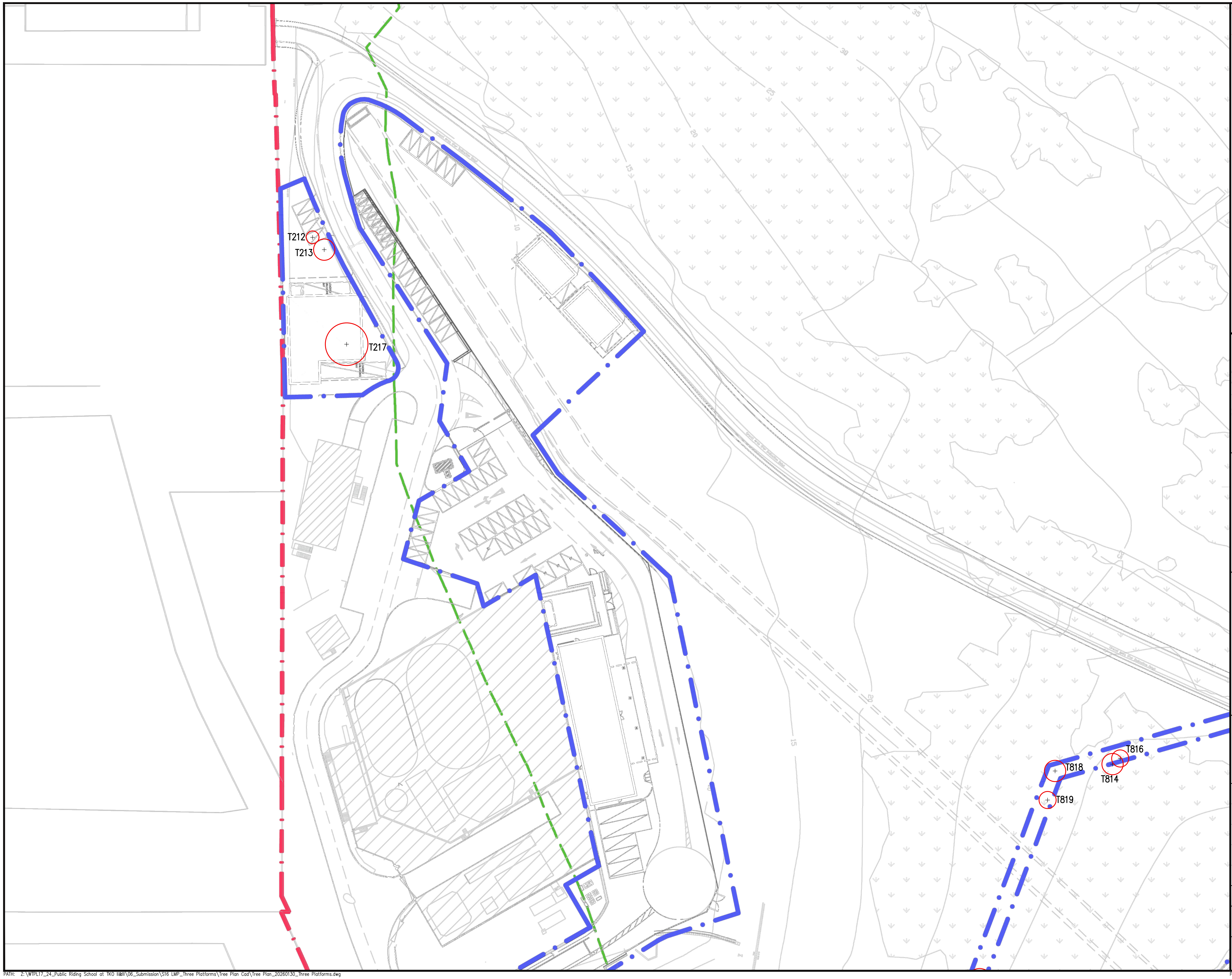
7.1.2 Tree Preservation and Removal Proposal is provided in this report. Tree removal work will be carried out after the necessary approval from all related department unless under emergency condition.

7.1.3 The softworks contractor will be responsible for maintenance of the planting during the establishment period allowed for in the construction contract, usually for the first year after the beginning of the schemes operational phase. This will ensure that the soft landscapes within the Application Boundary are in a healthy condition prior to the finished scheme being handed back to management office of the site.

-End-

Appendix A

Tree Treatment Plan, Tree Treatment Schedule and Photographic Record for Existing Trees



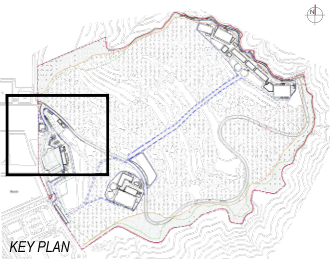
LEGEND:

- TKOL STAGE II/III (GLA-TSK 500)
- APPLICATION SITE
- NO-BUILD ZONE
- CAP ZONE
- COUNTRY PARK ZONE

T## TREE NUMBER

○ TREE TO BE RETAINED

○ TREE TO BE FELLED



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Tel: (852) 2893 0370 Fax: (852) 2893 3139
WWW.OTHERLAND.COM.HK

CLIENT:
THE HONG KONG JOCKEY CLUB

PROJECT:
PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

TITLE:
TREE TREATMENT PLAN 01

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CHECKED BY:	RT
APPROVED BY:	RT
DRAWING DATE:	20260128
PROJECT No:	–

SHEET No:	REV:
WTPL17_TPRP_TTP_1	B

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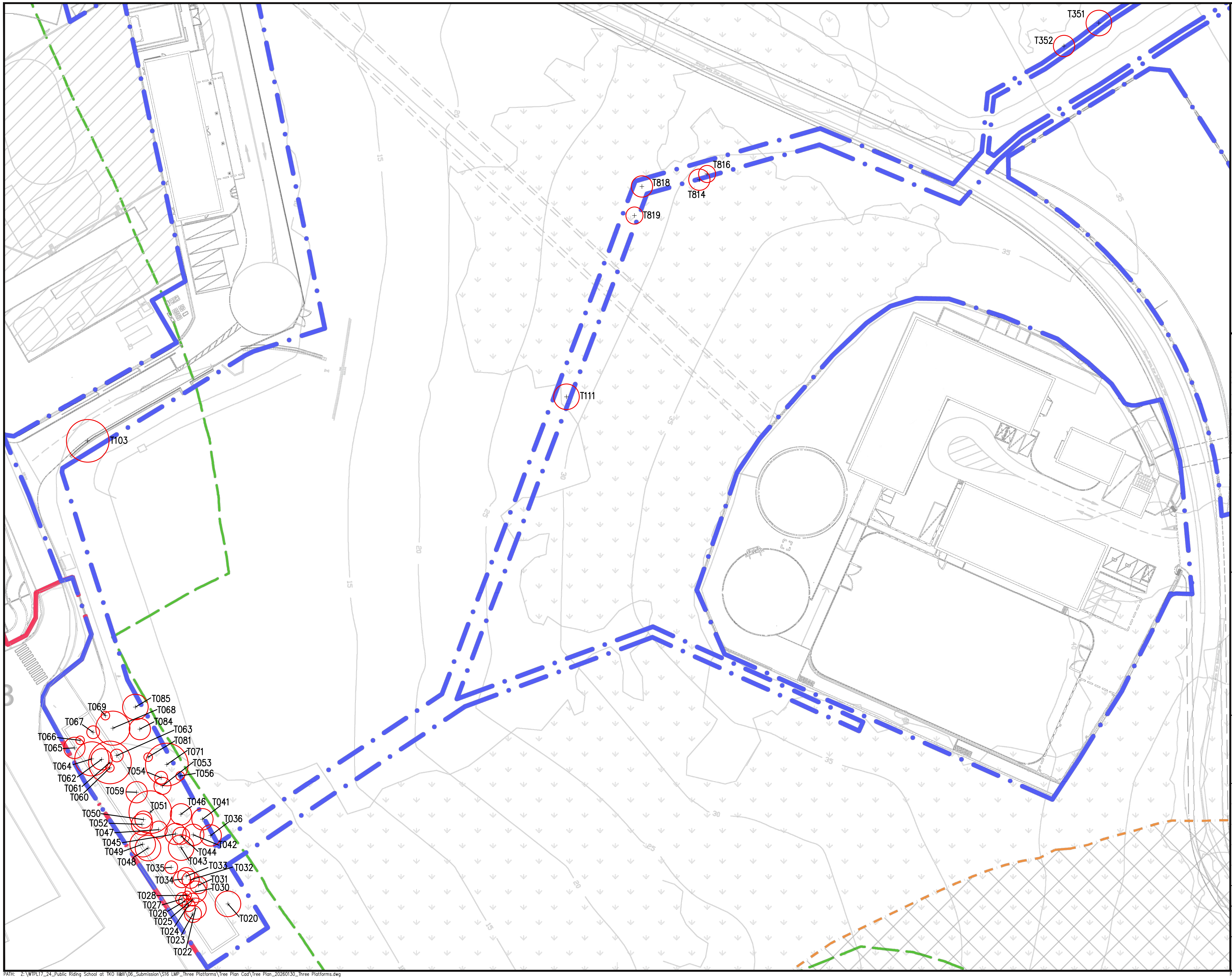
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LEGEND:

🟥 TKOL STAGE II/III (GLA-TSK 500)

🟦 APPLICATION SITE

🟧 NO-BUILD ZONE

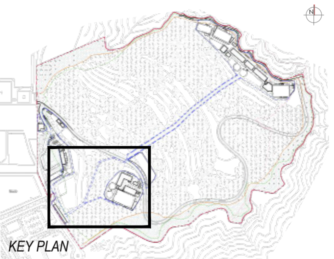
🟩 CAP ZONE

COUNTRY PARK ZONE

T## TREE NUMBER

○ TREE TO BE RETAINED

○ TREE TO BE FELLED


KEY PLAN

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TITLE:

TREE TREATMENT PLAN 02

SCALE:	1:800 (A3)
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APPROVED BY:	RT
DRAWING DATE:	20260128
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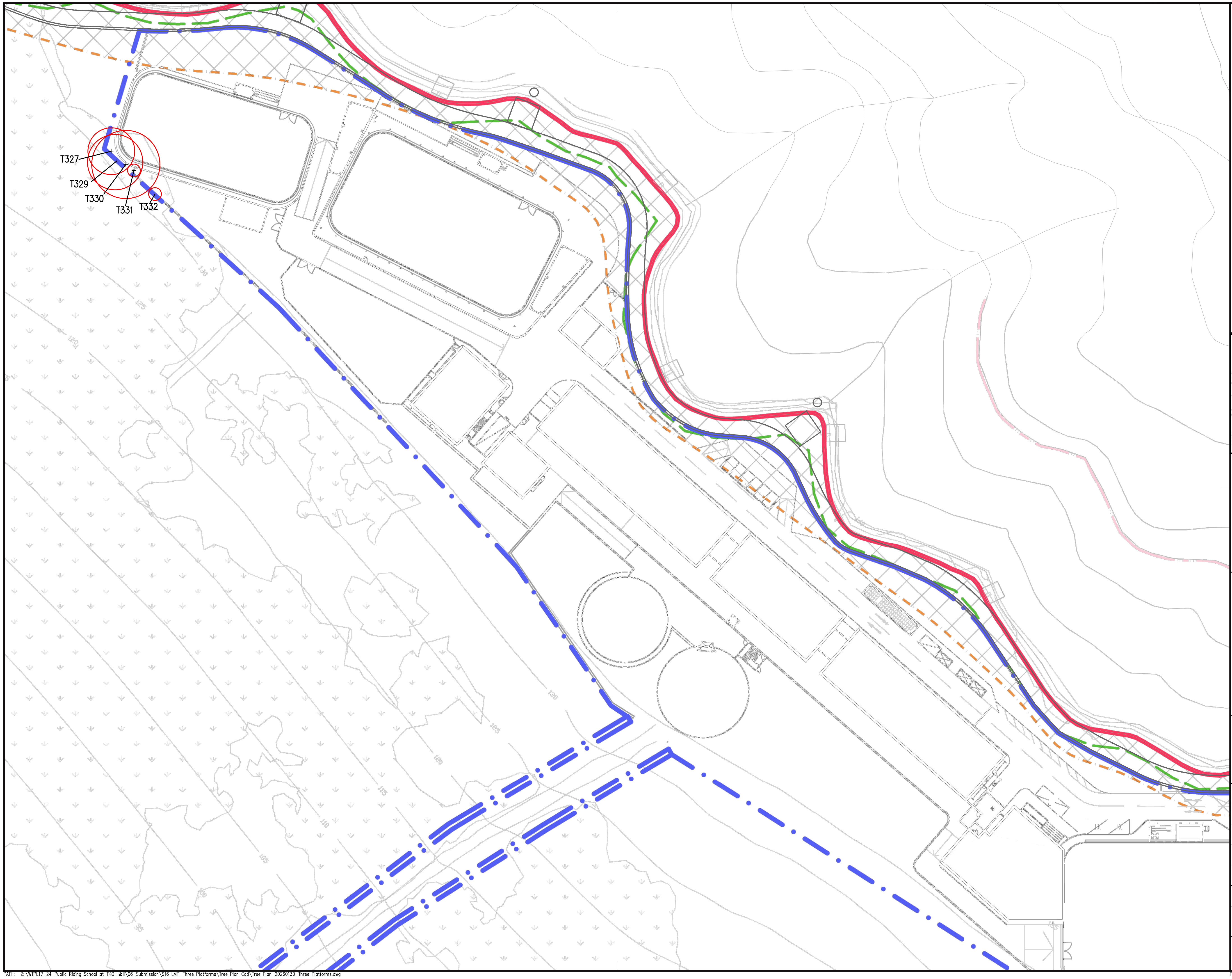
PLOT: Konichan DATE: 2 February 2026



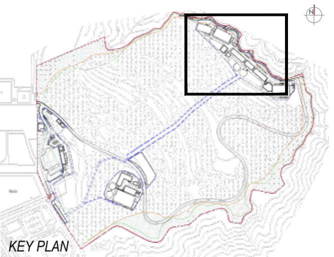
LEGEND:

- TKOL STAGE II/III (GLA-TSK 500)
- APPLICATION SITE
- NO-BUILD ZONE
- CAP ZONE
- COUNTRY PARK ZONE

T## TREE NUMBER

○ TREE TO BE RETAINED

○ TREE TO BE FELLED


KEY PLAN

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PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

TITLE:

TREE TREATMENT PLAN 03

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CHECKED BY:	RT
APPROVED BY:	RT
DRAWING DATE:	20260128
PROJECT No:	–
SHEET No: WTPL17_TPRP_TTP_3	REV: B

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PLOT: Konichan DATE: 2 February 2026

Tree Treatment Schedule

Prepared by Yeung Ho Yin Otto GMTLS, DevB - Registered Arborist (TM327832)
Date of Survey: 12,13,17,18, 26, 27 March & 20 September 2025

Tree no.	Photo no.	Species		Tree Size			Proposed Treatment (Retain/Transplant/Fell)	Remarks[1]
		Scientific name	Chinese name	Height (m)	DBH[2] (mm)	Crown spread (m)		(Old and Valuable Tree (OVT), potentially registrable OVT, rare species, protected species, ecological and historical significance, etc.)
T020	T020	*Macaranga tanarius* var. *tomentosa*	血桐	4	308	6	Fell	-
T022	T022	*Macaranga tanarius* var. *tomentosa*	血桐	4	124	5	Fell	-
T023	T023	*Macaranga tanarius* var. *tomentosa*	血桐	5	184	4	Fell	-
T024	T024	*Macaranga tanarius* var. *tomentosa*	血桐	5	167	3	Fell	-
T025	T025	*Macaranga tanarius* var. *tomentosa*	血桐	5	124	3	Fell	-
T026	T026	*Macaranga tanarius* var. *tomentosa*	血桐	5	102	3	Fell	-
T027	T027	*Macaranga tanarius* var. *tomentosa*	血桐	5	95	3	Fell	-
T028	T028	*Macaranga tanarius* var. *tomentosa*	血桐	5	99	2	Fell	-
T030	T030	*Macaranga tanarius* var. *tomentosa*	血桐	6	157	5	Fell	-
T031	T031	*Macaranga tanarius* var. *tomentosa*	血桐	6	216	4	Fell	-
T032	T032	*Macaranga tanarius* var. *tomentosa*	血桐	6	134	4	Fell	-
T033	T033	*Macaranga tanarius* var. *tomentosa*	血桐	5	185	4	Fell	-
T034	T034	*Macaranga tanarius* var. *tomentosa*	血桐	5	213	4	Fell	-
T035	T035	*Macaranga tanarius* var. *tomentosa*	血桐	5	115	3	Fell	-
T036	T036	*Macaranga tanarius* var. *tomentosa*	血桐	7	179	5	Fell	-
T041	T041	*Macaranga tanarius* var. *tomentosa*	血桐	7	187	5	Fell	-
T042	T042	*Macaranga tanarius* var. *tomentosa*	血桐	6	159	5	Fell	-
T043	T043	*Macaranga tanarius* var. *tomentosa*	血桐	6	166	6	Fell	-
T044	T044	*Macaranga tanarius* var. *tomentosa*	血桐	7	143	4	Fell	-
T045	T045	*Macaranga tanarius* var. *tomentosa*	血桐	7	183	5	Fell	-
T046	T046	*Macaranga tanarius* var. *tomentosa*	血桐	5	156	5	Fell	-
T047	T047	*Ficus microcarpa*	細葉榕	9	651	4	Fell	-
T048	T048	*Macaranga tanarius* var. *tomentosa*	血桐	5	111	6	Fell	-
T049	T049	*Macaranga tanarius* var. *tomentosa*	血桐	5	197	6	Fell	-
T050	T050	*Macaranga tanarius* var. *tomentosa*	血桐	7	159	4	Fell	-
T051	T051	*Ficus microcarpa*	細葉榕	9	533	10	Fell	-
T052	T052	*Macaranga tanarius* var. *tomentosa*	血桐	7	126	5	Fell	-
T053	T053	*Macaranga tanarius* var. *tomentosa*	血桐	7	127	4	Fell	-
T054	T054	*Macaranga tanarius* var. *tomentosa*	血桐	6	95	3	Fell	-
T056	T056	*Macaranga tanarius* var. *tomentosa*	血桐	5	108	2	Fell	-
T059	T059	*Macaranga tanarius* var. *tomentosa*	血桐	9	260	5	Fell	-
T060	T060	*Bischofia javanica*	秋楓	5	95	2	Fell	-
T061	T061	*Macaranga tanarius* var. *tomentosa*	血桐	6	271	7	Fell	-
T062	T062	*Macaranga tanarius* var. *tomentosa*	血桐	7	194	5	Fell	-
T063	T063	*Macaranga tanarius* var. *tomentosa*	血桐	5	129	3	Fell	-
T064	T064	*Ficus microcarpa*	細葉榕	7	630	7	Fell	-
T065	T065	*Ficus microcarpa*	細葉榕	7	315	5	Fell	-
T066	T066	*Bischofia javanica*	秋楓	5	99	2	Fell	-
T067	T067	*Macaranga tanarius* var. *tomentosa*	血桐	6	180	3	Fell	-
T068	T068	*Macaranga tanarius* var. *tomentosa*	血桐	7	401	7	Fell	-
T069	T069	*Macaranga tanarius* var. *tomentosa*	血桐	3	125	2	Fell	-

Tree Treatment Schedule

Tree no.	Photo no.	Species		Tree Size			Proposed Treatment (Retain/Transplant/Fell)	Remarks[1]
		Scientific name	Chinese name	Height (m)	DBH[2] (mm)	Crown spread (m)		(Old and Valuable Tree (OVT), potentially registrable OVT, rare species, protected species, ecological and historical significance, etc.)
T071	T071	*Acacia confusa*	台灣相思	6	255	6	Fell	-
T081	T081	*Celtis sinensis*	朴樹	4	111	2	Fell	-
T084	T084	*Celtis sinensis*	朴樹	8	282	5	Fell	-
T085	T085	*Acacia confusa*	台灣相思	10	351	6	Fell	-
T103	T103	*Acacia confusa*	台灣相思	5	295	5	Fell	-
T111	T111	*Acacia confusa*	台灣相思	8	398	6	Fell	-
T212	T212	*Casuarina equisetifolia*	木麻黃	6	255	3	Fell	-
T213	T213	*Ficus microcarpa*	細葉榕	6	255	5	Fell	-
T217	T217	*Ficus microcarpa*	細葉榕	9	418	7	Fell	-
T300	T300	*Celtis sinensis*	朴樹	4	131	3	Fell	-
T327	T327	*Ficus microcarpa*	細葉榕	9	294	8	Fell	-
T329	T329	*Ficus microcarpa*	細葉榕	10	436	13	Fell	-
T330	T330	*Ficus microcarpa*	細葉榕	9	760	12	Fell	-
T331	T331	*Mallotus paniculatus*	白楸	2	159	3	Fell	-
T332	T332	*Mallotus paniculatus*	白楸	3	95	3	Fell	-
T351	T351	*Macaranga tanarius* var. *tomentosa*	血桐	5	193	6	Fell	-
T352	T352	*Macaranga tanarius* var. *tomentosa*	血桐	4	105	5	Fell	-
T814	T814	*Acacia confusa*	台灣相思	11	494	10	Fell	-
T816	T816	*Acacia confusa*	台灣相思	8	291	5	Fell	-
T818	T818	*Acacia confusa*	台灣相思	6	286	4	Fell	-
T819	T819	*Acacia confusa*	台灣相思	7	323	4	Fell	-

Summary Table

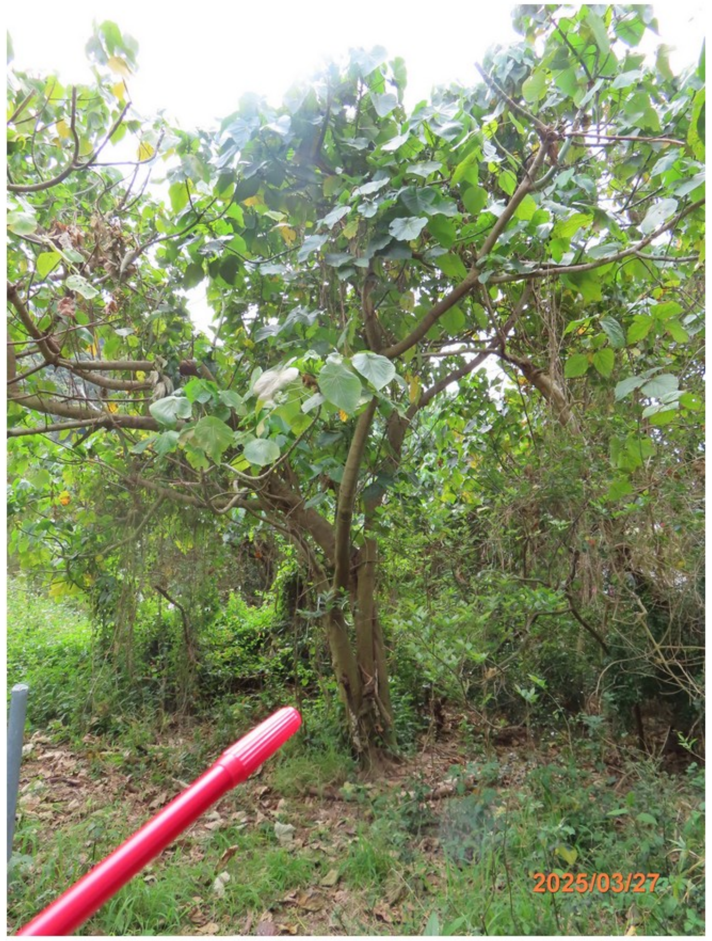
	Number of Tree(s)
Tree to be Retained	0
Tree to be Transplanted	0
Tree to be Felled	62
Total Number of Existing Tree(s)	62

Note:

[1] Please state whether the OVT, potentially registrable OVT, trees of rare or protected species, trees with ecological and historical significance, etc. within and/or adjacent to the site is likely to be affected by the proposed development.

[2] DBH of a tree refers to its diameter at breast height (i.e. measured at 1.3m above ground level).

Photographic Record for Existing Trees



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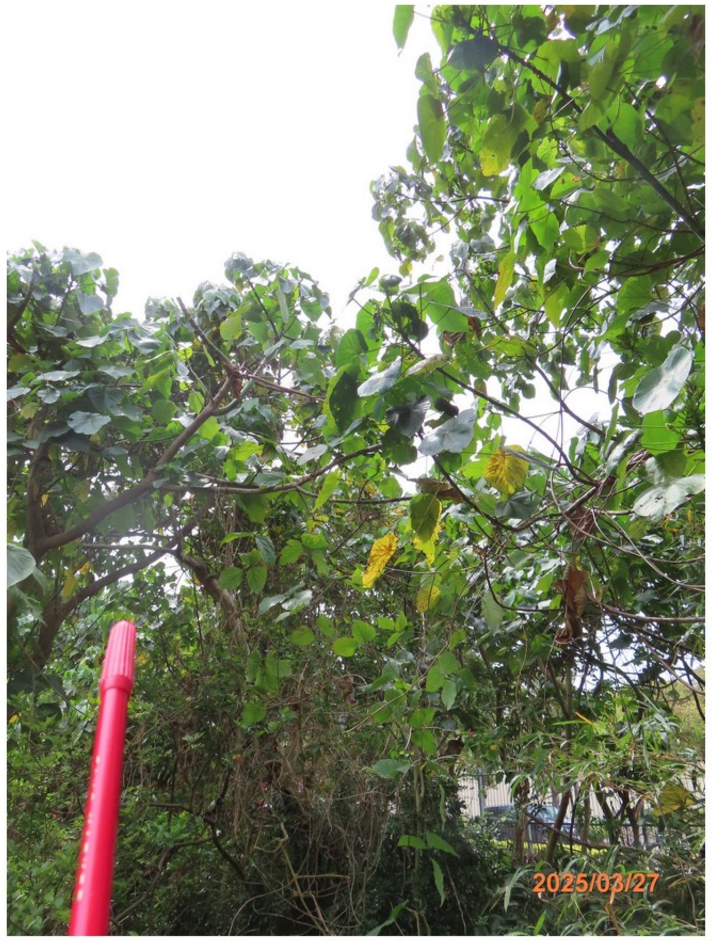

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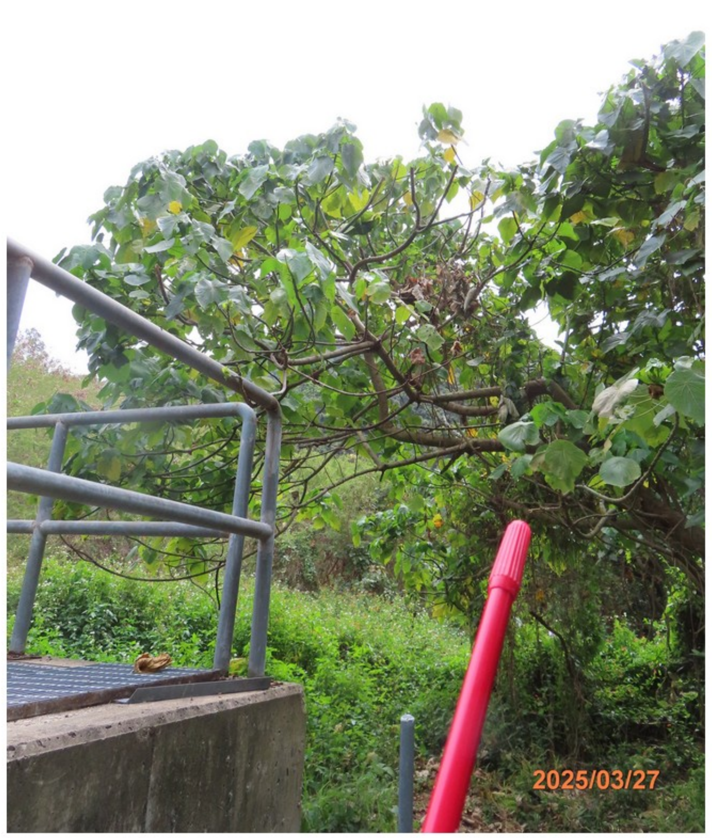

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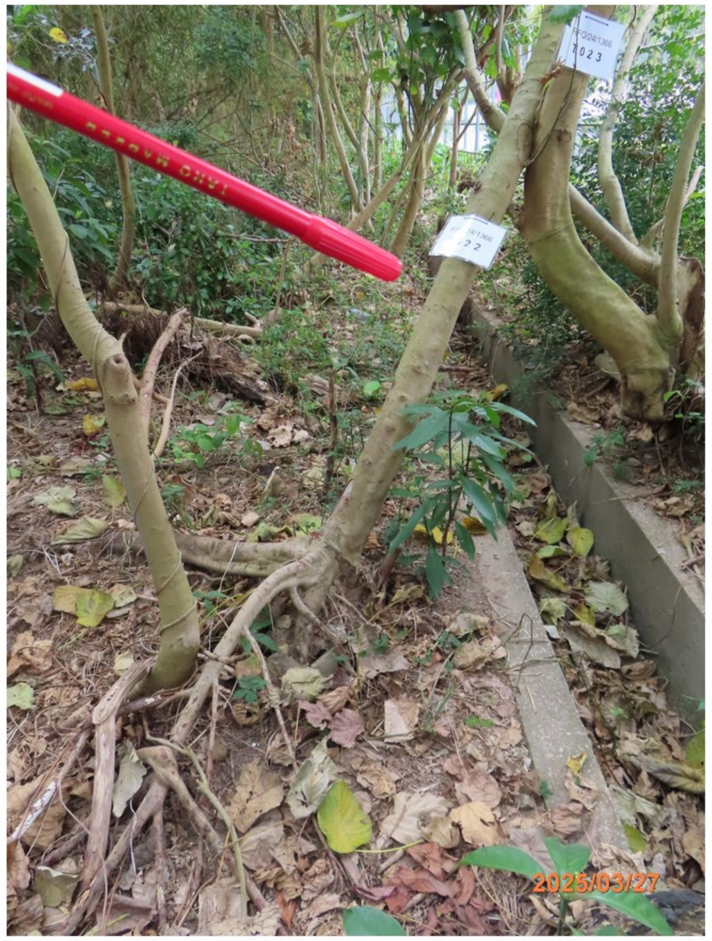

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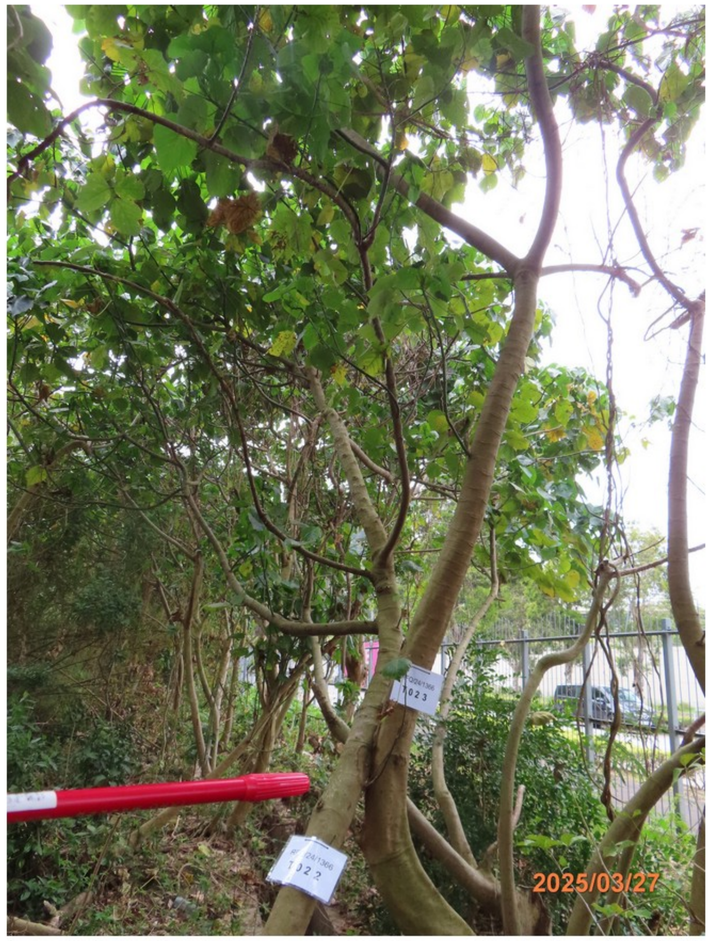

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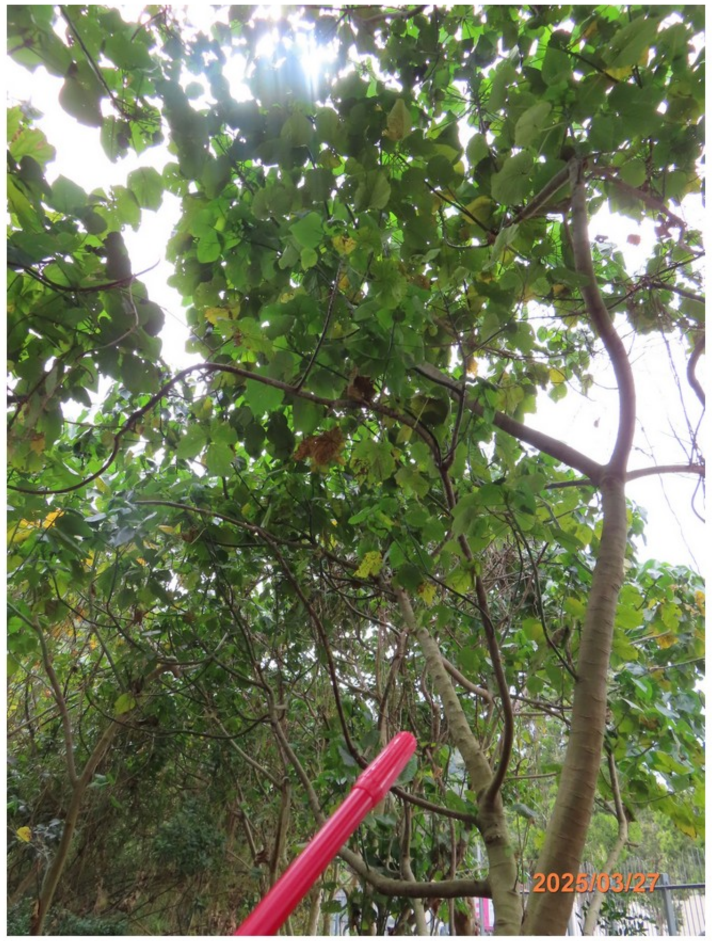

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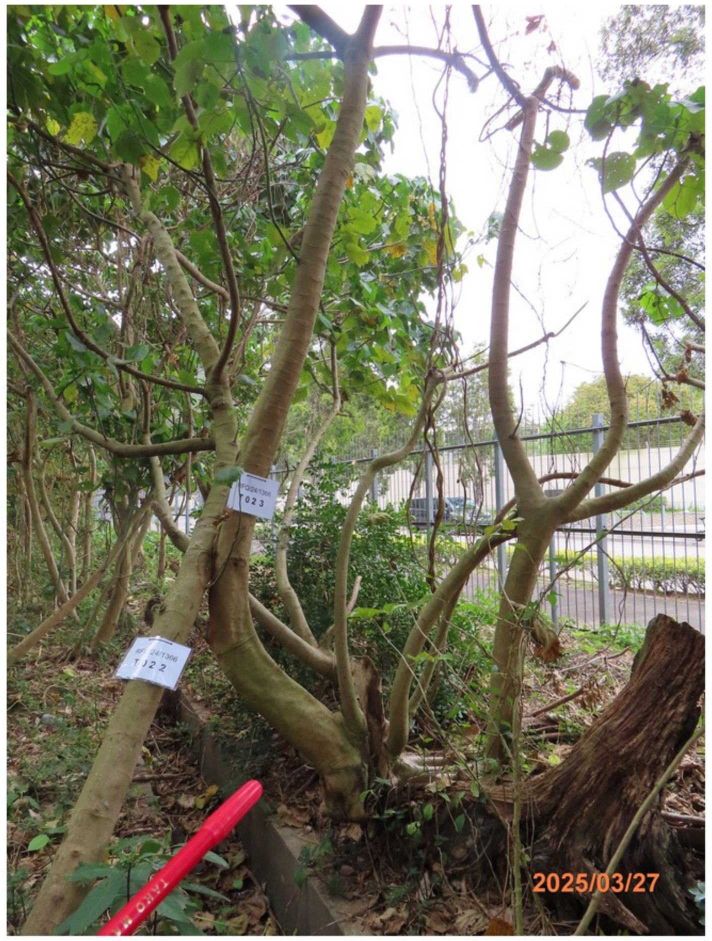

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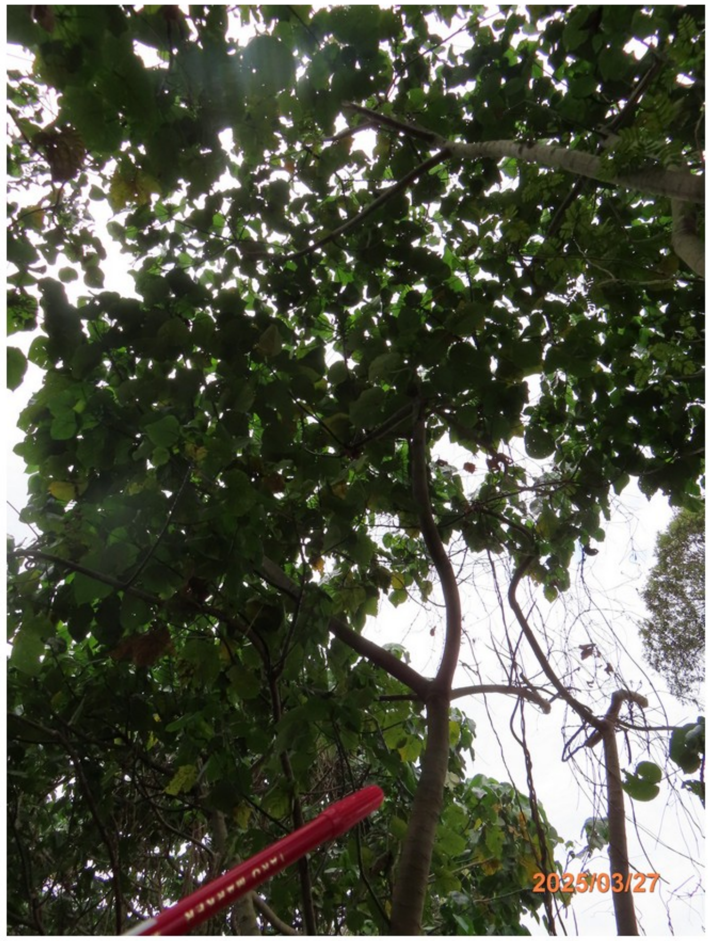
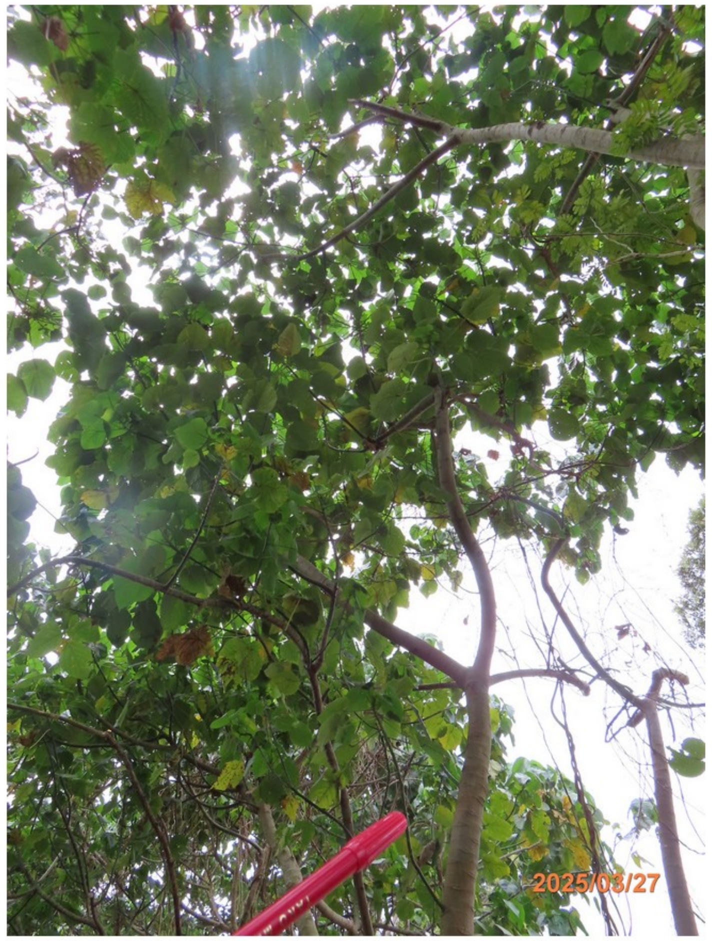


T023 (2)

Photographic Record for Existing Trees



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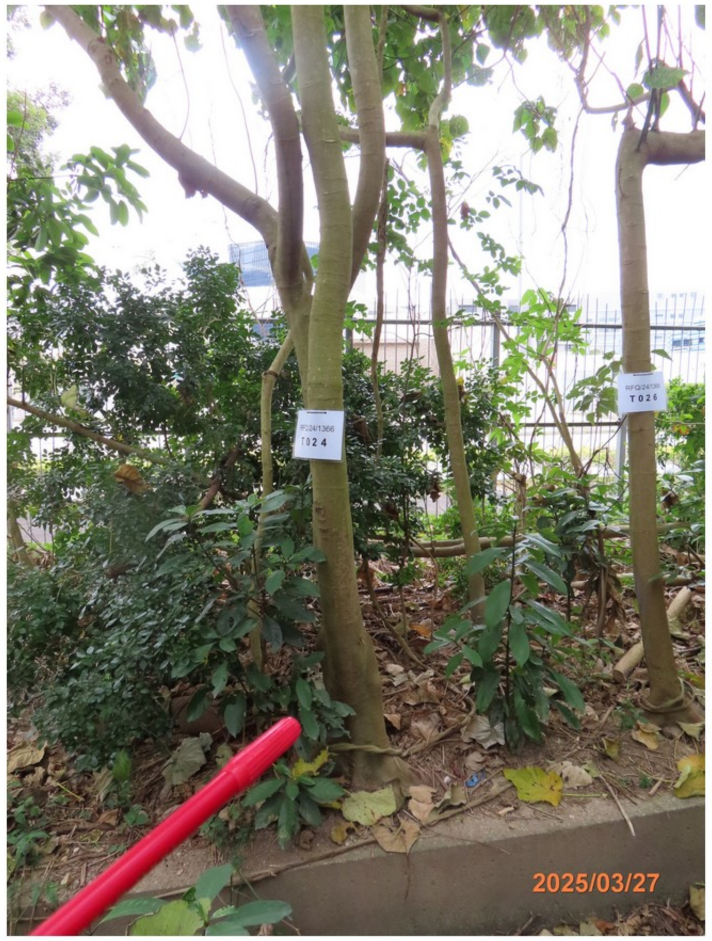
T024
2025/03/27

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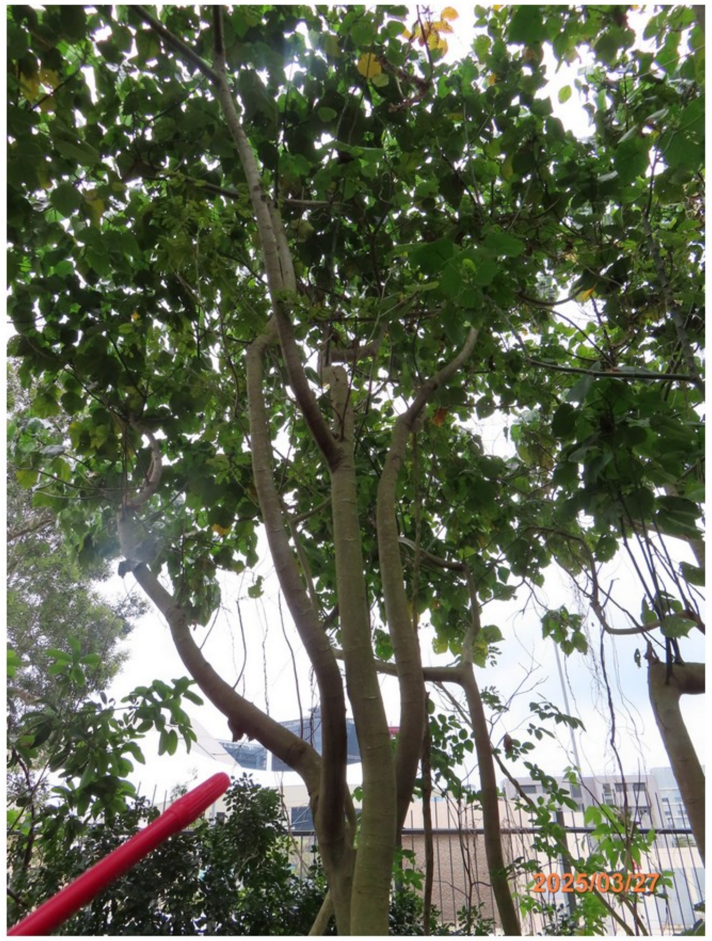
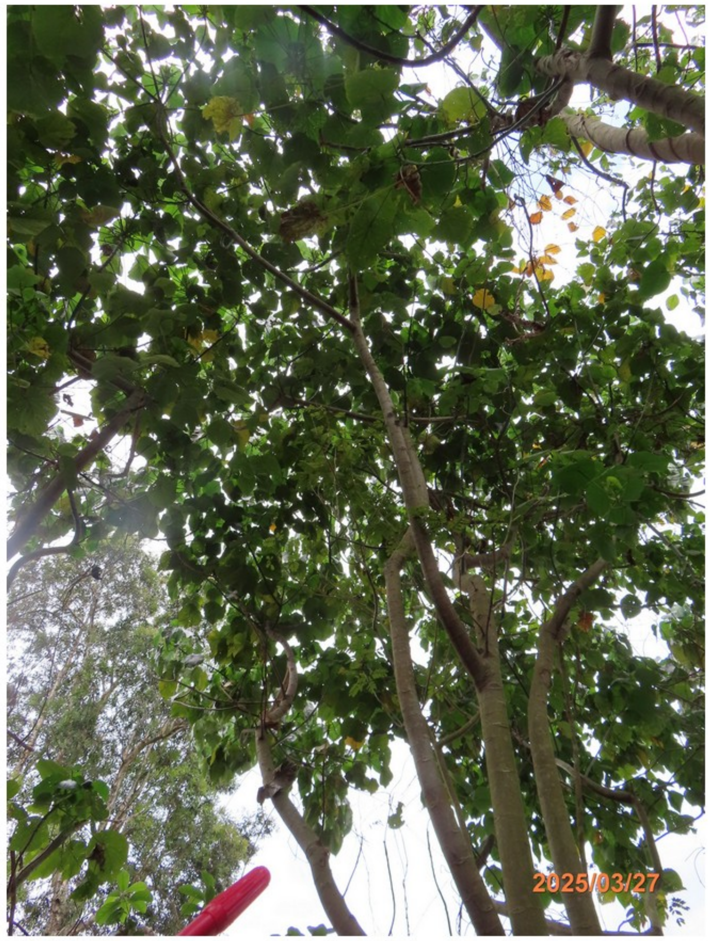
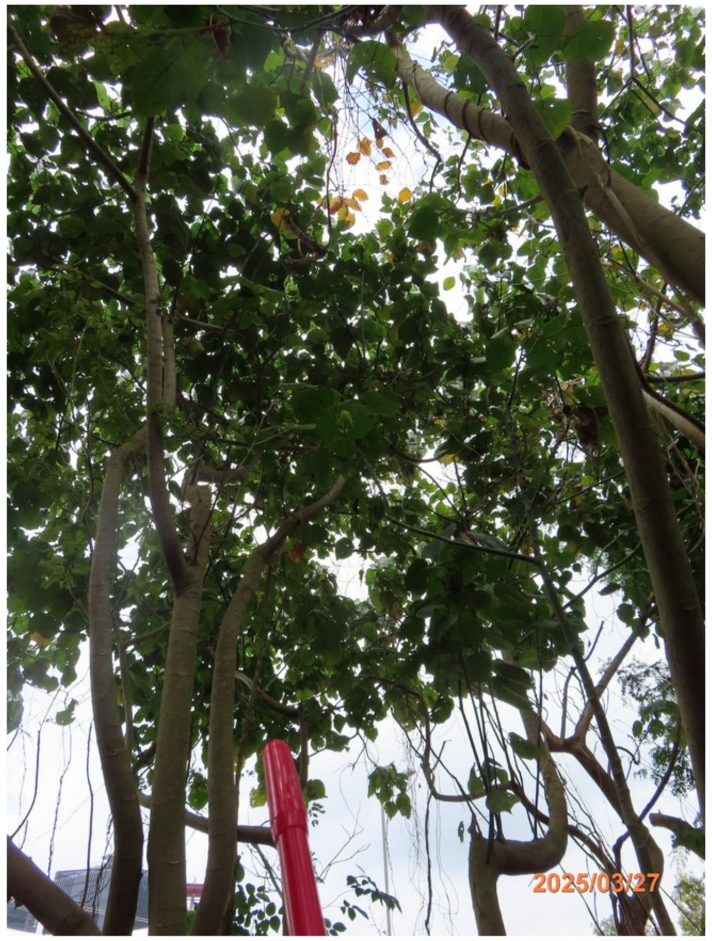


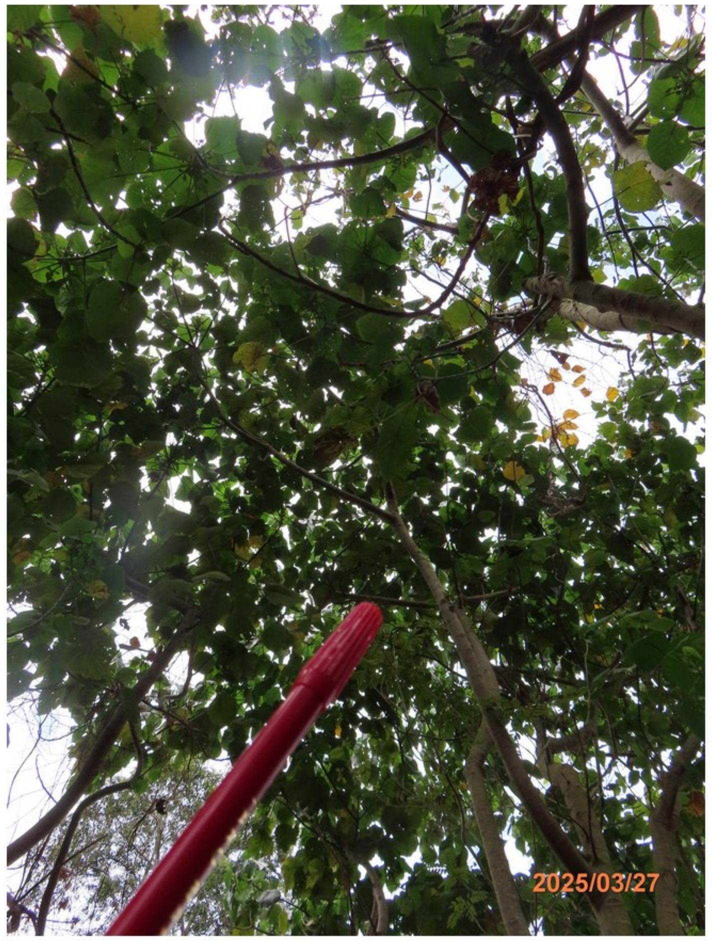
T024 (2)



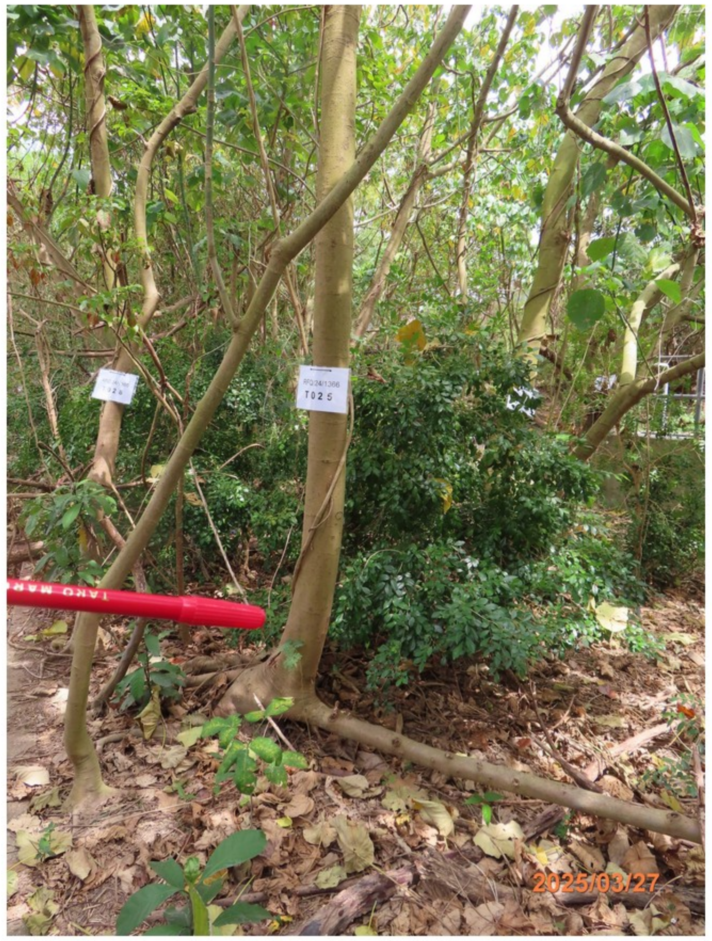
T024 (3)



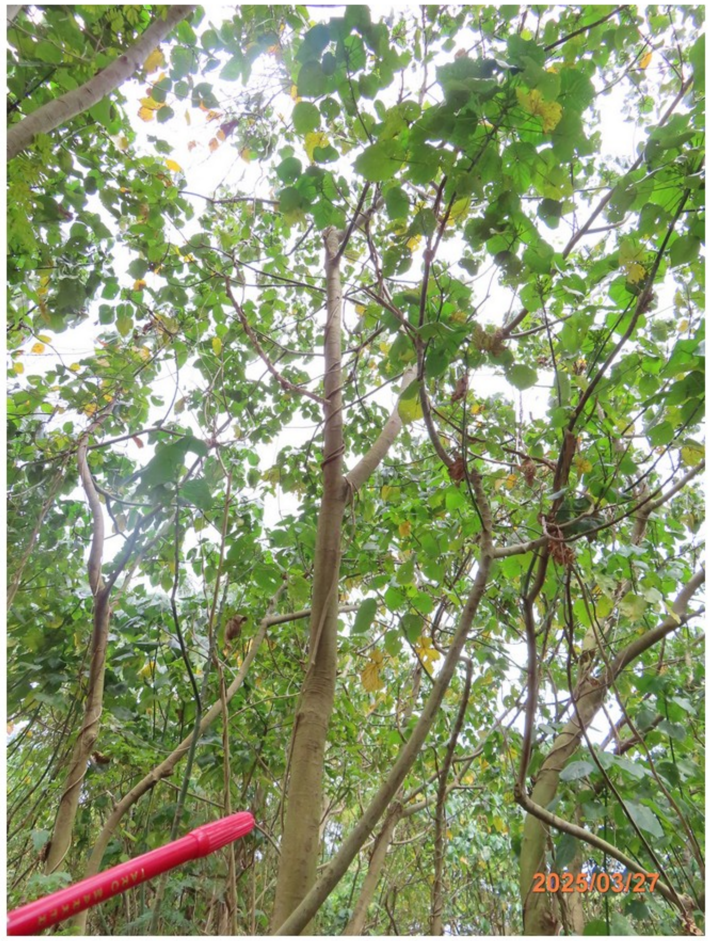
T024 (4)



T024 (5)


T025
2025/03/27

T025 (1)



T025 (2)

Photographic Record for Existing Trees

T025 (3)

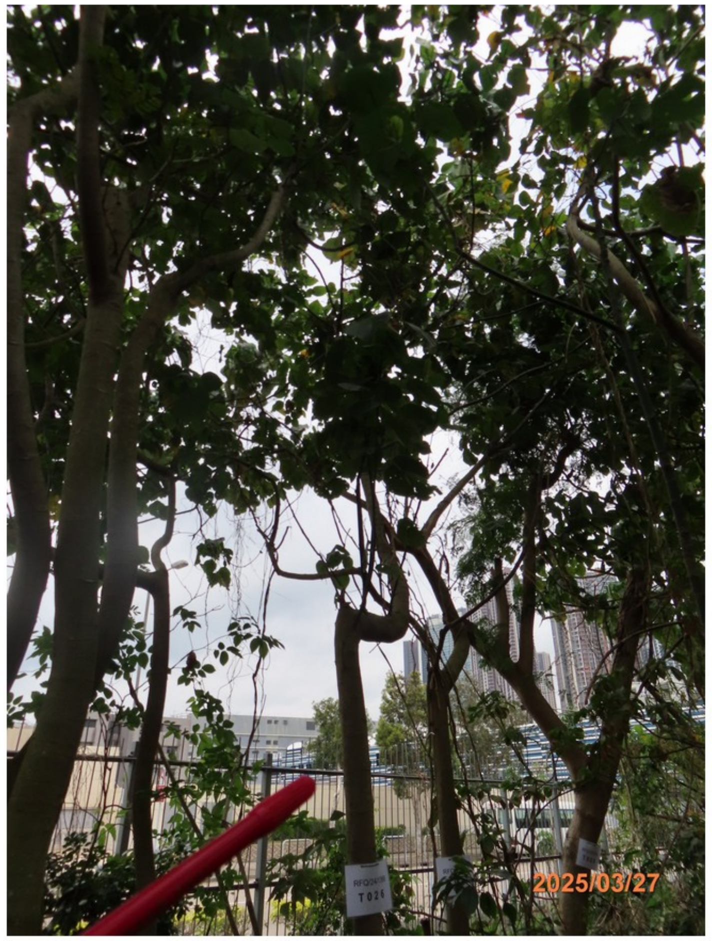
T025
2025/03/27

T025 (4)

T025 (5)

T025 (6)

T026 (1)



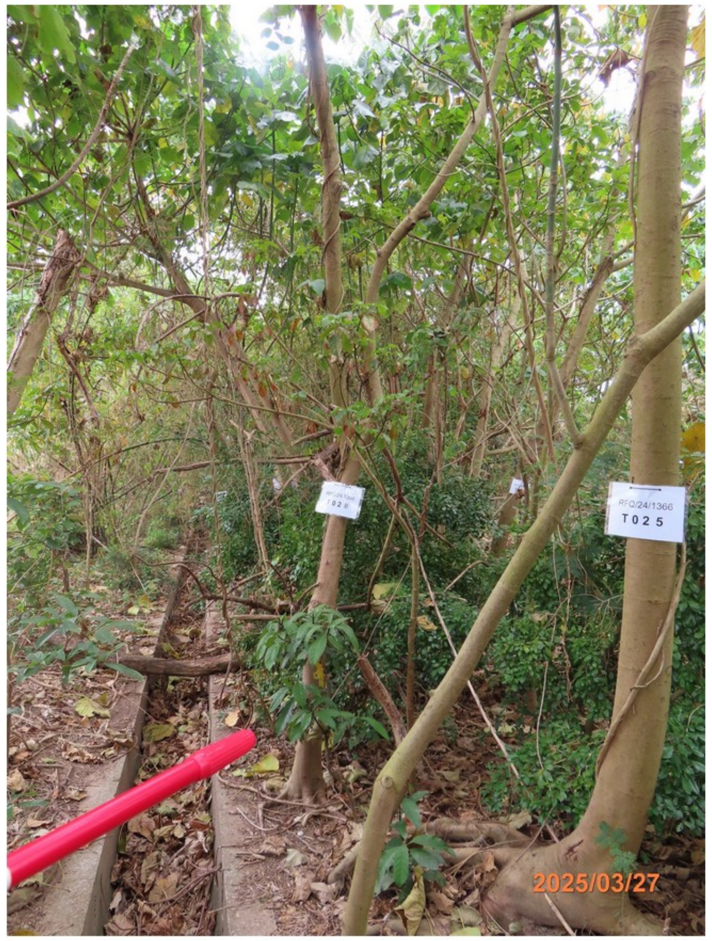
T026 (2)

RFQ/24/100
T026
2025/03/27

T027 (1)

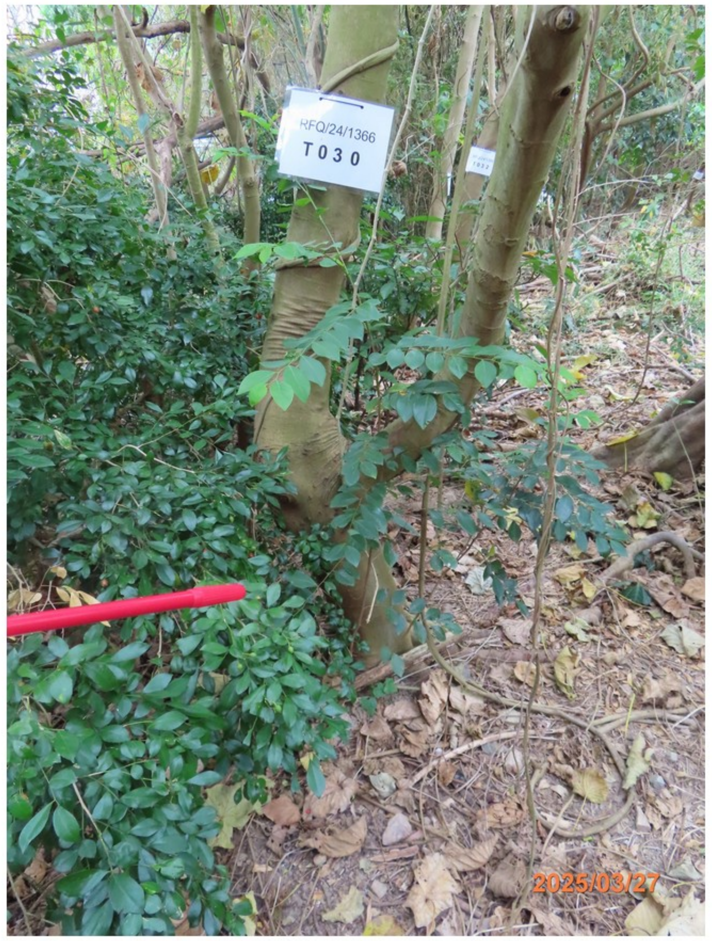
T027 (2)

Photographic Record for Existing Trees


RFQ/24/1366
T025
2025/03/27

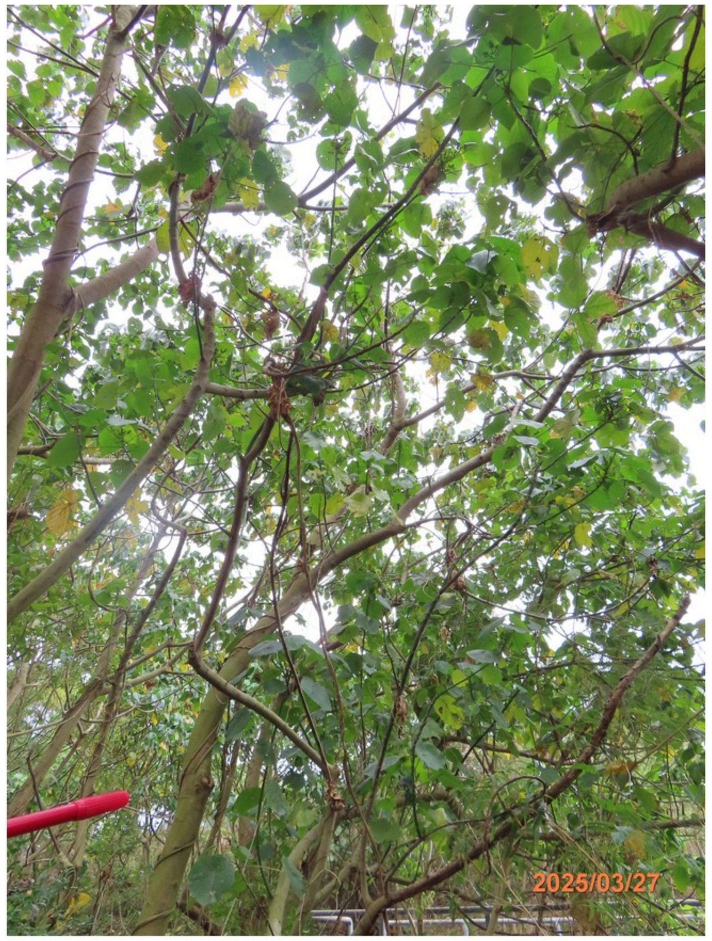
T028 (1)

T028 (2)


RFQ/24/1366
T030
2025/03/27

T030 (1)

T030 (2)



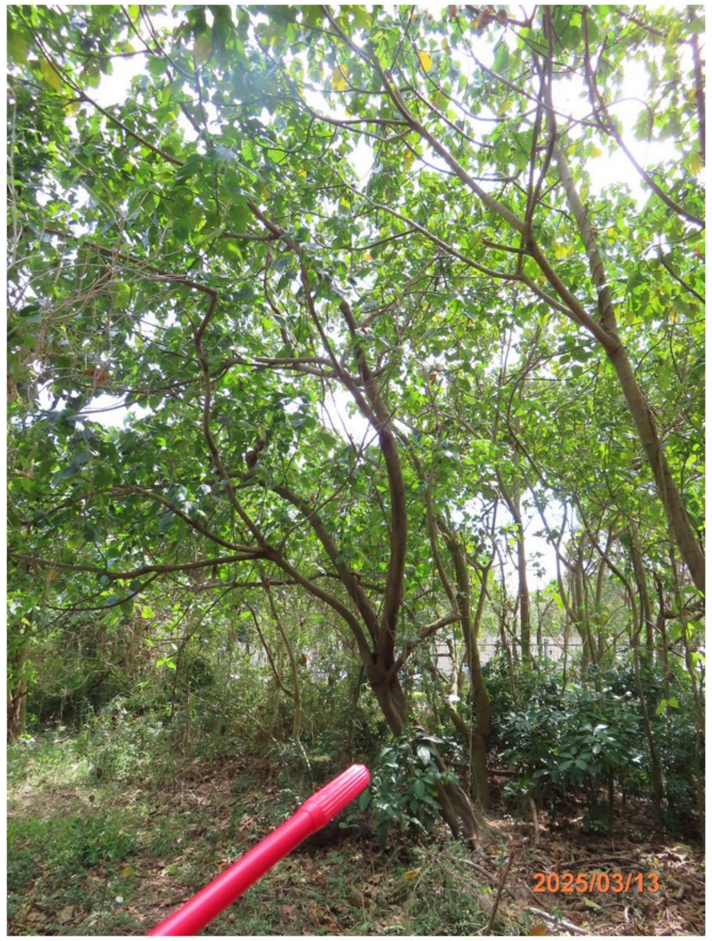
T030 (3)

T030 (4)

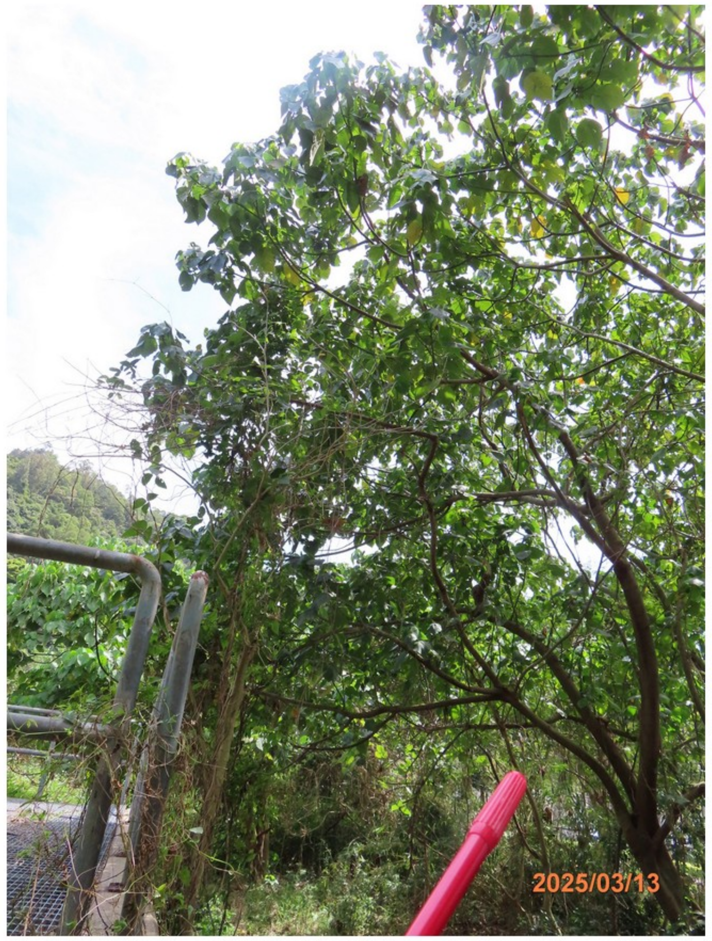
T030 (5)

T030 (6)

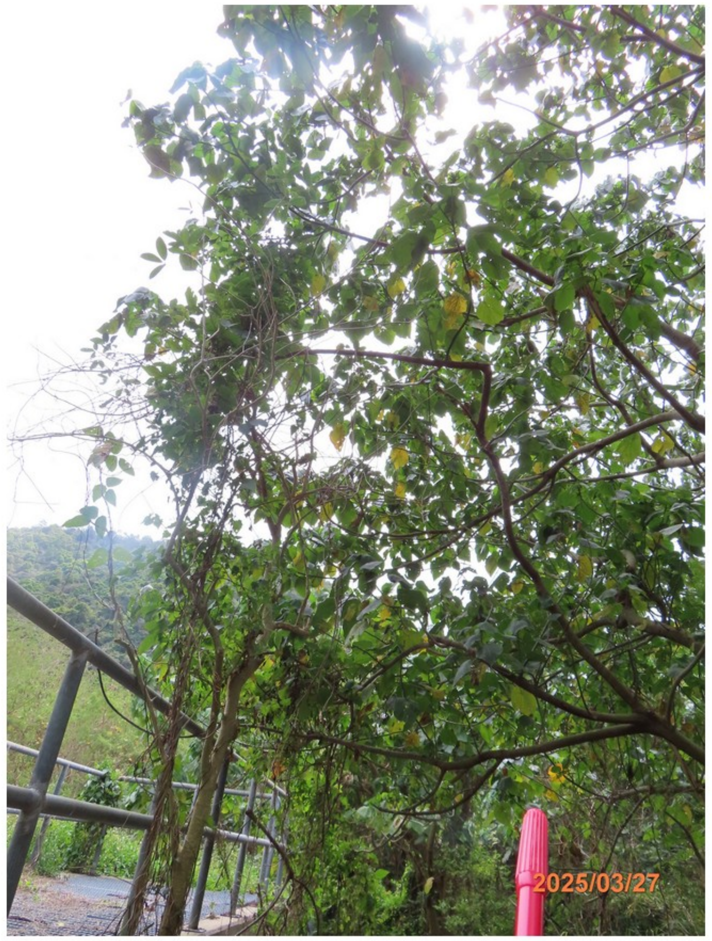
Photographic Record for Existing Trees



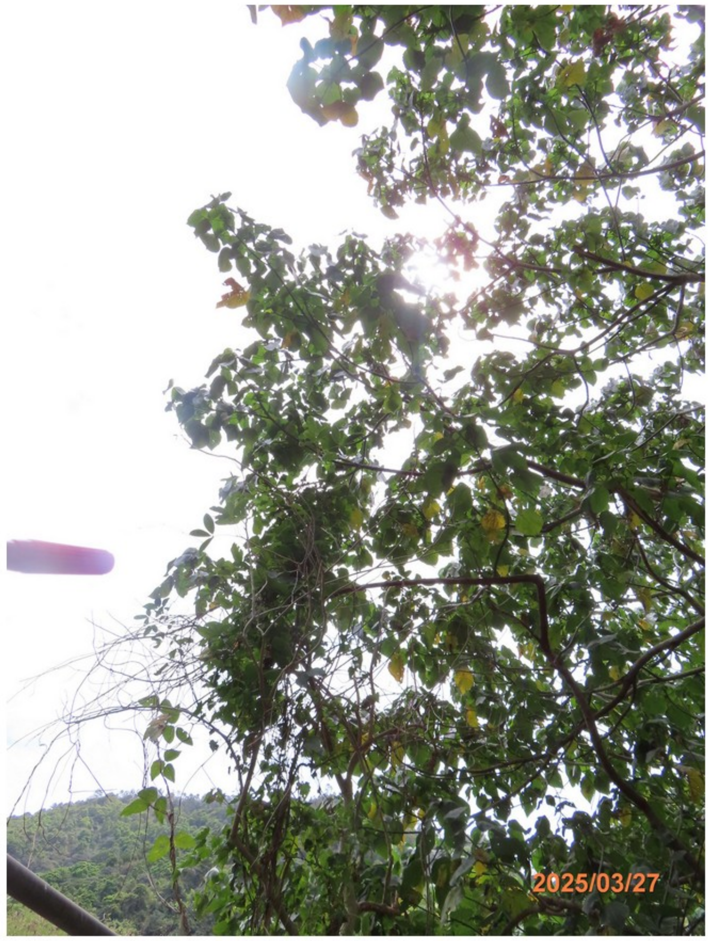
T031 (1)



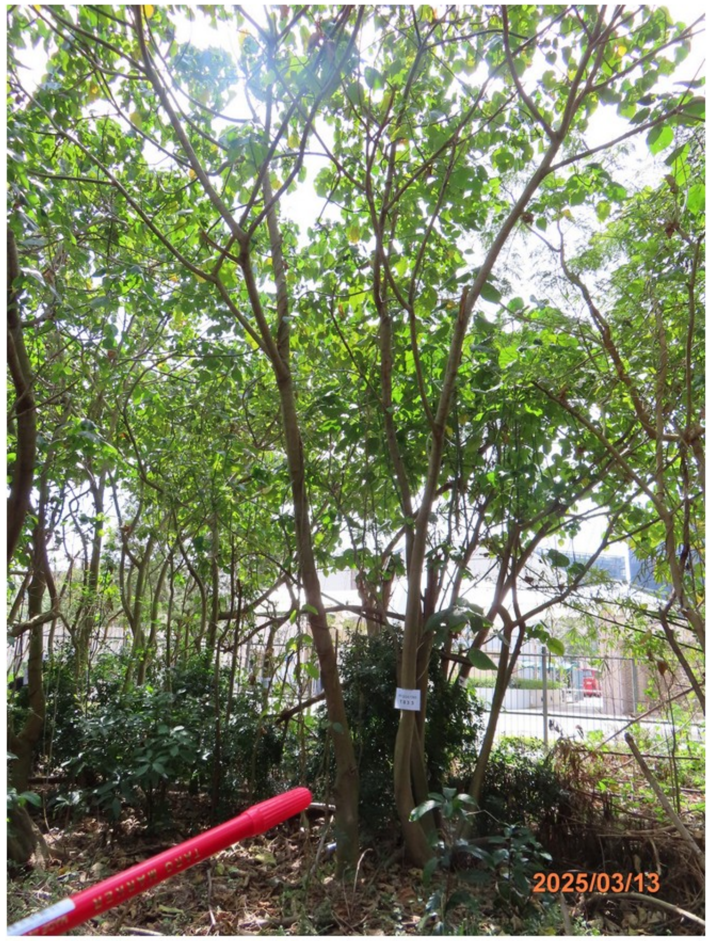
T031 (2)



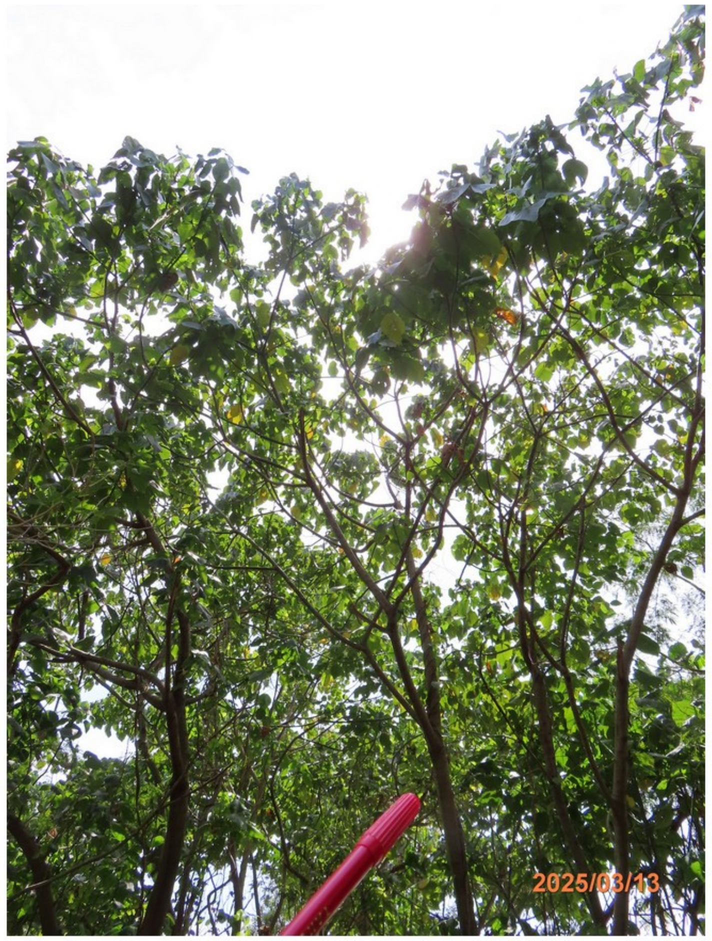
T031 (3)



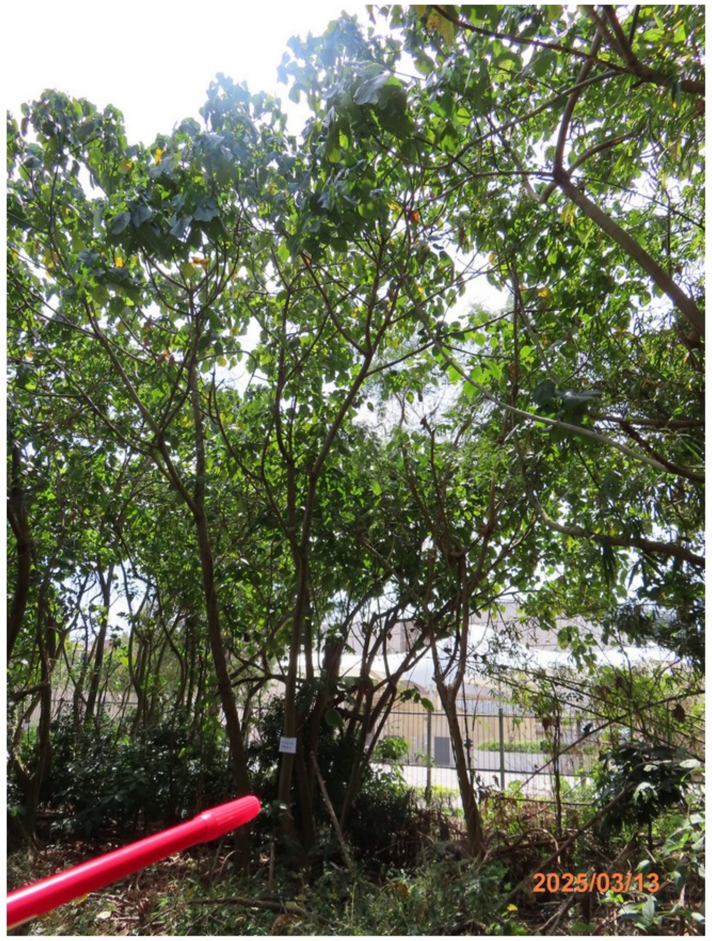
T031 (4)



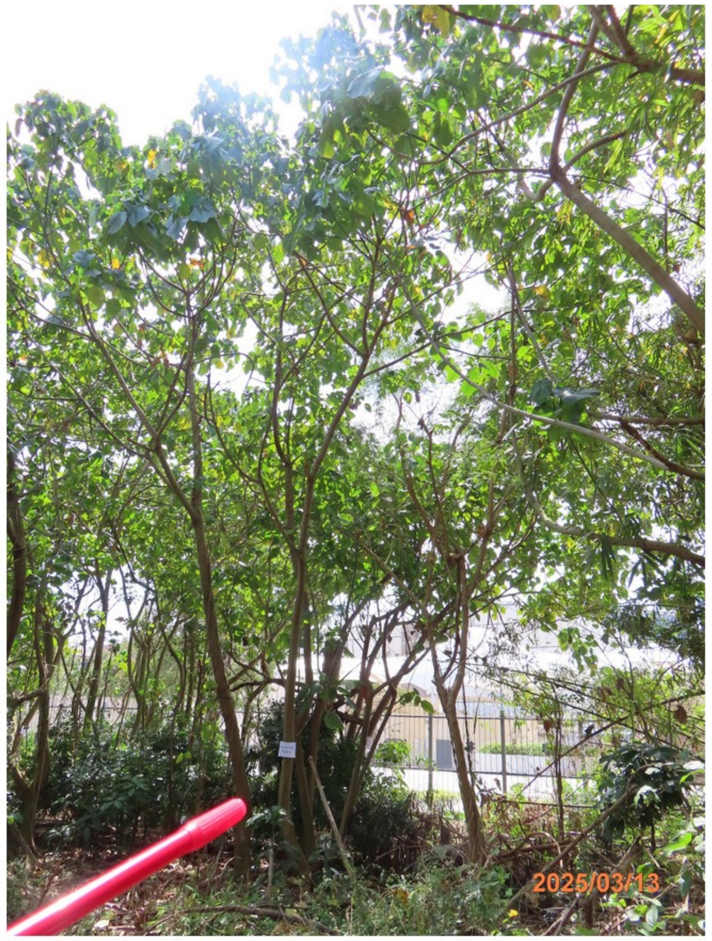
T032 (1)



T032 (2)

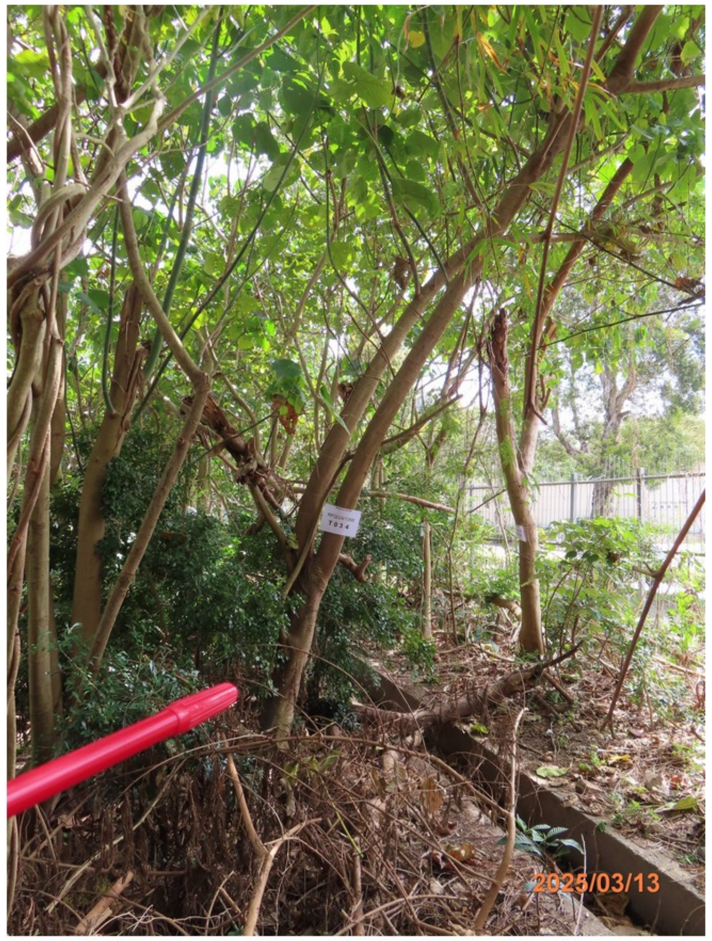


T033 (1)



T033 (2)

Photographic Record for Existing Trees


2025/03/13

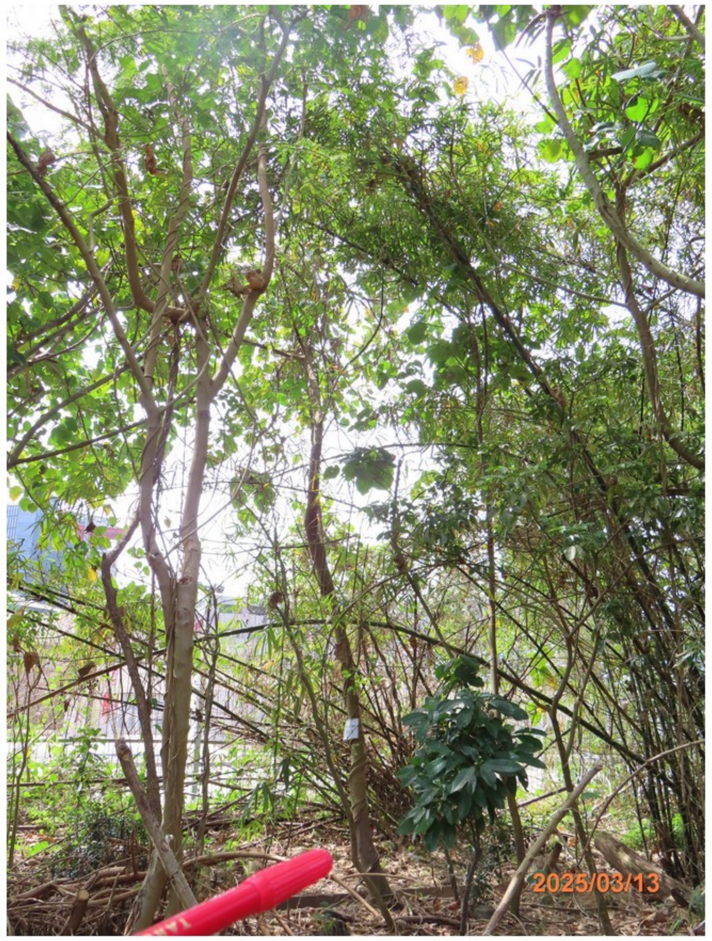
T034 (1)

2025/03/13

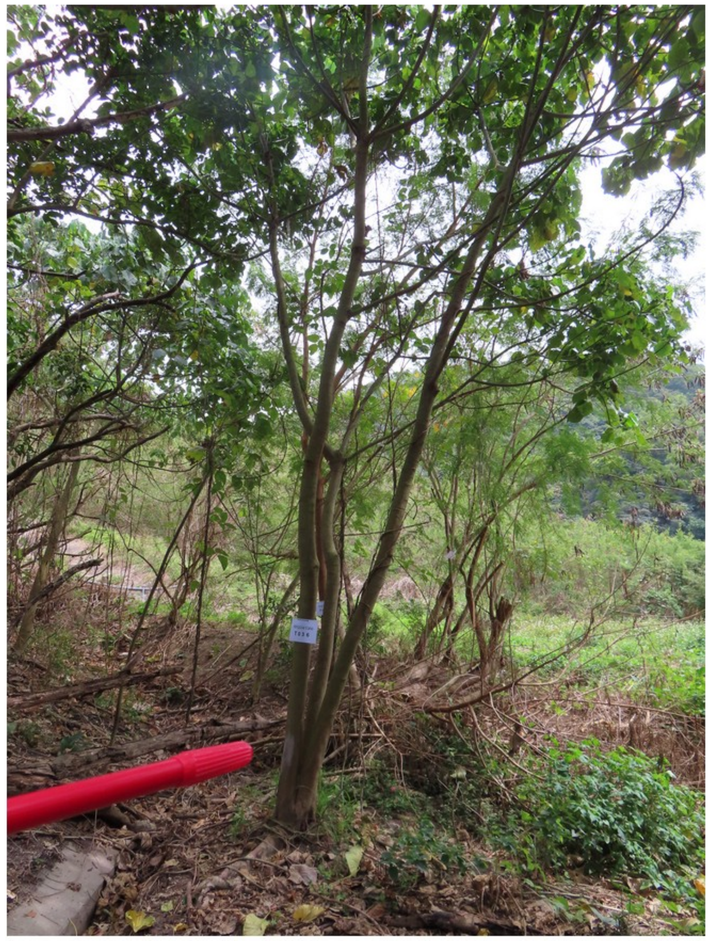
T034 (2)

2025/03/13

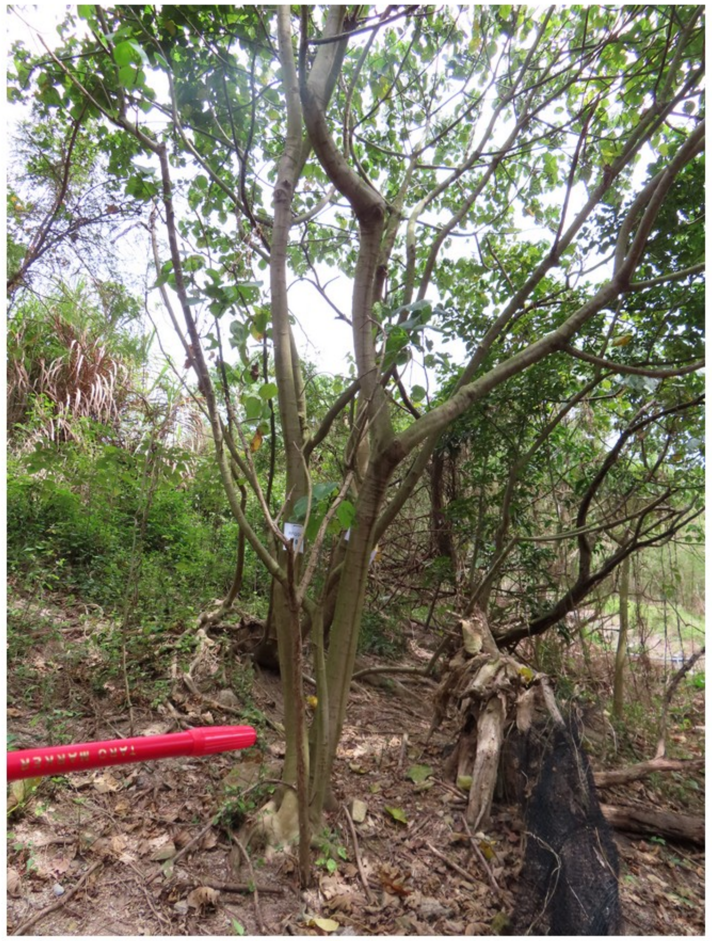
T034 (3)


2025/03/13

T035


T036 (1)

T036 (2)


T041 (1)

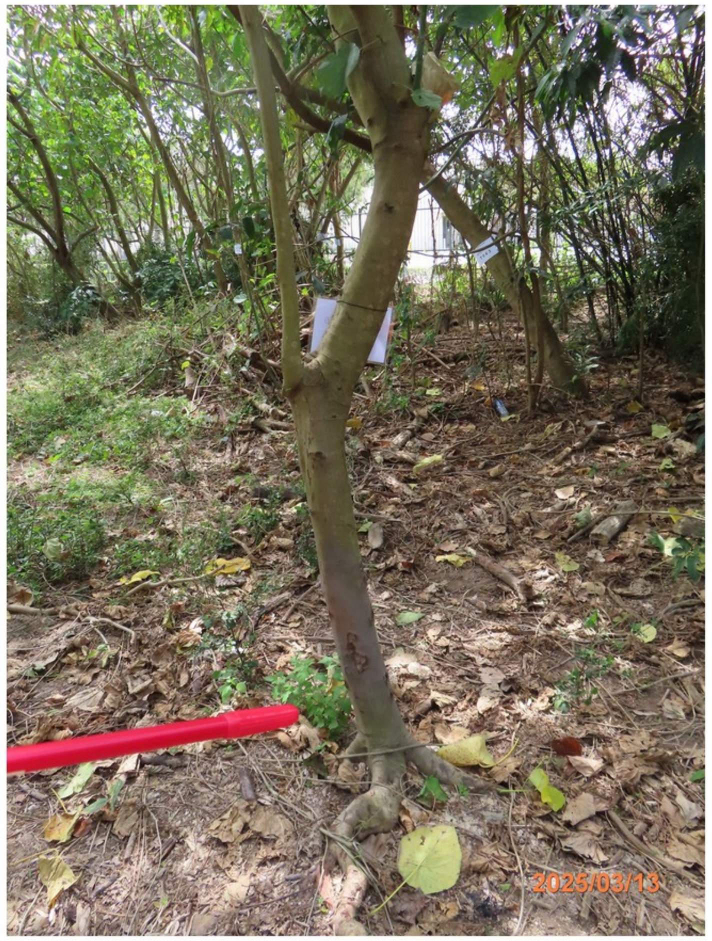
T041 (2)

Photographic Record for Existing Trees

T041 (3)

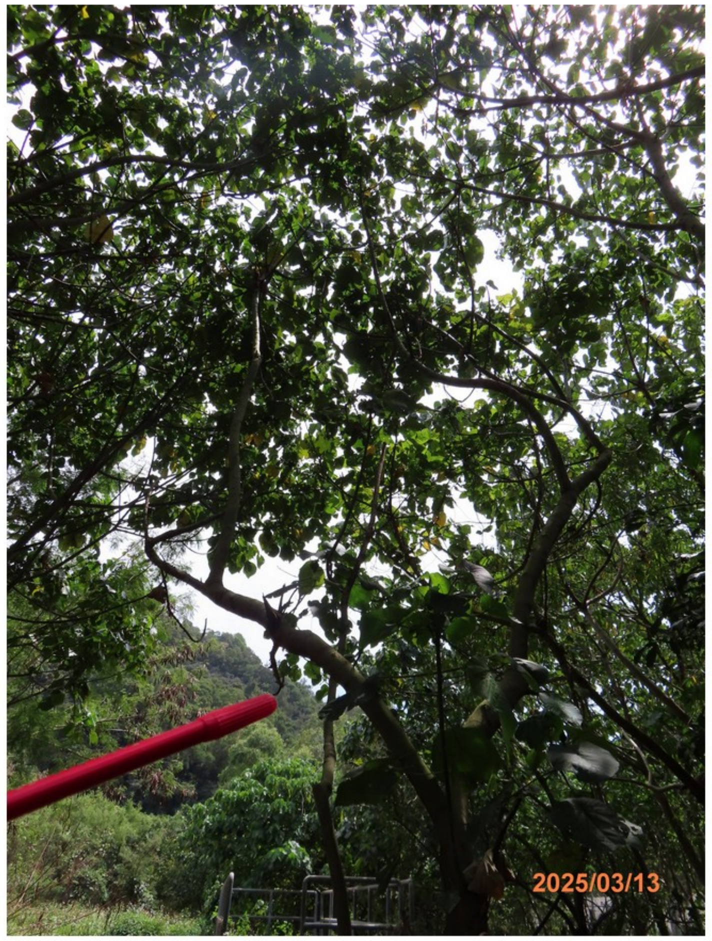
T041 (4)

T041 (5)

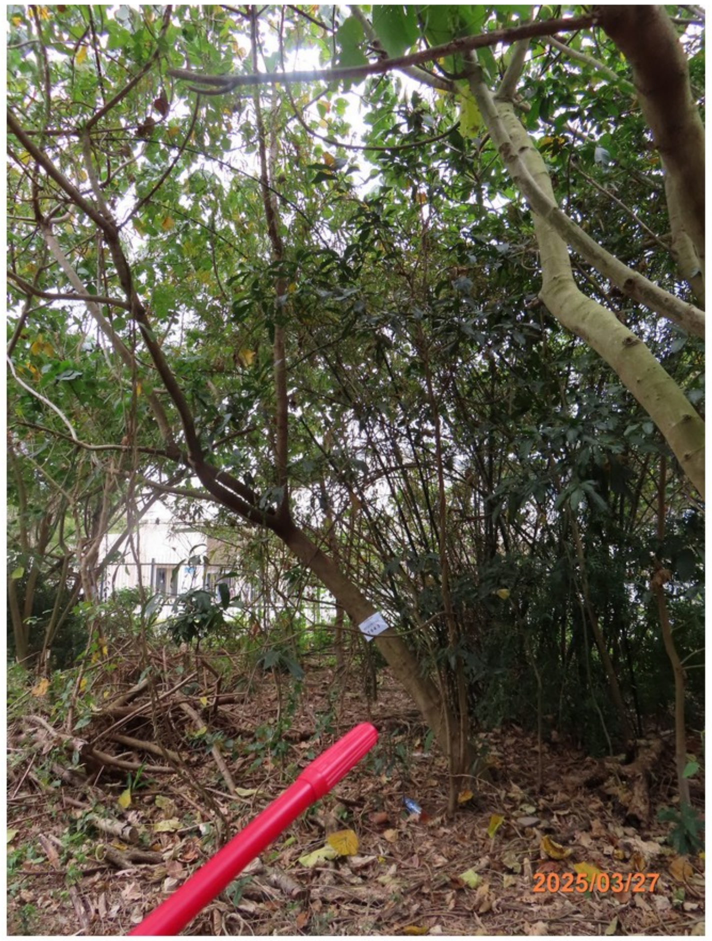


T042 (1)

T042 (2)



T042 (3)



T043 (1)

T043 (2)

Photographic Record for Existing Trees

T043 (3)

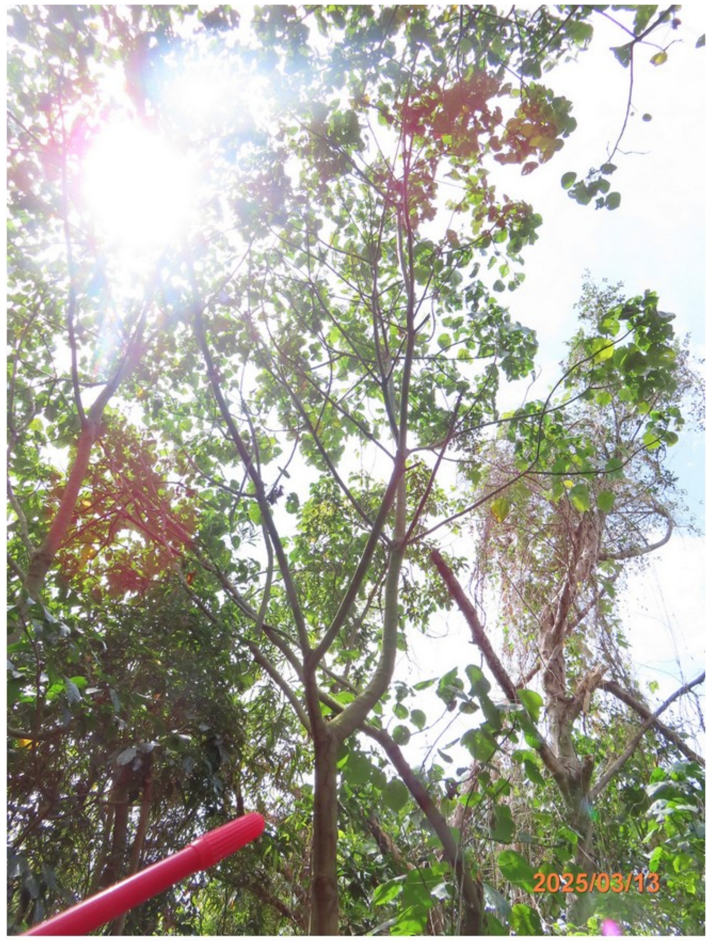
T042
2025/03/13

T044 (1)

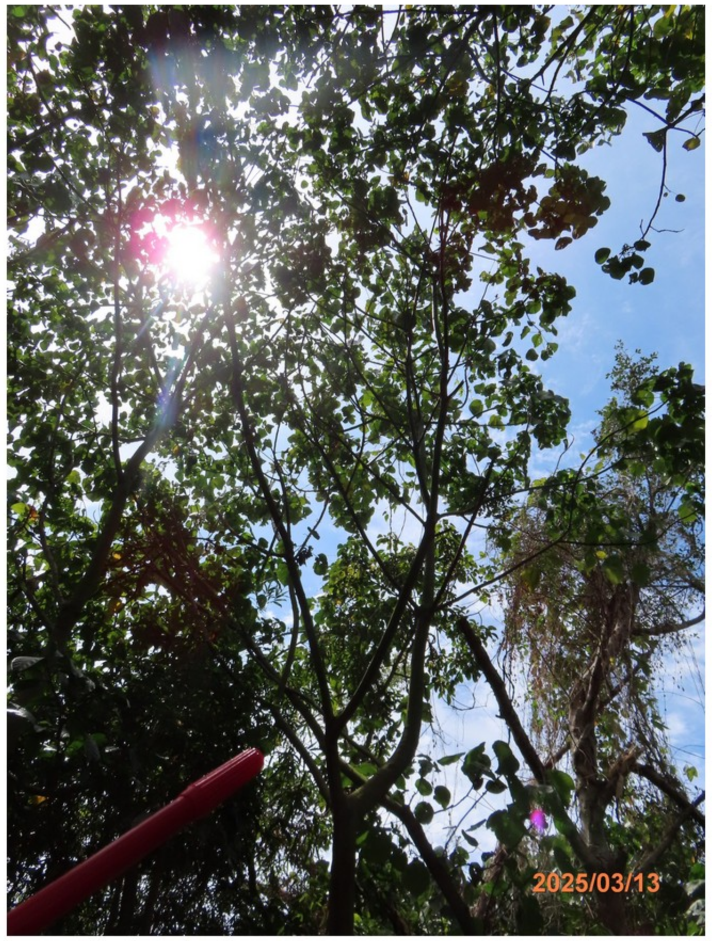
T044 (2)

T044
2025/03/13

T045 (1)



T045 (2)

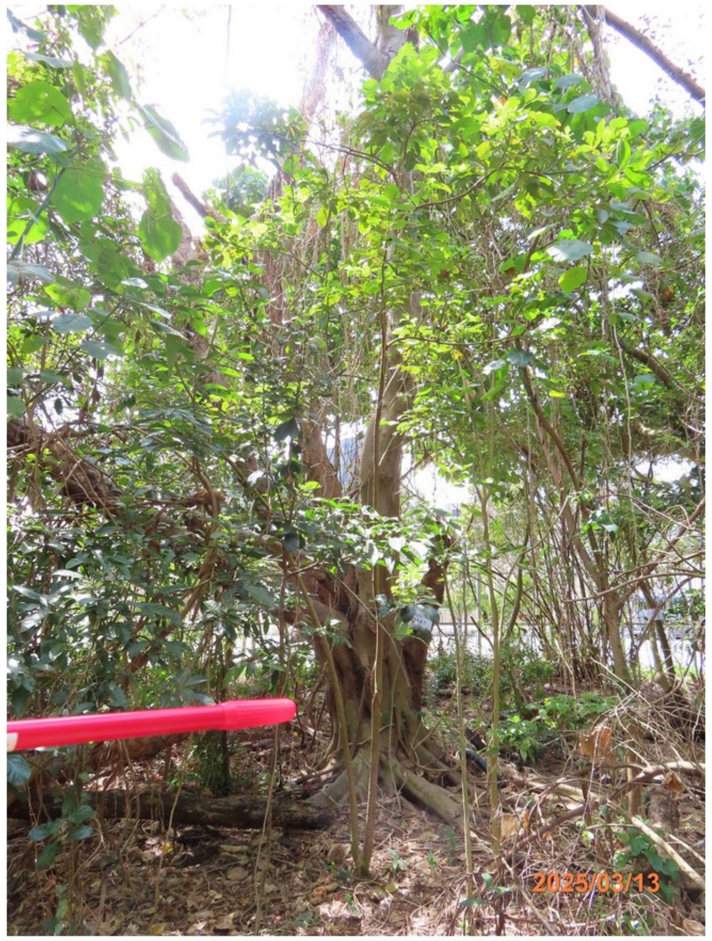


T045 (3)

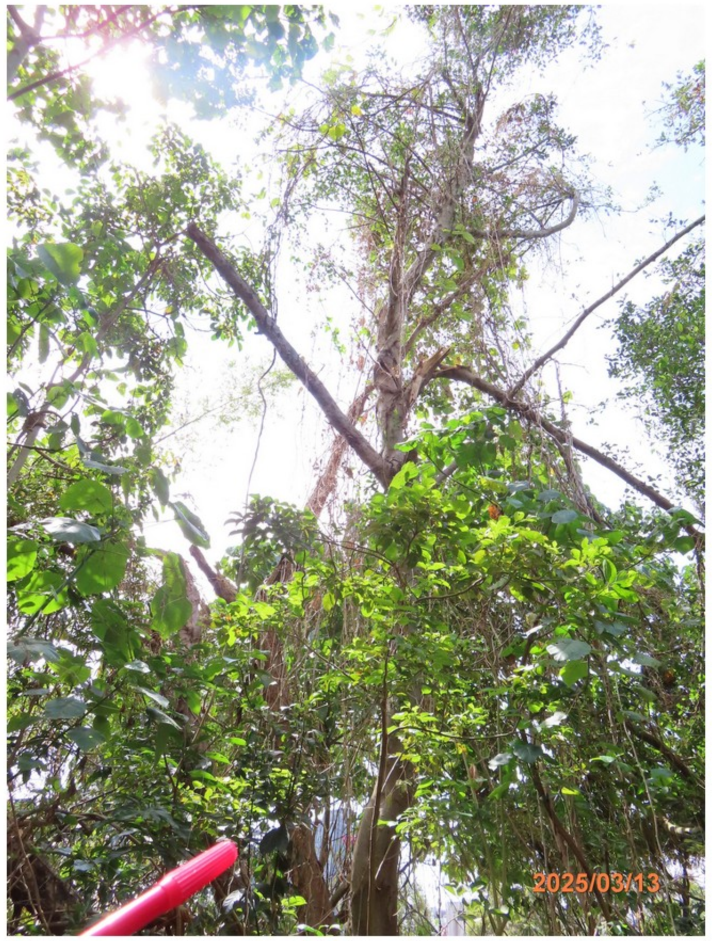
T046 (1)

T046 (2)

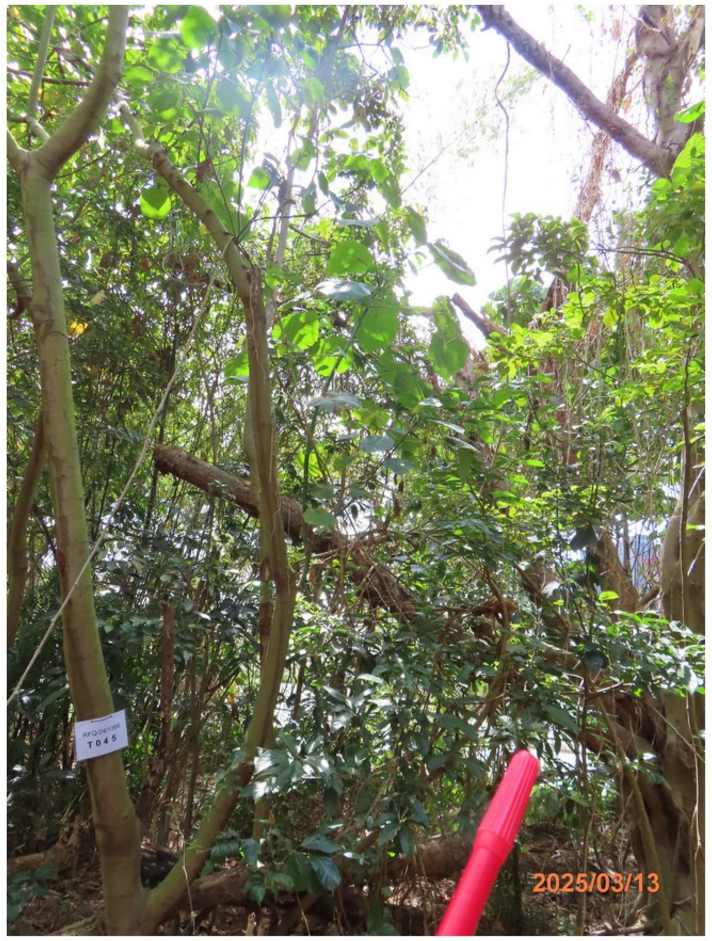
Photographic Record for Existing Trees



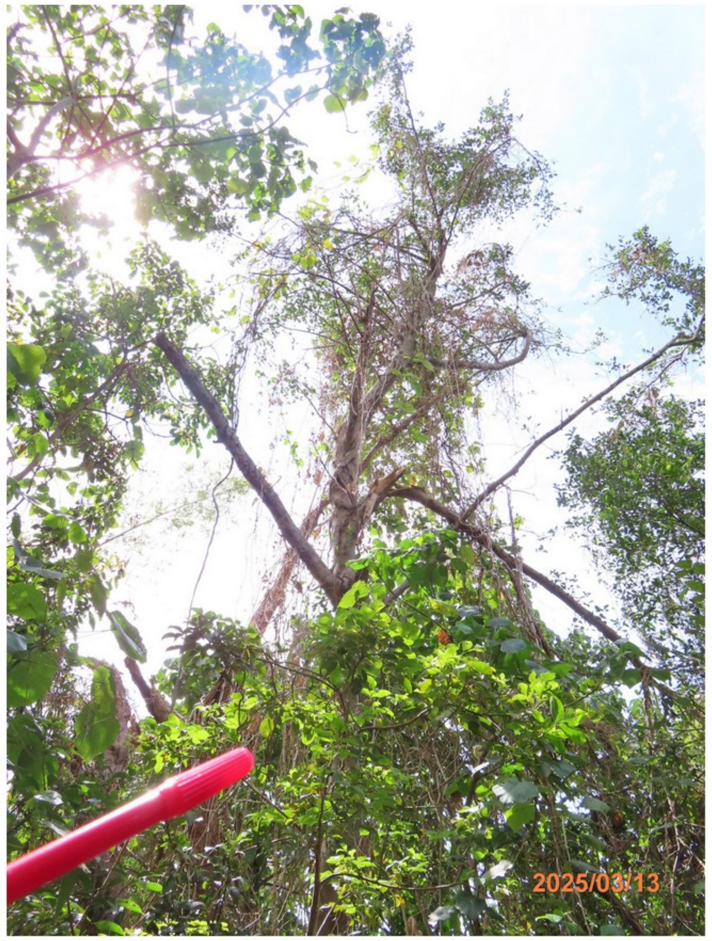
T047 (1)



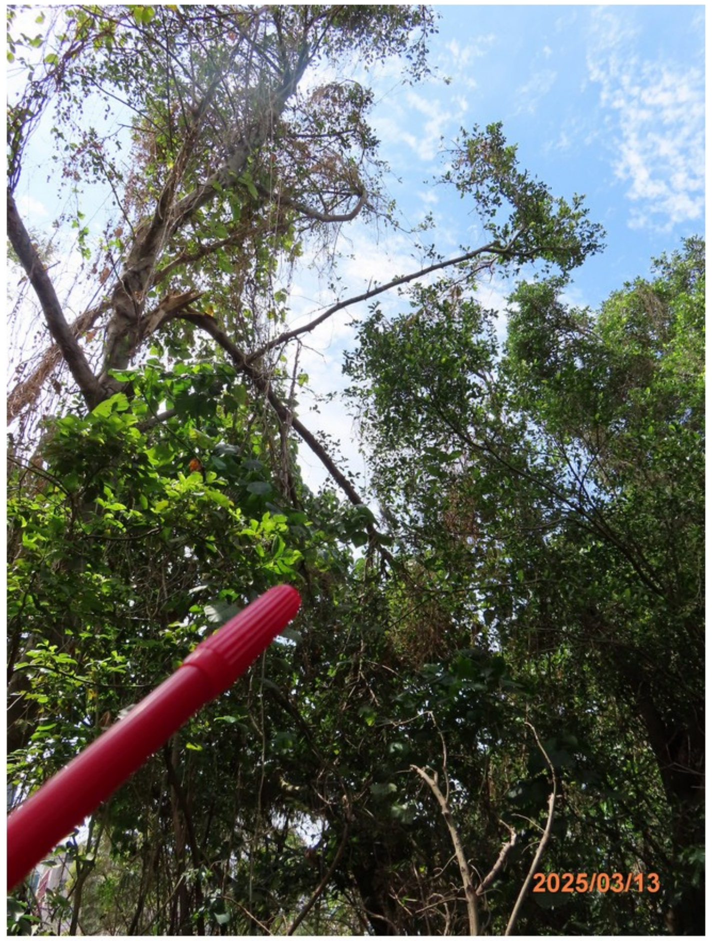
T047 (2)



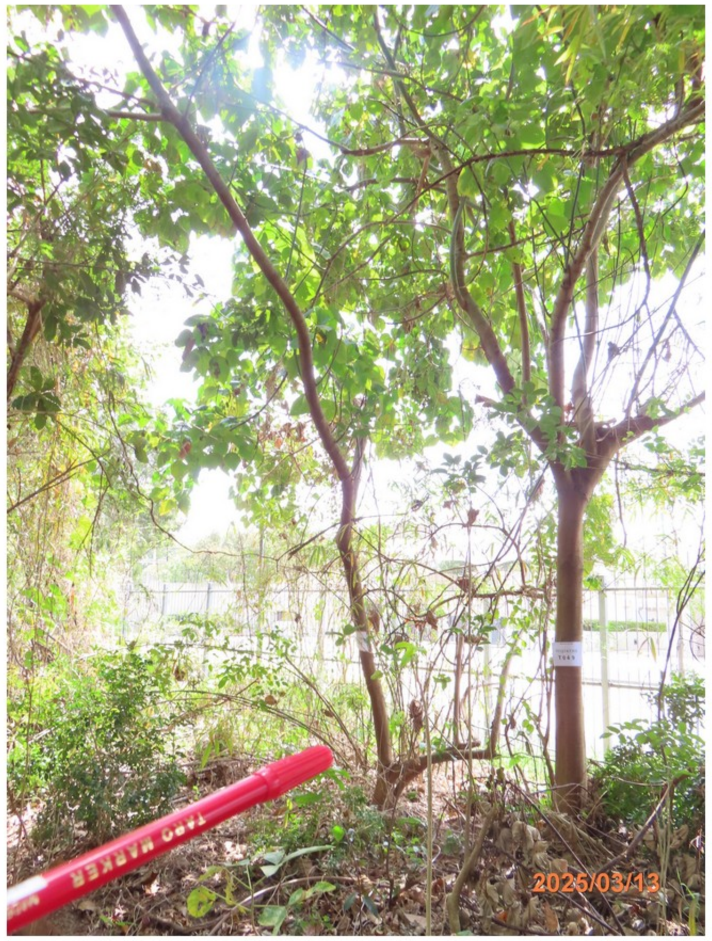
T047 (3)



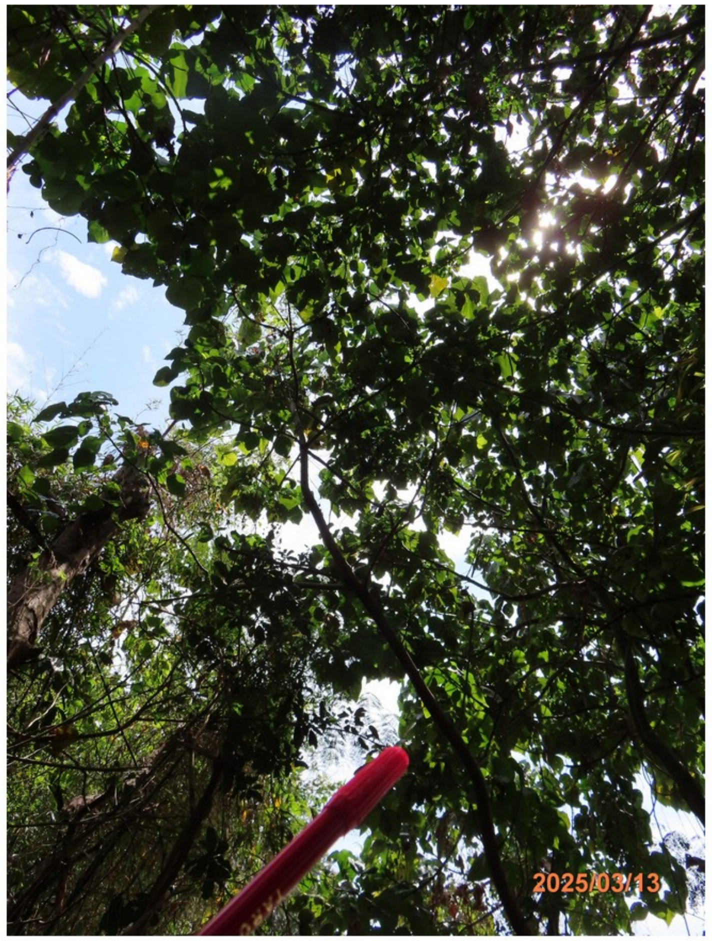
T047 (4)



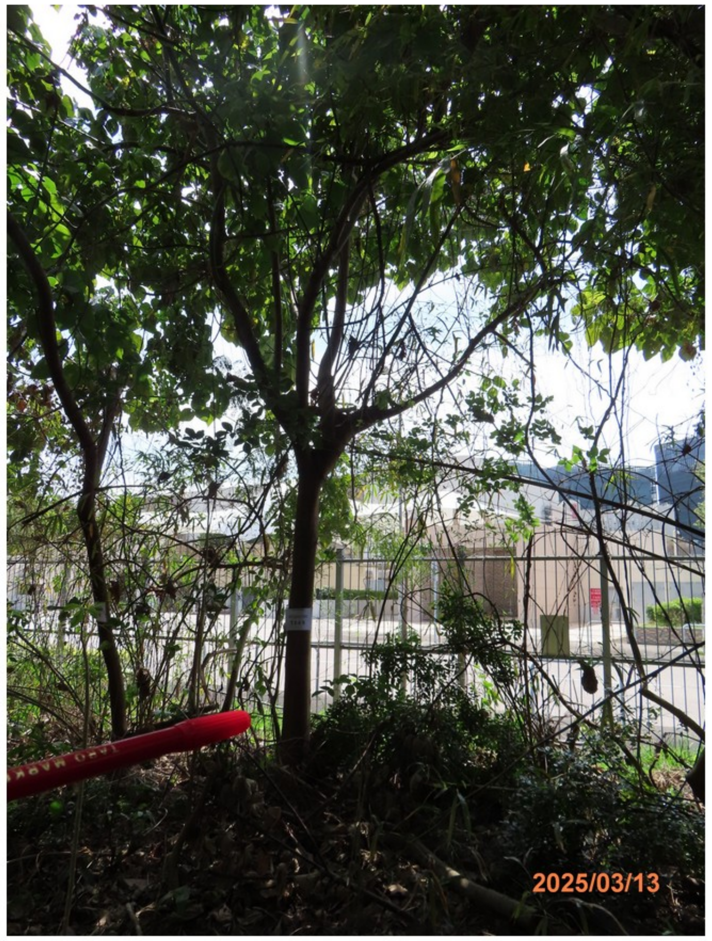
T047 (5)



T048 (1)

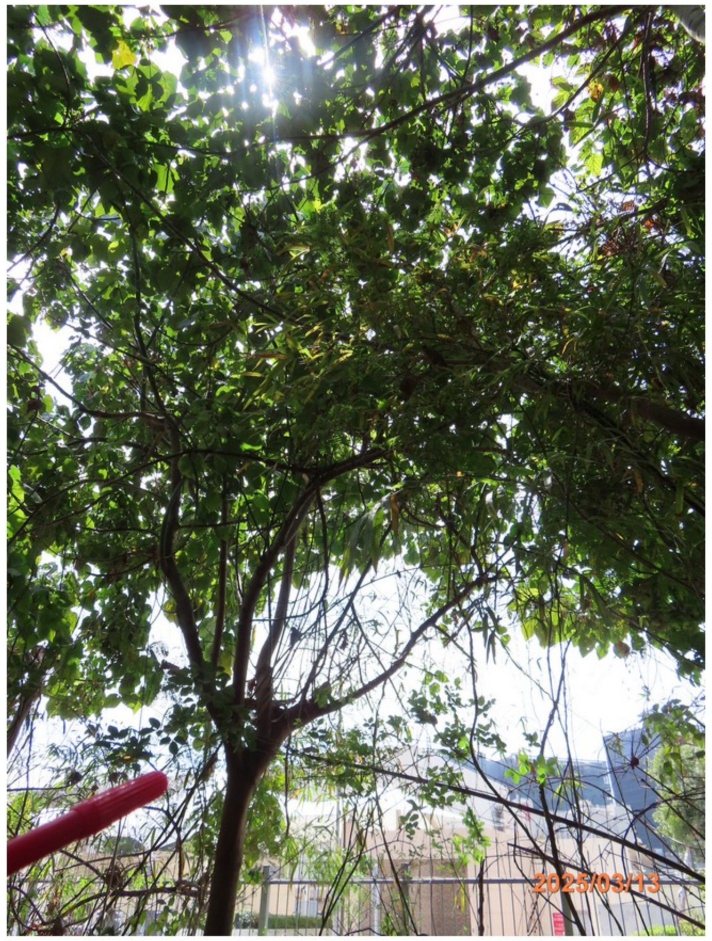


T048 (2)



T049 (1)

Photographic Record for Existing Trees


2025/03/13

T049 (2)

2025/03/13

T050 (1)

2025/03/13

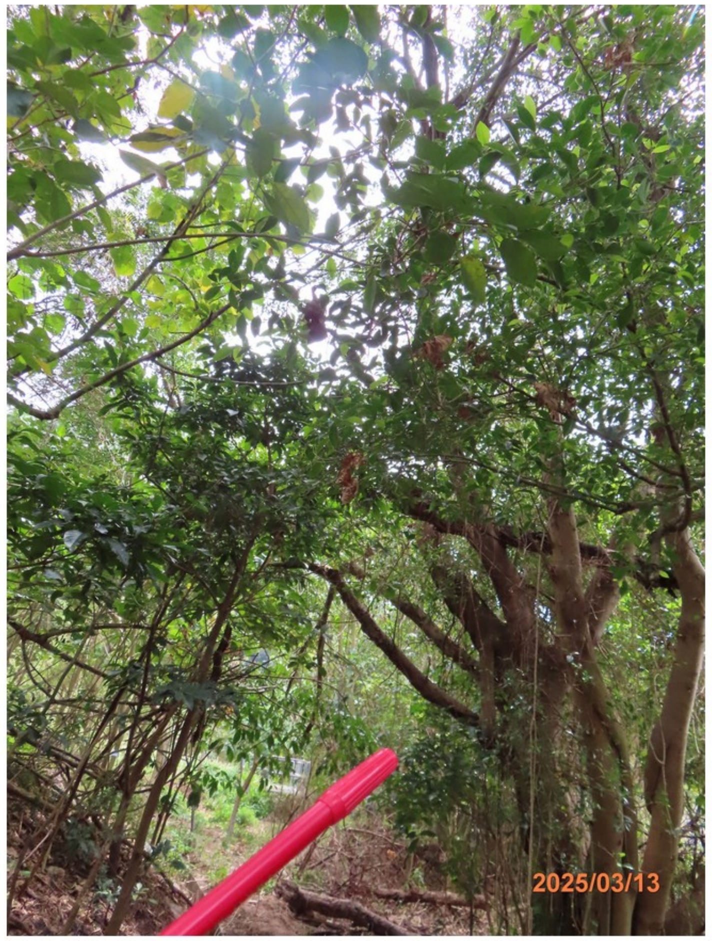
T050 (2)

2025/03/13

T050 (3)

2025/03/13

T051 (1)


2025/03/13

T051 (2)

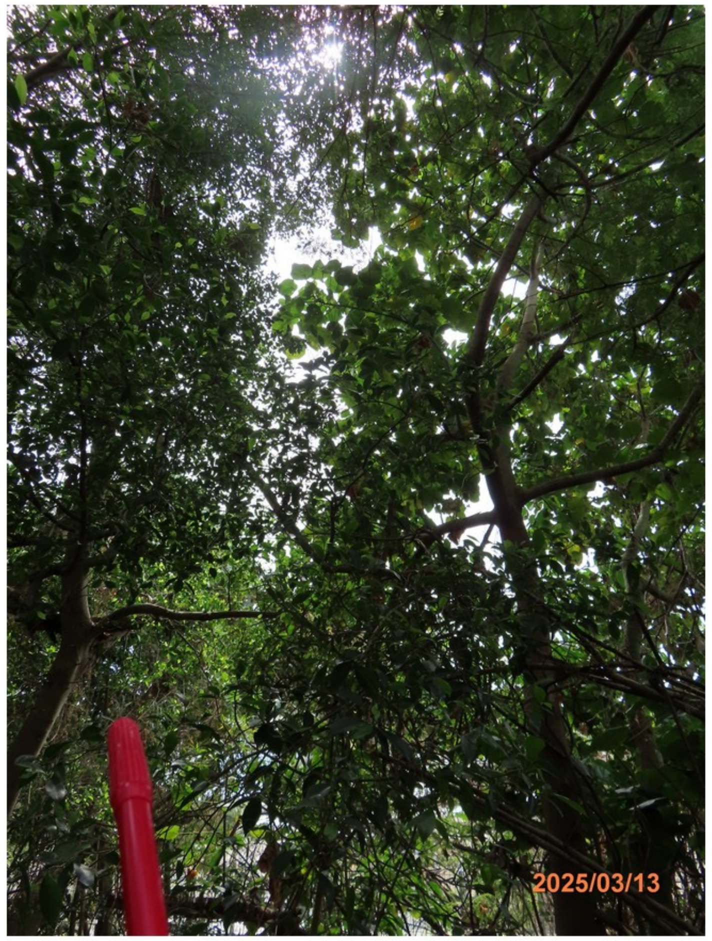
2025/03/13

T051 (3)

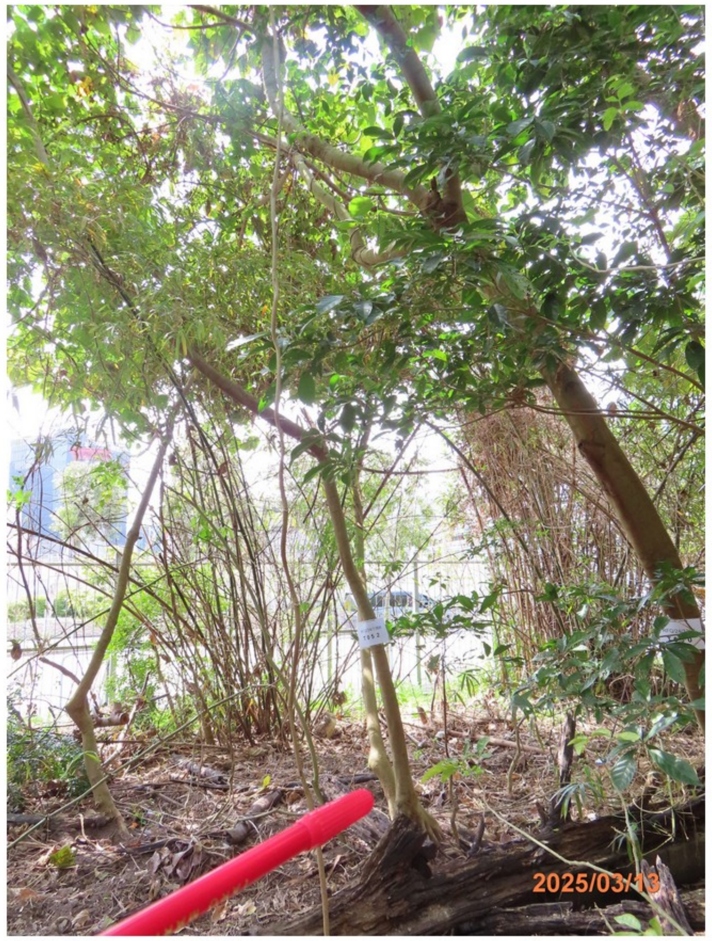
2025/03/13

T051 (4)

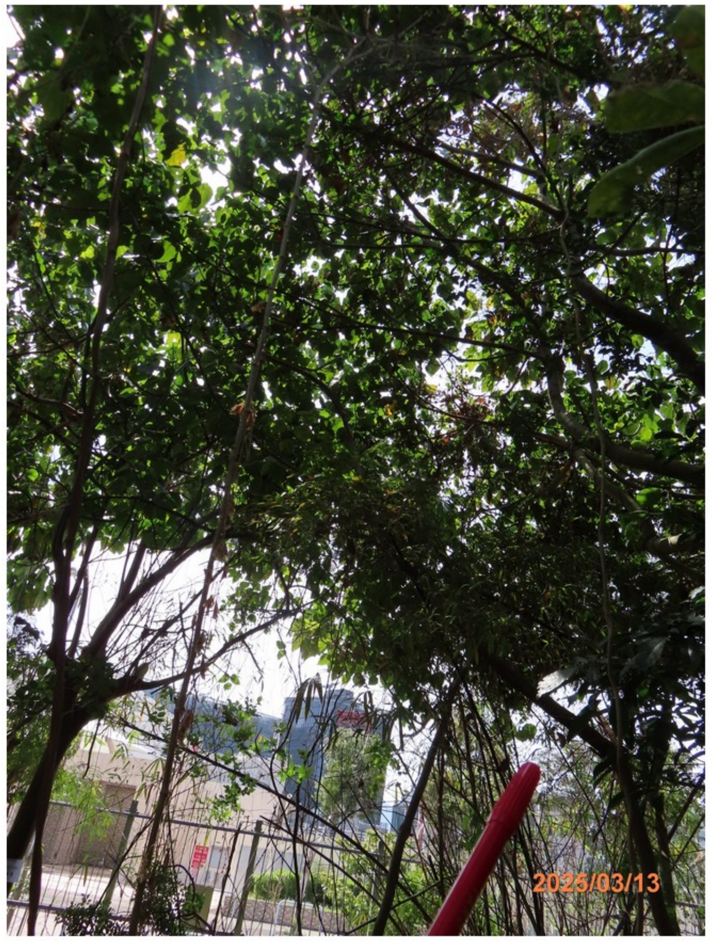
Photographic Record for Existing Trees


2025/03/13

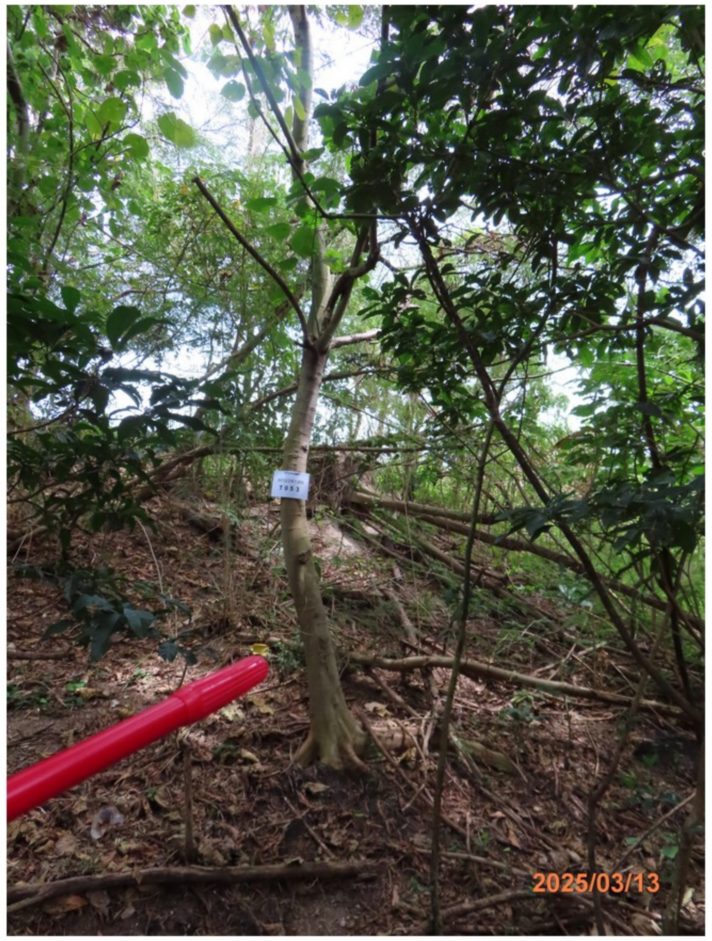
T051 (5)


2025/03/13

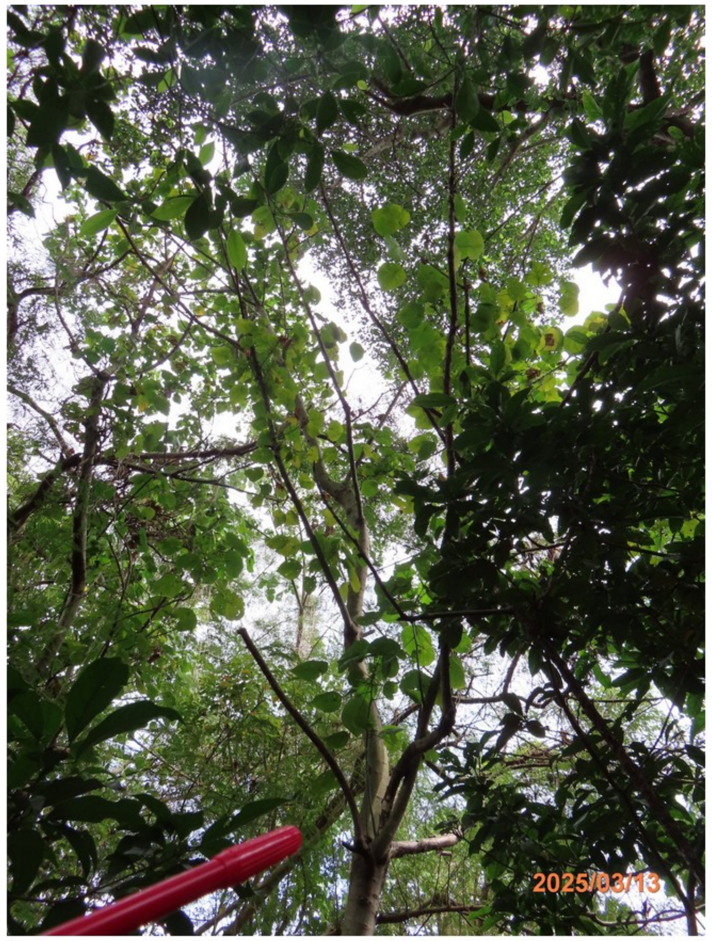
T052 (1)


2025/03/13

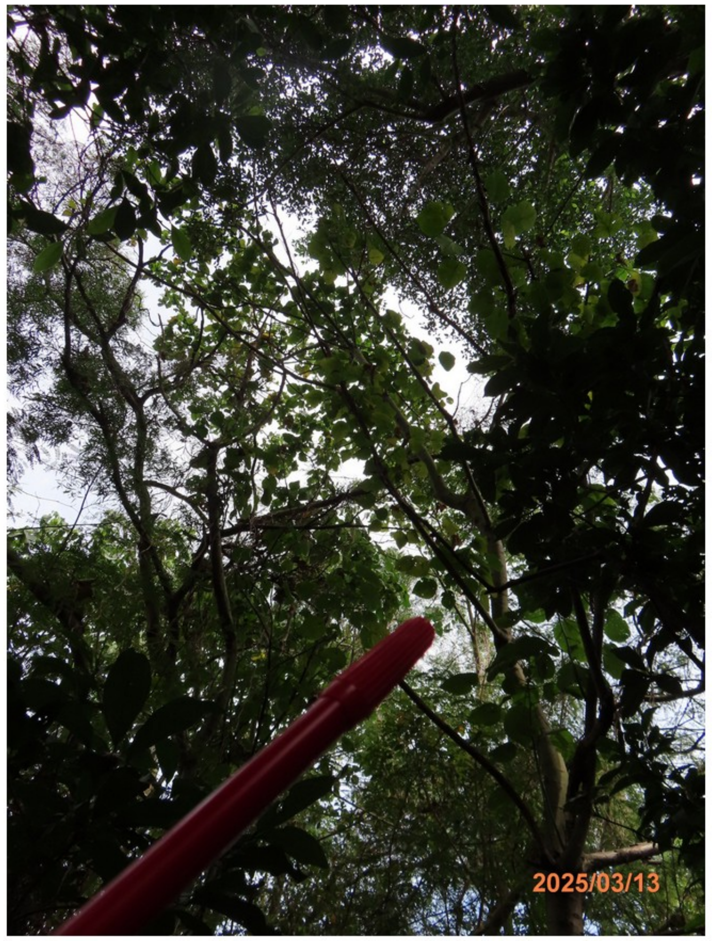
T052 (2)


2025/03/13

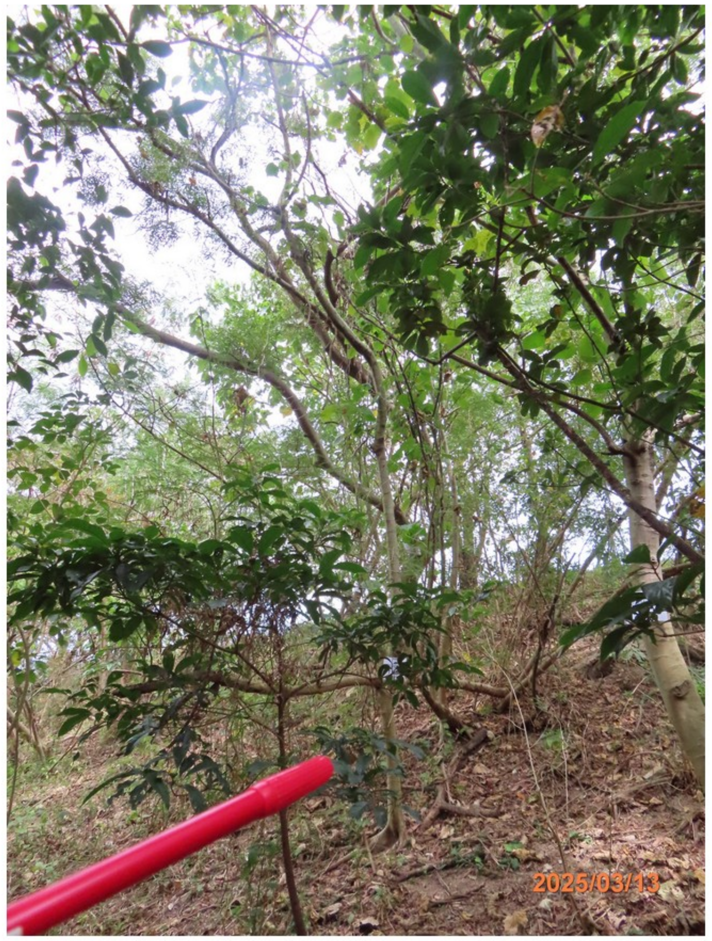
T053 (1)


2025/03/13

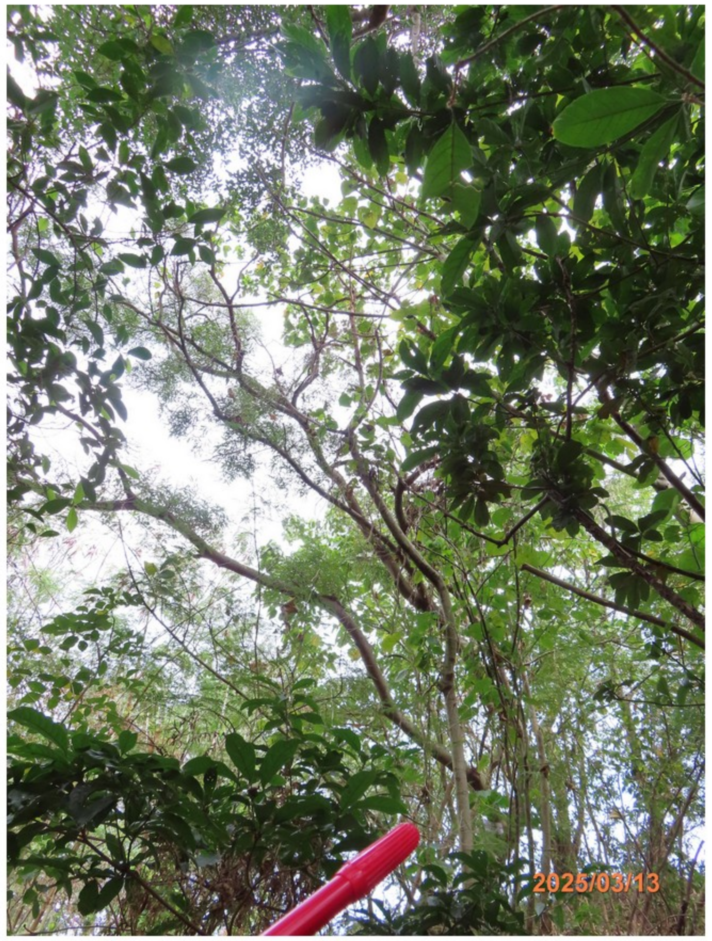
T053 (2)


2025/03/13

T053 (3)

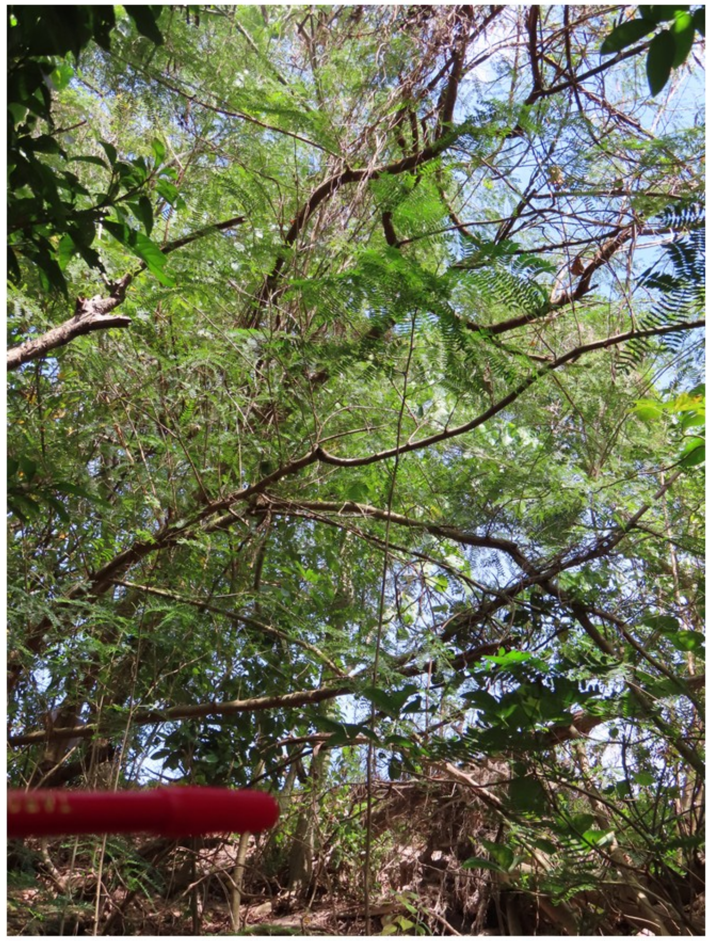

2025/03/13

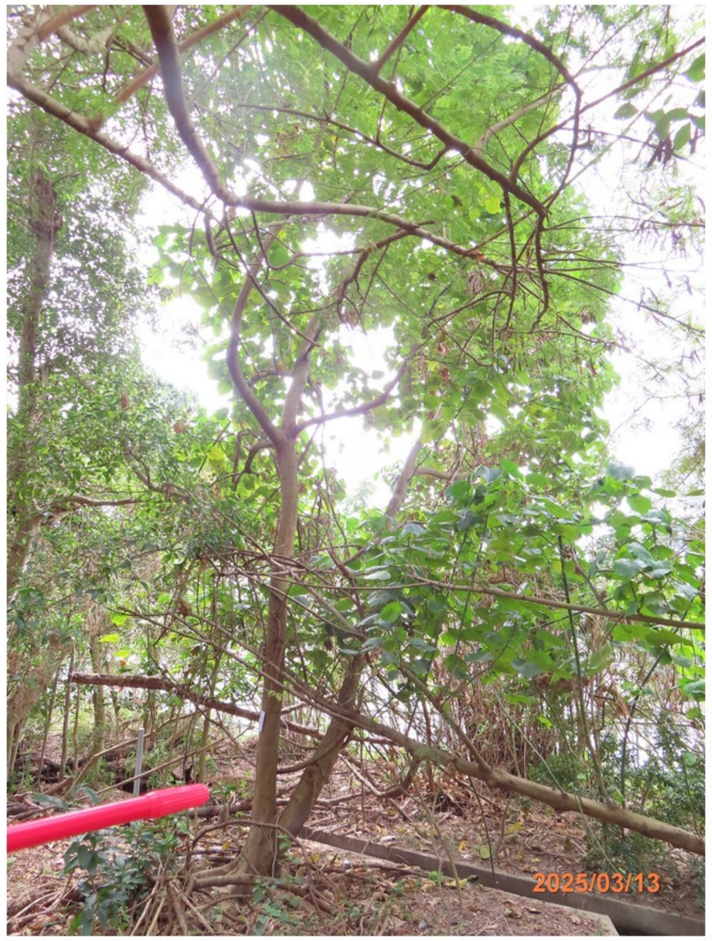
T054 (1)


2025/03/13

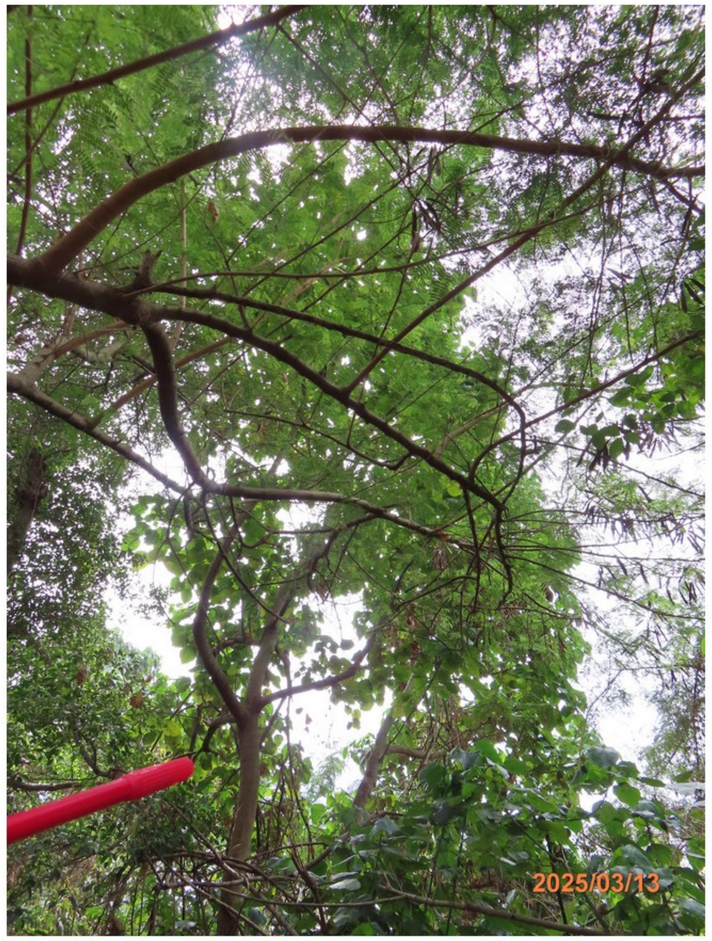
T054 (2)

Photographic Record for Existing Trees

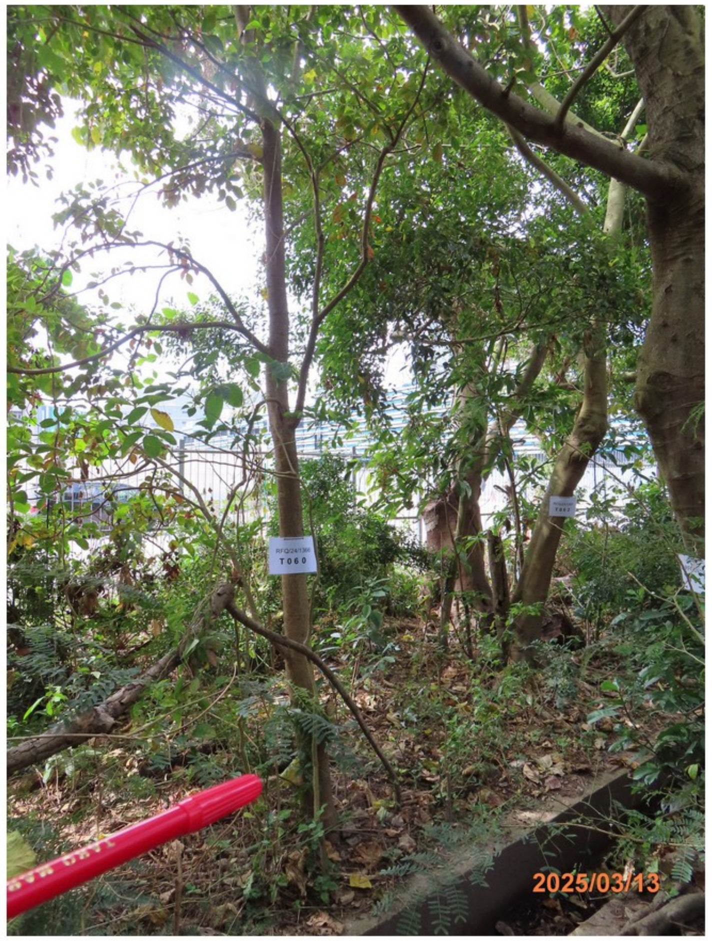

T056

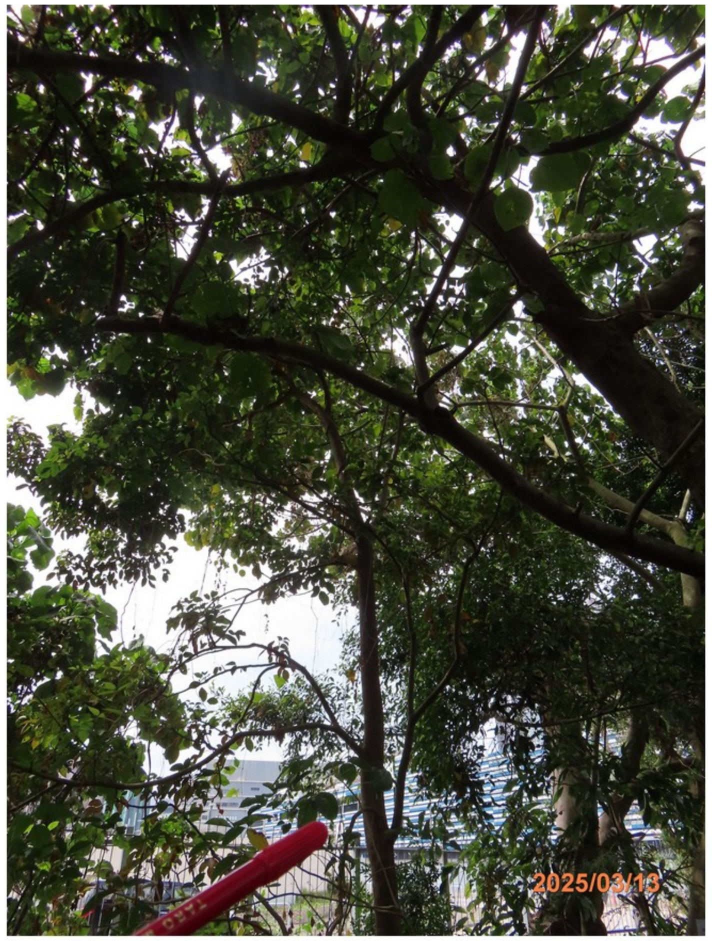


T059 (1)

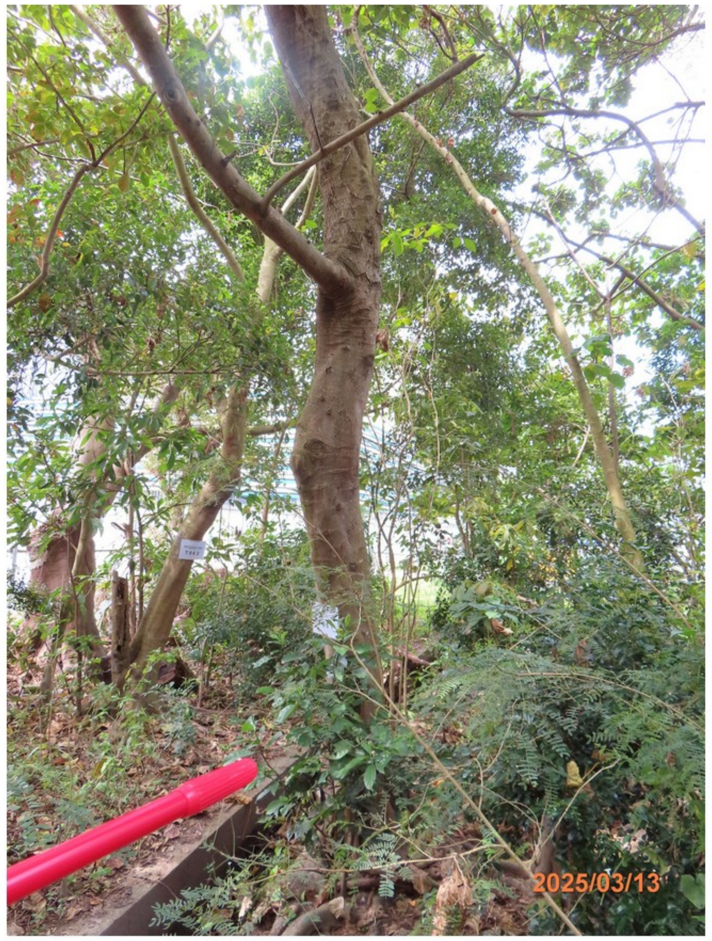


T059 (2)

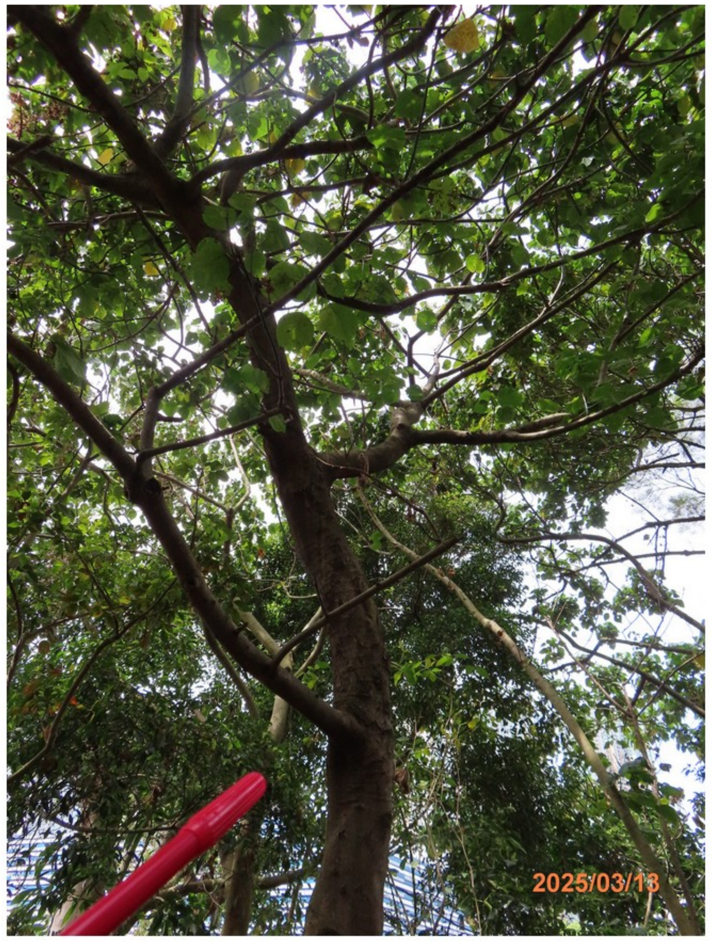

T060
2025/03/13
T060 (1)



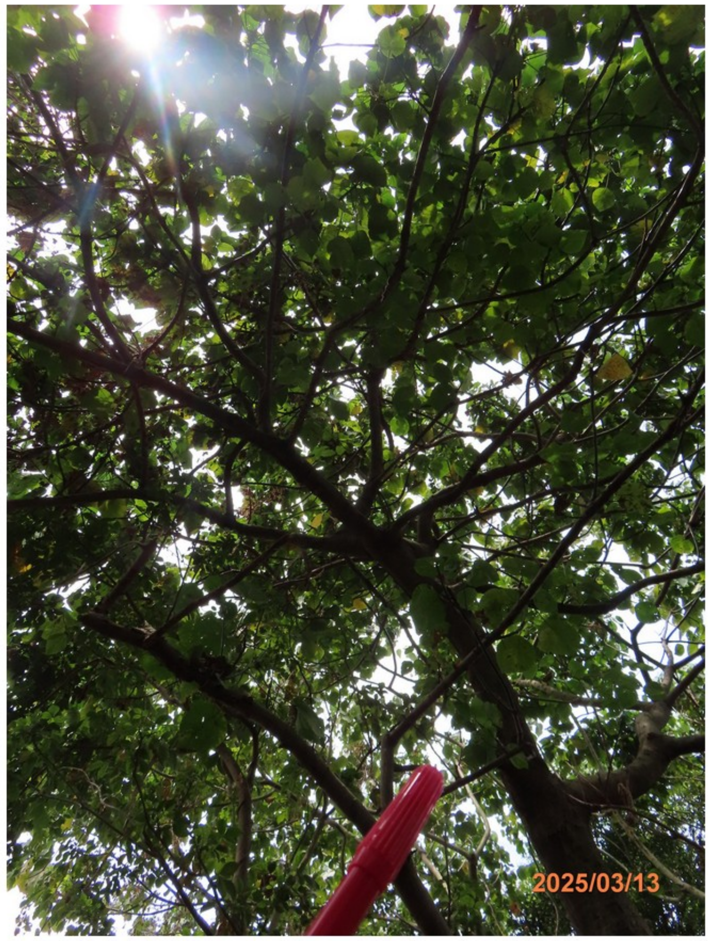
T060 (2)



T061 (1)



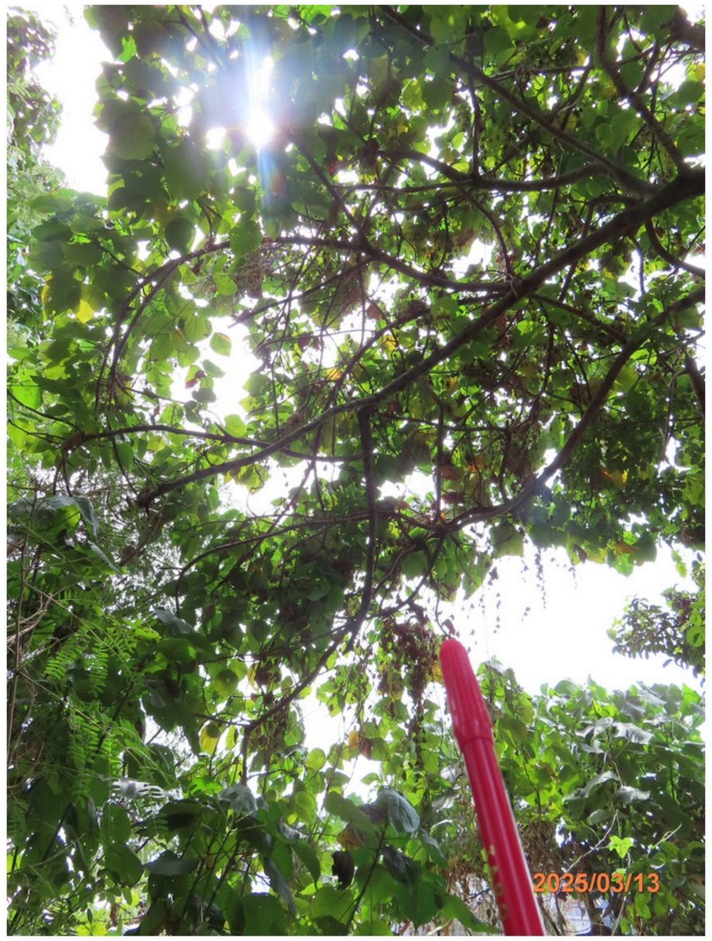
T061 (2)



T061 (3)

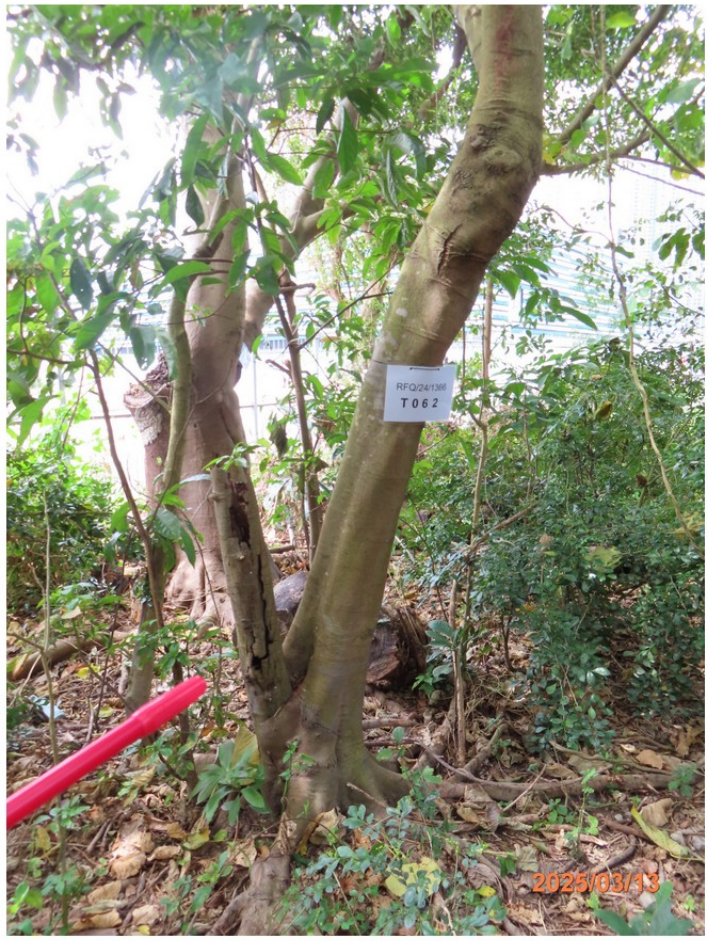
Photographic Record for Existing Trees

T061 (4)



T061 (5)

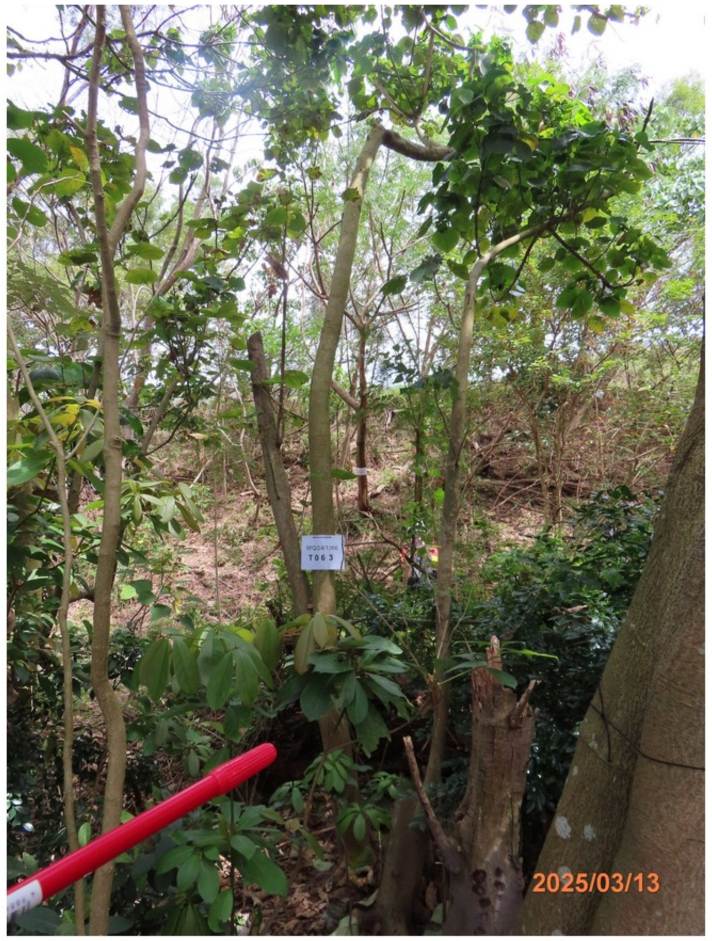
T061 (6)


T062
2025/03/13

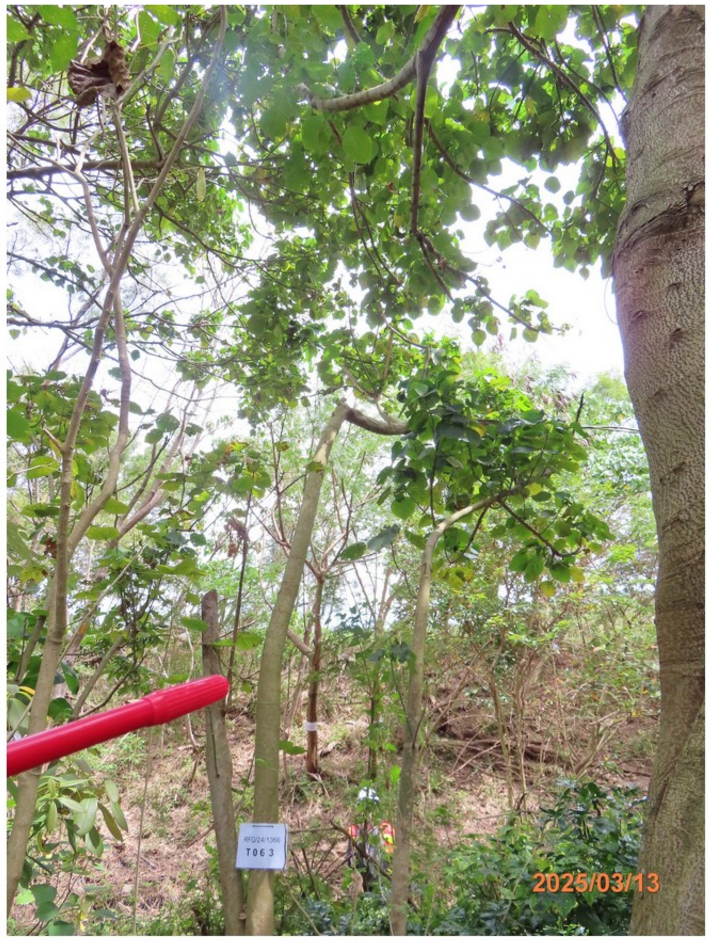
T062 (1)

T062 (2)

T062 (3)

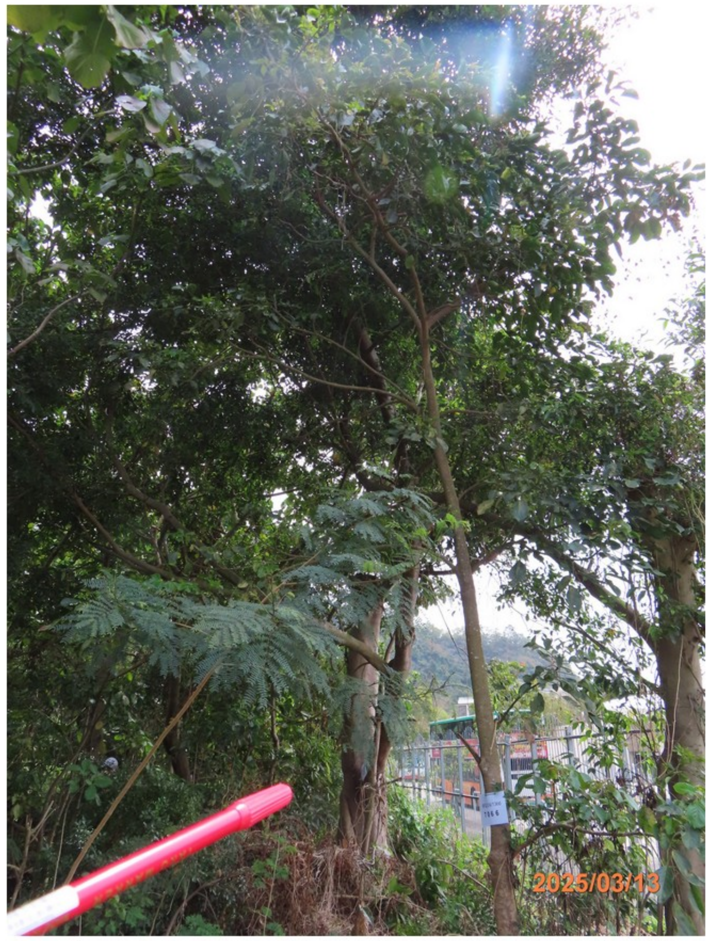

T063
2025/03/13

T063 (1)

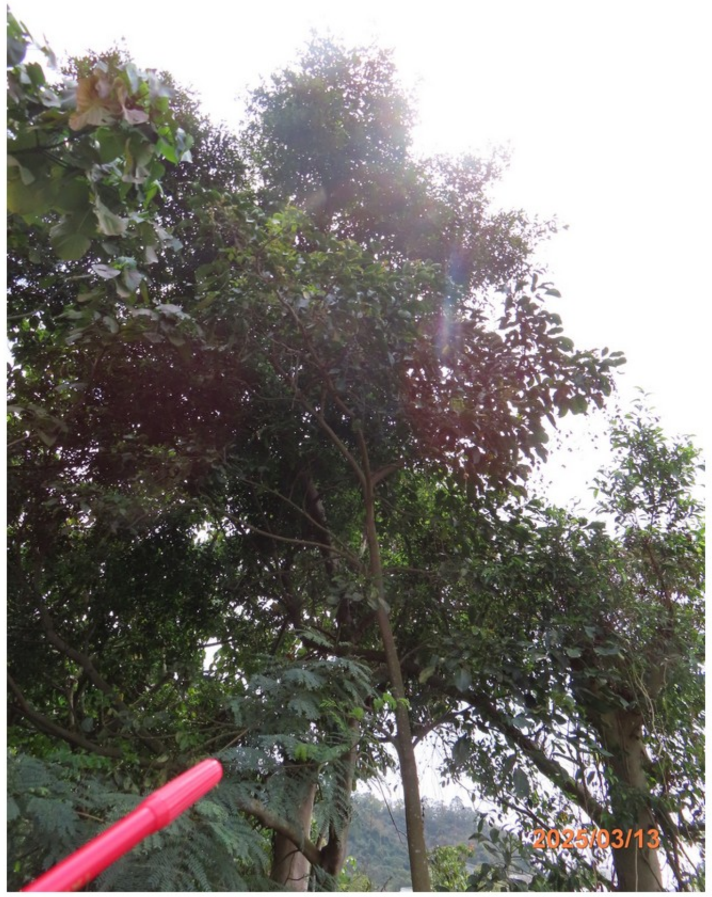

T063
2025/03/13

T063 (2)

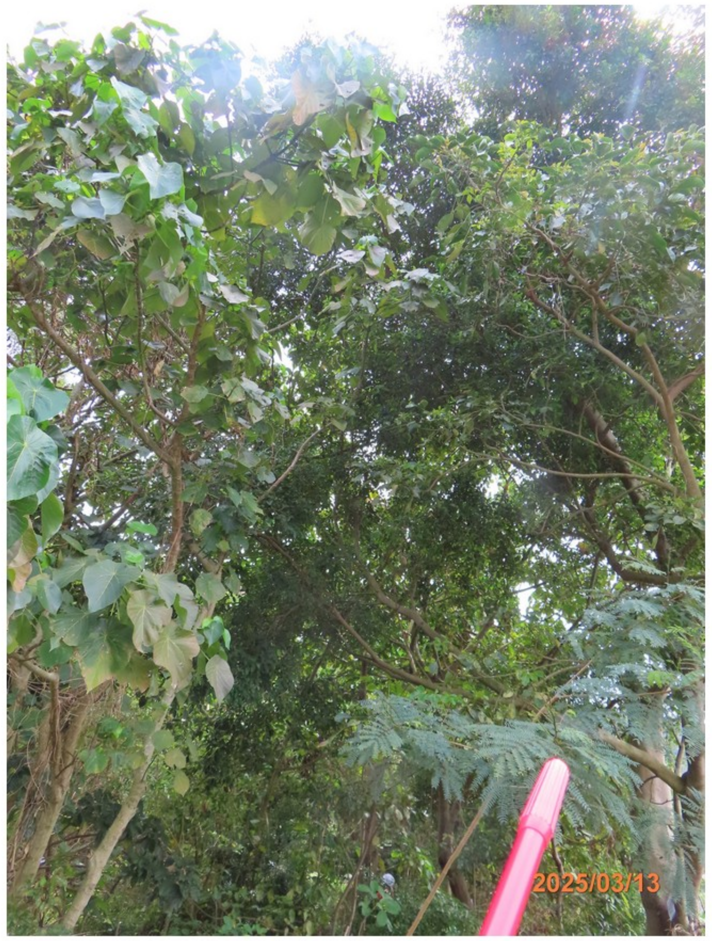
Photographic Record for Existing Trees



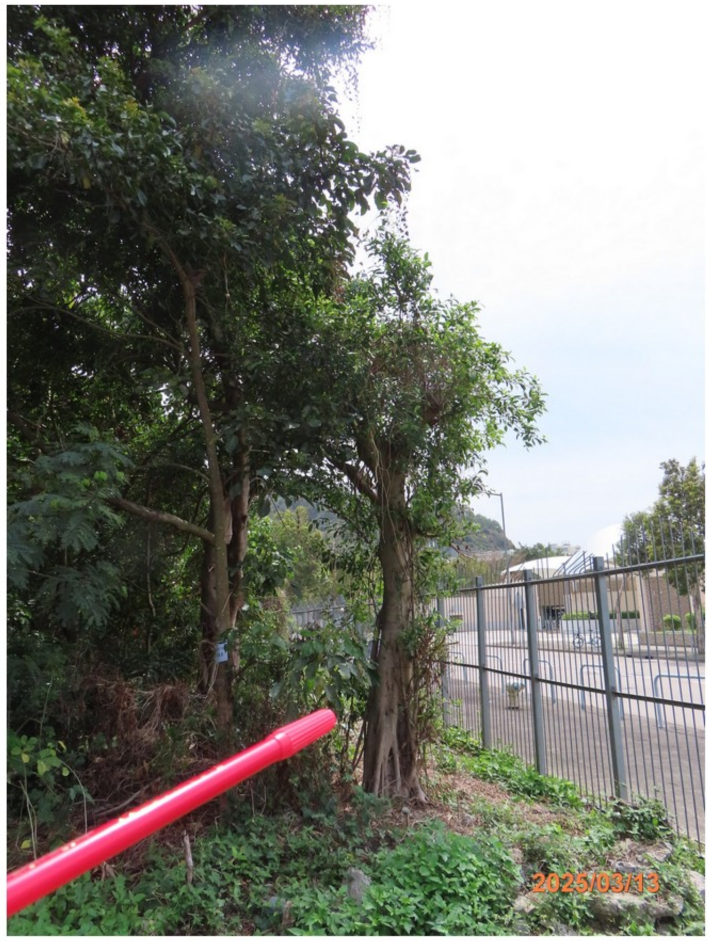
T064 (1)



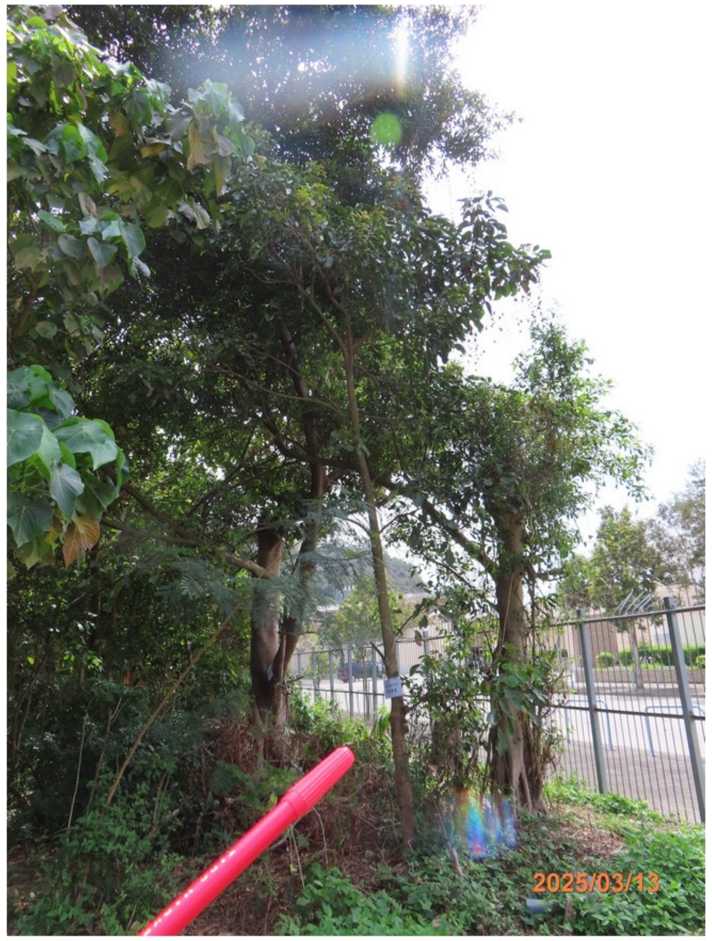
T064 (2)



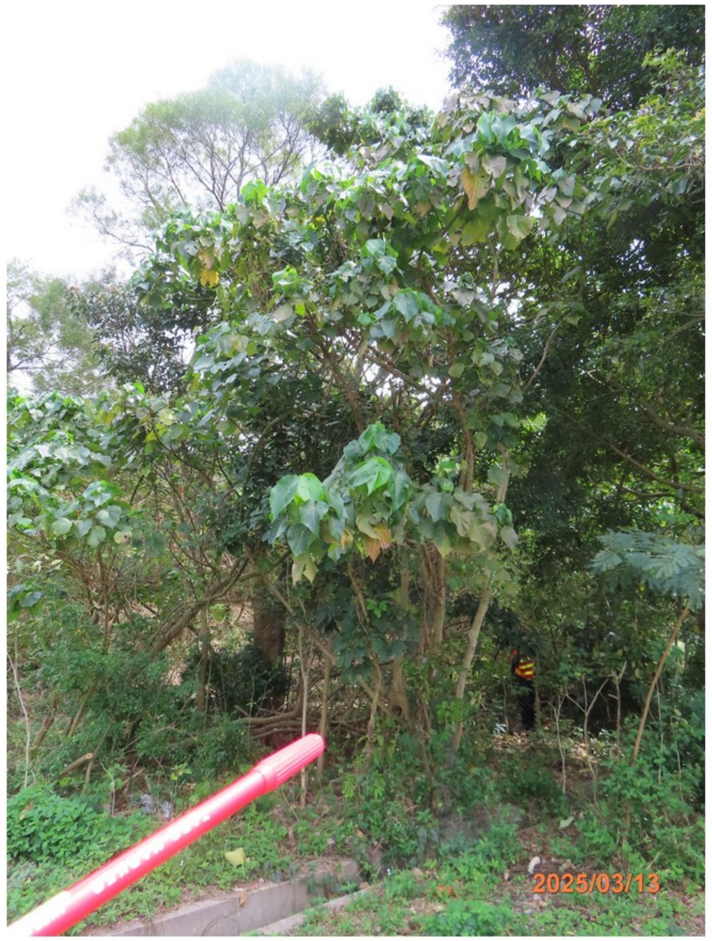
T064 (3)



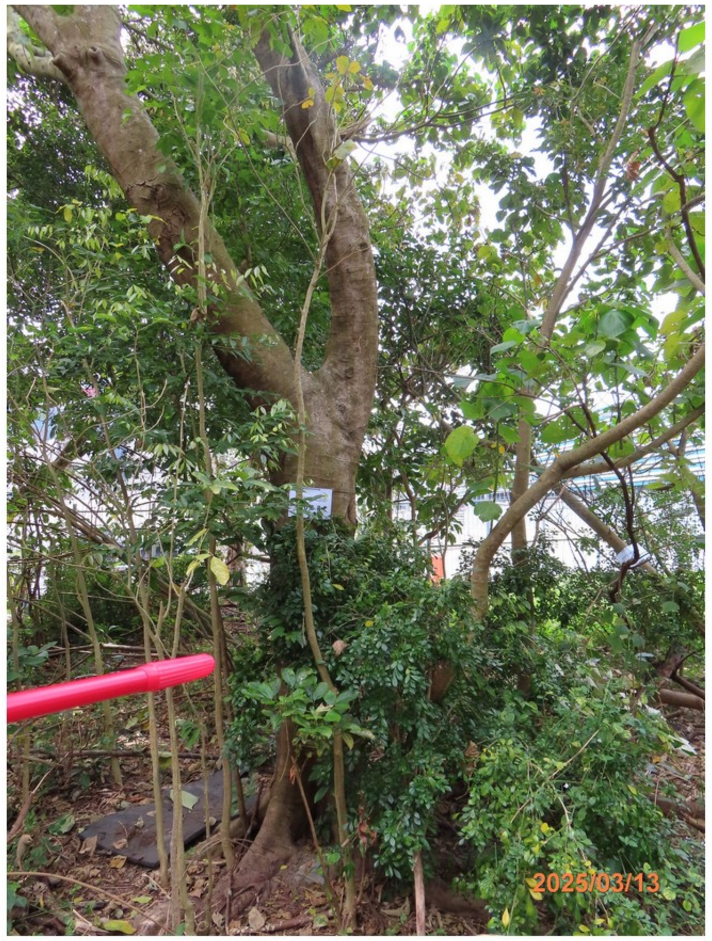
T065



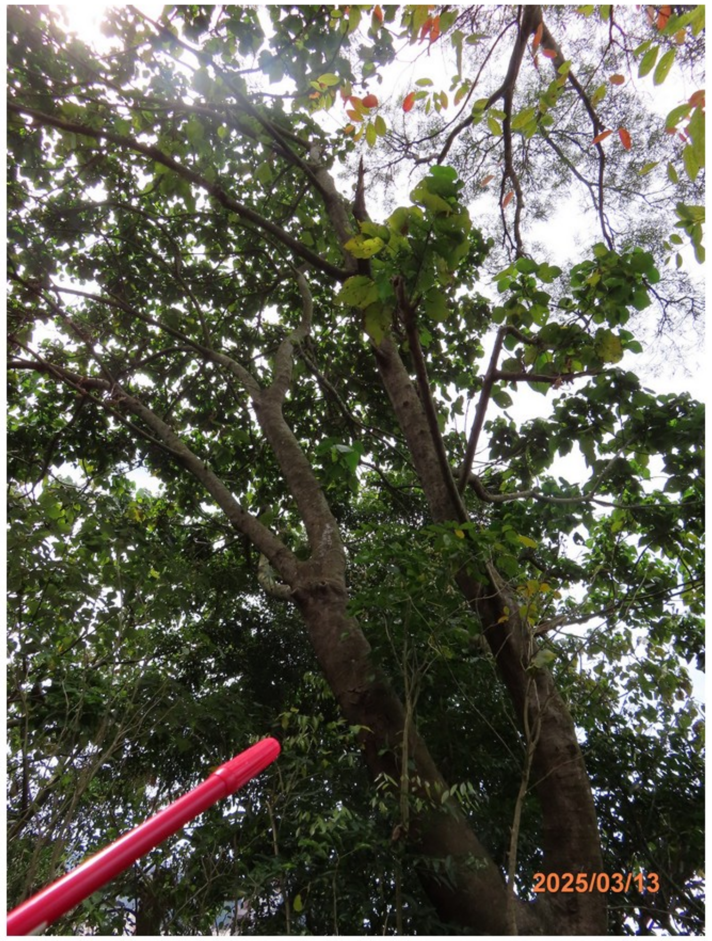
T066



T067



T068 (1)



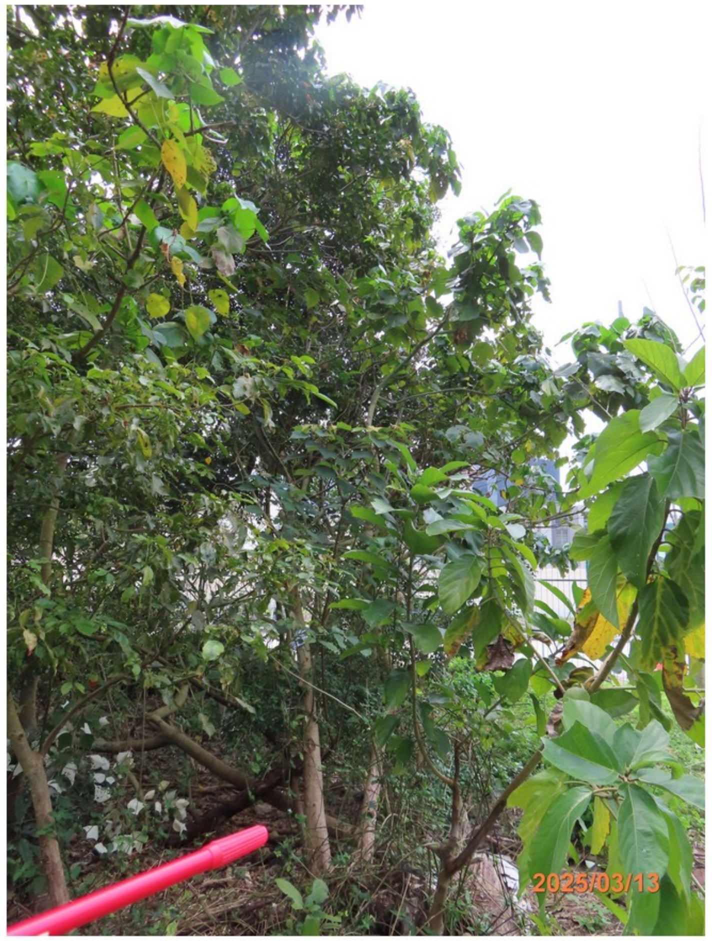
T068 (2)

Photographic Record for Existing Trees

T068 (3)

T068 (4)

T068 (5)



T069

T071 (1)

T071 (2)

T081

T084 (1)

Photographic Record for Existing Trees

T084 (2)

T085 (1)

T085 (2)

T085 (3)

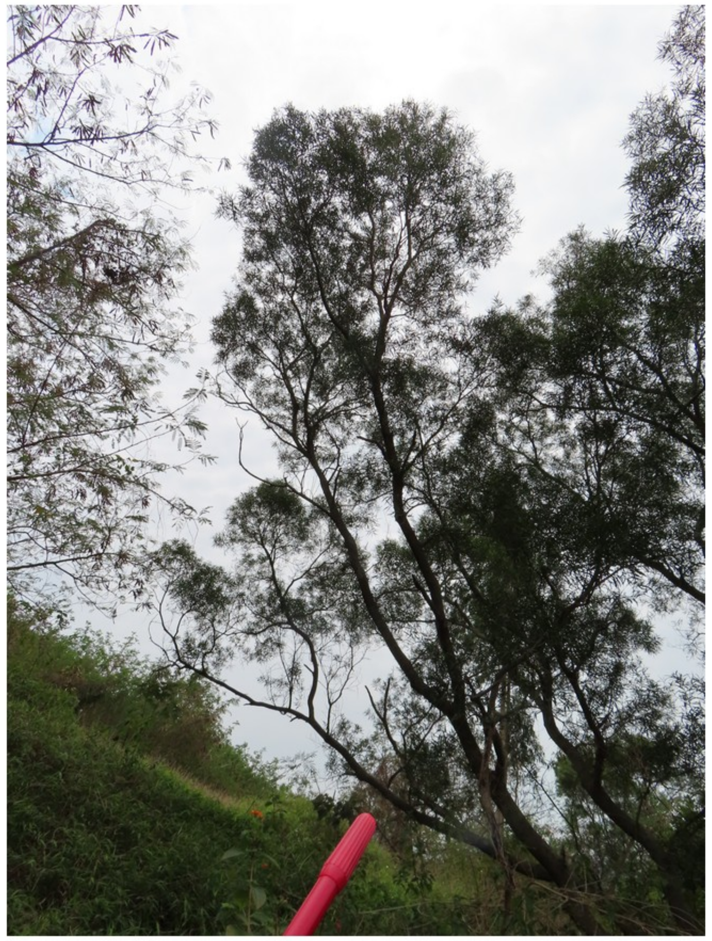
TARO MARK
2025/03/12
T103

T111 (1)

T111 (2)

T111 (3)

Photographic Record for Existing Trees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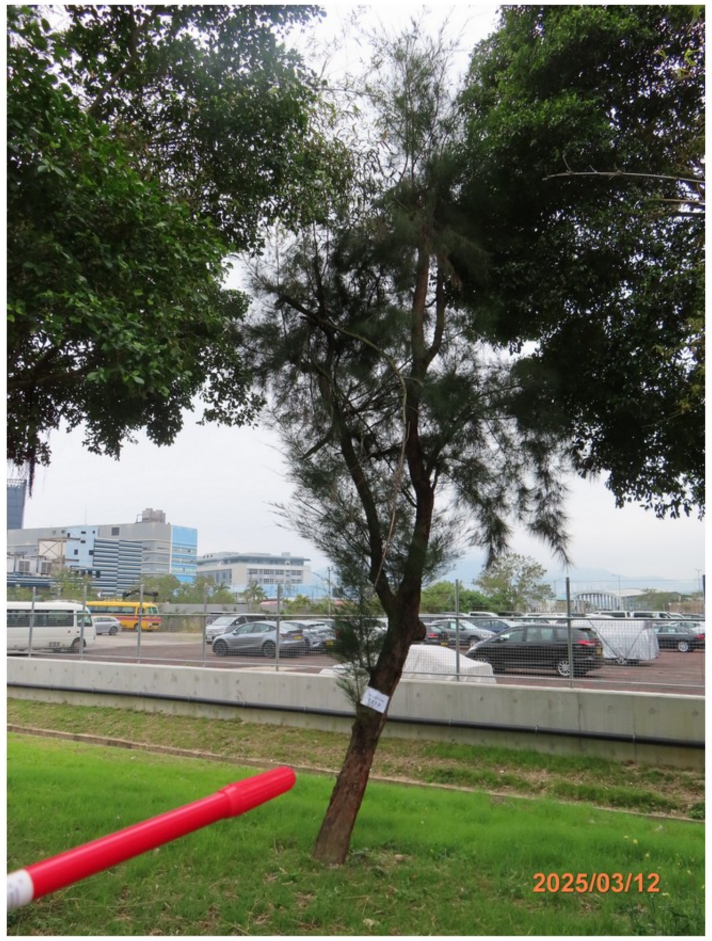

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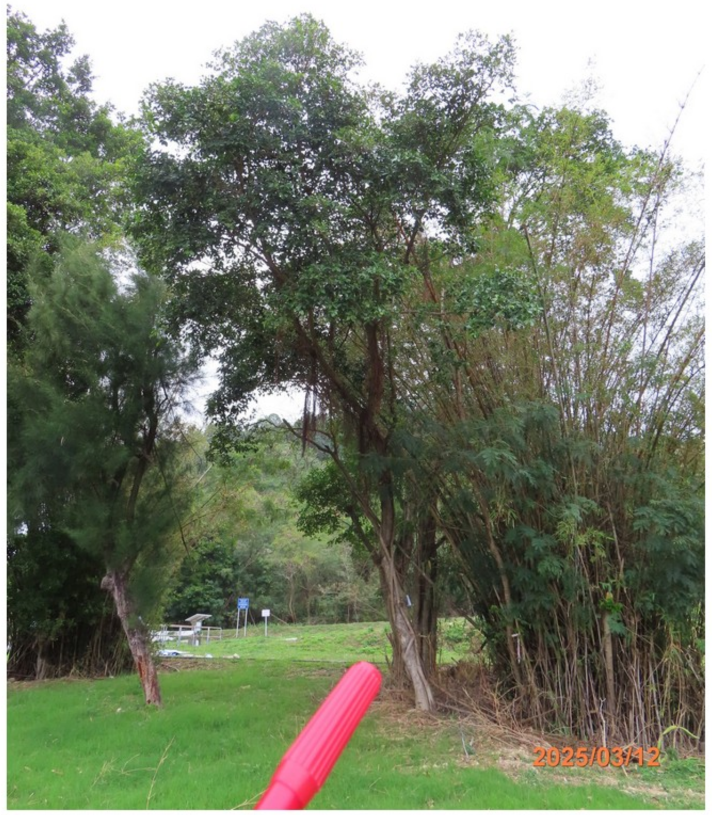

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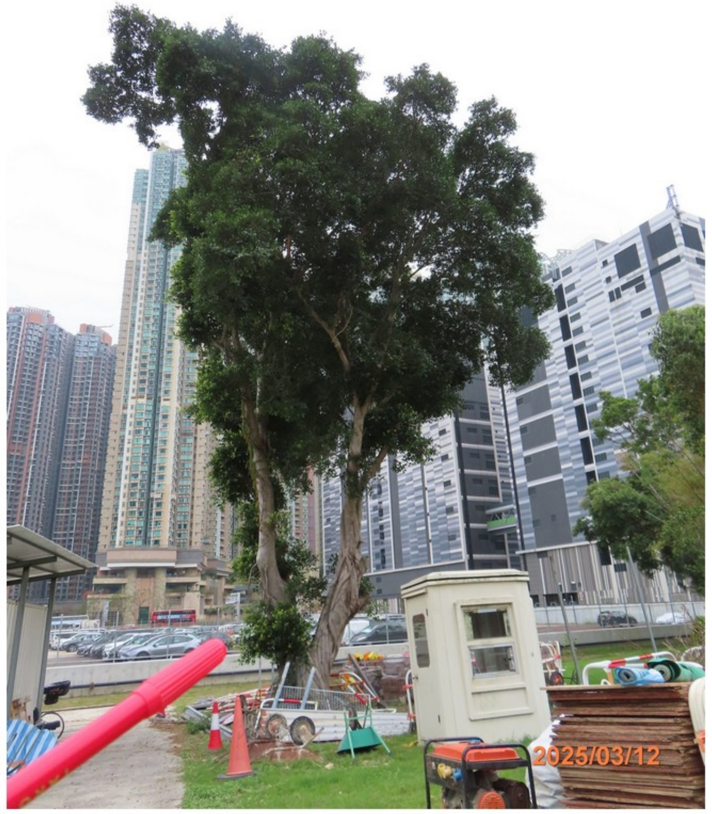

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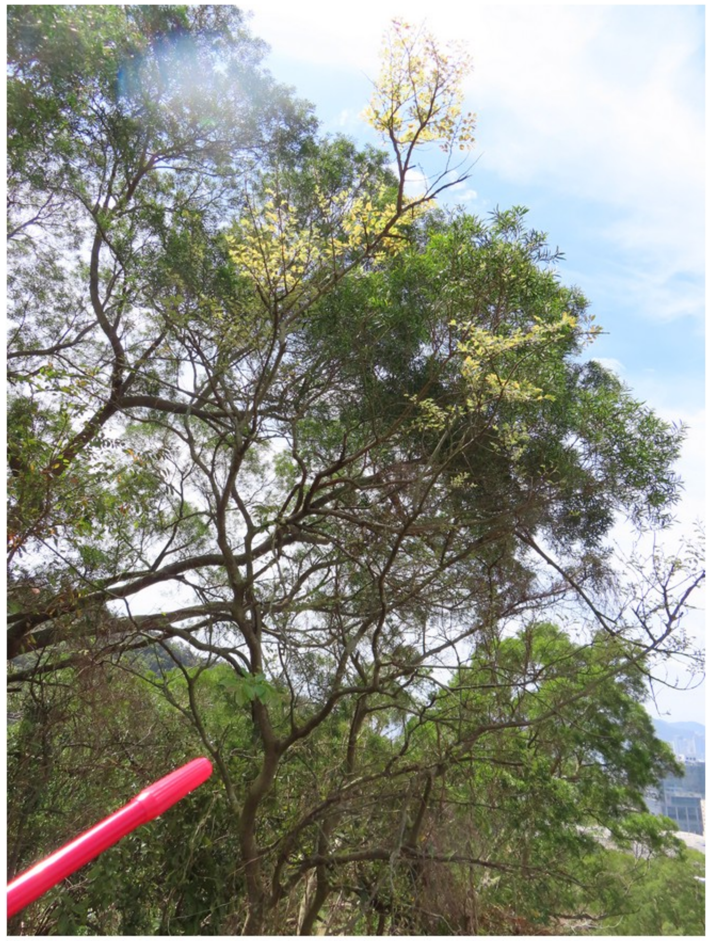
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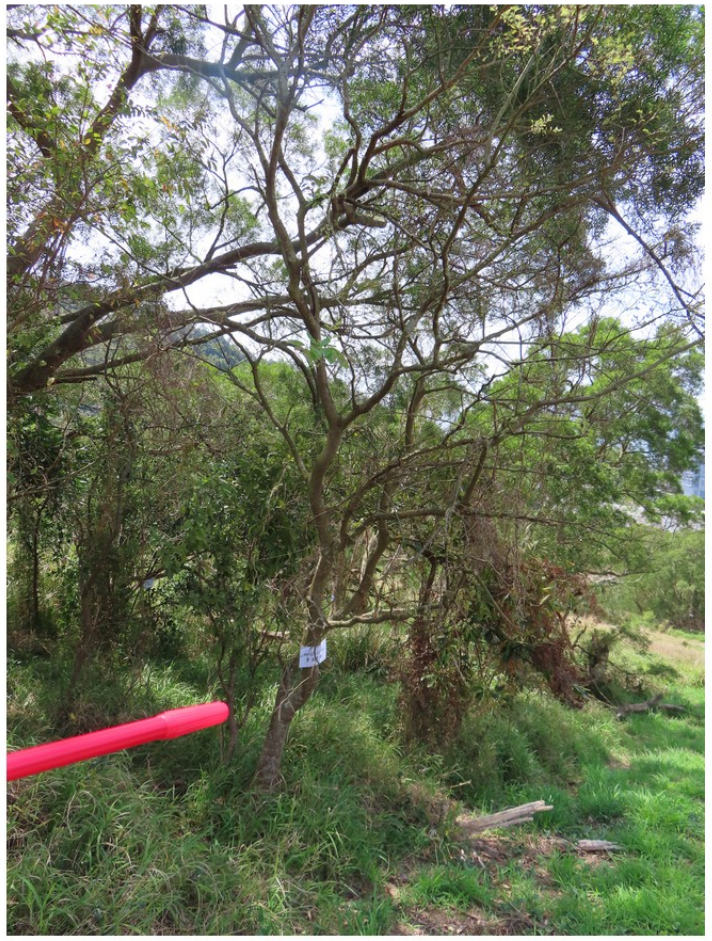
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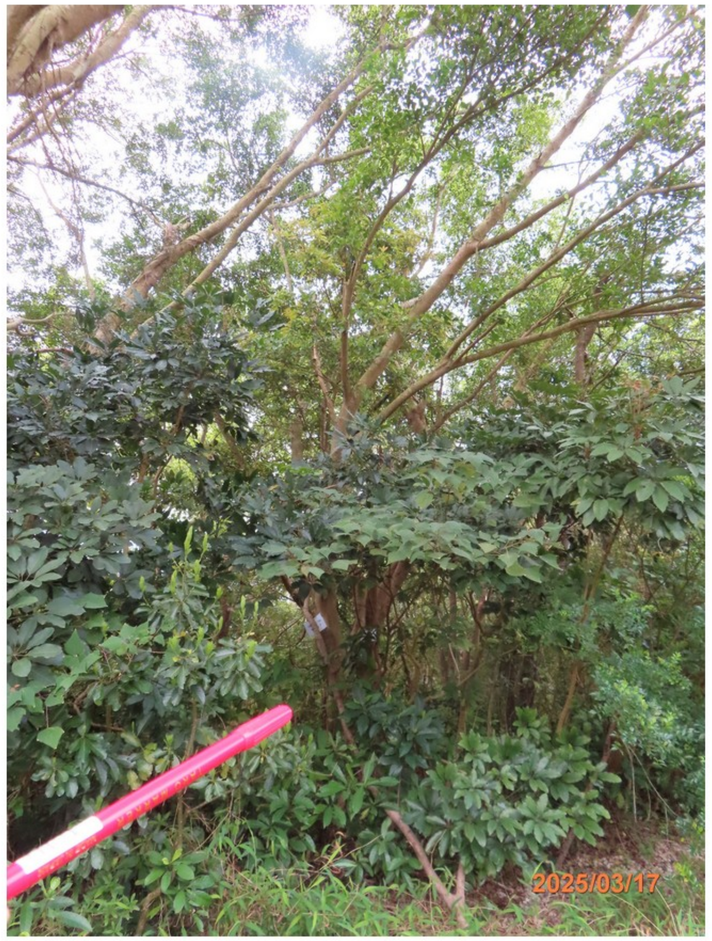

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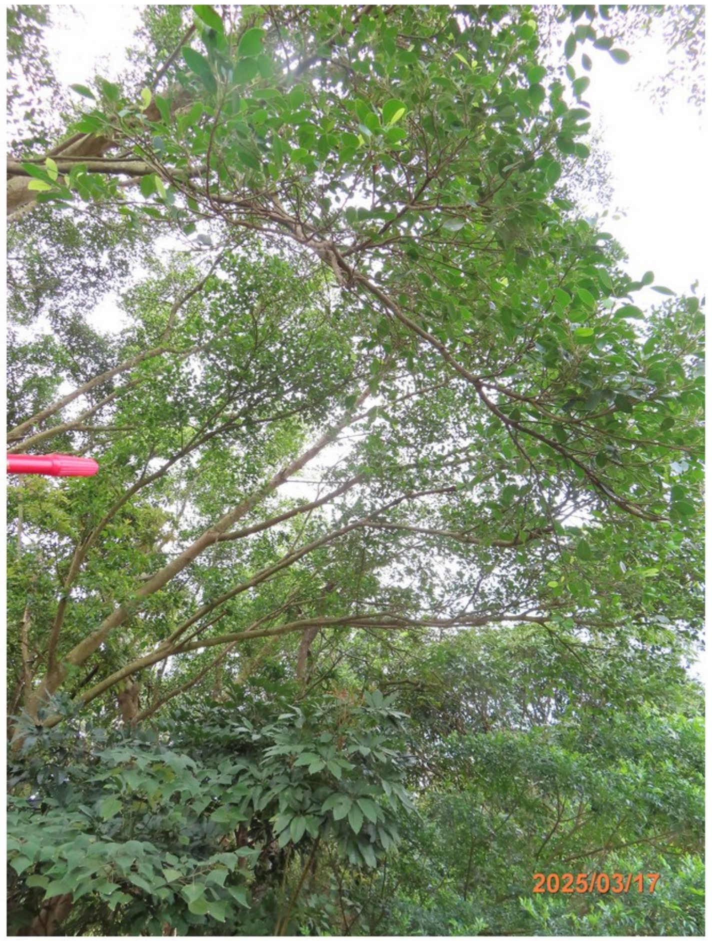

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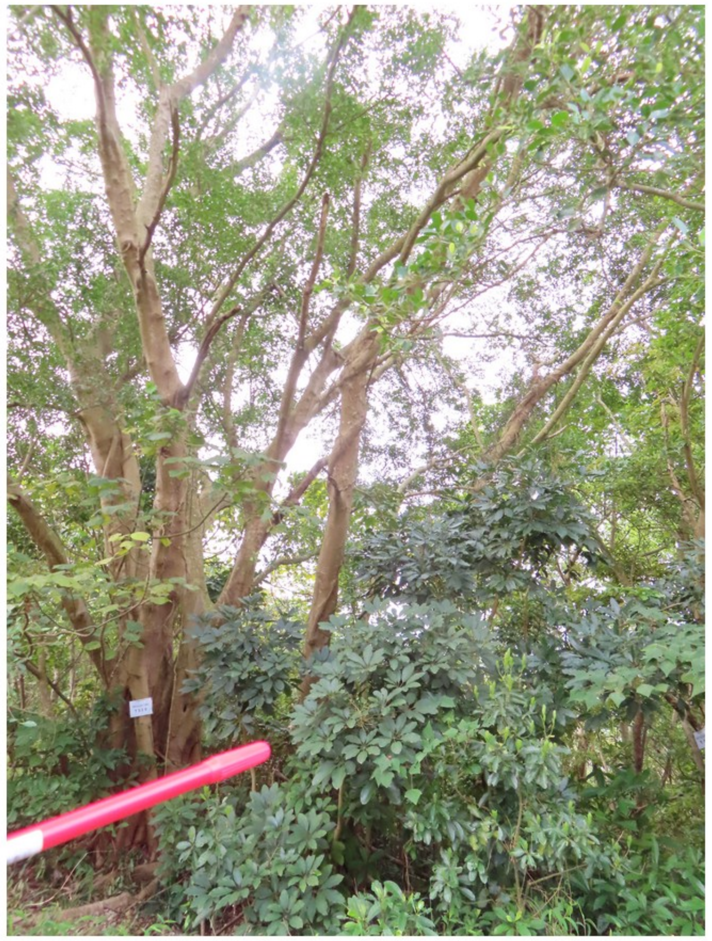
T327 (3)

T327 (4)

T327 (5)



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T329 (3)

T330 (1)

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T330 (3)

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T330 (6)

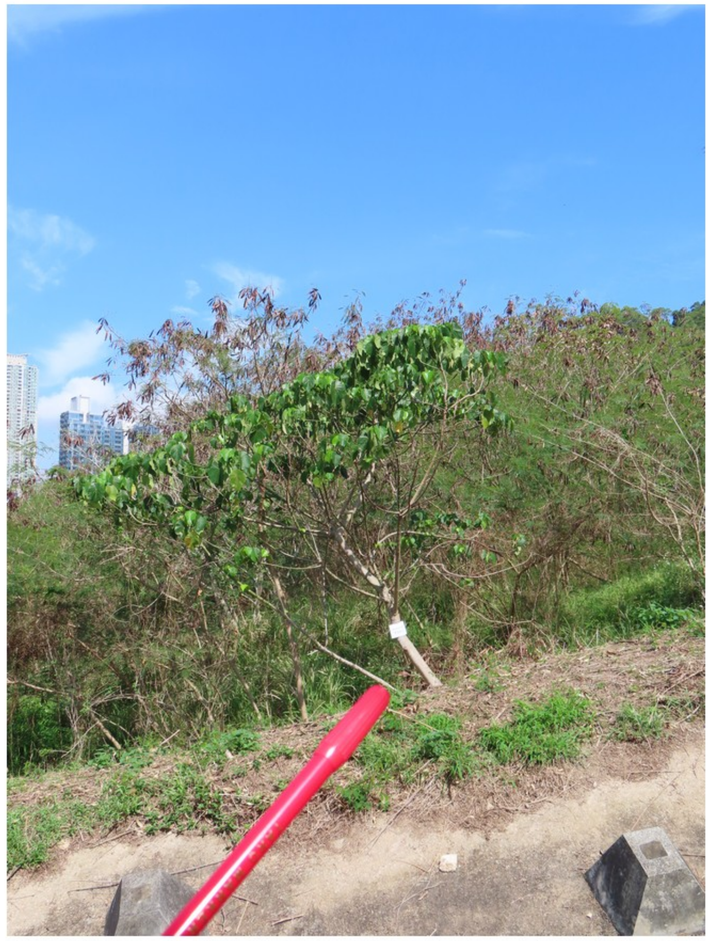
T331 (1)

T331 (2)

T332

T351

Photographic Record for Existing Trees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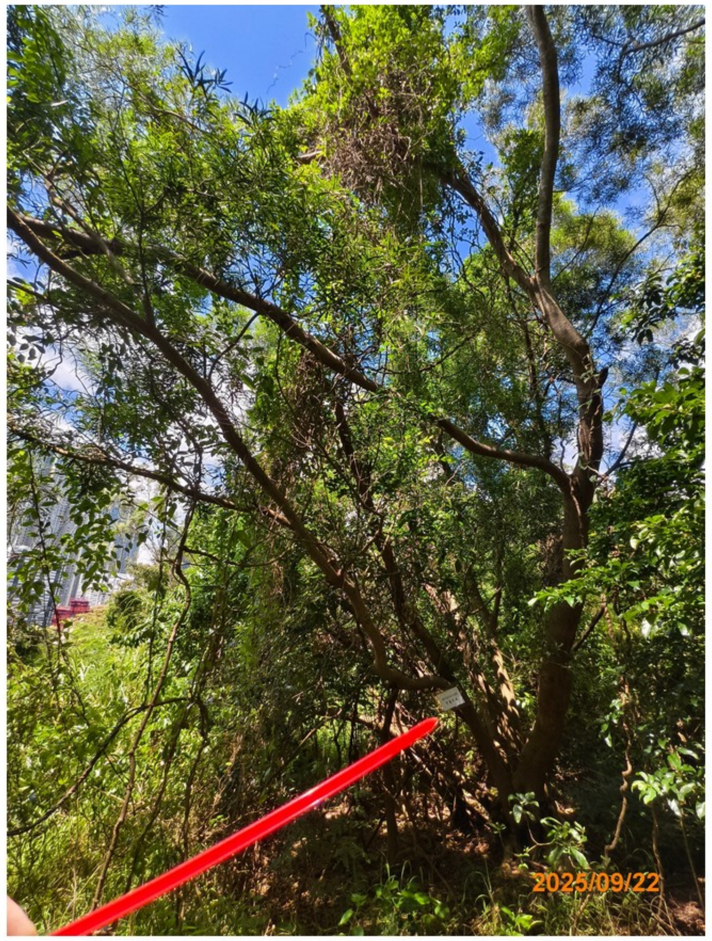

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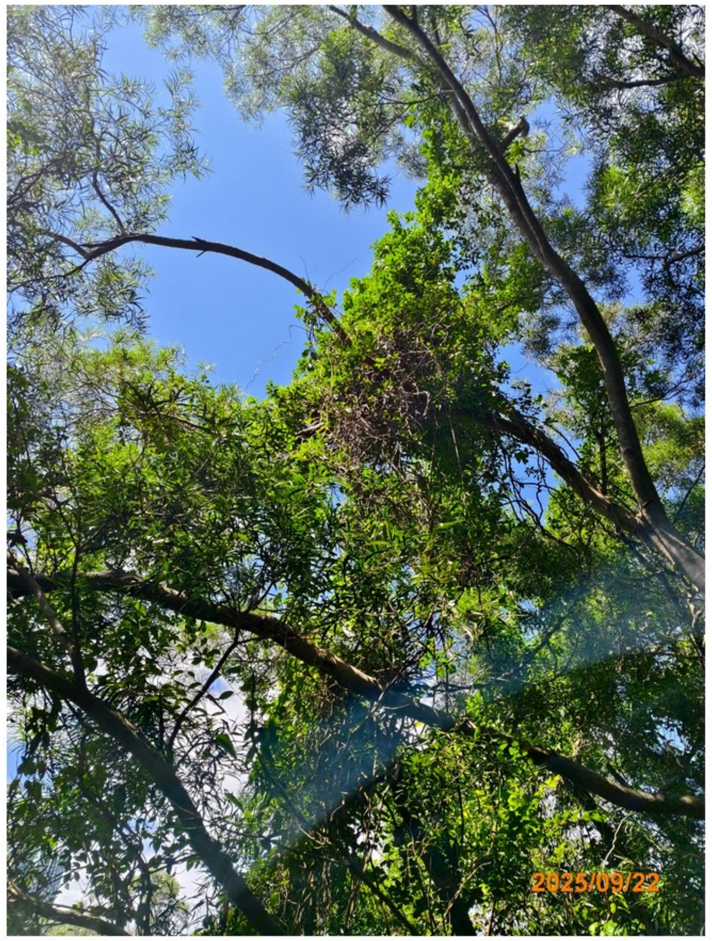

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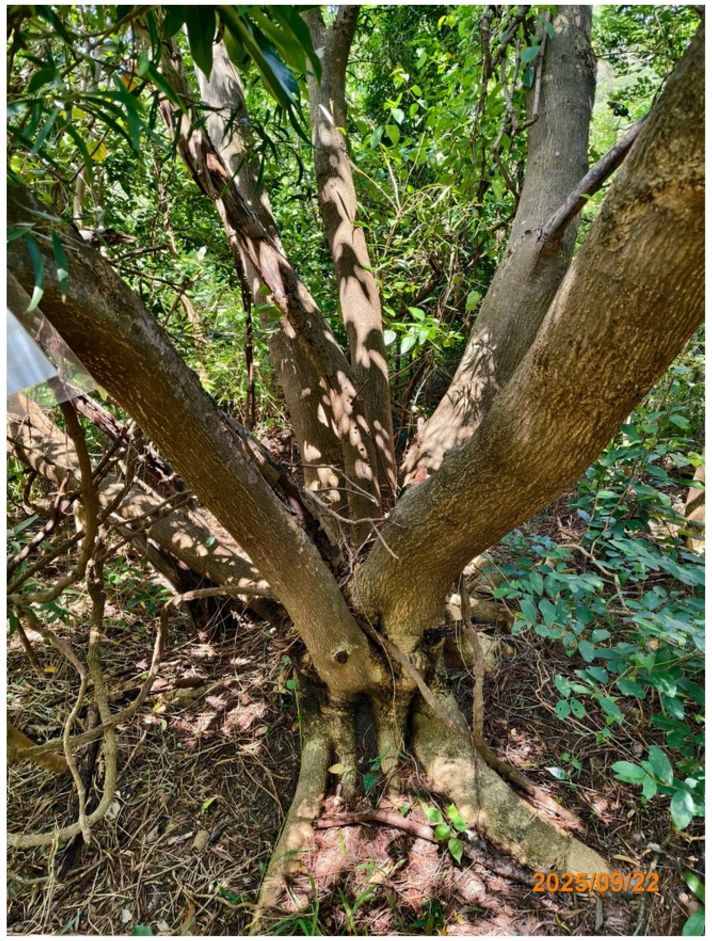

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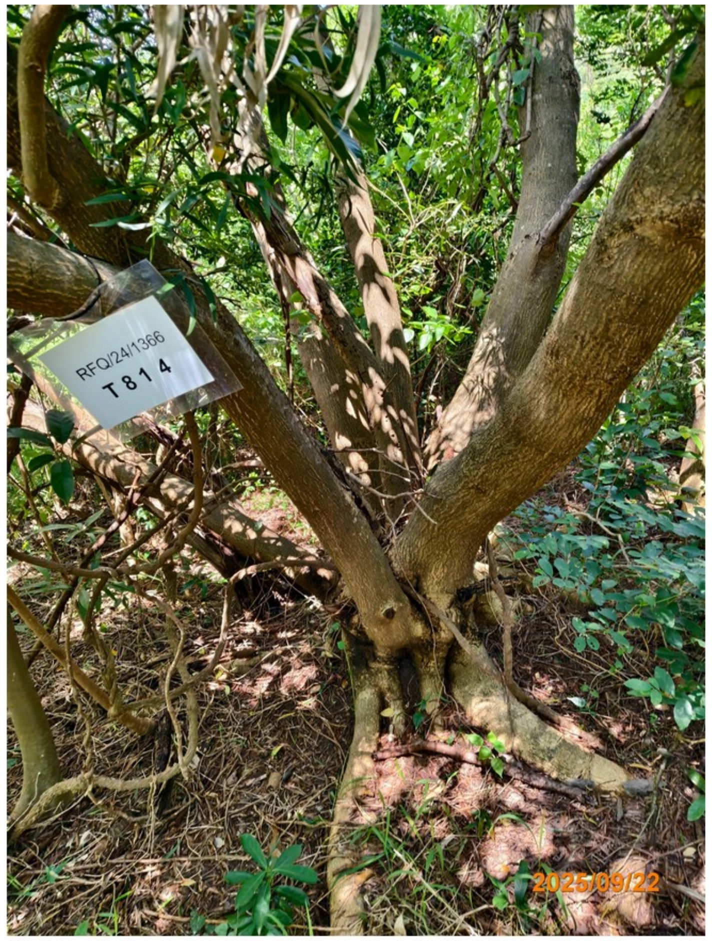
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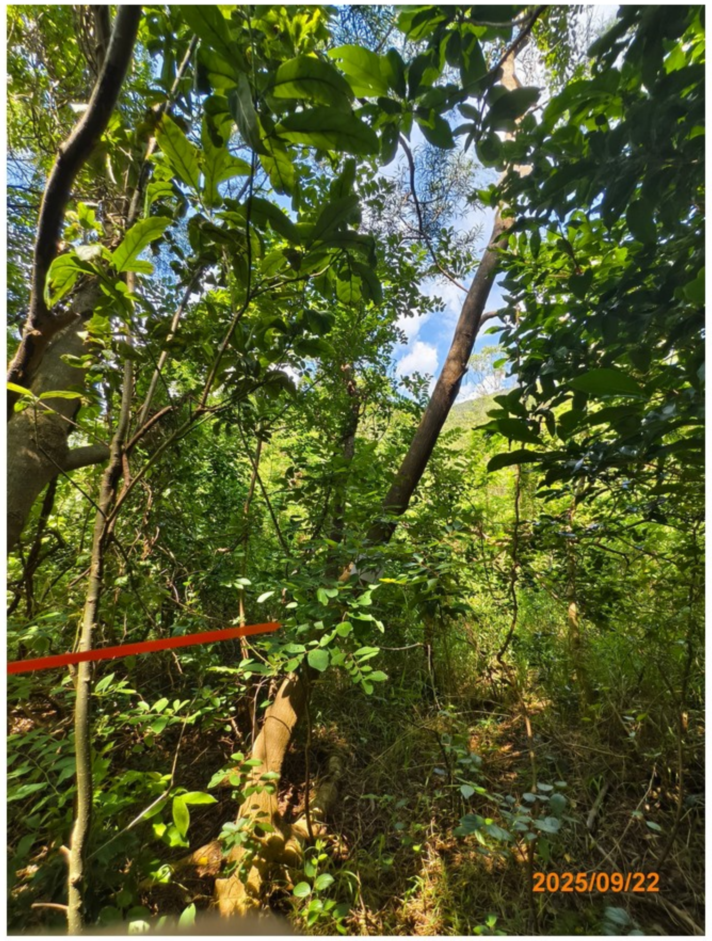

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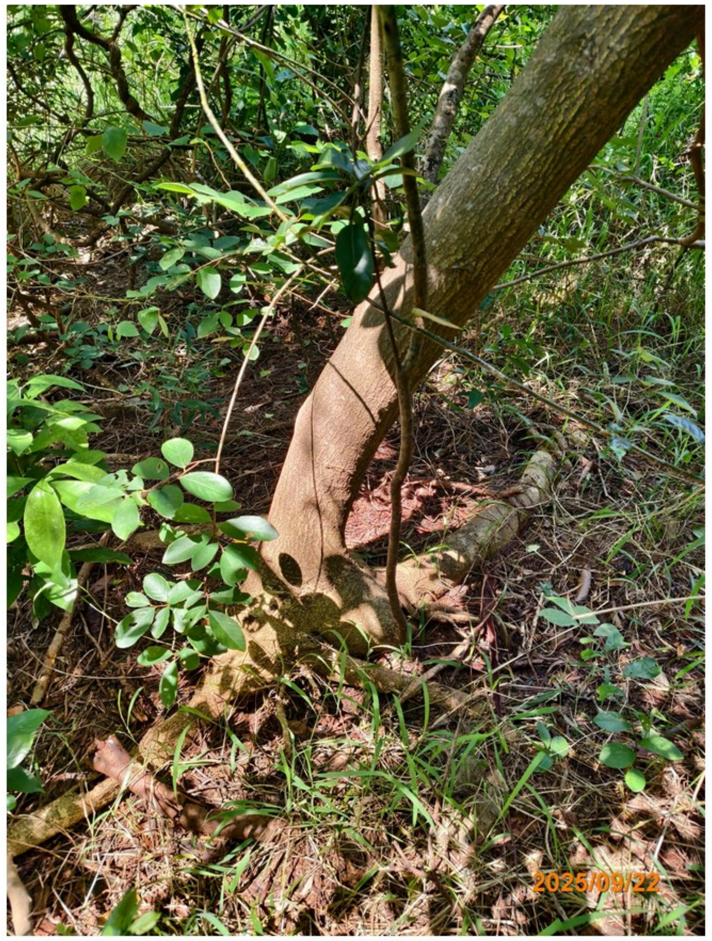

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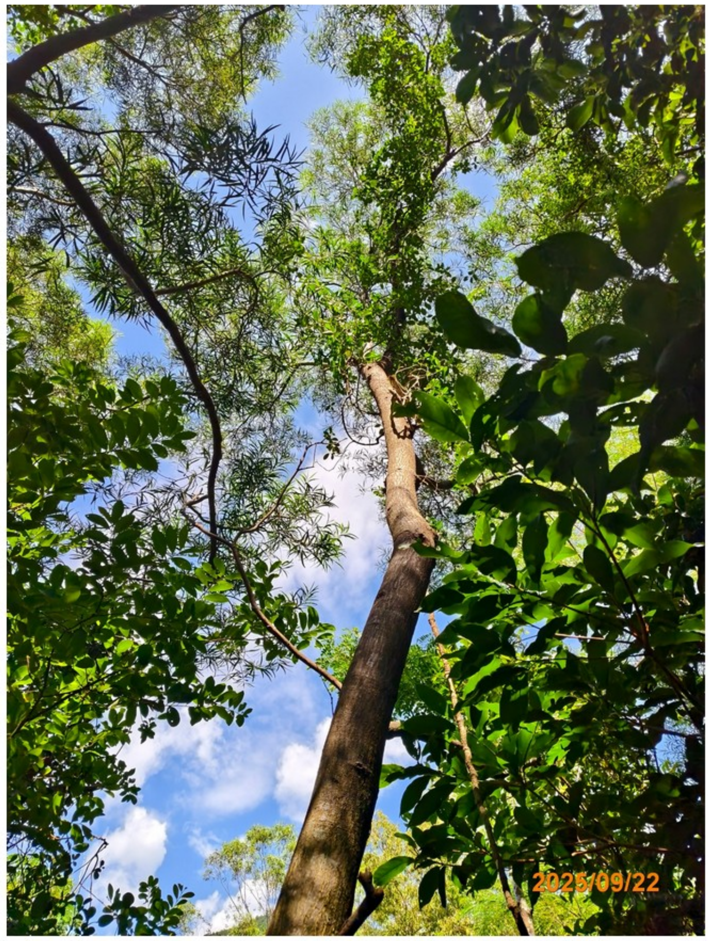

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Photographic Record for Existing Trees

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T818 (2)

T818 (3)

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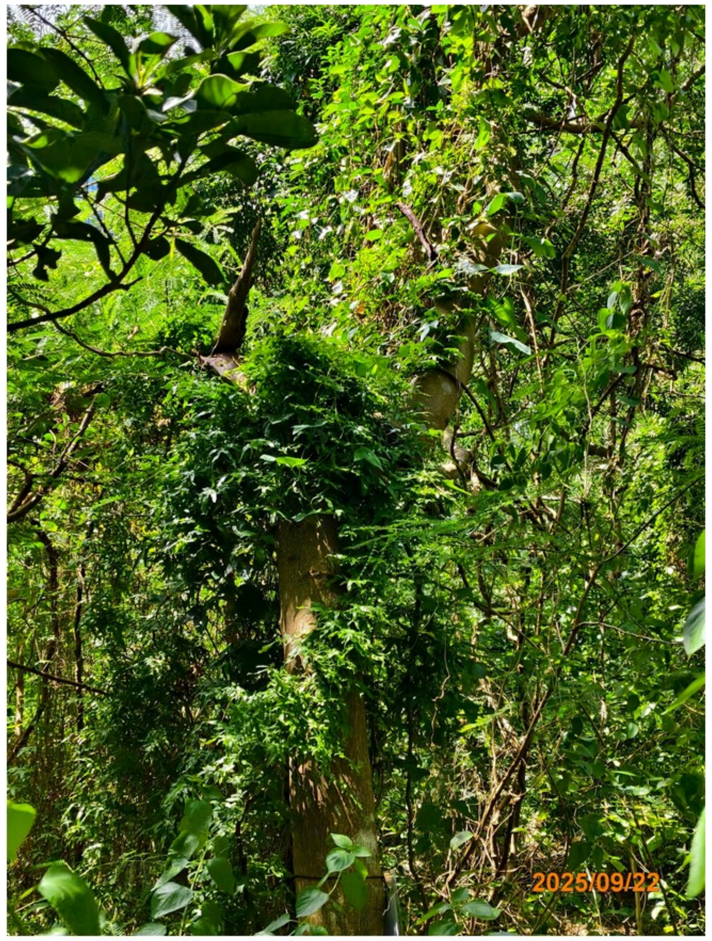


T819 (2)

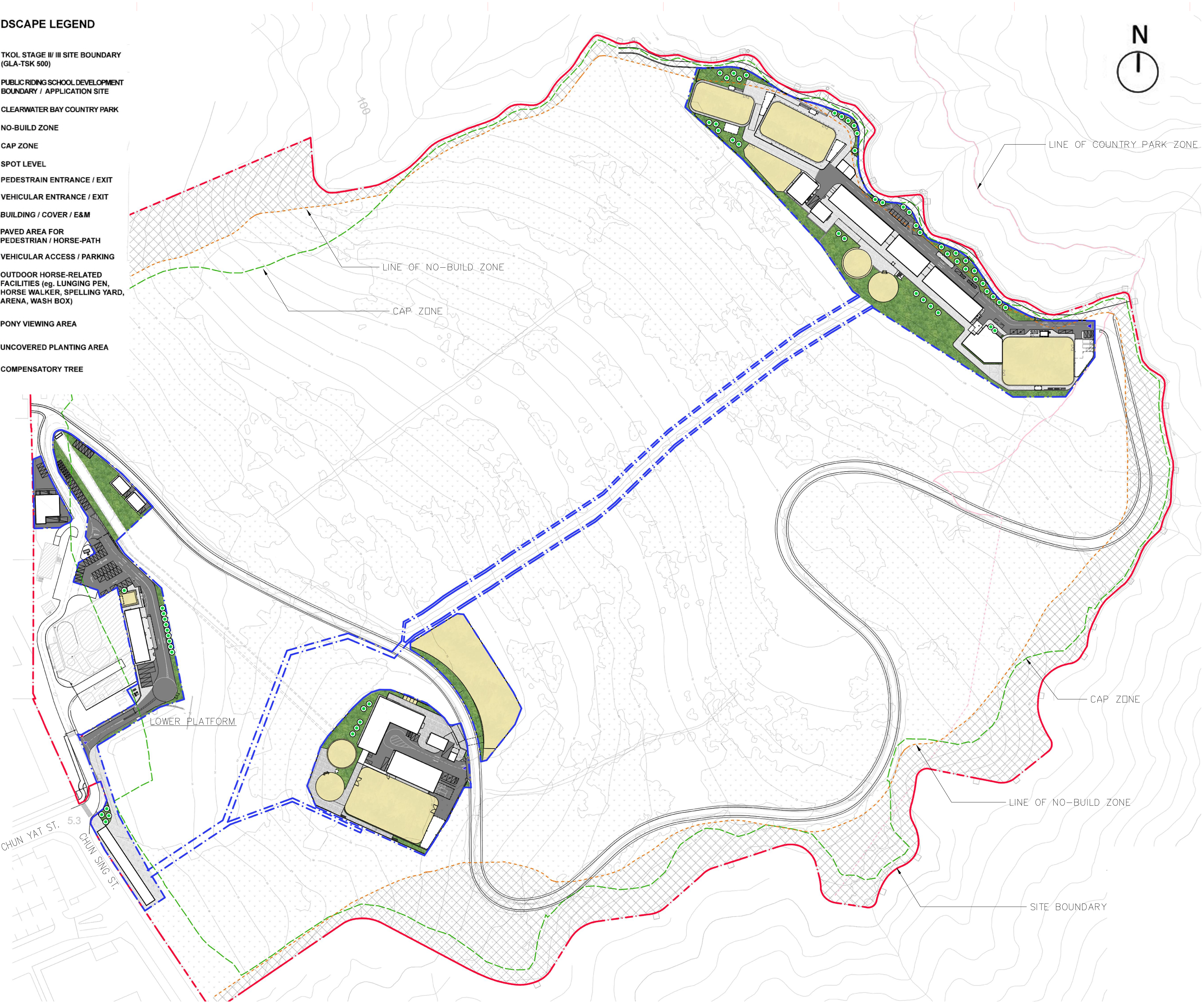
T819 (3)

Appendix B

Landscape Master Plan

LANDSCAPE LEGEND

- 🟥 TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
- 🟦 PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY / APPLICATION SITE
- CLEARWATER BAY COUNTRY PARK
- NO-BUILD ZONE
- CAP ZONE
- ✢ SPOT LEVEL
- ▲ PEDESTRAIN ENTRANCE / EXIT
- ▲ VEHICULAR ENTRANCE / EXIT
- ☐ BUILDING / COVER / E&M
- ▨ PAVED AREA FOR PEDESTRIAN / HORSE-PATH
- ■ VEHICULAR ACCESS / PARKING
- 🟨 OUTDOOR HORSE-RELATED FACILITIES (eg. LUNGING PEN, HORSE WALKER, SPELLING YARD, ARENA, WASH BOX)
- ▨ PONY VIEWING AREA
- 🟩 UNCOVERED PLANTING AREA
- ● COMPENSATORY TREE



PATH: Z:\WTPL17_24_Public Riding School at TKO II&III\06_Submission\S16 LMP_Three Platforms\colour plan\20260130_LMP_3 Platform.dwg

LEGEND/NOTE

LMP SUBMISSION

REV	DATE	DESCRIPTION
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CLIENT:
THE HONG KONG JOCKEY CLUB

PROJECT:
PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

TITLE:
LANDSCAPE MASTER PLAN - OVERALL

SCALE:	1:2500 (A3)
DRAWN BY:	KC
CHECKED BY:	RT
APPROVED BY:	RT
DRAWING DATE:	20260128
PROJECT No:	-
SHEET No: WTPL17_LMP_01	REV: B

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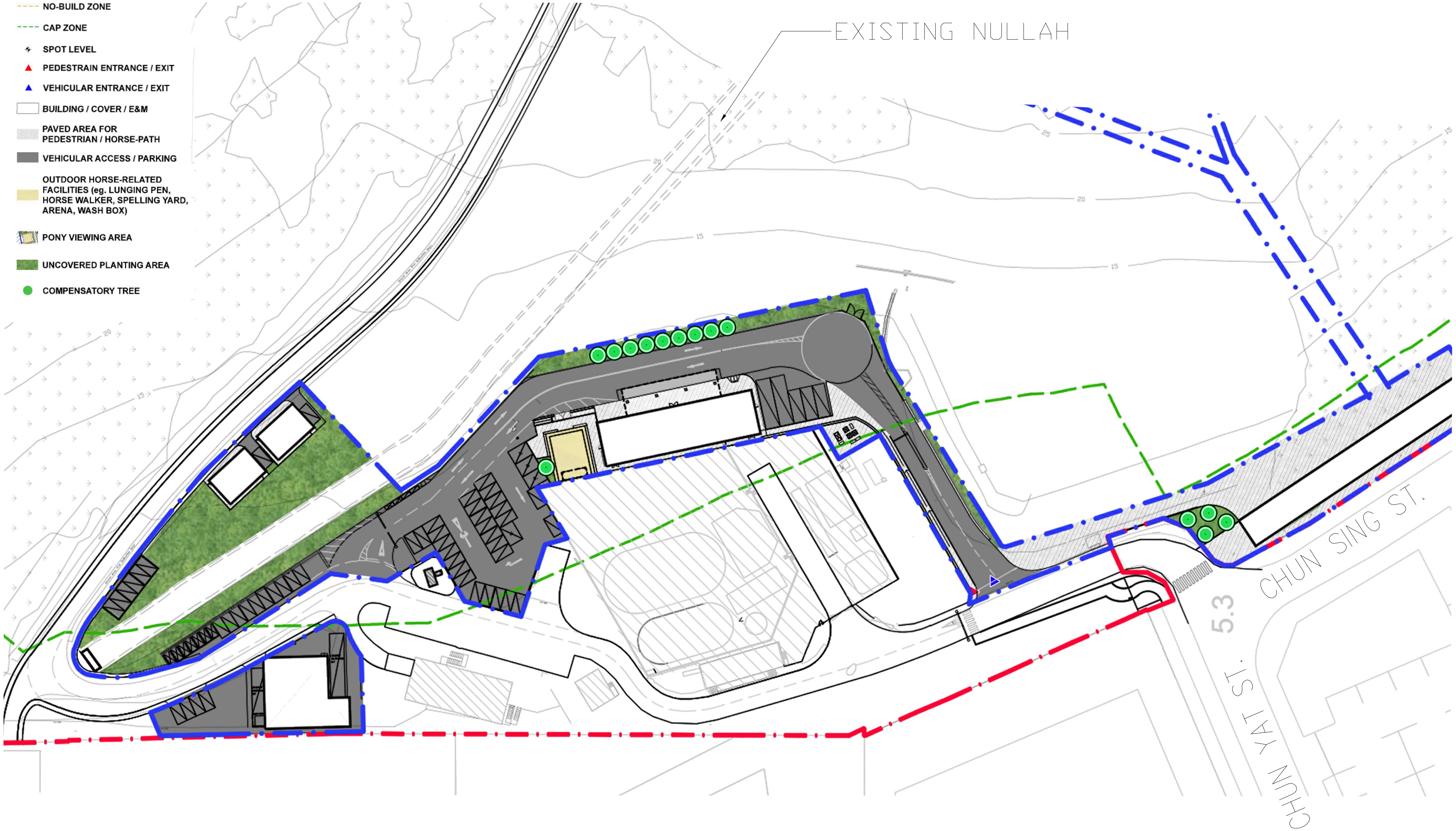
PLOT: Konichan DATE: 2 February 2026

LANDSCAPE LEGEND

- TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
- PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY / APPLICATION SITE
- CLEARWATER BAY COUNTRY PARK
- NO-BUILD ZONE
- CAP ZONE
- SPOT LEVEL
- ▲ PEDESTRAIN ENTRANCE / EXIT
- ▲ VEHICULAR ENTRANCE / EXIT
- ☐ BUILDING / COVER / E&M
- ▨ PAVED AREA FOR PEDESTRIAN / HORSE-PATH
- ▨ VEHICULAR ACCESS / PARKING
- ▨ OUTDOOR HORSE-RELATED FACILITIES (eg. LUNGING PEN, HORSE WALKER, SPELLING YARD, ARENA, WASH BOX)
- ▨ PONY VIEWING AREA
- 🟩 UNCOVERED PLANTING AREA
- ● COMPENSATORY TREE



LEGEND/NOTE

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TITLE:
LANDSCAPE MASTER PLAN - LOWER PLATFORM

SCALE:	1:1000 (A3)
DRAWN BY:	KC
CHECKED BY:	RT
APPROVED BY:	RT
DRAWING DATE:	20260128
PROJECT No:	-
SHEET No: WTPL17_LMP_02	REV: B

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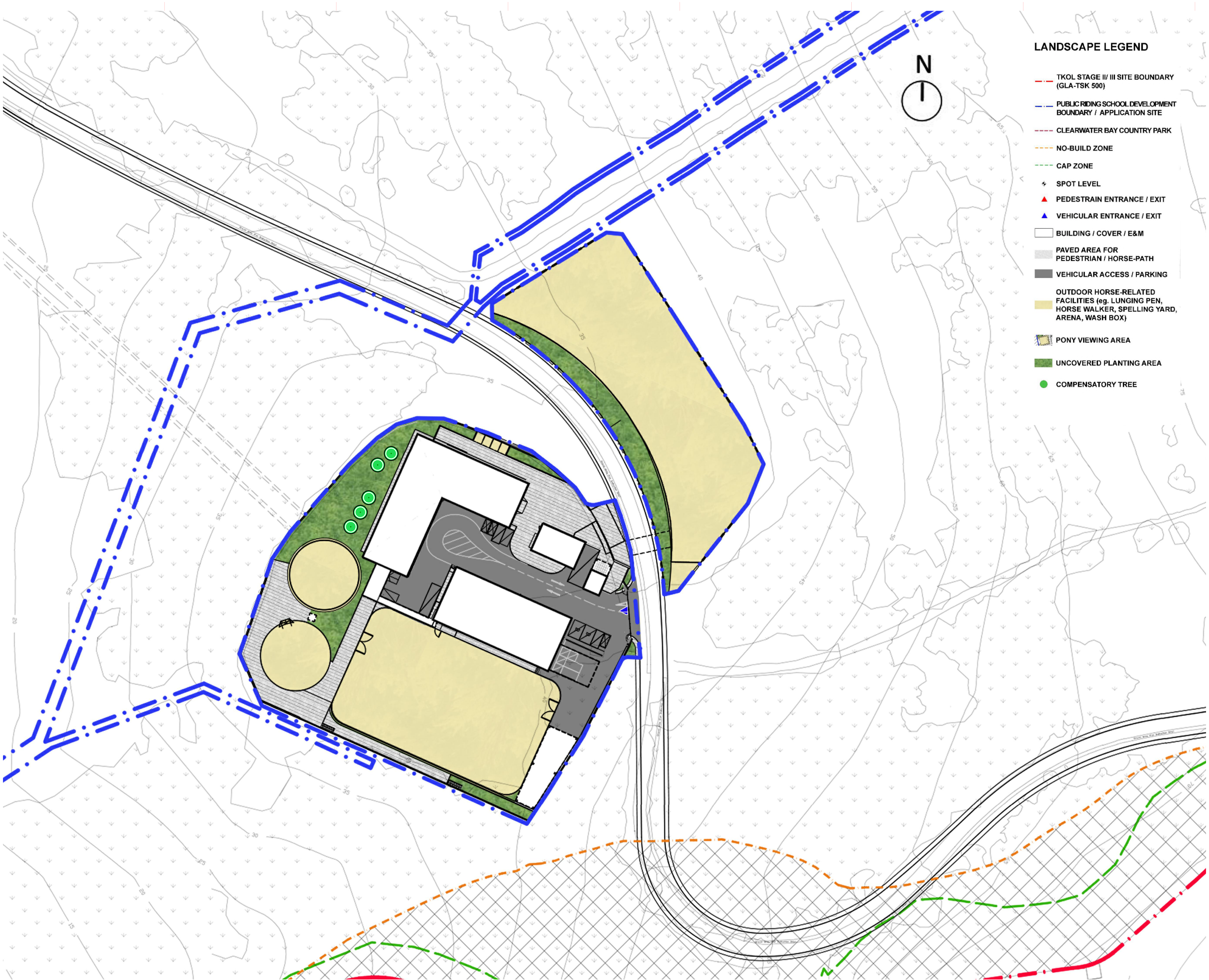

LANDSCAPE LEGEND

- TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
- PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY / APPLICATION SITE
- CLEARWATER BAY COUNTRY PARK
- NO-BUILD ZONE
- CAP ZONE
- SPOT LEVEL
- ▲ PEDESTRAIN ENTRANCE / EXIT
- ▲ VEHICULAR ENTRANCE / EXIT
- ☐ BUILDING / COVER / E&M
- PAVED AREA FOR PEDESTRIAN / HORSE-PATH
- ■ VEHICULAR ACCESS / PARKING
- OUTDOOR HORSE-RELATED FACILITIES (eg. LUNGING PEN, HORSE WALKER, SPELLING YARD, ARENA, WASH BOX)
- ▨ PONY VIEWING AREA
- 🟩 UNCOVERED PLANTING AREA
- ● COMPENSATORY TREE

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LEGEND/NOTE

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TITLE:
LANDSCAPE MASTER PLAN - MIDDLE PLATFORM

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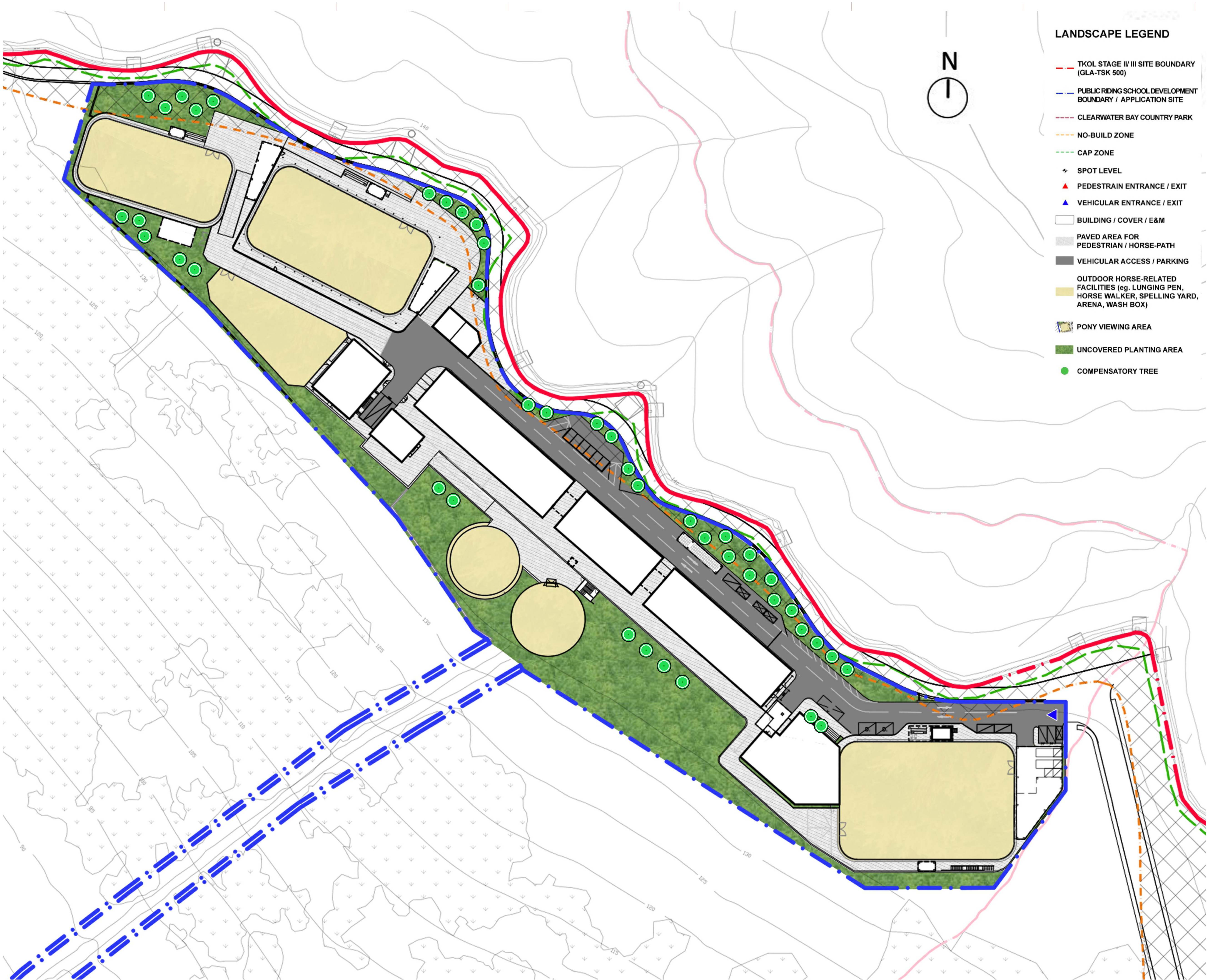

LANDSCAPE LEGEND

— · —	TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
— · —	PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY / APPLICATION SITE
- - -	CLEARWATER BAY COUNTRY PARK
- - -	NO-BUILD ZONE
- - -	CAP ZONE
✢	SPOT LEVEL
▲	PEDESTRAIN ENTRANCE / EXIT
▲	VEHICULAR ENTRANCE / EXIT
☐	BUILDING / COVER / E&M
▨	PAVED AREA FOR PEDESTRIAN / HORSE-PATH
■	VEHICULAR ACCESS / PARKING
■	OUTDOOR HORSE-RELATED FACILITIES (eg. LUNGING PEN, HORSE WALKER, SPELLING YARD, ARENA, WASH BOX)
▨	PONY VIEWING AREA
🟩	UNCOVERED PLANTING AREA
●	COMPENSATORY TREE

PATH: Z:\WTPL17_24_Public Riding School at TKO II&III\06_Submission\S16 LMP_Three Platforms\colour plan\20260130_LMP_3 Platform.dwg

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TITLE:
LANDSCAPE MASTER PLAN - UPPER PLATFORM

SCALE:	1:1000 (A3)
DRAWN BY:	KC
CHECKED BY:	RT
APPROVED BY:	RT
DRAWING DATE:	20260128
PROJECT No:	-
SHEET No: WTPL17_LMP_04	REV: B

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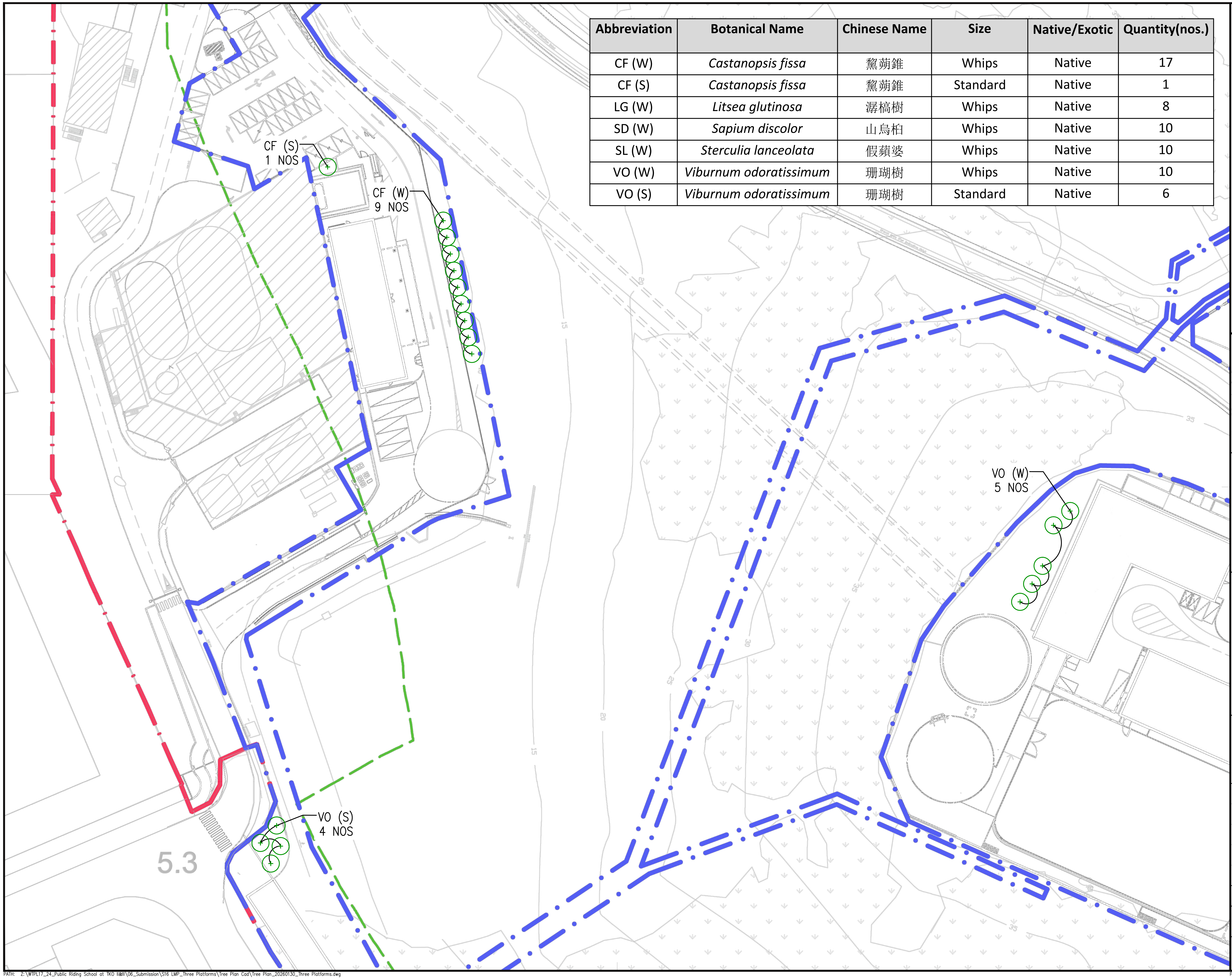
PLOT: Konichan DATE: 2 February 2026

Appendix C

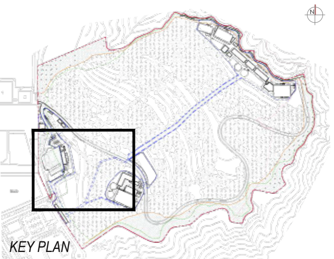
Compensation Planting Plan

Abbreviation	Botanical Name	Chinese Name	Size	Native/Exotic	Quantity(nos.)
CF (W)	*Castanopsis fissa*	黧蒴錐	Whips	Native	17
CF (S)	*Castanopsis fissa*	黧蒴錐	Standard	Native	1
LG (W)	*Litsea glutinosa*	潺槁樹	Whips	Native	8
SD (W)	*Sapium discolor*	山烏柏	Whips	Native	10
SL (W)	*Sterculia lanceolata*	假蘋婆	Whips	Native	10
VO (W)	*Viburnum odoratissimum*	珊瑚樹	Whips	Native	10
VO (S)	*Viburnum odoratissimum*	珊瑚樹	Standard	Native	6



LEGEND:

🟥	TKOL STAGE II/III (GLA-TSK 500)
🟦	THE APPLICATION SITE
🟧	NO-BUILD ZONE
🟩	CAP ZONE
🟪	COUNTRY PARK ZONE
T##	TREE NUMBER
○	TREE TO BE RETAINED
⊕	COMPENSATORY TREE (TO BE MAINTAINED BY APPLICANT)



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TITLE:
COMPENSATION TREE PLAN 01

SCALE:	1:800 (A3)
DRAWN BY:	KC
CHECKED BY:	RT
APPROVED BY:	RT
DRAWING DATE:	20260128
PROJECT No:	—
SHEET No: WTPL17_TPRP_CTP_1	REV: B

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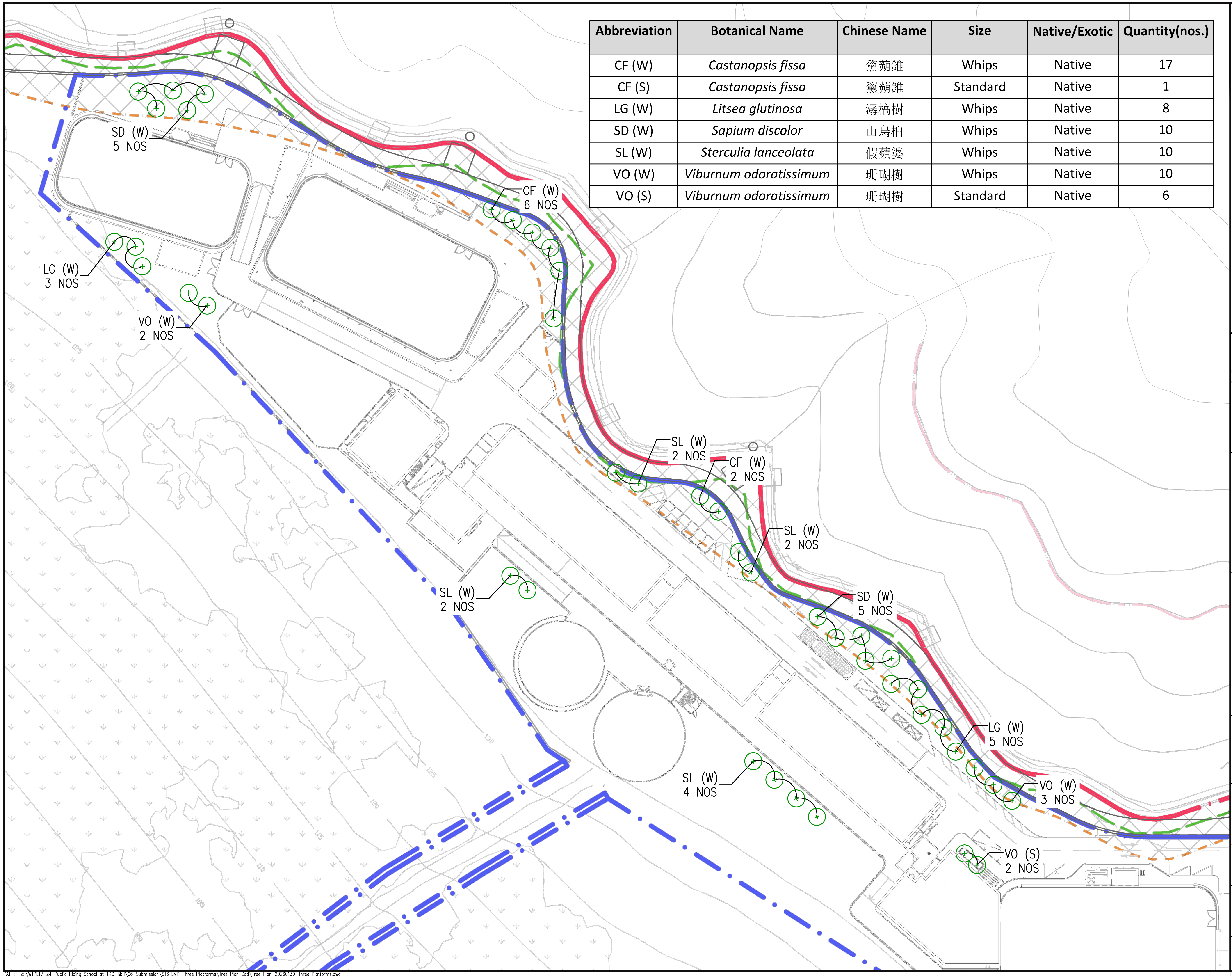
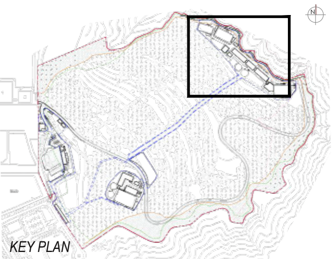
Abbreviation	Botanical Name	Chinese Name	Size	Native/Exotic	Quantity(nos.)
CF (W)	*Castanopsis fissa*	黧蒴錐	Whips	Native	17
CF (S)	*Castanopsis fissa*	黧蒴錐	Standard	Native	1
LG (W)	*Litsea glutinosa*	潺槁樹	Whips	Native	8
SD (W)	*Sapium discolor*	山烏桕	Whips	Native	10
SL (W)	*Sterculia lanceolata*	假蘋婆	Whips	Native	10
VO (W)	*Viburnum odoratissimum*	珊瑚樹	Whips	Native	10
VO (S)	*Viburnum odoratissimum*	珊瑚樹	Standard	Native	6



LEGEND:

- 🟥 TKOL STAGE II/III (GLA-TSK 500)
- 🟦 THE APPLICATION SITE
- 🟧 NO-BUILD ZONE
- 🟩 CAP ZONE
- COUNTRY PARK ZONE
- T## TREE NUMBER
- ○ TREE TO BE RETAINED
- ⊕ COMPENSATORY TREE (TO BE MAINTAINED BY APPLICANT)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PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

TITLE:
COMPENSATION TREE PLAN 02

SCALE:	1:800 (A3)
DRAWN BY:	KC
CHECKED BY:	RT
APPROVED BY:	RT
DRAWING DATE:	20260128
PROJECT No:	–
SHEET No: WTPL17_TPRP_CTP_2	REV: B

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PLOT: Konichan DATE: 2 February 2026

Appendix 3

TRAFFIC IMPACT ASSESSMENT

03/02/2026

Reference number CHK50812010

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

TRAFFIC IMPACT ASSESSMENT

Report (Rev. 0)

SYSTRA MVA

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

TRAFFIC IMPACT ASSESSMENT

IDENTIFICATION TABLE	
Client/Project owner	The Hong Kong Jockey Club
Project	Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))
Study	Traffic Impact Assessment
Type of document	Report (Rev. 0)
Date	03/02/2026
Reference number	CHK50812010

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1. INTRODUCTION

1.1 Background

1.1.1 This XXX (Assessment) is prepared in support of the Section 16 (“**S16**”) Planning Application to allow for the development of a Public Riding School with ancillary facilities (e.g. utility trench) (collectively as the “**PRS**”) at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories ("**TKOL II/III**") for the HKJC Public Riding Schools Limited (the “**Applicant**”). The Application Site comprises of three (3) existing platforms and land required for the provision of ancillary utility trench connecting to the three (3) platforms (collectively as the “**Application Site**”) within TKOL II/III. The PRS aligns with the Government’s policy objectives in fostering more public participation in the community through wider visibility and popularity of horse riding, supporting equestrian as an elite sport, and maintaining Hong Kong as a centre for major international sports events.

1.1.2 The Application Site is predominately zoned “Open Space” (“O”) on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 ("**Approved OZP**”), whilst a strip of area at the north is zoned “Green Belt” (“**GB**”) and a minor portion abutting Chun Sing Street is zoned “Other Specified Uses” annotated “Industrial Estate” (“**OU(Industrial Estate)**”) on the Approved OZP. The PRS with ancillary facilities (‘Horse Riding School’ subsumed under ‘Place of Recreation, Sports or Culture’ use) is a Column 2 use under the “O”, “GB” and “OU(Industrial Estate)” zones that may be permitted with or without conditions on Application under S16 of the Town Planning Ordinance (“**TPO**”). There are no plot ratio (“**PR**”), building height (“**BH**”), and site coverage (“**SC**”) restrictions imposed on the “O”, “GB” and “OU(Industrial Estate)” zones of the Approved OZP. While a portion of TKOL II/III falls within the Clear Water Bay Country Park (“**CWBCP**”), the Application Site does not involve any areas falling within the Country Park Boundary.

1.1.3 The PRS is located on three (3) platforms, namely the Lower Platform (i.e. Reception and Hospitality Lounges) (approx.+6.0mPD), Middle Platform (i.e. Pony Paddock & Pavilion I)(approx. +40.0mPD) and Upper Platform (i.e. Horse Paddock & Pavilion II) (approx.140.0mPD), with a proposed total GFA of approx. 9,000m^2 and a proposed building height of 4.8m to 7.7m. An ancillary utility trench connecting to the three (3) platforms is also proposed to accommodate various essential utilities services in support of the PRS operations.

1.2 Study Objectives

1.2.1 The objectives of this Traffic Impact Assessment (TIA) study are summarised as follows:

- Present the development schedule of the Proposed PRS Development and suggest the required internal transport provisions;
- Review the vehicular access arrangement of the proposed development;
- Conduct the manual classified count traffic surveys to determine the existing traffic conditions in the vicinity;
- Assess the existing junction capacities in the local area;

- Estimate the traffic generations and attractions from the Proposed PRS Development and carry traffic distribution and assignment of the traffic generated;
- Estimate the future traffic flows for the design year on the local road network;
- Assess the traffic impact of the Proposed PRS Development on the local road network and the junctions for the design year; and
- Recommend traffic improvement measures, if considered necessary, to alleviate the potential traffic problem on the surrounding road networks.

1.3 Report Structure

1.3.1 Following this introductory chapter, there are six further chapters:

- ***Chapter 2*** – The proposed development, which presents the development schedule, proposed vehicular access arrangement and internal facility, including car parking and layby provisions;
- ***Chapter 3*** – Existing Traffic Context, which reviews the current traffic condition at local road network in the vicinity, presents the findings from traffic count surveys and assesses the existing conditions;
- ***Chapter 4*** – Traffic Forecast, which discusses the potential traffic generation and attraction of the Proposed PRS Development and summarizes the methodology of the future traffic forecasts for the design year based on the proposed implementation programme;
- ***Chapter 5*** – Traffic Impact Assessment, which presents the traffic assessment the findings of the traffic impact assessments in the local networks for the operation of the Proposed PRS Development in the future design year and recommends improvement measures, if necessary;
- ***Chapter 6 –*** Public Transport Provision Services, which discusses the potential public transport demand of the proposed development and the occupancy of existing public transport services;
- ***Chapter 7 –*** Future Pedestrian Conditions, which discussed the potential pedestrian generation and attraction of the proposed development and presents the pedestrian assessment findings of the pedestrian crossing and footpaths;
- ***Chapter 8*** – Summary and Conclusion, which summarises the findings of the study and present the conclusions regarding the traffic issues for the Proposed PRS Development in the study findings.

2. THE PROPOSED DEVELOPMENT

2.1 Site Location

2.1.1 As indicated in **Drawing No. 1.1**, the Proposed PRS Development is located at TKOL II/III adjacent to the LOHAS Park and Tseung Kwan O Industrial Estate. Chun Yat Street is direct access road connecting with the Proposed PRS Development at the lower platform.

2.1.2 At present, there is an existing access road connecting the three platforms. Under the consultancy study "Provision of Infrastructure to Support Potential After uses Development at Restored Landfills" by EPD, it is recommended to upgrade the existing access road with local road widening.

2.1.3 The existing vehicular access at Chun Yat Street will serve the Proposed PRS Development as well as the existing EDP facilities at the lower platform. The vehicular access of the Proposed PRS Development is shown in **Drawing No. 2.1**.

2.2 Development Schedule

2.2.1 The Proposed PRS Development comprises of three platforms namely, the lower platform, middle platform and upper platform. The Welcome Hub is located at the lower platform for guest reception and pony viewing area. Visitor parking spaces are provided at the lower platform.

2.2.2 The Middle Platform is planned for the Pony Paddock & Pavilion I offering pony riding, and riding lessons for beginners and persons with disabilities while the Upper Platform is planned for the Horse Paddock & Pavilion II offering the majority of the PRS riding activities. Shuttle services will be provided serving the transportation among the three platforms within the proposed development.

2.2.3 The development parameters are summarized in **Table 2.1**.

Table 2.1 Development Parameters

Component	Proposed Development Parameters
Site Area	46,500 m^2 (consisting areas of the three platforms and ancillary utility trench)
Lower Platform	10,200 m^2
Middle Platform	12,800 m^2 + 24 nos. of stalls
Upper Platform	20,700 m^2 + 50 nos. of stalls
Ancillary Utility Trench	2,800 m^2

2.2.4 The Proposed PRS Development is scheduled to be completed by year 2030. The layout plan of the Proposed PRS Development is shown in **Drawing No. 2.1**. The layout of each platform is shown in **Drawing Nos. 2.2** to **2.4**.

2.2.5 The proposed PRS development will operation all year round. Lectures and training classes will be available everyday while event day (i.e. Annual Open Day) will be arranged at a weekend.

2.3 Proposed Internal Transport Facilities

2.3.1 The Proposed PRS Development is mainly served as a public riding school. As there is no relevant requirement for the Proposed PRS Development specified in Hong Kong Planning Standard Guideline (HKPSG). Reference has been made with existing Tuen Mun Public Riding School (TMPRS). The proposed parking and servicing facilities for the Proposed PRS Development are summarized in **Table 2.2.**

Table 2.2 Proposed Parking and Servicing Facilities of the Proposed Development

Parking Facilities	Dimension	Location (7)	Proposed Provision	
Car Parking Space (Staff/Visitor/Maintenance)	5m (L) x 2.5m (W)	L	50	58(1)
		M	3	
		U	5	
Accessible Car Parking Space	5m (L) x 3.5m (W)	L	4	8(2)
		M	2	
		U	2	
Motorcycle Parking Space	2.4m (L) x 1.0m (W)	L	4(10)	
Coach Parking Space	12m (L) x 3.5m (W)	L	2(3)	
Golf Cart Parking Space	4m (L) x 2m (W)	L	7	14(4)
		M	3	
		U	4	
Shuttle Parking Space	8m (L) x 3m (W)	L	3(5)	
Loading/Unloading Bay	9.6m (L) x 3.0m (W)	M	1	2(8)
		U	1	
Loading/Unloading Bay	5.3m (L) x 2.5m (W)	M	1(6)	
Loading/Unloading Bay	11m (L) x 3.5m (W)	L	1(9)	
Loading/Unloading Bay	16m (L) x 3.5m (W)	L	1(6)	
Loading/Unloading Bay	12m (L) x 5.0m (W)	M	1(9)	
General Lay-by	25m (L) x 2.5m (W)	L	1	

Note:
(1) Under Tuen Mun PRS, 49 nos. of parking spaces has been provided for 95 horse stalls. With reference to the parking ratio in Tuen Mun PRS, a minimum of 39 parking spaces will be required at TKO PRS. Considering there will be internal transportation between the three platforms at TKO PRS and additional parking spaces have been provided (i.e. Total 59 nos.)
(2) With reference HKSPG, minimum 1 accessible parking space should be provided for every 50 parking spaces.
(3) Operation need for group visitors
(4) Operation need for staff transportation between 3 platforms
(5) Operational need for visitors transportation between 3 platforms
(6) Operational need for hay/beddings delivery
(7) L: Lower Platform, M: Middle Platform, U: Upper Platform
(8) Operational need for Horse
(9) Operational need for Refuse Collection Vehicle
(10) 5% of the total no. of car parking space provided

Remark: It is proposed to provide 14 nos. cycle parking spaces near the end of cycle track at Chun Yat Street. The exact number and location will be further agreed with Transport Department separately.

2.4 Vehicular Access Arrangement of the Proposed PRS Development

2.4.1 The proposed vehicular access of the proposed PRS development is located at the intersection of Chun Yat Street and Chun Sing Street. The vehicular access arrangement is shown in **Drawing No. 2.5**. Swept path analysis of 12m coaches have also been conducted and illustrated in **Drawing No. 2.5A**.

2.5 Pedestrian Access Arrangement of the Proposed PRS Development

2.5.1 At present, there is no proper crossing facilities at Chun Yat Street near main entrance of the proposed development. To enhance pedestrian accessibility to the proposed PRS development, a cautionary pedestrian crossing across Chun Yat Street has been proposed. The indicative location of pedestrian crossing is as indicated in **Drawing No. 2.5**.

2.5.2 With the proposed crossing facility, the pedestrian to/from proposed development can walk conveniently to the new bus stop at Chun Sing Street. The proposed pedestrian routing is presented below and illustrated in **Annex A**.

3. EXISTING TRAFFIC CONTEXT

3.1 Local Road Network

3.1.1 Chun Yat Street is a single 2-lane carriageway, which connects with Wan Po Road and Chun Choi Street. It is the main access to HKCOLO and Tai Chik Sha Ambulance Depot.

3.1.2 Wan Po Road is a dual 2-lane local distributor linking Tseung Kwan O Industrial Estate and Tseung Kwan O other areas, running in north-south direction.

3.1.3 Chun Sing Street is a single 2-lane carriageway connecting Chun Yat Street to the north and ends with cul-de-sac to the south. It provides the direct access for HSBC building.

3.2 Critical Junctions

3.2.1 Total of five local critical junctions along Wan Po Road, as listed in **Table 3.1**, are identified for assessment purpose in this study. The locations of the critical junctions are indicated in **Drawing No. 3.1**.

Table 3.1 Locations of Critical Junctions

Ref.(1)	Junction	Type	Drawing No.
A	Wan Po Road / Chun Yat Street	Signal	3.2
B	Wan Po Road / Wan O Road	Signal	3.3
C	Wan Po Road / Shek Kok Road / Sunrise Boulevard	Signal	3.4
D	Wan Po Road / LOHAS Park Road	Signal	3.5
E	Wan O Road / Sunrise Boulevard	Signal	3.6

Note: (1) Locations refer to **Drawing no. 3.1**.

3.2.2 The existing layout arrangements of these five local critical junctions are shown in **Drawing Nos. 3.2** to **3.6**.

3.2.3 In order to appraise the existing traffic conditions of these junctions, a manual classified traffic count was conducted at the identified key junctions to establish the current traffic condition. The survey was undertaken on a typical weekday on November 2024 during the AM peak hour of 07:30 to 10:30 and PM peak hour of 15:30 to 21:00 and on a typical weekend on October 2025 from 16:30 to 18:30. Analysis of the observed traffic data indicates that the AM and PM peak hour flows occurred from 08:00 to 09:00 and from 17:00 to 18:00 on weekday, and peak hour flows occurred from 17:00 to 18:00 at weekend respectively. The observed traffic flows are shown in **Drawing No. 3.7** and **Drawing No. 3.8** respectively.

3.2.4 Existing operational performance of the critical junctions during weekday and weekend and the results are listed in **Table 3.2** and **Table 3.3**.

Table 3.2 Existing Junction Operational Performance – Weekday

Ref.	Junction	RC/ RFC	
		AM Peak	PM Peak
A	Wan Po Road / Chun Yat Street	81%	69%
B	Wan Po Road / Wan O Road	43%	85%
C	Wan Po Road / Shek Kok Road / Sunrise Boulevard	68%	>100%
D	Wan Po Road / LOHAS Park Road	>100%	>100%
E	Wan O Road / Sunrise Boulevard	60%	>100%

Remark: RC = Reserve Capacity, RFC = Ratio to Flow capacity

Table 3.3 Existing Junction Operational Performance – Weekend

Ref.	Junction	RC/ RFC
		PM Peak
A	Wan Po Road / Chun Yat Street	>100%
B	Wan Po Road / Wan O Road	>100%
C	Wan Po Road / Shek Kok Road / Sunrise Boulevard	>100%
D	Wan Po Road / LOHAS Park Road	>100%
E	Wan O Road / Sunrise Boulevard	79%

Remark: RC = Reserve Capacity, RFC = Ratio to Flow capacity

3.2.5 **Table 3.2** and **Table 3.3** indicate that all the key local junctions are operating within capacity during peak hour periods.

3.3 Existing Road Links

3.3.1 Road links within the study area were identified for assessment of traffic impact for the proposed PRS development and summarized in **Table 3.4**.

Table 3.4 Existing Road Links for Assessment

Ref.	Road Link	Direction
S1	Wan Po Road (between LOHAS Park Road and Shek Kok Road)	Northbound
		Southbound
S2	Wan Po Road (between Shek Kok Road and Wan O Road)	Northbound
		Southbound
S3	Wan Po Road (between Wan O Road and Chun Yat Street)	Northbound
		Southbound
S4	Wan O Road	Eastbound
		Westbound
S5	Chun Yat Street (between Wan Po Road and Chun)	Eastbound
		Westbound

3.3.2 The locations of the above 4 road links are illustrated in **Drawing No. 3.1.**

3.3.3 Existing operational performance of the road links during weekday and weekend and the results are listed in **Table 3.5** and **Table 3.6**.

Table 3.5 Existing Road Link Operational Performance in 2024 - Weekday

Index	Dir.	2024 Obs. Flows (pcu/hr)		Design Capacity (Veh/hr)	2024 Obs. Flows (Veh/hr)		V/C Ratio	
		AM	PM		AM	PM	AM	PM
S1	NB	645	810	2,800	475	630	0.17	0.23
	SB	1,110	735	2,600	865	580	0.33	0.22
S2	NB	440	530	2,800	310	400	0.11	0.14
	SB	935	480	2,600	725	340	0.28	0.13
S3	NB	1,080	1,170	2,800	620	785	0.22	0.28
	SB	1,450	880	2,800	990	515	0.35	0.18
S4	EB	840	660	4,200	550	430	0.13	0.10
	WB	965	900	2,600	610	620	0.24	0.24
S5	EB	130	65	1,100	105	50	0.10	0.05
	WB	115	80	1,100	85	60	0.08	0.06

Table 3.6 Existing Road Link Operational Performance in 2025 - Weekend

Index	Dir.	2025 Obs. Flows (pcu/hr)	Design Capacity (Veh/hr)	2025 Obs. Flows (Veh/hr)	V/C Ratio
S1	NB	635	2,800	505	0.18
	SB	650	2,600	520	0.20
S2	NB	455	2,800	335	0.12
	SB	435	2,600	300	0.12
S3	NB	910	2,800	570	0.20
	SB	710	2,800	385	0.14
S4	EB	580	4,200	380	0.09
	WB	760	2,600	515	0.20
S5	EB	50	1,100	35	0.03
	WB	55	1,100	45	0.04

3.3.4 The results in **Table 3.5** and **Table 3.6** indicated that all the identified road links are at present operating with ample space capacity.

3.4 Existing Pedestrian Conditions

3.4.1 In order to appraise the existing condition of footpaths in the close proximity of the proposed development, pedestrian head count survey has been conducted in the vicinity of the proposed development at a typical weekday and weekend in October 2025 to ascertain the pedestrian demand at existing pedestrian facilities. Analysis of the observed pedestrian flows data indicates that the AM and PM peak 15-minute flows occurred from 08:45 to 09:00 and from 18:10 to 18:25 at weekday, and peak 15-minute flows occurred from 17:00 to 17:15 at weekend respectively. The location of existing pedestrian facilities connecting the proposed development are indicated in **Drawing No. 3.9**.

3.4.2 The footpaths along the major routes are identified for assessment and are summarised in **Table 3.7**.

Table 3.7 Existing Pedestrian Facilities for Assessment

Ref.	Pedestrian Facilities
Footpaths	
F1	Northern Footpath of Sunrise Blvd near Wan Po Road
F2	Western Footpath of Wan Po Road near Sunrise Blvd
F3	Western Footpath of Wan Po Road near Chun Yat Street EB
F4	Southern Footpath of Chun Yat Street near Wan Po Road NB
F5	Western Footpath of Wan Po Road near Chun Yat Street WB
F6	Southern Footpath of Chun Yat Street near Wan Po Road SB
F7	Southern Footpath of Wan Po Road near Wan O Road

3.4.3 Operational assessment for the footpaths at the observed peak 15-minute flows and existing signalized crossing during weekday and weekend have been carried out and the results are summarised in **Table 3.8** and **Table 3.9** respectively.

Table 3.8 Existing Footpath Operational Performance in 2025 - Weekday

Footpath Section (1)	Clear Width (Approx. in metres)	Effective Width (Approx. in meters) (2)	Two-way Pedestrian Flows (in ped/15min)		Two-way hourly Pedestrian Flow Rate (in ped/min/m) (3)		Level of Service (LOS) (4)	
			AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
F1	3.50	2.50	20	30	0.53	0.80	A	A
F2	3.60	2.60	30	60	0.77	1.54	A	A
F3	3.60	2.60	75	55	1.92	1.41	A	A
F4	4.50	3.50	110	55	2.10	1.05	A	A
F5	3.50	2.50	60	25	1.60	0.67	A	A
F6	5.00	4.00	5	5	0.08	0.08	A	A
F7	3.90	2.90	10	10	0.23	0.23	A	A

Note: (1) Footpath sections refer to **Drawing No. 3.9**.
(2) Effective width of footpath is defined as the actual width of footpath by excluding the dead widths on both sides.
(3) Two–way pedestrian flow rate = Two-way 15-mins pedestrian flows / 15 min / Effective width of footpath.
(4) Details of Pedestrian Walkway LOS refer to T.P.D.M. Volume 6 Chapter 10 Section 10.4.2.

Table 3.9 Existing Footpath Operational Performance in 2025 - Weekend

Footpath Section (1)	Clear Width (Approx. in metres)	Effective Width (Approx. in meters) (2)	Two-way Pedestrian Flows (in ped/15min)	Two-way hourly Pedestrian Flow Rate (in ped/min/m) (3)	Level of Service (LOS) (4)
F1	3.50	2.50	70	1.87	A
F2	3.60	2.60	25	0.64	A
F3	3.60	2.60	20	0.51	A
F4	4.50	3.50	10	0.19	A
F5	3.50	2.50	5	0.13	A
F6	5.00	4.00	5	0.08	A
F7	3.90	2.90	10	0.23	A

Note: (1) Footpath sections refer to **Drawing No. 3.9**.
(2) Effective width of footpath is defined as the actual width of footpath by excluding the dead widths on both sides.
(3) Two–way pedestrian flow rate = Two-way 15-mins pedestrian flows / 15 min / Effective width of footpath.
(4) Details of Pedestrian Walkway LOS refer to T.P.D.M. Volume 6 Chapter 10 Section 10.4.2.

3.4.4 According to the results in **Table 3.8** and **Table 3.9**, all assessed footpaths are operating within capacity.

4. TRAFFIC FORECAST (CONSTRUCTION AND OPERATION)

4.1 Design Year

4.1.1 It is anticipated that the Proposed PRS Development will be completed and operated by year 2030.

4.1.2 In order to assess the impact of the construction traffic on the local road network, year 2030 has been adopted for the design year for construction traffic impact assessment during construction stage.

4.1.3 In order to assess the impact of the operation traffic on the local road network, it is necessary to forecast the traffic flows for design year 2033, the adopted design year, which is 3 years upon completion of proposed PRS development during operation stage for normal operation on weekday and event day at weekend.

4.1.4 To investigate the traffic impact of the proposed PRS development on the surrounding road network, the operational performance of the critical junctions and footpaths that is based on the forecast peak hour vehicular traffic flows during construction stage and operation stage were assessed under the following scenarios:

Construction Stage

- 2030 Reference Traffic Forecast (without construction works)
- 2030 Design Traffic Forecast (with construction works)

Operation Stage

- 2033 Reference Traffic Forecast (without proposed PRS development) – Weekday
- 2033 Reference Traffic Forecast (without proposed PRS development) – Weekend
- 2033 Design Traffic Forecast (with proposed PRS development) – Normal Operation
- 2033 Design Traffic Forecast (with proposed PRS development) – Event Day

4.2 Traffic Forecast Assumptions

4.2.1 To estimate the 2030 reference traffic flows (without construction works) and 2033 reference traffic flows (without proposed PRS development) in the local road network, an appropriate growth factor has to be identified for the area in the first instance with reference to the following information.

- Historical Trend - Historical traffic data of the Annual Traffic Census (ATC) reports published annually by Transport Department;
- Planning Data - Base and future years (2021, 2026 & 2031) of planning data for 2021-based Territorial Population and Employment Data Matrix (TPEDM) published by Planning Department; and
- Hong Kong Population Projection 2022 – 2046 published by Census and Statistics Department.

Historical Trend

4.2.2 The transport department has traffic count station in the vicinity of the proposed development. The concerned traffic count station located within the study area have been selected between years 2018 and 2023. The record of traffic flows and the annual percentage change at the concerned traffic count station have been extracted from the ATC, to establish the historical growth trend and summarized in **Table 4.1**.

Table 4.1 ATC Traffic Counts between Year 2018 to Year 2023

Station No.	Road Name	Average Annual Daily Traffic (AADT)					
		2018	2019	2020	2021	2022	2023
5304	Wan Po Road	40,700	44,800	43,100	45,130	43,160	30,420
Annual Average Growth Rate (%)		-5.66%					

Planning Data

4.2.3 Reference has been made to the latest 2021-Based Territorial Population and Employment Data Matrices (TPEDM) planning data published by Planning Department for years 2021, 2026 and 2031 in the study area. The average annual growth rate from years 2021 to 2031 is illustrated in **Table 4.2**.

Table 4.2 Population and Employment Growth in the Local Area

TPEDM Zone	Population & Employment Growth				Growth Rate per annum (%)
	2021	2024(1)	2026	2031	2024-2031
Sai Kung	600,600	631,200	643,350	662,250	0.69%

Note: (1) interpolated from years 2019 and 2026

Hong Kong Population Projection

4.2.4 For years beyond 2031, reference has been made to planning data from Hong Kong Population Projection 2022 – 2046 published by Census and Statistics Department for 2031 and 2036. The average annual growth rate from years 2031 - 2036 is illustrated in **Table 4.3**.

Table 4.3 Hong Kong Population Projection 2022 – 2046

Hong Kong	Population		Growth Rate per annum (%)
	2031	2036	2031-2036
	7,820,200	8,022,400	+0.51%

Adopted Growth Rate

4.2.5 The annual growth rate of +0.69% derived from TPEDM data for years from 2024 to 2031 is the highest. For year beyond 2031, the annual growth rate derived from Hong Kong Population Projection is +0.51% p.a..

4.2.6 For conservative, an annual growth of +0.69% for 2024 to 2031 and +0.51% 2031 to 2033 were adopted to project the 2024 observed traffic flows to 2033 traffic flows. An annual growth of +0.69% for 2024 to 2030 was adopted to project the 2024 observed traffic flows to 2030 traffic flows.

4.3 Committed and Potential Development

4.3.1 In the vicinity of the proposed development, there are some planned/committed developments. It is anticipated that the major traffic growth in the area will be contributed by these planned/committed developments. The design parameters, estimated vehicular trips of the committed developments are summarised in **Table 4.4**.

Table 4.4 Trip Generation / Attraction of Committed/Planned in the Vicinity

Index	**Planned/ Committed Development**	**Adopted Trip Rates (pcu/hr/flats or pcu/hr/rooms or pcu/hr/100m² GFA)**				**Trip Generation (pcu/hr)**			
		AM		**PM**		**AM**		**PM**	
		Gen	**Att**	**Gen**	**Att**	**Gen**	**Att**	**Gen**	**Att**
1	LOHAS Park Development (Package 11 to 13)(1) -Average Flat size ~60m² -No. of Units: 6,400	0.0718(2)	0.0425(2)	0.0286(2)	0.0370(2)	460	272	183	237
2	Development at GIC Site (RTHK Site) on Wan Po Road(3)	-	-	-	-	22(4)	39(4)	42(4)	41(4)
3	Data Centre Development Site at TKOTL 131(5) -112,640 m² of GFA	0.0045(6)	0.0114(6)	0.0114(6)	0.0045(6)	6	13	13	6
4	Government Laboratory	-	-	-	-	30(7)	30(7)	30(7)	30(7)
5	Public Housing Development at Pak Shing Kok Road, Tseung Kwan O(8) -Average Flat size ~40m² -No. of Units: 3,024 -Retail: 1,715m² of GFA	0.0432(9) 0.2296(10)	0.0326(9) 0.2434(10)	0.0237(9) 0.3100(10)	0.0301(9) 0.3563(10)	131 4	99 4	72 5	91 6
6	Chinese Medicine Hospital Development and Government Chinese Medicines Testing institute (GCMTI) (11)								
	-No. of beds: 400	0.2125(12)	0.3281(12)	0.3294(12)	0.1706(12)	85	132	132	69
	-No. of public carpark space: 146	0.2621(13)	0.2863(13)	0.1613(13)	0.2379(13)	38	42	24	35
7	Public Housing Development at Chiu Shun Road -Average Flat size <50m² -No. of Units: 594	0.0622(14)	0.0426(14)	0.0297(14)	0.0401(14)	37	26	18	24
8	Residential Development at Pak Shing Kok Ventilation Building(15) -Average Flat size <60m² -No. of Units: 610	0.0718(16)	0.0425(16)	0.0286(16)	0.0370(16)	44	26	18	23

Note:

(1) Refer to the approved planning application by TPB in 6 February 2015 (No.:A/TKO/98) and MTR official website

(2) TPDM mean trip rates for Private Housing average flat size 60m².

(3) Refer to Legislative Council Agenda A 17/18- The government has downgraded the project from Category B to Category C according to the official record of proceeding for the Legislative Council meeting on 8 November 2017.

(4) Although the development scheme is uncertain, it is assumed that the site would be still reserved for the new broadcasting house of RTHK. In-house trip rates as surveyed from the existing RTHK sites (including Television House, Broadcasting House and Educational TV).

(5) Refer to the clause of Building Covenant in Conditions of Sale for the lot as available on Lands Departments Website.

(6) Trip Rate obtained from in-house trip rate survey conducted at existing data centre in TKOTL 122

(7) Reference to meeting minutes of Sai Kung District Council Meetings on 7 May 2018, it is anticipated 20 veh/hr during peak hours, pcu factor of 1.5pcu/veh is adopted.

(8) Reference to the planning brief from Hong Kong Housing Authority on 15 July 2022.

(9) TPDM mean trip rates for Subsidised Housing: Public Rental flat size 40m^2.
(10) TPDM mean trip rates for retail.
(11) Reference to approved planning application by TPB in 25 Nov 2022 (No.:A/TKO/127).
(12) Trip Rate obtained from in-house trip rate survey conducted at Prince of Wales Hospital.
(13) Trip Rate obtained from in-house trip rate survey conducted at Cheung Sha Wan Government Offices Carpark.
(14) Reference to “Subsidised Housing with 50sqm average flat size” from TPDM
(15) Refer to MTR Properties (https://www.mtr.com.hk/ch/corporate/properties/tkol_hanghau.html)
(16) Reference to “Private Housing with 60sqm average flat size” from TPDM

4.4 Reference Traffic Forecast

4.4.1 Based on an annual growth rate between 2024 to 2030 is +0.69% p.a., 2030 reference traffic flows (without construction works) have been projected from 2024 observed flows and shown in **Drawing No. 4.1**.

2030 Reference Flows (without construction works) = 2024 Observed Traffic Flows x Growth Factor (+0.69% for 6 years)

4.4.2 Based on an annual growth rate between 2024 to 2031 is +0.69% p.a. and 2031 to 2033 is +0.51% p.a. and the traffic generation of committed and potential developments shown in **Table 4.4**, 2033 reference traffic flows (without PRS development) have been projected from 2024 observed flows on weekday and at weekend shown in **Drawing Nos. 4.2** and **4.3** respectively.

2033 Reference Flows (without PRS development) – Weekday = 2024 Observed Traffic Flows (Weekday) x Growth Factor (+0.69% for 7 years and +0.51% for 2 years) + Committed Development Traffic

2033 Reference Flows (without PRS development) – Weekend = 2025 Observed Traffic Flows (Weekend) x Growth Factor (+0.69% for 6 years and +0.51% for 2 years) + Committed Development Traffic

4.5 Construction Traffic Generation of Proposed PRS Development

4.5.1 According to construction programme, the proposed PRS development will generate and attract 75 trucks/day (i.e. 10 working hours) or 7.5 trucks/hour one-way. **Table 4.5** summarizes the construction traffic generations for the construction works at the AM and PM peak hour.

Table 4.5 Construction Traffic Generation of the Proposed PRS Development (pcu/hr)

Peak Hour Construction Traffic AM(PM)	
Generation	**Attraction**
19(19)	19(19)

Remark: Adopted pcu factor 2.5for construction vehicle

4.5.2 Construction of the Proposed PRS Development would generate a two-way total of 38 pcu/hr in the AM and PM peak.

4.6 Proposed PRS Development Traffic Trips

Normal Operation

4.6.1 In order to estimate the traffic generation and attraction for normal operation of the proposed PRS development, reference has been made to the trip rate survey conducted at existing TMPRS on a typical weekday in November 2024. The adopted trip rate is shown in **Table 4.6**.

Table 4.6 Adopted Trip Rates for the Proposed PRS Development (pcu/hr/horse stall)

Reference Site	AM Peak (1)		PM Peak (1)	
	Generation	Attraction	Generation	Attraction
Tuen Mun Public Riding School (95 horse stalls)	0.108	0.149	0.176	0.149

Note: (1) AM and PM peak hourly flows occurred at 09:00 to 10:00 and 16:15 to 17:15 respectively.

4.6.2 Based on the adopted trip rates given in **Table 4.6**, the total trips generated by the proposed PRS development was computed and shown in **Table 4.7**.

Table 4.7 Trip Generation for Normal Operation of Proposed PRS Development (pcu/hr)

Development Parameter	AM Peak (1)		PM Peak (1)	
	Generation	Attraction	Generation	Attraction
Proposed PRS Development (74 horse stalls)	8	11	13	11

Note: (1) AM and PM peak hourly flows occurred at 09:00 to 10:00 and 16:15 to 17:15 respectively.

4.6.3 The Proposed PRS Development would generate a two-way total of 19 pcu/hr and 24 pcu/hr in the AM and PM peak respectively under normal operation.

Event Day

4.6.4 Apart from the normal operation, assessment has been conducted for the maximum capacity for the proposed development during the open day. The PRS open day will be held once in a year with a maximum of 660 visitors in hour. With reference to previous riding school, the open day will be held in the afternoon of a typical weekend.

4.6.5 In order to estimate the trip generation and attraction for event day of the proposed PRS development, the anticipated transport mode of the visitor on open day has made reference to visitor data at Tuen Mun PRS as summarised in **Table 4.8**.

Table 4.8 Trip Generation for Event Day of Proposed PRS Development

Mode of Transport	Visitors		Traffic Flow (pcu/hr)	
	Generation	Attraction	Generation	Attraction
Private Car	96[2]	96 [2]	32[3]	32[3]
Taxi	138[1]	297[1]	46[2]	99[2]
Public Transport	426[1]	267[1]	-[4]	-[4]
Total	**660**[5]	**660**[5]	**78**	**131**

Note:
(1) Based on surveyed public transport modal split at existing TMPRS
(2) Assumed occupancy per private car will be 3 ppl
(3) All visitor car parking spaces of the proposed PRS development are assumed to be occupied on Event Day under a prebooking system (32 nos)
(4) Public transport demand will be absorbed by existing public transport services. Details refer to **Section 6.2**.
(5) Maximum nos. of visitors of event at TKOPRS

4.6.6 The Proposed PRS Development would generate a two-way total of 159pcu/hr in the peak hour on event day.

4.7 Design Traffic Forecast

2030 Design Traffic Flows (with construction works)

4.7.1 The construction traffic flows of the proposed PRS development in **Table 4.5** were then superimposed onto the 2030 reference traffic flows (without construction works) as shown in **Drawing No. 4.1**.

2030 Design Flows (with construction works) = 2030 Reference Flows + Construction Traffic of Proposed PRS Development

4.7.2 The forecasted Year 2033 Design Traffic Flows are shown in **Drawing No. 4.4**.

2033 Design Traffic Flows (with proposed PRS development)

4.7.3 The development flows of the proposed PRS development were then superimposed onto the 2033 reference traffic flows (without PRS development) as shown in **Drawing Nos. 4.2** and **4.3**.

2033 Design Flows (with proposed PRS development) – Normal Operation = 2033 Reference Flows - Weekday + Proposed PRS Development Traffic (Normal Operation)

2033 Design Flows (with proposed PRS development) – Event Day = 2033 Reference Flows - Weekend + Proposed PRS Development Traffic (Event Day)

4.7.4 The forecasted Year 2033 Design Traffic Flows for Normal Operation and Event Day are shown in **Drawing Nos. 4.5** and **4.6** respectively.

4.8 Sensitivity Traffic Forecast for TKO Area 137

4.8.1 Under the Agreement No. CE40/2023 (CE), Civil Engineering and Development Department (CEDD) has conducted the technical assessments for the development of Tsuen Kwan O Area 137 and associated Reclamation sites. The planned development targeted to produce 50,000 flats, located at the southern end of Wan Po Road, Tseung Kwan O.

4.8.2 The population intake will take place in phases from year 2030 to year 2041 tentatively. To ascertain the potential traffic impact of TKO Area 137, the associated development traffic generations have been estimated and summarised in **Table 4.9**.

Table 4.9 Traffic Generation / Attraction of TKO Area 137

Planned/ Committed Development	**Adopted Trip Rates (pcu/hr/flats or pcu/hr/rooms or pcu/hr/100m^2 GFA)**				**Trip Generation (pcu/hr)**			
	AM		**PM**		**AM**		**PM**	
	Gen	**Att**	**Gen**	**Att**	**Gen**	**Att**	**Gen**	**Att**
Tseung Kwan O Area 137 *Public Housing*(1)(2) - Average Flat size ~55m^2 -No. of Units: 34,500	0.0622(3)	0.0426(3)	0.0297(3)	0.0401(3)	2,146	1,470	1,025	1,384
Private Housing(1)(2) -Average Flat size ~82.5m^2 -No. of Units: 15,500	0.1058(4)	0.0605(4)	0.0426(4)	0.0590(4)	1,640	938	661	915
Retail/Commercial(1)(2) -194,080m^2	0.2296(5)	0.2434(5)	0.3100(5)	0.3563(5)	446	473	602	692
Total					**4,232**	**2,881**	**2,288**	**2,991**

Note:
(1) Refer to Proposed Amendments to the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/30 (https://www.tpb.gov.hk/en/meetings/TPB/Agenda/1330_tpb_agenda.html)
(2) Refer to LC Paper No. CB(1)44/2035(05) https://www.legco.gov.hk/yr2023/english/panels/dev/papers/dev20230131cb1-44-5-e.pdf
(3) TPDM mean trip rates for HOS/PRPS with average flat size 50m^2.
(4) TPDM mean trip rates for Private Housing with average flat size 80m^2.
(5) TPDM mean trip rates for Retail.

4.8.3 Based on the latest available information, the full population of TKO Area 137 has been assumed in year 2033 as a conservative approach.

4.8.4 The development flows of the TKO Area 137 were then superimposed onto the 2033 Design Flows (with proposed PRS development) under Normal Operation (**Drawing No. 4.5**).

4.8.5 The forecasted Year 2033 Design Traffic Flows (with TKO Area 137 development) for sensitivity test are shown in **Drawing No. 4.7**.

5. TRAFFIC IMPACT ASSESSMENT

5.1 Construction Traffic Impact Assessment

5.1.1 To assess the traffic impact due to the construction traffic of the Proposed PRS Development on the local road network, capacity analysis of the identified critical junctions and road links in the study area for both reference and design scenarios in year 2030 has been carried out based on the existing junction layouts. The results are summarised and presented in **Table 5.1**, **Table 5.2** and **Table 5.3**.

Table 5.1 Operation Performance of Critical Junctions in 2030

Ref.	**Junction**	**RC/RFC[1]**			
		2030 Reference		**2030 Design**	
		AM Peak	**PM Peak**	**AM Peak**	**PM Peak**
A	Wan Po Road / Chun Yat Street	74%	62%	70%	58%
B	Wan Po Road / Wan O Road	37%	60%	35%	58%
C	Wan Po Road / Shek Kok Road / Sunrise Boulevard	20%	54%	20%	53%
D	Wan Po Road / LOHAS Park Road	88%	>100%	87%	>100%
E	Wan O Road / Sunrise Boulevard	19%	79%	18%	79%

Note: (1) RC = Reserve Capacity, RFC = Ratio to Flow capacity

5.1.2 **Table 5.1** indicates that all the critical junctions will be operating within capacity during the peak periods under reference and design scenario in year 2030.

Table 5.2 Road Link Operational Performance in 2030 (without Construction Works)

Index	**Dir.**	**2030 Ref. Flows (pcu/hr)**		**Design Capacity (Veh/hr)**	**2030 Ref. Flows (Veh/hr)**		**V/C Ratio**	
		AM	**PM**		**AM**	**PM**	**AM**	**PM**
S1	NB	920	1070	2,800	680	835	0.24	0.30
	SB	1,545	1,010	2,600	1,200	800	0.46	0.31
S2	NB	670	745	2,800	470	560	0.17	0.20
	SB	1,325	730	2,600	1,030	520	0.40	0.20
S3	NB	1,125	1,220	2,800	645	820	0.23	0.29
	SB	1,515	920	2,800	1,035	540	0.37	0.19
S4	EB	1,085	880	4,200	710	570	0.17	0.14
	WB	1,355	1,170	2,600	860	805	0.33	0.31
S5	EB	135	70	1,100	110	55	0.10	0.05
	WB	120	85	1100	90	65	0.08	0.06

Table 5.3 Road Link Operational Performance in 2030 (with Construction Works)

Index	Dir.	2030 Des. Flows (pcu/hr)		Design Capacity (Veh/hr)	2030 Des. Flows (Veh/hr)		V/C Ratio	
		AM	PM		AM	PM	AM	PM
S1	NB	925	1,075	2,800	685	840	0.25	0.30
	SB	1,550	1,015	2,600	1,205	805	0.46	0.31
S2	NB	675	750	2,800	475	565	0.17	0.20
	SB	1,330	735	2,600	1,030	520	0.40	0.20
S3	NB	1,145	1,240	2,800	660	830	0.24	0.30
	SB	1,535	940	2,800	1,045	550	0.37	0.20
S4	EB	1,100	895	4,200	720	580	0.17	0.14
	WB	1,370	1,185	2,600	870	815	0.34	0.31
S5	EB	155	90	1,100	125	70	0.11	0.06
	WB	140	105	1,100	105	80	0.10	0.07

5.1.3 **Table 5.2** and **Table 5.3** indicates that all the road links will be operating within capacity during the peak periods under reference and design scenario in year 2030.

5.2 Operational Traffic Impact Assessment

5.2.1 In order to evaluate the traffic impact due to the Proposed PRS Development on the local road network, capacity analysis of the identified critical junctions and road links in the study area for both reference and design scenarios in year 2033 has been carried out based on the existing junction layouts. The results are summarised and presented in **Table 5.4** to **Table 5.9**.

Table 5.4 Operation Performance of Critical Junctions in 2033

Ref.	Junction	RC/RFC[1]			
		2033 Reference (Weekday)		2033 Design (Normal Operation)	
		AM Peak	PM Peak	AM Peak	PM Peak
A	Wan Po Road / Chun Yat Street	71%	59%	69%	57%
B	Wan Po Road / Wan O Road	35%	58%	34%	57%
C	Wan Po Road / Shek Kok Road / Sunrise Boulevard	19%	51%	19%	50%
D	Wan Po Road / LOHAS Park Road	86%	>100%	85%	>100%
E	Wan O Road / Sunrise Boulevard	18%	77%	17%	77%

Note: (1) RC = Reserve Capacity, RFC = Ratio to Flow capacity

Table 5.5 Operation Performance of Critical Junctions in 2033

Ref.	Junction	RC/RFC(1)	
		2033 Reference (Weekend)	2033 Design (Event Day)
A	Wan Po Road / Chun Yat Street	>100%	96%
B	Wan Po Road / Wan O Road	76%	73%
C	Wan Po Road / Shek Kok Road / Sunrise Boulevard	79%	69%
D	Wan Po Road / LOHAS Park Road	>100%	>100%
E	Wan O Road / Sunrise Boulevard	42%	42%

Note: (1) RC = Reserve Capacity, RFC = Ratio to Flow capacity

Table 5.6 Road Link Operational Performance in 2033 (without Proposed Development) – Weekday

Index	Dir.	2033 Ref. Flows (pcu/hr)		Design Capacity (Veh/hr)	2033 Ref. Flows (Veh/hr)		V/C Ratio	
		AM	PM		AM	PM	AM	PM
S1	NB	930	1,085	2,800	690	845	0.25	0.30
	SB	1,570	1,025	2,600	1,220	810	0.47	0.31
S2	NB	680	755	2,800	475	570	0.17	0.20
	SB	1,340	745	2,600	1,040	530	0.40	0.20
S3	NB	1,145	1,245	2,800	660	835	0.24	0.30
	SB	1,540	935	2,800	1,050	545	0.38	0.20
S4	EB	1,100	890	4,200	720	580	0.17	0.14
	WB	1,375	1,190	2,600	870	820	0.34	0.32
S5	EB	140	70	1,100	115	55	0.11	0.05
	WB	120	85	1,100	90	65	0.08	0.06

Table 5.7 Road Link Operational Performance in 2033 (with Proposed Development) – Normal Operation

Index	Dir.	2033 Des. Flows (pcu/hr)		Design Capacity (Veh/hr)	2033 Des. Flows (Veh/hr)		V/C Ratio	
		AM	PM		AM	PM	AM	PM
S1	NB	935	1,095	2,800	690	855	0.25	0.31
	SB	1,575	1,030	2,600	1,225	815	0.47	0.31
S2	NB	685	765	2,800	480	575	0.17	0.21
	SB	1,345	750	2,600	1,045	535	0.40	0.21
S3	NB	1,155	1,260	2,800	665	845	0.24	0.30
	SB	1,550	945	2,800	1,055	555	0.38	0.20
S4	EB	1,105	895	4,200	725	580	0.17	0.14
	WB	1,380	1,195	2,600	875	825	0.34	0.32
S5	EB	150	80	1,100	120	60	0.11	0.06
	WB	130	100	1,100	95	75	0.09	0.07

Table 5.8 Road Link Operational Performance in 2033 (without Proposed Development) – Weekend

Index	Dir.	2033 Ref. Flows (pcu/hr)	Design Capacity (Veh/hr)	2033 Ref. Flows (Veh/hr)	V/C Ratio
S1	NB	890	2,800	710	0.25
	SB	925	2,600	740	0.29
S2	NB	665	2,800	490	0.18
	SB	685	2,600	475	0.18
S3	NB	955	2,800	595	0.21
	SB	745	2,800	405	0.15
S4	EB	800	4,200	525	0.13
	WB	1,030	2,600	700	0.27
S5	EB	55	1,100	40	0.04
	WB	60	1,100	50	0.05

Table 5.9 Road Link Operational Performance in 2033 (with Proposed Development) – Event Day

Index	Dir.	2033 Des. Flows (pcu/hr)	Design Capacity (Veh/hr)	2033 Des. Flows (Veh/hr)	V/C Ratio
S1	NB	935	2,800	745	0.27
	SB	985	2,600	785	0.30
S2	NB	710	2,800	525	0.19
	SB	745	2,600	515	0.20
S3	NB	1,035	2,800	645	0.23
	SB	875	2,800	475	0.17
S4	EB	875	4,200	570	0.14
	WB	1,065	2,600	720	0.28
S5	EB	185	1,100	135	0.12
	WB	140	1,100	115	0.11

5.2.2 **Table 5.4** to **Table 5.9** indicates that all the critical junctions and road links will operate within capacity during the peak periods under reference and design scenario in year 2033.

5.3 Sensitivity Test for TKO Area 137

5.3.1 To evaluate the potential impact upon intake of TKO Area 137, sensitivity test has been carried out at Year 2033 with the planned development TKO Area 137. Based on the latest available information, the full population of TKO Area 137 has been assumed in year 2033 as a conservative approach. . The results are summarised and presented in **Table 5.10** and **Table 5.11**.

Table 5.10 Operation Performance of Critical Junctions in 2033 - Normal Operation

Ref.	Junction	RC/RFC$^{(1)}$ 2033 Design (w/ TKO Area 137) (Normal Operation)	
		AM Peak	PM Peak
A	Wan Po Road / Chun Yat Street	-54%	-28%
B	Wan Po Road / Wan O Road	-66%	-55%
C	Wan Po Road / Shek Kok Road / Sunrise Boulevard	-8%	11%
D	Wan Po Road / LOHAS Park Road	50%	71%
E	Wan O Road / Sunrise Boulevard	-47%	-40%

5.3.2 Note: (1) RC = Reserve Capacity, RFC = Ratio to Flow capacity in **Table 5.10** and **Table 5.11.**Table 5.10**Table 5.10** indicates that Junctions A, B, C and E will operate beyond its capacity during the peak periods under reference and design scenario in year 2033.

Table 5.11 Road Link Operational Performance in 2033 (with TKO Area 137 development) – Normal Operation

Index	Dir.	2033 Des. Flows (w/ TKO Area 137) (Normal Operation) (pcu/hr)		Design Capacity (Veh/hr)	2033 Des. Flows (w/ TKO Area 137) (Normal Operation) (Veh/hr)		V/C Ratio	
		AM	PM		AM	PM	AM	PM
S1	NB	1,360	1,440	2,800	1,005	1,120	0.36	0.40
	SB	2,010	1,480	2,600	1,565	1,170	0.60	0.45
S2	NB	1,110	1,110	2,800	780	835	0.28	0.30
	SB	1,780	1,200	2,600	1,380	855	0.53	0.33
S3	NB	5,390	3,550	2,800	3,100	2,385	**1.11**	0.85
	SB	4,430	3,935	2,800	3,020	2,305	**1.08**	0.82
S4	EB	3,555	3,440	4,200	2,330	2,235	0.56	0.53
	WB	5,190	3,140	2,600	3,290	2,165	**1.27**	0.83
S5	EB	150	80	1,100	120	60	0.11	0.06
	WB	130	100	1,100	95	75	0.09	0.07

5.3.3 **Table 5.11** indicates that all the road links, except S3 northbound and southbound during AM peak, and S4 westbound during AM peak, will operate within capacity during the peak periods under reference and design scenario in year 2033.

5.3.4 It is understood that necessary local road improvement works will be determined from a separated holistic study based on the actual traffic demand to better cater for changing circumstances including the population and traffic demand.

5.3.5 It is worth noting that the above situation is due the potential traffic impact from the planned development, instead of the proposed PRS development. Therefore, no additional traffic improvement works will be required for the proposed PRS development under this sensitivity test.

6. PUBLIC TRANSPORT PROVISION SERVICES

6.1 Public Transport Services

6.1.1 At present, there are bus routes and GMB routes operating in the near vicinity to the proposed development. The nearest bus stops are located at Wan Po Road, which is about 300m from the proposed development.

6.1.2 Details of the existing public transport services in the vicinity are summarised in **Table 6.1** and illustrated in **Drawing No. 6.1**.

Table 6.1 Existing Public Transport Services in the vicinity

Route	Service	Destinations	Peak Hour Frequency (minutes)
MTR (Drawing No. 6.1)			
TKO Line	MTR	LOHAS Park ↔ North Point	6-7
Buses (Drawing No. 6.1)			
49(1)	KMB	Ching Fu Court ↔ Tseung Kwan O Industrial Estate	07:00, 07:30, 17:10, 17:30
98	KMB	Tseung Kwan O Industrial Estate ↔ Ngau Tau Kok Station (Circular)	15-20
98D(1)(4)	KMB	LOHAS Park Station → Tsim Sha Tsui East	07:05, 07:30, 07:55, 08:25
290E(1)(3)	KMB	Tsung Kwan O Industrial Estate ↔ Tsuen Wan West Station	06:55, 07:15, 07:35, 17:05, 17:20, 17:30, 17:50
290X	KMB	LOHAS Park Station ↔ Tsuen Wan West Station	12-40
298E(3)	KMB	Hang Hau (North) → Tseung Kwan O Industrial Estate (Circular)	15-30
298F(3)	KMB	Hang Hau (North) → Tseung Kwan O Industrial Estate (Circular)	15-25
298X(1)	KMB	Hang Hau (North) (Tseung Kwan O Hospital) ↔ Mei Foo	20-30
690S(1)(3)	KMB/CTB	Hang Hau (Ming Tak Estate) ↔ Central (Exchange Square)	07:30, 07:36, 07:42, 07:48, 07:54, 08:02, 08:10, 08:20, 08:40, 09:00, 17:40, 18:00, 18:15, 18:30
694S(1)(3)	CTB	Tiu Keng Leng Station (via: LOHAS Park) ↔ Siu Sai Wan Estate	07:50, 08:10, 17:45, 18:05
790	CTB	Oscar By The Sea (via: LOHAS Park) ↔ Tsim Sha Tsui (Mody Road)	20
793	CTB	Tseung Kwan O Industrial Estate ↔ So Uk	15-60
795(1)(3)	CTB	Tseung Kwan O Industrial Estate (via: LOHAS Park) ↔Cheung Sha Wan (Hoi Tat)	07:30, 07:50, 08:10, 17:50, 18:05, 18:20
796X	CTB	Tseung Kwan O Industrial Estate / Tseung Kwan O Station ↔Tsim Sha Tsui (East)	12-30
797	CTB	LOHAS Park / Tseung Kwan O Industrial Estate ↔ San Po Kong	20-30

Route	Service	Destinations	Peak Hour Frequency (minutes)
798P[(1)(3)]	CTB	Tseung Kwan O Industrial Estate ↔ Tai Wai Station (via: Sha Tin)	06:40, 08:15
798X[(1)(3)]	CTB	Tseung Kwan O Industrial Estate ↔ Fo Tan (Chun Yeung Estate) (via: Sha Tin)	07:00, 07:55,18:20
A28	CTB	LOHAS Park ↔ Airport (via HZMB Hong Kong Port)	55-60
N290[(2)]	KMB	LOHAS Park Station ↔ Tsuen Wan West Station	00:50, 01:20, 04:20, 04:40
N796[(2)]	CTB	LOHAS Park ↔ Mongkok (via Tsim Sha Tsui)	20 - 30
GMB (Drawing No. 6.1)			
112M	GMB	LOHAS Park Station ↔ Tseung Kwan O Industrial Estate	12 - 30
112S[(2)]	GMB	Tseung Kwan O Station ↔ Tseung Kwan O Industrial Estate	30
113	GMB	The Beaumount ↔ Hang Hau Station Public Transport Interchange	4 - 15
115	GMB	Tseung Kwan O Industrial Estate (Chun Cheong Street) Terminus ↔ Po Lam	15 - 30

Note: (1) Mon to Fri (except Public Holiday)
(2) Overnight Service
(3) AM/PM Service
(4) Special Departure
(5) Monday to Saturday (except Public Holiday)

6.1.3 The walking distance and time from the nearby public transport have been estimated and summarised in **Table 6.2** and presented diagrammatically in **Annex A**.

Table 6.2 Walking Distance and Time to/from nearby Public Transport Facilities

Index	Location	Walking Distance (m)	Estimated Time Required (min)
1	Bus Stop and GMB stop at Chun Yat St near Wan Po Rd	350	5
2	Bus Stop at Wan O Rd EB	600	9
3	Bus Stop and GMB stop at Wan Po Rd SB near Mega Plus	650	9
4	Bus Stop at Wan Po Rd NB near Chun Cheong St	400	5
5	Bus Stop at Wan O Rd WB	600	9
6	Bus Stop and GMB stop at Wan Po Rd NB near LOHAS Park	700	11

6.1.4 As shown in above, there are comprehensive bus and GMB services provided within the catchment of the proposed development.

6.1.5 Apart from the bus and GMB services, the MTR LOHAS Park Station is the nearest railway station. At present, the walking time between the MTR LOHAS Park Station and proposed development is estimated to be 20min as shown in **Annex A**.

6.1.6 It is anticipated some future users will possibly walk along the existing pedestrian facilities to/from MTR LOHAS Park Station. Nevertheless, to enhance the accessibility to/from MTR Station, potential improvement could be considered. The details will be discussed in **Section 6.3**.

6.2 Public Transport Demand by the Proposed PRS Development

6.2.1 The Peak Hourly Public Transport Demand of the proposed PRS development under the normal operation and event day have been derived and summarised in **Table 6.3**.

Table 6.3 Anticipated PT Demand attracted by Proposed PRS Development for in Year 2033

Normal Operation				Event Day			
AM Peak		PM Peak		Peak Inbound		Peak Outbound	
Inbound	Outbound	Inbound	Outbound				
7(1)	3(1)	4(1)	7(1)	426 (1)		267 (1)	
				Rail	328 (2)	Rail	206 (2)
				Bus/GMB	98 (2)	Bus/GMB	61 (2)

Note: (1) Based on survey public transport demand (pax/stall) collected in TMPRS
(2) Reference to population data on mode of transport in 2021 Population Census, the modal split between railway and road-base transport.

6.2.2 To review the current demand on public transport services in the vicinity of subject PRS, the occupancies of the existing franchised buses and GMB at Wan O Road, Wan Po Road, Chun Yat Street were recorded. The existing occupancy of each bus route are summarised in **Table 6.4** to **Table 6.7** for normal operation and **Table 6.8** to **Table 6.9** for event day respectively.

Normal Operation

Table 6.4 Bus Occupancy in Inbound Direction during AM Peak Hour on Weekday

Route No.	Origin(s)	Location (2)	Observed peak hour Frequency	Existing Average Occupancy (Patronage / hr) (1)	Observed Remaining Capacities (Patronage / hr) (1)
Bus 49	Tsing Yi	Wan Po Road SB near MEGA Plus	1 trip	14	76
Bus 98	Ngau Tau Kok		6 trips	239	301
Bus 797	San Po Kong		1 trip	36	54
Bus 798X	Fo Tan		0 trip	-	0
Bus 793	So Uk		3 trips	104	166
Bus 98D	MTR LOHAS Park Station	Wan Po Road SB near LOHAS Park	0 trip	0	0
Bus 298E	Po Lam / Hang Hau	Chun Yat St near Wan Po Rd	4 trips	136	224
Bus 298F			0 trip	0	0
GMB 115		Chun Yat St near Wan Po Rd	1 trip	14	2
Bus 790	Tsim Sha Tsui	Wan O Road EB	0 trip	0	0
Bus 796X		Chun Yat St near Wan Po Rd	1 trip	27	63
Bus 290E	Tsuen Wan West	Chun Yat St near Wan Po Rd	0 trip	0	0
Bus 290X		Wan Po Road SB near MEGA Plus	2 trips	23	157
Bus 298X	Mei Foo	Wan O Road EB	0 trip	0	0
Bus 690S	Central		0 trip	0	0
Bus 694S	Siu Sai Wan		0 trip	0	0
Bus 795	Cheung Sah Wan		0 trip	0	0
Bus A28	Airport	Wan Po Road SB near MEGA Plus	0 trip	0	0
Bus 798P	Tai Wai		0 trip	0	0
GMB 112M	Tseung Kwan O Industrial Estate	Wan Po Road NB near LOHAS Park	2 trips	16	16
Total					**1,059**

Note: (1) Based on a Bus Capacity of 90 (120 x 75%) passengers/hr and GMB capacity of 16/19 seats
(2) Refer to Drawing 6.1

Table 6.5 Bus Occupancy in Outbound Direction during AM Peak Hour on Weekday

Route No.	Origin(s)	Location(2)	Observed peak hour Frequency	Existing Average Occupancy (Patronage / hr) (1)	Observed Remaining Capacities (Patronage / hr) (1)
Bus 98	Tseung Kwan O Industrial Estate	Wan Po Rd NB near LOHAS Park	4 trips	163	197
Bus 290E			0 trip	0	0
Bus 298E			4 trips	82	278
Bus 298F			0 trip	0	0
Bus 796X			2 trips	63	117
GMB 115			4 trips	30	34
Bus 49		Wan Po Rd NB near Chun Cheong St	0 trip	0	0
Bus 793			4 trips	42	318
Bus 798P			0 trip	0	0
Bus 798X			0 trip	0	0
Bus 795		Wan O Rd WB	0 trip	0	0
Bus A28	MTR LOHAS Park Station LOHAS Park	Wan Po Rd NB near LOHAS Park	1 trip	0	90
Bus 290X			3 trips	37	233
Bus 797			1 trip	68	22
Bus 98D			1 trip	2	88
Bus 298X	Hang Hau	Wan O Rd WB	2 trips	32	148
Bus 690S			3 trips	104	166
Bus 694S	Tseung Kwan O		1 trip	27	63
Bus 790			2 trips	41	139
GMB 112M	MTR LOHAS Park Station	Wan Po Road SB near MEGA Plus	1 trip	16	0
Total					**1,893**

Note: (1) Based on a Bus Capacity of 90 (120 x 75%) passengers/hr and GMB capacity of 16/19 seats
(2) Refer to **Drawing 6.1**

Table 6.6 Bus Occupancy in Inbound Direction during PM Peak Hour on Weekday

Route No.	Origin(s)	Location(2)	Observed peak hour Frequency	Existing Average Occupancy (Patronage / hr) (1)	Observed Remaining Capacities (Patronage / hr) (1)
Bus 49	Tsing Yi	Wan Po Road SB near MEGA Plus	0 trip	0	0
Bus 98	Ngau Tau Kok		5 trips	178	272
Bus 797	San Po Kong		2 trips	90	90
Bus 798X	Fo Tan		0 trip	0	0
Bus 793	So Uk		4 trips	78	282
Bus 98D	MTR LOHAS Park Station	Wan Po Road SB near LOHAS Park	0 trip	0	0
Bus 298E	Po Lam / Hang Hau	Chun Yat St near Wan Po Rd	0 trip	0	0
Bus 298F			3 trips	28	242
GMB 115		Chun Yat St near Wan Po Rd	5 trips	53	27
Bus 790	Tsim Sha Tsui	Wan O Road EB	2 trips	23	157
Bus 796X		Chun Yat St near Wan Po Rd	3 trips	55	215

Route No.	Origin(s)	Location[2]	Observed peak hour Frequency	Existing Average Occupancy (Patronage / hr) [1]	Observed Remaining Capacities (Patronage / hr) [1]
Bus 290E	Tsuen Wan West	Chun Yat St near Wan Po Rd	0 trip	0	0
Bus 290X		Wan Po Road SB near MEGA Plus	3 trips	37	233
Bus 298X	Mei Foo	Wan O Road EB	0 trip	0	0
Bus 690S	Central		0 trip	0	0
Bus 694S	Siu Sai Wan		0 trip	0	0
Bus 795	Cheung Sah Wan		0 trip	0	0
Bus A28	Airport	Wan Po Road SB near MEGA Plus	1 trip	5	85
Bus 798P	Tai Wai		0 trip	0	0
GMB 112M	Tseung Kwan O Industrial Estate	Wan Po Road NB near LOHAS Park	3 trips	24	24
Total					**1,627**

Noted: (1) Based on a Bus Capacity of 90 (120 x 75%) passengers/hr and GMB capacity of 16/19 seats
(2) Refer to **Drawing 6.1**

Table 6.7 Bus Occupancy in Outbound Direction during PM Peak Hour on Weekday

Route No.	Origin(s)	Location[2]	Observed peak hour Frequency	Existing Average Occupancy (Patronage / hr) [1]	Observed Remaining Capacities (Patronage / hr) [1]
Bus 98	Tseung Kwan O Industrial Estate	Wan Po Rd NB near LOHAS Park	6 trips	267	273
Bus 290E			0 trip	0	0
Bus 298E			0 trip	0	0
Bus 298F			3 trips	109	161
Bus 796X			3 trips	37	233
GMB 115			3 trips	40	8
Bus 49		Wan Po Rd NB near Chun Cheong St	1 trip	2	88
Bus 793			3 trips	37	233
Bus 798P			0 trip	0	0
Bus 798X			0 trip	0	0
Bus 795		Wan O Rd WB	0 trip	0	0
Bus A28	MTR LOHAS Park Station	Wan Po Rd NB near LOHAS Park	1 trip	2	88
Bus 290X			2 trips	28	152
Bus 797			4 trips	55	305
Bus 98D			0 trip	0	0
Bus 298X	Hang Hau	Wan O Rd WB	0 trip	0	0
Bus 690S			0 trip	0	0
Bus 694S	Tseung Kwan O		0 trip	0	0
Bus 790			2 trips	28	152
GMB 112M	MTR LOHAS Park Station	Wan Po Road SB near MEGA Plus	0 trip	0	0
Total					**1,693**

Note: (1) Based on a Bus Capacity of 90 (120 x 75%) passengers/hr and GMB capacity of 16/19 seats
(2) Refer to Drawing 6.1

6.2.3 **Table 6.4** to **Table 6.7** indicate that all of existing bus and GMB services has sufficient capacity (i.e., 1,059 > 7 patronage/hr and 1,893 > 3 patronage/hr during AM peak hour inbound and outbound , 1,627 > 4 patronage/hr and 1,693 > 7 patronage/hr during PM peak hour inbound and outbound respectively) to cater for the additional public transport demand due to the proposed PRS development under the normal operation.

Event Day

Table 6.8 Bus Occupancy in Inbound Direction during Peak Hour on Weekend

Route No.	Origin(s)	Location$^{(2)}$	Observed peak hour Frequency	Existing Average Occupancy (Patronage / hr) $^{(1)}$	Observed Remaining Capacities (Patronage / hr) $^{(1)}$
Bus 98	Ngau Tau Kok	Wan Po Road SB near MEGA Plus	2 trips	37	143
Bus 797	San Po Kong		2 trips	18	162
Bus 793	So Uk		2 trips	45	135
Bus 298E	Po Lam / Hang Hau	Chun Yat St near Wan Po Rd	1 trip	41	49
Bus 298F			2 trips	50	130
GMB 115		Chun Yat St near Wan Po Rd	2 trips	8	27
Bus 790	Tsim Sha Tsui	Wan O Road EB	2 trips	50	130
Bus 796X	Tsim Sha Tsui	Chun Yat St near Wan Po Rd	0 trip	0	0
Bus 290X	Tsuen Wan West	Wan Po Road SB near MEGA Plus	1 trip	5	85
Bus 298X	Mei Foo	Wan O Road EB	0 trips	0	0
Bus A28	Airport	Wan Po Road SB near LOHAS Park	1 trip	5	85
GMB 112M	Tseung Kwan O Industrial Estate	Wan Po Road NB near LOHAS Park	3 trips	34	14
Total					**960**

Note: (1) Based on a Bus Capacity of 90 (120 x 75%) passengers/hr and GMB capacity of 16/19 seats
(2) Refer to Drawing 6.1

Table 6.9 Bus Occupancy in Outbound Direction during Peak Hour on Weekend

Route No.	Origin(s)	Location$^{(2)}$	Observed peak hour Frequency	Existing Average Occupancy (Patronage / hr) $^{(1)}$	Observed Remaining Capacities (Patronage / hr) $^{(1)}$
Bus 98	Tseung Kwan O Industrial Estate	Wan Po Rd NB near LOHAS Park	5 trips	423	27
GMB 115			3 trips	42	6
Bus 793		Wan Po Rd NB near Chun Cheong St	2 trips	104	76
Bus 796X			1 trip	45	45
Bus 298E			0 trip	0	0
Bus 298F			2 trips	54	126
Bus A28	MTR LOHAS Park Station	Wan Po Rd NB near LOHAS Park	1 trip	5	85
Bus 290X			3 trips	78	192
Bus 797			2 trips	108	72
Bus 298X	Hang Hau	Wan O Rd WB	0 trips	0	0
Bus 790	Tseung Kwan O		3 trips	19	251

Route No.	Origin(s)	Location(2)	Observed peak hour Frequency	Existing Average Occupancy (Patronage / hr) (1)	Observed Remaining Capacities (Patronage / hr) (1)
GMB 112M	MTR LOHAS Park Station	Wan Po Road SB near Mega Plus	3 trips	39	9
Total					**889**

Note: (1) Based on a Bus Capacity of 90 (120 x 75%) passengers/hr and GMB capacity of 16/19 seats
(2) Refer to **Drawing 6.1**

6.2.4 **Table 6.8** and **Table 6.9** indicate that all of existing bus and GMB services has sufficient capacity (i.e., 960 > 98 patronage/hr during peak hour inbound, 889 > 61 patronage/hr during peak hour outbound) to cater for the additional public transport demand due to the proposed PRS development under the event day.

6.2.5 Based on the above assessment results, there will be sufficient bus and GMB capacity to serve the public transport demand of the proposed PRS.

6.3 Proposed Additional Bus Stop at Chun Sing Street

6.3.1 With reference to **Table 6.3**, the railway related demand are summarised in **Table 6.10**.

Table 6.10 Anticipated PT Demand by railway of the Proposed PRS Development

Observed Peak Hour Frequency					
Weekday				Weekend	
AM		PM		Peak Hour	
From MTR LOHAS Park Station	To MTR LOHAS Park Station	From MTR LOHAS Park Station	To MTR LOHAS Park Station	From MTR LOHAS Park Station	To MTR LOHAS Park Station
7(1)	3(1)	4(1)	7(1)	328(2)	206(2)

Note: (1) For conservative, assume all public transport (i.e. rail, bus and GMB) demand on weekday.
(2) Refer to **Table 6.3,** for public transport demand on weekend.

6.3.2 As mentioned in **Section 6.1.6**, some future users will possibly walk along the existing pedestrian facilities to/from LOHAS Park Station. To enhance the accessibility to/from MTR Station, it is proposed to study the feasibility to provide some bus services at Chun Sing Street.

6.3.3 At present, there are some existing bus route nos. A28(CTB), 290X (KMB) and 797 (CTB) running along MTR LOHAS Park Station, Chun Yat Street and Chun Sing Street, as shown in **Annex B**.

6.3.4 It is recommended to add a new stop at Chun Sing Street for the above 3 routes to serve the visitors from the proposed PRS development to the MTR LOHAS Park Station. The location of proposed additional stop is **Drawing No. 6.2**.

6.3.5 The observed frequencies and remaining capacities of these 3 bus routes are extracted from to **Table 6.9** and summarised in **Table 6.11** and **Table 6.12**.

Table 6.11 Observed Remaining Capacities of Route Nos. A28, 290X and 797

Route No.	Observed Remaining Capacities (Patronage / hr) (1)					
	Weekday				Weekend	
	AM		PM		Peak	
	From MTR LOHAS Park Station	To MTR LOHAS Park Station	From MTR LOHAS Park Station	To MTR LOHAS Park Station	From MTR LOHAS Park Station	To MTR LOHAS Park Station
Bus 797	22	54	305	90	162	72
Bus 290X	233	157	152	233	85	192
Bus A28	90	0	88	85	85	85
Total	**345**	**211**	**545**	**408**	**332**	**349**

Note: (1) Based on a Bus Capacity of 120 passengers/hr and GMB capacity of 16/19 seats

Table 6.12 Observed Peak Hour Frequency of Route Nos. A28, 290X and 797

Route No.	Observed Peak Hour Frequency					
	Weekday				Weekend	
	AM		PM		Peak	
	From MTR LOHAS Park Station	To MTR LOHAS Park Station	From MTR LOHAS Park Station	To MTR LOHAS Park Station	From MTR LOHAS Park Station	To MTR LOHAS Park Station
Bus 797	1	1	4	2	2	2
Bus 290X	3	2	2	3	1	3
Bus A28	1	0	1	1	1	1
Total	**5**	**3**	**7**	**6**	**4**	**6**
Total (2-way)	**8**		**13**		**10**	

6.3.6 **Table 6.10** and **Table 6.11**, indicate that the above three bus routes (A28, 290X and 797) have sufficient capacity (i.e., 332 > 328 patronage/hr during peak hour inbound, 349 > 206 patronage/hr during peak hour outbound) on weekend to cater for the additional public transport demand due to the proposed PRS development for the event day.

6.3.7 With reference to the observed frequency under **Table 6.12,** the maximum arrival rate for Bus Route Nos. A28, 290X and 797 is 13 trips per hour (i.e., arrive every 4.6min in average). To serve the 13 bus trips per hour at Chun Sing Street, 1 no. of road-side bus bay with length of 14m will be sufficient.

7. FUTURE PEDESTRIAN CONDITIONS

7.1 Design Year

7.1.1 In order to assess the impact of the development related pedestrian flows on the local road network, it is necessary to forecast the pedestrian flows for design year 2033, the adopted design year, which is 3 years upon completion of the proposed development.

7.2 Reference Pedestrian Flow

7.2.1 As mentioned in **Section 4.2.6**, a natural growth rate of +0.69% p.a. was adopted for years the 2025 to 2031 and +0.51% p.a. was adopted for years 2031 to 2033 to project the 2025 observed pedestrian flows to 2033 reference pedestrian flows.

7.2.2 Based on the adopted growth rate, the 2025 observed pedestrian flows (weekday and weekend) are projected to produce the 2033 reference pedestrian flows.

7.2.3 The 2033 Reference Pedestrian Flows (without proposed PRS development) will be derived as follows.

2033 Reference Pedestrian Flows (weekday) = 2025 Pedestrian Flows x Growth Factor (+0.69% p.a. for 6 years and +0.51% p.a. for 2 year)

2033 Reference Pedestrian Flows (weekend) = 2025 Pedestrian Flows x Growth Factor (+0.69% p.a. for 6 years and +0.51% p.a. for 2 year)

7.3 Development Pedestrian Trip Generation

7.3.1 In order to estimate the pedestrian trip generation and attraction of the proposed development, reference has been made to the public transport demand of the proposed development during AM and PM peak hours. The pedestrian trip generation and attractions are summarized in **Table 7.1**.

Table 7.1 Pedestrian Trip Generation and Attraction of the Proposed Development (ped/15-min)

Proposed Development	Normal Operation (1)				Event Day (1)	
	AM		PM			
	Gen.	Att.	Gen.	Att.	Gen.	Att.
	2	1	1	2	107	67

Note: (1) Refer to estimated public transport demand on event day in **Table 6.3**.

7.3.2 It is estimated that the proposed PRS development will generate a two-way total of 3 ped/15-min in the AM peak hour and 3 ped/15-min in the PM peak hour under normal operation, and generate a two-way total of 174 ped/15-min in peak hour on event day respectively.

7.4 Design Pedestrian Forecasts

7.4.1 In order to estimate the pedestrian trip generation and attraction of the proposed development, reference has been made to the public transport demand of the proposed development during AM and PM peak hours. The pedestrian trip generation and attractions are summarized in **Table 7.1**.

7.4.2 The pedestrian trip generation and attractions of the proposed development are then superimposed onto the 2033 reference pedestrian flows to derive the 2033 design pedestrian traffic forecasts (with proposed PRS development).

2033 Design Pedestrian Flows (normal operation) = 2033 Reference Pedestrian Flows (weekday) + Proposed PRS Development Pedestrian Trip Generation (Normal Operation)

2033 Design Pedestrian Flows (event day) = 2033 Reference Pedestrian Flows (weekend) + Proposed PRS Development Pedestrian Trip Generation (Event Day)

7.5 Pedestrian Facilities Assessment

7.5.1 Operational assessment for the footpaths and signalised crossing for reference and design scenarios in year 2033 have been carried out and the results are summarised in **Table 7.2** to **Table 7.5** respectively.

Table 7.2 Footpath Operational Performance in 2033 (without Proposed Development) – Weekday

Footpath Section (1)	Clear Width (Approx. in metres)	Effective Width (Approx. in meters) (2)	Two-way Pedestrian Flows (in ped/15min)		Two-way hourly Pedestrian Flow Rate (in ped/min/m) (3)		Level of Service (LOS) (4)	
			AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
F1	3.50	2.50	20	30	0.53	0.80	A	A
F2	3.60	2.60	30	65	0.77	1.67	A	A
F3	3.60	2.60	80	60	2.05	1.54	A	A
F4	4.50	3.50	115	60	2.19	1.14	A	A
F5	3.50	2.50	65	25	1.73	0.67	A	A
F6	5.00	4.00	5	5	0.08	0.08	A	A
F7	3.90	2.90	10	10	0.23	0.23	A	A

Note: (1) Footpath sections refer to **Drawing No. 3.9**.
(2) Effective width of footpath is defined as the actual width of footpath by excluding the dead widths on both sides.
(3) Two–way pedestrian flow rate = Two-way 15-mins pedestrian flows / 15 min / Effective width of footpath.
(4) Details of Pedestrian Walkway LOS refer to T.P.D.M. Volume 6 Chapter 10 Section 10.4.2.

Table 7.3 Footpath Operational Performance in 2033 (without Proposed Development) – Weekend

Footpath Section (1)	Clear Width (Approx. in metres)	Effective Width (Approx. in meters) (2)	Two-way Pedestrian Flows (in ped/15min)	Two-way hourly Pedestrian Flow Rate (in ped/min/m) (3)	Level of Service (LOS) (4)
F1	3.50	2.50	75	2.00	A
F2	3.60	2.60	25	0.64	A
F3	3.60	2.60	20	0.51	A
F4	4.50	3.50	10	0.19	A
F5	3.50	2.50	5	0.13	A

Footpath Section (1)	Clear Width (Approx. in metres)	Effective Width (Approx. in meters) (2)	Two-way Pedestrian Flows (in ped/15min)	Two-way hourly Pedestrian Flow Rate (in ped/min/m) (3)	Level of Service (LOS) (4)
F6	5.00	4.00	5	0.08	A
F7	3.90	2.90	10	0.23	A

Note:
(1) Footpath sections refer to **Drawing No. 3.9**.
(2) Effective width of footpath is defined as the actual width of footpath by excluding the dead widths on both sides.
(3) Two–way pedestrian flow rate = Two-way 15-mins pedestrian flows / 15 min / Effective width of footpath.
(4) Details of Pedestrian Walkway LOS refer to T.P.D.M. Volume 6 Chapter 10 Section 10.4.2.

Table 7.4 Footpath Operational Performance in 2033 (with Proposed Development) – Normal Operation

Footpath Section (1)	Clear Width (Approx. in metres)	Effective Width (Approx. in meters) (2)	Two-way Pedestrian Flows (in ped/15min)		Two-way hourly Pedestrian Flow Rate (in ped/min/m) (3)		Level of Service (LOS) (4)	
			AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
F1	3.50	2.50	25	35	0.67	0.93	A	A
F2	3.60	2.60	35	70	0.90	1.79	A	A
F3	3.60	2.60	84	65	2.15	1.67	A	A
F4	4.50	3.50	115	60	2.19	1.14	A	A
F5	3.50	2.50	65	25	1.73	0.67	A	A
F6	5.00	4.00	10	10	0.17	0.17	A	A
F7	3.90	2.90	10	10	0.23	0.23	A	A

Note:
(1) Footpath sections refer to **Drawing No. 3.9**.
(2) Effective width of footpath is defined as the actual width of footpath by excluding the dead widths on both sides.
(3) Two–way pedestrian flow rate = Two-way 15-mins pedestrian flows / 15 min / Effective width of footpath.
(4) Details of Pedestrian Walkway LOS refer to T.P.D.M. Volume 6 Chapter 10 Section 10.4.2.

Table 7.5 Footpath Operational Performance in 2033 (with Proposed Development) – Event Day

Footpath Section (1)	Clear Width (Approx. in metres)	Effective Width (Approx. in meters) (2)	Two-way Pedestrian Flows (in ped/15min)	Two-way hourly Pedestrian Flow Rate (in ped/min/m) (3)	Level of Service (LOS) (4)
F1	3.50	2.50	205	5.47	A
F2	3.60	2.60	155	3.97	A
F3	3.60	2.60	160	4.10	A
F4	4.50	3.50	20	0.38	A
F5	3.50	2.50	15	0.40	A
F6	5.00	4.00	180	3.00	A
F7	3.90	2.90	25	0.57	A

Note:
(1) Footpath sections refer to **Drawing No. 3.9**.
(2) Effective width of footpath is defined as the actual width of footpath by excluding the dead widths on both sides.
(3) Two–way pedestrian flow rate = Two-way 15-mins pedestrian flows / 15 min / Effective width of footpath.
(4) Details of Pedestrian Walkway LOS refer to T.P.D.M. Volume 6 Chapter 10 Section 10.4.2.

7.5.2 According to the results in **Table 7.2** to **Table 7.5**, all assessed footpaths are operating within capacity in design year 2033.

8. CONCLUSION

8.1 Summary

8.1.1 The Hong Kong Jockey Club (HKJC) made a commitment to support the development of equestrian sport in Hong Kong after the 2008 Olympic and Paralympic Games.

8.1.2 Wong Tung & Partners Limited is commissioned by HKJC as the lead-consultant and MVA Hong Kong Limited is the traffic sub-consultant to undertake the Traffic Impact Assessment (TIA) for the proposed development. The purpose of this TIA report is to review the traffic condition and examine the impact of the traffic generated by the Proposed PRS Development on the local road network to support Section 16 Application of the proposed development.

8.1.3 The Proposed PRS Development is scheduled to be completed by year 2030.

8.1.4 In order to appraise the existing traffic conditions of these junctions, a manual classified traffic count was conducted at the identified key junctions to establish the current traffic condition. The survey was undertaken on a typical weekday on November 2024 during the AM peak hour of 07:30 to 09:30 and PM peak hour of 17:00 to 19:00 and a typical weekend on September 2025 during 16:30 to 18:30. Analysis of the observed traffic data on weekday indicates that the AM and PM peak hour flows occurred from 08:00 to 09:00 and from 17:00 to 18:00 respectively, observed data at weekend indicates the peak hour flows occurred from 17:00 to 18:00.

8.1.5 Traffic forecasts for years 2030 and 2033 have been derived. It is revealed that the major traffic growth in the area is mainly due to trip generations of the planned and committed developments to/from LOHAS Park Development along Sunrise Boulevard and LOHAS Park Road. Apart from the trip generations due to the planned and committed developments to/from LOHAS Park Development along Sunrise Boulevard and LOHAS Park Road, the future background growth for traffic movements to/from other destinations/origins have also been considered.

8.1.6 It is anticipated that the construction of Proposed PRS Development would generate two-way traffic of 38 pcu/hr during AM and PM peak hours during construction.

8.1.7 The assessment results revealed that all critical junctions will still operate within their capacities in design year 2030.

8.1.8 It is anticipated that the Proposed PRS Development would generate two-way traffic of 19 pcu/hr and 24 pcu/hr during AM and PM peak hours respectively under normal operation, 174 pcu/hr during peak hour on event day.

8.1.9 The assessment results revealed that all critical junctions and road links will still operate within their capacities in design year 2033.

8.1.10 To ascertain the potential traffic impact of TKO Area 137, a sensitivity test has been conducted. The results indicated some road junctions and road link will operate beyond its capacities. It is worth noting that this situation is due the potential traffic impact from the planned development, instead of the proposed PRS development. Therefore, no additional traffic improvement works will be required for the proposed PRS development under this sensitivity test.

8.1.11 It is estimated that the proposed PRS development will generate a two-way total of 3 ped/15-min in the AM peak hour and 3 ped/15-min in the PM peak hour under normal operation, and generate a two-way total of 159 ped/15-min in peak hour on event day respectively.

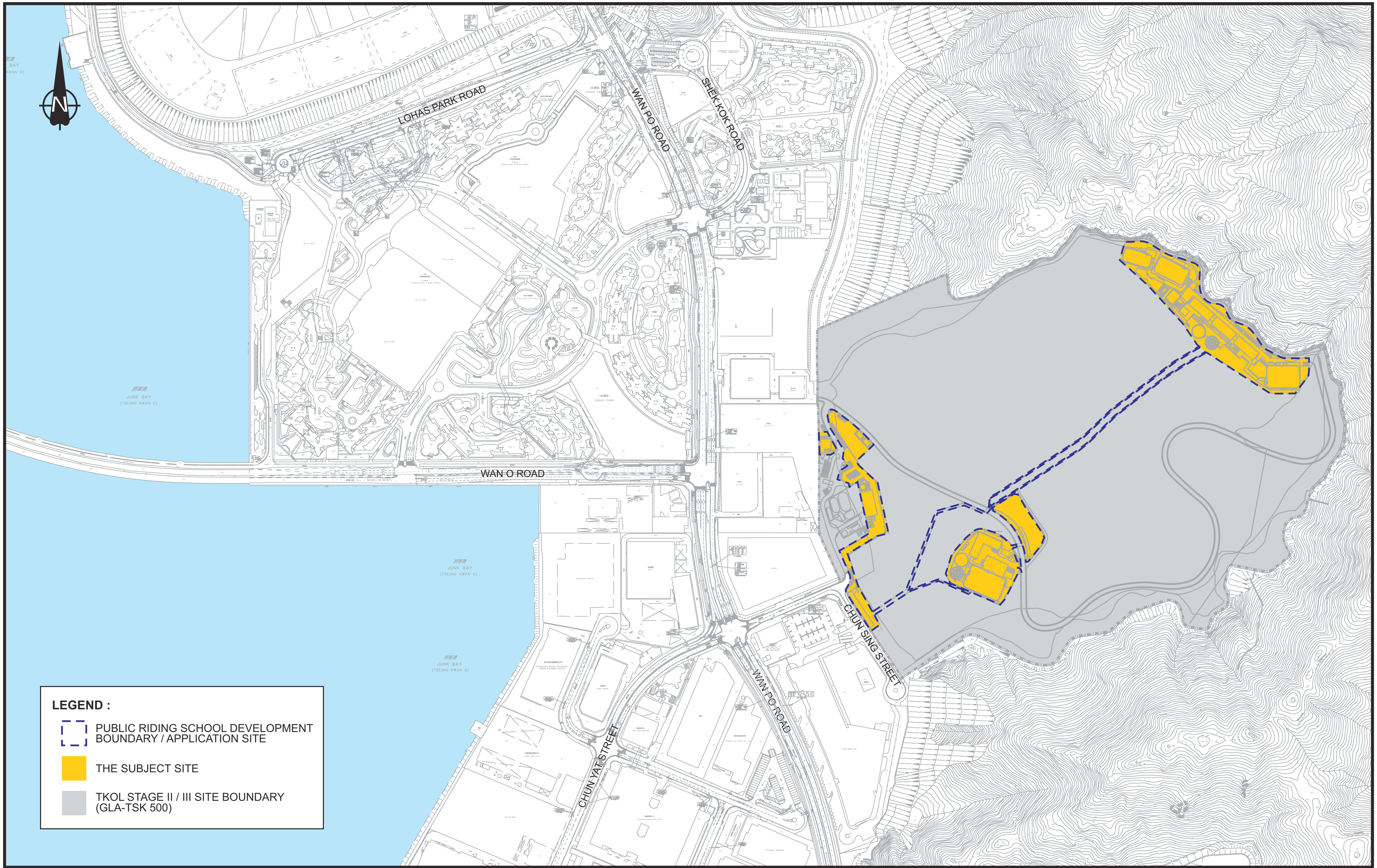
8.1.12 The assessment results reveal that all assessed footpaths are operating within capacity in design year 2033.

8.1.13 In view of the comprehensive coverage of the public transport services and the available different choices on transport modes, the Proposed PRS Development is considered to have very good accessibility via the public transport.

8.2 Conclusion

8.2.1 Based on the traffic analysis, the Proposed PRS Development would generate minimal traffic during the proposed peak periods and have minimal impact on the junction performance.

8.2.2 In view of that, the Proposed PRS Development is considered acceptable in traffic point of view.


N
LOHAS PARK ROAD
WAN PO ROAD
SHEK KOK ROAD
WAN O ROAD
CHUN SING STREET
CHUN YAT STREET
WAN PO ROAD
JUNK BAY
(TSEUNG KWAN O)
LEGEND :
PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY / APPLICATION SITE
THE SUBJECT SITE
TKOL STAGE II / III SITE BOUNDARY (GLA-TSK 500)

-	-	-	-
-	-	-	-
-	-	-	-
A	MINOR AMENDMENT	GPH	28JAN26
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

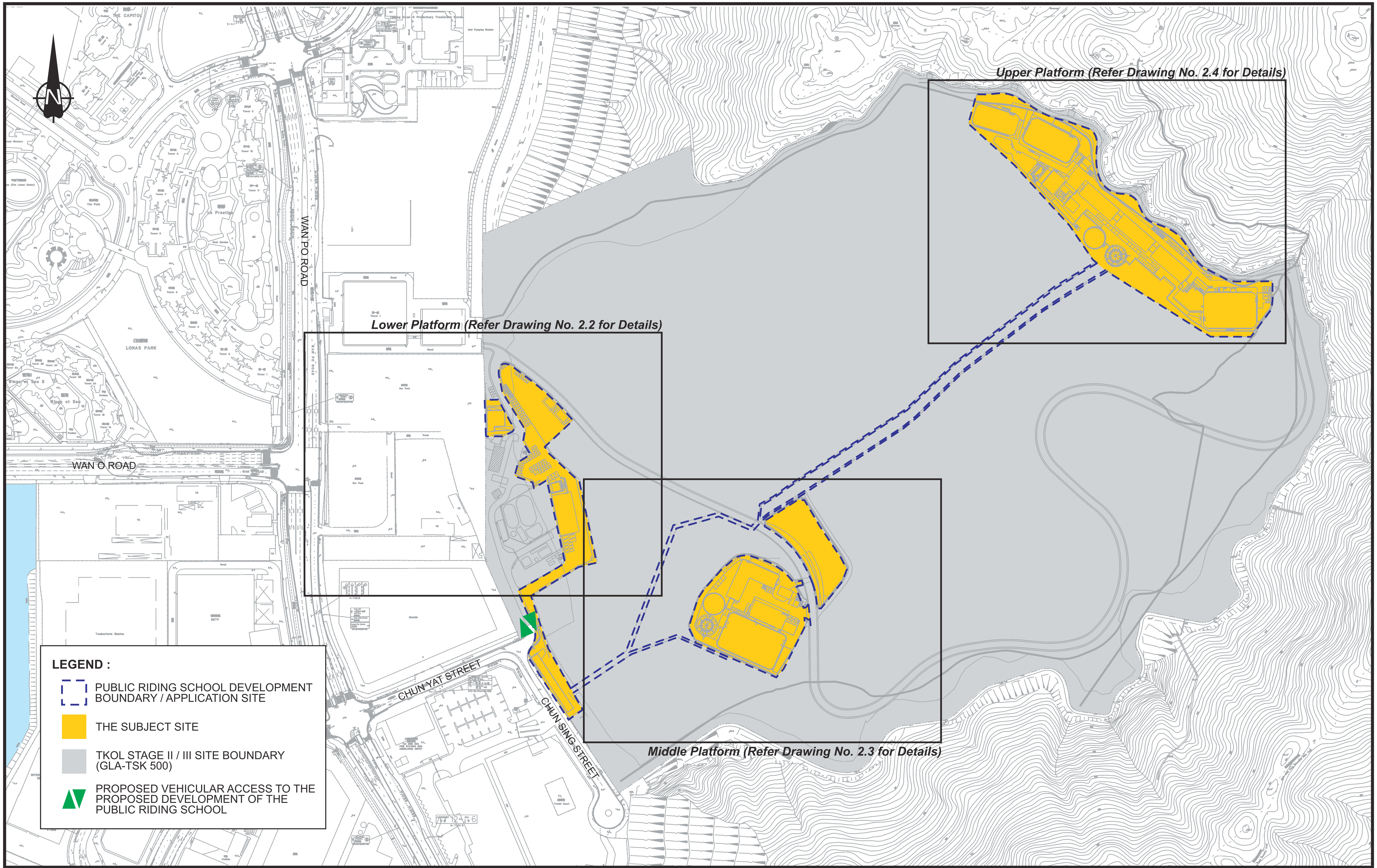
SUBJECT SITE LOCATION

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	JUL 2025	1.1	A

SYSTRA MVA

CHK50812010/TIA/F11-A.CDR/LLH/28JAN26

Original Size : A3


N
Upper Platform (Refer Drawing No. 2.4 for Details)
Lower Platform (Refer Drawing No. 2.2 for Details)
Middle Platform (Refer Drawing No. 2.3 for Details)
WAN PO ROAD
WAN O ROAD
CHUN YAT STREET
CHUN SING STREET
THE CAPITOL
LOHAS PARK

LEGEND :

- ⬚ PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY / APPLICATION SITE
- 🟨 THE SUBJECT SITE
- ⬜ TKOL STAGE II / III SITE BOUNDARY (GLA-TSK 500)
- ▲ PROPOSED VEHICULAR ACCESS TO THE PROPOSED DEVELOPMENT OF THE PUBLIC RIDING SCHOOL

-	-	-	-
-	-	-	-
-	-	-	-
A	MINOR AMENDMENT	GPH	28JAN26
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

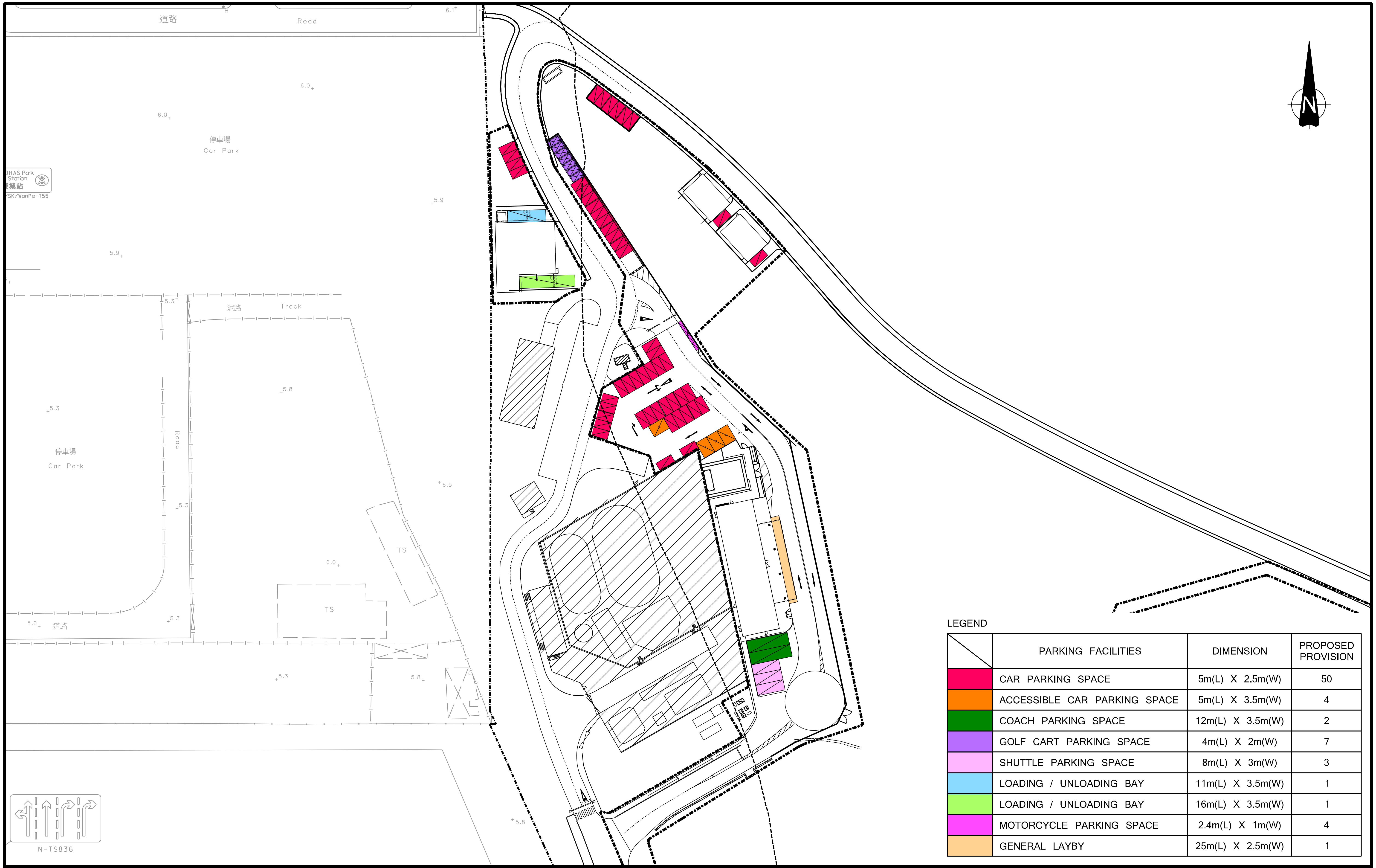
Drawing Title

PROPOSED DEVELOPMENT LAYOUT PLAN

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	JUL 2025	2.1	A

CHK50812010/TIA/F21-A.CDR/LLH/28JAN26

Original Size : A3


道路
Road
6.1
6.0
6.0
停車場
Car Park
HAS Park Station
SK/WanPo-T55
5.9
5.9
5.3
泥路
Track
5.8
5.3
Road
停車場
Car Park
6.5
5.3
TS
6.0
TS
5.6
道路
5.3
5.3
5.8
5.8
N-TS836
N

LEGEND

	PARKING FACILITIES	DIMENSION	PROPOSED PROVISION
🟥	CAR PARKING SPACE	5m(L) X 2.5m(W)	50
🟧	ACCESSIBLE CAR PARKING SPACE	5m(L) X 3.5m(W)	4
🟩	COACH PARKING SPACE	12m(L) X 3.5m(W)	2
🟪	GOLF CART PARKING SPACE	4m(L) X 2m(W)	7
🟪	SHUTTLE PARKING SPACE	8m(L) X 3m(W)	3
🟦	LOADING / UNLOADING BAY	11m(L) X 3.5m(W)	1
🟩	LOADING / UNLOADING BAY	16m(L) X 3.5m(W)	1
🟪	MOTORCYCLE PARKING SPACE	2.4m(L) X 1m(W)	4
🟨	GENERAL LAYBY	25m(L) X 2.5m(W)	1

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	14JAN26
A	MINOR AMENDMENT	GPH	24NOV25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

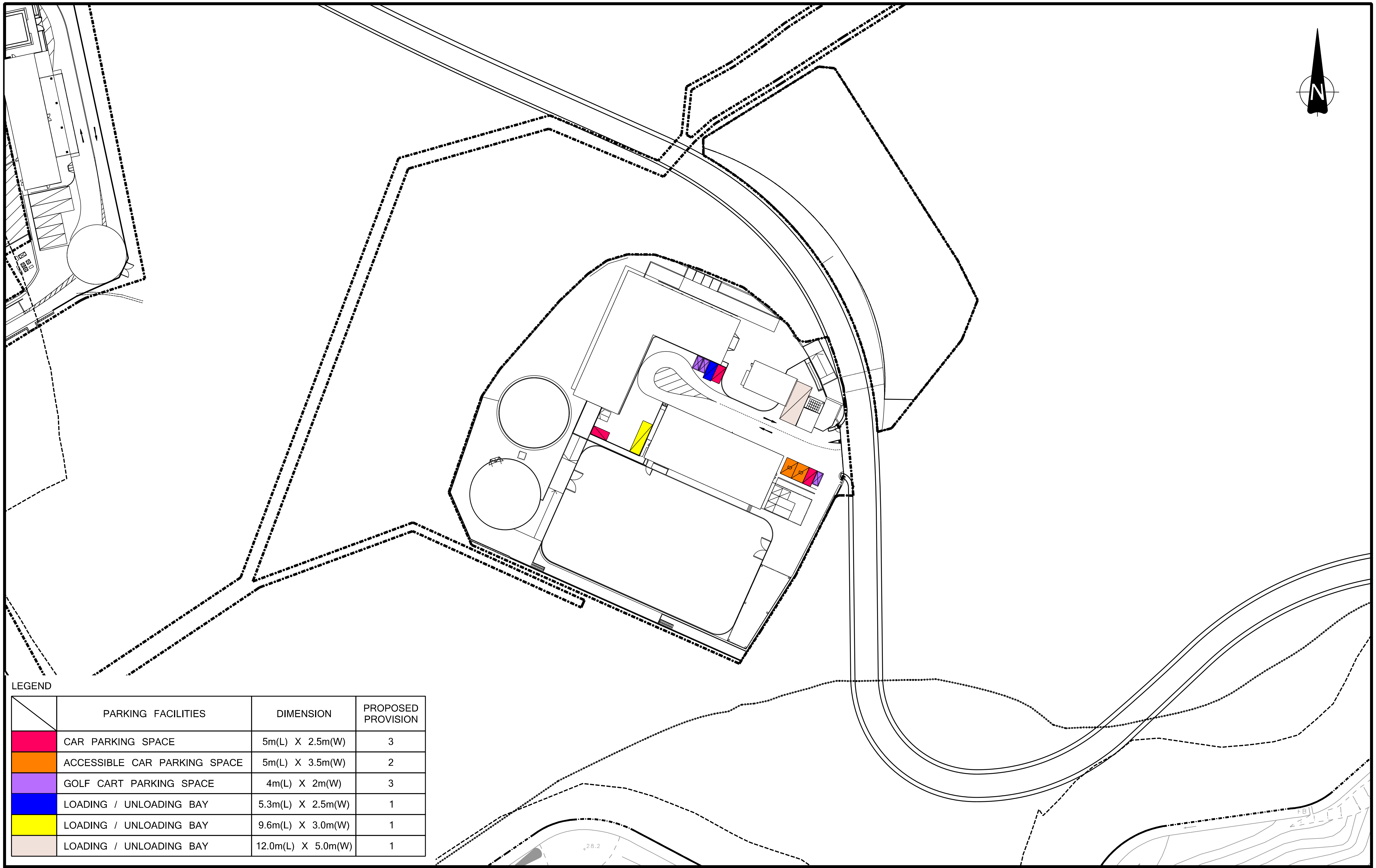
Drawing Title

PROPOSED LOWER PLATFORM

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:1000(A3)	JUN 2025	2.2	B

SYSTRA MVA

Original Size : A3



LEGEND

	PARKING FACILITIES	DIMENSION	PROPOSED PROVISION
🟥	CAR PARKING SPACE	5m(L) X 2.5m(W)	3
🟧	ACCESSIBLE CAR PARKING SPACE	5m(L) X 3.5m(W)	2
🟪	GOLF CART PARKING SPACE	4m(L) X 2m(W)	3
🟦	LOADING / UNLOADING BAY	5.3m(L) X 2.5m(W)	1
🟨	LOADING / UNLOADING BAY	9.6m(L) X 3.0m(W)	1
⬜	LOADING / UNLOADING BAY	12.0m(L) X 5.0m(W)	1

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	14JAN26
A	MINOR AMENDMENT	GPH	24NOV25

Project Title

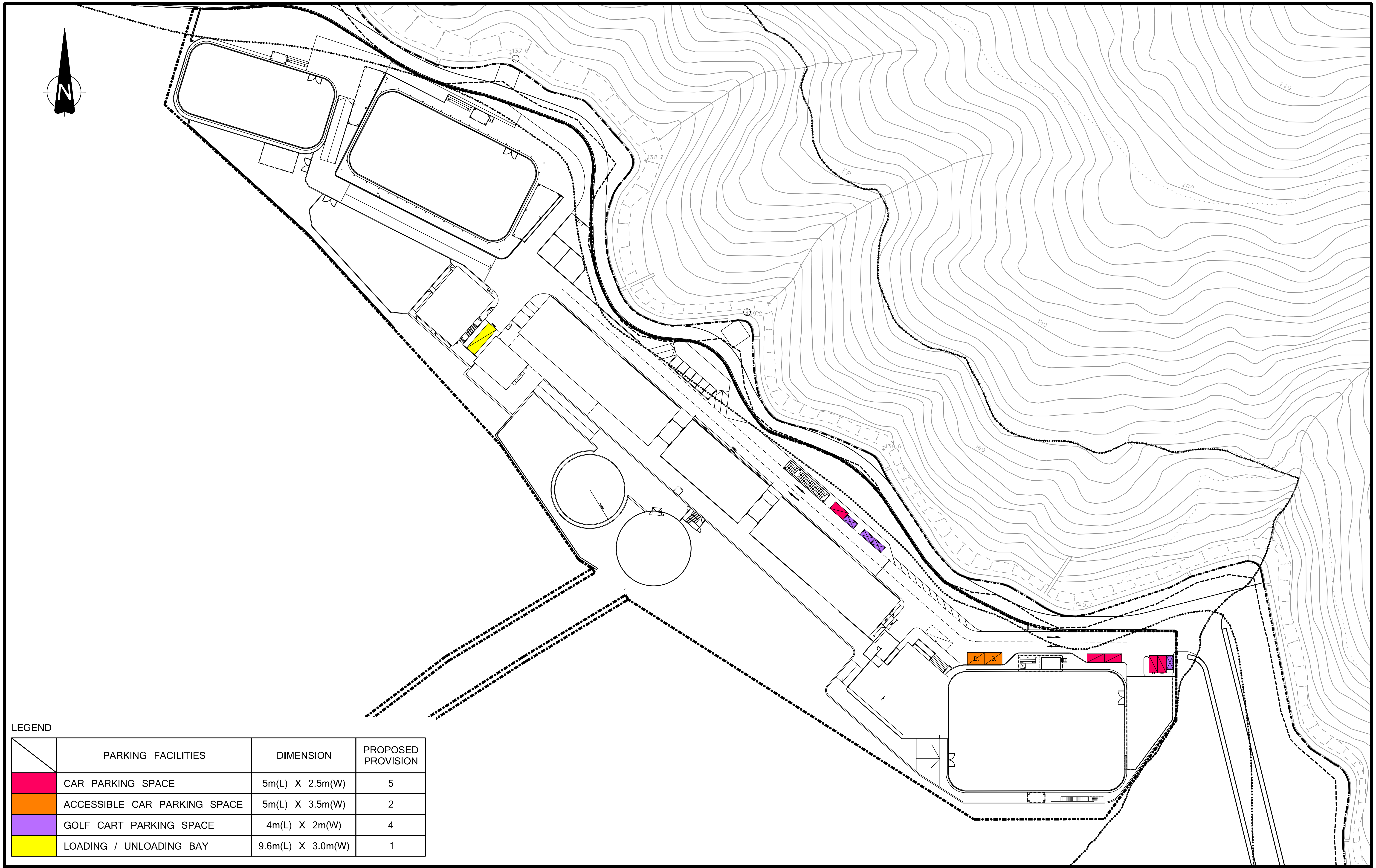
PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

Drawing Title

PROPOSED MIDDLE PLATFORM

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:1000(A3)	JUN 2025	2.3	B

Original Size : A3



LEGEND

◸	PARKING FACILITIES	DIMENSION	PROPOSED PROVISION
🟥	CAR PARKING SPACE	5m(L) X 2.5m(W)	5
🟧	ACCESSIBLE CAR PARKING SPACE	5m(L) X 3.5m(W)	2
🟪	GOLF CART PARKING SPACE	4m(L) X 2m(W)	4
🟨	LOADING / UNLOADING BAY	9.6m(L) X 3.0m(W)	1

-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	14JAN26
A	MINOR AMENDMENT	GPH	24NOV25
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR
CULTURE (PUBLIC RIDING SCHOOL) WITH
ANCILLARY FACILITIES AT GOVERNMENT LAND IN
D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN
TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

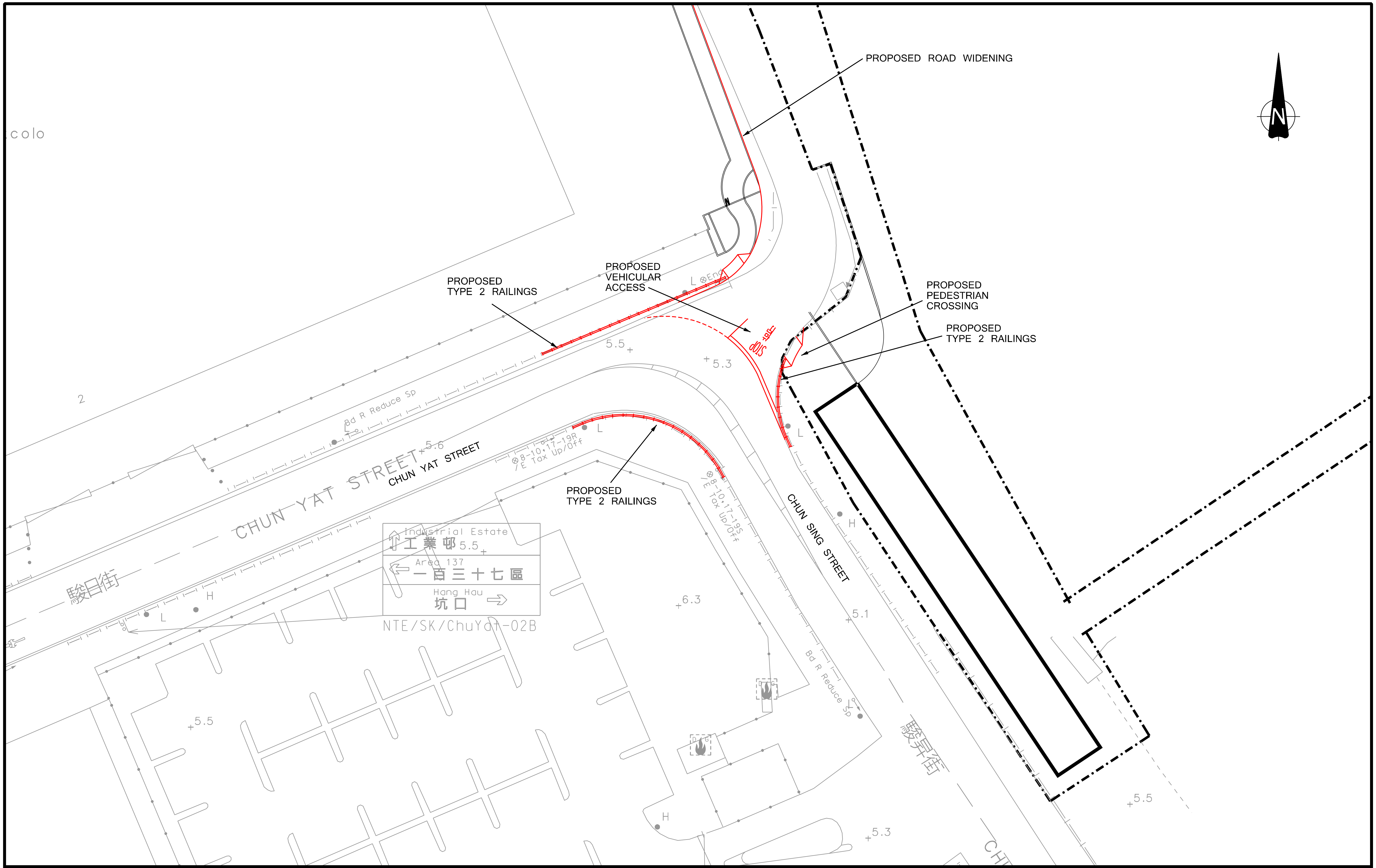
Drawing Title

PROPOSED UPPER PLATFORM

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:1000(A3)	JUN 2025	2.4	B

SYSTRA MVA

Original Size : A3


PROPOSED ROAD WIDENING
N
colo
PROPOSED TYPE 2 RAILINGS
PROPOSED VEHICULAR ACCESS
PROPOSED PEDESTRIAN CROSSING
PROPOSED TYPE 2 RAILINGS
PROPOSED TYPE 2 RAILINGS
SLOW
CHUN YAT STREET
CHUN YAT STREET
駿日街
CHUN SING STREET
駿昇街
Bd R Reduce Sp
Bd R Reduce Sp
8-10,17-19R /E Tax Up/Off
8-10,17-19S /E Tax Up/Off
Industrial Estate 工業邨
Area 137 一百三十七區
Hang Hau 坑口
NTE/SK/ChuYat-02B
L
H
2
5.5
5.3
5.6
5.5
6.3
5.1
5.5
5.5
5.3

-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	14JAN26
A	MINOR AMENDMENT	GPH	24NOV25
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR
CULTURE (PUBLIC RIDING SCHOOL) WITH
ANCILLARY FACILITIES AT GOVERNMENT LAND IN
D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN
TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

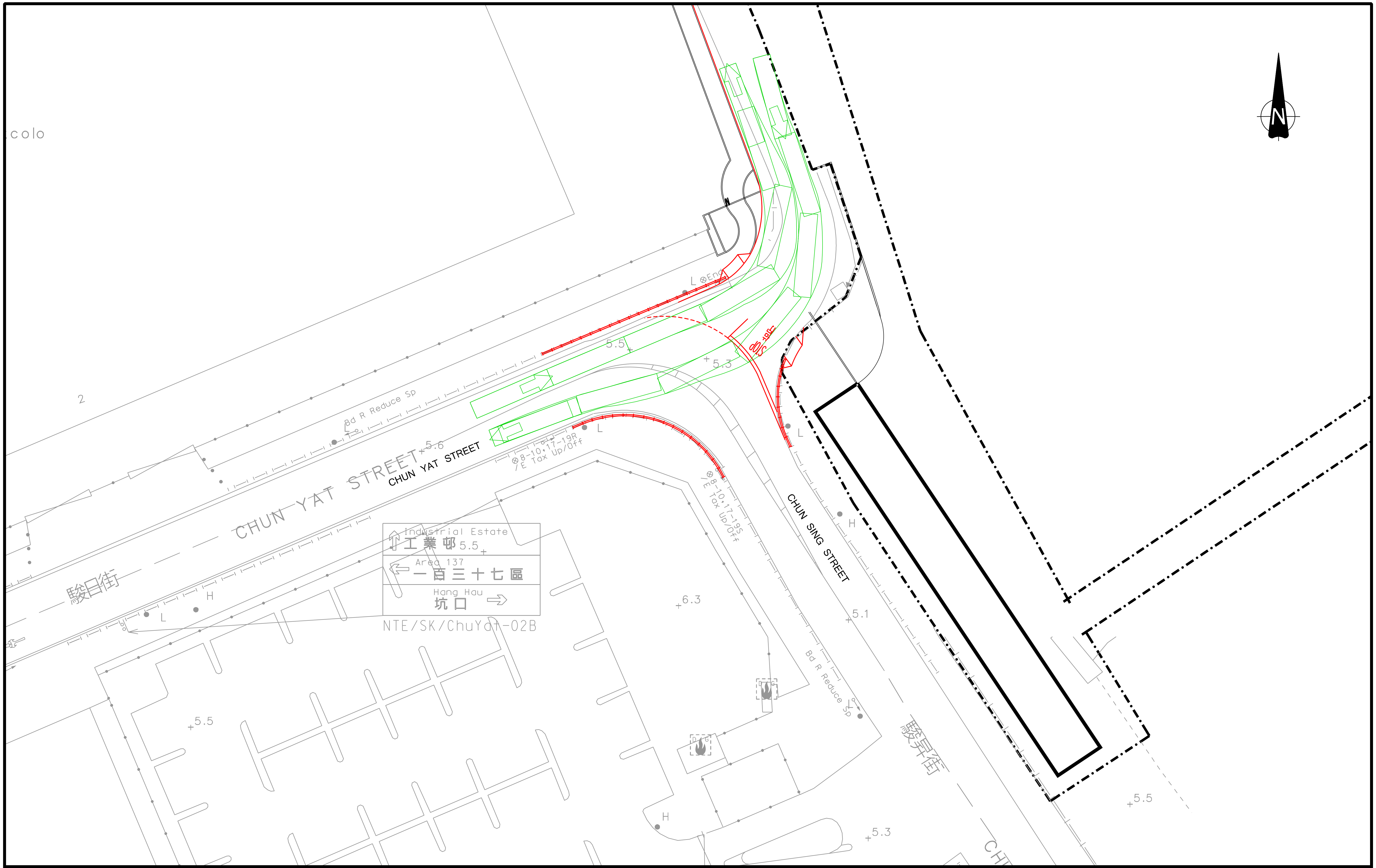
Drawing Title

**PROPOSED VEHICULAR AND
PEDESTRIAN ACCESS ARRANGEMENT**

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:500(A3)	OCT 2025	2.5	B

SYSTRA MVA

Original Size : A3


colo
2
CHUN YAT STREET
CHUN YAT STREET
駿日街
Bd R Reduce Sp
5.6
5.5
5.3
L
L ⊗End
⊗8-10,17-19R / E Tax Up/Off
⊗8-10,17-19S / E Tax Up/Off
CHUN SING STREET
駿昇街
Industrial Estate
工業邨
5.5
Area 137
一百三十七區
Hang Hau
坑口
NTE/SK/ChuYat-02B
H
L
6.3
5.1
Bd R Reduce Sp
5.5
5.5
5.3
5.3
H
CH
N

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

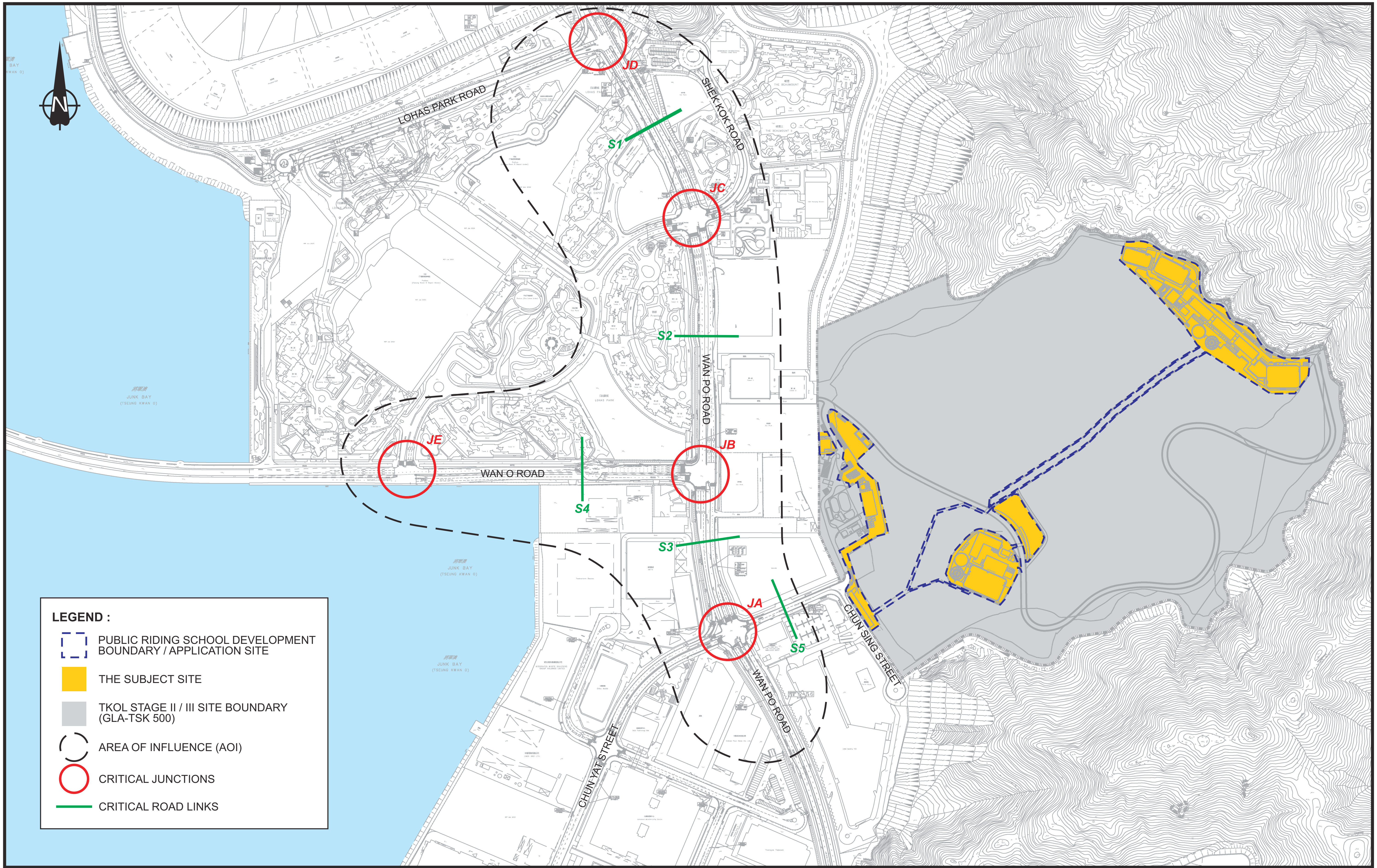
Drawing Title

SWEPT PATH ANALYSIS FOR 12m LONG VEHICLE

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:500(A3)	OCT 2025	**2.5A**	-

SYSTRA MVA

Original Size : A3



N
LOHAS PARK ROAD
SHEK KOK ROAD
WAN PO ROAD
WAN O ROAD
WAN PO ROAD
CHUN SING STREET
CHUN YAT STREET
JUNK BAY (TSEUNG KWAN O)
JUNK BAY (TSEUNG KWAN O)
JUNK BAY (TSEUNG KWAN O)
JD
JC
JB
JA
JE
S1
S2
S3
S4
S5
LEGEND :
PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY / APPLICATION SITE
THE SUBJECT SITE
TKOL STAGE II / III SITE BOUNDARY (GLA-TSK 500)
AREA OF INFLUENCE (AOI)
CRITICAL JUNCTIONS
CRITICAL ROAD LINKS

Rev.	Description	Checked	Date
-	-	-	-
C	MINOR AMENDMENT	GPH	28JAN26
B	MINOR AMENDMENT	PML	26SEP25
A	TD'S COMMENT INCORPORATED	PML	2SEP25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

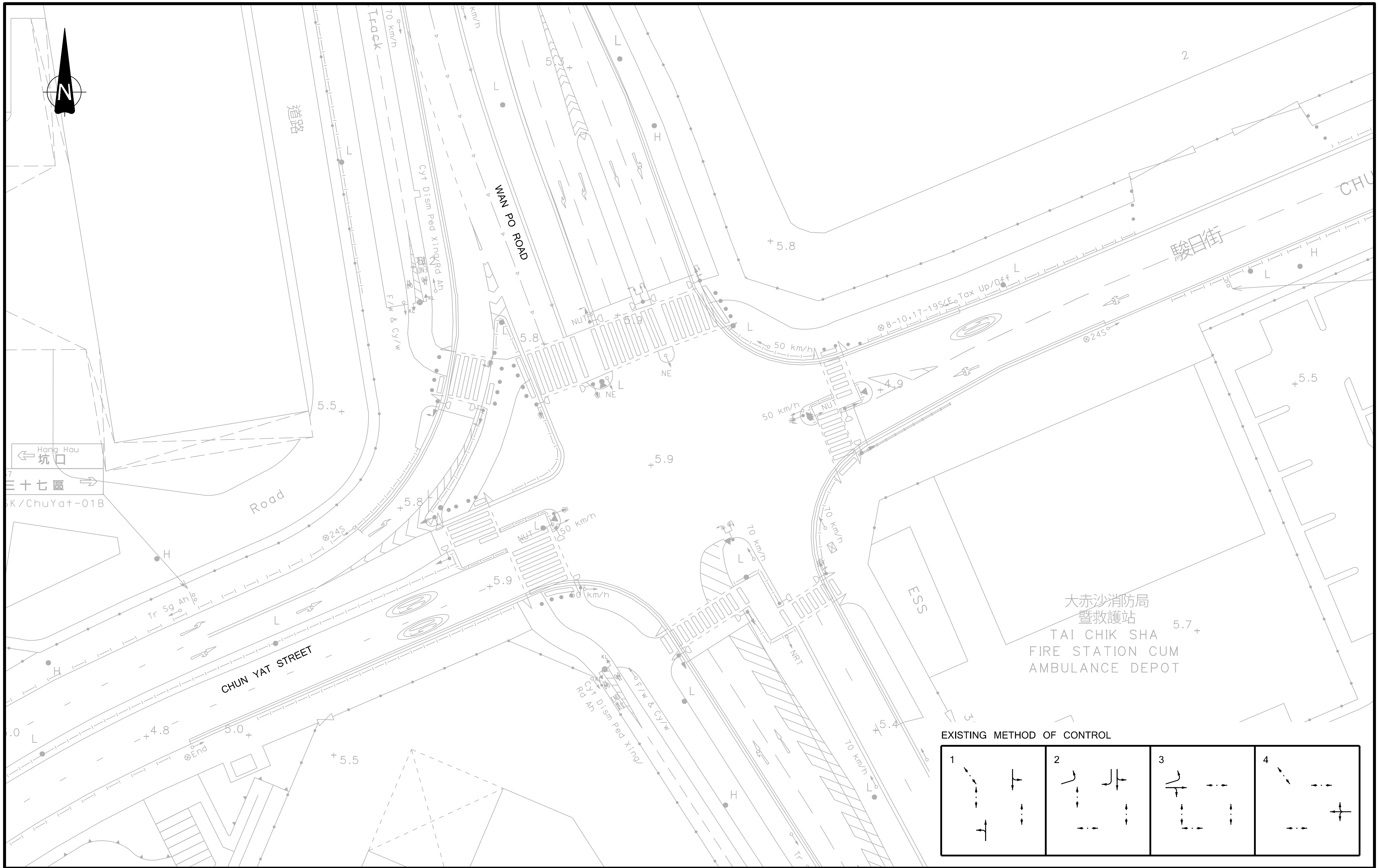
LOCATION OF KEY JUNCTIONS AND ROAD LINKS

SYSTRA MVA

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	JUL 2025	3.1	C

CHK50812010/TIA/F31-C.CDR/LLH/28JAN26

Original Size : A3


N
WAN PO ROAD
CHUN YAT STREET
駿日街
CHU
Road
道路
Track
70 km/h
50 km/h
Cyt Dism Ped Xing/Rd Ah
F/w & Cy/w
NUT
NE
NRT
L
H
2
5.3
5.8
5.9
5.5
5.4
4.9
4.8
5.0
5.7
Hang Hau
坑口
三十七區
K/ChuYat-01B
Tr Sg Ah
⊗24S
⊗8-10,17-19S/E Tax Up/Off
⊗End
ESS
大赤沙消防局
暨救護站
TAI CHIK SHA
FIRE STATION CUM
AMBULANCE DEPOT
EXISTING METHOD OF CONTROL
1
2
3
4

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
-	-	-	-
A	MINOR AMENDMENT	GPH	24NOV25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

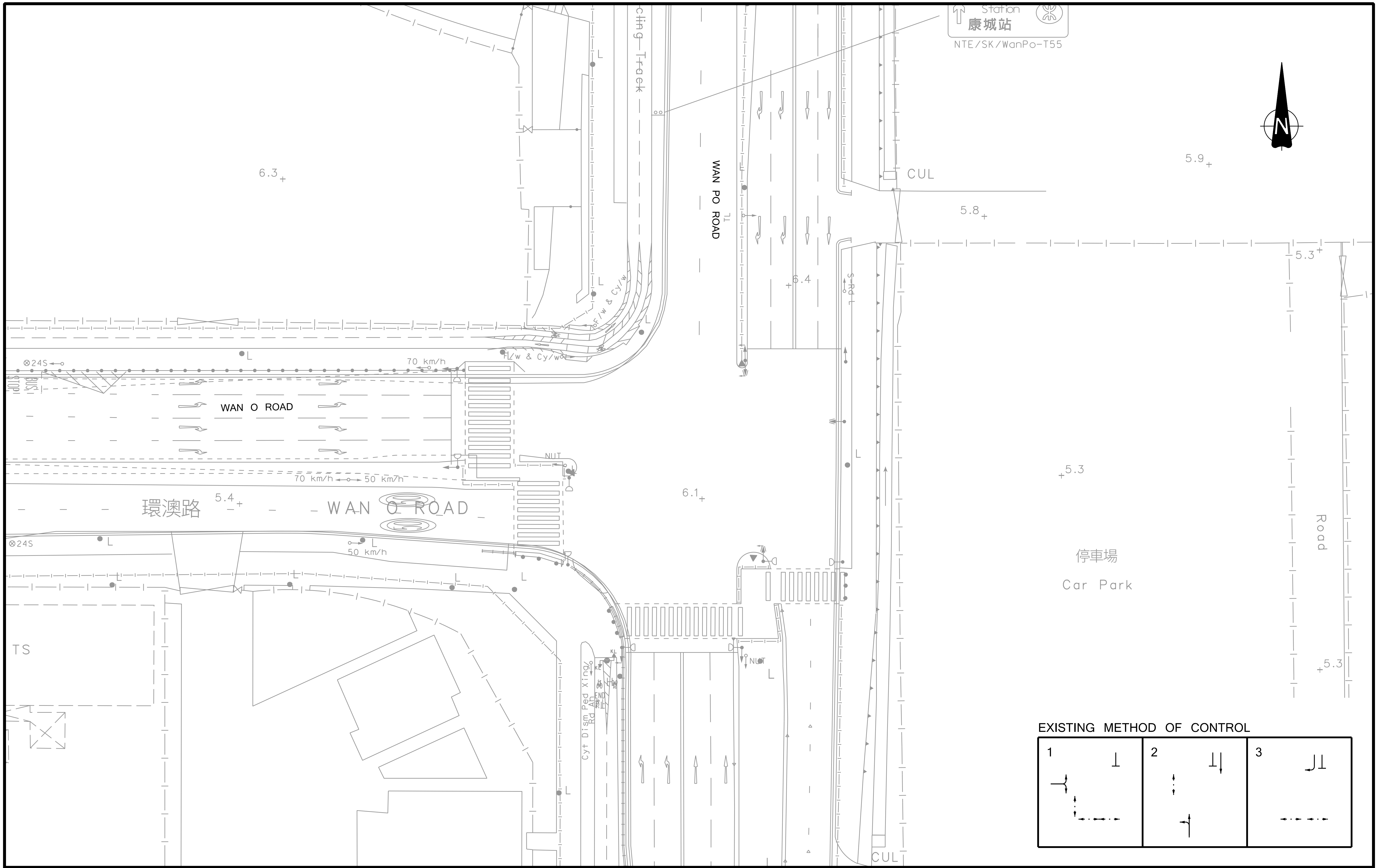
Drawing Title

EXISTING JUNCTION LAYOUT OF WAN PO ROAD / CHUN YAT STREET (JA)

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:500(A3)	NOV 2024	3.2	A

SYSTRA MVA

Original Size : A3


Station
康城站
NTE/SK/WanPo-T55
cling Track
WAN PO ROAD
CUL
5.9
5.8
5.3
6.3
6.4
S-Rd L
F/w & Cy/w
⊗24S
70 km/h
WAN O ROAD
NUT
70 km/h
50 km/h
環澳路
5.4
WAN O ROAD
6.1
5.3
停車場
Car Park
Road
⊗24S
50 km/h
TS
Cyt Dism Ped Xing/Rd Ah
END
NLT
L
5.3
CUL
EXISTING METHOD OF CONTROL
1
2
3

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
-	-	-	-
A	MINOR AMENDMENT	GPH	24NOV25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

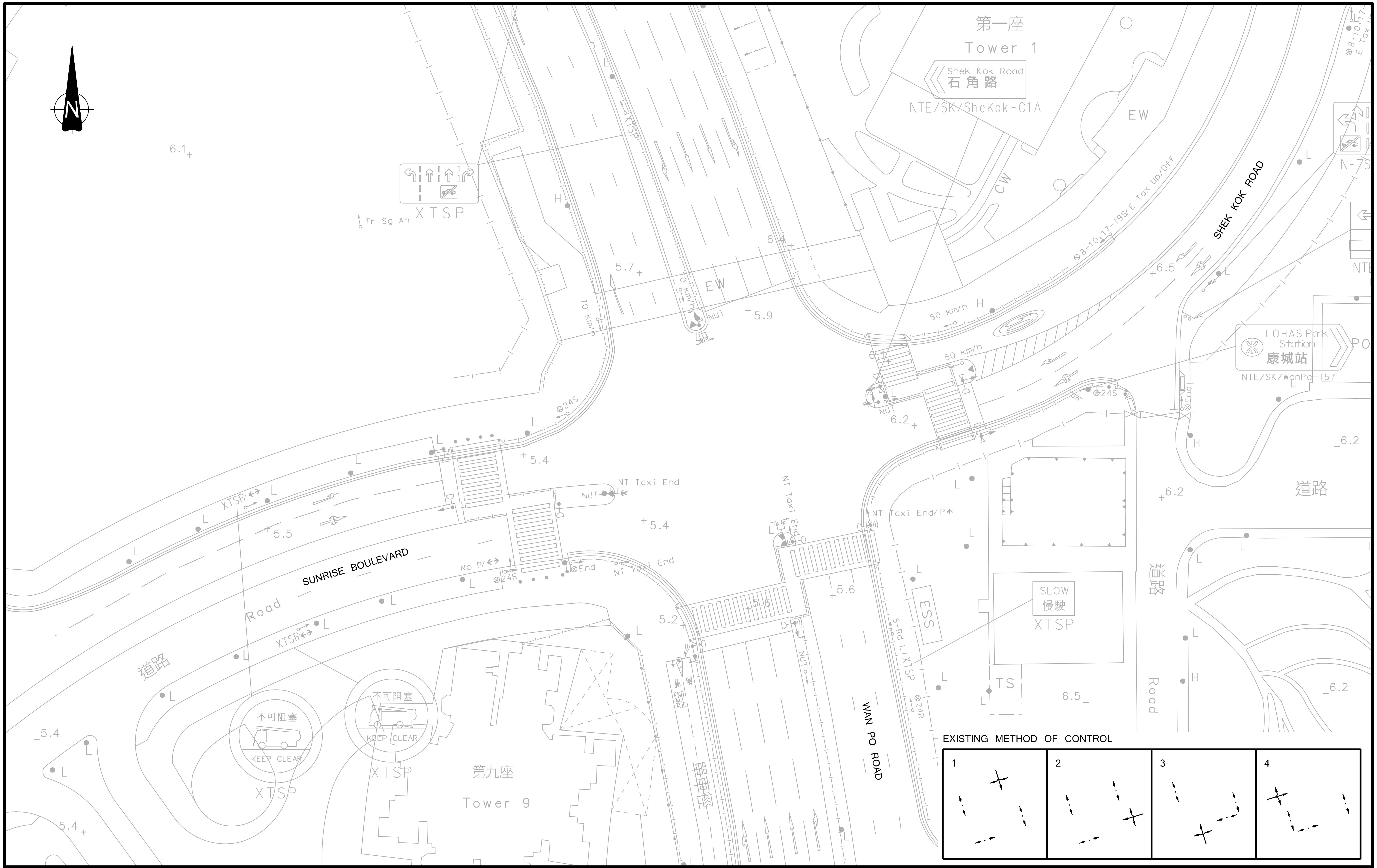
Drawing Title

EXISTING JUNCTION LAYOUT OF
WAN PO ROAD / WAN O ROAD (JB)

SYSTRA MVA

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:500(A3)	NOV 2024	3.3	A

Original Size : A3


N
Tower 1
第一座
Shek Kok Road
石角路
NTE/SK/SheKok-01A
EW
CW
SHEK KOK ROAD
8-10,17-19S/E Tax Up/Off
50 km/h
LOHAS Park Station
康城站
NTE/SK/WanPo-157
XTSP
Tr Sg Ah
70 km/h
NUT
NT Taxi End
NT Taxi End/P
SUNRISE BOULEVARD
Road
道路
No P/
24R
24S
WAN PO ROAD
S-Rd L/XTSP
ESS
SLOW
慢駛
TS
不可阻塞
KEEP CLEAR
第九座
Tower 9
6.1
5.7
5.9
6.4
6.5
6.2
5.4
5.5
5.6
5.2
EXISTING METHOD OF CONTROL
1
2
3
4

-	-	-	-
-	-	-	-
-	-	-	-
A	MINOR AMENDMENT	GPH	24NOV25
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

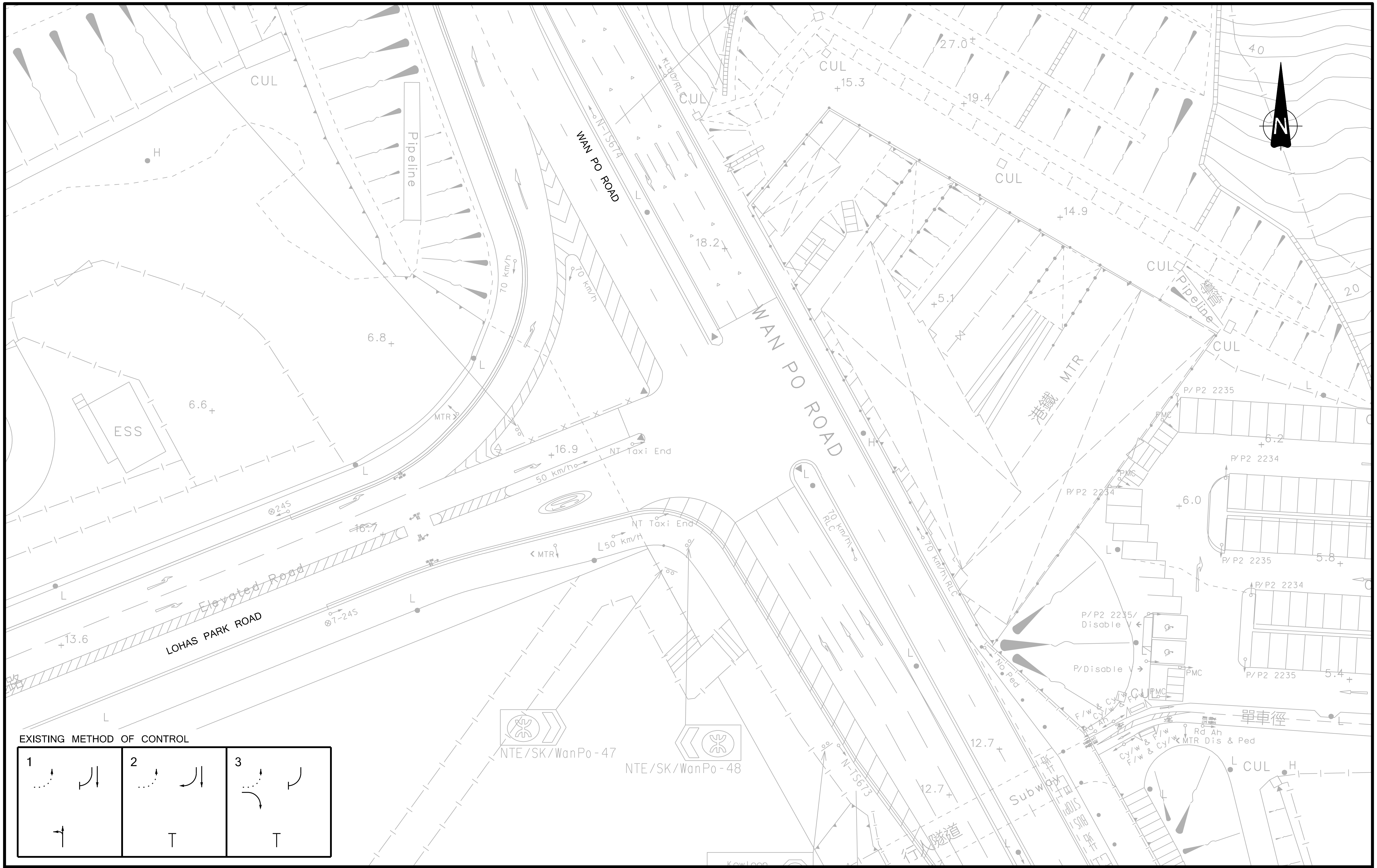
Drawing Title

EXISTING JUNCTION LAYOUT OF
WAN PO ROAD / SHEK KOK ROAD / SUNRISE BOULEVARD (JC)

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:500(A3)	NOV 2024	3.4	A

SYSTRA MVA

Original Size : A3


N
WAN PO ROAD
WAN PO ROAD
LOHAS PARK ROAD
Elevated Road
Pipeline
CUL
ESS
MTR
港鐵 MTR
NT Taxi End
50 km/h
70 km/h
70 km/h RLC
Subway
行人隧道
單車徑
NTE/SK/WanPo-47
NTE/SK/WanPo-48
N-TS674
N-TS673
No Ped
P/Disable
P/P2 2234
P/P2 2235
PMC
6.8
6.6
16.9
16.7
13.6
18.2
15.3
19.4
27.0
14.9
5.1
6.2
6.0
5.8
5.4
12.7
40
20
EXISTING METHOD OF CONTROL
1
2
3

-	-	-	-
-	-	-	-
-	-	-	-
A	MINOR AMENDMENT	GPH	24NOV25
Rev.	Description	Checked	Date

Project Title

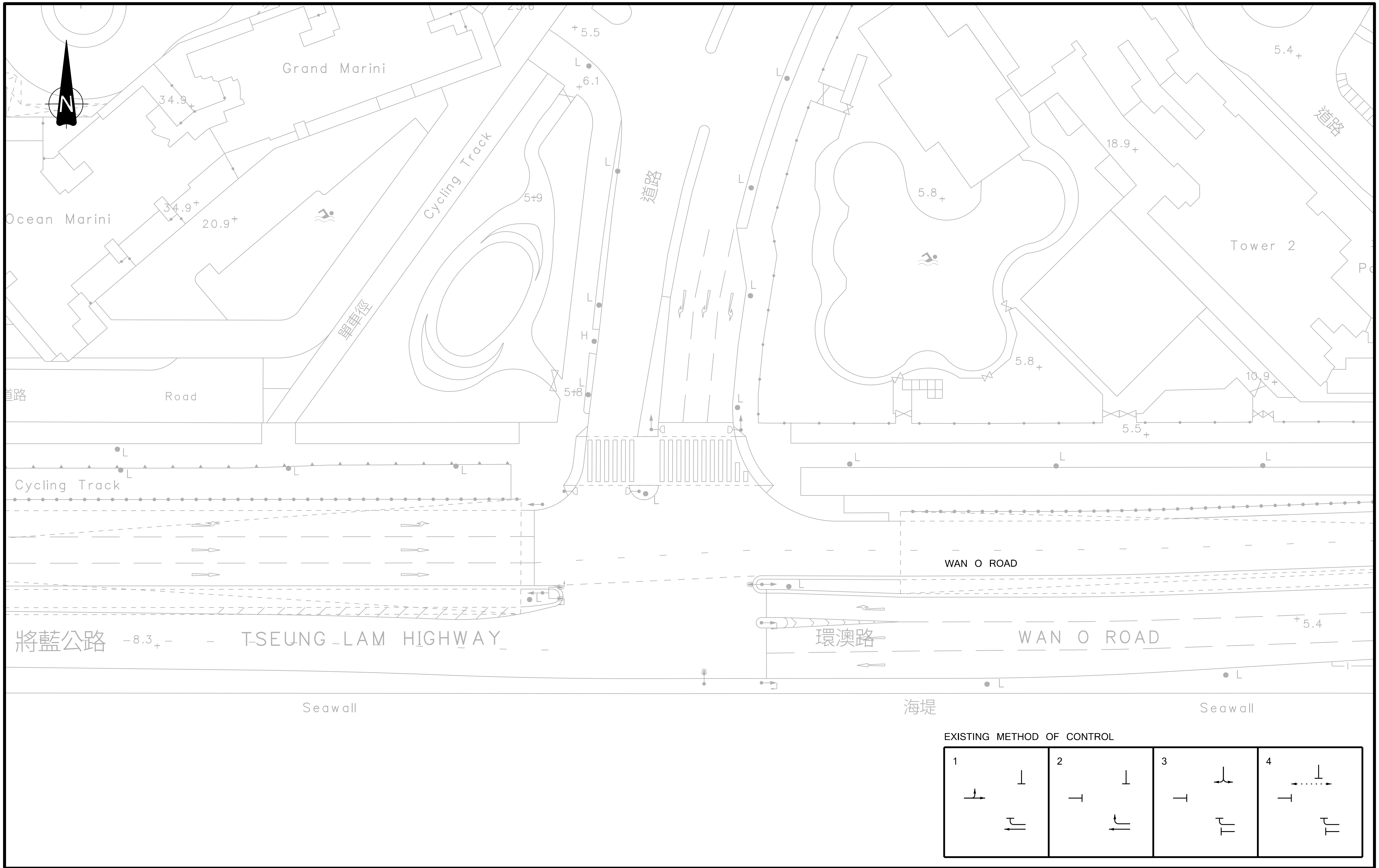
PROPOSED PLACE OF RECREATION, SPORTS OR
CULTURE (PUBLIC RIDING SCHOOL) WITH
ANCILLARY FACILITIES AT GOVERNMENT LAND IN
D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN
TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

Drawing Title

**EXISTING JUNCTION LAYOUT OF WAN PO ROAD /
LOHAS PARK ROAD (JD)**

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:500(A3)	NOV 2024	3.5	A

Original Size : A3


N
Grand Marini
34.9
Ocean Marini
34.9
20.9
Cycling Track
單車徑
5.9
5.5
6.1
道路
5.8
18.9
5.4
道路
Tower 2
5.8
10.9
5.5
5.8
道路
Road
L
H
Cycling Track
WAN O ROAD
將藍公路
8.3
TSEUNG LAM HIGHWAY
環澳路
WAN O ROAD
5.4
Seawall
海堤
Seawall
EXISTING METHOD OF CONTROL
1
2
3
4

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
-	-	-	-
A	MINOR AMENDMENT	GPH	24NOV25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

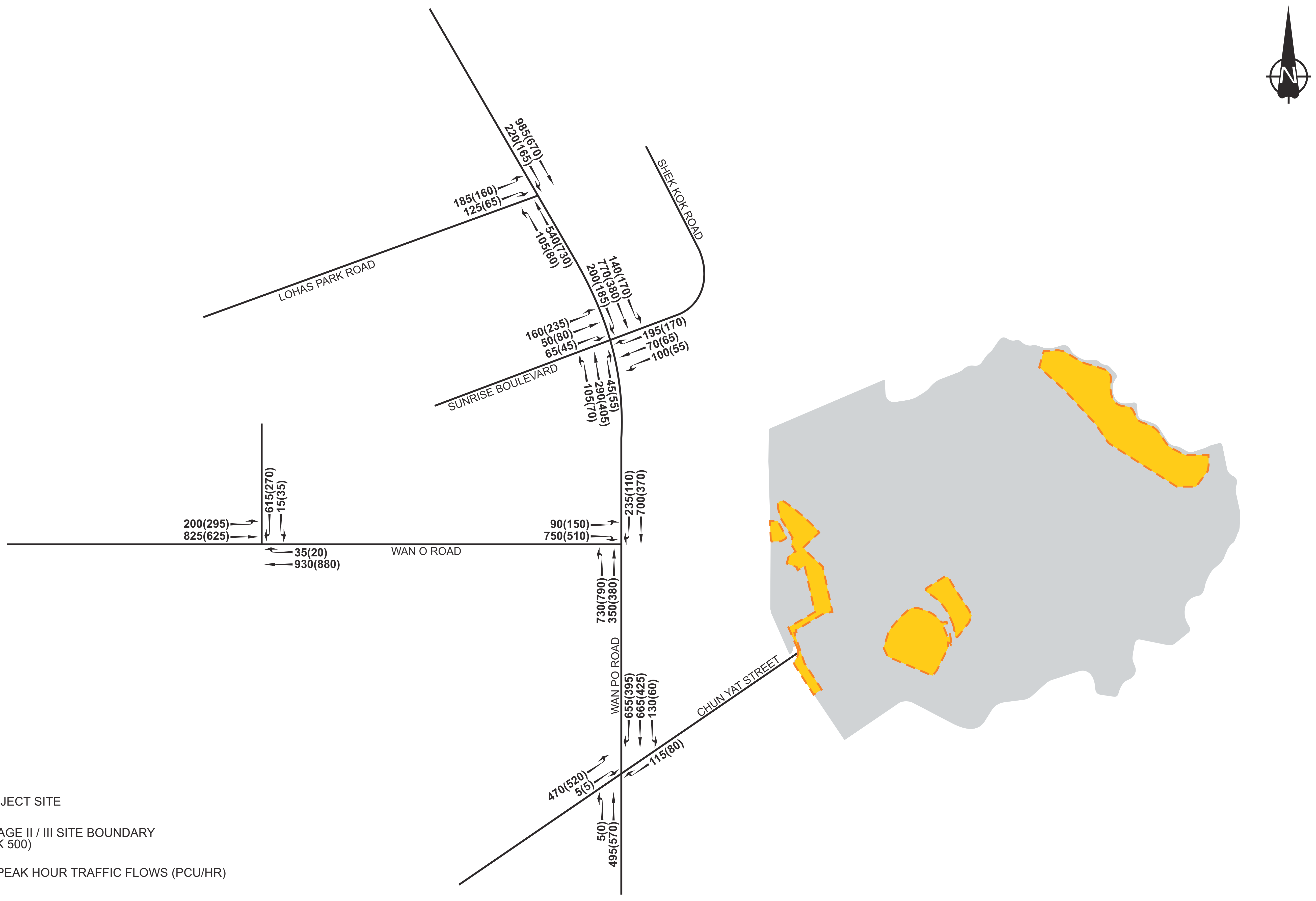
Drawing Title

EXISTING JUNCTION LAYOUT OF
WAN O ROAD / SUNRISE BOULEVARD (JE)

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:500(A3)	NOV 2024	3.6	A

SYSTRA MVA

Original Size : A3


N
985(670)
220(165)
185(160)
125(65)
540(730)
105(80)
LOHAS PARK ROAD
SHEK KOK ROAD
140(170)
770(380)
200(185)
160(235)
50(80)
65(45)
195(170)
70(65)
100(55)
SUNRISE BOULEVARD
105(70)
290(405)
45(55)
615(270)
15(35)
200(295)
825(625)
35(20)
930(880)
WAN O ROAD
90(150)
750(510)
235(110)
700(370)
730(790)
350(380)
WAN PO ROAD
655(395)
665(425)
130(60)
CHUN YAT STREET
470(520)
5(5)
115(80)
5(0)
495(570)

LEGEND :

🟨 THE SUBJECT SITE

⬜ TKOL STAGE II / III SITE BOUNDARY
(GLA-TSK 500)

90(150) AM(PM) PEAK HOUR TRAFFIC FLOWS (PCU/HR)

-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	28JAN26
A	MINOR AMENDMENT	PML	26SEP25
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

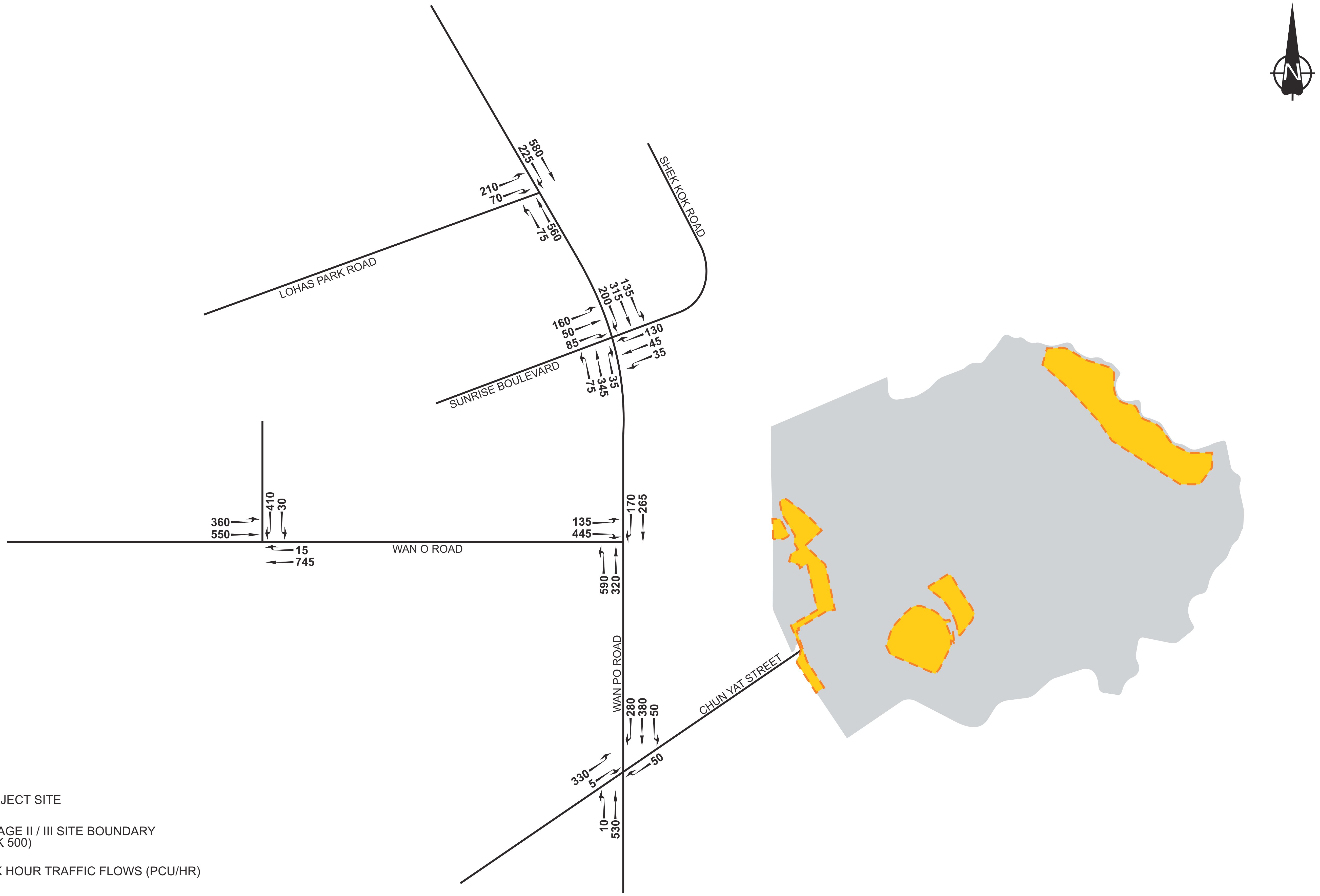
Drawing Title

OBSERVED TRAFFIC FLOWS (WEEKDAY)

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	JUL 2025	3.7	B

CHK50812010/TIA/F37-B.CDR/LLH/28JAN26

Original Size : A3


N
LOHAS PARK ROAD
580
225
210
70
560
75
SHEK KOK ROAD
135
315
200
160
50
85
130
45
35
SUNRISE BOULEVARD
75
345
35
410
30
360
550
15
745
WAN O ROAD
135
445
170
265
590
320
WAN PO ROAD
CHUN YAT STREET
280
380
50
330
5
50
10
530

LEGEND :

🟨 THE SUBJECT SITE

▨ TKOL STAGE II / III SITE BOUNDARY
(GLA-TSK 500)

135 PM PEAK HOUR TRAFFIC FLOWS (PCU/HR)

-	-	-	-
-	-	-	-
-	-	-	-
A	MINOR AMENDMENT	GPH	28JAN26
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

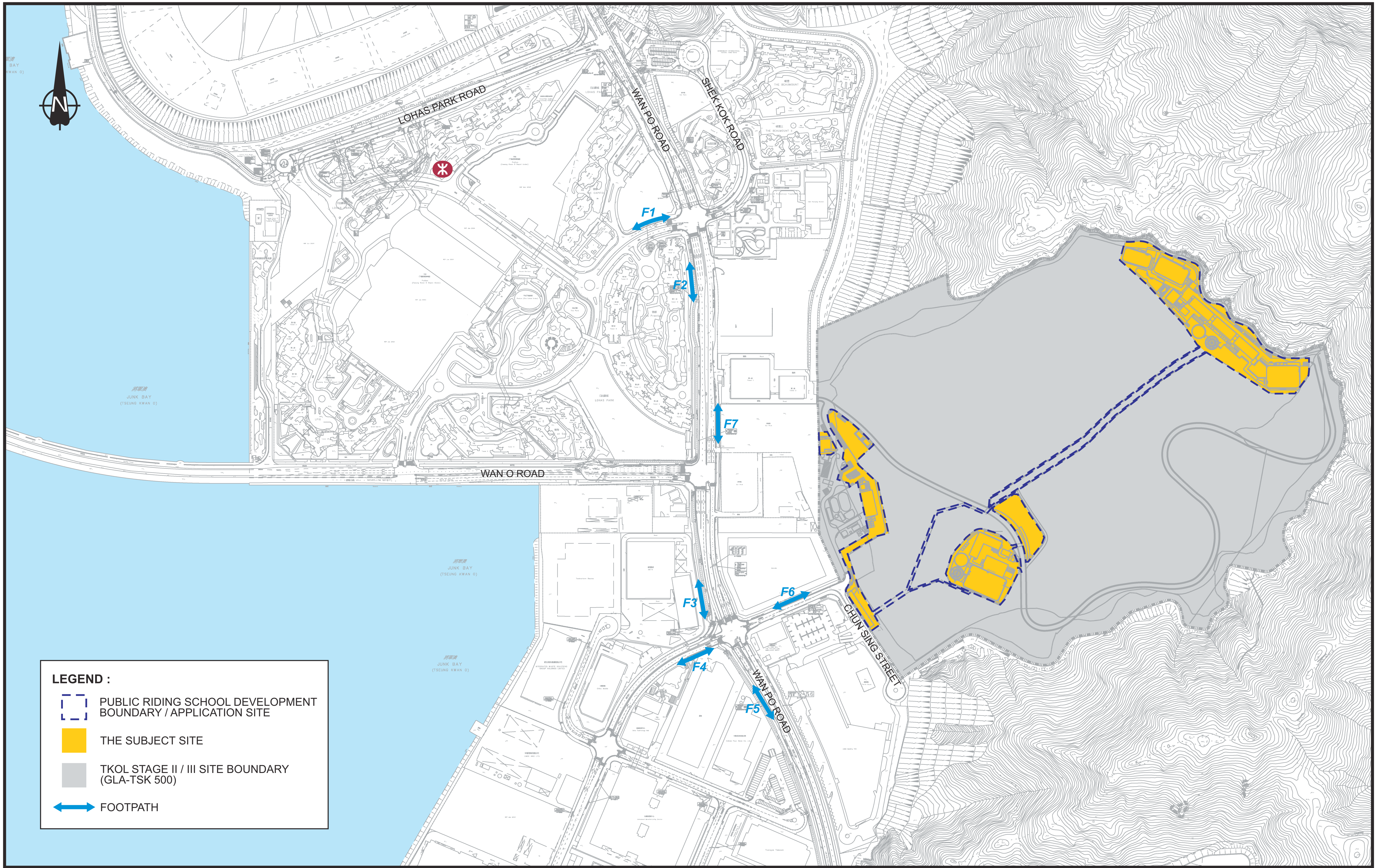
OBSERVED TRAFFIC FLOWS (WEEKEND)

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	OCT 2025	3.8	A

SYSTRA MVA

CHK50812010/TIA/F38-A.CDR/LLH/28JAN26

Original Size : A3


N
LOHAS PARK ROAD
WAN PO ROAD
SHEK KOK ROAD
F1
F2
F7
WAN O ROAD
JUNK BAY
(TSEUNG KWAN O)
JUNK BAY
(TSEUNG KWAN O)
JUNK BAY
(TSEUNG KWAN O)
F3
F6
F4
F5
WAN PO ROAD
CHUN SING STREET
LOHAS PARK

LEGEND :

⬚	PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY / APPLICATION SITE
🟨	THE SUBJECT SITE
⬜	TKOL STAGE II / III SITE BOUNDARY (GLA-TSK 500)
⟷	FOOTPATH

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	28JAN26
A	MINOR AMENDMENT	GPH	24NOV25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

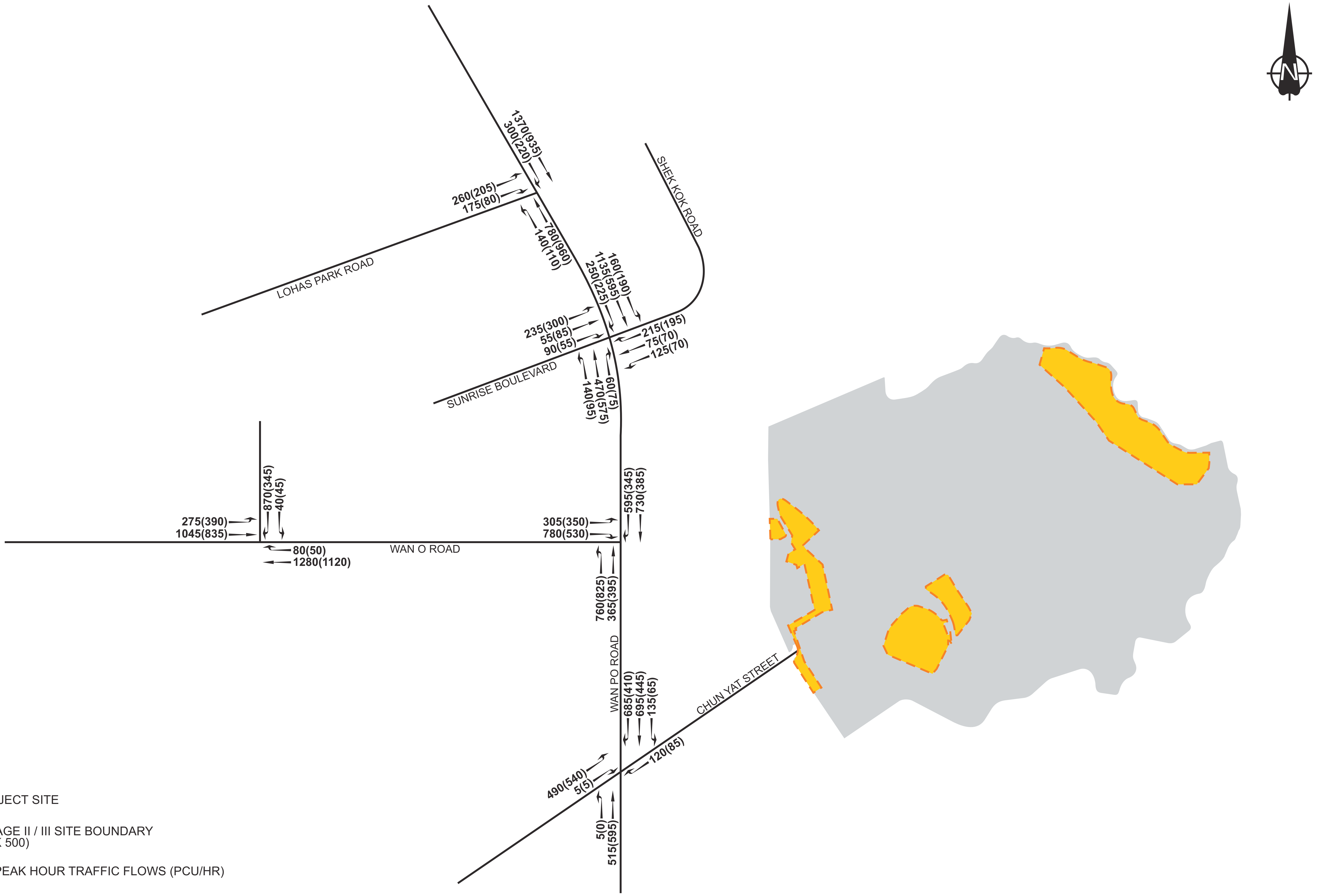
LOCATION OF EXISTING PEDESTRIAN FACILITIES

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	OCT 2025	3.9	B

SYSTRA MVA

CHK50812010/TIA/F39-B.CDR/LLH/28JAN26

Original Size : A3


N
1370(935)
300(220)
260(205)
175(80)
780(960)
140(110)
LOHAS PARK ROAD
SHEK KOK ROAD
160(190)
1135(595)
250(225)
235(300)
55(85)
90(55)
215(195)
75(70)
125(70)
SUNRISE BOULEVARD
140(95)
470(575)
60(75)
870(345)
40(45)
275(390)
1045(835)
80(50)
1280(1120)
WAN O ROAD
305(350)
780(530)
595(345)
730(385)
760(825)
365(395)
WAN PO ROAD
685(410)
695(445)
135(65)
CHUN YAT STREET
120(85)
490(540)
5(5)
5(0)
515(595)

LEGEND :

🟨 THE SUBJECT SITE

▨ TKOL STAGE II / III SITE BOUNDARY
(GLA-TSK 500)

305(350) AM(PM) PEAK HOUR TRAFFIC FLOWS (PCU/HR)

-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	28JAN26
A	MINOR AMENDMENT	PML	9OCT25
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

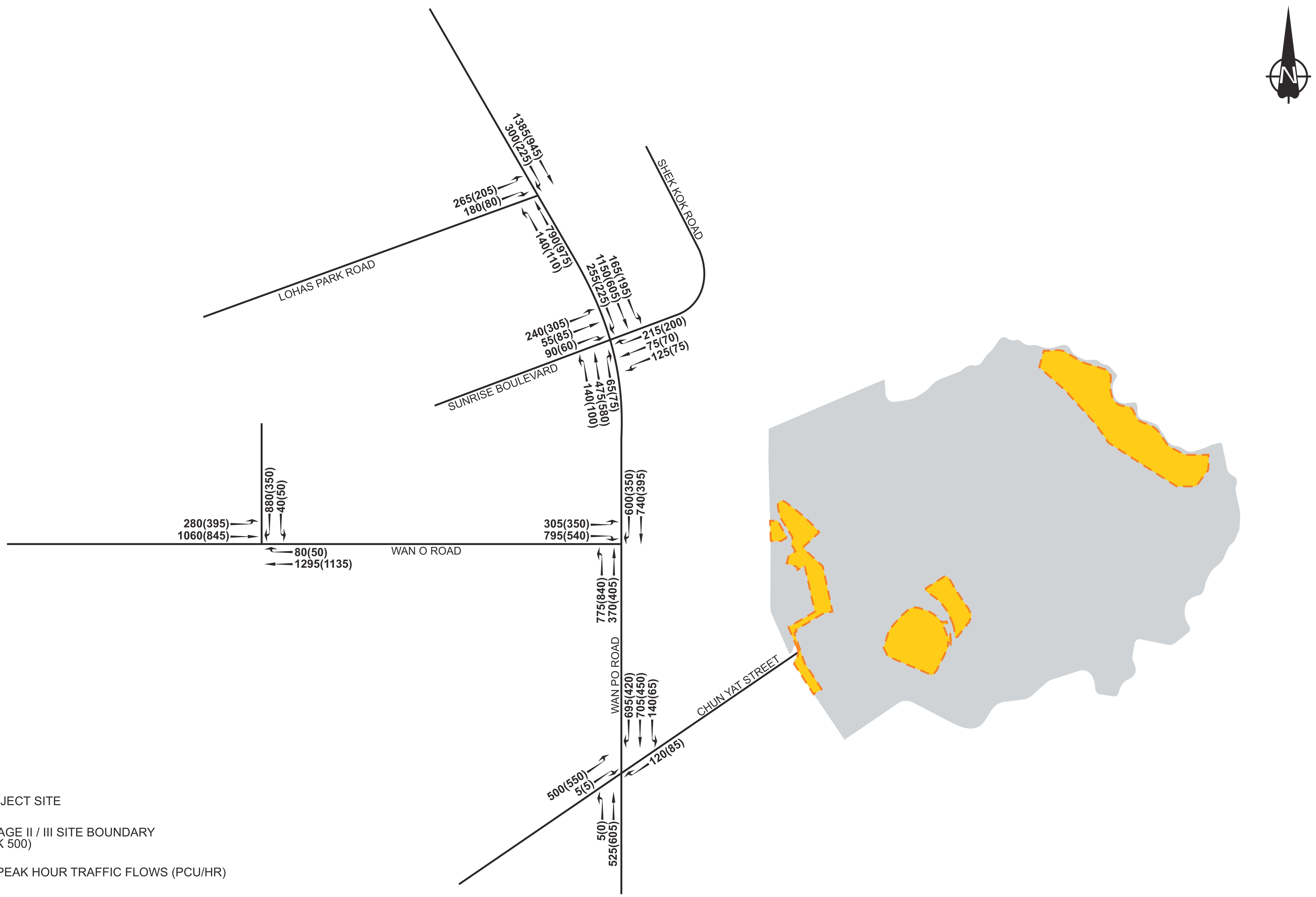
YEAR 2030 REFERENCE TRAFFIC FLOWS
(WITHOUT CONSTRUCTION WORKS)

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	JUL 2025	4.1	B

SYSTRA MVA

CHK50812010/TIA/F41-B.CDR/LLH/28JAN26

Original Size : A3


N
1385(945)
300(225)
265(205)
180(80)
790(975)
140(110)
LOHAS PARK ROAD
SHEK KOK ROAD
165(195)
1150(605)
255(225)
240(305)
55(85)
90(60)
215(200)
75(70)
125(75)
SUNRISE BOULEVARD
65(75)
475(580)
140(100)
880(350)
40(50)
280(395)
1060(845)
80(50)
1295(1135)
WAN O ROAD
305(350)
795(540)
600(350)
740(395)
775(840)
370(405)
WAN PO ROAD
695(420)
705(450)
140(65)
CHUN YAT STREET
120(85)
500(550)
5(5)
5(0)
525(605)

LEGEND :

🟨 THE SUBJECT SITE

⬜ TKOL STAGE II / III SITE BOUNDARY (GLA-TSK 500)

305(350) AM(PM) PEAK HOUR TRAFFIC FLOWS (PCU/HR)

-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	28JAN26
A	MINOR AMENDMENT	PML	9OCT25
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

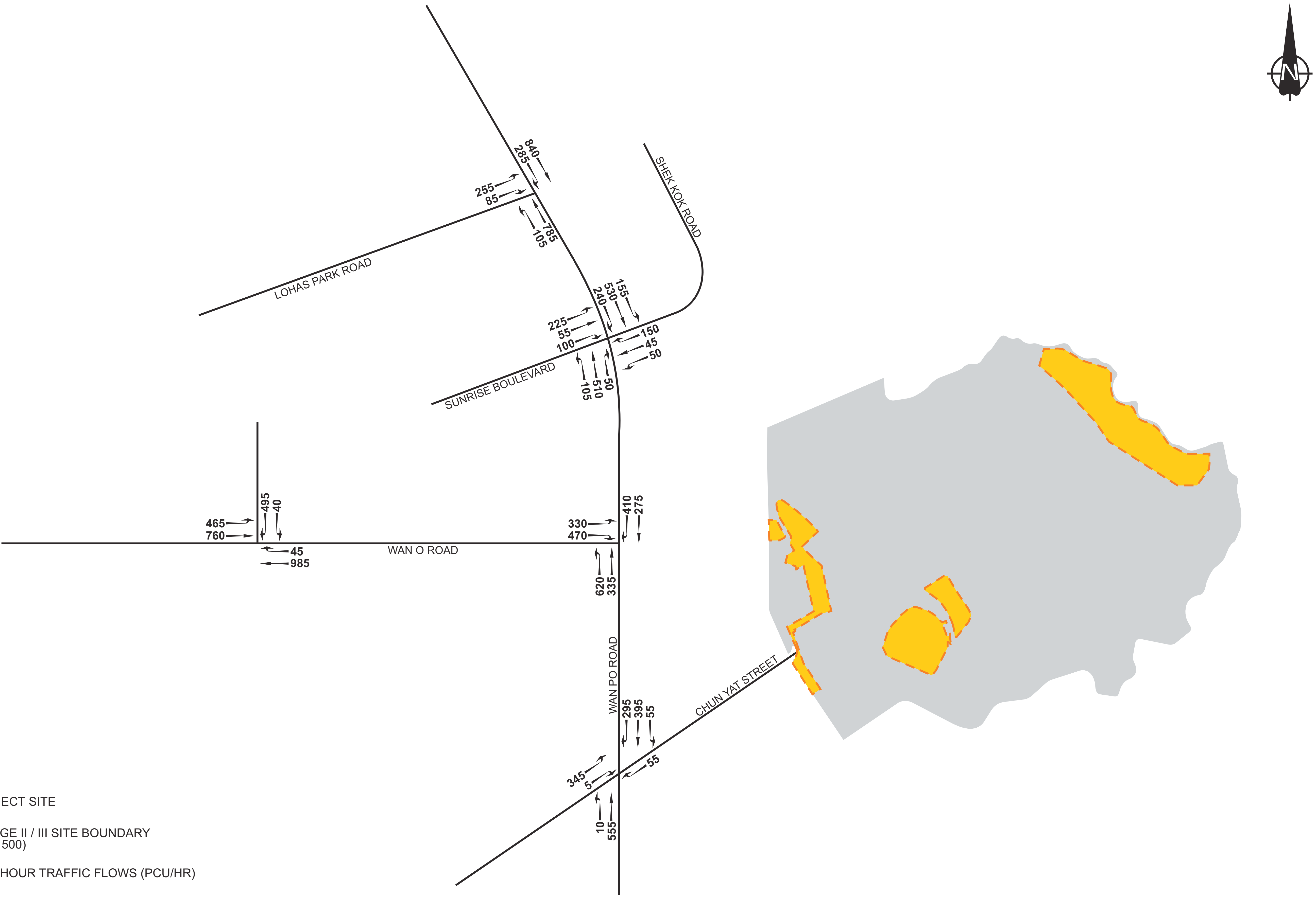
YEAR 2033 REFERENCE TRAFFIC FLOWS (WITHOUT PROPOSED PRS DEVELOPMENT) - WEEKDAY

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	JUL 2025	4.2	B

SYSTRA MVA

CHK50812010/TIA/F42-B.CDR/LLH/28JAN26

Original Size : A3


N
LOHAS PARK ROAD
SHEK KOK ROAD
SUNRISE BOULEVARD
WAN O ROAD
WAN PO ROAD
CHUN YAT STREET
840
285
255
85
785
105
155
530
240
225
55
100
150
45
50
105
510
50
495
40
465
760
45
985
330
470
410
275
620
335
295
395
55
345
5
55
10
555

LEGEND :

🟨 THE SUBJECT SITE

⬜ TKOL STAGE II / III SITE BOUNDARY (GLA-TSK 500)

330 PM PEAK HOUR TRAFFIC FLOWS (PCU/HR)

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	28JAN26
A	MINOR AMENDMENT	PML	9OCT25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

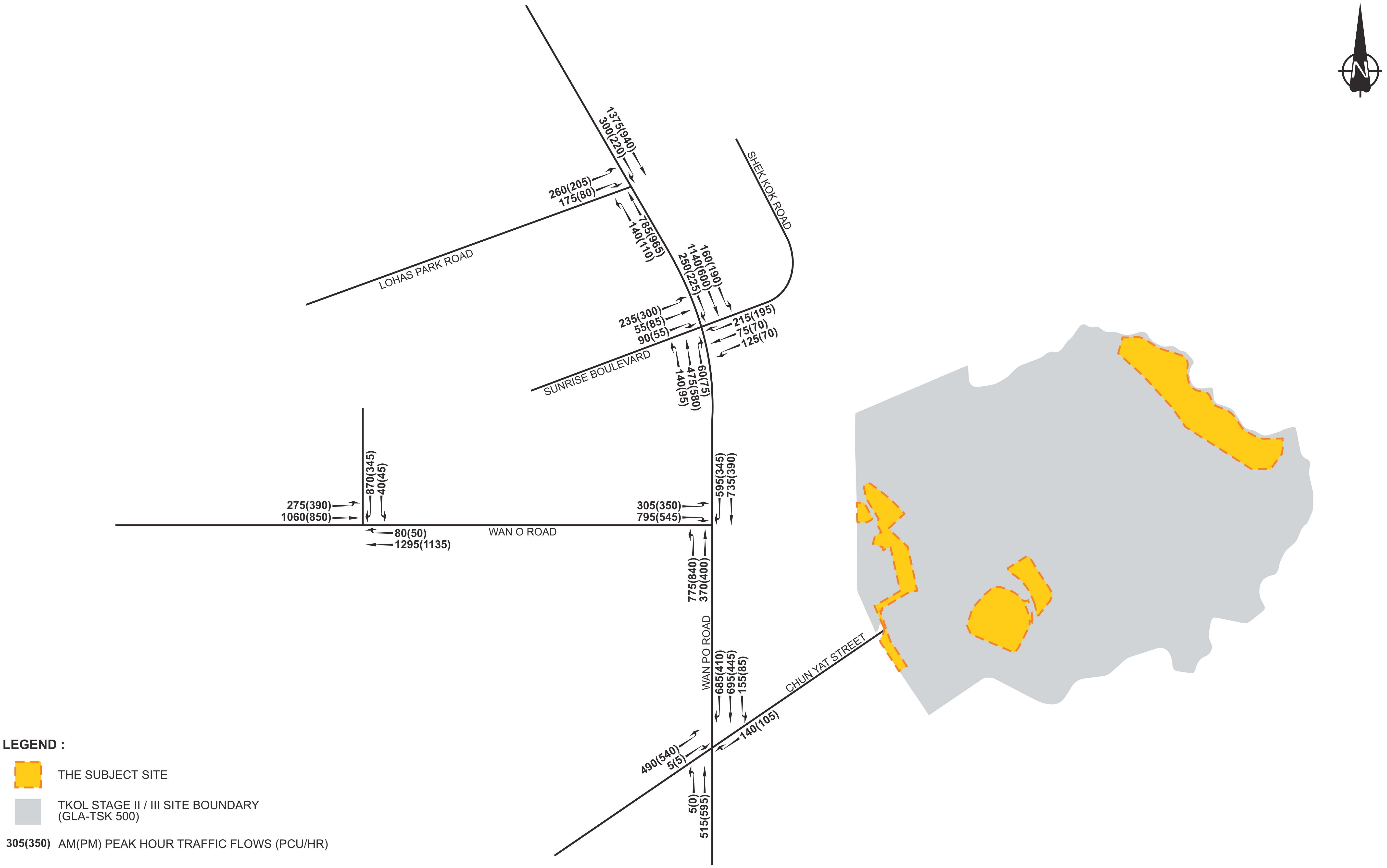
YEAR 2033 REFERENCE TRAFFIC FLOWS (WITHOUT PROPOSED PRS DEVELOPMENT) - WEEKEND

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	JUL 2025	4.3	B

SYSTRA MVA

CHK50812010/TIA/F43-B.CDR/LLH/28JAN26

Original Size : A3


N
LOHAS PARK ROAD
SHEK KOK ROAD
SUNRISE BOULEVARD
WAN O ROAD
WAN PO ROAD
CHUN YAT STREET
1375(940)
300(220)
260(205)
175(80)
785(965)
140(110)
160(190)
1140(600)
250(225)
235(300)
55(85)
90(55)
215(195)
75(70)
125(70)
140(95)
475(580)
60(75)
870(345)
40(45)
275(390)
1060(850)
80(50)
1295(1135)
305(350)
795(545)
595(345)
735(390)
775(840)
370(400)
685(410)
695(445)
155(85)
490(540)
5(5)
140(105)
5(0)
515(595)

LEGEND :

🟨 THE SUBJECT SITE

⬜ TKOL STAGE II / III SITE BOUNDARY (GLA-TSK 500)

305(350) AM(PM) PEAK HOUR TRAFFIC FLOWS (PCU/HR)

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	28JAN26
A	MINOR AMENDMENT	PML	9OCT25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

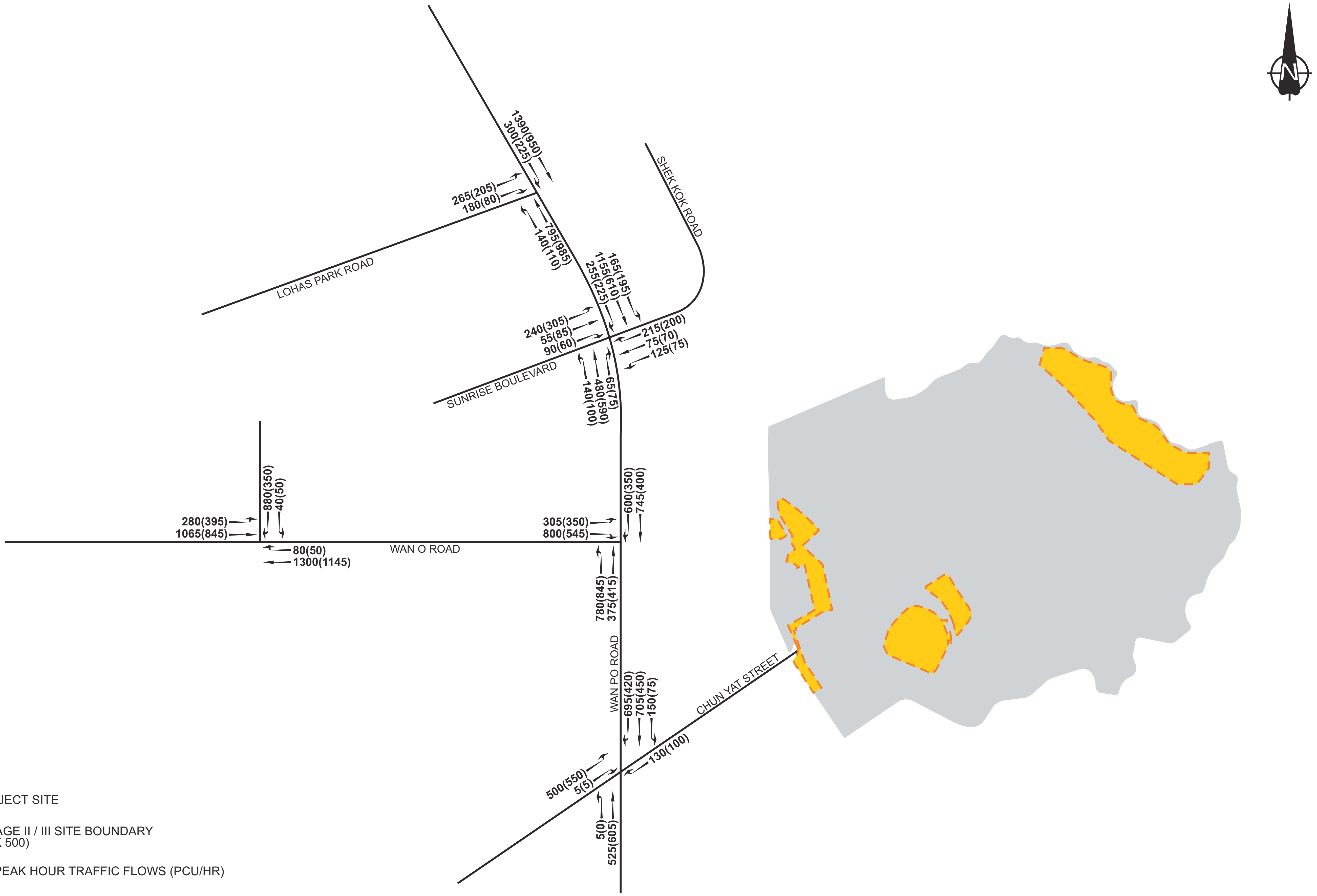
YEAR 2030 DESIGN TRAFFIC FLOWS (WITH CONSTRUCTION WORKS)

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	JUL 2025	4.4	B

SYSTRA MVA

CHK50812010/TIA/F44-B.CDR/LLH/28JAN26

Original Size : A3


N
1390(950)
300(225)
265(205)
180(80)
795(985)
140(110)
LOHAS PARK ROAD
SHEK KOK ROAD
165(195)
1155(610)
255(225)
240(305)
55(85)
90(60)
215(200)
75(70)
125(75)
SUNRISE BOULEVARD
65(75)
480(590)
140(100)
280(395)
1065(845)
880(350)
40(50)
80(50)
1300(1145)
WAN O ROAD
305(350)
800(545)
600(350)
745(400)
780(845)
375(415)
WAN PO ROAD
695(420)
705(450)
150(75)
CHUN YAT STREET
130(100)
500(550)
5(5)
5(0)
525(605)

LEGEND :

🟨 THE SUBJECT SITE

⬜ TKOL STAGE II / III SITE BOUNDARY
(GLA-TSK 500)

305(350) AM(PM) PEAK HOUR TRAFFIC FLOWS (PCU/HR)

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	28JAN26
A	MINOR AMENDMENT	GPH	24NOV25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR
CULTURE (PUBLIC RIDING SCHOOL) WITH
ANCILLARY FACILITIES AT GOVERNMENT LAND IN
D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN
TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

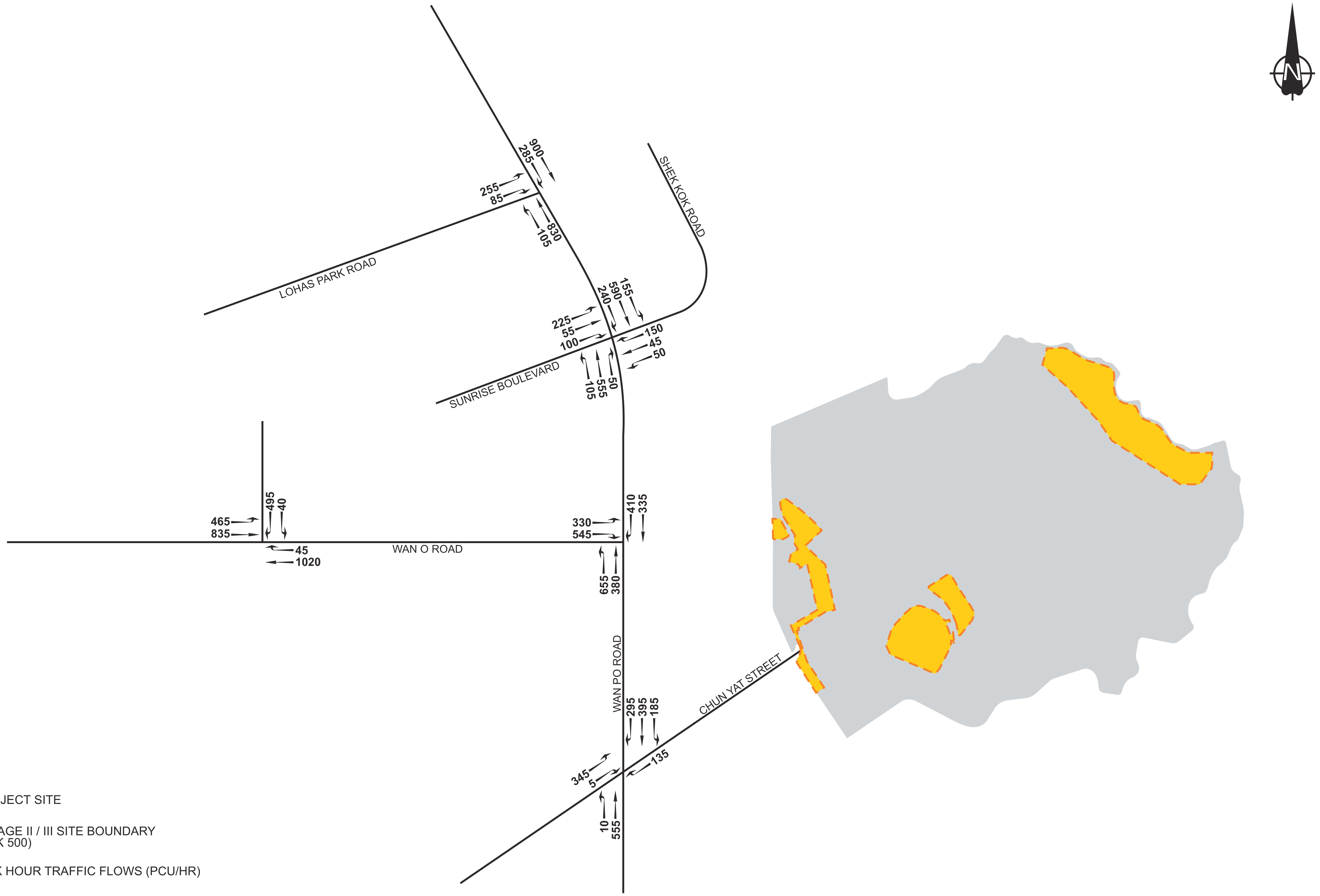
YEAR 2033 DESIGN TRAFFIC FLOWS
(WITH PROPOSED PRS DEVELOPMENT) - NORMAL OPERATION

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	OCT 2025	4.5	B

SYSTRA MVA

CHK50812010/TIA/F45-B.CDR/LLH/28JAN26

Original Size : A3


N
LOHAS PARK ROAD
SHEK KOK ROAD
SUNRISE BOULEVARD
WAN O ROAD
WAN PO ROAD
CHUN YAT STREET
900
285
255
85
830
105
155
590
240
225
55
100
150
45
50
105
555
50
495
40
465
835
45
1020
410
335
330
545
655
380
295
395
185
345
5
135
10
555

LEGEND :

🟨 THE SUBJECT SITE

▨ TKOL STAGE II / III SITE BOUNDARY
(GLA-TSK 500)

330 PM PEAK HOUR TRAFFIC FLOWS (PCU/HR)

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	28JAN26
A	MINOR AMENDMENT	GPH	24NOV25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

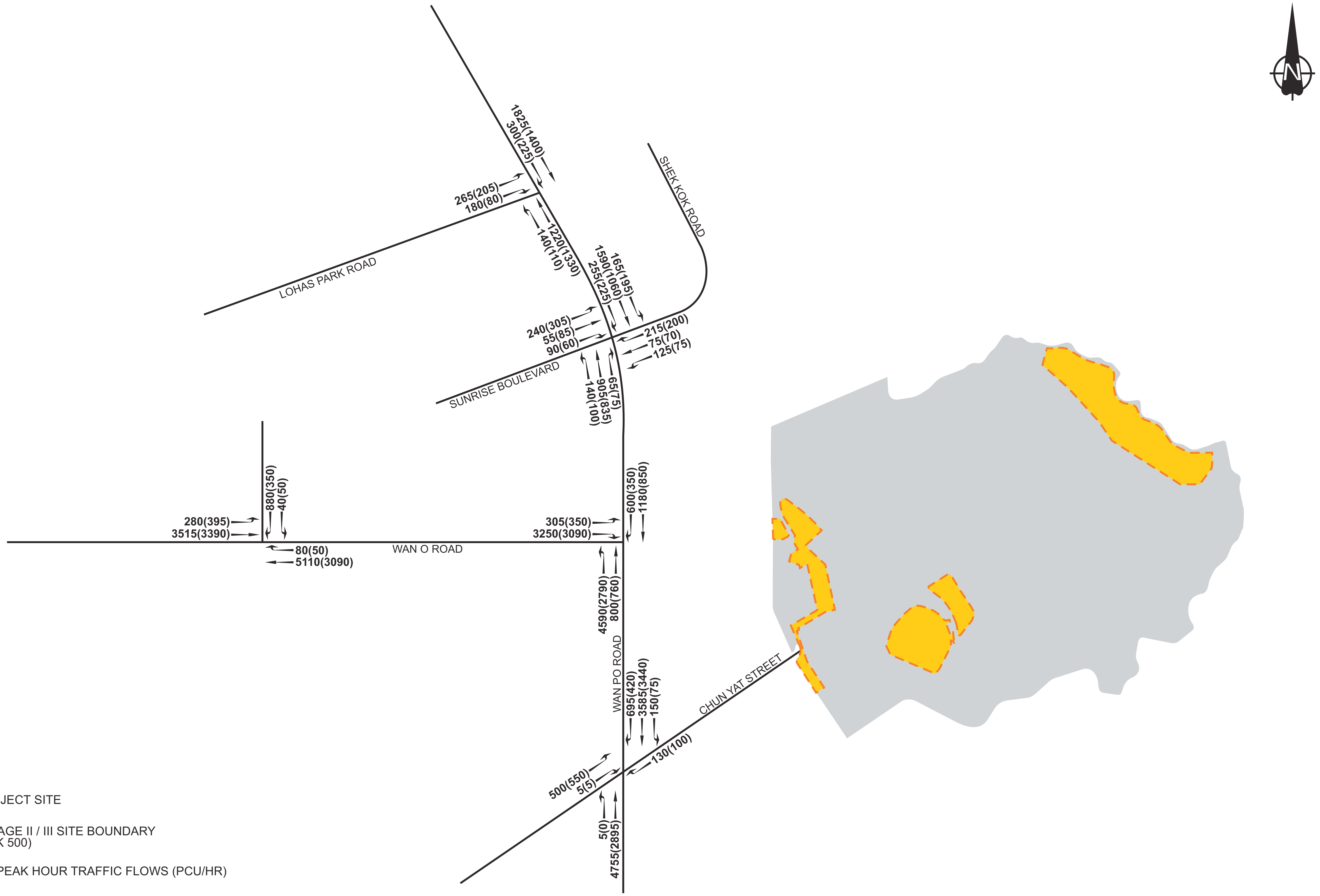
YEAR 2033 DESIGN TRAFFIC FLOWS (WITH PROPOSED PRS DEVELOPMENT) - EVENT DAY

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	OCT 2025	4.6	B

SYSTRA MVA

CHK50812010/TIA/F46-B.CDR/LLH/28JAN26

Original Size : A3


N
1825(1400)
300(225)
265(205)
180(80)
1220(1330)
140(110)
LOHAS PARK ROAD
SHEK KOK ROAD
165(195)
1590(1060)
255(225)
240(305)
55(85)
90(60)
215(200)
75(70)
125(75)
SUNRISE BOULEVARD
65(75)
905(835)
140(100)
880(350)
40(50)
280(395)
3515(3390)
80(50)
5110(3090)
WAN O ROAD
600(350)
1180(850)
305(350)
3250(3090)
4590(2790)
800(760)
WAN PO ROAD
695(420)
3585(3440)
150(75)
CHUN YAT STREET
130(100)
500(550)
5(5)
5(0)
4755(2895)

LEGEND :

🟨 THE SUBJECT SITE

⬜ TKOL STAGE II / III SITE BOUNDARY
(GLA-TSK 500)

305(350) AM(PM) PEAK HOUR TRAFFIC FLOWS (PCU/HR)

-	-	-	-
-	-	-	-
-	-	-	-
A	MINOR AMENDMENT	GPH	28JAN26
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

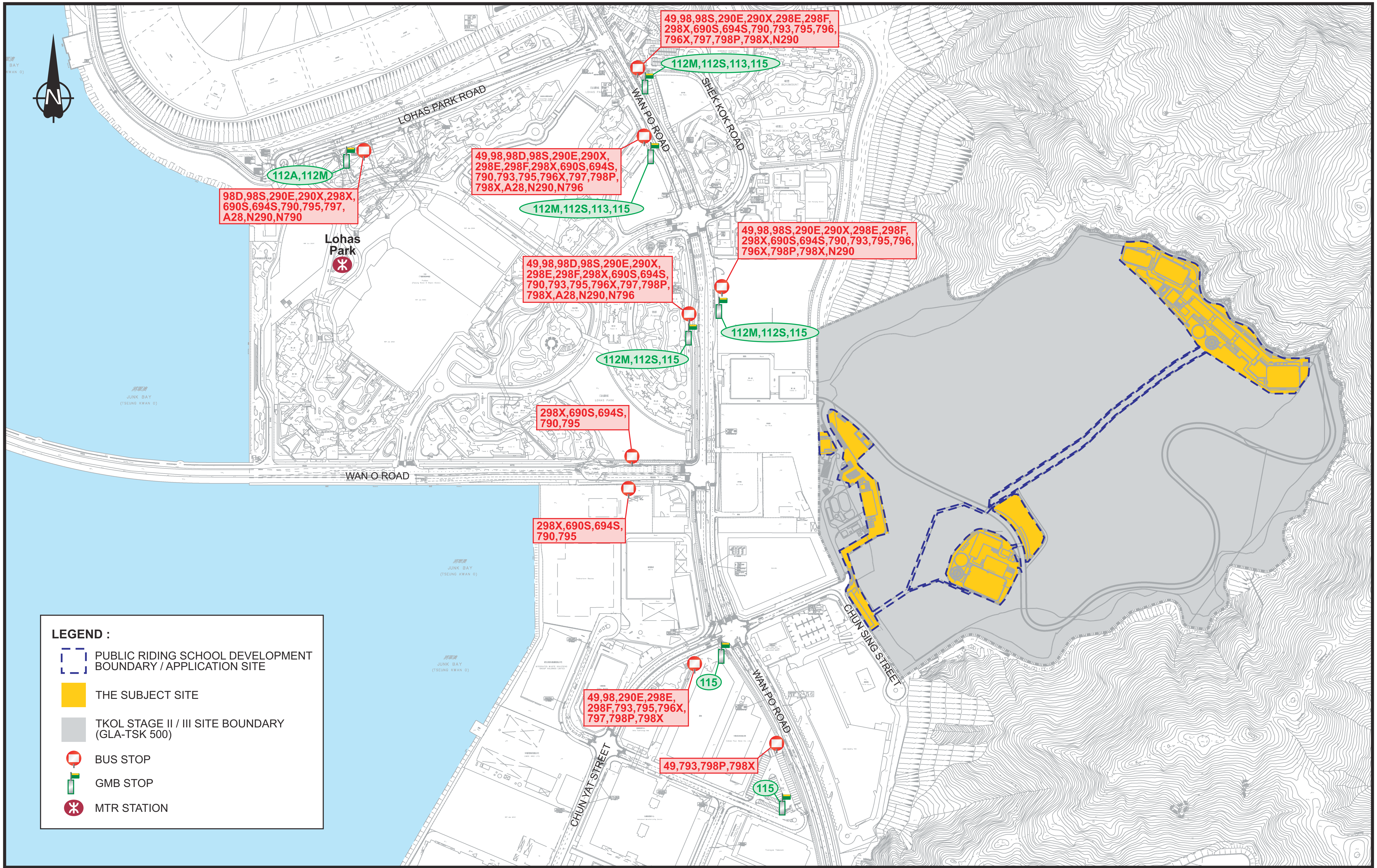
YEAR 2033 DESIGN TRAFFIC FLOWS (WITH TKO AREA 137 DEVELOPMENT) - SENSITIVITY TEST

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	NOV 2025	4.7	A

SYSTRA MVA

CHK50812010/TIA/F47-A.CDR/LLH/28JAN26

Original Size : A3


N
LOHAS PARK ROAD
WAN PO ROAD
SHEK KOK ROAD
WAN O ROAD
CHUN YAT STREET
CHUN SING STREET
JUNK BAY (TSEUNG KWAN O)
Lohas Park
49,98,98S,290E,290X,298E,298F, 298X,690S,694S,790,793,795,796, 796X,797,798P,798X,N290
112M,112S,113,115
112A,112M
98D,98S,290E,290X,298X, 690S,694S,790,795,797, A28,N290,N790
49,98,98D,98S,290E,290X, 298E,298F,298X,690S,694S, 790,793,795,796X,797,798P, 798X,A28,N290,N796
112M,112S,113,115
49,98,98S,290E,290X,298E,298F, 298X,690S,694S,790,793,795,796, 796X,798P,798X,N290
49,98,98D,98S,290E,290X, 298E,298F,298X,690S,694S, 790,793,795,796X,797,798P, 798X,A28,N290,N796
112M,112S,115
112M,112S,115
298X,690S,694S, 790,795
298X,690S,694S, 790,795
115
49,98,290E,298E, 298F,793,795,796X, 797,798P,798X
49,793,798P,798X
115
LEGEND :
PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY / APPLICATION SITE
THE SUBJECT SITE
TKOL STAGE II / III SITE BOUNDARY (GLA-TSK 500)
BUS STOP
GMB STOP
MTR STATION

-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	PML	28JAN26
A	MINOR AMENDMENT	PML	10OCT25
Rev.	Description	Checked	Date

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

Drawing Title

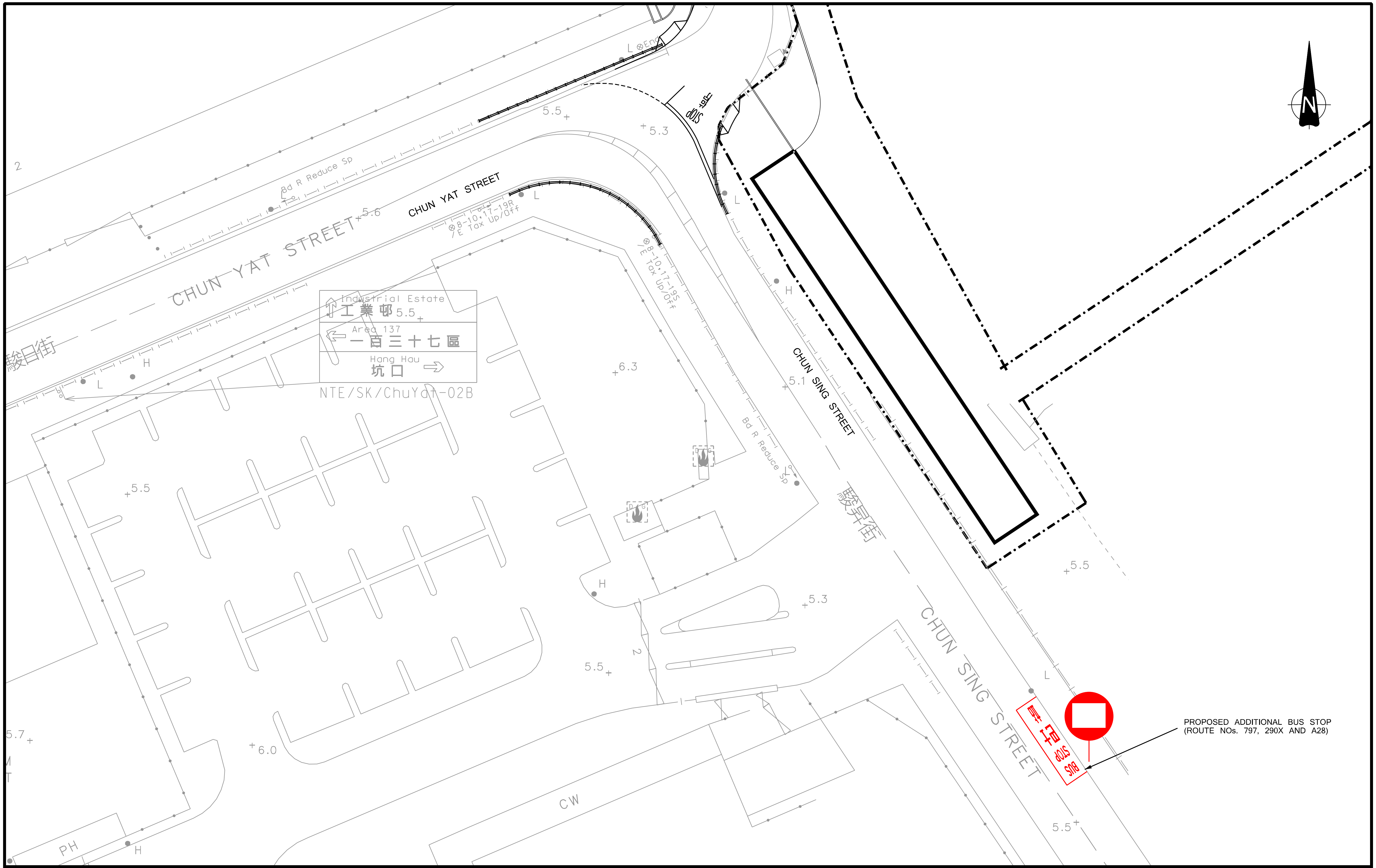
EXISTING PUBLIC TRANSPORT SERVICE IN THE VICINITY

Designed	Checked	Scale	Date	Drawing No.	Rev.
LRY	GPH	NTS	JUL 2025	6.1	B

SYSTRA MVA

CHK50812010/TIA/F61-B.CDR/LLH/28JAN26

Original Size : A3


N
CHUN YAT STREET
駿日街
CHUN SING STREET
駿昇街
Industrial Estate
工業邨
Area 137
一百三十七區
Hang Hau
坑口
NTE/SK/ChuYat-02B
Bd R Reduce Sp
⊗8-10,17-19R /E Tax Up/Off
⊗8-10,17-19S /E Tax Up/Off
巴士站
BUS STOP
5.5
5.3
5.6
6.3
5.1
5.7
6.0
L
H
CW
PH

PROPOSED ADDITIONAL BUS STOP (ROUTE NOs. 797, 290X AND A28)

Rev.	Description	Checked	Date
-	-	-	-
-	-	-	-
B	MINOR AMENDMENT	GPH	14JAN26
A	MINOR AMENDMENT	GPH	24NOV25

Project Title

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D.233, THE RESTORED LANDFILL SITE(TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500(PART))

Drawing Title

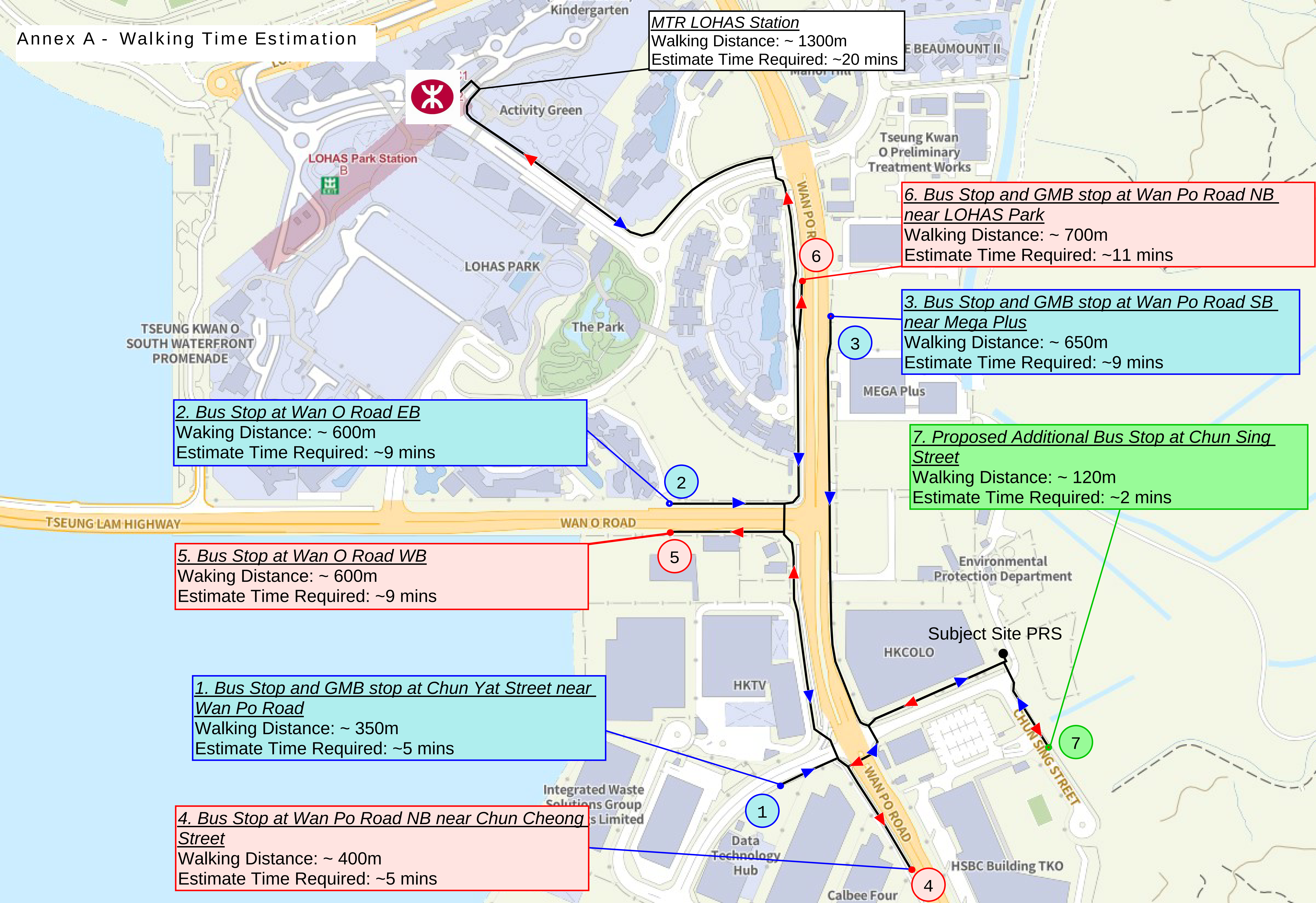
PROPOSED ADDITIONAL STOP FOR BUS ROUTE NOS. A28, 290X AND 797 AT CHUN SING STREET

Designed	Checked	Scale	Date	Drawing No.	Rev.
HKH	GPH	1:500(A3)	OCT 2025	6.2	B

SYSTRA MVA

Original Size : A3

Annex A - Walking Time Estimation



MTR LOHAS Station
Walking Distance: ~ 1300m
Estimate Time Required: ~20 mins

6. Bus Stop and GMB stop at Wan Po Road NB near LOHAS Park
Walking Distance: ~ 700m
Estimate Time Required: ~11 mins

3. Bus Stop and GMB stop at Wan Po Road SB near Mega Plus
Walking Distance: ~ 650m
Estimate Time Required: ~9 mins

2. Bus Stop at Wan O Road EB
Waking Distance: ~ 600m
Estimate Time Required: ~9 mins

7. Proposed Additional Bus Stop at Chun Sing Street
Walking Distance: ~ 120m
Estimate Time Required: ~2 mins

5. Bus Stop at Wan O Road WB
Waking Distance: ~ 600m
Estimate Time Required: ~9 mins

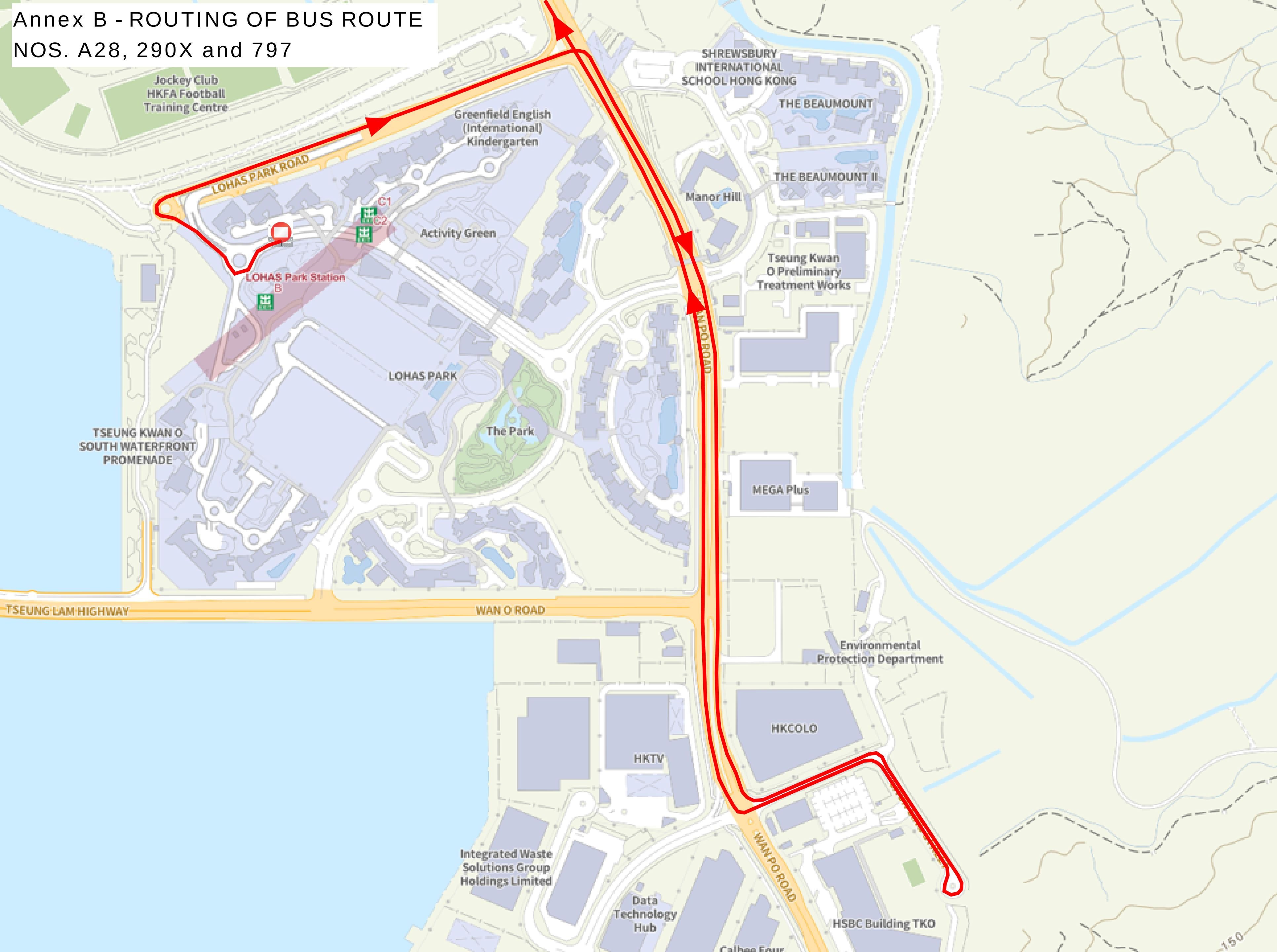
1. Bus Stop and GMB stop at Chun Yat Street near Wan Po Road
Walking Distance: ~ 350m
Estimate Time Required: ~5 mins

4. Bus Stop at Wan Po Road NB near Chun Cheong Street
Walking Distance: ~ 400m
Estimate Time Required: ~5 mins

Subject Site PRS

Kindergarten
BEAUMOUNT II
Activity Green
LOHAS Park Station
B
Tseung Kwan O Preliminary Treatment Works
WAN PO ROAD
LOHAS PARK
The Park
TSEUNG KWAN O SOUTH WATERFRONT PROMENADE
MEGA Plus
TSEUNG LAM HIGHWAY
WAN O ROAD
Environmental Protection Department
HKCOLO
HKTV
CHUN SING STREET
Integrated Waste Solutions Group Holdings Limited
Data Technology Hub
HSBC Building TKO
Calbee Four
1
2
3
4
5
6
7

Annex B - ROUTING OF BUS ROUTE NOS. A28, 290X and 797


Jockey Club HKFA Football Training Centre
LOHAS PARK ROAD
Greenfield English (International) Kindergarten
SHREWSBURY INTERNATIONAL SCHOOL HONG KONG
THE BEAUMOUNT
THE BEAUMOUNT II
Manor Hill
C1
C2
Activity Green
LOHAS Park Station
B
Tseung Kwan O Preliminary Treatment Works
WAN PO ROAD
LOHAS PARK
TSEUNG KWAN O SOUTH WATERFRONT PROMENADE
The Park
MEGA Plus
TSEUNG LAM HIGHWAY
WAN O ROAD
Environmental Protection Department
HKCOLO
HKTV
Integrated Waste Solutions Group Holdings Limited
Data Technology Hub
WAN PO ROAD
HSBC Building TKO
Calbee Four
150

Appendix A - Calculation Sheets

2024 Observed Traffic Flows (Weekday)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Chun Yat Street (JA)

Design Year: 2024

Description: 2024 Observe Flows (Weekday)

Designed By: HKH

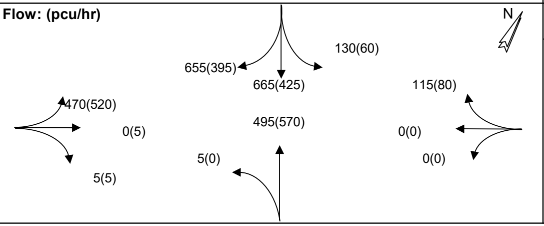
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)		Revised Saturation Flow (pcu/hr)		Flow (pcu/hr)	y Value	Critical y	Flow (pcu/hr)	y Value	Critical y
Wan Po Road (SB)	↓→	A	1,2	3.200	20			35%	26%	1885	1900	375	0.199		229	0.121	
	↓	A	1,2	3.600						2115	2115	420	0.199		256	0.121	
Wan Po Road (SB)	↲	C	2	3.300		25				1965	1965	330	0.168		199	0.101	
	↲	C	2	3.300		20				1940	1940	325	0.168		196	0.101	
Wan Po Road (NB)	←↑	B	1	3.700	15			2%	0%	1980	1985	241	0.122		275	0.139	
	↑	B	1	3.700						2125	2125	259	0.122	0.122	295	0.139	0.139
Chun Yat Street (EB)	↗	D	2,3	3.600	35					1895	1895	470	0.248	0.248	520	0.274	0.274
Chun Yat Street (EB)	→↓	E	3	3.600		25		100%	50%	1995	2055	5	0.003		10	0.005	
Chun Yat Street (WB)	←↕	F	4	5.100	25	20		0% / 100%	0% / 100%	1975	1975	115	0.058	0.058	80	0.041	0.041

Pedestrian Crossing	Phase	Stage						
	Gp	1,4	MIN GREEN + FLASH =	5	+	5	=	10
	Hp	1,2,4	MIN GREEN + FLASH =	5	+	5	=	10
	Ip	3	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	2,3,4	MIN GREEN + FLASH =	5	+	8	=	13
	Kp	2	MIN GREEN + FLASH =	5	+	6	=	11
	Lp	1,2,3	MIN GREEN + FLASH =	5	+	6	=	11
	Mp	2	MIN GREEN + FLASH =	5	+	5	=	10
	Np	3	MIN GREEN + FLASH =	8	+	7	=	15

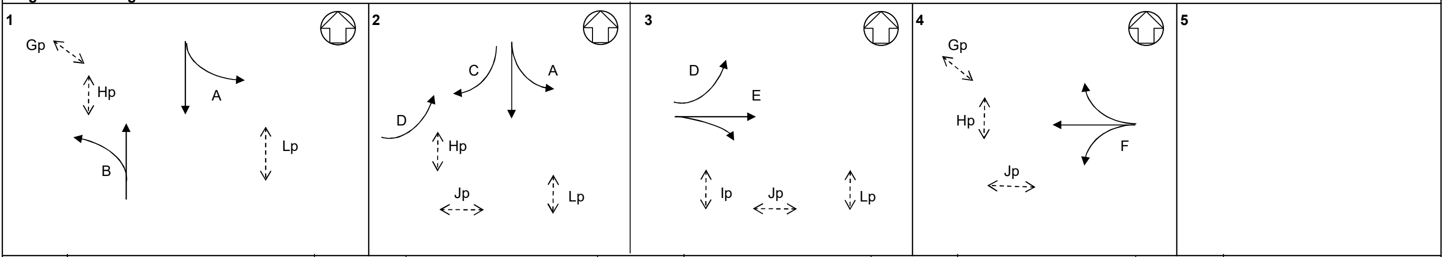
Notes:

Flow: (pcu/hr)



Group		B,D,F	**Group**		B,D,F
y		0.428	**y**		0.454
L (sec)		18	**L (sec)**		18
C (sec)		130	**C (sec)**		120
y pract.		0.775	**y pract.**		0.765
R.C. (%)		81%	**R.C. (%)**		69%

Stage / Phase Diagrams



I/G= 7		I/G= 9		I/G=		I/G= 5		I/G=	
I/G= 7		I/G= 9		I/G=		I/G= 5		I/G=	

Date: 5 Nov 2024

Junction: Wan Po Road / Chun Yat Street (JA)

JA

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Wan O Road (JB)

Design Year: 2024

Description: 2024 Observe Flows (Weekday)

Designed By: HKH

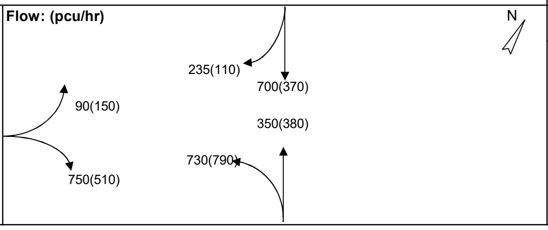
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m)		Gradient (%)	Pro. Turning (%)		Revised Saturation Flow (pcu/hr)		AM Peak			PM Peak		
					Left	Right		AM	PM	AM	PM	Flow (pcu/hr)	y Value	Critical y	Flow (pcu/hr)	y Value	Critical y
Wan Po Road (NB)	↰	C	3	4.100	15					1840	1840	348	0.189		377	0.205	
	↰	C	3	4.100	20					2015	2015	382	0.190	0.190	413	0.205	0.205
	↑	C	3	4.000						2155	2155	175	0.081		190	0.088	
	↑	C	3	4.100						2165	2165	175	0.081		190	0.088	
Wan O Road (EB)	↱	B	2	3.500	20					1830	1830	90	0.049		150	0.082	
	↴	B	2	3.200		25				1825	1825	365	0.200	0.200	248	0.136	0.136
	↴	B	2	3.200		20				1930	1930	385	0.199		262	0.136	
Wan Po Road (SB)	↓	A	1	3.400						2095	2095	350	0.167	0.167	185	0.088	0.088
	↓	A	1	3.400						2095	2095	350	0.167		185	0.088	
	↲	A	1	3.400		15				1905	1905	120	0.063		56	0.029	
	↲	A	1	3.400		20				1820	1820	115	0.063		54	0.030	

Pedestrian Crossing	Dp	1,3	MIN GREEN + FLASH =	5	+	9	=	14
	Ep	2	MIN GREEN + FLASH =	5	+	10	=	15
	Fp	1,2	MIN GREEN + FLASH =	8	+	15	=	23
	Gp	3	MIN GREEN + FLASH =	5	+	9	=	14

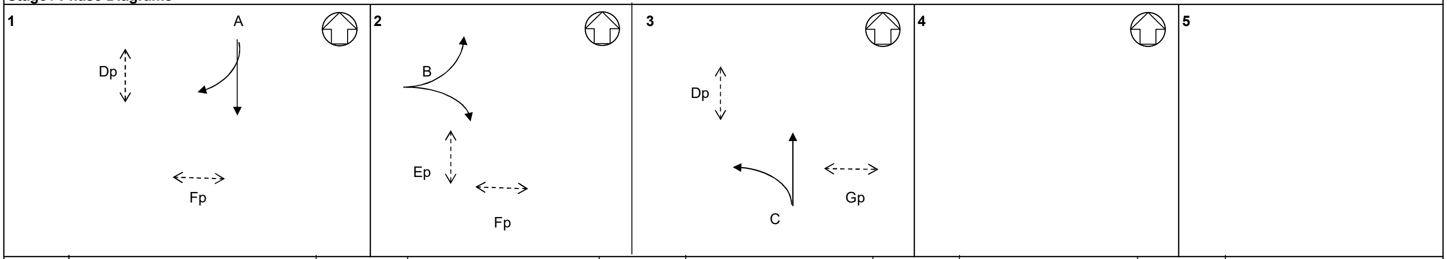
Notes:

Flow: (pcu/hr)



Group		A,B,C	Group		A,B,C
y		0.557	y		0.429
L (sec)		14	L (sec)		14
C (sec)		120	C (sec)		120
y pract.		0.795	y pract.		0.795
R.C. (%)		43%	R.C. (%)		85%

Stage / Phase Diagrams



I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	
I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	

Date: 5 Nov 2024	**Junction:** JB Wan Po Road / Wan O Road (JB)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

Design Year: 2024

Description: 2024 Observe Flows (Weekday)

Designed By: HKH

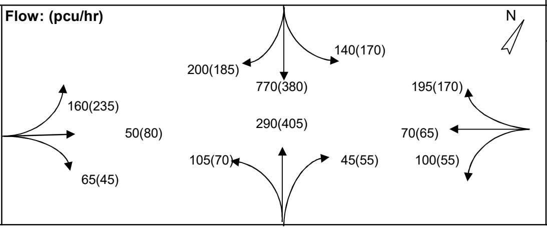
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Access Road (EB)	↑→	B	2	3.400	15					1775	1775	127	0.072	0.072	166	0.094	0.094
	↕→	B	2	4.100	20	25		22% / 44%	36% / 23%	2075	2080	148	0.071		194	0.093	
Wan Po Road (SB)	↳	A	1	3.100	15					1750	1750	140	0.080		170	0.097	0.097
	↓	A	1	3.500						2105	2105	385	0.183	0.183	190	0.090	
	↓	A	1	3.500						2105	2105	385	0.183		190	0.090	
	↲	A	1	3.200		25				1960	1960	200	0.102		185	0.094	
Shek Kok Road (WB)	←↕	D	4	3.600	10	30		53% / 9%	37% / 20%	1950	1985	187	0.096		150	0.076	0.076
	↰	D	4	3.500		25				1855	1855	178	0.096	0.096	140	0.075	
Wan Po Road (NB)	←↑	C	3	3.600	15			88%	48%	1815	1885	119	0.066	0.066	147	0.078	0.078
	↑	C	3	3.500						2105	2105	138	0.066		164	0.078	
	↑	C	3	3.500						2105	2105	138	0.066		164	0.078	
	↱	C	3	3.600		25				1995	1995	45	0.023		55	0.028	

Pedestrian Crossing	Phase	Stage						
	Ep	2	MIN GREEN + FLASH =	5	+	6	=	11
	Fp	1,3,4	MIN GREEN + FLASH =	5	+	7	=	12
	Gp	3	MIN GREEN + FLASH =	5	+	9	=	14
	Hp	1,2,4	MIN GREEN + FLASH =	7	+	13	=	20
	Ip	4	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	1,2,3	MIN GREEN + FLASH =	5	+	7	=	12

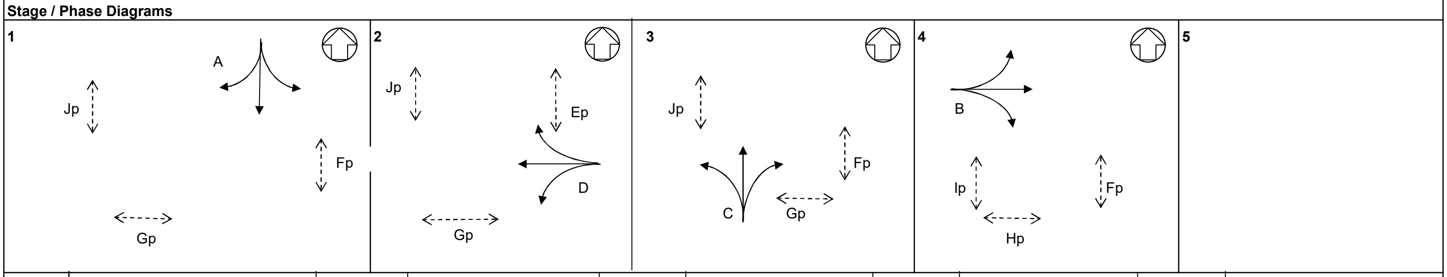
Notes:

Flow: (pcu/hr)



Group		A,D,C,B	Group		A,D,C,B
y		0.416	y		0.344
L (sec)		27	L (sec)		27
C (sec)		120	C (sec)		120
y pract.		0.698	y pract.		0.698
R.C. (%)		68%	R.C. (%)		103%

Stage / Phase Diagrams



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I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	

Date:
5 Nov 2024

Junction: JC
Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

TRAFFIC SIGNALS CALCULATION **Job No.: CHK50812010** **MVA HONG KONG LIMITED**

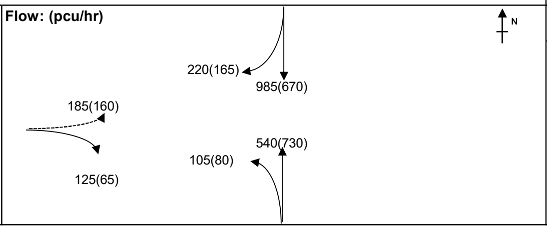
Junction: Wan Po Road / LOHAS Park Road (JD) Design Year: 2024

Description: 2024 Observe Flows (Weekday) Designed By: HKH Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m)		Gradient (%)	Pro. Turning (%)		Revised Saturation Flow (pcu/hr)		AM Peak			PM Peak		
					Left	Right		AM	PM	AM	PM	Flow (pcu/hr)	y Value	Critical y	Flow (pcu/hr)	y Value	Critical y
Wan Po Road (SB)	↓	B	1,2	3.500						1965	1965	476	0.242		323	0.164	
	↓	B	1,2	3.500						2105	2105	509	0.242		347	0.165	
	↲	C	2	3.500		15				1915	1915	220	0.115	0.115	165	0.086	0.086
Wan Po Road (NB)	↑	A	1	3.500						2105	2105	270	0.128	0.128	365	0.173	0.173
	↑	A	1	3.500						2105	2105	270	0.128		365	0.173	
	↰	A	1	3.500	10					1710	1710	105	0.061		80	0.047	
Lohas Park Road (EB)	↗	E	1,2,3	3.500	35					1885	1885	185	0.098		160	0.085	
	↘	D	3	4.000		15				1960	1960	125	0.064	0.064	65	0.033	0.033

Notes:

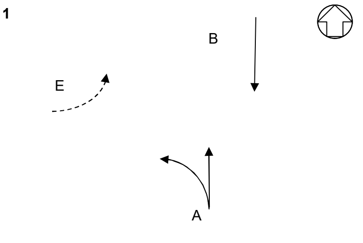
Flow: (pcu/hr)



Group		A,C,D	Group		A,C,D
y		0.307	y		0.293
L (sec)		12	L (sec)		12
C (sec)		120	C (sec)		120
y pract.		0.810	y pract.		0.810
R.C. (%)		164%	R.C. (%)		177%

Stage / Phase Diagrams

1



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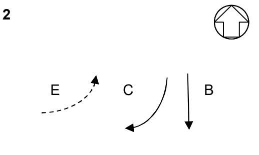
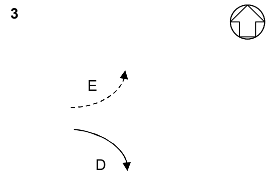


3



4

5

I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	
I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	

Date: 5 Nov 2024	**Junction:** JD Wan Po Road / LOHAS Park Road (JD)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan O Road / Sunrise Boulevard (JE)

Design Year: 2024

Description: 2024 Observe Flows (Weekday)

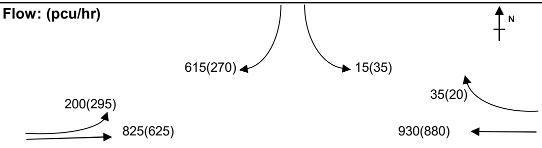
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
	⮥	A	1	3.800	20					1855	1855	200	0.108		295	0.159	0.159
Wan O Road (EB)	→	A	1	3.500						2105	2105	413	0.196	0.196	313	0.149	
	→	A	1	3.500						2105	2105	412	0.196		312	0.148	
	⮤	C	2	4.000		25				2035	2035	35	0.017		20	0.010	
Wan O Road (WB)	←	B	1,2,4	3.800						2135	2135	481	0.225		455	0.213	
	←	B	1,2,4	3.800						1995	1995	449	0.225		425	0.213	
	↳	E	3	3.500	18					1815	1815	15	0.008		35	0.019	
Sunrise Boulevard (SB)	↲	D	3	3.500		25				1985	1985	306	0.154	0.154	134	0.068	
	↲	D	3	3.500		30				2005	2005	309	0.154		136	0.068	0.068
Pedestrian Crossing		Fp	4	MIN GREEN + FLASH =			16	+	12	=	28			*			*

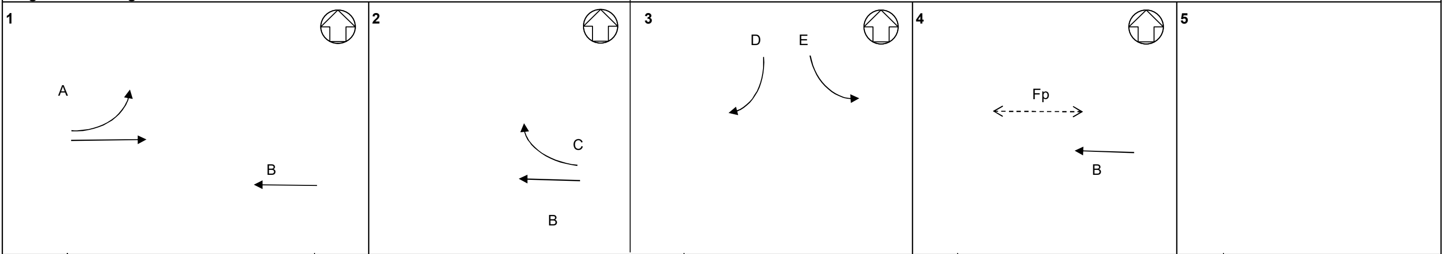
Notes:

Flow: (pcu/hr)



Group		A,C,D,Fp	**Group**		A,C,D,Fp
y		0.350	**y**		0.227
L (sec)		49	**L (sec)**		49
C (sec)		130	**C (sec)**		120
y pract.		0.561	**y pract.**		0.533
R.C. (%)		60%	**R.C. (%)**		135%

Stage / Phase Diagrams



I/G= 2		I/G= 5	5	I/G= 5		I/G= 6	28	I/G=	
I/G= 2		I/G= 5	5	I/G= 5		I/G= 6	28	I/G=	

Date: 5 Nov 2024

Junction: Wan O Road / Sunrise Boulevard (JE)

JE

2025 Observed Traffic Flows (Weekend)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Chun Yat Street (JA)

Design Year: 2025

Description: 2025 Observe Flows (Weekend)

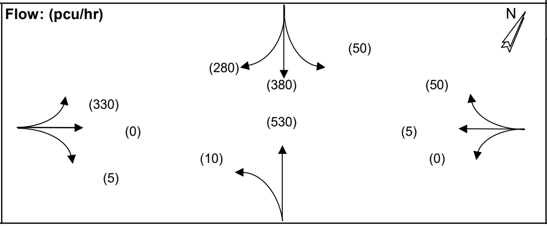
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr)	Revised Saturation Flow (pcu/hr) PM	Flow (pcu/hr)	y Value	Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↓→	A	1,2	3.200	20				25%		1900				203	0.107	
	↓	A	1,2	3.600							2115				227	0.107	
Wan Po Road (SB)	↲	C	2	3.300		25					1965				141	0.072	
	↲	C	2	3.300		20					1940				139	0.072	
Wan Po Road (NB)	←↑	B	1	3.700	15				4%		1975				260	0.132	
	↑	B	1	3.700							2125				280	0.132	0.132
Chun Yat Street (EB)	↱	D	2,3	3.600	35						1895				330	0.174	0.174
Chun Yat Street (EB)	→↓	E	3	3.600		25			100%		1995				5	0.003	
Chun Yat Street (WB)	←↑↓	F	4	5.100	25	20			0% / 91%		1990				55	0.028	0.028
Pedestrian Crossing		Gp	1,4	MIN GREEN + FLASH =			5	+	5	=	10						
		Hp	1,2,4	MIN GREEN + FLASH =			5	+	5	=	10						
		Ip	3	MIN GREEN + FLASH =			5	+	7	=	12						
		Jp	2,3,4	MIN GREEN + FLASH =			5	+	8	=	13						
		Kp	2	MIN GREEN + FLASH =			5	+	6	=	11						
		Lp	1,2,3	MIN GREEN + FLASH =			5	+	6	=	11						
		Mp	2	MIN GREEN + FLASH =			5	+	5	=	10						
		Np	3	MIN GREEN + FLASH =			8	+	7	=	15						

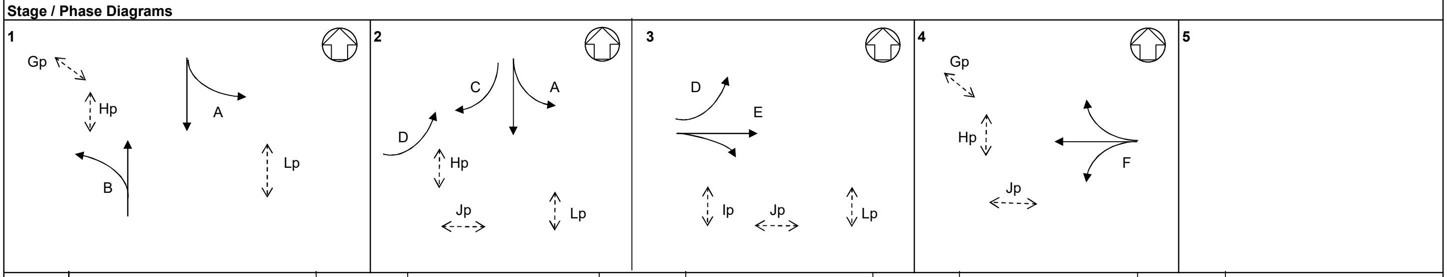
Notes:

Flow: (pcu/hr)



Group			Group		B,D,F
y			y		0.334
L (sec)			L (sec)		18
C (sec)			C (sec)		120
y pract.			y pract.		0.765
R.C. (%)			R.C. (%)		129%

Stage / Phase Diagrams



I/G= 7	I/G= 9	I/G=	I/G= 5	I/G=

Date: 5 Nov 2024

Junction: Wan Po Road / Chun Yat Street (JA) JA

TRAFFIC SIGNALS CALCULATION **Job No.: CHK50812010** **MVA HONG KONG LIMITED**

Junction: Wan Po Road / Wan O Road (JB) Design Year: 2025

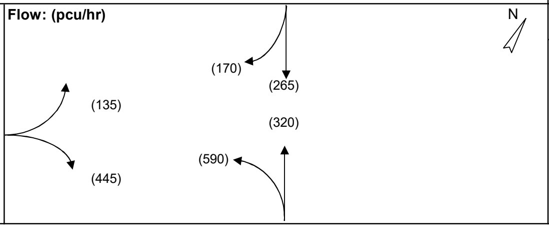
Description: 2025 Observe Flows (Weekend) Designed By: HKH Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr)	Revised Saturation Flow (pcu/hr) PM	Flow (pcu/hr)	y Value	Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (NB)	↰	C	3	4.100	15						1840				282	0.153	0.153
	↰	C	3	4.100	20						2015				308	0.153	
	↑	C	3	4.000							2155				160	0.074	
	↑	C	3	4.100							2165				160	0.074	
Wan O Road (EB)	⤴	B	2	3.500	20						1830				135	0.074	
	⤵	B	2	3.200		25					1825				216	0.118	
	⤵	B	2	3.200		20					1930				229	0.119	0.119
Wan Po Road (SB)	↓	A	1	3.400							2095				133	0.063	0.063
	↓	A	1	3.400							2095				132	0.063	
	↲	A	1	3.400		15					1905				87	0.046	
	↲	A	1	3.400		20					1820				83	0.046	

Pedestrian Crossing	Dp	1,3	MIN GREEN + FLASH =	5	+	9	=	14
	Ep	2	MIN GREEN + FLASH =	5	+	10	=	15
	Fp	1,2	MIN GREEN + FLASH =	8	+	15	=	23
	Gp	3	MIN GREEN + FLASH =	5	+	9	=	14

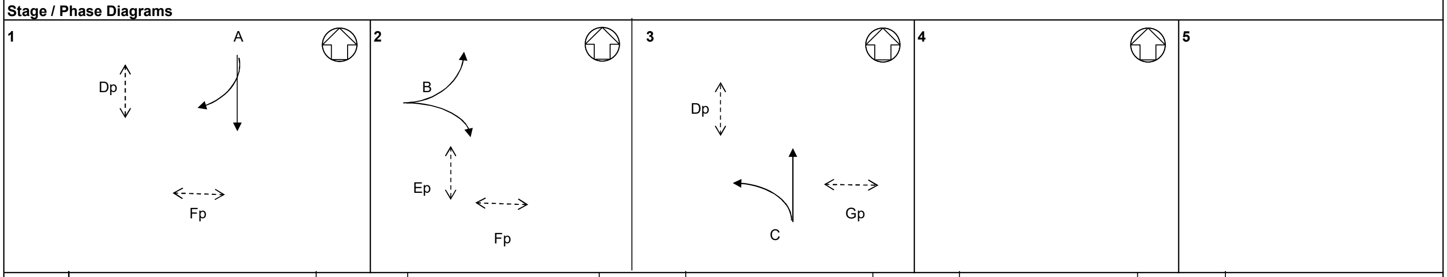
Notes:

Flow: (pcu/hr)



Group			**Group**		A,B,C
y			**y**		0.335
L (sec)			**L (sec)**		14
C (sec)			**C (sec)**		120
y pract.			**y pract.**		0.795
R.C. (%)			**R.C. (%)**		137%

Stage / Phase Diagrams



I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	

Date: 5 Nov 2024	**Junction:** JB Wan Po Road / Wan O Road (JB)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

Design Year: 2025

Description: 2025 Observe Flows (Weekend)

Designed By: HKH

Checked By: PML

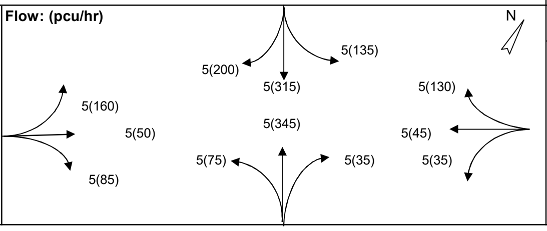
Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr)	Revised Saturation Flow (pcu/hr) PM	Flow (pcu/hr)	y Value	Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Access Road (EB)	⬏	B	2	3.400	15						1775				136	0.077	
	↕→	B	2	4.100	20	25			15% / 53%		2075				159	0.077	0.077
Wan Po Road (SB)	↳	A	1	3.100	15						1750				135	0.077	
	↓	A	1	3.500							2105				158	0.075	
	↓	A	1	3.500							2105				157	0.075	
	↲	A	1	3.200		25					1960				200	0.102	0.102
Shek Kok Road (WB)	←↕	D	4	3.600	10	30			32% / 27%		1995				109	0.055	0.055
	↰	D	4	3.500		25					1855				101	0.054	
Wan Po Road (NB)	←↑	C	3	3.600	15				58%		1865				129	0.069	
	↑	C	3	3.500							2105				146	0.069	0.069
	↑	C	3	3.500							2105				145	0.069	
	↱	C	3	3.600		25					1995				35	0.018	

Pedestrian Crossing

Ep	2	MIN GREEN + FLASH =	5	+	6	=	11
Fp	1,3,4	MIN GREEN + FLASH =	5	+	7	=	12
Gp	3	MIN GREEN + FLASH =	5	+	9	=	14
Hp	1,2,4	MIN GREEN + FLASH =	7	+	13	=	20
Ip	4	MIN GREEN + FLASH =	5	+	7	=	12
Jp	1,2,3	MIN GREEN + FLASH =	5	+	7	=	12

Notes:

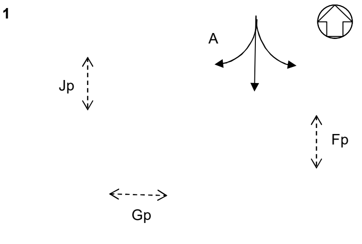
Flow: (pcu/hr)



Group			Group		A,D,C,B
y			y		0.303
L (sec)			L (sec)		27
C (sec)			C (sec)		120
y pract.			y pract.		0.698
R.C. (%)			R.C. (%)		130%

Stage / Phase Diagrams

1



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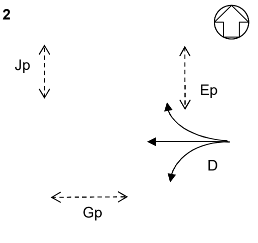

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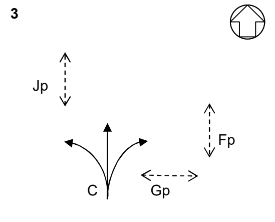

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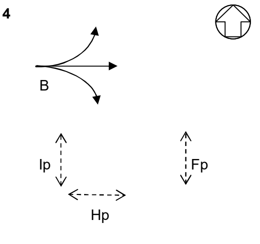


5

I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	

Date: 5 Nov 2024

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC) JC

TRAFFIC SIGNALS CALCULATION **Job No.: CHK50812010** **MVA HONG KONG LIMITED**

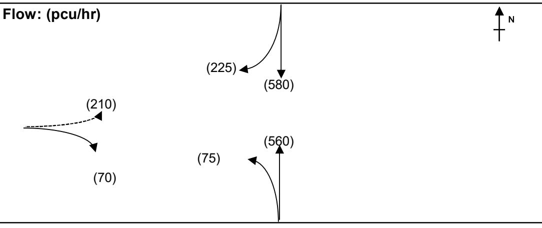
Junction: Wan Po Road / LOHAS Park Road (JD)　　Design Year: 2025

Description: 2025 Observe Flows (Weekend)　　Designed By: HKH　　Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)		Revised Saturation Flow (pcu/hr)					PM Peak		
									PM		PM	Flow (pcu/hr)	y Value	Critical y	Flow (pcu/hr)	y Value	Critical y
	↓	B	1,2	3.500							1965				280	0.142	
Wan Po Road (SB)	↓	B	1,2	3.500							2105				300	0.143	
	↲	C	2	3.500		15					1915				225	0.117	0.117
	↑	A	1	3.500							2105				280	0.133	0.133
Wan Po Road (NB)	↑	A	1	3.500							2105				280	0.133	
	↰	A	1	3.500	10						1710				75	0.044	
Lohas Park Road (EB)	↱	E	1,2,3	3.500	35						1885				210	0.111	
	↴	D	3	4.000		15					1960				70	0.036	0.036

Notes:

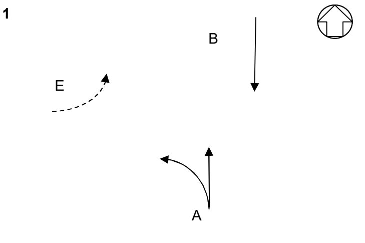
Flow: (pcu/hr)



Group			Group		A,C,D
y			y		0.286
L (sec)			L (sec)		12
C (sec)			C (sec)		120
y pract.			y pract.		0.810
R.C. (%)			R.C. (%)		183%

Stage / Phase Diagrams

1



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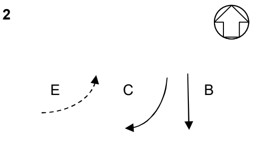

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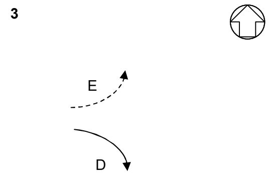


4

5

I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	

Date: 5 Nov 2024

Junction: JD
Wan Po Road / LOHAS Park Road (JD)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan O Road / Sunrise Boulevard (JE)

Design Year: 2025

Description: 2025 Observe Flows (Weekend)

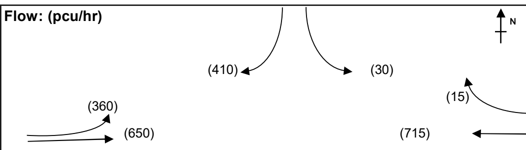
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)		Revised Saturation Flow (pcu/hr)					PM Peak		
									PM		PM	Flow (pcu/hr)	y Value	Critical y	Flow (pcu/hr)	y Value	Critical y
	↗	A	1	3.800	20						1855				360	0.194	0.194
Wan O Road (EB)	→	A	1	3.500							2105				325	0.154	
	→	A	1	3.500							2105				325	0.154	
	↖	C	2	4.000		25					2035				15	0.007	
Wan O Road (WB)	←	B	1,2,4	3.800							2135				370	0.173	
	←	B	1,2,4	3.800							1995				345	0.173	
	↳	E	3	3.500	18						1815				30	0.017	
Sunrise Boulevard (SB)	↲	D	3	3.500		25					1985				204	0.103	0.103
	↲	D	3	3.500		30					2005				206	0.103	
Pedestrian Crossing		Fp	4	MIN GREEN + FLASH =			16	+	12	=	28						*

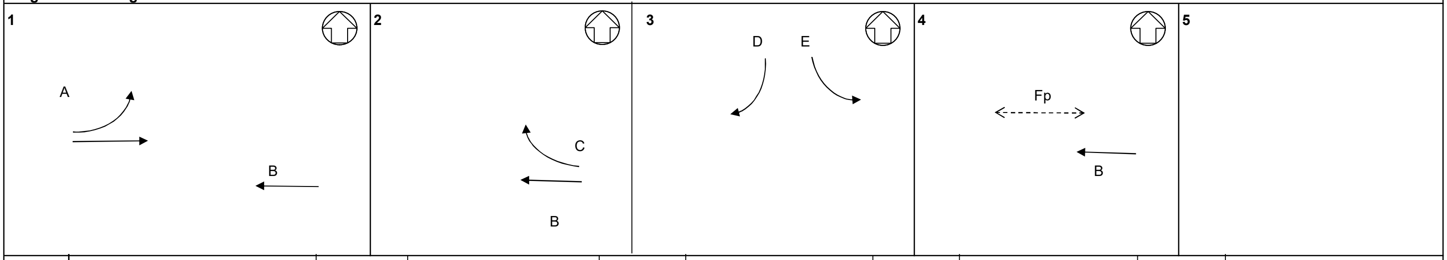
Notes:

Flow: (pcu/hr)



Group			Group		A,C,D,Fp
y			y		0.297
L (sec)			L (sec)		49
C (sec)			C (sec)		120
y pract.			y pract.		0.533
R.C. (%)			R.C. (%)		79%

Stage / Phase Diagrams



I/G= 2		I/G= 5	5	I/G= 5		I/G= 6	28	I/G=	

Date: 5 Nov 2024

Junction: Wan O Road / Sunrise Boulevard (JE)

JE

2030 Reference Traffic Forecast (without construction works)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Chun Yat Street (JA)

Design Year: 2030

Description: 2030 Reference Flows (Weekday)

Designed By: HKH

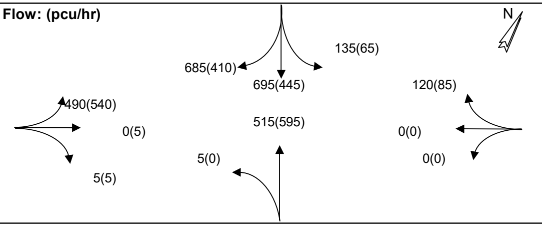
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)		A	1,2	3.200	20			35%	27%	1885	1895	391	0.207		241	0.127	
		A	1,2	3.600						2115	2115	439	0.208		269	0.127	
Wan Po Road (SB)		C	2	3.300		25				1965	1965	345	0.176		206	0.105	
		C	2	3.300		20				1940	1940	340	0.175		204	0.105	
Wan Po Road (NB)		B	1	3.700	15			2%	0%	1980	1985	251	0.127	0.127	287	0.145	
		B	1	3.700						2125	2125	269	0.127		308	0.145	0.145
Chun Yat Street (EB)		D	2,3	3.600	35					1895	1895	490	0.259	0.259	540	0.285	0.285
Chun Yat Street (EB)		E	3	3.600		25		100%	50%	1995	2055	5	0.003		10	0.005	
Chun Yat Street (WB)		F	4	5.100	25	20		0% / 100%	0% / 100%	1975	1975	120	0.061	0.061	85	0.043	0.043

Pedestrian Crossing	Phase	Stage		Min Green		Flash		Total
	Gp	1,4	MIN GREEN + FLASH =	5	+	5	=	10
	Hp	1,2,4	MIN GREEN + FLASH =	5	+	5	=	10
	Ip	3	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	2,3,4	MIN GREEN + FLASH =	5	+	8	=	13
	Kp	2	MIN GREEN + FLASH =	5	+	6	=	11
	Lp	1,2,3	MIN GREEN + FLASH =	5	+	6	=	11
	Mp	2	MIN GREEN + FLASH =	5	+	5	=	10
	Np	3	MIN GREEN + FLASH =	8	+	7	=	15

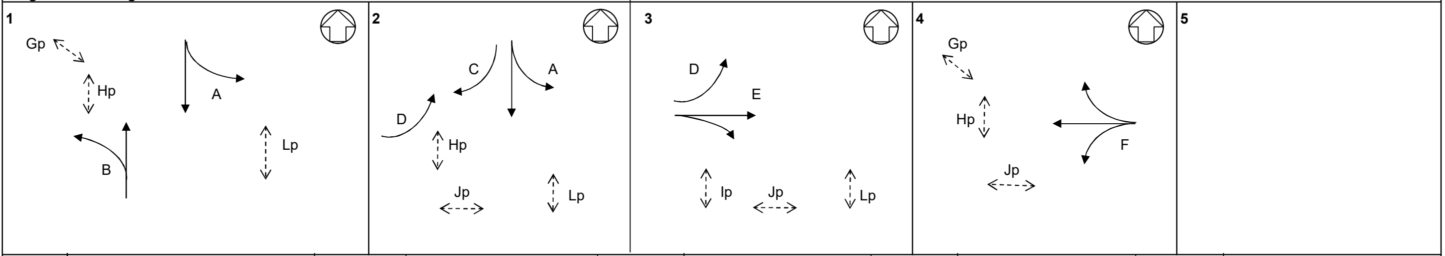
Notes:

Flow: (pcu/hr)



Group		B,D,F	Group		B,D,F
y		0.446	y		0.473
L (sec)		18	L (sec)		18
C (sec)		130	C (sec)		120
y pract.		0.775	y pract.		0.765
R.C. (%)		74%	R.C. (%)		62%

Stage / Phase Diagrams



I/G= 7		I/G= 9		I/G=		I/G= 5		I/G=	
I/G= 7		I/G= 9		I/G=		I/G= 5		I/G=	

Date: 5 Nov 2024

Junction: Wan Po Road / Chun Yat Street (JA) JA

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Wan O Road (JB)

Design Year: 2030

Description: 2030 Reference Flows (Weekday)

Designed By: HKH

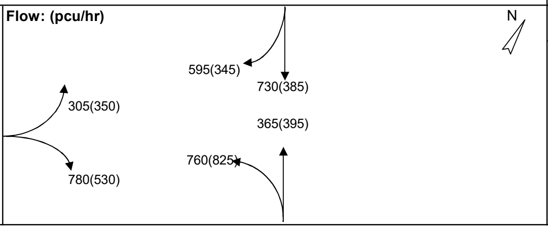
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m)		Gradient (%)	Pro. Turning (%)		Revised Saturation Flow (pcu/hr)		AM Peak			PM Peak		
					Left	Right		AM	PM	AM	PM	Flow (pcu/hr)	y Value	Critical y	Flow (pcu/hr)	y Value	Critical y
Wan Po Road (NB)	↰	C	3	4.100	15					1840	1840	363	0.197	0.197	394	0.214	0.214
	↰	C	3	4.100	20					2015	2015	397	0.197		431	0.214	
	↑	C	3	4.000						2155	2155	182	0.084		197	0.091	
	↑	C	3	4.100						2165	2165	183	0.085		198	0.091	
Wan O Road (EB)	↱	B	2	3.500	20					1830	1830	305	0.167		350	0.191	0.191
	↴	B	2	3.200		25				1825	1825	379	0.208		258	0.141	
	↴	B	2	3.200		20				1930	1930	401	0.208	0.208	272	0.141	
Wan Po Road (SB)	↓	A	1	3.400						2095	2095	365	0.174	0.174	193	0.092	
	↓	A	1	3.400						2095	2095	365	0.174		192	0.092	
	↲	A	1	3.400		15				1905	1905	304	0.160		176	0.092	
	↲	A	1	3.400		20				1820	1820	291	0.160		169	0.093	0.093

Pedestrian Crossing	Phase	Stage						
	Dp	1,3	MIN GREEN + FLASH =	5	+	9	=	14
	Ep	2	MIN GREEN + FLASH =	5	+	10	=	15
	Fp	1,2	MIN GREEN + FLASH =	8	+	15	=	23
	Gp	3	MIN GREEN + FLASH =	5	+	9	=	14

Notes:

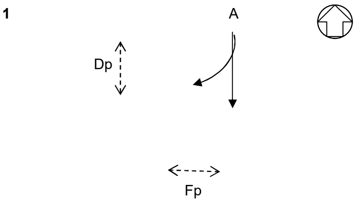
Flow: (pcu/hr)



Group		A,B,C	Group		A,B,C
y		0.579	y		0.498
L (sec)		14	L (sec)		14
C (sec)		120	C (sec)		120
y pract.		0.795	y pract.		0.795
R.C. (%)		37%	R.C. (%)		60%

Stage / Phase Diagrams

1



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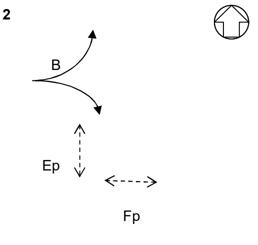

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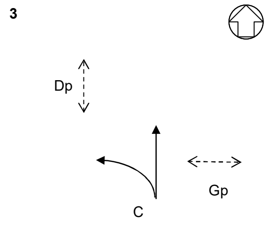


4

5

I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	
I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	

Date:	Junction:
5 Nov 2024	Wan Po Road / Wan O Road (JB) JB

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

Design Year: 2030

Description: 2030 Reference Flows (Weekday)

Designed By: HKH

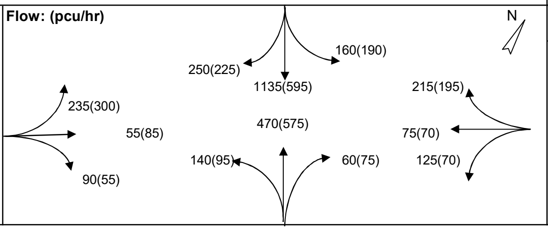
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Access Road (EB)	→↑	B	2	3.400	15					1775	1775	176	0.099	0.099	203	0.114	0.114
	→↑↓	B	2	4.100	20	25		29% / 44%	41% / 23%	2065	2075	204	0.099		237	0.114	
Wan Po Road (SB)	↳	A	1	3.100	15					1750	1750	160	0.091		190	0.109	
	↓	A	1	3.500						2105	2105	568	0.270	0.270	298	0.142	0.142
	↓	A	1	3.500						2105	2105	567	0.269		297	0.141	
	↲	A	1	3.200		25				1960	1960	250	0.128		225	0.115	
Shek Kok Road (WB)	←↑↓	D	4	3.600	10	30		59% / 6%	40% / 19%	1940	1975	212	0.109		173	0.088	0.088
	↰	D	4	3.500		25				1855	1855	203	0.109	0.109	162	0.087	
Wan Po Road (NB)	←↑	C	3	3.600	15			76%	46%	1835	1890	185	0.101		207	0.110	
	↑	C	3	3.500						2105	2105	213	0.101	0.101	232	0.110	0.110
	↑	C	3	3.500						2105	2105	212	0.101		231	0.110	
	↱	C	3	3.600		25				1995	1995	60	0.030		75	0.038	

Pedestrian Crossing	Phase	Stage						
	Ep	2	MIN GREEN + FLASH =	5	+	6	=	11
	Fp	1,3,4	MIN GREEN + FLASH =	5	+	7	=	12
	Gp	3	MIN GREEN + FLASH =	5	+	9	=	14
	Hp	1,2,4	MIN GREEN + FLASH =	7	+	13	=	20
	Ip	4	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	1,2,3	MIN GREEN + FLASH =	5	+	7	=	12

Notes:

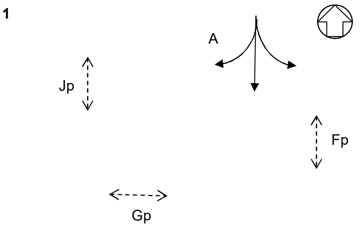
Flow: (pcu/hr)



Group		A,D,C,B	Group		A,D,C,B
y		0.580	y		0.454
L (sec)		27	L (sec)		27
C (sec)		120	C (sec)		120
y pract.		0.698	y pract.		0.698
R.C. (%)		20%	R.C. (%)		54%

Stage / Phase Diagrams

1



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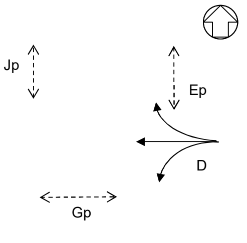

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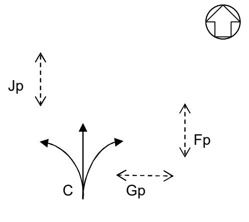

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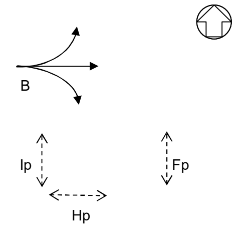


5

I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	
I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	

Date:	Junction: JC
5 Nov 2024	Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / LOHAS Park Road (JD)

Design Year: 2030

Description: 2030 Reference Flows (Weekday)

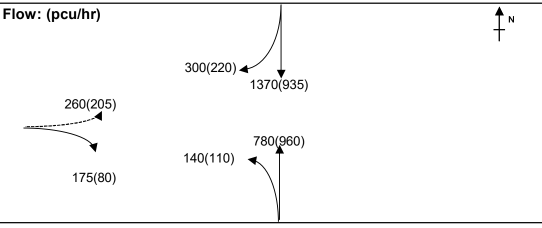
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↓	B	1,2	3.500						1965	1965	661	0.336		451	0.230	
	↓	B	1,2	3.500						2105	2105	709	0.337		484	0.230	
	↲	C	2	3.500		15				1915	1915	300	0.157	0.157	220	0.115	0.115
Wan Po Road (NB)	↑	A	1	3.500						2105	2105	390	0.185	0.185	480	0.228	0.228
	↑	A	1	3.500						2105	2105	390	0.185		480	0.228	
	↰	A	1	3.500	10					1710	1710	140	0.082		110	0.064	
Lohas Park Road (EB)	⮥	E	1,2,3	3.500	35					1885	1885	260	0.138		205	0.109	
	⮧	D	3	4.000		15				1960	1960	175	0.089	0.089	80	0.041	0.041

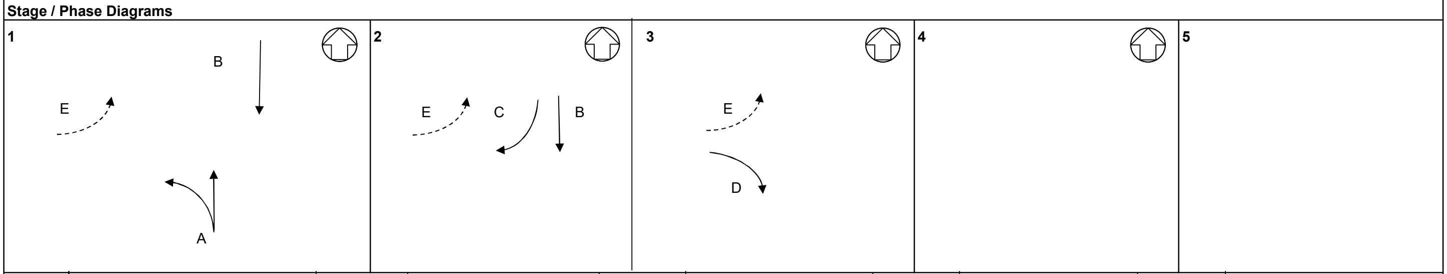
Notes:

Flow: (pcu/hr)



Group		A,C,D	Group		A,C,D
y		0.431	y		0.384
L (sec)		12	L (sec)		12
C (sec)		120	C (sec)		120
y pract.		0.810	y pract.		0.810
R.C. (%)		88%	R.C. (%)		111%

Stage / Phase Diagrams



I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	
I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	

Date: 5 Nov 2024

Junction: JD
Wan Po Road / LOHAS Park Road (JD)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan O Road / Sunrise Boulevard (JE)

Design Year: 2030

Description: 2030 Reference Flows (Weekday)

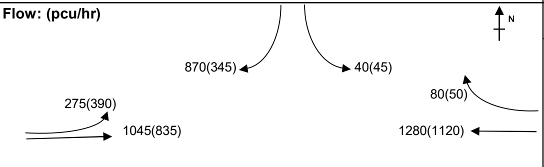
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
	↰	A	1	3.800	20					1855	1855	275	0.148		390	0.210	0.210
Wan O Road (EB)	→	A	1	3.500						2105	2105	523	0.248	0.248	418	0.199	
	→	A	1	3.500						2105	2105	522	0.248		417	0.198	
	↱	C	2	4.000		25				2035	2035	80	0.039	0.039	50	0.025	
Wan O Road (WB)	←	B	1,2,4	3.800						2135	2135	662	0.310		579	0.271	
	←	B	1,2,4	3.800						1995	1995	618	0.310		541	0.271	
	↳	E	3	3.500	18					1815	1815	40	0.022		45	0.025	
Sunrise Boulevard (SB)	↲	D	3	3.500		25				1985	1985	433	0.218	0.218	172	0.087	0.087
	↲	D	3	3.500		30				2005	2005	437	0.218		173	0.086	
Pedestrian Crossing		Fp	4	MIN GREEN + FLASH =			16	+	12	=	28			*			*

Notes:

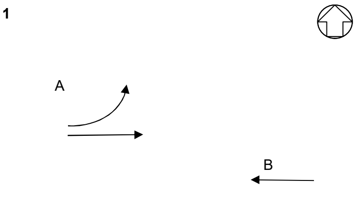
Flow: (pcu/hr)



Group		A,C,D,Fp	Group		A,C,D,Fp
y		0.506	y		0.297
L (sec)		43	L (sec)		49
C (sec)		130	C (sec)		120
y pract.		0.602	y pract.		0.533
R.C. (%)		19%	R.C. (%)		79%

Stage / Phase Diagrams

1



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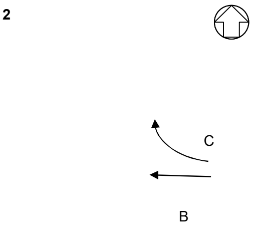

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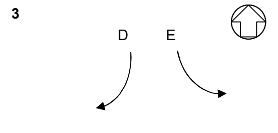

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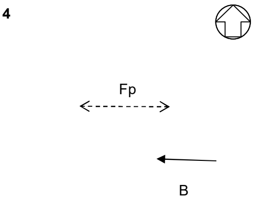


5

I/G= 2		I/G= 5		I/G= 5		I/G= 6	28	I/G=	
I/G= 2		I/G= 5	5	I/G= 5		I/G= 6	28	I/G=	

Date:	Junction: JE
5 Nov 2024	Wan O Road / Sunrise Boulevard (JE)

2030 Design Traffic Forecast
(with construction works)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Chun Yat Street (JA)

Design Year: 2030

Description: 2030 Design Flows (Construction Stage)

Designed By: HKH

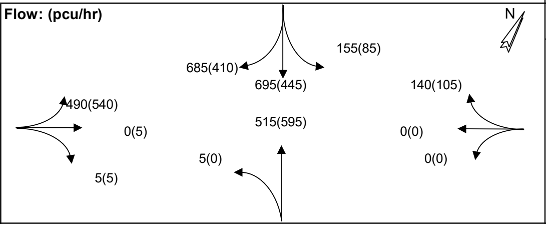
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↓→	A	1,2	3.200	20			39%	34%	1880	1885	400	0.213		250	0.133	
	↓	A	1,2	3.600						2115	2115	450	0.213		280	0.132	
Wan Po Road (SB)	↲	C	2	3.300		25				1965	1965	345	0.176		206	0.105	
	↲	C	2	3.300		20				1940	1940	340	0.175		204	0.105	
Wan Po Road (NB)	←↑	B	1	3.700	15			2%	0%	1980	1985	251	0.127	0.127	287	0.145	
	↑	B	1	3.700						2125	2125	269	0.127		308	0.145	0.145
Chun Yat Street (EB)	↗	D	2,3	3.600	35					1895	1895	490	0.259	0.259	540	0.285	0.285
Chun Yat Street (EB)	→↓	E	3	3.600		25		100%	50%	1995	2055	5	0.003		10	0.005	
Chun Yat Street (WB)	↕←	F	4	5.100	25	20		0% / 100%	0% / 100%	1975	1975	140	0.071	0.071	105	0.053	0.053

Pedestrian Crossing	Phase	Stage		Min Green		Flash		Total
Pedestrian Crossing	Gp	1,4	MIN GREEN + FLASH =	5	+	5	=	10
	Hp	1,2,4	MIN GREEN + FLASH =	5	+	5	=	10
	Ip	3	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	2,3,4	MIN GREEN + FLASH =	5	+	8	=	13
	Kp	2	MIN GREEN + FLASH =	5	+	6	=	11
	Lp	1,2,3	MIN GREEN + FLASH =	5	+	6	=	11
	Mp	2	MIN GREEN + FLASH =	5	+	5	=	10
	Np	3	MIN GREEN + FLASH =	8	+	7	=	15

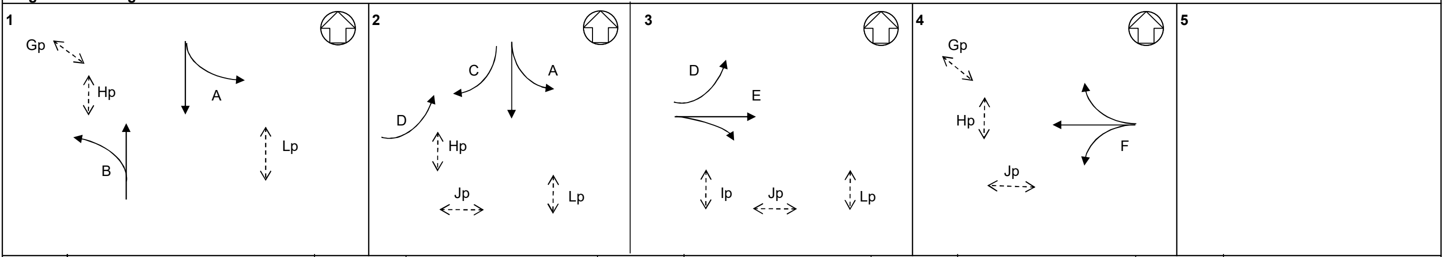
Notes:

Flow: (pcu/hr)



Group		B,D,F	Group		B,D,F
y		0.456	y		0.483
L (sec)		18	L (sec)		18
C (sec)		130	C (sec)		120
y pract.		0.775	y pract.		0.765
R.C. (%)		70%	R.C. (%)		58%

Stage / Phase Diagrams



I/G= 7		I/G= 9		I/G=		I/G= 5		I/G=	
I/G= 7		I/G= 9		I/G=		I/G= 5		I/G=	

Date: 5 Nov 2024

Junction: Wan Po Road / Chun Yat Street (JA) JA

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Wan O Road (JB)

Design Year: 2030

Description: 2030 Design Flows (Construction Stage)

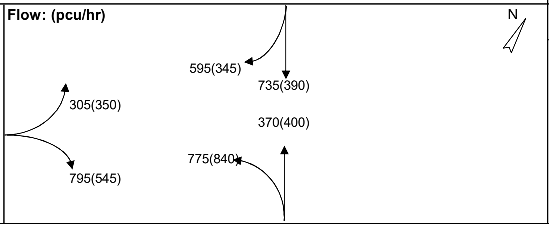
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (NB)	↰	C	3	4.100	15					1840	1840	370	0.201	0.201	401	0.218	0.218
	↰	C	3	4.100	20					2015	2015	405	0.201		439	0.218	
	↑	C	3	4.000						2155	2155	185	0.086		200	0.093	
	↑	C	3	4.100						2165	2165	185	0.085		200	0.092	
Wan O Road (EB)	↱	B	2	3.500	20					1830	1830	305	0.167		350	0.191	0.191
	↴	B	2	3.200		25				1825	1825	386	0.212		265	0.145	
	↴	B	2	3.200		20				1930	1930	409	0.212	0.212	280	0.145	
Wan Po Road (SB)	↓	A	1	3.400						2095	2095	368	0.176	0.176	195	0.093	0.093
	↓	A	1	3.400						2095	2095	367	0.175		195	0.093	
	↲	A	1	3.400		15				1905	1905	304	0.160		176	0.092	
	↲	A	1	3.400		20				1820	1820	291	0.160		169	0.093	
Pedestrian Crossing		Dp	1,3	MIN GREEN + FLASH =			5	+	9	=	14						
		Ep	2	MIN GREEN + FLASH =			5	+	10	=	15						
		Fp	1,2	MIN GREEN + FLASH =			8	+	15	=	23						
		Gp	3	MIN GREEN + FLASH =			5	+	9	=	14						

Notes:

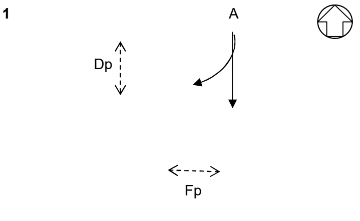
Flow: (pcu/hr)



Group		A,B,C	Group		A,B,C
y		0.589	y		0.502
L (sec)		14	L (sec)		14
C (sec)		120	C (sec)		120
y pract.		0.795	y pract.		0.795
R.C. (%)		35%	R.C. (%)		58%

Stage / Phase Diagrams

1



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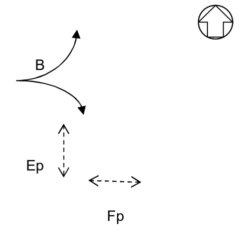

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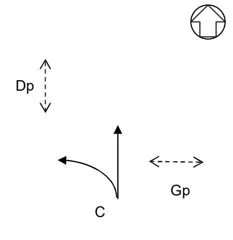


4

5

I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	
I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	

Date: 5 Nov 2024

Junction: JB
Wan Po Road / Wan O Road (JB)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

Design Year: 2030

Description: 2030 Design Flows (Construction Stage)

Designed By: HKH

Checked By: PML

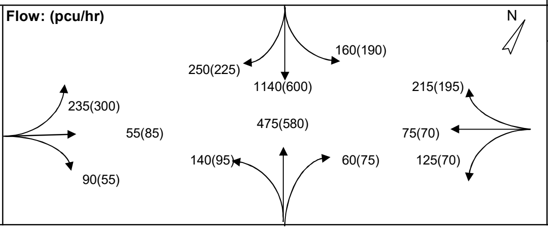
Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Access Road (EB)	→↑	B	2	3.400	15					1775	1775	176	0.099	0.099	203	0.114	0.114
	↑→↓	B	2	4.100	20	25		29% / 44%	41% / 23%	2065	2075	204	0.099		237	0.114	
Wan Po Road (SB)	↳	A	1	3.100	15					1750	1750	160	0.091		190	0.109	
	↓	A	1	3.500						2105	2105	570	0.271	0.271	300	0.143	0.143
	↓	A	1	3.500						2105	2105	570	0.271		300	0.143	
	↲	A	1	3.200		25				1960	1960	250	0.128		225	0.115	
Shek Kok Road (WB)	↑←↓	D	4	3.600	10	30		59% / 6%	40% / 19%	1940	1975	212	0.109		173	0.088	0.088
	↰	D	4	3.500		25				1855	1855	203	0.109	0.109	162	0.087	
Wan Po Road (NB)	←↑	C	3	3.600	15			75%	45%	1835	1890	187	0.102	0.102	209	0.111	
	↑	C	3	3.500						2105	2105	214	0.102		233	0.111	0.111
	↑	C	3	3.500						2105	2105	214	0.102		233	0.111	
	↱	C	3	3.600		25				1995	1995	60	0.030		75	0.038	

Pedestrian Crossing

	Phase	Stage						
Pedestrian Crossing	Ep	2	MIN GREEN + FLASH =	5	+	6	=	11
	Fp	1,3,4	MIN GREEN + FLASH =	5	+	7	=	12
	Gp	3	MIN GREEN + FLASH =	5	+	9	=	14
	Hp	1,2,4	MIN GREEN + FLASH =	7	+	13	=	20
	Ip	4	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	1,2,3	MIN GREEN + FLASH =	5	+	7	=	12

Notes:

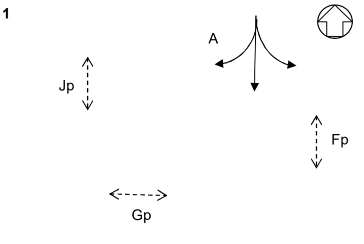
Flow: (pcu/hr)



Group		A,D,C,B	Group		A,D,C,B
y		0.581	y		0.455
L (sec)		27	L (sec)		27
C (sec)		120	C (sec)		120
y pract.		0.698	y pract.		0.698
R.C. (%)		20%	R.C. (%)		53%

Stage / Phase Diagrams

1



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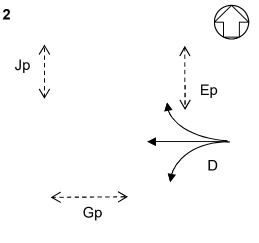

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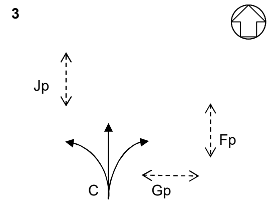

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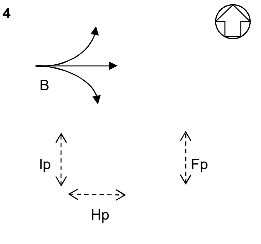


5

I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	
I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	

Date:	Junction: JC
5 Nov 2024	Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / LOHAS Park Road (JD)

Design Year: 2030

Description: 2030 Design Flows (Construction Stage)

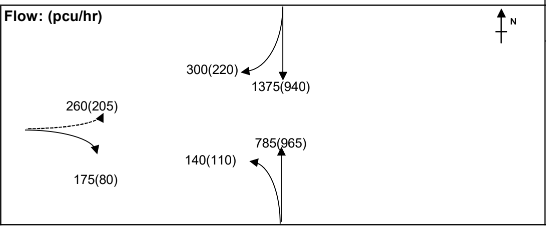
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↓	B	1,2	3.500						1965	1965	664	0.338		454	0.231	
	↓	B	1,2	3.500						2105	2105	711	0.338		486	0.231	
	↲	C	2	3.500		15				1915	1915	300	0.157	0.157	220	0.115	0.115
Wan Po Road (NB)	↑	A	1	3.500						2105	2105	393	0.187	0.187	483	0.229	0.229
	↑	A	1	3.500						2105	2105	392	0.186		482	0.229	
	↰	A	1	3.500	10					1710	1710	140	0.082		110	0.064	
Lohas Park Road (EB)	⤴	E	1,2,3	3.500	35					1885	1885	260	0.138		205	0.109	
	⤵	D	3	4.000		15				1960	1960	175	0.089	0.089	80	0.041	0.041

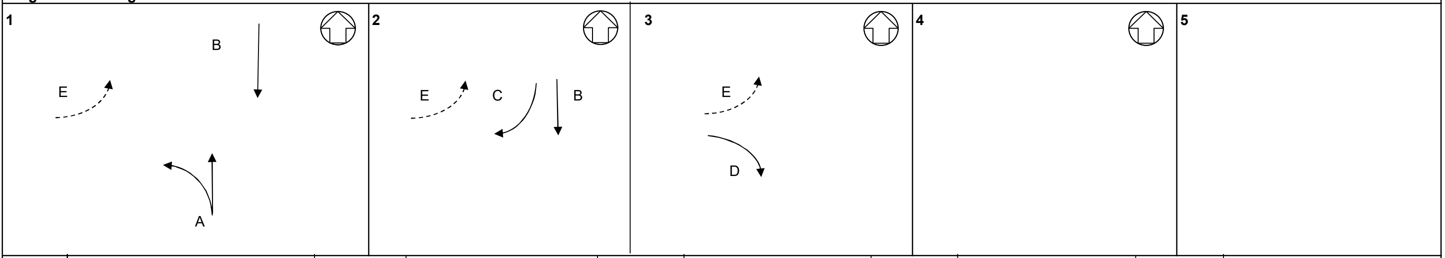
Notes:

Flow: (pcu/hr)



Group		A,C,D	Group		A,C,D
y		0.433	y		0.385
L (sec)		12	L (sec)		12
C (sec)		120	C (sec)		120
y pract.		0.810	y pract.		0.810
R.C. (%)		87%	R.C. (%)		110%

Stage / Phase Diagrams



I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	
I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	

Date:	Junction: JD
5 Nov 2024	Wan Po Road / LOHAS Park Road (JD)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan O Road / Sunrise Boulevard (JE)

Design Year: 2030

Description: 2030 Design Flows (Construction Stage)

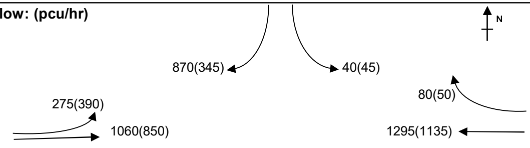
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
	⤴	A	1	3.800	20					1855	1855	275	0.148		390	0.210	0.210
Wan O Road (EB)	→	A	1	3.500						2105	2105	530	0.252	0.252	425	0.202	
	→	A	1	3.500						2105	2105	530	0.252		425	0.202	
	↖	C	2	4.000		25				2035	2035	80	0.039	0.039	50	0.025	
Wan O Road (WB)	←	B	1,2,4	3.800						2135	2135	669	0.313		587	0.275	
	←	B	1,2,4	3.800						1995	1995	626	0.314		548	0.275	
	↳	E	3	3.500	18					1815	1815	40	0.022		45	0.025	
Sunrise Boulevard (SB)	↲	D	3	3.500		25				1985	1985	433	0.218	0.218	172	0.087	0.087
	↲	D	3	3.500		30				2005	2005	437	0.218		173	0.086	
Pedestrian Crossing		Fp	4	MIN GREEN + FLASH =			16	+	12	=	28			*			*

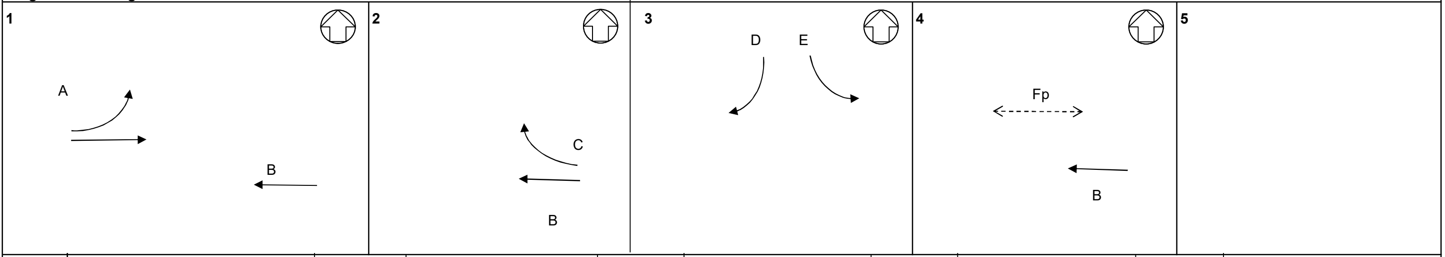
Notes:

Flow: (pcu/hr)



		AM			PM
Group		A,C,D,Fp	**Group**		A,C,D,Fp
y		0.509	**y**		0.297
L (sec)		43	**L (sec)**		49
C (sec)		130	**C (sec)**		120
y pract.		0.602	**y pract.**		0.533
R.C. (%)		18%	**R.C. (%)**		79%

Stage / Phase Diagrams



I/G= 2		I/G= 5		I/G= 5		I/G= 6	28	I/G=	
I/G= 2		I/G= 5	5	I/G= 5		I/G= 6	28	I/G=	

Date: 5 Nov 2024

Junction: Wan O Road / Sunrise Boulevard (JE) JE

2033 Reference Traffic Forecast (without Proposed PRS Development) - Weekday

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Chun Yat Street (JA)

Design Year: 2033

Description: 2033 Reference Flows (Weekday)

Designed By: HKH

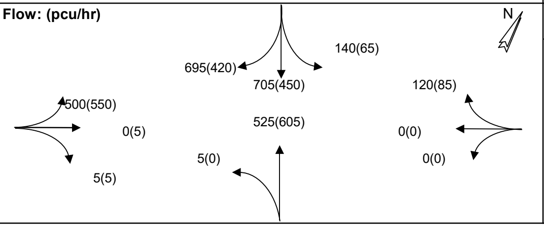
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↳	A	1,2	3.200	20			35%	27%	1885	1895	398	0.211		244	0.129	
	↓	A	1,2	3.600						2115	2115	447	0.211		271	0.128	
Wan Po Road (SB)	↲	C	2	3.300		25				1965	1965	350	0.178		211	0.107	
	↲	C	2	3.300		20				1940	1940	345	0.178		209	0.108	
Wan Po Road (NB)	↰	B	1	3.700	15			2%	0%	1980	1985	256	0.129	0.129	292	0.147	
	↑	B	1	3.700						2125	2125	274	0.129		313	0.147	0.147
Chun Yat Street (EB)	⬏	D	2,3	3.600	35					1895	1895	500	0.264	0.264	550	0.290	0.290
Chun Yat Street (EB)	↴	E	3	3.600		25		100%	50%	1995	2055	5	0.003		10	0.005	
Chun Yat Street (WB)	✣	F	4	5.100	25	20		0% / 100%	0% / 100%	1975	1975	120	0.061	0.061	85	0.043	0.043

Pedestrian Crossing	Phase	Stage						
Pedestrian Crossing	Gp	1,4	MIN GREEN + FLASH =	5	+	5	=	10
	Hp	1,2,4	MIN GREEN + FLASH =	5	+	5	=	10
	Ip	3	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	2,3,4	MIN GREEN + FLASH =	5	+	8	=	13
	Kp	2	MIN GREEN + FLASH =	5	+	6	=	11
	Lp	1,2,3	MIN GREEN + FLASH =	5	+	6	=	11
	Mp	2	MIN GREEN + FLASH =	5	+	5	=	10
	Np	3	MIN GREEN + FLASH =	8	+	7	=	15

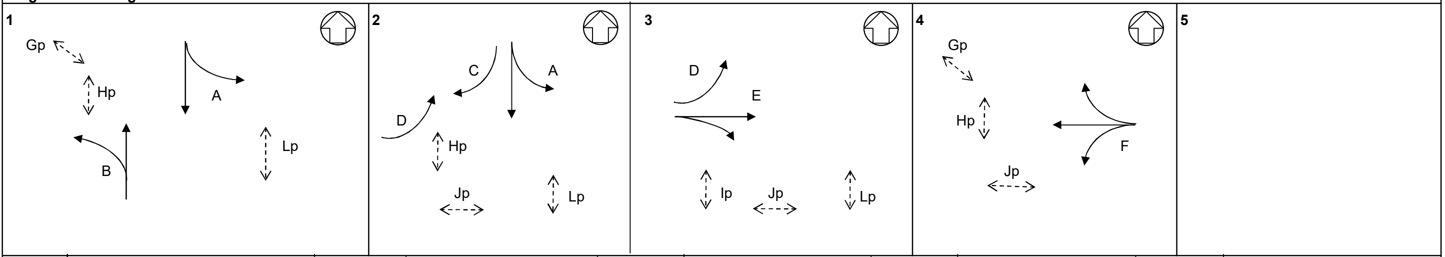
Notes:

Flow: (pcu/hr)



Group		B,D,F	**Group**		B,D,F
y		0.454	**y**		0.481
L (sec)		18	**L (sec)**		18
C (sec)		130	**C (sec)**		120
y pract.		0.775	**y pract.**		0.765
R.C. (%)		71%	**R.C. (%)**		59%

Stage / Phase Diagrams



I/G= 7		I/G= 9		I/G=		I/G= 5		I/G=	
I/G= 7		I/G= 9		I/G=		I/G= 5		I/G=	

Date: 5 Nov 2024	**Junction:** JA Wan Po Road / Chun Yat Street (JA)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

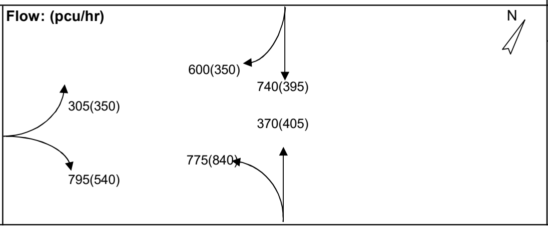
Junction: Wan Po Road / Wan O Road (JB)
Design Year: 2033
Description: 2033 Reference Flows (Weekday)
Designed By: HKH
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (NB)	↰	C	3	4.100	15					1840	1840	370	0.201	0.201	401	0.218	0.218
	↰	C	3	4.100	20					2015	2015	405	0.201		439	0.218	
	↑	C	3	4.000						2155	2155	185	0.086		202	0.094	
	↑	C	3	4.100						2165	2165	185	0.085		203	0.094	
Wan O Road (EB)	↱	B	2	3.500	20					1830	1830	305	0.167		350	0.191	0.191
	↴	B	2	3.200		25				1825	1825	386	0.212		262	0.144	
	↴	B	2	3.200		20				1930	1930	409	0.212	0.212	278	0.144	
Wan Po Road (SB)	↓	A	1	3.400						2095	2095	370	0.177	0.177	198	0.095	0.095
	↓	A	1	3.400						2095	2095	370	0.177		197	0.094	
	↲	A	1	3.400		15				1905	1905	307	0.161		179	0.094	
	↲	A	1	3.400		20				1820	1820	293	0.161		171	0.094	

Pedestrian Crossing
Dp 1,3 MIN GREEN + FLASH = 5 + 9 = 14
Ep 2 MIN GREEN + FLASH = 5 + 10 = 15
Fp 1,2 MIN GREEN + FLASH = 8 + 15 = 23
Gp 3 MIN GREEN + FLASH = 5 + 9 = 14

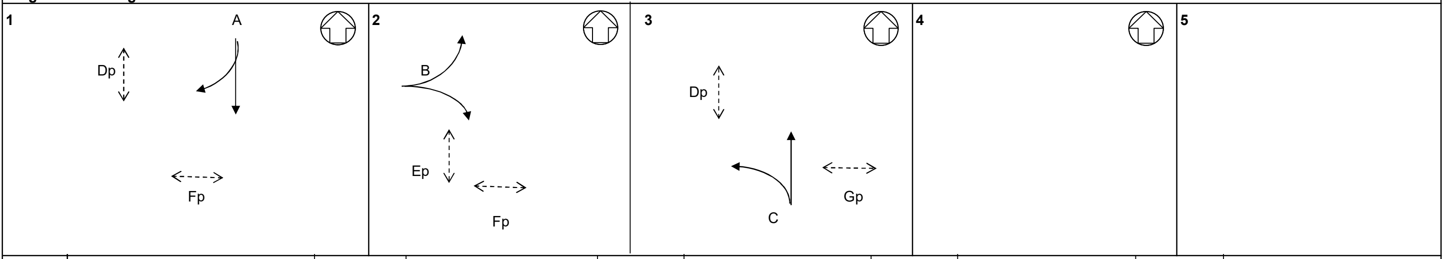
Notes:

Flow: (pcu/hr)



Group		A,B,C	Group		A,B,C
y		0.590	y		0.504
L (sec)		14	L (sec)		14
C (sec)		120	C (sec)		120
y pract.		0.795	y pract.		0.795
R.C. (%)		35%	R.C. (%)		58%

Stage / Phase Diagrams



I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	
I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	

Date: 5 Nov 2024
Junction: Wan Po Road / Wan O Road (JB)
JB

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

Design Year: 2033

Description: 2033 Reference Flows (Weekday)

Designed By: HKH

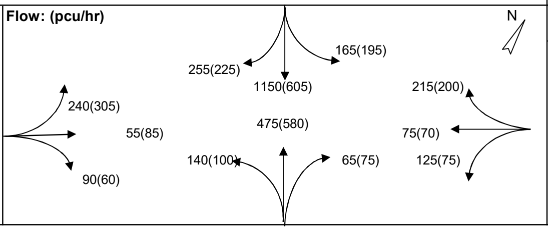
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Access Road (EB)	↑→	B	2	3.400	15					1775	1775	178	0.100	0.100	208	0.117	0.117
	↑→↓	B	2	4.100	20	25		30% / 43%	40% / 25%	2065	2070	207	0.100		242	0.117	
Wan Po Road (SB)	↳	A	1	3.100	15					1750	1750	165	0.094		195	0.111	
	↓	A	1	3.500						2105	2105	575	0.273	0.273	303	0.144	0.144
	↓	A	1	3.500						2105	2105	575	0.273		302	0.143	
	↲	A	1	3.200		25				1960	1960	255	0.130		225	0.115	
Shek Kok Road (WB)	↑←↓	D	4	3.600	10	30		59% / 6%	42% / 19%	1940	1970	212	0.109		178	0.090	0.090
	↰	D	4	3.500		25				1855	1855	203	0.109	0.109	167	0.090	
Wan Po Road (NB)	←↑	C	3	3.600	15			75%	48%	1835	1885	187	0.102	0.102	210	0.111	
	↑	C	3	3.500						2105	2105	214	0.102		235	0.112	0.112
	↑	C	3	3.500						2105	2105	214	0.102		235	0.112	
	↱	C	3	3.600		25				1995	1995	65	0.033		75	0.038	

Pedestrian Crossing	Phase	Stage						
	Ep	2	MIN GREEN + FLASH =	5	+	6	=	11
	Fp	1,3,4	MIN GREEN + FLASH =	5	+	7	=	12
	Gp	3	MIN GREEN + FLASH =	5	+	9	=	14
	Hp	1,2,4	MIN GREEN + FLASH =	7	+	13	=	20
	Ip	4	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	1,2,3	MIN GREEN + FLASH =	5	+	7	=	12

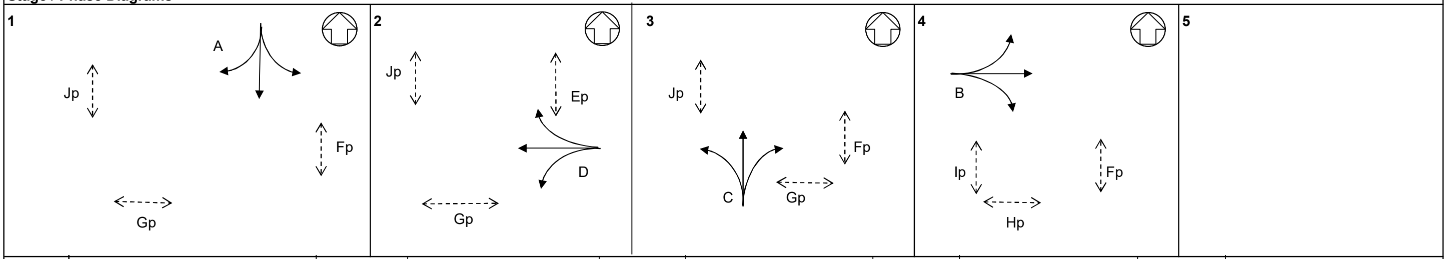
Notes:

Flow: (pcu/hr)



Group		A,D,C,B	Group		A,D,C,B
y		0.585	y		0.463
L (sec)		27	L (sec)		27
C (sec)		120	C (sec)		120
y pract.		0.698	y pract.		0.698
R.C. (%)		19%	R.C. (%)		51%

Stage / Phase Diagrams



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I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	

Date: 5 Nov 2024

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

JC

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / LOHAS Park Road (JD)

Design Year: 2033

Description: 2033 Reference Flows (Weekday)

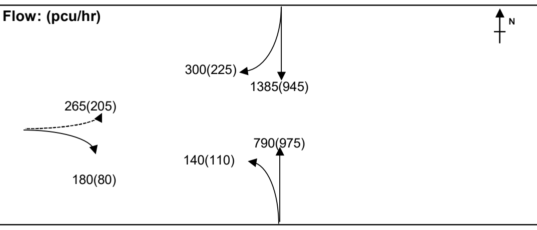
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↓	B	1,2	3.500						1965	1965	669	0.340		456	0.232	
	↓	B	1,2	3.500						2105	2105	716	0.340		489	0.232	
	↲	C	2	3.500		15				1915	1915	300	0.157	0.157	225	0.117	0.117
Wan Po Road (NB)	↑	A	1	3.500						2105	2105	395	0.188	0.188	488	0.232	0.232
	↑	A	1	3.500						2105	2105	395	0.188		487	0.231	
	↰	A	1	3.500	10					1710	1710	140	0.082		110	0.064	
Lohas Park Road (EB)	↗	E	1,2,3	3.500	35					1885	1885	265	0.141		205	0.109	
	↘	D	3	4.000		15				1960	1960	180	0.092	0.092	80	0.041	0.041

Notes:

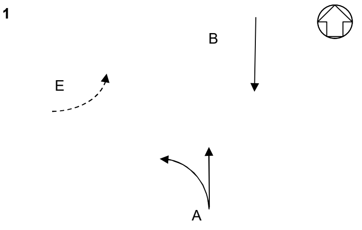
Flow: (pcu/hr)



Group		A,C,D	Group		A,C,D
y		0.436	y		0.390
L (sec)		12	L (sec)		12
C (sec)		120	C (sec)		120
y pract.		0.810	y pract.		0.810
R.C. (%)		86%	R.C. (%)		108%

Stage / Phase Diagrams

1



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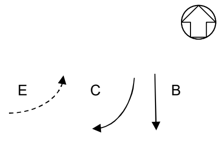
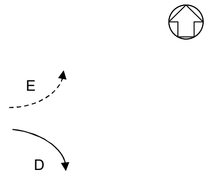


3



4

5

I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	
I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	

Date:	Junction: JD
5 Nov 2024	Wan Po Road / LOHAS Park Road (JD)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan O Road / Sunrise Boulevard (JE)

Design Year: 2033

Description: 2033 Reference Flows (Weekday)

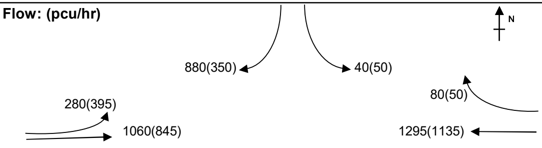
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
	↰	A	1	3.800	20					1855	1855	280	0.151		395	0.213	0.213
Wan O Road (EB)	→	A	1	3.500						2105	2105	530	0.252	0.252	423	0.201	
	→	A	1	3.500						2105	2105	530	0.252		422	0.200	
	↱	C	2	4.000		25				2035	2035	80	0.039	0.039	50	0.025	
Wan O Road (WB)	←	B	1,2,4	3.800						2135	2135	669	0.313		587	0.275	
	←	B	1,2,4	3.800						1995	1995	626	0.314		548	0.275	
	↳	E	3	3.500	18					1815	1815	40	0.022		50	0.028	
Sunrise Boulevard (SB)	↲	D	3	3.500		25				1985	1985	438	0.221	0.221	174	0.088	
	↲	D	3	3.500		30				2005	2005	442	0.220		176	0.088	0.088
Pedestrian Crossing		Fp	4	MIN GREEN + FLASH =			16	+	12	=	28			*			*

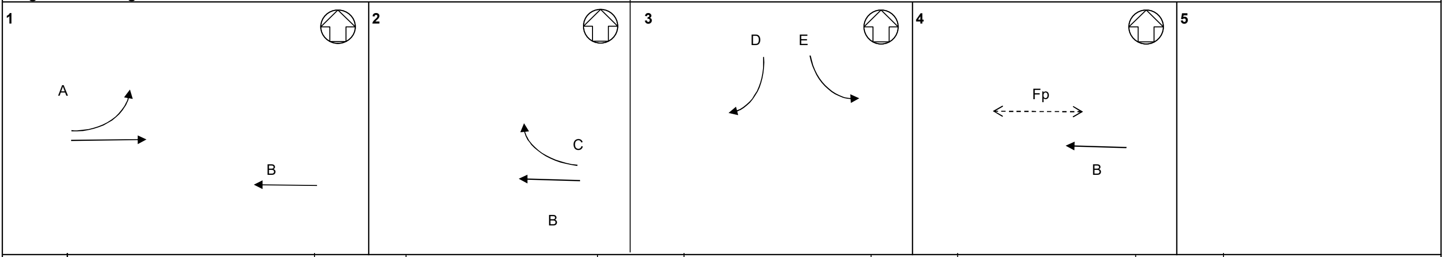
Notes:

Flow: (pcu/hr)



Group		A,C,D,Fp	Group		A,C,D,Fp
y		0.512	y		0.301
L (sec)		43	L (sec)		49
C (sec)		130	C (sec)		120
y pract.		0.602	y pract.		0.533
R.C. (%)		18%	R.C. (%)		77%

Stage / Phase Diagrams



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Date: 5 Nov 2024

Junction: Wan O Road / Sunrise Boulevard (JE)

JE

2033 Design Traffic Forecast (with Proposed PRS Development) - Normal Operation

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010 **MVA HONG KONG LIMITED**

Junction: Wan Po Road / Chun Yat Street (JA)

Design Year: 2033

Description: 2033 Design Flows (Normal Operation)

Designed By: HKH

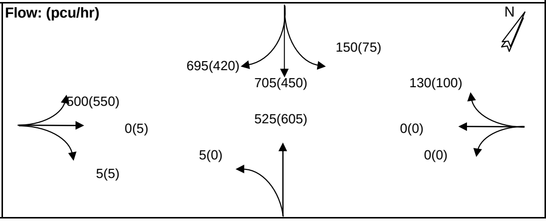
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↓↳	A	1,2	3.200	20			37%	30%	1880	1890	403	0.214		248	0.131	
	↓	A	1,2	3.600						2115	2115	452	0.214		277	0.131	
Wan Po Road (SB)	↲	C	2	3.300		25				1965	1965	350	0.178		211	0.107	
	↲	C	2	3.300		20				1940	1940	345	0.178		209	0.108	
Wan Po Road (NB)	↰↑	B	1	3.700	15			2%	0%	1980	1985	256	0.129	0.129	292	0.147	
	↑	B	1	3.700						2125	2125	274	0.129		313	0.147	0.147
Chun Yat Street (EB)	⬏	D	2,3	3.600	35					1895	1895	500	0.264	0.264	550	0.290	0.290
Chun Yat Street (EB)	→↓	E	3	3.600		25		100%	50%	1995	2055	5	0.003		10	0.005	
Chun Yat Street (WB)	←↑↓	F	4	5.100	25	20		0% / 100%	0% / 100%	1975	1975	130	0.066	0.066	100	0.051	0.051

Pedestrian Crossing	Phase	Stage						
Pedestrian Crossing	Gp	1,4	MIN GREEN + FLASH =	5	+	5	=	10
	Hp	1,2,4	MIN GREEN + FLASH =	5	+	5	=	10
	Ip	3	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	2,3,4	MIN GREEN + FLASH =	5	+	8	=	13
	Kp	2	MIN GREEN + FLASH =	5	+	6	=	11
	Lp	1,2,3	MIN GREEN + FLASH =	5	+	6	=	11
	Mp	2	MIN GREEN + FLASH =	5	+	5	=	10
	Np	3	MIN GREEN + FLASH =	8	+	7	=	15

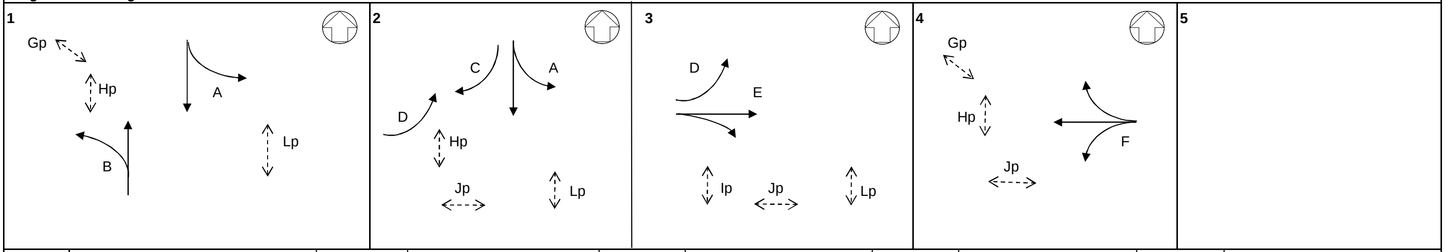
Notes:

Flow: (pcu/hr)



Group	B,C,Ip,F	B,D,F	Group	B,C,Ip,F	B,D,F
y	0.373	0.459	y	0.306	0.488
L (sec)	35	18	L (sec)	35	18
C (sec)	130	130	C (sec)	120	120
y pract.	0.658	0.775	y pract.	0.638	0.765
R.C. (%)	76%	69%	R.C. (%)	109%	57%

Stage / Phase Diagrams



I/G= 7		I/G= 9		I/G=		I/G= 5		I/G=
I/G= 7		I/G= 9		I/G=		I/G= 5		I/G=

Date: 5 Nov 2024	**Junction:** JA Wan Po Road / Chun Yat Street (JA)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Wan O Road (JB)

Design Year: 2033

Description: 2033 Design Flows (Normal Operation)

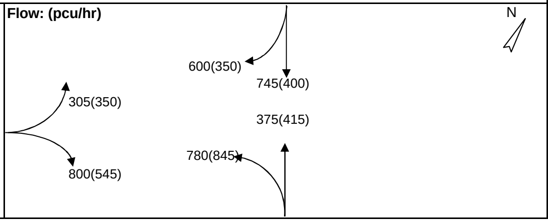
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m)		Gradient (%)	Pro. Turning (%)		Revised Saturation Flow (pcu/hr)		AM Peak			PM Peak		
					Left	Right		AM	PM	AM	PM	Flow (pcu/hr)	y Value	Critical y	Flow (pcu/hr)	y Value	Critical y
Wan Po Road (NB)	↰	C	3	4.100	15					1840	1840	372	0.202		403	0.219	
	↰	C	3	4.100	20					2015	2015	408	0.202	0.202	442	0.219	0.219
	↑	C	3	4.000						2155	2155	187	0.087		207	0.096	
	↑	C	3	4.100						2165	2165	188	0.087		208	0.096	
Wan O Road (EB)	↗	B	2	3.500	20					1830	1830	305	0.167		350	0.191	0.191
	↘	B	2	3.200		25				1825	1825	389	0.213	0.213	265	0.145	
	↘	B	2	3.200		20				1930	1930	411	0.213		280	0.145	
Wan Po Road (SB)	↓	A	1	3.400						2095	2095	373	0.178	0.178	200	0.095	0.095
	↓	A	1	3.400						2095	2095	372	0.178		200	0.095	
	↲	A	1	3.400		15				1905	1905	307	0.161		179	0.094	
	↲	A	1	3.400		20				1820	1820	293	0.161		171	0.094	
Pedestrian Crossing		Dp	1,3	MIN GREEN + FLASH =			5	+	9	=	14						
		Ep	2	MIN GREEN + FLASH =			5	+	10	=	15						
		Fp	1,2	MIN GREEN + FLASH =			8	+	15	=	23						
		Gp	3	MIN GREEN + FLASH =			5	+	9	=	14						

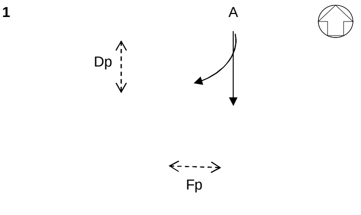
Notes:

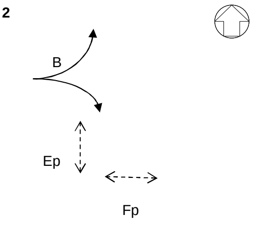
Flow: (pcu/hr)

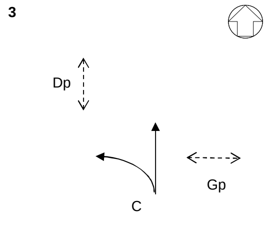


Group	A,B,Gp	A,B,C	Group	A,B,Gp	A,B,C
y	0.391	0.594	y	0.287	0.506
L (sec)	35	14	L (sec)	35	14
C (sec)	120	120	C (sec)	120	120
y pract.	0.638	0.795	y pract.	0.638	0.795
R.C. (%)	63%	34%	R.C. (%)	122%	57%

Stage / Phase Diagrams







4

5

I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	
I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	

Date:	Junction:
5 Nov 2024	Wan Po Road / Wan O Road (JB) JB

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

Design Year: 2033

Description: 2033 Design Flows (Normal Operation)

Designed By: HKH

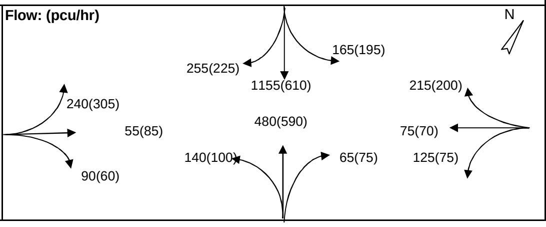
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Access Road (EB)		B	2	3.400	15					1775	1775	178	0.100	0.100	208	0.117	0.117
		B	2	4.100	20	25		30% / 43%	40% / 25%	2065	2070	207	0.100		242	0.117	
Wan Po Road (SB)		A	1	3.100	15					1750	1750	165	0.094		195	0.111	
		A	1	3.500						2105	2105	578	0.275	0.275	305	0.145	0.145
		A	1	3.500						2105	2105	577	0.274		305	0.145	
		A	1	3.200		25				1960	1960	255	0.130		225	0.115	
Shek Kok Road (WB)		D	4	3.600	10	30		59% / 6%	42% / 19%	1940	1970	212	0.109		178	0.090	0.090
		D	4	3.500		25				1855	1855	203	0.109	0.109	167	0.090	
Wan Po Road (NB)		C	3	3.600	15			74%	47%	1840	1885	188	0.102		214	0.114	0.114
		C	3	3.500						2105	2105	216	0.103	0.103	238	0.113	
		C	3	3.500						2105	2105	216	0.103		238	0.113	
		C	3	3.600		25				1995	1995	65	0.033		75	0.038	

Pedestrian Crossing	Ep	2	MIN GREEN + FLASH =	5	+	6	=	11
	Fp	1,3,4	MIN GREEN + FLASH =	5	+	7	=	12
	Gp	3	MIN GREEN + FLASH =	5	+	9	=	14
	Hp	1,2,4	MIN GREEN + FLASH =	7	+	13	=	20
	Ip	4	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	1,2,3	MIN GREEN + FLASH =	5	+	7	=	12

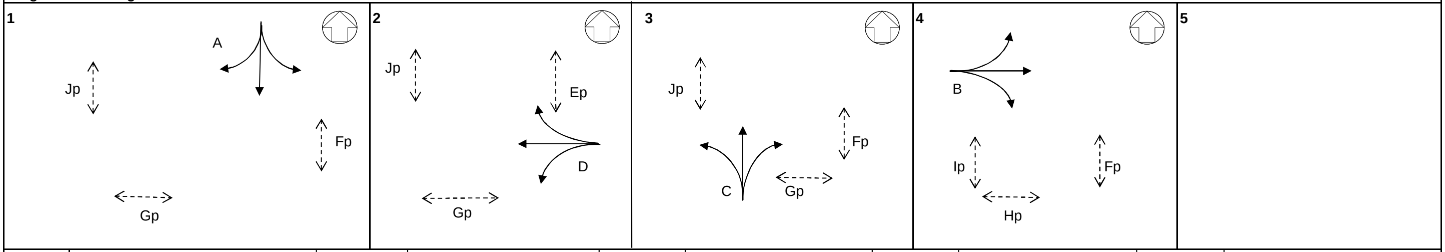
Notes:

Flow: (pcu/hr)



Group	A,D,C,Ip	A,D,C,B	Group	A,Ep,C,B	A,D,C,B
y	0.487	0.587	y	0.376	0.466
L (sec)	38	27	L (sec)	34	27
C (sec)	120	120	C (sec)	120	120
y pract.	0.615	0.698	y pract.	0.645	0.698
R.C. (%)	26%	19%	R.C. (%)	72%	50%

Stage / Phase Diagrams



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I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	

Date: 5 Nov 2024

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

JC

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / LOHAS Park Road (JD)

Design Year: 2033

Description: 2033 Design Flows (Normal Operation)

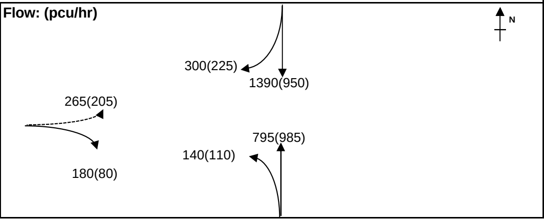
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↓	B	1,2	3.500						1965	1965	671	0.341		459	0.234	
	↓	B	1,2	3.500						2105	2105	719	0.342		491	0.233	
	↲	C	2	3.500		15				1915	1915	300	0.157	0.157	225	0.117	0.117
Wan Po Road (NB)	↑	A	1	3.500						2105	2105	398	0.189	0.189	493	0.234	0.234
	↑	A	1	3.500						2105	2105	397	0.189		492	0.234	
	↰	A	1	3.500	10					1710	1710	140	0.082		110	0.064	
Lohas Park Road (EB)	⮥	E	1,2,3	3.500	35					1885	1885	265	0.141		205	0.109	
	⮧	D	3	4.000		15				1960	1960	180	0.092	0.092	80	0.041	0.041

Notes:

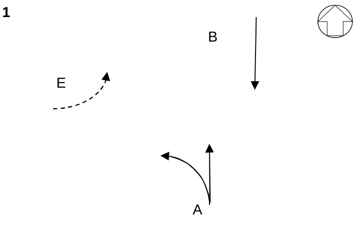
Flow: (pcu/hr)



Group	B,D	A,C,D	Group	B,D	A,C,D
y	0.433	0.438	y	0.274	0.393
L (sec)	10	12	L (sec)	10	12
C (sec)	120	120	C (sec)	120	120
y pract.	0.825	0.810	y pract.	0.825	0.810
R.C. (%)	90%	85%	R.C. (%)	201%	106%

Stage / Phase Diagrams

1



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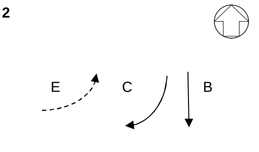

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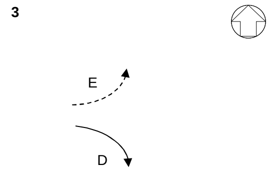


4

5

I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	
I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	

Date: 5 Nov 2024

Junction: Wan Po Road / LOHAS Park Road (JD)

JD

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan O Road / Sunrise Boulevard (JE)

Design Year: 2033

Description: 2033 Design Flows (Normal Operation)

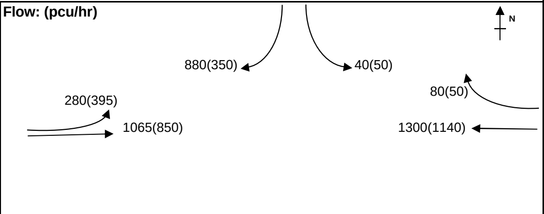
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan O Road (EB)	⤴	A	1	3.800	20					1855	1855	280	0.151		395	0.213	0.213
	→	A	1	3.500						2105	2105	533	0.253	0.253	425	0.202	
	→	A	1	3.500						2105	2105	532	0.253		425	0.202	
Wan O Road (WB)	↰	C	2	4.000		25				2035	2035	80	0.039	0.039	50	0.025	
	←	B	1,2,4	3.800						2135	2135	672	0.315		589	0.276	
	←	B	1,2,4	3.800						1995	1995	628	0.315		551	0.276	
Sunrise Boulevard (SB)	↳	E	3	3.500	18					1815	1815	40	0.022		50	0.028	
	↲	D	3	3.500		25				1985	1985	438	0.221	0.221	174	0.088	
	↲	D	3	3.500		30				2005	2005	442	0.220		176	0.088	0.088
Pedestrian Crossing		Fp	4	MIN GREEN + FLASH =			16	+	12	=	28			*			*

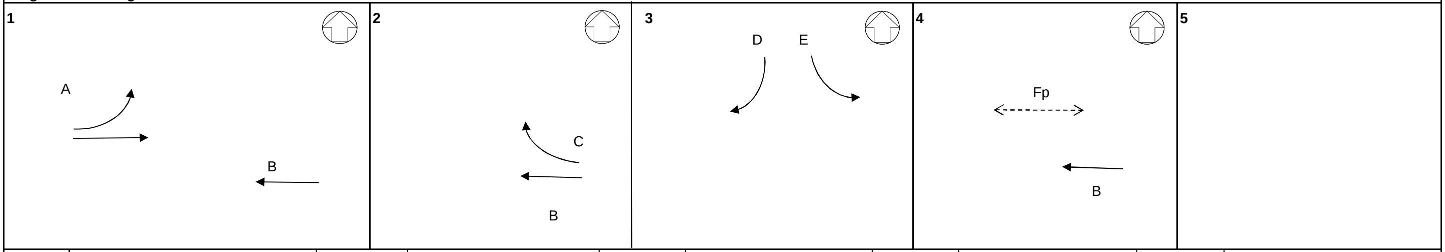
Notes:

Flow: (pcu/hr)



Group	B,D	A,C,D,Fp	Group	B,D	A,C,D,Fp
y	0.535	0.513	y	0.364	0.301
L (sec)	15	43	L (sec)	15	49
C (sec)	130	130	C (sec)	120	120
y pract.	0.796	0.602	y pract.	0.788	0.533
R.C. (%)	49%	17%	R.C. (%)	116%	77%

Stage / Phase Diagrams



I/G= 2		I/G= 5		I/G= 5		I/G= 6	28	I/G=	
I/G= 2		I/G= 5	5	I/G= 5		I/G= 6	28	I/G=	

Date:	Junction: JE
5 Nov 2024	Wan O Road / Sunrise Boulevard (JE)

2033 Reference Traffic Forecast (without Proposed PRS Development) - Weekend

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010 **MVA HONG KONG LIMITED**

Junction: Wan Po Road / Chun Yat Street (JA) Design Year: 2033

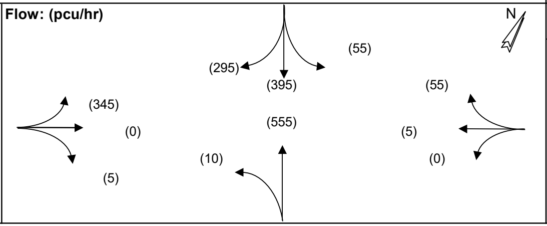
Description: 2033 Reference Flows (Weekend) Designed By: HKH Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)	PM	Revised Saturation Flow (pcu/hr)	PM	Flow (pcu/hr)	y Value	Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↓→	A	1,2	3.200	20				26%		1900				213	0.112	
	↓	A	1,2	3.600							2115				237	0.112	
Wan Po Road (SB)	↲	C	2	3.300		25					1965				148	0.075	
	↲	C	2	3.300		20					1940				147	0.076	
Wan Po Road (NB)	←↑	B	1	3.700	15				4%		1980				272	0.137	
	↑	B	1	3.700							2125				293	0.138	0.138
Chun Yat Street (EB)	↱	D	2,3	3.600	35						1895				345	0.182	0.182
Chun Yat Street (EB)	→↓	E	3	3.600		25			100%		1995				5	0.003	
Chun Yat Street (WB)	←↑↓	F	4	5.100	25	20			0% / 92%		1990				60	0.030	0.030

Pedestrian Crossing	Phase	Stage		Min Green		Flash		Total
	Gp	1,4	MIN GREEN + FLASH =	5	+	5	=	10
	Hp	1,2,4	MIN GREEN + FLASH =	5	+	5	=	10
	Ip	3	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	2,3,4	MIN GREEN + FLASH =	5	+	8	=	13
	Kp	2	MIN GREEN + FLASH =	5	+	6	=	11
	Lp	1,2,3	MIN GREEN + FLASH =	5	+	6	=	11
	Mp	2	MIN GREEN + FLASH =	5	+	5	=	10
	Np	3	MIN GREEN + FLASH =	8	+	7	=	15

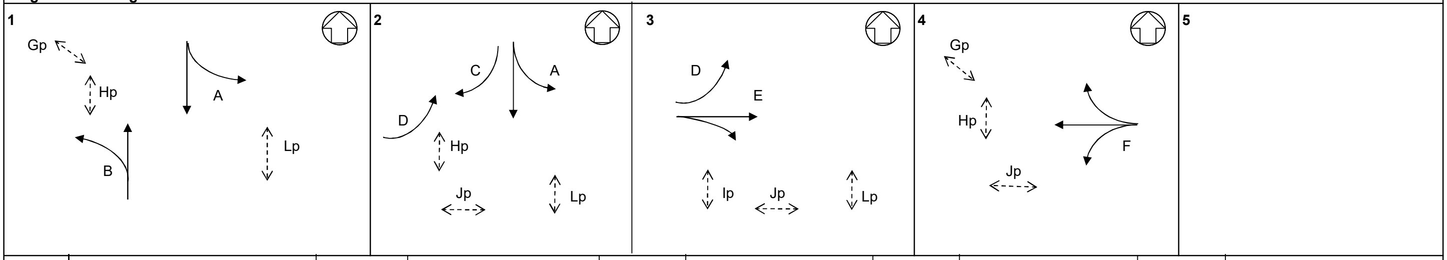
Notes:

Flow: (pcu/hr)



Group			Group		B,D,F
y			y		0.350
L (sec)			L (sec)		18
C (sec)			C (sec)		120
y pract.			y pract.		0.765
R.C. (%)			R.C. (%)		119%

Stage / Phase Diagrams



I/G= 7	I/G= 9	I/G=	I/G= 5	I/G=

Date: 5 Nov 2024

Junction: Wan Po Road / Chun Yat Street (JA) JA

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Wan O Road (JB)

Design Year: 2033

Description: 2033 Reference Flows (Weekend)

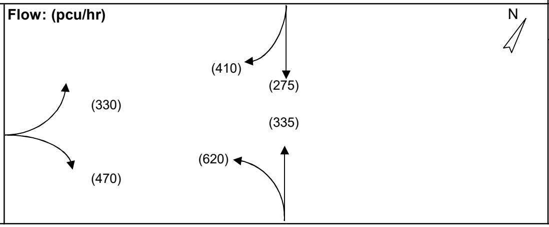
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr)	Revised Saturation Flow (pcu/hr) PM	Flow (pcu/hr)	y Value	Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (NB)	↰	C	3	4.100	15						1840				296	0.161	0.161
	↰	C	3	4.100	20						2015				324	0.161	
	↑	C	3	4.000							2155				167	0.077	
	↑	C	3	4.100							2165				168	0.078	
Wan O Road (EB)	⬏	B	2	3.500	20						1830				330	0.180	0.180
	↴	B	2	3.200		25					1825				228	0.125	
	↴	B	2	3.200		20					1930				242	0.125	
Wan Po Road (SB)	↓	A	1	3.400							2095				138	0.066	
	↓	A	1	3.400							2095				137	0.065	
	↲	A	1	3.400		15					1905				210	0.110	0.110
	↲	A	1	3.400		20					1820				200	0.110	
Pedestrian Crossing		Dp	1,3	MIN GREEN + FLASH =			5	+	9	=	14						
		Ep	2	MIN GREEN + FLASH =			5	+	10	=	15						
		Fp	1,2	MIN GREEN + FLASH =			8	+	15	=	23						
		Gp	3	MIN GREEN + FLASH =			5	+	9	=	14						

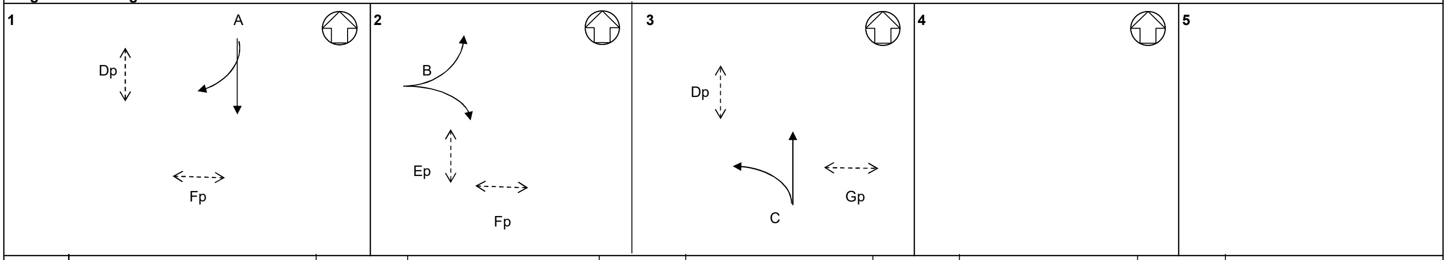
Notes:

Flow: (pcu/hr)



Group			Group		A,B,C
y			y		0.451
L (sec)			L (sec)		14
C (sec)			C (sec)		120
y pract.			y pract.		0.795
R.C. (%)			R.C. (%)		76%

Stage / Phase Diagrams



I/G= 6	I/G= 5	I/G= 6	I/G=	I/G=

Date: 5 Nov 2024

Junction: Wan Po Road / Wan O Road (JB) JB

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010 **MVA HONG KONG LIMITED**

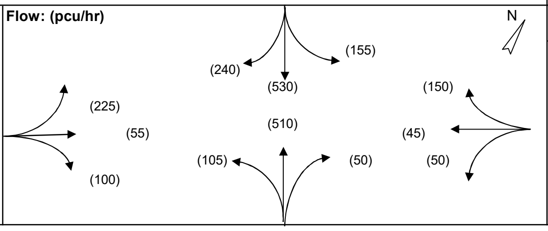
Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)
Design Year: 2033

Description: 2033 Reference Flows (Weekend)
Designed By: HKH
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr)	Revised Saturation Flow (pcu/hr) PM	Flow (pcu/hr)	y Value	Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Access Road (EB)		B	2	3.400	15						1775				176	0.099	0.099
		B	2	4.100	20	25			24% / 49%		2065				204	0.099	
Wan Po Road (SB)		A	1	3.100	15						1750				155	0.089	
		A	1	3.500							2105				265	0.126	0.126
		A	1	3.500							2105				265	0.126	
		A	1	3.200		25					1960				240	0.122	
Shek Kok Road (WB)		D	4	3.600	10	30			40% / 25%		1975				126	0.064	
		D	4	3.500		25					1855				119	0.064	0.064
Wan Po Road (NB)		C	3	3.600	15				56%		1870				189	0.101	
		C	3	3.500							2105				213	0.101	0.101
		C	3	3.500							2105				213	0.101	
		C	3	3.600		25					1995				50	0.025	
Pedestrian Crossing		Ep	2	MIN GREEN + FLASH =			5	+	6	=	11						
		Fp	1,3,4	MIN GREEN + FLASH =			5	+	7	=	12						
		Gp	3	MIN GREEN + FLASH =			5	+	9	=	14						
		Hp	1,2,4	MIN GREEN + FLASH =			7	+	13	=	20						
		Ip	4	MIN GREEN + FLASH =			5	+	7	=	12						
		Jp	1,2,3	MIN GREEN + FLASH =			5	+	7	=	12						

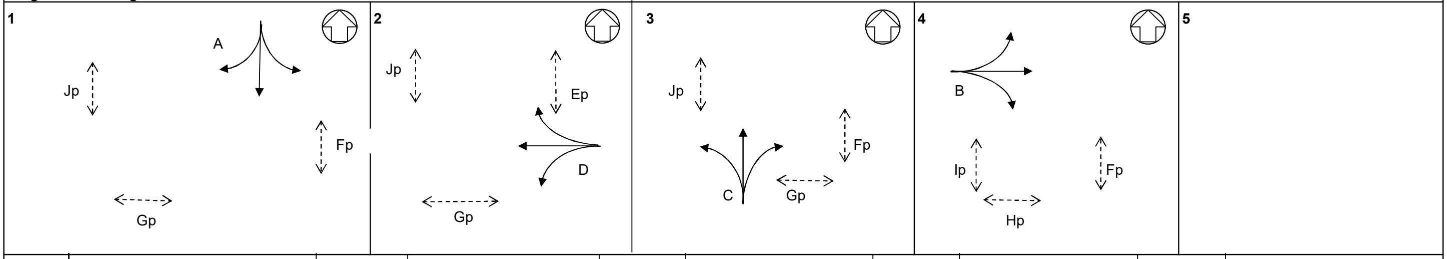
Notes:

Flow: (pcu/hr)



Group			**Group**		A,D,C,B
y			**y**		0.390
L (sec)			**L (sec)**		27
C (sec)			**C (sec)**		120
y pract.			**y pract.**		0.698
R.C. (%)			**R.C. (%)**		79%

Stage / Phase Diagrams



I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	

Date: 5 Nov 2024

Junction: JC
Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / LOHAS Park Road (JD)

Design Year: 2033

Description: 2033 Reference Flows (Weekend)

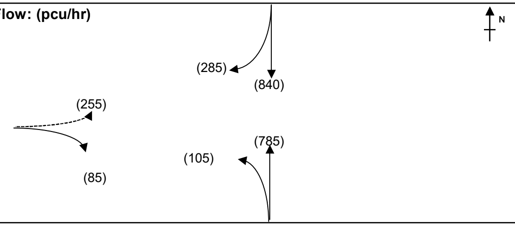
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)		Revised Saturation Flow (pcu/hr)					PM Peak		
									PM		PM	Flow (pcu/hr)	y Value	Critical y	Flow (pcu/hr)	y Value	Critical y
Wan Po Road (SB)	↓	B	1,2	3.500							1965				406	0.207	
	↓	B	1,2	3.500							2105				434	0.206	
	↲	C	2	3.500		15					1915				285	0.149	0.149
Wan Po Road (NB)	↑	A	1	3.500							2105				393	0.187	0.187
	↑	A	1	3.500							2105				392	0.186	
	↰	A	1	3.500	10						1710				105	0.061	
Lohas Park Road (EB)	↱	E	1,2,3	3.500	35						1885				255	0.135	
	↴	D	3	4.000		15					1960				85	0.043	0.043

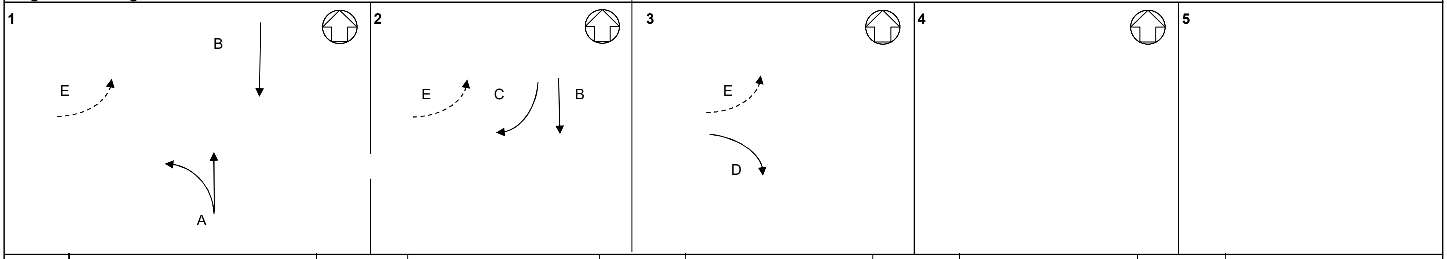
Notes:

Flow: (pcu/hr)



Group			Group		A,C,D
y			y		0.379
L (sec)			L (sec)		12
C (sec)			C (sec)		120
y pract.			y pract.		0.810
R.C. (%)			R.C. (%)		114%

Stage / Phase Diagrams



I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	

Date: 5 Nov 2024

Junction: JD
Wan Po Road / LOHAS Park Road (JD)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan O Road / Sunrise Boulevard (JE)

Design Year: 2033

Description: 2033 Reference Flows (Weekend)

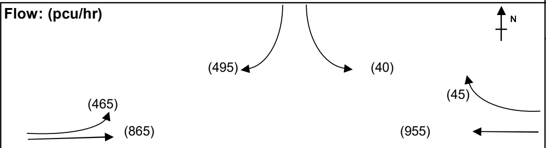
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m)		Gradient (%)	Pro. Turning (%)		Revised Saturation Flow (pcu/hr)					PM Peak		
					Left	Right			PM		PM	Flow (pcu/hr)	y Value	Critical y	Flow (pcu/hr)	y Value	Critical y
Wan O Road (EB)	↱	A	1	3.800	20						1855				465	0.251	0.251
	→	A	1	3.500							2105				433	0.206	
	→	A	1	3.500							2105				432	0.205	
Wan O Road (WB)	↰	C	2	4.000		25					2035				45	0.022	
	←	B	1,2,4	3.800							2135				494	0.231	
	←	B	1,2,4	3.800							1995				461	0.231	
Sunrise Boulevard (SB)	↳	E	3	3.500	18						1815				40	0.022	
	↲	D	3	3.500		25					1985				246	0.124	
	↲	D	3	3.500		30					2005				249	0.124	0.124
Pedestrian Crossing		Fp	4	MIN GREEN + FLASH =			16	+	12	=	28						*

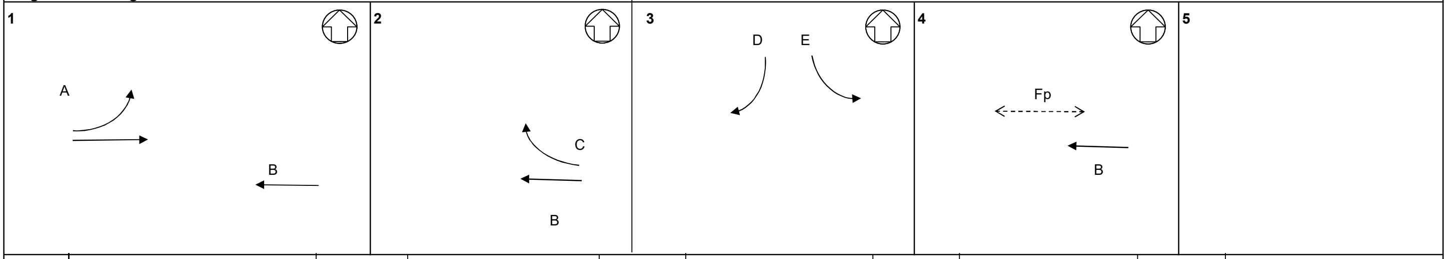
Notes:

Flow: (pcu/hr)



Group			**Group**		A,C,D,Fp
y			**y**		0.375
L (sec)			**L (sec)**		49
C (sec)			**C (sec)**		120
y pract.			**y pract.**		0.533
R.C. (%)			**R.C. (%)**		42%

Stage / Phase Diagrams



I/G= 2		I/G= 5	5	I/G= 5		I/G= 6	28	I/G=

Date: 5 Nov 2024

Junction: Wan O Road / Sunrise Boulevard (JE)

JE

2033 Design Traffic Forecast
(with Proposed PRS Development)
- Event Day

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Chun Yat Street (JA)

Design Year: 2033

Description: 2033 Design Flows (Event Day)

Designed By: HKH

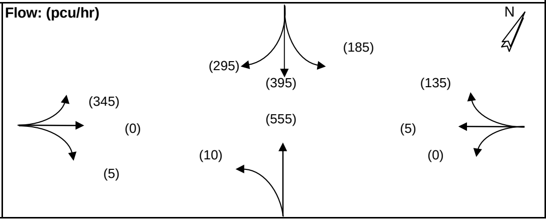
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr)	Revised Saturation Flow (pcu/hr) PM	Flow (pcu/hr)	y Value	Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↓→	A	1,2	3.200	20				69%		1840				270	0.147	
	↓	A	1,2	3.600							2115				310	0.147	
Wan Po Road (SB)	↲	C	2	3.300		25					1965				148	0.075	
	↲	C	2	3.300		20					1940				147	0.076	
Wan Po Road (NB)	←↑	B	1	3.700	15				4%		1980				272	0.137	
	↑	B	1	3.700							2125				293	0.138	0.138
Chun Yat Street (EB)	→↑	D	2,3	3.600	35						1895				345	0.182	0.182
Chun Yat Street (EB)	→↓	E	3	3.600		25			100%		1995				5	0.003	
Chun Yat Street (WB)	←↑↓	F	4	5.100	25	20			0% / 96%		1980				140	0.071	0.071

Pedestrian Crossing	Phase	Stage						
	Gp	1,4	MIN GREEN + FLASH =	5	+	5	=	10
	Hp	1,2,4	MIN GREEN + FLASH =	5	+	5	=	10
	Ip	3	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	2,3,4	MIN GREEN + FLASH =	5	+	8	=	13
	Kp	2	MIN GREEN + FLASH =	5	+	6	=	11
	Lp	1,2,3	MIN GREEN + FLASH =	5	+	6	=	11
	Mp	2	MIN GREEN + FLASH =	5	+	5	=	10
	Np	3	MIN GREEN + FLASH =	8	+	7	=	15

Notes:

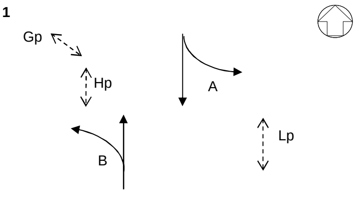
Flow: (pcu/hr)



Group			Group	B,C,Ip,F	B,D,F
y			y	0.284	0.391
L (sec)			L (sec)	35	18
C (sec)			C (sec)	120	120
y pract.			y pract.	0.638	0.765
R.C. (%)			R.C. (%)	124%	96%

Stage / Phase Diagrams

1



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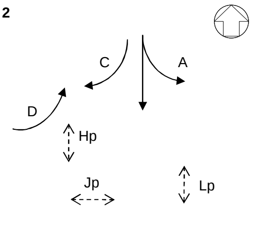

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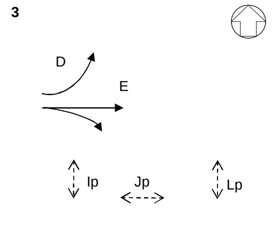

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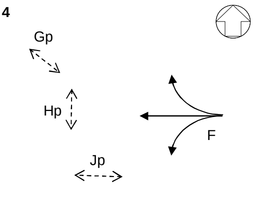


5

I/G= 7

I/G= 9

I/G=

I/G= 5

I/G=

Date: 5 Nov 2024

Junction: Wan Po Road / Chun Yat Street (JA) JA

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Wan O Road (JB)

Design Year: 2033

Description: 2033 Design Flows (Event Day)

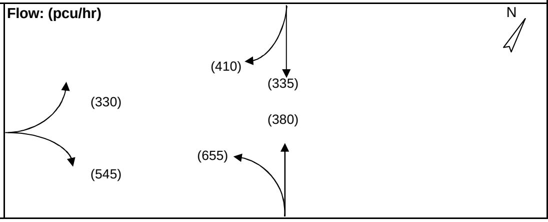
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr)	Revised Saturation Flow (pcu/hr) PM	Flow (pcu/hr)	y Value	Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (NB)	↰	C	3	4.100	15						1840				313	0.170	0.170
	↰	C	3	4.100	20						2015				342	0.170	
	↑	C	3	4.000							2155				190	0.088	
	↑	C	3	4.100							2165				190	0.088	
Wan O Road (EB)	↱	B	2	3.500	20						1830				330	0.180	0.180
	↴	B	2	3.200		25					1825				265	0.145	
	↴	B	2	3.200		20					1930				280	0.145	
Wan Po Road (SB)	↓	A	1	3.400							2095				168	0.080	
	↓	A	1	3.400							2095				167	0.080	
	↲	A	1	3.400		15					1905				210	0.110	0.110
	↲	A	1	3.400		20					1820				200	0.110	
Pedestrian Crossing		Dp	1,3	MIN GREEN + FLASH =			5	+	9	=	14						
		Ep	2	MIN GREEN + FLASH =			5	+	10	=	15						
		Fp	1,2	MIN GREEN + FLASH =			8	+	15	=	23						
		Gp	3	MIN GREEN + FLASH =			5	+	9	=	14						

Notes:

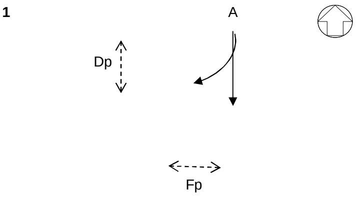
Flow: (pcu/hr)



Group			Group	A,B,Gp	A,B,C
y			y	0.291	0.461
L (sec)			L (sec)	35	14
C (sec)			C (sec)	120	120
y pract.			y pract.	0.638	0.795
R.C. (%)			R.C. (%)	119%	73%

Stage / Phase Diagrams

1



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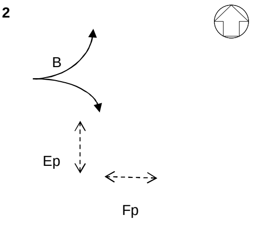

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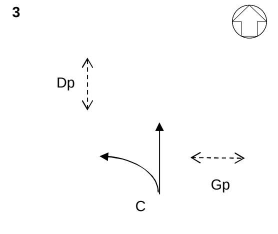


4

5

I/G= 6	I/G= 5	I/G= 6	I/G=	I/G=

Date: 5 Nov 2024

Junction: Wan Po Road / Wan O Road (JB) JB

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

Design Year: 2033

Description: 2033 Design Flows (Event Day)

Designed By: HKH

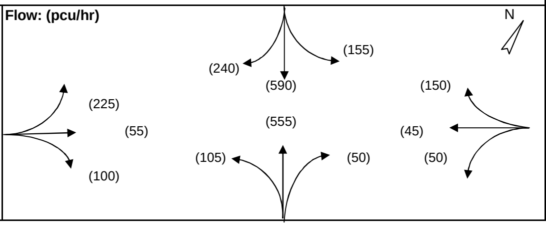
Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr)	Revised Saturation Flow (pcu/hr) PM	Flow (pcu/hr)	y Value	Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Access Road (EB)		B	2	3.400	15						1775				176	0.099	0.099
		B	2	4.100	20	25		#DIV/0!	24% / 49%	#DIV/0!	2065				204	0.099	
Wan Po Road (SB)		A	1	3.100	15						1750				155	0.089	
		A	1	3.500							2105				295	0.140	0.140
		A	1	3.500							2105				295	0.140	
		A	1	3.200		25					1960				240	0.122	
Shek Kok Road (WB)		D	4	3.600	10	30		#DIV/0!	40% / 25%	#DIV/0!	1975				126	0.064	
		D	4	3.500		25					1855				119	0.064	0.064
Wan Po Road (NB)		C	3	3.600	15			#DIV/0!	51%	#DIV/0!	1880				204	0.109	0.109
		C	3	3.500							2105				228	0.108	
		C	3	3.500							2105				228	0.108	
		C	3	3.600		25					1995				50	0.025	

Pedestrian Crossing	Phase	Stage						
	Ep	2	MIN GREEN + FLASH =	5	+	6	=	11
	Fp	1,3,4	MIN GREEN + FLASH =	5	+	7	=	12
	Gp	3	MIN GREEN + FLASH =	5	+	9	=	14
	Hp	1,2,4	MIN GREEN + FLASH =	7	+	13	=	20
	Ip	4	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	1,2,3	MIN GREEN + FLASH =	5	+	7	=	12

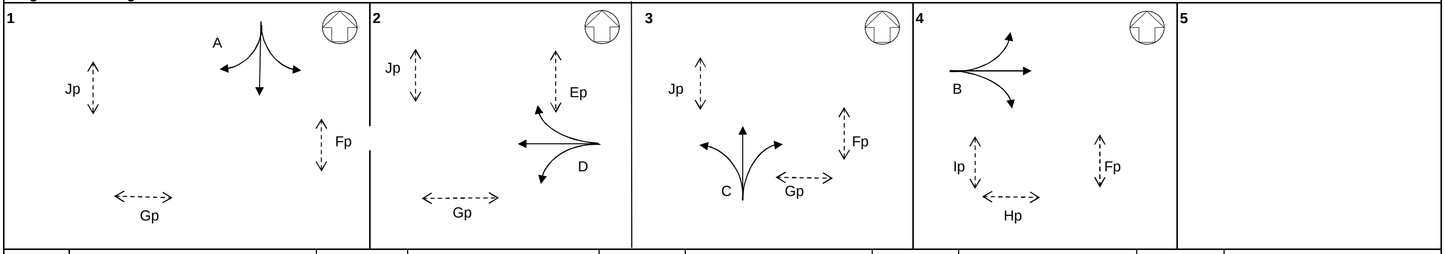
Notes:

Flow: (pcu/hr)



Group			Group	A,Ep,C,B	A,D,C,B
y			y	0.348	0.412
L (sec)			L (sec)	34	27
C (sec)			C (sec)	120	120
y pract.			y pract.	0.645	0.698
R.C. (%)			R.C. (%)	85%	69%

Stage / Phase Diagrams



I/G= 10	I/G= 6	I/G= 9	I/G= 6	I/G=

Date: 5 Nov 2024

Junction: JC
Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / LOHAS Park Road (JD)

Design Year: 2033

Description: 2033 Design Flows (Event Day)

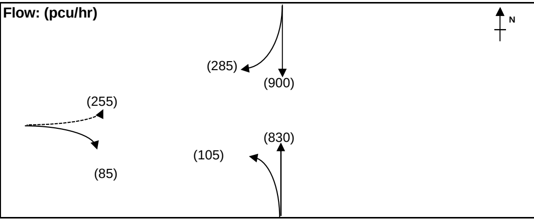
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m)		Gradient (%)	Pro. Turning (%)		Revised Saturation Flow (pcu/hr)					PM Peak		
					Left	Right			PM		PM	Flow (pcu/hr)	y Value	Critical y	Flow (pcu/hr)	y Value	Critical y
Wan Po Road (SB)	↓	B	1,2	3.500							1965				435	0.221	
	↓	B	1,2	3.500							2105				465	0.221	
	↲	C	2	3.500		15					1915				285	0.149	0.149
Wan Po Road (NB)	↑	A	1	3.500							2105				415	0.197	0.197
	↑	A	1	3.500							2105				415	0.197	
	↰	A	1	3.500	10						1710				105	0.061	
Lohas Park Road (EB)	↗	E	1,2,3	3.500	35						1885				255	0.135	
	↘	D	3	4.000		15					1960				85	0.043	0.043

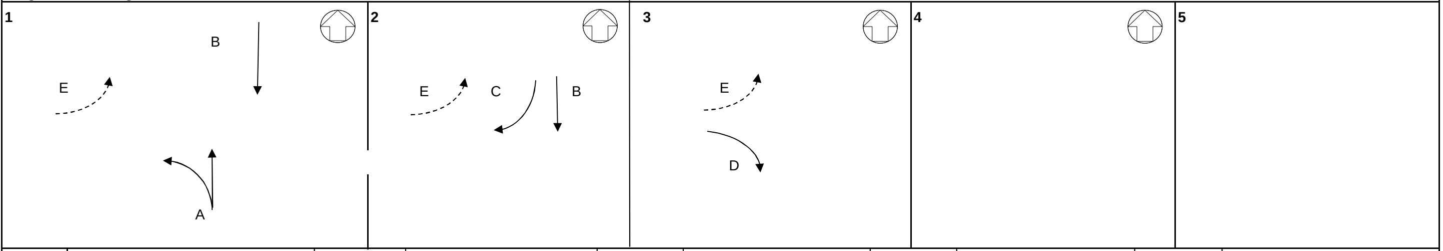
Notes:

Flow: (pcu/hr)



Group			Group	B,D	A,C,D
y			y	0.265	0.389
L (sec)			L (sec)	10	12
C (sec)			C (sec)	120	120
y pract.			y pract.	0.825	0.810
R.C. (%)			R.C. (%)	212%	108%

Stage / Phase Diagrams



I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	

Date: 5 Nov 2024

Junction: JD
Wan Po Road / LOHAS Park Road (JD)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan O Road / Sunrise Boulevard (JE)

Design Year: 2033

Description: 2033 Design Flows (Event Day)

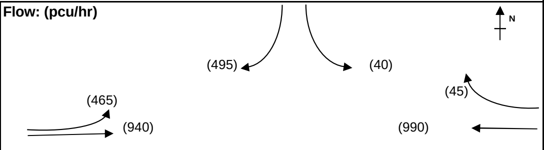
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%)	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr)	Revised Saturation Flow (pcu/hr) PM	Flow (pcu/hr)	y Value	Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
	⤴	A	1	3.800	20						1855				465	0.251	0.251
Wan O Road (EB)	→	A	1	3.500							2105				470	0.223	
	→	A	1	3.500							2105				470	0.223	
	↖	C	2	4.000		25					2035				45	0.022	
Wan O Road (WB)	←	B	1,2,4	3.800							2135				512	0.240	
	←	B	1,2,4	3.800							1995				478	0.240	
	↳	E	3	3.500	18						1815				40	0.022	
Sunrise Boulevard (SB)	↲	D	3	3.500		25					1985				246	0.124	
	↲	D	3	3.500		30					2005				249	0.124	0.124
Pedestrian Crossing		Fp	4	MIN GREEN + FLASH =			16	+	12	=	28						*

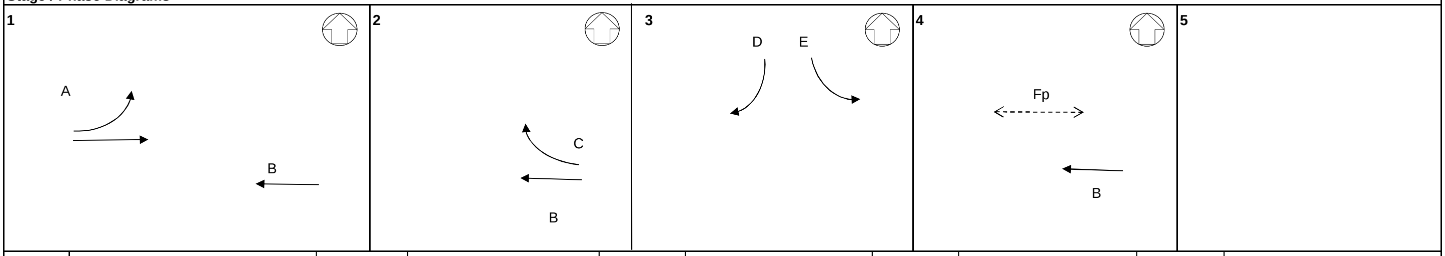
Notes:

Flow: (pcu/hr)



Group			Group	B,D	A,C,D,Fp
y			y	0.364	0.375
L (sec)			L (sec)	15	49
C (sec)			C (sec)	120	120
y pract.			y pract.	0.788	0.533
R.C. (%)			R.C. (%)	116%	42%

Stage / Phase Diagrams



I/G= 2		I/G= 5	5	I/G= 5		I/G= 6	28	I/G=	

Date:	Junction:
5 Nov 2024	Wan O Road / Sunrise Boulevard (JE)

JE

2033 Design Traffic Forecast (with TKO Area 137 Development) - Sensitivity Test

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Chun Yat Street (JA)

Design Year: 2033

Description: 2033 Design Flow (Sensitivity Test)

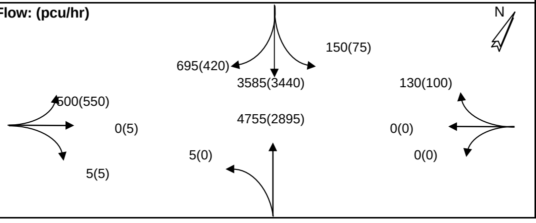
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)		A	1,2	3.200	20			8%	4%	1925	1930	1779	0.924		1676	0.868	
		A	1,2	3.600						2115	2115	1956	0.925		1839	0.870	
Wan Po Road (SB)		C	2	3.300		25				1965	1965	350	0.178	0.178	211	0.107	
		C	2	3.300		20				1940	1940	345	0.178		209	0.108	
Wan Po Road (NB)		B	1	3.700	15			0%	0%	1985	1985	2299	1.158	1.158	1398	0.704	
		B	1	3.700						2125	2125	2461	1.158		1497	0.704	0.704
Chun Yat Street (EB)		D	2,3	3.600	35					1895	1895	500	0.264		550	0.290	0.290
Chun Yat Street (EB)		E	3	3.600		25		100%	50%	1995	2055	5	0.003		10	0.005	
Chun Yat Street (WB)		F	4	5.100	25	20		0% / 100%	0% / 100%	1975	1975	130	0.066		100	0.051	
Pedestrian Crossing		Gp	1,4	MIN GREEN + FLASH =			5	+	5	=	10						
		Hp	1,2,4	MIN GREEN + FLASH =			5	+	5	=	10						
		Ip	3	MIN GREEN + FLASH =			5	+	7	=	12			*			
		Jp	2,3,4	MIN GREEN + FLASH =			5	+	8	=	13						
		Kp	2	MIN GREEN + FLASH =			5	+	6	=	11						
		Lp	1,2,3	MIN GREEN + FLASH =			5	+	6	=	11						
		Mp	2	MIN GREEN + FLASH =			5	+	5	=	10						
		Np	3	MIN GREEN + FLASH =			8	+	7	=	15						

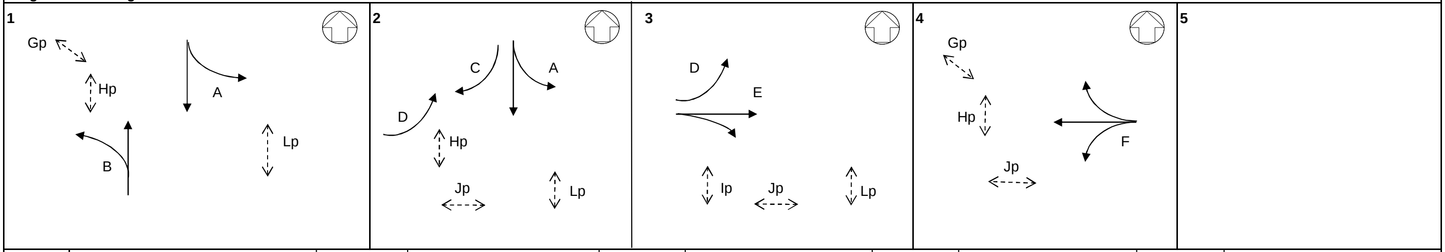
Notes:

Flow: (pcu/hr)



Group	B,C,E,F	B,C,Ip,F	Group	B,C,Ip,F	B,D,F
y	1.336	1.336	y	0.812	0.995
L (sec)	35	41	L (sec)	41	24
C (sec)	130	130	C (sec)	120	120
y pract.	0.658	0.616	y pract.	0.593	0.720
R.C. (%)	-51%	-54%	R.C. (%)	-27%	-28%

Stage / Phase Diagrams



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I/G= 7		I/G= 9		I/G=		I/G= 5	5	I/G=	

Date: 5 Nov 2024

Junction: Wan Po Road / Chun Yat Street (JA) JA

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Wan O Road (JB)

Design Year: 2033

Description: 2033 Design Flow (Sensitivity Test)

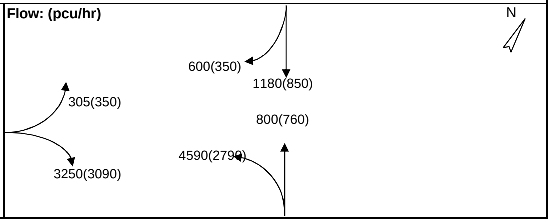
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (NB)	↰	C	3	4.100	15					1840	1840	2191	1.191	1.191	1332	0.724	0.724
	↰	C	3	4.100	20					2015	2015	2399	1.191		1458	0.724	
	↑	C	3	4.000						2155	2155	399	0.185		379	0.176	
	↑	C	3	4.100						2165	2165	401	0.185		381	0.176	
Wan O Road (EB)	⬏	B	2	3.500	20					1830	1830	305	0.167		350	0.191	
	↴	B	2	3.200		25				1825	1825	1580	0.866	0.866	1502	0.823	0.823
	↴	B	2	3.200		20				1930	1930	1670	0.865		1588	0.823	
Wan Po Road (SB)	↓	A	1	3.400						2095	2095	590	0.282	0.282	425	0.203	0.203
	↓	A	1	3.400						2095	2095	590	0.282		425	0.203	
	↲	A	1	3.400		15				1905	1905	307	0.161		179	0.094	
	↲	A	1	3.400		20				1820	1820	293	0.161		171	0.094	
Pedestrian Crossing		Dp	1,3	MIN GREEN + FLASH =			5	+	9	=	14						
		Ep	2	MIN GREEN + FLASH =			5	+	10	=	15						
		Fp	1,2	MIN GREEN + FLASH =			8	+	15	=	23						
		Gp	3	MIN GREEN + FLASH =			5	+	9	=	14						

Notes:

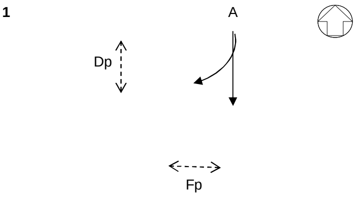
Flow: (pcu/hr)



Group	A,B,Gp	A,B,C	Group	A,B,Gp	A,B,C
y	1.147	2.338	y	1.026	1.750
L (sec)	35	14	L (sec)	35	14
C (sec)	120	120	C (sec)	120	120
y pract.	0.638	0.795	y pract.	0.638	0.795
R.C. (%)	-44%	-66%	R.C. (%)	-38%	-55%

Stage / Phase Diagrams

1



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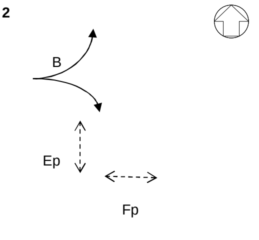

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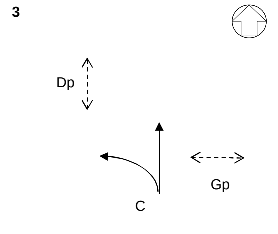

4

5

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I/G= 6		I/G= 5		I/G= 6		I/G=		I/G=	

Date:	Junction:
5 Nov 2024	Wan Po Road / Wan O Road (JB) JB

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

Design Year: 2033

Description: 2033 Design Flow (Sensitivity Test)

Designed By: HKH

Checked By: PML

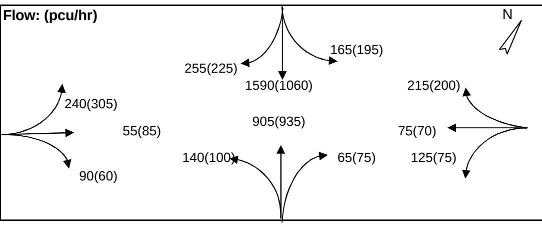
Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Access Road (EB)		B	2	3.400	15					1775	1775	178	0.100	0.100	208	0.117	0.117
		B	2	4.100	20	25		30% / 43%	40% / 25%	2065	2070	207	0.100		242	0.117	
Wan Po Road (SB)		A	1	3.100	15					1750	1750	165	0.094		195	0.111	
		A	1	3.500						2105	2105	795	0.378	0.378	530	0.252	0.252
		A	1	3.500						2105	2105	795	0.378		530	0.252	
		A	1	3.200		25				1960	1960	255	0.130		225	0.115	
Shek Kok Road (WB)		D	4	3.600	10	30		59% / 6%	42% / 19%	1940	1970	212	0.109		178	0.090	0.090
		D	4	3.500		25				1855	1855	203	0.109	0.109	167	0.090	
Wan Po Road (NB)		C	3	3.600	15			43%	31%	1895	1915	324	0.171		324	0.169	0.169
		C	3	3.500						2105	2105	361	0.171	0.171	356	0.169	
		C	3	3.500						2105	2105	360	0.171		355	0.169	
		C	3	3.600		25				1995	1995	65	0.033		75	0.038	

Pedestrian Crossing

	Phase	Stage						
Pedestrian Crossing	Ep	2	MIN GREEN + FLASH =	5	+	6	=	11
	Fp	1,3,4	MIN GREEN + FLASH =	5	+	7	=	12
	Gp	3	MIN GREEN + FLASH =	5	+	9	=	14
	Hp	1,2,4	MIN GREEN + FLASH =	7	+	13	=	20
	Ip	4	MIN GREEN + FLASH =	5	+	7	=	12
	Jp	1,2,3	MIN GREEN + FLASH =	5	+	7	=	12

Notes:

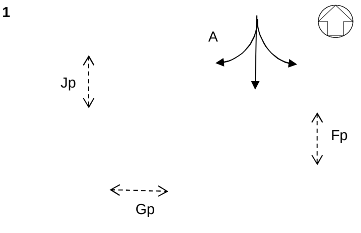
Flow: (pcu/hr)



Group	A,D,C,Ip	A,D,C,B	Group	A,Ep,C,B	A,D,C,B
y	0.659	0.759	y	0.538	0.629
L (sec)	38	27	L (sec)	34	27
C (sec)	120	120	C (sec)	120	120
y pract.	0.615	0.698	y pract.	0.645	0.698
R.C. (%)	-7%	-8%	R.C. (%)	20%	11%

Stage / Phase Diagrams

1



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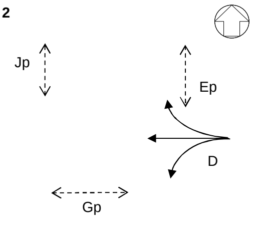

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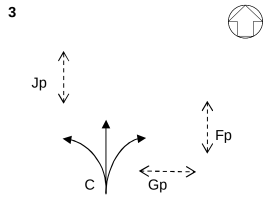

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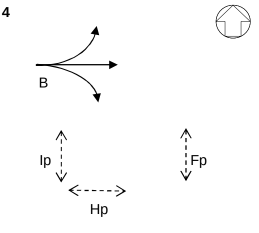

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I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	
I/G= 10		I/G= 6		I/G= 9		I/G= 6		I/G=	

Date: 5 Nov 2024	**Junction:** JC Wan Po Road / Shek Kok Road / Sunrise Boulevard (JC)

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010

MVA HONG KONG LIMITED

Junction: Wan Po Road / LOHAS Park Road (JD)

Design Year: 2033

Description: 2033 Design Flow (Sensitivity Test)

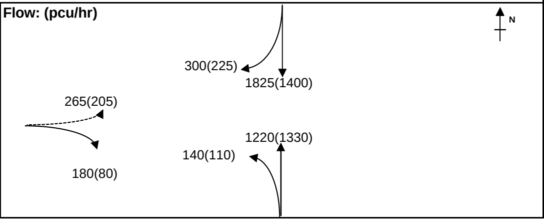
Designed By: HKH

Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
Wan Po Road (SB)	↓	B	1,2	3.500						1965	1965	881	0.448		676	0.344	
	↓	B	1,2	3.500						2105	2105	944	0.448		724	0.344	
	↲	C	2	3.500		15				1915	1915	300	0.157	0.157	225	0.117	0.117
Wan Po Road (NB)	↑	A	1	3.500						2105	2105	610	0.290	0.290	665	0.316	0.316
	↑	A	1	3.500						2105	2105	610	0.290		665	0.316	
	↰	A	1	3.500	10					1710	1710	140	0.082		110	0.064	
Lohas Park Road (EB)	↗	E	1,2,3	3.500	35					1885	1885	265	0.141		205	0.109	
	↘	D	3	4.000		15				1960	1960	180	0.092	0.092	80	0.041	0.041

Notes:

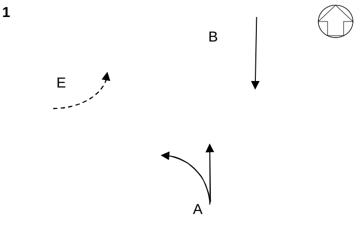
Flow: (pcu/hr)



Group	B,D	A,C,D	Group	B,D	A,C,D
y	0.540	0.538	y	0.385	0.474
L (sec)	10	12	L (sec)	10	12
C (sec)	120	120	C (sec)	120	120
y pract.	0.825	0.810	y pract.	0.825	0.810
R.C. (%)	53%	50%	R.C. (%)	114%	71%

Stage / Phase Diagrams

1



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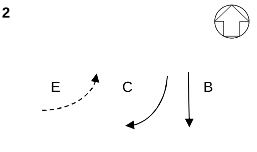

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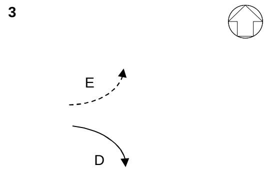

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I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	
I/G= 5		I/G= 5		I/G= 5		I/G=		I/G=	

Date:	Junction:
5 Nov 2024	Wan Po Road / LOHAS Park Road (JD) JD

TRAFFIC SIGNALS CALCULATION

Job No.: CHK50812010 **MVA HONG KONG LIMITED**

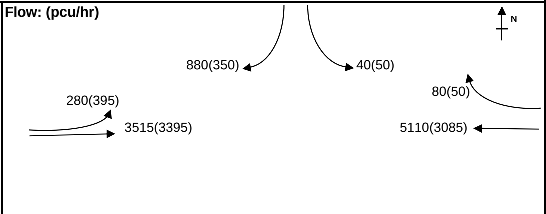
Junction: Wan O Road / Sunrise Boulevard (JE) Design Year: 2033

Description: 2033 Design Flow (Sensitivity Test) Designed By: HKH Checked By: PML

Approach	Movements	Phase	Stage	Width (m)	Radius (m) Left	Radius (m) Right	Gradient (%)	Pro. Turning (%) AM	Pro. Turning (%) PM	Revised Saturation Flow (pcu/hr) AM	Revised Saturation Flow (pcu/hr) PM	AM Peak Flow (pcu/hr)	AM Peak y Value	AM Peak Critical y	PM Peak Flow (pcu/hr)	PM Peak y Value	PM Peak Critical y
	↱	A	1	3.800	20					1855	1855	280	0.151		395	0.213	
Wan O Road (EB)	→	A	1	3.500						2105	2105	1758	0.835	0.835	1698	0.807	0.807
	→	A	1	3.500						2105	2105	1757	0.835		1697	0.806	
	↰	C	2	4.000		25				2035	2035	80	0.039		50	0.025	
Wan O Road (WB)	←	B	1,2,4	3.800						2135	2135	2642	1.237		1595	0.747	
	←	B	1,2,4	3.800						1995	1995	2468	1.237		1490	0.747	
	↳	E	3	3.500	18					1815	1815	40	0.022		50	0.028	
Sunrise Boulevard (SB)	↲	D	3	3.500		25				1985	1985	438	0.221	0.221	174	0.088	
	↲	D	3	3.500		30				2005	2005	442	0.220		176	0.088	0.088
Pedestrian Crossing		Fp	4	MIN GREEN + FLASH =			16	+	12	=	28			*			*

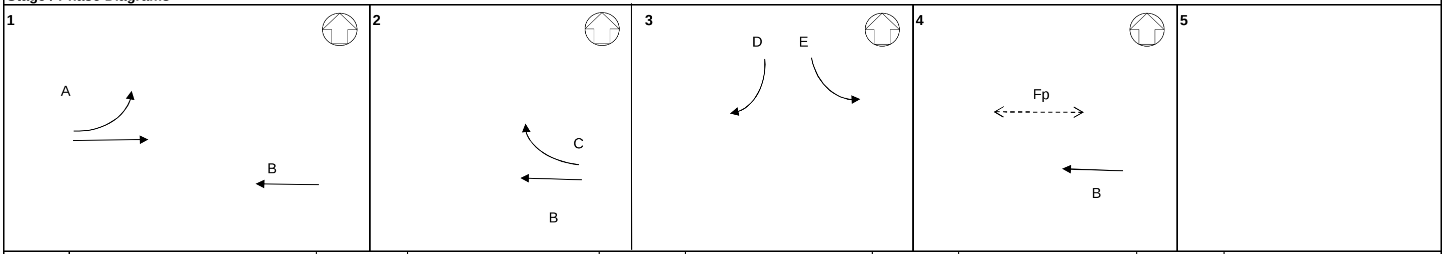
Notes:

Flow: (pcu/hr)



Group	B,D	A,C,D,Fp	Group	B,D	A,C,D,Fp
y	1.458	1.056	y	0.835	0.894
L (sec)	15	49	L (sec)	15	49
C (sec)	130	130	C (sec)	120	120
y pract.	0.796	0.561	y pract.	0.788	0.533
R.C. (%)	-45%	-47%	R.C. (%)	-6%	-40%

Stage / Phase Diagrams



I/G= 2		I/G= 5	5	I/G= 5		I/G= 6	28	I/G=	
I/G= 2		I/G= 5	5	I/G= 5		I/G= 6	28	I/G=	

Date: 5 Nov 2024

Junction: Wan O Road / Sunrise Boulevard (JE) JE

SECTION 16 PLANNING APPLICATION TOWN PLANNING ORDINANCE (CAP. 131)

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

- Supplementary Planning Statement -

Volume 2 of 3

TOWNLAND CONSULTANTS LIMITED

Appendix 4

VISUAL IMPACT ASSESSMENT

VISUAL IMPACT ASSESSMENT IN SUPPORT OF THE SECTION 16 PLANNING APPLICATION FOR PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

TOWNLAND CONSULTANTS LIMITED

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1 INTRODUCTION

1.1 This Visual Impact Assessment ("**VIA**") is prepared in support of the Section 16 ("**S16**") Planning Application to allow for the development of a Public Riding School with ancillary facilities (e.g. utility trench) (collectively as the "**PRS**") at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories ("**TKOL II/III**") for the HKJC Public Riding Schools Limited (the "**Applicant**"). The Application Site comprises of three (3) existing platforms and land required for the provision of ancillary utility trench connecting to the three (3) platforms (collectively as the "**Application Site**") within TKOL II/III. The PRS aligns with the Government's policy objectives in fostering more public participation in the community through wider visibility and popularity of horse riding, supporting equestrian as an elite sport, and maintaining Hong Kong as a centre for major international sports events.

1.2 The Application Site is predominately zoned "Open Space" ("**O**") on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 ("**Approved OZP**"), whilst a strip of area at the north is zoned "Green Belt" ("**GB**") and a minor portion abutting Chun Sing Street is zoned "Other Specified Uses" annotated "Industrial Estate" ("**OU(Industrial Estate)**") on the Approved OZP (**Figure 1** refers). The PRS with ancillary facilities ('Horse Riding School' subsumed under 'Place of Recreation, Sports or Culture' use) is a Column 2 use under the "O", "GB" and "OU(Industrial Estate)" zones that may be permitted with or without conditions on Application under S16 of the Town Planning Ordinance ("**TPO**"). There are no plot ratio ("**PR**"), building height ("**BH**"), and site coverage ("**SC**") restrictions imposed on the "O", "GB" and "OU(Industrial Estate)" zones of the Approved OZP. While a portion of TKOL II/III falls within the Clear Water Bay Country Park ("**CWBCP**"), the Application Site does not involve any areas falling within the Country Park Boundary.

1.3 Townland Consultants Limited ("**TOWNLAND**") is commissioned by the Applicant to prepare and submit this VIA in support of the S16 Planning Application. The PRS is located on three (3) platforms, namely the Lower Platform (i.e. Reception and Hospitality Lounges) (approx.+6.0mPD), Middle Platform (i.e. Pony Paddock & Pavilion I)(approx. +40.0mPD) and Upper Platform (i.e. Horse Paddock & Pavilion II) (approx.140.0mPD), with a proposed total GFA of approx. 9,000m^2 and a proposed building height of 4.8m to 7.7m. An ancillary utility trench connecting to the three (3) platforms is also proposed to accommodate various essential utilities services in support of the PRS operations.

1.4 This VIA is prepared in accordance with the Town Planning Board Guidelines on Submission of VIA for Planning Applications to the Board ("**TPB PG-No. 41A**"). The main aim of a VIA is to present sufficient information in a structured manner to facilitate the Town Planning Board ("**TPB**"/"**BOARD**") to visualise the relationship of the PRS with the surrounding context. This VIA will demonstrate that the PRS will not result in any pronounced changes in development scale, intensity or visual change from key public viewing points against the Existing Condition.

1.5 The outline of this VIA is set out as follows:

- Section 2 outlines the visual context and visual elements of the Site and its Surrounding Area;
- Section 3 describes the main development parameters for the PRS;
- Section 4 identifies the Assessment Area and analyses the potential Viewpoints ("**VPs**");
- Section 5 identifies and evaluates the potential visual impacts from the identified VPs;
- Section 6 assesses the overall visual impact of the PRS; and
- Section 7 concludes the VIA.

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2 VISUAL CONTEXT AND VISUAL ELEMENTS

Local Context

2.1 The Application Site comprises of the three (3) relatively flat platforms and the land required for the provision of ancillary utility trench connecting to the platforms to accommodate proposed essential utilities in supporting the operation of PRS (***Figure 1*** refers). TKOL II/III is a restored landfill capped with vegetation. It has a total area of approx. 40 ha, of which the Application Site is approx. 46,500m^2. The Application Site falls within the part of the existing Government Lot Allocation GLA-TSK 500 allocated to the EPD for aftercare works.

Surrounding Context

2.2 Generally, TKOL II/III is predominantly surrounded by densely vegetated areas, except area to the west where various existing and planned high-rise residential developments, industrial buildings/ data centres are located. Various bus stops and Green Minibus stops are along Wan Po Road and Wan O Road.

2.3 Key visual elements surrounding the Application Site are summarised below (***Figure 2*** refers):

- To the immediate north of the Application Site is a densely vegetated area with hilly terrain (positive visual element). The Clear Water Bay Country Park is located to the immediate northeast and east of the Application Site, including Miu Tsai Tun (approx. 330mPD) and High Junk Peak (approx. 340mPD) (positive visual elements).

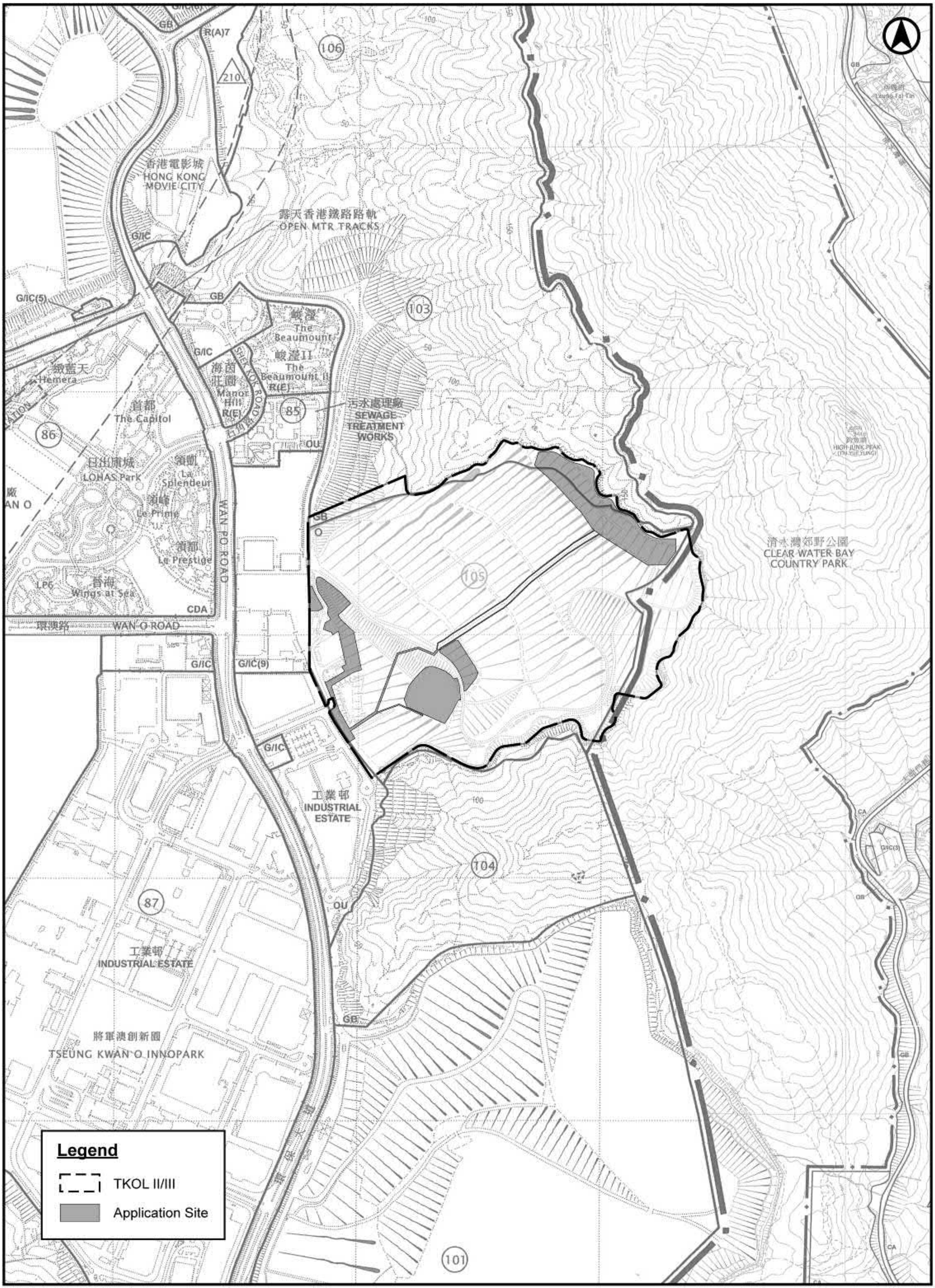
- To the immediate south of the Application Site is the foothill of Tai Chik Sha with dense vegetation (positive visual element). South East New Territories Landfill, currently a negative visual element but to be transformed to a positive visual element after restoration, is located to the further south of the Application Site.

- To the southwest of the Application Site is Tseung Kwan O InnoPark (up to approx. 79.8mPD), a cluster of industrial buildings (negative visual elements). Buildings to the immediate southwest include HSBC Building TKO (approx. 28.2mPD), Tai Chik Sha Fire Station cum Ambulance Depot (approx. 20.8mPD), and HKCOLO (approx.19.6mPD) (neutral visual elements).

- To the immediate west of the Application Site are MEGA Plus Data Centre (approx. 59.6mPD), MEGA IDC Data Centre (approx. 60mPD), and a G/IC Site reserved for a Communications Tower (approx. 76mPD) (the “**Communications Tower**”). These are neutral visual elements.

- To the further west of the Application Site across Wan Po Road is LOHAS Park, a large-scale comprehensive residential/ commercial development and supporting community facilities with maximum BH up to approx. 217.3mPD. A planned Joint-user Building with Government Laboratory Facilities with a BH of approx. 95mPD is located on Wan O Road opposite to LOHAS Park. These are neutral visual elements.

- To the immediate northwest of the Application Site consists of Tseung Kwan O Preliminary Treatment Works (negative visual element) (approx.15.1mPD), Shrewsbury International School Hong Kong (neutral visual element) (approx. 40.9mPD), and a cluster of high-rise residential developments (neutral visual elements), namely Manor Hill (approx. 129.9mPD) and The Beaumount (approx. 133.3mPD) and The Beaumount II (approx. 135mPD).


106
210
香港電影城
HONG KONG MOVIE CITY
露天香港鐵路路軌
OPEN MTR TRACKS
G/IC
G/IC(5)
GB
103
峻瀅
The Beaumount
峻瀅II
The Beaumount II
R(E)
海茵莊園
Manor Hill
R(E)
SHEUNG TAK ROAD
緻藍天
Hemera
首都
The Capitol
86
85
污水處理廠
SEWAGE TREATMENT WORKS
OU
日出康城
LOHAS Park
領凱
La Splendeur
領峯
Le Prime
領都
La Prestige
香海
Wings at Sea
LP6
WAN PO ROAD
CDA
環澳路
WAN O ROAD
G/IC
G/IC(9)
GB
O
105
清水灣郊野公園
CLEAR WATER BAY COUNTRY PARK
HIGH JUNK PEAK
R(A)7
G/IC
工業邨
INDUSTRIAL ESTATE
104
87
OU
工業邨
INDUSTRIAL ESTATE
GB
將軍澳創新園
TSEUNG KWAN O INNOPARK
101
Legend
TKOL II/III
Application Site

HKJC/TKOL/2

FIGURE 1 APPROVED TSEUNG KWAN O OUTLINE ZONING PLAN NO. S/TKO/32 (EXTRACT)

SCALE 1 : 10,000

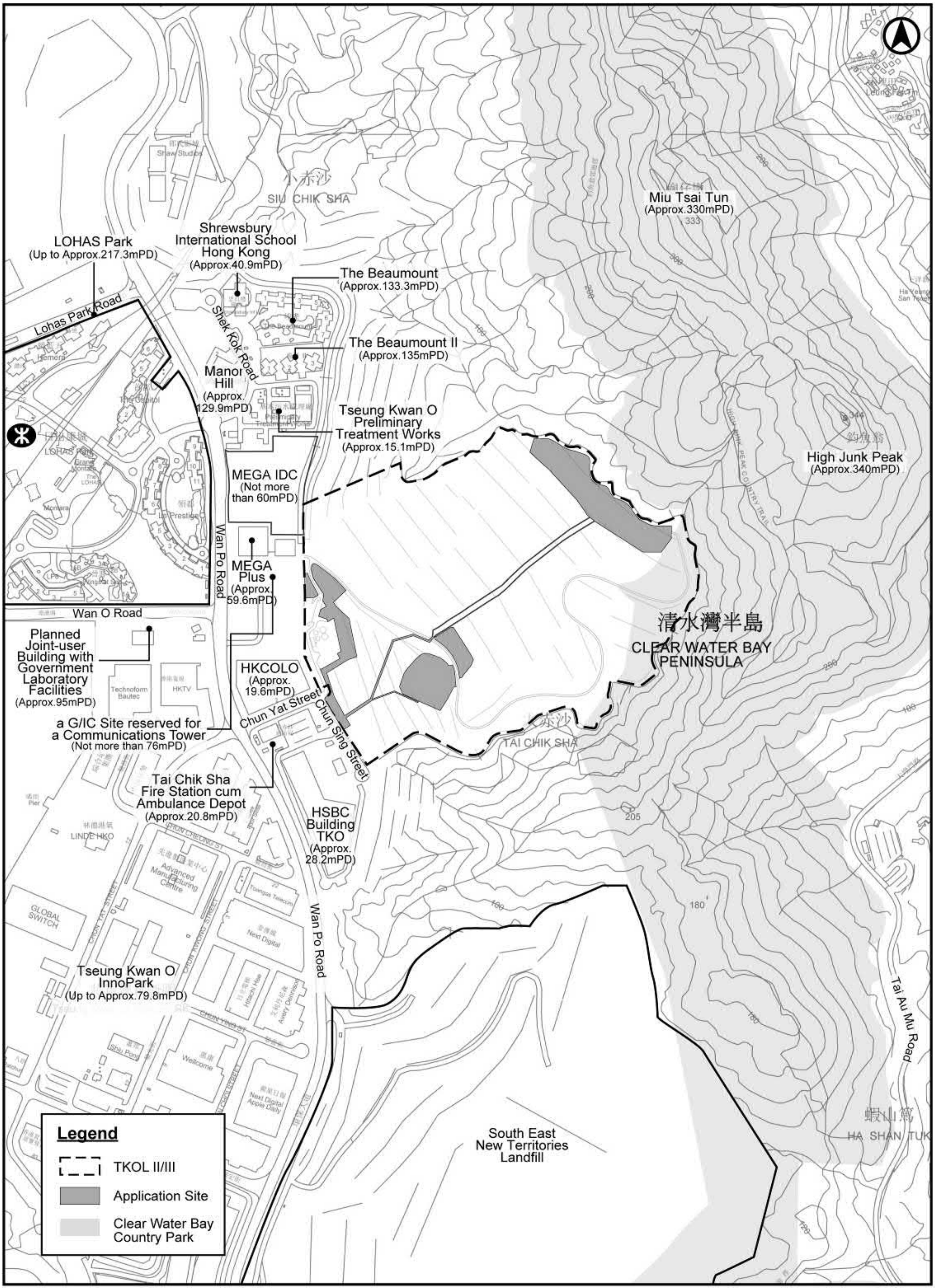

小赤沙
SIU CHIK SHA
Shaw Studios
LOHAS Park
(Up to Approx.217.3mPD)
Shrewsbury International School Hong Kong
(Approx.40.9mPD)
The Beaumount
(Approx.133.3mPD)
The Beaumount II
(Approx.135mPD)
Miu Tsai Tun
(Approx.330mPD)
333
Lohas Park Road
Shek Kok Road
Manor Hill
(Approx. 129.9mPD)
Tseung Kwan O Preliminary Treatment Works
(Approx.15.1mPD)
Hemera
The Capitol
LOHAS Park
Grand Montara
Montara
Le Prestige
MEGA IDC
(Not more than 60mPD)
MEGA Plus
(Approx. 59.6mPD)
Wan Po Road
Wan O Road
High Junk Peak
(Approx.340mPD)
344
鈎魚翁
HIGH JUNK PEAK COUNTRY TRAIL
清水灣半島
CLEAR WATER BAY PENINSULA
Planned Joint-user Building with Government Laboratory Facilities
(Approx.95mPD)
Technoform Bautec
HKTV
HKCOLO
(Approx. 19.6mPD)
Chun Yat Street
Chun Sing Street
a G/IC Site reserved for a Communications Tower
(Not more than 76mPD)
大赤沙
TAI CHIK SHA
Tai Chik Sha Fire Station cum Ambulance Depot
(Approx.20.8mPD)
HSBC Building TKO
(Approx. 28.2mPD)
LINDE HKO
Pier
CHUN CHEUNG ST
Advanced Manufacturing Centre
GLOBAL SWITCH
CHUN YAT STREET
CHUN KWONG STREET
Towngas Telecom
Next Digital
Hitachi Hise
Avery Dennison
CHUN YING ST
Shiu Pong
Wellcome
Next Digital Apple Daily
Tseung Kwan O InnoPark
(Up to Approx.79.8mPD)
Wan Po Road
205
180
100
200
300
Tai Au Mu Road
South East New Territories Landfill
蝦山篤
HA SHAN TUK
Leung Fai Tin
Legend
TKOL II/III
Application Site
Clear Water Bay Country Park

FIGURE 2 SITE LOCATION PLAN

SCALE 1 : 10,000

3 THE DEVELOPMENT PROPOSAL

The Public Riding School

3.1 The Environmental Protection Department ("**EPD**") has long been supportive of the development of restored landfills into popular and well utilised recreational and sports facilities and of suitable proposals from organizations or groups to develop self-funded recreational facilities and operate the facilities on a non-profit-making and self-financing basis on restored landfills with the support/consent of relevant policy bureau and departments. Building on the successful precedents, the Applicant has expressed to EPD in developing the three (3) relatively flat platforms deemed technical feasible and safe for recreational use into Hong Kong's fourth PRS as outlined in the Supplementary Planning Statement ("**SPS**").

3.2 The PRS will adopt an integrated design and engineering approach combining strategies as mentioned in the SPS to ensure no disruption to the ongoing waste degradation process and aftercare works and facilities of the restored landfill, in compliance to the loading capacities of the platforms, as well as ensure the safety of all riders and visitors within the PRS. Ultimately, the PRS will offer an immersive equestrian experience through visitor-centric amenities that integrates with the natural landscape and promotes horse welfare and safety.

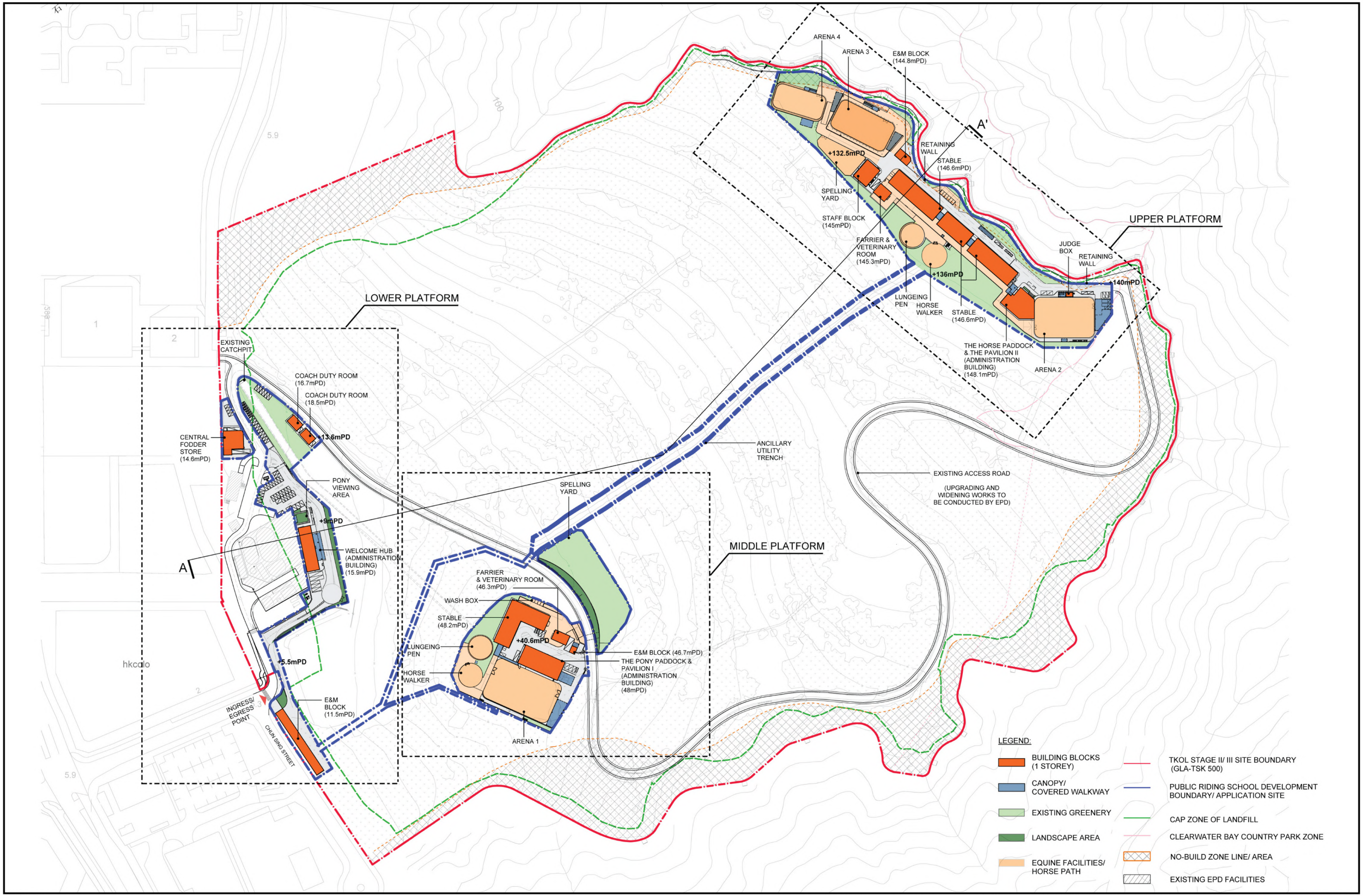
3.3 The PRS is located on three platforms, namely the Lower Platform (i.e. Reception and Hospitality Lounges) (approx.+6.0mPD), Middle Platform (i.e. Pony Paddock & Pavilion I)(approx. +40.0mPD) and Upper Platform (i.e. Horse Paddock & Pavilion II) (approx.140.0mPD). The platforms are connected by an ancillary utility trench to house the essential utilities service to enable PRS operation and an existing internal road currently used by EPD for aftercare and monitoring works of TKOL II/III. The PRS will incorporate various outdoor equestrian facilities, including Lungeing Pen, Horse Walker, Spelling Yards and Arenas. A Pony Viewing Area, unique to this PRS, is provided as a Public Planning Gain. In support of the operation of the PRS, various ancillary low-rise building structures are proposed at the platforms, including administration blocks, storerooms, E&M Blocks, and staff blocks (staff resting area and coach duty room) etc. The Master Layout Plan of The PRS is provided in ***Figure 3***.

3.4 The key development parameters are summarised in ***Table 3.1***.

Table 3.1 Development Schedule

TECHNICAL SCHEDULE OF THE PRS	
Overall Development	
Application Site Area	Approx. 46,500m^{2} (consisting areas of the three platforms (43,700m^{2}) and associated ancillary utility trench (2,800 m^{2}))
Total GFA	Approx. 9,000 m^{2}
Domestic	Approx. 200m$^{2*(1)}$
Non-domestic	Approx. 8,800m^{2}
Total Site Coverage	Approx. 20.9%
Domestic	Approx. 0.4%
Non-domestic	Approx. 20.5%
Building Height	
Storeys	Proposed 1 storey
Main Roof (m)$^{*(2)}$	Proposed 4.8 to 7.7m
No. of Building Blocks	Proposed 17 nos.
Lower Platform – Reception and Hospitality Lounges	
Site Area	Approx.10,200 m^{2}
GFA	
Domestic	Approx. 200m^{2} $^{*(1)}$
Non-domestic	Approx. 980m^{2}
Site Coverage	
Domestic	Approx. 0.4%
Non-domestic	Approx. 3.2%
Building Height	
Storeys	Proposed 1 storey
Main Roof (m)	Proposed 4.8m to 7.0m
Main Roof (mPD)$^{*(2)}$	Proposed +11.5mPD to +18.5mPD
No. of Building Blocks	Proposed 5 nos.
Middle Platform – Pony Paddock & Pavillion I	
Site Area	Approx.12,800 m^{2}
GFA	
Domestic	N/A
Non-domestic	Approx. 2,480 m^{2}
Site Coverage	
Domestic	N/A
Non-domestic	Approx. 5.3%
Building Height:	
Storeys	Proposed 1 storey
Main Roof (m)	Proposed 6.0m to 7.7m
Main Roof (mPD)	Proposed. +46.3mPD to +48.2mPD
No. of Building Blocks	Proposed 4 nos.
Upper Platform – Horse Paddock & Pavilion II	
Site Area	Approx. 20,700 m^{2}
GFA	
Domestic	N/A
Non-domestic	Approx. 5,340 m^{2}
Site Coverage	
Domestic	N/A
Non-domestic	Approx. 12.0%
Building Height:	
Storeys	Proposed 1 storey
Main Roof (m)	Proposed 5.0m to 7.7m
Main Roof (mPD) $^{*(2)}$	Proposed +144.8mPD to +148.1mPD
No. of Building Blocks	Proposed 8 nos.

**(1) Domestic GFA for Coach Duty Room for the coach staying on shift*
**(2) The proposed buildings will be supported on varying levels of foundations on platform.*



ARENA 4
ARENA 3
E&M BLOCK (144.8mPD)
A'
RETAINING WALL
STABLE (146.6mPD)
+132.5mPD
SPELLING YARD
STAFF BLOCK (145mPD)
FARRIER & VETERINARY ROOM (145.3mPD)
UPPER PLATFORM
JUDGE BOX
RETAINING WALL
140mPD
+136mPD
LUNGEING PEN
HORSE WALKER
STABLE (146.6mPD)
THE HORSE PADDOCK & THE PAVILION II (ADMINISTRATION BUILDING) (148.1mPD)
ARENA 2
LOWER PLATFORM
EXISTING CATCHPIT
COACH DUTY ROOM (16.7mPD)
COACH DUTY ROOM (18.5mPD)
+13.6mPD
CENTRAL FODDER STORE (14.6mPD)
PONY VIEWING AREA
+9mPD
WELCOME HUB (ADMINISTRATION BUILDING) (15.9mPD)
A
+5.5mPD
INGRESS/ EGRESS POINT
CHUN SING STREET
E&M BLOCK (11.5mPD)
ANCILLARY UTILITY TRENCH
EXISTING ACCESS ROAD
(UPGRADING AND WIDENING WORKS TO BE CONDUCTED BY EPD)
SPELLING YARD
MIDDLE PLATFORM
FARRIER & VETERINARY ROOM (46.3mPD)
WASH BOX
STABLE (48.2mPD)
+40.6mPD
LUNGEING PEN
HORSE WALKER
E&M BLOCK (46.7mPD)
THE PONY PADDOCK & PAVILION I (ADMINISTRATION BUILDING) (48mPD)
ARENA 1
hkcalo
5.9
100
LEGEND:
BUILDING BLOCKS (1 STOREY)
CANOPY/ COVERED WALKWAY
EXISTING GREENERY
LANDSCAPE AREA
EQUINE FACILITIES/ HORSE PATH
TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY/ APPLICATION SITE
CAP ZONE OF LANDFILL
CLEARWATER BAY COUNTRY PARK ZONE
NO-BUILD ZONE LINE/ AREA
EXISTING EPD FACILITIES

FIGURE 3 MASTER LAYOUT PLAN OF THE PUBLIC RIDING SCHOOL

4 ASSESSMENT AREA

4.1 An Assessment Area (i.e. visual envelope) is delineated for the VIA to cover the area of visual influence within which the PRS with ancillary facilities is pronouncedly visible from key public viewers (***Figure 4*** refers). As per Para. 4.3 of TPB PG-No. 41A, the assessment boundary is set out with regard to the size and BH of the PRS, the distance and location of public viewers, the potential visibility from the selected viewing points, the hilly terrain of the Site and the topographical conditions of the surrounding environment.

5 IDENTIFICATION AND CLASSIFICATION OF VPS

5.1 As per para. 4.5 of TPB PG-No. 41A, the VIA focuses on public views and local vantage points as these areas are easily accessible and popular to the public. The VIA may also assess the impact on public viewers from the most influenced viewing points. This may include users of the key pedestrian nodes, open space, public areas for outdoor facilities, recreation, rest, leisure, walking and prominent travel routes in the surrounding neighbourhood. Six (6) VPs have been selected to effectively represent the public views in relation to the PRS, covering the fields of views from all public viewers in direct sight of the PRS (***Figure 4*** refers).

5.2 A brief description and evaluation of the identified VPs is outlined below:

- **Viewpoint 1 (VP1): View from Tseung Kwan O Waterfront Park** – This is a long-range static VP located approx. 2.1km northwest of the Application Site along the TKO Waterfront Park near Tseung Lam Highway Garden. It is a public recreational open space along the TKO Waterfront and a popular spot among locals that provides a panoramic view of Junk Bay, TKO South and the mountain backdrop at Clear Water Bay Country Park. This VP represents the users of the waterfront who may use the space for walking, exercising, cycling, resting, sitting-out or sightseeing. Given the recreational nature of activities at this VP and the panoramic coastal views, the sensitivity of this VP is considered **high**.

- **Viewpoint 2 (VP2): View from the Footpath on Tseung Kwan O Cross Bay Bridge** – This is a long-range kinetic VP located approx.1.2km west of the Application Site along the footpath on the TKO Cross Bay Bridge that spans over Junk Bay. It is a marine crossing that consists of carriageway, footpath and cycle track. This VP represents the users of the Bridge, pedestrian passers-by and cyclists who would use the space for commuting, exercising, leisure or sightseeing with occasional view towards the Application Site. While the viewers at this VP are primarily engaged in walking/transient activities, the public attachment of the landmark bridge, the sensitivity at this viewpoint is considered **medium**.

- **Viewpoint 3 (VP3): View from the Green Minibus Terminus outside The Beaumount II on Shek Kok Road** – This is a medium-range static VP located 450m northwest of the Application Site at the green minibus terminus outside The Beaumount II. This VP represents the pedestrian passers-by, nearby residents, students and workers in the vicinity. The public viewers at this VP are primarily transient in nature and/or waiting for public transportation, as such, the sensitivity of this VP is considered **low**.

- **Viewpoint 4 (VP4): View from the Junction of Wan O Road and Wan Po Road** – This is a short-range kinetic VP located approx. 250m west of the Application Site at the junction of Wan O Road and Wan Po Road with busy traffic flow. This VP represents the nearby workers, visitors, residents, pedestrian passers-by and cyclists that may transverse through this junction with occasional view towards the Application Site. Given the transient nature of this VP, the sensitivity of this VP is considered **medium**.

- **Viewpoint 5 (VP5): View from the Bus Stop outside Advanced Manufacturing Centre on Chun Kwong Street** – This is a medium-range static VP located approx. 460m southwest of the Application Site adjacent to the Advanced Manufacturing Centre at TKO InnoPark on Chun Kwong Street. This VP represents the pedestrian passers-by and workers of TKO InnoPark. The public viewers at this VP are primarily transient in nature and/or waiting for public transportation, as such, the sensitivity of this VP is considered **low**.

- **Viewpoint 6 (VP6): View from High Junk Peak** – This is a medium-range static VP located approx. 540m northeast of the Application Site along the High Junk Peak Country Trail. This is an elevated VP at approx. 340mPD offering a panoramic view of TKO South, Lei Yue Mun and Hong Kong Island. This VP represents the users of the trail for leisure, exercise and sightseeing purposes with direct sightline and frequent view towards the Application Site. Due to the recreational nature of viewer activities, the substantial value ascribed by the public to the panoramic TKO south, coastal and mountain scenery, the sensitivity of this VP is considered **high**.

5.3 The results from the initial assessment reveal that views of the Application Site from three (3) out of the six (6) locations investigated (i.e. VPs 1,3 and 4) are fully blocked.

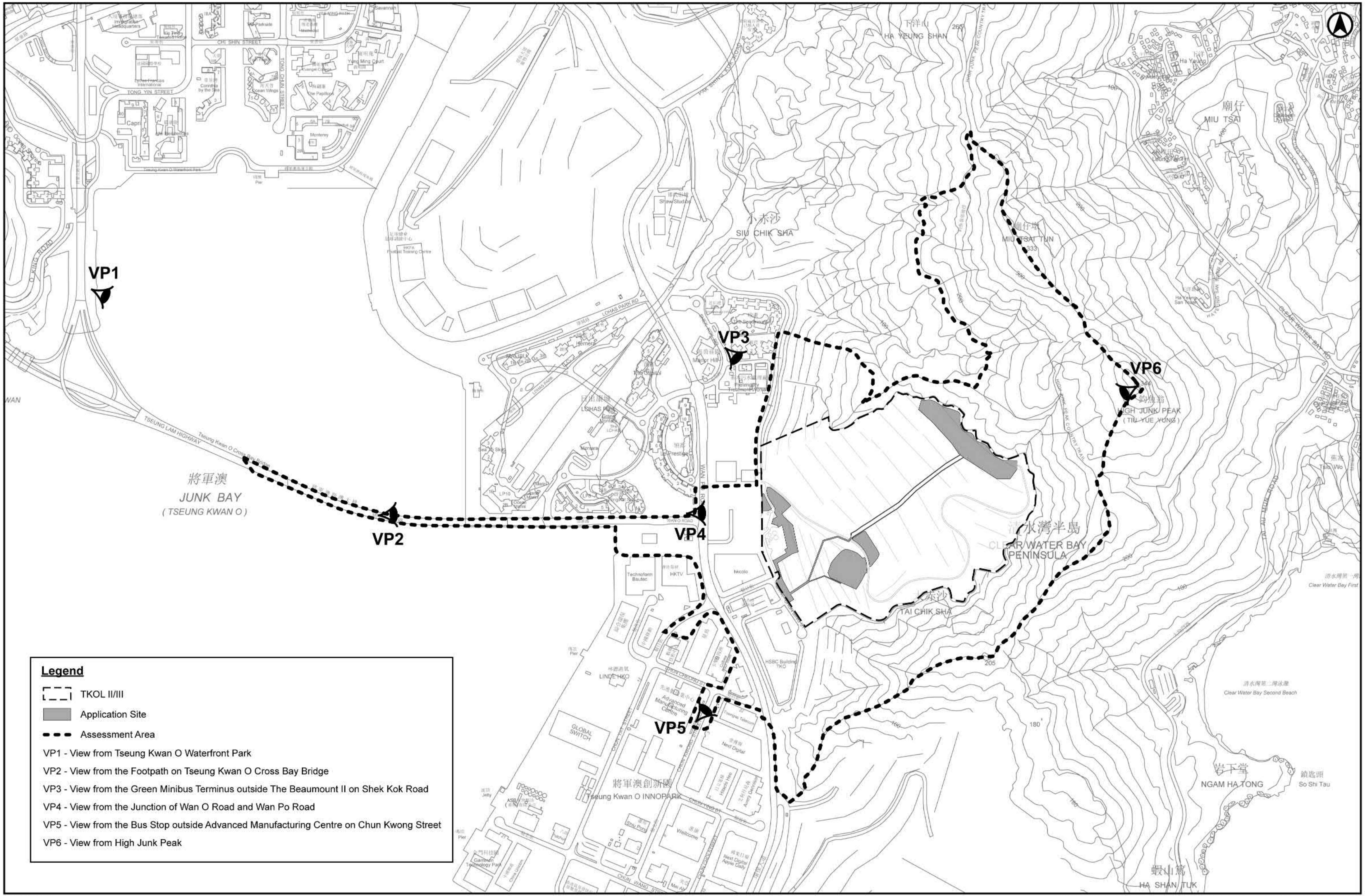

VP1
VP2
VP3
VP4
VP5
VP6
將軍澳
JUNK BAY
(TSEUNG KWAN O)
小赤沙
SIU CHIK SHA
清水灣半島
CLEAR WATER BAY PENINSULA
大赤沙
TAI CHIK SHA
HIGH JUNK PEAK
(TIU YUE YUNG)
下洋山
HA YEUNG SHAN
廟仔
MIU TSAI
MIU TSAI TUN
將軍澳創新園
Tseung Kwan O INNOPARK
岩下堂
NGAM HA TONG
So Shi Tau
蝦山篤
HA SHAN TUK
Clear Water Bay First
Clear Water Bay Second Beach
TSEUNG LAM HIGHWAY
Tseung Kwan O Cross Bay Bridge
LOHAS PARK RD
CHI SHIN STREET
TONG YIN STREET
WAN O ROAD
Legend
TKOL II/III
Application Site
Assessment Area
VP1 - View from Tseung Kwan O Waterfront Park
VP2 - View from the Footpath on Tseung Kwan O Cross Bay Bridge
VP3 - View from the Green Minibus Terminus outside The Beaumount II on Shek Kok Road
VP4 - View from the Junction of Wan O Road and Wan Po Road
VP5 - View from the Bus Stop outside Advanced Manufacturing Centre on Chun Kwong Street
VP6 - View from High Junk Peak

FIGURE 4 LOCATION OF VIEWPOINTS

SCALE 1 : 10,000

6 ASSESSMENT OF VISUAL IMPACTS

6.1 This Section evaluates the visual impact of the PRS with ancillary facilities by comparing it with the Existing Condition. Reference is made to TPB PG-No. 41A and the following Table (***Table 6.1*** refers) summarises the relevant appraisal components. Generally, the visual appraisal for the PRS is carried out on the basis of visual composition, visual obstruction, and visual change. ***Table 6.1*** summarises the major considerations to be discussed for each appraisal component.

Table 6.1 - Appraisal Components

Appraisal Components	**Major Considerations**
Visual Composition	Visual composition is the total visual effect of all the visual elements due to their variation in location, massing, height, disposition, scale, form, proportion and character vis-à-vis the overall visual backdrop. Visual composition may result in visual balance, compatibility, harmony, unity or contrast. The appraisal should have due regard to the overall visual context and character within the wider and local contexts.
Visual Obstruction	The applicant should appraise if the Proposed Scheme may improve or degrade the condition, quality and character of visual resources. A development may cause views in its foreground or background to be intercepted or blocked. The appraisal should assess the degree of visual obstruction and loss of views or visual openness due to the Proposed Scheme from all key public viewing points.
Visual Change	The effects of visual changes from key public viewing points with direct sightlines (considering degree of visibility and viewing distance) to the Proposed Scheme should be assessed and demonstrated in VIA. The changes in the existing and future public views should be compared before and after the Proposed Scheme.

6.2 TPB PG-No. 41A sets out the classifications of visual impact and its associated description. The classifications are tabulated below (***Table 6.2*** refers) to appraise the Overall Visual Resultant Impact of the PRS at the VPs identified (***Para. 4.12 of TPB-PG No. 41A*** refers).

Table 6.2 - Classification of Overall Resultant Visual Impact

Classification of Overall Resultant Visual Impact	**Description**
Beneficial	The impact is beneficial if the project will complement the visual character of its setting, and/or will improve overall visual quality.
Negligible	The impact is negligible if the assessment indicates that there will be no noticeable effects or insignificant visual effects caused by the project.
Slight	The impact is slight if there will be slight adverse visual effects caused by the project.
Moderate	The impact is moderate if there will be some adverse visual effects caused by the project, but these can be eliminated, reduced or moderated to a certain extent by design/mitigation measures.
Substantial	The impact is substantial if the adverse effects are considered too excessive and obstructive, and significant modification is required to mitigate the impacts.

6.3 Photomontages at ***Figures 5-10*** illustrate the condition(s) of the PRS with ancillary facilities and/or against Existing Condition.

Viewpoint 1 (VP1): View from Tseung Kwan O Waterfront Park (***Figure 5*** refers)

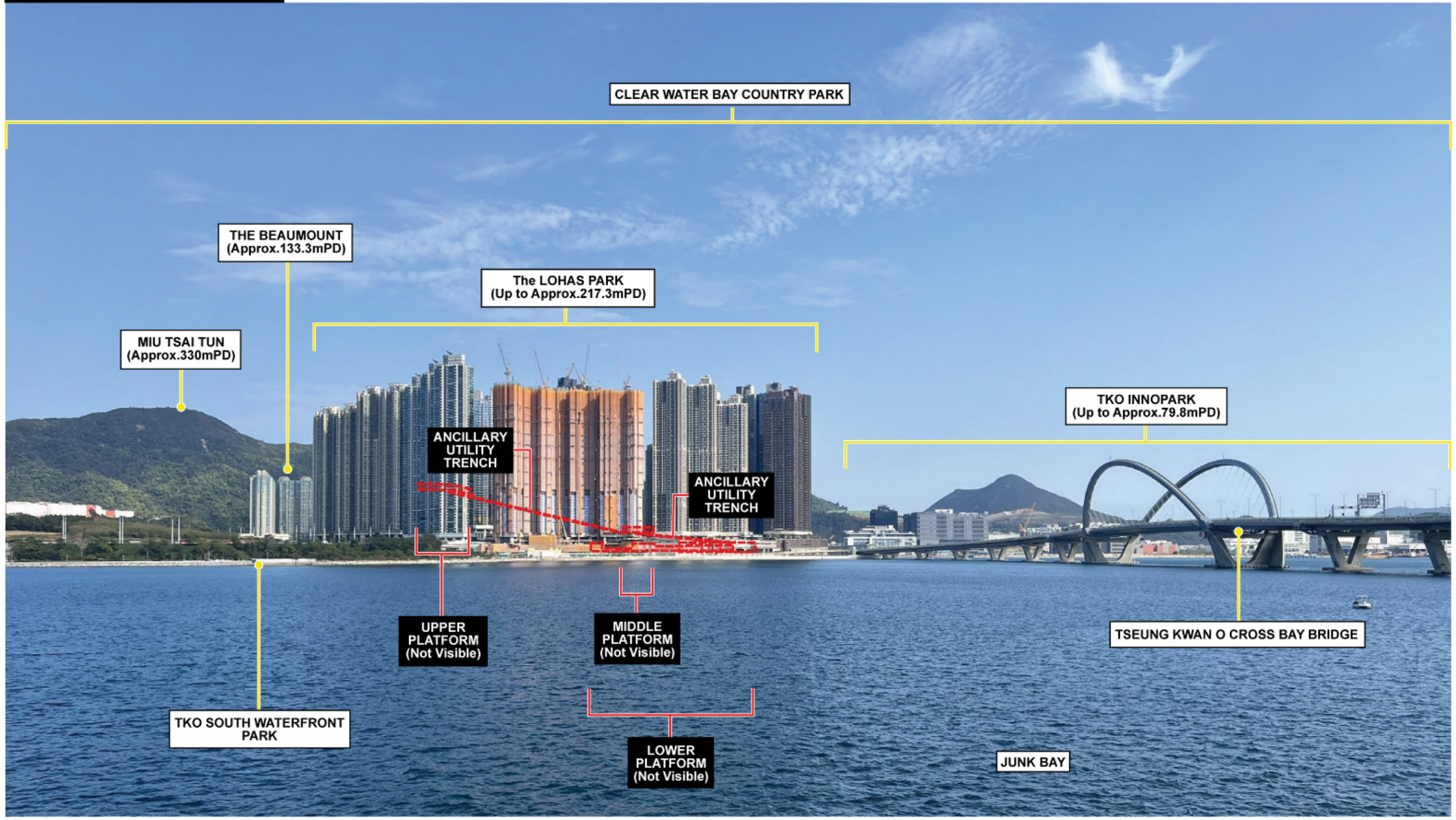
6.4 **Visual composition:** The visual elements of this VP comprise of Junk Bay (positive visual element) in the foreground, Tseung Kwan O Cross Bay Bridge (neutral visual element), high-rise residential developments (neutral visual element) in LOHAS Park and the Beaumount (neutral visual element), TKO Innopark (negative visual element), and TKO South Waterfront Park with trees (positive visual elements) in the middle ground; and mountain and open sky backdrops (positive visual element) (positive visual elements). Given the Application Site is completely screened by the high-rise residential developments in front, there is no change to the visual composition at this VP in when compared with Existing Condition.

6.5 **Visual obstruction**: Since the Application Site is fully screened by the residential developments in front with the mountain and open sky backdrops remaining unaffected, there is no change to the visual openness and degree of obstruction at this VP when compared with Existing Condition. As a result, the Proposed Scheme will not degrade the condition, quality and character of this VP when compared with Existing Condition.

6.6 **Visual Change:** There is no change in views as the Proposed Scheme is not visible from this VP. Additionally, not least the considerable viewing distance between the VP and the Application Site, the public viewers at this VP are generally engaged in recreational activities and would be less sensitive to visual changes.

6.7 Overall, as the Application Site is entirely obscured by the high-rise residential development in front, resulting in no alterations to the visual composition, openness or degree of obstruction at this VP, the resultant visual impact caused by the PRS is considered **negligible**.

PROPOSED SCHEME


CLEAR WATER BAY COUNTRY PARK
THE BEAUMOUNT (Approx.133.3mPD)
The LOHAS PARK (Up to Approx.217.3mPD)
MIU TSAI TUN (Approx.330mPD)
ANCILLARY UTILITY TRENCH
ANCILLARY UTILITY TRENCH
TKO INNOPARK (Up to Approx.79.8mPD)
UPPER PLATFORM (Not Visible)
MIDDLE PLATFORM (Not Visible)
TSEUNG KWAN O CROSS BAY BRIDGE
TKO SOUTH WATERFRONT PARK
LOWER PLATFORM (Not Visible)
JUNK BAY

Legend

— **Application Site**

— Surrounding Visual Elements

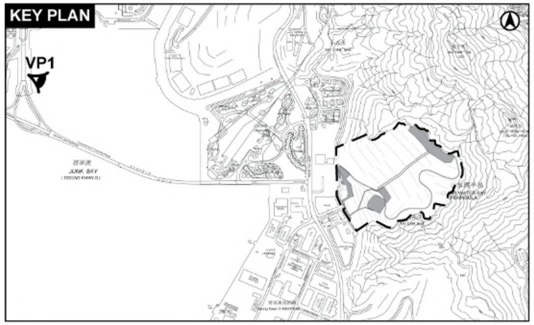

KEY PLAN
VP1
JUNK BAY

FIGURE 5 VIEWPOINT 1 : VIEW FROM TSEUNG KWAN O WATERFRONT PARK

Viewpoint 2 (VP2): View from the Footpath on Tseung Kwan O Cross Bay Bridge (***Figure 6*** refers)

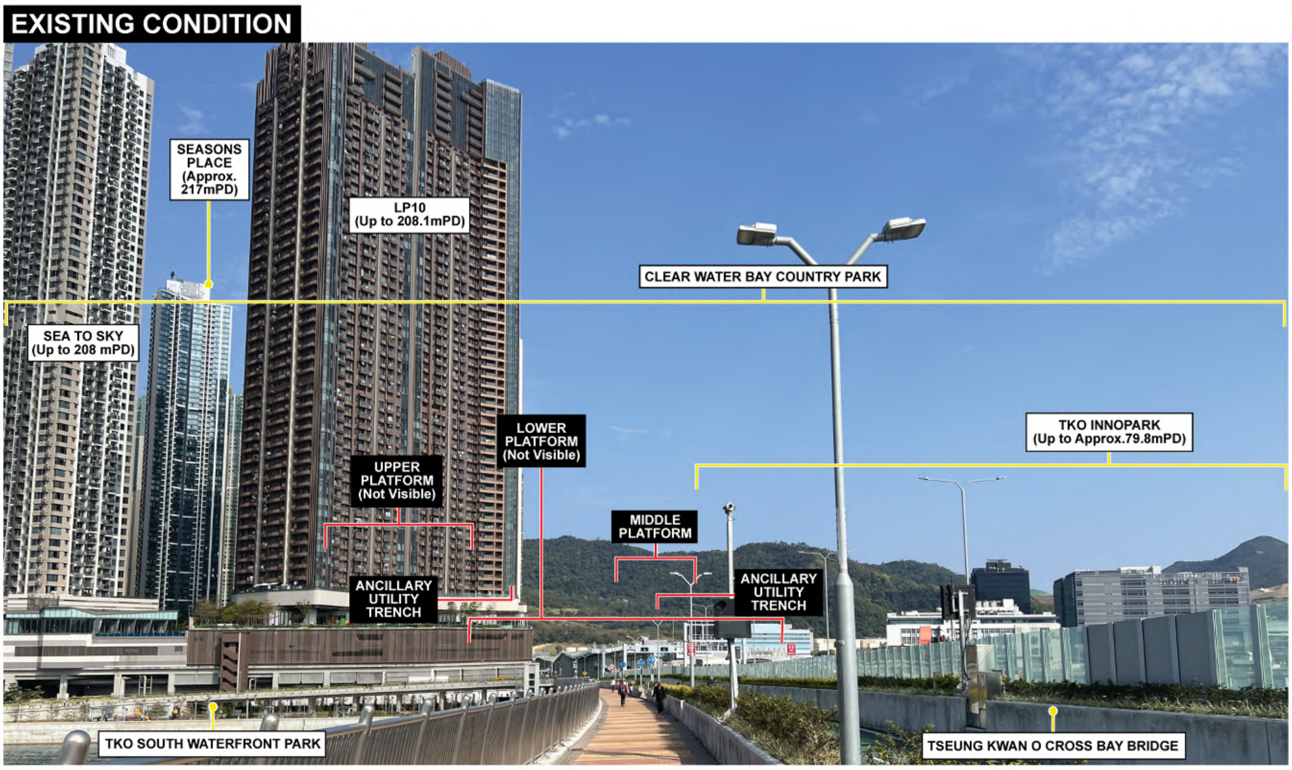
6.8 **Visual composition:** The visual elements of this VP comprise of various street furniture (neutral visual element), roadside plantings (positive visual element) and noise barrier (negative visual element) on the TKO Cross Bay Bridge in the foreground; a cluster of high-rise residential developments of LOHAS Park (neutral visual elements) (including LP6, Sea to Sky and Seasons Place), the Communications Tower (neutral visual elements), the planned Joint-user Building with Government Laboratory Facilities (neutral visual elements) and low to medium-rise developments of TKO InnoPark (negative visual element) in the middle ground; and the vegetation within TKOL II/ III, Clear Water Bay Country Park and open sky view (positive visual elements) in the background. The Lower and Upper Platforms and the majority of the utility trench of the PRS will be completely screened by the developments in the foreground. Only a very minor portion of the low-rise structures at the Middle Platform are visible from this VP, blending seamlessly into the background with negligible impact to the visual composition of this VP.

6.9 **Visual obstruction**: The Middle Platform will obscure a very minor portion of the existing vegetation within the TKOL II/III, the view towards the mountain and open sky backdrops remains unobstructed when compared to the Existing Condition. The degree of visual obstruction by the PRS is considered negligible and the visual openness is largely preserved as compared to the Existing Condition. Additionally, this VP is distant from the Application Site and the low-rise and low-density PRS with nature-inspired and earth-tone design are able to well-integrated with the natural settings in the background and surrounding context. Overall, the PRS will not degrade the condition, quality and character of this VP when compared to Existing Condition.

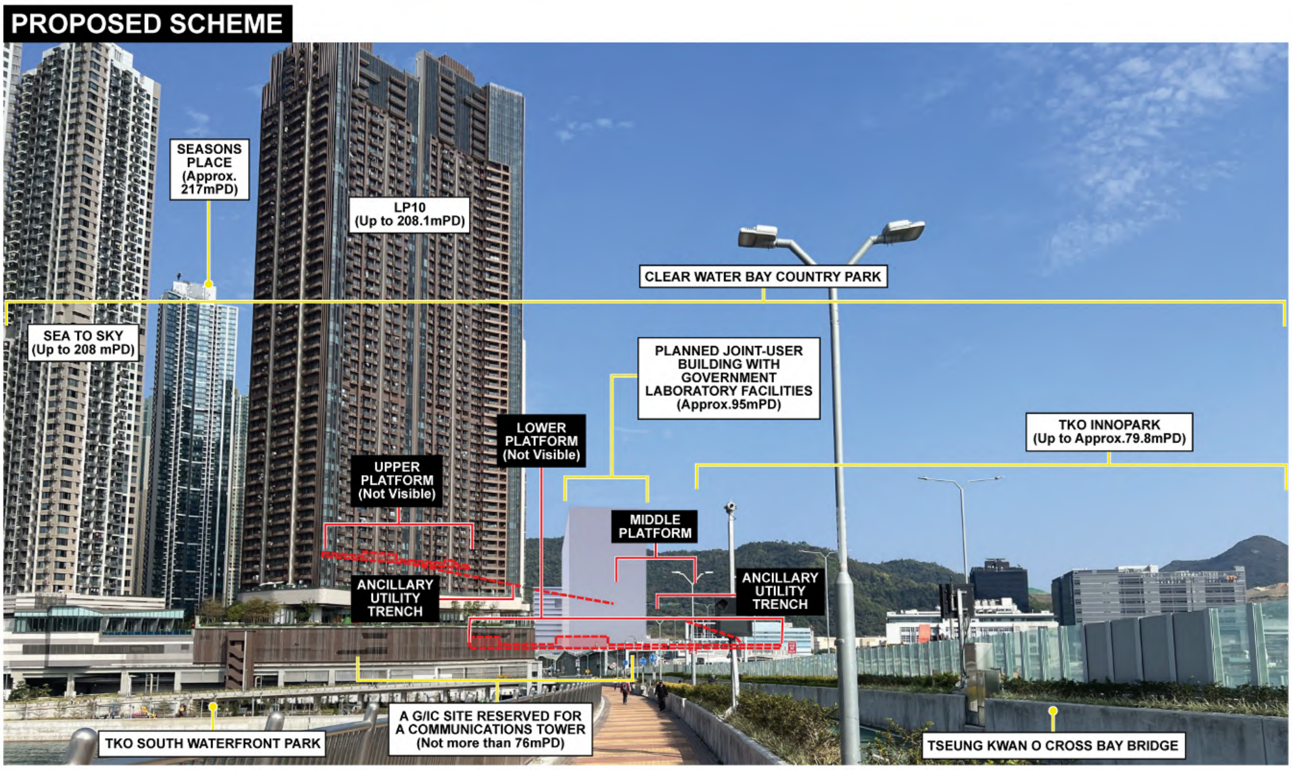
6.10 **Visual Change:** Given the long viewing distance between this VP and the Application Site, reduction in visibility of the Application Site as result of developments in the foreground, and the low-rise and low-density nature of the PRS, the low-rise man-made structures are barely visible to the public viewers at this VP and resulting in minimal visual change.

6.11 Only a minor portion of the low-rise structures at the Middle Platform will be visible at this VP and will blend with the natural surroundings, resulting in no notable alteration to the visual openness or obstruction of the mountain and sky backdrops. As such, the visual difference compared to the existing condition is negligible. Given the transient nature of this VP and its distance from the Application Site, the overall resultant visual impact caused by the PRS at this VP is considered **negligible.**

EXISTING CONDITION


SEASONS PLACE (Approx. 217mPD)
LP10 (Up to 208.1mPD)
CLEAR WATER BAY COUNTRY PARK
SEA TO SKY (Up to 208 mPD)
TKO INNOPARK (Up to Approx.79.8mPD)
LOWER PLATFORM (Not Visible)
UPPER PLATFORM (Not Visible)
MIDDLE PLATFORM
ANCILLARY UTILITY TRENCH
ANCILLARY UTILITY TRENCH
TKO SOUTH WATERFRONT PARK
TSEUNG KWAN O CROSS BAY BRIDGE

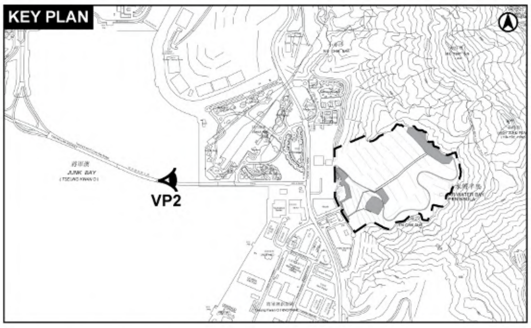
PROPOSED SCHEME


SEASONS PLACE (Approx. 217mPD)
LP10 (Up to 208.1mPD)
CLEAR WATER BAY COUNTRY PARK
SEA TO SKY (Up to 208 mPD)
PLANNED JOINT-USER BUILDING WITH GOVERNMENT LABORATORY FACILITIES (Approx.95mPD)
TKO INNOPARK (Up to Approx.79.8mPD)
LOWER PLATFORM (Not Visible)
UPPER PLATFORM (Not Visible)
MIDDLE PLATFORM
ANCILLARY UTILITY TRENCH
ANCILLARY UTILITY TRENCH
A G/IC SITE RESERVED FOR A COMMUNICATIONS TOWER (Not more than 76mPD)
TKO SOUTH WATERFRONT PARK
TSEUNG KWAN O CROSS BAY BRIDGE

Legend

🟥 Application Site

🟨 Surrounding Visual Elements


KEY PLAN
VP2

Source of the Development Parameters of the Communications Tower: Discussion Paper No. PWSC(2013-14)28 for Public Works Subcommittee of Finance Committee dated 18 December 2013

Source of the Joint-user Building with Government Laboratory Facilities: Sai Kung District Council Meeting paper for 3 January 2023 SKDC(M) Paper No. 1/23

FIGURE 6 VIEWPOINT 2 : VIEW FROM THE FOOTPATH ON TSEUNG KWAN O CROSS BAY BRIDGE

Viewpoint 3 (VP3): View from the Green Minibus Terminus outside The Beaumount II on Shek Kok Road (***Figure 7*** refers)

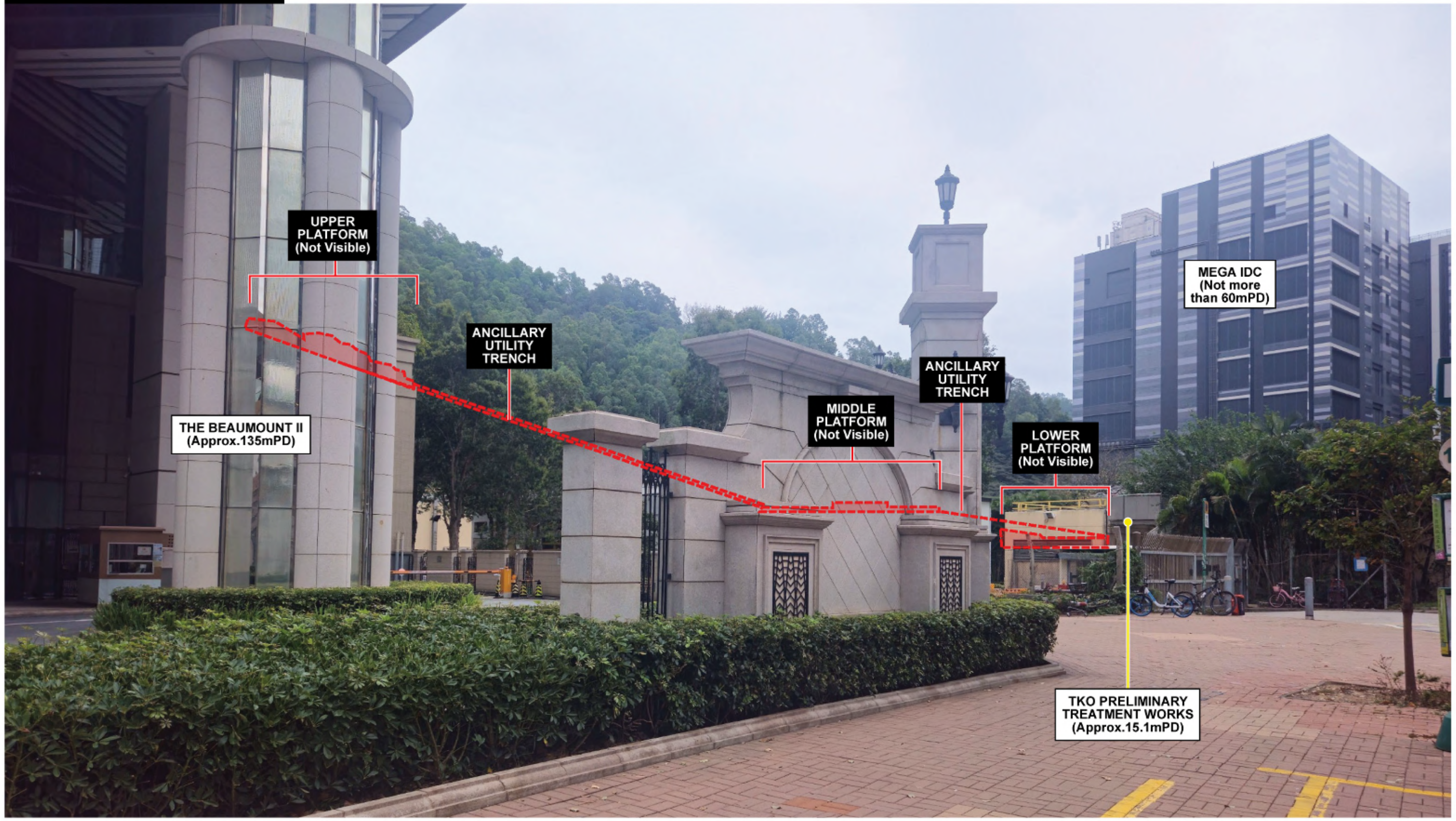
6.12 **Visual composition:** The visual elements of this VP comprise of footpath (neutral visual element) and shrub planting (positive visual element) in the foreground; facilities and building structures of The Beaumount II (neutral visual elements), TKO Preliminary Treatment Works (negative visual element), Mega IDC(neutral visual elements) and densely vegetated mountain in the middle ground; and the open sky backdrop. As the Application Site is fully screened by the existing man-made structures and dense vegetation in front, the visual composition at this VP remains unchanged when compared to Existing Condition.

6.13 **Visual obstruction**: Given the Application Site is completely obscured by the existing developments and the densely vegetated mountain in the middle ground and the open sky backdrop remains unaffected, there is no visual obstruction at this VP. The visual openness and the conditions, quality and characters of the assessment area will not be degraded when compared with Existing Condition.

6.14 **Visual Change:** The public viewers at this VP primarily engage in waiting for public transportation with only occasional views towards the Application Site. Further, since the Application Site is fully screened by the existing developments and densely vegetated mountain in front, the visual openness is fully preserved and there is no visual change to be experienced by the public at this VP when compared to Existing Condition.

6.15 The Application Site is fully screened by existing man-made structures and dense vegetation, leaving the visual elements and openness at this VP unchanged. In this regard, there will not be visual change for the public viewers, and the overall resultant visual impact caused by the PRS at this VP is considered **negligible** when compared to the Existing Condition.

PROPOSED SCHEME


UPPER PLATFORM (Not Visible)
ANCILLARY UTILITY TRENCH
THE BEAUMOUNT II (Approx.135mPD)
MIDDLE PLATFORM (Not Visible)
ANCILLARY UTILITY TRENCH
LOWER PLATFORM (Not Visible)
MEGA IDC (Not more than 60mPD)
TKO PRELIMINARY TREATMENT WORKS (Approx.15.1mPD)

Legend

— Application Site

— Surrounding Visual Elements

KEY PLAN

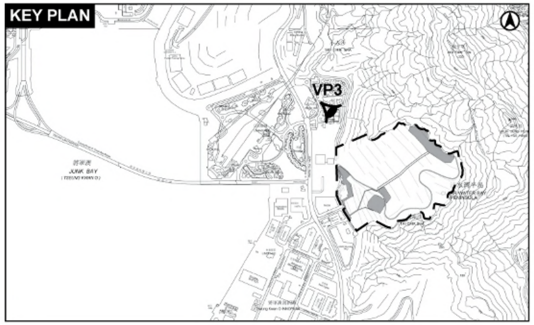


FIGURE 7 VIEWPOINT 3 : VIEW FROM THE GREEN MINIBUS TERMINUS OUTSIDE THE BEAUMOUNT II ON SHEK KOK ROAD

Viewpoint 4 (VP4): View from the Junction of Wan O Road and Wan Po Road (***Figure 8*** refers)

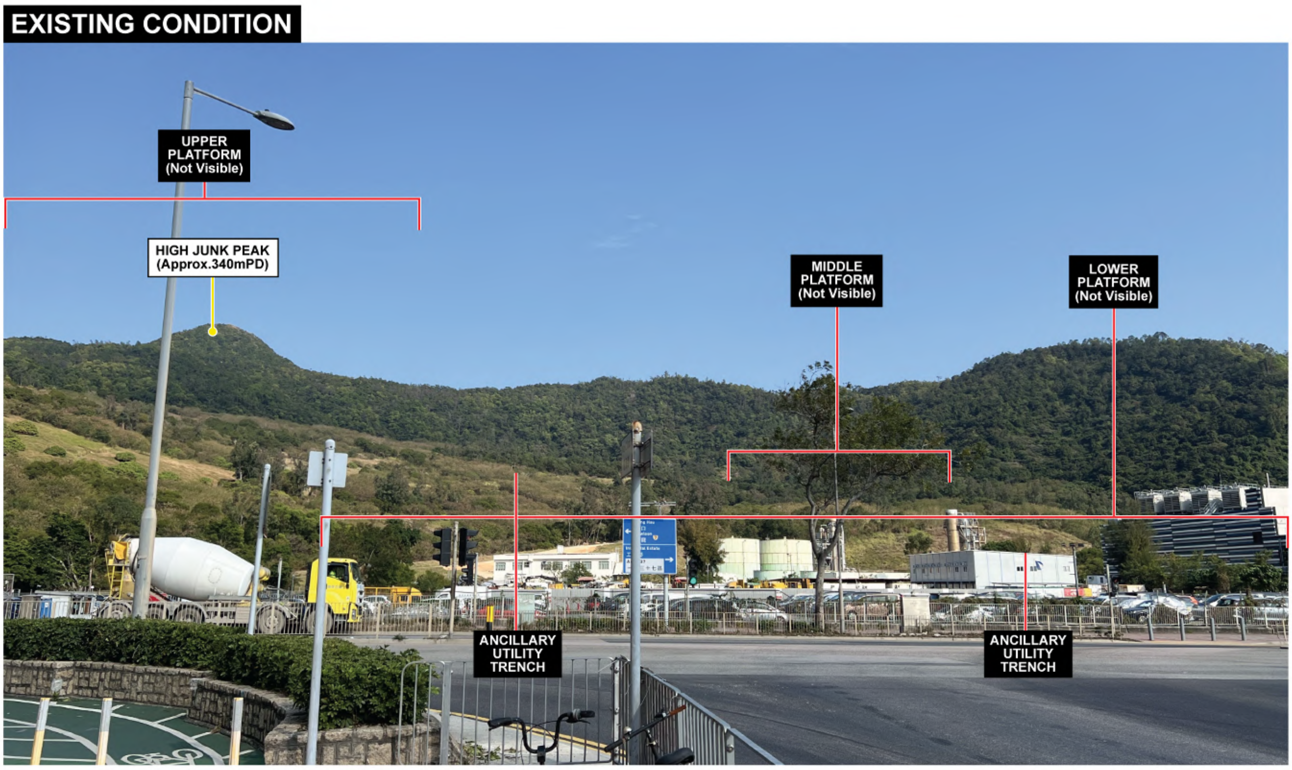
6.16 **Visual composition:** The major visual elements of this VP comprise of cycling track, junction, street furniture (neutral visual elements), and roadside planting (positive visual element) in the foreground; the Communications Tower (neutral visual element) in the middle ground; and the High Junk Peak and open sky view (positive visual elements) in the background. Given the Application Site is completely obscured by the Communications Tower in the middle ground and the mountain and open sky backdrops remain unaffected by the PRS, there is no alteration of the visual composition due to the PRS when compared to Existing Condition.

6.17 **Visual obstruction**: Since the PRS is fully blocked by the Communications Tower in the middle ground, and the obstruction to the mountain and open sky backdrop will solely result from the Communications Tower, the PRS introduces no additional visual obstruction at this VP. Overall, the visual openness and the condition, quality and character of this VP will not be affected by the PRS at this VP.

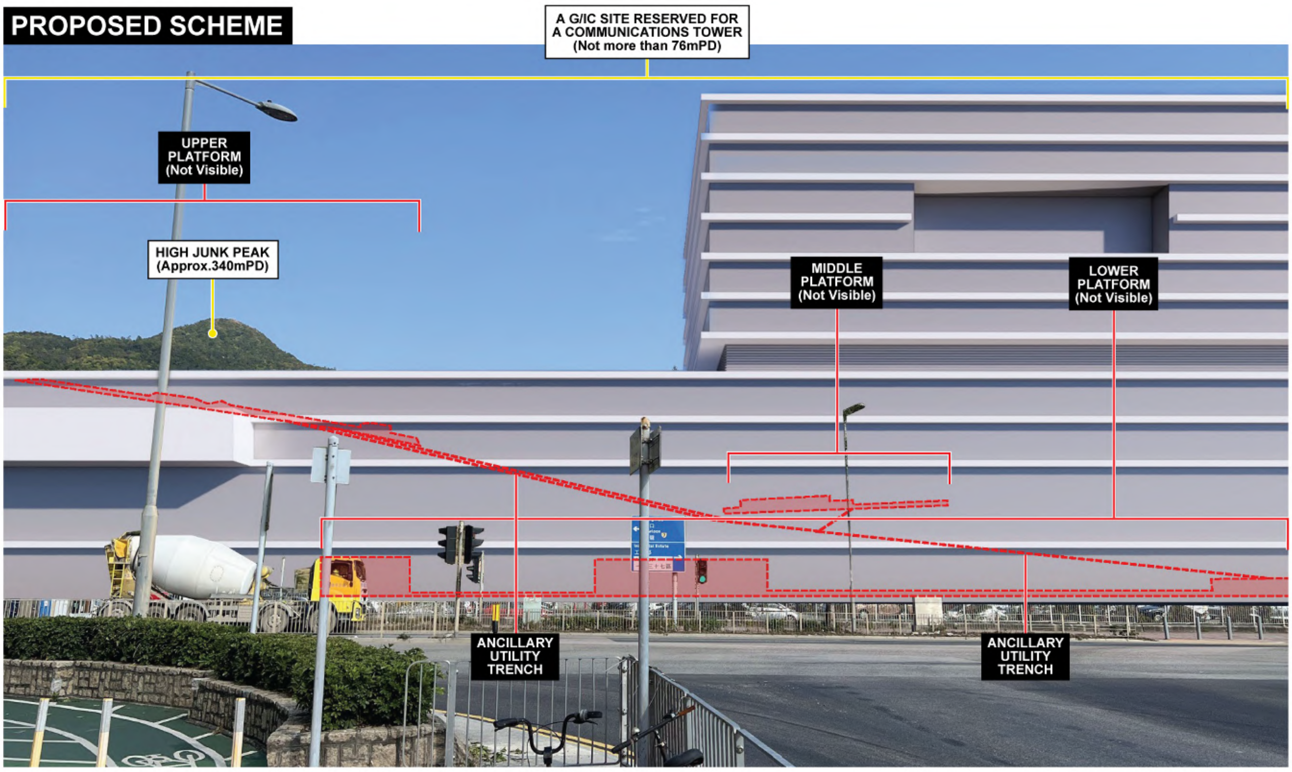
6.18 **Visual Change:** Given the visual prominence of the Communications Tower in the middle ground and the PRS will be fully screened, the PRS will not introduce visual change at this VP. With no direct sightline to the Application Site, the visual change to be experienced by public viewers at this VP is predominantly attributed to the Communications Tower.

6.19 Since the PRS will be fully screened by the Communications Tower in front and will not introduce alterations to the visual composition, the degree of visual obstruction and openness, and visual change, the overall resultant visual impact caused by the PRS at this VP is considered **negligible.**

EXISTING CONDITION

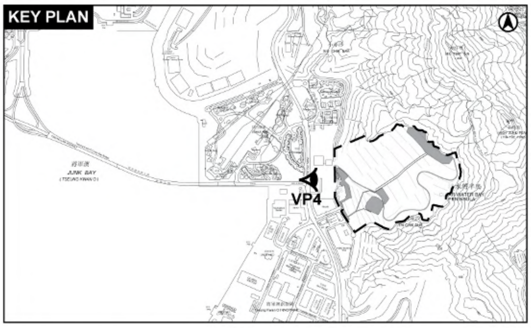

UPPER PLATFORM (Not Visible)
HIGH JUNK PEAK (Approx.340mPD)
MIDDLE PLATFORM (Not Visible)
LOWER PLATFORM (Not Visible)
ANCILLARY UTILITY TRENCH
ANCILLARY UTILITY TRENCH

PROPOSED SCHEME


A G/IC SITE RESERVED FOR A COMMUNICATIONS TOWER (Not more than 76mPD)
UPPER PLATFORM (Not Visible)
HIGH JUNK PEAK (Approx.340mPD)
MIDDLE PLATFORM (Not Visible)
LOWER PLATFORM (Not Visible)
ANCILLARY UTILITY TRENCH
ANCILLARY UTILITY TRENCH

Legend

- 🟥 Application Site
- 🟨 Surrounding Visual Elements


KEY PLAN
VP4

Source of the Development Parameters of the Communications Tower:
Discussion Paper No. PWSC(2013-14)28 for Public Works Subcommittee
of Finance Committee dated 18 December 2013

FIGURE 8 VIEWPOINT 4 : VIEW FROM THE JUNCTION OF WAN O ROAD AND WAN PO ROAD

Viewpoint 5: View from the Bus Stop outside Advanced Manufacturing Centre on Chun Kwong Street (***Figure 9*** refers)

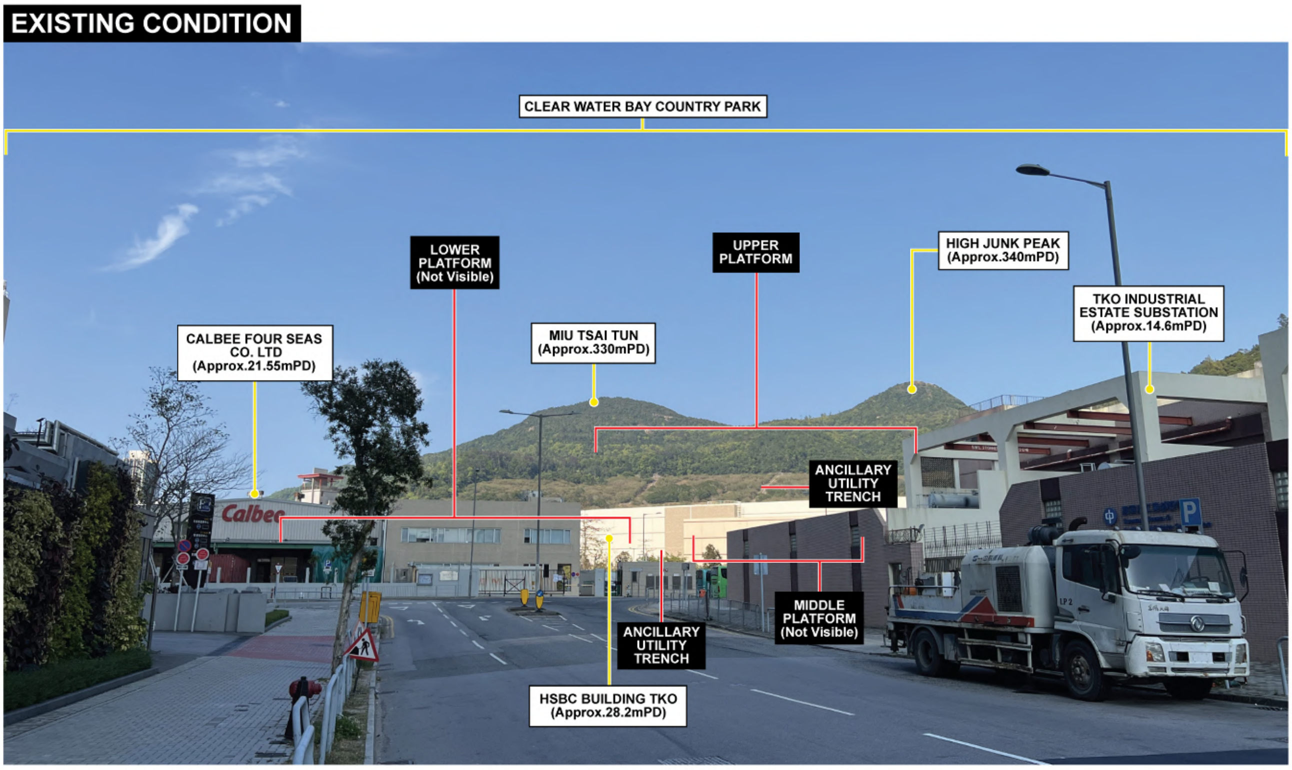
6.20 **Visual composition:** Major visual elements of this VP comprise of TKO Industrial Estate Substation (negative visual element) and Calbee Four Seas Co. Ltd (neutral visual element) in the foreground; HSBC Building TKO (neutral visual element) in the middle ground; and TKOL II/III, Clear Water Bay Country Park and open sky view (positive visual elements) in the background. The Upper Platform of the PRS will be visible from this VP, while the Lower and Middle Platforms will be entirely screened by the existing man-made structures in the foreground and middle ground. Due to the long distance between this VP and the Upper Platform as well as the low-rise nature of the building structures, only a minor portion mountain backdrop will be blocked. Although a minor portion of vegetation will be removed due to the utility trench along the existing nullah, there is negligible change to the visual composition. Given majority of visual elements are not affected, the visual composition of this VP will not be significantly altered when compared to the Existing Condition. Mountain backdrop, yet the overall visual openness remains largely unaffected.

6.21 **Visual obstruction**: While the Upper Platform of PRS and the ancillary utility trench will lead to a very minor obstruction to the mountain backdrop yet the overall visual openness will remain unchanged. The degree of obstruction is considered negligible, and the condition, quality and character of this VP will largely be preserved and will not be degraded due to the PRS when compared to the Existing Condition.

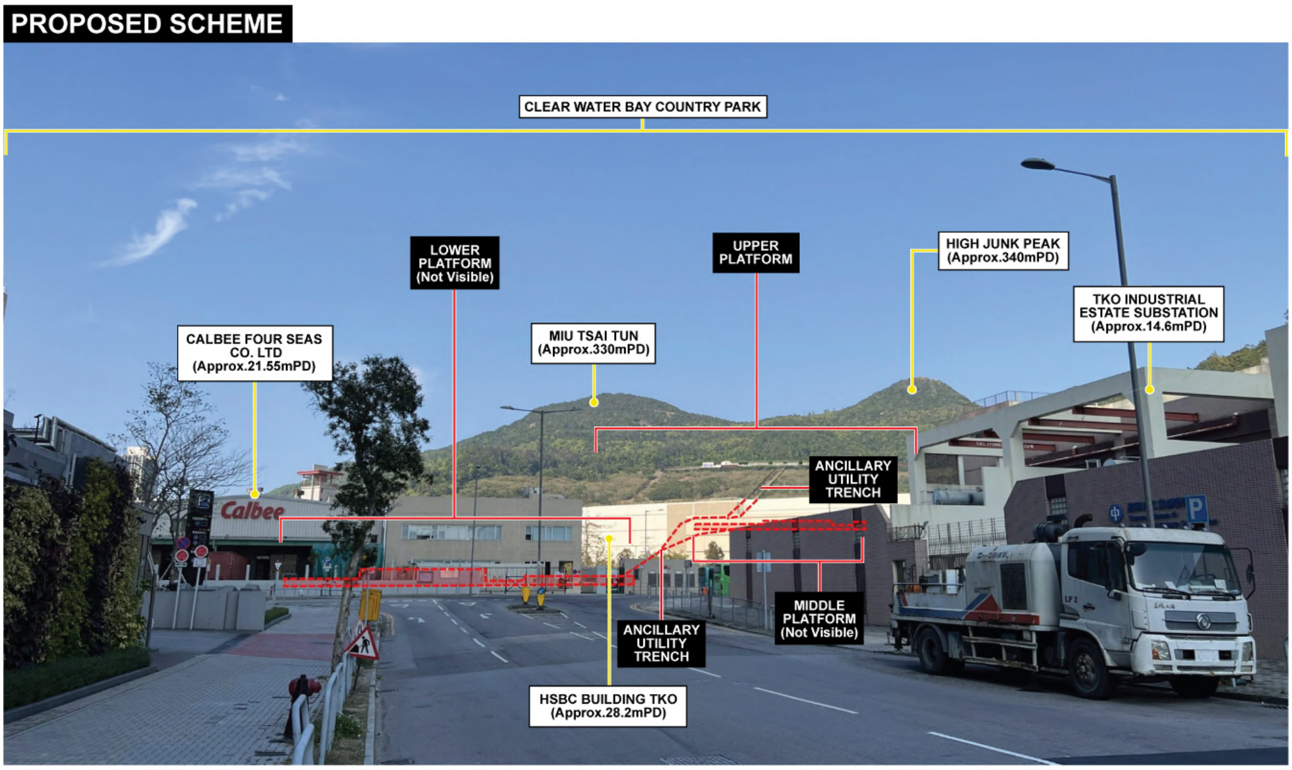
6.22 **Visual Change:** In view of the distance between this VP and the Application Site and the marginally visible low-rise structures at the Upper Platform, the visual change to be experienced by the public is considered minimal. Façade treatments (e.g. use of nature themed and earth tone colour and materials) and landscape treatment (e.g. ornamental tree plantings, etc) will be incorporated to soften the building edge, enhance the visual amenity of the PRS and allow the man-made structures blend in with the surrounding natural landscape.

6.23 In view of the transient nature of this VP, the low-rise nature of the proposed structures, and the considerable distance from this VP, the overall visual openness remains largely unchanged. Despite the minor obstruction to the mountain backdrop caused by the low-rise structures at the Upper Platform and the ancillary utility trench, such impact is considered minimal. Furthermore, carefully designed façade treatments and landscaping will allow the PRS to integrate harmoniously with the natural surroundings. In light of the above, the overall resultant visual impact caused by the PRS at this VP is considered **negligible** when compared to the Existing Condition.

EXISTING CONDITION


CLEAR WATER BAY COUNTRY PARK
LOWER PLATFORM (Not Visible)
UPPER PLATFORM
HIGH JUNK PEAK (Approx.340mPD)
TKO INDUSTRIAL ESTATE SUBSTATION (Approx.14.6mPD)
CALBEE FOUR SEAS CO. LTD (Approx.21.55mPD)
MIU TSAI TUN (Approx.330mPD)
ANCILLARY UTILITY TRENCH
MIDDLE PLATFORM (Not Visible)
ANCILLARY UTILITY TRENCH
HSBC BUILDING TKO (Approx.28.2mPD)

PROPOSED SCHEME


CLEAR WATER BAY COUNTRY PARK
LOWER PLATFORM (Not Visible)
UPPER PLATFORM
HIGH JUNK PEAK (Approx.340mPD)
TKO INDUSTRIAL ESTATE SUBSTATION (Approx.14.6mPD)
CALBEE FOUR SEAS CO. LTD (Approx.21.55mPD)
MIU TSAI TUN (Approx.330mPD)
ANCILLARY UTILITY TRENCH
MIDDLE PLATFORM (Not Visible)
ANCILLARY UTILITY TRENCH
HSBC BUILDING TKO (Approx.28.2mPD)

*For reference only

Legend

- Application Site
- Surrounding Visual Elements

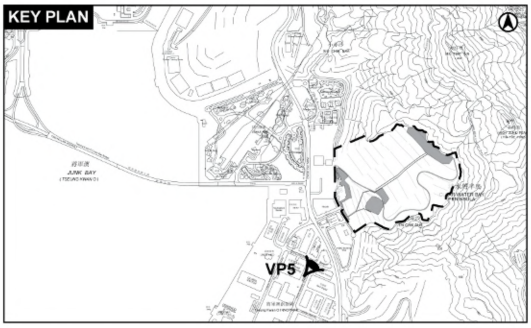

KEY PLAN
VP5

FIGURE 9 VIEWPOINT 5 : VIEW FROM THE BUS STOP OUTSIDE ADVANCED MANUFACTURING CENTRE ON CHUN KWONG STREET

Viewpoint 6: View from High Junk Peak (***Figure 10*** refers)

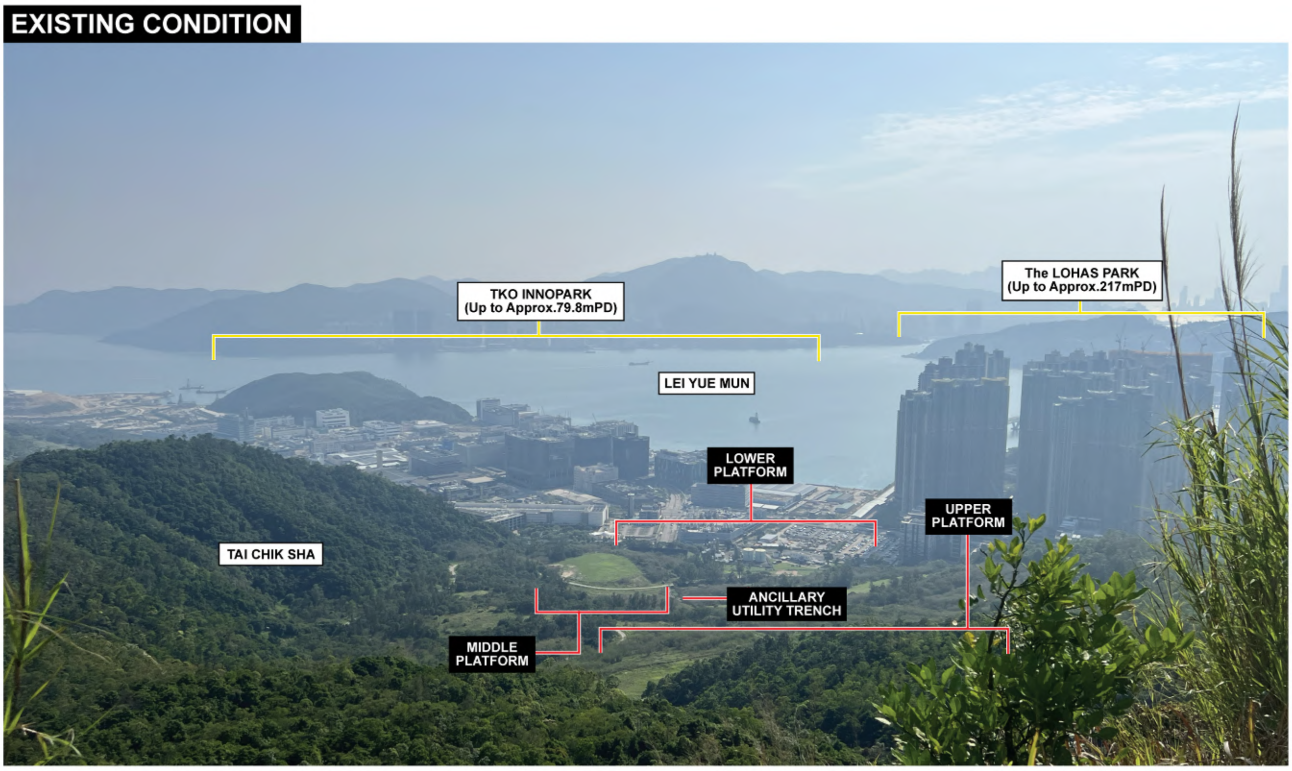
6.24 **Visual composition:** The major visual elements of this VP include the dense vegetation of Clear Water Bay Country Park (positive visual element) in the foreground; TKOL II/ III and Tai Chik Sha (positive visual elements) in the middle ground; the LOHAS Park (neutral visual elements), the Communications Tower (neutral visual element), planned Joint-user Building with Government Laboratory Facilities (neutral visual element), TKO InnoPark (negative visual element), Lei Yue Mun (positive visual element), mountain range on Hong Kong Island (positive visual element) and the open sky (positive visual element) in the background. The majority of the Upper Platform is mostly screened by the existing vegetation in the foreground, whilst the Lower Platform, Middle Platform, and the ancillary utility trench remain visible at this VP. Although the PRS will introduce various man-made structures and pavements which replaced the existing greenery within the Site, the scale and massing of the PRS is not incompatible with the remaining portion of TKOL II/ III. Given the vegetation still dominates the visual composition of this VP, the visual composition will not be significantly altered by the PRS.

6.25 **Visual obstruction**: Despite there are some vegetation clearances due to the PRS, the PRS will not lead to any obstruction to the view of the key positive visual elements as shown in the photomontages. In addition, the low-rise and low-intensity nature of the PRS is not incompatible with the surrounding natural environment. Most importantly, the existing panorama and visual openness are preserved. As such, the condition, quality and character of this VP will largely be preserved and will not be degraded when compared to the Existing Condition.

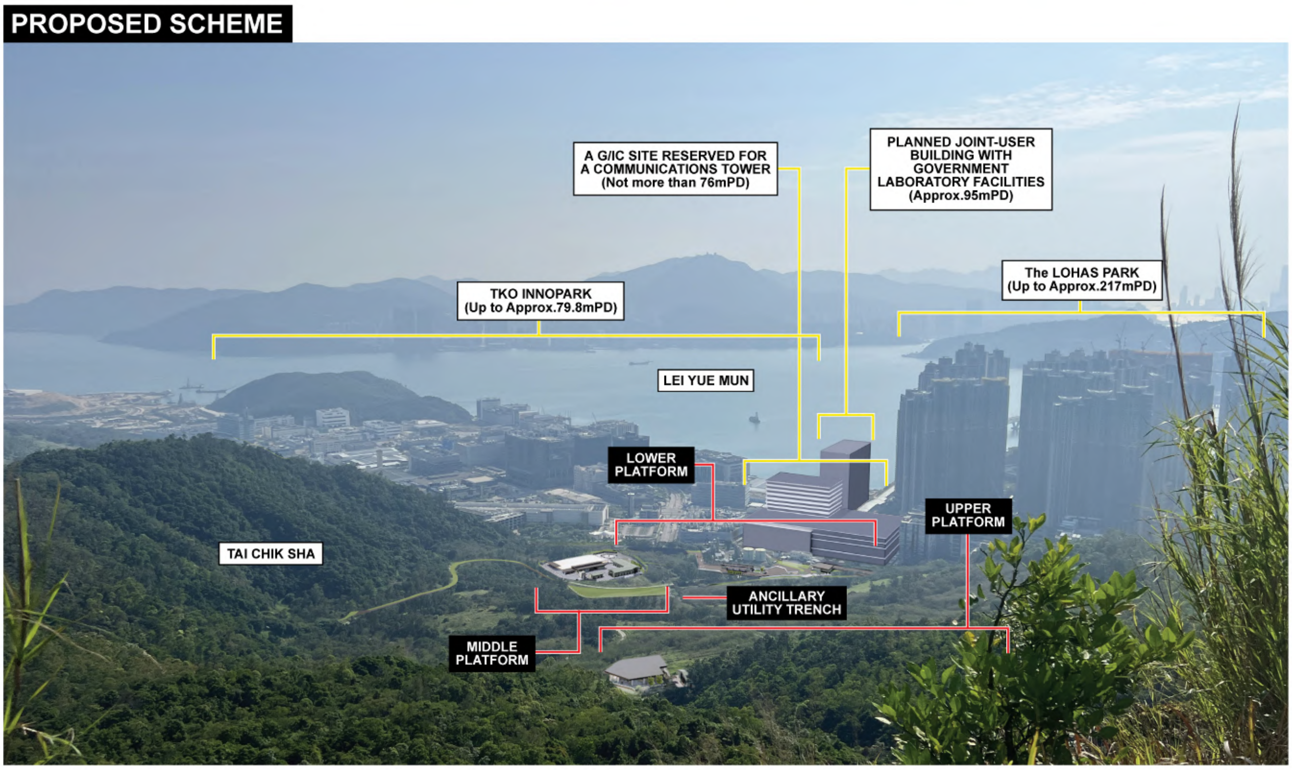
6.26 **Visual Change:** This VP along the High Junk Peak Country Trail offers panoramic vistas of the cityscape of TKO South and Lei Yue Mun harbour view. While the PRS will not obstruct any views towards the abovementioned panorama, the introduction of man-made structures at various platforms of TKOL II/III and the ancillary utility trench will inevitably lead to some visual changes. Nevertheless, the development nature of the PRS is not incompatible with the natural setting of the Application Site. Further, façade treatments incorporating nature-inspired designs, earth-tone colours and materials, along with the thoughtfully designed landscape features will be incorporated to integrate the man-made structures with the surrounding natural landscape. Landscape treatment, the Pony Viewing Area with grassy features at the Lower Platform, extensive Spelling Yards at the Middle Platform, and landscape buffer at the northern boundary of the Upper Platform to blend with the adjacent woodland and CWBCP. These measures will soften the building edges of the PRS and year-round colour to enhance the aesthetic appeal of the PRS while reinforcing the natural character of TKOL II/III. In this connection, the effect of visual changes is considered slight with the mitigation measures in place further enhancing the overall visual amenity value within TKOL II/III.

6.26.1 The low-rise and low-density PRS will neither significantly alter the visual compositions (e.g. CWBCP, Lei Yue Mun, mountain range on Hong Kong Island and the open sky) nor obstruct major views of these positive visual elements. Although the PRS may result in some visual change, it is considered slight. Mitigation measures (i.e. façade design and landscape treatments) which elevate the aesthetic appeal and reinforce the natural character of TKOL II/II will be incorporated. In light of the above, the overall resultant visual impact caused by the PRS at this VP is considered **negligible** when compared to the Existing Condition.

EXISTING CONDITION


TKO INNOPARK
(Up to Approx.79.8mPD)
The LOHAS PARK
(Up to Approx.217mPD)
LEI YUE MUN
LOWER PLATFORM
UPPER PLATFORM
TAI CHIK SHA
ANCILLARY UTILITY TRENCH
MIDDLE PLATFORM

PROPOSED SCHEME


A G/IC SITE RESERVED FOR A COMMUNICATIONS TOWER
(Not more than 76mPD)
PLANNED JOINT-USER BUILDING WITH GOVERNMENT LABORATORY FACILITIES
(Approx.95mPD)
TKO INNOPARK
(Up to Approx.79.8mPD)
The LOHAS PARK
(Up to Approx.217mPD)
LEI YUE MUN
LOWER PLATFORM
UPPER PLATFORM
TAI CHIK SHA
ANCILLARY UTILITY TRENCH
MIDDLE PLATFORM

*For reference only

Legend

— Application Site

— Surrounding Visual Elements

Source of the Development Parameters of the Communications Tower: Discussion Paper No. PWSC(2013-14)28 for Public Works Subcommittee of Finance Committee dated 18 December 2013

Source of the Joint-user Building with Government Laboratory Facilities: Sai Kung District Council Meeting paper for 3 January 2023 SKDC(M) Paper No. 1/23

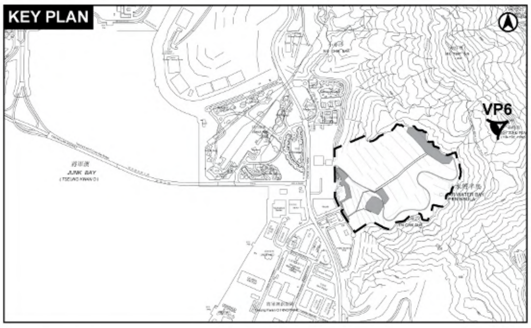

KEY PLAN
VP6

FIGURE 10 VIEWPOINT 6 : VIEW FROM HIGH JUNK PEAK

7 CONCLUSION

7.1 The PRS is a low-rise and low-density recreational facility for the after use of the restored landfill with unique topographical conditions. The massing, scale and BH of the building structures are also not incompatible with natural setting at the TKOL II/III. Ultimately, the PRS will invigorate the Application Site by introducing a visually captivating and nature-inspired design that harmonizes with its natural surroundings. Furthermore, landscape treatments have been incorporated where appropriate and grassy features of the PRS facilities can enhance visual interest. Public viewers at elevated places could enjoy unobstructed vistas of graceful horse movements, which will foster a deeper sense of connection to the equestrian environment. The overall design of the PRS intend to transform the currently vacant site into a community-focused landmark while enhancing the visual interest of the restored landfill and enriching the character of the surrounding area.

7.2 This VIA is undertaken to evaluate the visual impact of the PRS against the Existing Condition. A total of Six (6) VPs were identified with three (3) VPs assessed while the Application Site is not visible from three (3) VPs. With support of the photomontages, the VIA concludes that the PRS will have **negligible** visual impacts at the identified VPs. ***Table 7.1*** summarises the overall cumulative visual impact by the PRS compared to the Existing Condition.

Table 7.1 – Summary Table of Visual Impact

Viewpoints Assessed	Sensitivity	Resultant Visual Impact
Viewpoint 1: View from Tseung Kwan O Waterfront Park	High	Negligible
Viewpoint 2: View from Tseung Kwan O Cross Bay Bridge	Medium	Negligible
Viewpoint 3: View from the Minibus Terminus outside The Beaumount II on Shek Kok Road	Low	Negligible
Viewpoint 4: View from the Junction of Wan O Road and Wan Po Road	Medium	Negligible
Viewpoint 5: View from the Bus Stop outside Advanced Manufacturing Centre on Chun Kwong Street	Low	Negligible
Viewpoint 6: View from High Junk Peak	High	Negligible

Edited &
Approved by: Vincent Lau
Prepared by: Agnes Leung

Date: 30 January 2026
File Ref: HKJC/TKOL/2

Appendix 5

ENVIRONMENTAL ASSESSMENT

ARUP

The Hong Kong Jockey Club

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Environmental Assessment Report

Rev 2 | January 2026

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This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 304521

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Kowloon Tong
Kowloon, Hong Kong
arup.com

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1. Introduction

1.1 Project Background

1.1.1.1 This Environmental Assessment is prepared in support of the Section 16 ("S16") Planning Application to allow for the development of a Public Riding School with ancillary facilities (e.g. utility trench) (collectively as the "PRS") at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories ("TKOL II/III") for the HKJC Public Riding Schools Limited (the "Applicant"). The Application Site comprises of three (3) existing platforms and land required for the provision of ancillary utility trench connecting to the three (3) platforms (collectively as the "Application Site") within TKOL II/III. The PRS aligns with the Government's policy objectives in fostering more public participation in the community through wider visibility and popularity of horse riding, supporting equestrian as an elite sport, and maintaining Hong Kong as a centre for major international sports events.

1.1.1.2 The Application Site is predominately zoned "Open Space" ("O") on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 ("Approved OZP"), whilst a strip of area at the north is zoned "Green Belt" ("GB") and a minor portion abutting Chun Sing Street is zoned "Other Specified Uses" annotated "Industrial Estate" ("OU(Industrial Estate)") on the Approved OZP. The PRS with ancillary facilities ('Horse Riding School' subsumed under 'Place of Recreation, Sports or Culture' use) is a Column 2 use under the "O", "GB" and "OU(Industrial Estate)" zones that may be permitted with or without conditions on Application under S16 of the Town Planning Ordinance ("TPO"). There are no plot ratio ("PR"), building height ("BH"), and site coverage ("SC") restrictions imposed on the "O", "GB" and "OU(Industrial Estate)" zones of the Approved OZP. While a portion of TKOL II/III falls within the Clear Water Bay Country Park ("CWBCP"), the Application Site does not involve any areas falling within the Country Park Boundary.

1.1.1.3 The PRS is located on three (3) platforms, namely the Lower Platform (i.e. Reception and Hospitality Lounges) (approx.+6.0mPD), Middle Platform (i.e. Pony Paddock & Pavilion I)(approx. +40.0mPD) and Upper Platform (i.e. Horse Paddock & Pavilion II) (approx.140.0mPD), with a proposed total GFA of approx. 9,000m² and a proposed building height of 4.8m to 7.7m. An ancillary utility trench connecting to the three (3) platforms is also proposed to accommodate various essential utilities services in support of the PRS operations.

1.2 Objectives and Scopes of the EA Report

1.2.1.1 The objectives and scopes of the Environmental Assessment Report (EA Report) are as follows:

- Carry out an environmental assessment to evaluate the potential environmental impacts during construction and operation of the PRS and propose control measures where necessary; and
- Support the planning application for the Application Site.

1.3 Structure of the EA Report

1.3.1.1 The structure of this EA Report is as follows:

Table 1.1 Structure of this EA Report

Section	Title	Aims
1	Introduction	To give a general introduction of the Project and EA Report.
2	Project Description	To describe the project elements and major activities.
3	Air Quality	To identify and assess the potential air quality impacts of the Project, and propose control measures to be implemented during both construction phase and operational phase of the Project.
4	Noise	To identify and assess the potential noise impacts of the Project, and propose control measures to be implemented during both construction phase and operational phase of the Project.
5	Water Quality	To identify and assess the potential water quality impacts of the Project, and propose control measures to be implemented during both construction phase and operational phase of the Project.
6	Waste Management Implications	To identify and assess the potential waste management implications of the Project, and propose control measures to be implemented during both construction phase and operational phase of the Project.
7	Land Contamination	To identify and assess the potential land contamination of the Project, and propose control measures to be implemented during both construction phase and operational phase of the Project.
8	Ecology	To identify and assess the potential ecological impacts of the Project, and propose control measures to be implemented during both construction phase and operational phase of the Project.
9	Landscape and Visual	To identify and assess the potential landscape and visual impacts of the Project, and propose control measures to be implemented during both construction phase and operational phase of the Project.
10	Landfill Gas Hazard	To identify and assess the potential landfill gas hazard of the Project, and propose control measures to be implemented during both construction phase and operational phase of the Project.
11	Sewerage Impact Assessment	To identify and assess the potential sewerage impact assessment of the Project, and propose control measures to be implemented during both construction phase and operational phase of the Project.
12	Review on EIAO Implication	To review if there are any implications on EIAO and ascertain “no material change” and no new DP due to the Project.

2. Project Description

2.1 Project Location

2.1.1.1 The Project is located at the restored landfill site (TKOL II/III) in the Tseung Kwan O, with the Clear Water Bay Country Park (CWBCP) to the east and Tseung Kwan O InnoPark (previously known as Tseung Kwan O Industrial Estate) and residential developments (e.g. Le Prestige Lohas Park) to the west, as shown as "Application Site" in **Figure 2.1**.

2.2 Project Description of the Project

2.2.1.1 The Project is a Public Riding School. Its tentative master layout plan is given in **Appendix 2.1**, which will be subject to further refinement during detailed design stage. The environmental implication due to the further refinement will be reviewed in the Environmental Review during detailed design stage.

2.2.1.2 The Project consists of three flat platforms (namely Upper Platform, Middle Platform and Lower Platform) and ancillary facilities (e.g. utility trench and Electrical and Mechanical), as shown as "Application Site" in **Figure 2.1**.

2.2.2 Key Project Elements of the Project

2.2.2.1 The key elements of the Project are listed in **Table 2.1** with brief description, and illustrated in **Appendix 2.1**:

Table 2.1 Brief Description of the Operation of the Key Elements of the Project

Key Element	Brief Description
Stable	Stable is designed to house horses in individual stalls, providing them with a safe and comfortable space to rest and sleep. Each stall is equipped with facilities for fresh water and feed. Hay is also provided on the ground. Besides, wash areas are provided to clean the horse after lessons or training. Tentatively, the proposed stable at Middle Platform and Upper Platform will accommodate not more than 100 horses.
Arena	Arena is paddock which is utilized for riding lessons or equestrian training. It is relatively spacious to allow a greater variety of activities. It requires specialized footing materials and construction for providing optimal floor conditions for professional training. Apart from the arena, there are other supporting facilities to be in vicinity of the arena area, including arena equipment storage area, parking space for maintenance vehicles, spectator stands, judge booth and/or instructor's shelter.
Lungeing pen	Lungeing pen is utilized to warm-up horses prior to any lessons or training session. The horse will move in a circle guided by the mechanical arms.
Horse walker	Horse walker is utilized not only for daily exercise but cooling down after lessons or training session. It allows each horse to walk freely within the separation gates and without handlers.
Spelling Yard	Spelling Yard is a grazing area which is a designated field where horses could roam and feed on grass. It is necessary to ensure there are no toxins or contaminants, which could adversely affect the horses.
Farrier rooms	Farrier rooms are utilized for regular hoof care (e.g. trimming of the hooves, fitted for new shoes and the resetting of an existing shoe, etc.). Flame will be used to heat up the shoes to desire temperature, which will not induce any industrial emission.

Key Element	Brief Description
Veterinary rooms	Veterinary rooms are utilized for the examination by veterinarians for the regular veterinary care for horses.
Administration buildings, training facilities and auxiliary facilities	Administration buildings, namely "Welcome Hub", "Pony Paddock & Pavilion I" and "Horse Paddock & Pavilion II", are for daily administration and management of the PRS. Other training facilities, such as lecture room and lounge, and auxiliary facilities (e.g. toilets, changing room and rest area) are also provided.
Waste management and storage facilities	Waste management and storage facilities are provided for manure handling and refuse storage. Waste generated from the operation of the PRS will be properly collected and stored prior to disposal.
Storage facilities	Storage facilities are provided to store various equipment and resources (e.g. feed, hay and bedding etc.) required for the PRS operation.
Coach Duty Rooms	Coach Duty Rooms are staff quarters utilized for staff of the PRS stay overnight to provide full-time support to the horses at the stable.
Staff facilities	Staff facilities, such as toilets, changing and shower rooms, breakrooms and rest room, etc., are provided.
Electrical and Mechanical (E&M) block & ancillary utilities	E&M and ancillary utilities, such as fresh and flushing water supply, electricity supply, power supply and fire services, are provided to support the daily PRS operation.
Ancillary parking	Ancillary parking spaces are provided for visitors and staff, as well as the internal transportation within the PRS.
Entry road	Entry road is provided for visitors and staff to enter the PRS, connecting to the access road of the restored landfill (i.e. TKOL II/III).

2.2.2.2 Based on the latest development parameter, the total Gross Floor Area (GFA) is approximately 9,000m², with building height of 4.8m to 7.7m.

2.2.2.3 In addition, the Project would be granted by the Government the right-of-way of the Access Road within the TKOL II/III, to support the access to the three platforms.

2.2.3 Key Construction Works of the Project

2.2.3.1 All building structures of the PRS will be located outside the boundary of CWBCP and no construction works nor ground investigation works would be carried out within CWBCP. The major construction works and construction methods are listed in **Table 2.2**.

Table 2.2 Summary of the Major Construction Works and Construction Method for the Project

Major Construction Works	Construction Method
Site clearance	Obstacles like vegetation, rocks and debris will be removed to prepare the site for further construction works.
Site formation	Surface soil and rock will be moved by excavator to create a desired level base for the foundation The extent would be dependent on the level difference. The tentative extent is given in **Appendix 2.2**.
Replacement of top soil for areas with horses' direct contact	The top soil will be excavated by excavator, and will be replaced by new soil.
Construction of buildings and structures	Typical construction activities for in-situ reinforced concrete buildings is expected including formwork and falsework erection, rebar fixing, and concreting works.

2.3 Implementation Programme of the Project

2.3.1.1 The Project will commence its construction in 2027 for operation in 2030.

3. Air Quality

3.1 Legislation, Standards and Guidelines

3.1.1 General

3.1.1.1 The relevant legislation, standards and guidelines applicable to the present study for the air quality assessment of both construction and operational phase include the following:

- Air Pollution Control Ordinance (APCO) (Cap. 311);
- Air Pollution Control (Construction Dust) Regulation;
- Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation;
- Air Pollution Control (Fuel Restriction) Regulations (Cap. 311I);
- Chapter 9 of the Hong Kong Planning Standards and Guidelines (HKPSG);
- Section 1 of Annexes 4 and 12 of Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM); and
- Recommended Pollution Control Clauses for Construction Contracts.

3.1.2 Air Pollution Control Ordinance (Cap. 311)

3.1.2.1 The principal legislation for controlling air pollutants is the APCO (Cap. 311) which provides a statutory framework for establishing the Air Quality Objectives (AQOs) and stipulating the antipollution requirements for air pollution sources. The AQOs stipulate limits on concentrations for 7 pollutants including Sulphur Dioxide (SO_2), Respirable Suspended Particulates (RSP), Fine Suspended Particulates (FSP), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), Ozone (O_3) and Lead (Pb). The latest AQOs which took effect in April 2025 are listed in **Table 3.1**.

Table 3.1 Hong Kong Air Quality Objectives (HKAQOs)

Pollutants	Limits on Concentration, μg/m³ [1] (The Number of Exceedance per calendar year allowed is shown in brackets)					
	10-min	1-hr	8-hr	24-hr	Peak Season	Annual
RSP (PM_{10})[2]				75 (9)		30 (N.A.)
FSP ($PM_{2.5}$)[3]				37.5 (18)		15 (N.A.)
NO_2		200 (18)		120 (9)		40 (N.A.)
SO_2	500 (3)			40 (3)		
O_3			160 (9)		100 (N.A.)	
CO		30000 (0)	10000 (0)	4000 (0)		
Pb						0.5 (N.A.)

Notes:

[1] All measurements of the concentration of gaseous air pollutants, i.e., sulphur dioxide, nitrogen dioxide, ozone and carbon monoxide, are to be adjusted to a reference temperature of 293 Kelvin and a reference pressure of 101.325 kilopascal.

[2] RSP mean suspended particulates in air with a nominal aerodynamic diameter of 10 micrometres or smaller.

[3] FSP mean suspended particulates in air with a nominal aerodynamic diameter of 2.5 micrometres or smaller.

3.1.3 Air Pollution Control (Construction Dust) Regulation

3.1.3.1 Air Pollution Control (Construction Dust) Regulation specifies processes that require special dust control. The Contractors are required to inform the Environmental Protection Department (EPD) and adopt proper dust suppression measures while carrying out "Notifiable Works" (which requires prior notification by the regulation) and "Regulatory Works" to meet the requirements as defined under the regulation.

3.1.4 Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation (Cap.311Z)

3.1.4.1 Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation specifies that all Nonroad Mobile Machinery (NRMMs), except for those exempted, used in specified activities and locations including construction sites, container terminals and back up facilities, restricted areas of the airport, designated waste disposal facilities and specified processes are required to comply with the prescribed emission standards.

3.1.5 Air Pollution Control (Fuel Restriction) Regulations (Cap 311I)

3.1.5.1 Air pollution Control (Fuel Restriction) Regulations controls the types of fuel allowed for use and their sulphur contents in commercial and industrial processes to reduce SO_2 emissions.

3.1.6 Chapter 9 of the Hong Kong Planning Standards and Guidelines (HKPSG)

3.1.6.1 The HKPSG specify buffer distances between sources of pollution and sensitive land uses to ensure acceptable air quality at the sensitive land uses. Examples of recommended buffer distances extracted from the HKPSG for relevant source and sensitive land use combinations are given in **Table 3.2** below.

Table 3.2 HKPSG Recommended Buffer Distances for Polluting Uses

Polluting Source	Parameter	Buffer Distance	Permitted Uses
Road and Highways	*Type of Road*		
	Trunk Road and Primary Distributor	>20m	active and passive recreational uses
		3-20m	passive recreational uses
		<3m	amenity areas
	District Distributor	>10m	active and passive recreational uses
		<10m	passive recreational uses
	Local Distributor	>5m	active and passive recreational uses
		<5m	passive recreational uses
	Under Flyovers	-	passive recreational uses
Industrial Area	*Difference in Height between Industrial Chimney Exit and the Site*		
	<20m	>200m	Active and passive recreational uses
		5-200m	Passive recreational uses
	20-30m	>100m	Active and passive recreational uses
		5-100m	Passive recreational uses
	30-40m	>50m	Active and passive recreational uses
		5-50m	Passive recreational uses

Polluting Source	Parameter	Buffer Distance	Permitted Uses
	>40m	>10m	Active and passive recreational uses
Construction and earth moving activities	-	<50m	passive recreational uses
		>50m	active and passive recreational uses
Odour sources [1]	-	200m	sensitive uses

Notes:

[1] Refer to S. 3.3.9 of HKPSG Chapter 9.

3.1.7 Technical Memorandum on Environmental Impact Assessment Process

3.1.7.1 In accordance with Annex 4 of EIAO-TM, the limit of 5 odour units based on an averaging time of 5 seconds for odour prediction assessment should not be exceeded at any receivers.

3.1.8 Recommended Pollution Control Clauses for Construction Contracts

3.1.8.1 General requirements of air pollution control, e.g. dust suppression and smoke control, are recommended for contractors.

3.2 Description of the Environment

3.2.1 Existing Ambient Air Quality Conditions

AQO Pollutants

3.2.1.1 The Tseung Kwan O Station is the monitoring station closest to the assessment area. The latest 5-year air quality monitoring data at the Tseung Kwan O Station (i.e. 2020 – 2024) is summarized in **Table 3.3** and compared with the latest AQOs for information.

Table 3.3 Air Quality Monitoring Data (Tseung Kwan O Station, 2020 - 2024)

Pollutant	Parameter	Concentration ($\mu g/m^3$)						AQO ($\mu g/m^3$)
		2020	2021	2022	2023	2024	5-Year Mean	
RSP	10th highest 24-hr	52	50	46	50	59	51 [69%]	75 (9)
	Annual	24	24	22	24	27	24 [81%]	30 (N/A)
FSP	19th highest 24-hr	26	26	28	27	31	28 [74%]	37.5 (18)
	Annual	12	13	13	**15**	14	13 [89%]	15
NO_2	19th highest 1-hr	136	132	110	116	105	120 [60%]	200 (18)
	10th highest 24-hr	51	60	48	50	46	51 [42%]	120 (9)
	Annual	23	26	21	22	22	23 [57%]	40 (N/A)
SO_2	4th highest 10-min	18	18	12	32	12	18 [4%]	500 (3)

Pollutant	Parameter	Concentration (µg/m^3)						AQO (µg/m^3)
		2020	2021	2022	2023	2024	5-Year Mean	
	4th highest 24-hr	7	9	7	6	8	7 [19%]	40 (3)
O_3	10th highest 8-hr	158	158	**167**	**160**	**168**	**162** **[101%]**	160 (9)
	Peak Season	**112**	**109**	**105**	**111**	**113**	**110** **[110%]**	100 (N/A)
CO	Max. 1-hr	1670	1750	1210	1300	1500	1486 [5%]	30000 (0)
	Max. 8-hr	1411	1375	1105	996	1209	1219 [12%]	10000 (0)
	Max. 24-hr	1152	1113	834	824	760	937 [23%]	4000 (0)

Notes:

[1] N/A – Not applicable

[2] Number of exceedance allowed under the AQO is shown in ( ), % of the AQO is shown in [ ].

[3] Monitoring results exceeding the AQO are bolded and underlined.

3.2.1.2 The 10th highest daily RSP levels were ranged from 46 to 59 µg/m^3, while the annual RSP levels were ranged from 22 to 27 µg/m^3. Both of them are within the corresponding AQOs.

3.2.1.3 The 19th highest daily FSP levels were ranged from 26 to 31 µg/m^3, while the annual FSP levels were ranged from 12 to 15 µg/m^3. One exceedance of annual FSP is found in Year 2023. Others are within the corresponding AQOs.

3.2.1.4 The 19th highest 1-hour NO_2 levels were ranged from 105 to 136 µg/m^3, the 10th highest 24-hour NO_2 levels were ranged from 46 to 60 µg/m^3, and annual NO_2 levels were ranged from 21 to 26 µg/m^3. All of them are within the corresponding AQOs.

3.2.1.5 The 4th highest 10-minute SO_2 were ranged from 12 to 32 µg/m^3, while the 4th highest daily SO_2 levels were ranged from 6 to 9 µg/m^3. Both of them are within the corresponding AQOs.

3.2.1.6 The 10th highest 8-hour O_3 were ranged from 158 to 168 µg/m^3, exceedances were found in Year 2022 to Year 2024. There is no obvious trend in recent years. The peak season O_3 levels were ranged from 105 to 113 µg/m^3, which all exceeded the corresponding AQOs.

3.2.1.7 The maximum 1-hour CO were ranged from 1210 to 1670 µg/m^3, the maximum 8-hour CO levels were ranged from 996 to 1411 µg/m^3, and the maximum 24-hour CO levels were ranged from 760 to 1152 µg/m^3. All of them are within the corresponding AQOs.

Non-AQO Pollutants

3.2.1.8 Based on the 5-year stack gas monitoring data (2020 – 2024) provided by the operator, the concentrations of pollutants are at very low level and mostly are below detectable level (see **Appendix 3.1**). The criteria of Vinyl Chloride and Benzene are referred to the approved EIA(2) and summarised in **Table 3.4**.

Table 3.4 Concentrations of Vinyl Chloride and Benzene from Stack Gas Monitoring Data

Pollutants	Averaging Time	Criteria (μg/m^3) [1]	Background Concentrations of Non-AQO Pollutants (μg/m^3) [2]	Monitoring data at stack (μg/m^3) [3]
Vinyl Chloride	1-hour	180,000	0.4	1.1
	Annual	100	0.33	
Benzene	1-hour	27	2.0	3.5
	8-hour	3	2.0	
	Annual	3	1.13	

Notes:

[1] Criteria for annual average are the Chronic Reference Concentration extracted from Yr 2000 updated standard from Integrated Risk Information System (IRIS) (USEPA, 2000). Criteria for 1-hour average are the Acute Reference Concentration extracted from Air Toxic Hot Spots Program Risk Assessment Guidelines, Part I – Technical Support Document for the Determination of Acute Reference Exposure Levels for Airborne Toxicants (California Air Resources Board, 2000).

[2] Reference to monitoring data of benzene and vinyl chloride at SENTX from 2022 to 2024.

[3] As the monitoring results for vinyl chloride are smaller than the detection limit, the detection limit, 0.4ppbv, represents its monitoring level. Maximum monitoring value of benzene during 2020 – 2024 is selected for representing the benzene level (1.1 ppbv). For unit conversion, the molecular weights for vinyl chloride and benzene are 62.5 g/mol and 78.11 g/mol, respectively.

3.2.2 Future Ambient Air Quality Conditions

3.2.2.1 It should be noted that the ambient air quality conditions described in the above sections are based on the historical monitoring data. The future ambient air quality is predicted by a regional air quality model named "Pollutants in the Atmosphere and their Transport over Hong Kong" (i.e. PATH).

3.2.2.2 The assessment area concerned 8 grids in the latest PATH model (i.e. PATH v3.0). As the construction of the Project will tentatively commence in Year 2027 and be completed in Year 2030, Year 2030 PATH model results are presented in **Table 3.5**. **Figure 3.1** illustrates the locations of the concerned PATH grids and the 500m assessment area.

Table 3.5 Future Ambient Air Quality for Concerned PATH Grids (Year 2030)

Pollutant	Parameter	Concentrations in Various PATH Grids at Level 1 (0m - 17m) (μg/m^3)						AQO (μg/m^3) [1]
		50_30	50_31	51_30	51_31	52_30	52_31	
RSP	10th highest 24-hr	50	49	51	50	50	50	75 (9)
	Annual	19	18	19	19	19	19	30 (N/A)
FSP	19th highest 24-hr	28	28	29	28	28	28	37.5 (18)
	Annual	11	11	11	11	11	11	15
NO$_2$	19th highest 1-hr	61	59	56	54	53	52	200 (18)
	10th highest 24-hr	22	22	20	20	21	19	120 (9)
	Annual	10	10	10	9	10	9	40 (N/A)
SO$_2$	4th highest 10-min	23	23	23	23	23	23	500 (3)
	4th highest 24-hr	7	7	7	7	7	7	40 (3)
O$_3$	10th highest 8-hr	**173**	**170**	**177**	**169**	**176**	**170**	160 (9)

Pollutant	Parameter	Concentrations in Various PATH Grids at Level 1 (0m - 17m) (µg/m^3)						AQO (µg/m^3) [1]
		50_30	50_31	51_30	51_31	52_30	52_31	
	Peak Season	**125**	**123**	**126**	**123**	**126**	**123**	100 (N/A)
CO	Max. 8-hr	515	516	510	511	508	507	30000 (0)
	Max. 8-hr	480	477	481	476	483	478	10000 (0)
	Max. 24-hr	445	445	446	442	448	442	4000 (0)

Note:

[1] Concentrations exceeding the AQO are bolded and underlined.

3.3 Assessment Area and Air Sensitive Receivers

3.3.1.1 The assessment area for air quality impact is generally defined by a distance of 500m from the boundary of Application Site.

3.3.1.2 Representative Air Sensitive Receivers (ASRs) within the assessment area have been identified for evaluation. The existing ASRs are identified by means of topographic maps, aerial photos, land status plans and site inspections. Committed/ Planned ASRs within the assessment area are identified by making reference to relevant documents as listed:

- Approved Tseung Kwan O Outline Zoning Plan (No. S/TKO/32 exhibited on 17 October 2025);
- Approved Clear Water Bay Peninsula South Outline Zoning Plan (No. S/SK-CWBS/2 dated on 9 June 2006);
- Planning Applications under S.16 / S.12a Town Planning Ordinance;
- Development Permission Area Plans and Outline Development Plans by the Planning Department (PlanD);
- Land Sale Programme published by the Lands Department (LandsD); and
- Other relevant published plans, including plans, drawings and applications by the correspondent project proponents.

3.3.1.3 Both planned and existing representative ASRs have been selected on the basis that they are close to the Application Site and are likely to receive the worst possible impact arising from the Project. In addition, planned ASRs are also identified based on the tentative master layout plan.

3.3.1.4 The locations of representative ASRs for air quality impact assessment are summarized in **Table 3.6** and are shown in **Figure 3.2** and **Appendix 3.2**. Based on the latest information during preparation of the EA, there are total 5 proposed projects identified within the 500m assessment area. Two of them are selected as representative ASRs as they are located a relatively closer distance from the Application Site. They are (i) proposed high-tier data centre at Tseung Kwan O Town Lot No. 131 located about 60m (PA02), and (ii) proposed GIC Site (PA05) located 5m from the Application Site. The other 4 proposed projects are located at least 190m from the Application Site. They are (iii) proposed Joint-user

Building with Government Laboratory's Facilities at Area 86 (south of Wan O Road) located more than 250m; (iv) proposed Indoor Recreation Centre at the junction of Wan Po Road and Shek Kok Road located more than 380m; (v) proposed primary and secondary school at the vacant site sandwiched between Le Prestige and Wings at Sea located more than 190m. Since the representative ASRs in **Table 3.6** covered ASRs located at nearer distances surrounding the Application Site, the 4 proposed projects located at least 190m from the Application Site would not be considered as ASRs in the assessment.

Table 3.6 Summary of Representative ASRs

ASR ID	Name	Land Uses [1]	Approximate Nearest Distance from the Application Site (m) [Lower / Middle / Upper Platform] [2]	Assessment Height (meter above ground)
***Existing ASRs* [3]**				
A01	HSBC Building TKO	Off	95 / 235 / 760 / 315	N.A. (only assessed in qualitative assessment)
A02	HKCOLO	Off	15 / 185 / 675 / 185	
A03	TKOL-II/III Site Office	Off	10 / 230 / 550 / 70	
A04	Le Prestige Lohas Park	Res	195 / 450 / 700 / 200	
A05	The Beaumount II	Res	385 / 590 / 460 / 375	
A06	MEGA Plus	Off	30 / 325 / 520 / 25	
A07	High Junk Peak Country Trail	Rec	830 / 650 / 170 / 130	
A08	Basketball Court of Tseung Kwan O Innopark	Rec	60 / 180 / 710 / 250	
***Planned ASRs* [4]**				
PA02	Planned high-tier data centre at Tseung Kwan O Town Lot No. 131	Off	60 / 350 / 510 / 45	N.A. (only assessed in qualitative assessment)
PA05	GIC Site	GIC	<5 / 200 / 585 / 5	
***Planned ASRs within the Application Site* [5]**				
PA01, E1, E2, E3, E4, N1, N2, N3, S1, S2, S3, W1, W2, W3, W4, LP12, LP11, LP10, LP09, LP13, LP08, LP14, LP15, LP16, LP17, LP06, LP07, LP01, LP19, LP04, LP20, LP05, LP18, LP02, LP03	Lower Platform of Proposed Public Riding School (e.g. administration buildings, auxiliary facilities, Coach Duty Rooms, etc.)	Rec	Within Application Site	1.5, 5, 10 (except PA01)
PA03, LP21, LP22, LP23, LP24, LP25, LP26, LP27, LP28, LP29	Middle Platform of Proposed Public Riding School	Rec	Within Application Site	1.5, 5, 10 (except PA03)

ASR ID	Name	Land Uses [1]	Approximate Nearest Distance from the Application Site (m) [Lower / Middle / Upper Platform] [2]	Assessment Height (meter above ground)
PA04, UP02, UP01, UP03, UP08, UP07, UP04, UP06, UP05	Upper Platform of Proposed Public Riding School	Rec	Within Application Site	1.5, 5, 10 (except PA04)
BN01, BN02, BS02, BS05, BS04, BS03, BS01, BN05, BN03, BN04	Site Boundary of Proposed Public Riding School	Rec	Within Application Site	1.5, 5, 10

Notes:

[1] Res – Residential; GIC – Government, Institution and Community; Edu – Educational; Rec – Recreational/Park; Off – Office; Ind – Industrial.

[2] Distance is rounded to the nearest 5m.

[3] Existing ASRs are assessed in qualitative assessment only.

[4] Planned ASRs PA02 and PA05 are assessed in qualitative assessment only. Besides, no development schedule was available at the time of the Report, and the latest information for PA02 and PA05 was released in 2018 and 2013 respectively.

[5] Among the planned ASRs within the Application Site – PA01, PA03 and PA04 are assessed in qualitative assessment only, while other ASRs along the boundary of lower/middle/upper platforms or the site boundary are assessed by quantitative assessment in **Section 3.5**. Locations and assessment heights of ASRs other than PA01, PA03 and PA04 are indicated in **Appendix 3.2**.

3.4 Construction Phase

3.4.1 Impacts Evaluation

3.4.1.1 The major construction works of the Project with potential air quality impact are the followings:

- Site clearance;
- Site formation;
- Replacement of top soil for areas with horses' direct contact; and
- Construction of buildings and structures;

3.4.1.2 During the construction phase, fugitive dust will be generated from construction activities, which mainly include site clearance, site formation, soil excavation, backfilling and wind erosion of open sites. In general, the ASRs are located more than 50m away from the construction works area at Lower Platform, except TKOL II/III Site Office (A03), HKCOLO (A02) and MEGA Plus (A06). The construction works area at Middle and Upper Platforms provide much longer separation distance of more than 150m. As site formation would only involve excavation with excavation depth limited to 0.5m with limited backfilling and the construction of superstructure and installation of pipelines and utilities of the Project would not generate significant dust emission. The active workfront for excavation works is limited to 500m^2 each day at each platform. The amount of excavated materials to be handled daily at each platform is limited to 250m^3. The amount of construction waste/ materials to be handled each day is about 750m^3, and the estimated number of induced trucks is about 75 per day throughout the construction phase. With the proper implementation of dust suppression measures, no adverse construction dust impacts arising from the construction works are anticipated.

3.4.1.3 Fuel combustion from the use of Powered Mechanical Equipment (PME) during construction works could also be a source of NO_2, SO_2 and CO. To improve air quality and protect public health, EPD has introduced the Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation, which came in effect on 1 June 2015, to regulate emissions from machines and non-road vehicles. Starting from 1 December 2015, only approved or exempted non-road mobile machinery are allowed to be used in construction sites. To further control SO_2 emissions, ultra-low sulphur diesel (ULSD) with a sulphur content of not more than 0.001% by weight and a viscosity of not more than 6 centistokes at 40ºC should be used to minimize SO_2 emissions according to the Air Pollution Control (Fuel Restriction) Regulations. Hence, with the effect of the Regulations, the emissions from PMEs are considered relatively small and will not cause adverse air quality impact.

3.4.1.4 Furthermore, it is understood that construction activities will not take place in the entire work site at the same time, but will be undertaken at multiple moving work fronts at different platforms, which provide longer separation distance from the nearby ASRs as indicated in **Table 3.6**. With proper implementation of the proposed dust control measures, the dust impact during the construction phase is not anticipated to be significant.

3.4.1.5 Construction vehicles would also be used for the transportation of fill materials required and spoils generated from the construction works. Given the small scale of construction, the number of induced traffic (i.e. about 75 trucks per day) would be limited. Besides, vehicle washing facilities at all site exits would be provided to wash away dusty materials from vehicle body and wheels before leaving the site. Therefore, no adverse air quality impact from the construction phase would be anticipated.

3.4.1.6 Two planned projects are identified within the 500m assessment area, which are High-tier Data Centre at Wan Po Road and Joint-user Building with Government Laboratory's Facilities at Area 86. The construction works would not involve site formation works as land is available for development, hence, would mainly include superstructure work which has limited dust emissions. The Data Centre has commenced construction and is scheduled to completion in 2026/27, while there is no available development schedule for the Building at Area 86 at the time of the Report. With appropriate dust control measures recommended in the Air Pollution Control (Construction Dust) Regulation as discussed in **Section 3.4.2**, cumulative construction dust impact of concurrent projects is not anticipated.

3.4.2 Dust Control Measures

3.4.2.1 All applicable dust control measures as recommended in the Air Pollution Control (Construction Dust) Regulation will be implemented to minimize dust emissions during construction phase. With the implementation of these measures, adverse construction dust impacts on the ASRs are not anticipated. Typical dust control measures include:

- Water spraying on any dusty materials before loading and uploading, stockpile of dusty materials, areas with removal of existing installations, areas where excavation or earth moving activities are carried out, and any unpaved main haul road;

- Adoption of side enclosure and covering of any aggregate or dusty material storage piles to reduce emissions. Where this is not practicable owing to frequent usage, watering shall be used to aggregate fines;

- Use of regular watering to reduce dust emissions from exposed site surfaces, unpaved roads, dusty construction areas;
- Provide effective dust screens, sheeting, or netting to enclose any scaffolding built around the perimeter of a building;
- Prevent placing dusty material storage piles and NRRM near ASRs as far as practicable;
- Cover or shelter any stockpile of dusty materials;
- Provide vehicle washing facilities at all construction site exits to wash away any dusty materials from vehicle body and wheels before they leave the site;
- Cover any dusty load on vehicles before they leave the site; and
- Loading, unloading, transfer, handling, or storage of bulk cement or dry pulverized fuel ash shall be carried out in a totally enclosed system or facility, and any vent or exhaust shall be fitted with an effective fabric filter or equivalent air pollution control system.

3.5 Operational Phase (Air Quality Impact)

3.5.1 Impacts Evaluation

3.5.1.1 Key air pollution sources in the vicinity of the Project (see **Figure 3.3**) during operational phase including the following and their details are discussed as follows.

- Vehicular emission from the Project, Access Road and existing roads;
- Industrial emission from the premises with Specified Process (SP) license; and
- Industrial emission from the existing leachate treatment plant.

3.5.1.2 No industrial emission sources are proposed in the Project.

3.5.1.3 As discussed in **Section 3.3.1.4**, there are proposed projects identified within the 500m assessment area with potential industrial emission. As deduced from the nature of works, the planned High-tier Data Centre will only have potential emission from emergency generators under emergency situation, hence, adverse air quality impact is not anticipated. Besides, the planned Joint-user Building with Government Laboratory's Facilities at Area 86 is located far away from the Application Site (~250m). Moreover, there is no available development schedule for the proposed projects at the time of the Report, thus will not be considered as concurrent projects. As a result, cumulative impact is not anticipated from the proposed projects.

Vehicular Emission from the Project and Open Roads

The Project

3.5.1.4 During the operation of the Project, there will be ancillary parking spaces provided within the site (with 2 no. of parking spaces for coach) and about 445veh/day (two-way) generate / attract to/from the adjacent road network as advised by traffic consultant. Comparing with the high existing traffic volume on Wan Po Road with Annual Average Daily Traffic (AADT) of 30,680 in Year 2024, the induced traffic from the Project is insignificant. Apart from running emission, the induced start emission is very limited as there are only 2 no.

of coach parking spaces. Therefore, the potential air quality impact due to the induced traffic on nearby ASRs is insignificant.

Access Road

3.5.1.5 Access Road is a private road that will serve both the landfill restoration operator and the PRS. As advised by the landfill restoration operator, there would be about 104 veh/day (two-way) for daily landfill restoration activities in general. For the PRS, to facilitate the internal transportation of staff and visitors within the Application Site, there will be about 50 veh/day (two-way) travelling on Access Road between the 3 platforms. In view of the limited traffic on the Access Road, the potential air quality impact is insignificant.

Existing Roads

3.5.1.6 Vehicular emission from the existing road networks including Wan Po Road, Wan O Road, Chun Yat Street and Chun Sing Street. The buffer distances from the air sensitive uses of the Project in Lower Platform, Middle Platform and Upper Platform will be located at more than 20m from these roads, which will meet the buffer distances from all types of roads as stipulated in HKPSG. Therefore, adverse air quality impact on the proposed air sensitive uses under the Project is not anticipated.

Industrial Emission from the Premises with SP License

3.5.1.7 Three premises (i.e. MEGA Plus, HKCOLO and HSBC Building TKO) with SP licenses are identified within 200m of the Application Site. The classification of the SP for the premises is "Electricity Works", of which the operation mode is "batch". The SP of HKCOLO has also specified that it is for emergency generator. As these three premises are used for data centres, potential air emission would be due to the use of emergency generators under emergency situation or regular maintenance. The frequency and duration of their operation and thus the air emission would be limited. In addition, exhaust gas catalytic purifiers are installed as specified in the SP licenses to minimize the potential air quality impact.

3.5.1.8 Moreover, the height of chimneys for MEGA Plus, HKCOLO, and HSBC Building TKO ranges from 16.7m and 68.5m above ground, 14.1m to 26.6m above ground, and 23.9m above ground respectively; while the height of the proposed air sensitive uses on the Lower Platform will be limited to one storey. Most of the chimneys are located at a higher level of more than 20m above ground (i.e. 43 out of 44 for MEGA Plus, 20 out of 30 for HKCOLO, and all 7 for HSBC Building TKO). For Middle Platform and Upper Platform, there is sufficient separation distance of more than 200m. Therefore, the adverse air quality impact on the proposed air sensitive uses under the Project is not anticipated.

Industrial Emission from Leachate Treatment Plant

3.5.1.9 There is a leachate treatment plant adjacent to the Application Site, which treats the collected leachate from the restored landfill (TKOL II/III). Potential pollution will emit from the flare process. Reference to the similar emission sources, i.e. landfill gas flare system, in recent approved EIAs (1), (2), (3), the concerned AQO pollution emission parameters are NO_x, RSP, FSP, SO_2, and CO while non-AQO parameters are Vinyl Chloride and Benzene.

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(1) AEIAR-256-2023- EIA for Tuen Mun Bypass

(2) AEIAR-265/2025-EIA for Development of Tseung Kwan O Area 137 and Associated Reclamation Sites

(3) AEIAR-147/2009 – EIA for WENT NEW Territories (WENT) Landfill Extensions

3.5.1.10 As discussed in **Section 3.2.1.8**, based on the 5-year stack gas monitoring data (2020 – 2024) provided by the operator, the concentrations of pollutants are at very low level and mostly are below detectable level (see **Appendix 3.1**). However, the detection limits of pollutants are lower than the AQO criteria and further quantitative assessment is proposed, except of Vinyl Chloride. The criteria of Vinyl Chloride and Benzene are referred to the approved EIA(2) and summarised in **Table 3.4**. Vinyl chloride were excluded from further assessment because its concentrations at the stack were significantly lower than the ambient air quality criteria even with the background concentrations. This suggests that, after accounting for dilution and dispersion in the atmosphere, the resulting concentrations at the receptor would be even lower and unlikely to pose a risk.

3.5.1.11 For NO_2, SO_2, RSP, FSP, CO and Benzene, a quantitative assessment has been conducted to ascertain no adverse air quality impact due to the proximity of the leachate plant chimney and the proposed ASRs within the Application Site. The quantitative assessment has evaluated the cumulative impact of existing open road, chimney of the leachate treatment plant and PATH background. The background of Benzene is taken from the monitoring data of South East New Territories Landfill Extension (SENT), align with EIA study for TKO137(2). Detailed information is showed in **Section 3.5.2**.

3.5.1.12 Regardless of the predicted cumulative air quality, it is recommended that the fresh air intakes of the proposed air sensitive uses (e.g. administration buildings, training facilities and auxiliary facilities, etc.) in the vicinity of the leachate treatment shall be located away from the chimney of the leachate treatment plant as far as practicable.

3.5.1.13 In addition, there might be maintenance works to be carried out after operation of the PRS. As the scale of the maintenance works is likely to be much smaller than that of the construction works, adverse air quality impact during the maintenance works is not anticipated. The good site practices as discussed in **Section 3.4.2** are also applicable.

3.5.2 Cumulative Impact

3.5.2.1 Cumulative air quality impact is a combination of the emissions impacts contributed from the near- and far-field sources on an hourly basis. According to EPD's *"Guidelines on Choice of Models and Model Parameters"*, AERMOD and Smart Air Modelling Platform (SAMP) are used to conduct the assessment.

3.5.2.2 A preliminary quantitative assessment was conducted to evaluate the cumulative air quality impact of various emission sources, i.e. existing roads, chimney emission from leachate treatment plant, and background contribution from PATHv3.0, on existing and proposed ASRs. Detailed information for the ASRs within the Application Site is illustrated in **Appendix 3.2**.

Tier 1 Emission – Primary Contribution

3.5.2.3 As discuss in **Section 3.5.1**, there is limited emission contributed from the Project and its induced traffic, Tier 1 emission is not applicable in this assessment.

Tier 2 Emission – Secondary Contribution

3.5.2.4 In the immediate vicinity of the Application Site, typically within the 500m assessment area, two major emission sources are identified: open road emission from existing roads and industrial emission from the leachate treatment plant.

3.5.2.5 Although the existing roads are distance to the proposed air sensitive uses within the Project as discussed in **Section 3.5.1**, the existing roads fall within the 500m assessment area. For a preliminary assessment, the vehicular emission inventory is derived based on the approved EIA Report of TKO137(2). Refer to the approved EIA Report for TKO137, a conservative estimate models open road vehicle emissions using the highest emission factor (Year 2030) and peak traffic data (Year 2041) for the period 2030–2046, covering up to five years after full population intake in 2041. Detailed information for existing roads is illustrated in **Appendix 3.3**.

3.5.2.6 The roads within the assessment area were modelled as "LINE" sources shown in **Appendix 3.3**. The EMFAC-HK in the EPD's SAMP v2.1 tool is used to derive the hourly composite vehicular running emission rates of NO_2 and NO based on the predicted 24-hour traffic forecast data for 18 vehicle classes based on the approved EIA Report for TKO137. Default values of speed fraction, trips and Vehicle Kilometres Travelled (VKT) has been used by SAMP to calculate emission factors. For conservative purpose, no zero-emission vehicles were included in the composite emission factors output by SAMP v2.1 and all roads are modelled with start and running emissions. Broad-brush approach is adopted for start emission, which assumes start emission at all roads. Also, all vehicle classes were assumed to have potential trip on all roads, including minibus and franchised bus which usually starts its engine at its termini throughout its service route.

3.5.2.7 Two carparks are identified within the 500m assessment area. One is located between Mega Plus and HKCOLO along Wan Po Road. Since it is parked with only private cars which have relatively low emission, so vehicular emission is anticipated insignificant. Another one is located at Chun Cheong Street with goods vehicles and private cars parking spaces. Since it is located more than 230m from the Application Site, air quality impact induced by vehicular emission will not be anticipated. As discussed in **Section 3.5.2.6**, start emission of all vehicle classes are modelled at all roads, the current broad-brush approach is considered sufficiently conservative.

3.5.2.8 Despite of the different modelled roads due to assessment area in the approved EIA for TKO137 and this Application Site, traffic data of this assessment have been sourced from roads that are either analogous to, or where feasible, identical with those under consideration. An additional scenario with doubled open road emissions have been also conducted for sensitive analyses.

3.5.2.9 Although the industrial emission from the leachate treatment plant is concluded to be very low at source, the chimney emission is considered in the assessment due to the concern regarding the detection limitation and proximity to ASRs. Detailed information for the calculation of the chimney emission is illustrated in **Appendix 3.4**.

3.5.2.10 AERMET (the meteorological pre-processor of AERMOD) obtained from EPD's SAMP v2.1 are shown in **Appendix 3.5**. The surface parameters such as albedo, Bowen ratio and surface roughness are determined by AERMET according to its land use characteristics within 10km for albedo and Bowen ratio, and 1 km for surface roughness.

Tier 3 Emission – Background Contribution

3.5.2.11 Under the current EPD guideline "Guidelines on Choice of Models and Model Parameters", the latest PATH v3.0 provided by EPD is adopted to provide meteorological data and air pollutant concentration estimates for Tier 3 background contribution. Background level in Year 2030 is selected based on the operation schedule for conservative approach.

Cumulative Assessment

3.5.2.12 Air pollutants NO_2, RSP, FSP, SO2, CO and Benzene are considered as key air pollutants for the operational air quality assessment and evaluated against the criteria of AQOs and other criteria. The 1-, 24-hour and annual average NO_2 concentrations, 24-hour and annual average RSP and FSP concentrations at the identified ASRs listed in **Appendix 3.2** are assessed and compared with the AQO to determine their compliance.

3.5.2.13 To provide a comprehensive understanding of the air quality impacts, it is important to distinguish between the two sets of ASRs. All existing ASRs and two planned ASRs (PA02 and PA05) presented in **Table 3.6** primarily address the direct impact of the Project on its immediate neighbours. Besides, the ASRs in **Appendix 3.2** evaluate the cumulative effects arising from secondary and background contributions to the Project. Given the distinct focus and analytical scope of each set, they are presented separately to ensure clarity and precision in impact assessment.

3.5.2.14 For cumulative short-term and long-term NO_2 concentrations, Ozone Limiting Method (OLM), in accordance with EPD's *"Guidelines on Choice of Models and Model Parameters"*, is adopted for the conversion of residual NO to NO_2. For other non-road sources, i.e. industrial emissions, initial NO_2/NOx ratios of 0.1 is adopted.

3.5.2.15 The cumulative air quality impact simulation demonstrated compliance of AQOs for all proposed ASRs within the Application Site in both sensitivity analyses, including the proposed administration building located nearest to the leachate treatment plant.

3.5.2.16 **Table 3.7** shows the predicted pollutant levels with the highest concentrations at two scenarios of the sensitivity analyses. To summarise, the ASRs with the highest NO_2 concentration can be found at the Administration Building and Lower Platform due to the proximity to the emission source. For other pollutants, the level of concentration distributed evenly over the Project as they are influenced by the region factor in a greater extent. Details for the preliminary simulation are summarized in **Appendix 3.6** and **Appendix 3.7**.

3.5.2.17 Concluded from the simulation, adverse cumulative air quality impact on the proposed air sensitive uses within the Application Site is not anticipated.

Table 3.7 Worst Predicted Cumulative RSP, FSP, NO_2, SO_2, CO and Benzene Concentrations at Representative ASRs during Operation Phase

Pollutants	Averaging Time	AQO (µg/m³) [1]	Assessment Result - Default Scenario (µg/m³) [1]	Assessment Result - Doubled Traffic Emission (µg/m³) [2]
RSP	10th highest 24-hour	75	51	51
	Annual	30	19	19
FSP	19th highest 24-hour	37.5	29	29
	Annual	15	12	12
NO_2	19th highest 1-hour	200	90	93
	10th highest 24-hour	120	27	34
	Annual	40	12	13
SO_2	4th highest 10-minute	500	48	48

Pollutants	Averaging Time	AQO (μg/m³) [1]	Assessment Result - Default Scenario (μg/m³) [1]	Assessment Result - Doubled Traffic Emission (μg/m³) [2]
	4th highest 24-hour	40	7	7
CO	Highest 1-hour	30000	521	521
	Highest 8-hour	10000	481	481
	Highest 24-hour	4000	446	446
Benzene	1-hour	27	3	3
	8-hour	3	2	2
	Annual	3	1	1

Notes:
[1] Benzene adopted the non-AQO criteria listed in **Table 3.4**.
[2] Detailed assessment result with default and doubled traffic emission are summarised in **Appendix 3.6** and **Appendix 3.7**, respectively.

3.5.3 Control Measures

3.5.3.1 As mentioned in **Section 3.5.1**, the fresh air intakes of the proposed air sensitive uses (e.g. administration buildings, training facilities and auxiliary facilities, etc.) in the vicinity of the leachate treatment plant shall be located away from the chimney of the leachate treatment plant as far as practicable.

3.6 Operational Phase (Odour Impact)

3.6.1 Impacts Evaluation

Odour from Closed Landfill (TKOL II/III)

3.6.1.1 According to the routine odour patrols by EPD between Year 2020 and Year 2024 (see **Appendix 3.9**), there was no odour detected at TKOL II/III. Therefore, adverse odour impact from TKOL II/III on the proposed ASRs under the Project is not anticipated.

Odour from the Project

3.6.1.2 Potential odorous sources proposed under the Project include stables and manure handlings locating at Middle Platform and Upper Platform. The representative existing and planned ASRs in the vicinity of the Project are located at more than 180m from the Middle Platform and Upper Platform.

3.6.1.3 With reference to the Approved EIA Report for Main Arena of the 2008 Olympic Equestrian Event (AEIAR-097/2006), odour patrols along different routes around the existing stables at Sha Tin Racecourse, which accommodated 1192 horses, were conducted to determine the shortest distance beyond which odour is insignificant. The findings of the odour patrol suggested there would be insignificant odour at distance of around 100m from the boundary of the stable area.

3.6.1.4 The proposed stables will only accommodate not more than 100 horses, distributed at Middle Platform and Upper Platform. Given that the number of horses accommodated is far less than that in the existing stables at Sha Tin Racecourse, as well as the separation distance of at least 180m from ASRs in the vicinity of the Project, adverse odour impacts on ASRs in the vicinity of the Project is not anticipated with the implementation of HKJC's standard measures in handling horse manure.

3.6.2 Control Measures

3.6.2.1 Current housekeeping rules will be applied to ensure a consistent good practice. They include:

- A sanitary environment shall always be maintained in the stable area. The current waste management practices adopted in other HKJC stables will be applied:
    - Clearing waste from stables twice a day and stockpiled in the enclosed containers inside manure handling;
    - Collecting waste by licensed waste collector once a day;
    - Implementing stable cleansing practices including the removal of waste bedding that contains horse manure, washing of stable box and replacement of new bedding; and
    - Covering of waste by lids in wheelie bins.
- Paper scraps are used as bedding material for the majority of the stables boxes to reduce dust particle level;
- During seasons of high humidity levels, the frequency of changing stable bedding will be increased accordingly;
- Waste storage area is covered by sheet to control dust and odour emissions; and
- Cleaning area outside the stables regularly to ensure they are free from horse excretion.

3.7 Environmental Monitoring and Audit

3.7.1 Construction Phase

3.7.1.1 During construction phase, it is anticipated that there will be no adverse air quality impacts with the implementation of control measures. Nevertheless, environmental monitoring and audit (EM&A) is recommended for construction phase to ensure better environment. Dust monitoring by sensors is recommended with the support of regular site audits on the implementation of dust control measures.

3.7.2 Operational Phase

3.7.2.1 During the operational phase, no adverse air quality impact is anticipated. Thus, EM&A is not required for the operational phase.

3.8 Summary

3.8.1.1 During construction phase, fugitive dust and gaseous emissions will be generated from construction activities. Given the scale of the project, the Project will unlikely generate significant dust emission. With proper implementation of proposed dust control measures as recommended in the Air Pollution Control (Construction Dust) Regulation, Regulation Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation and Air Pollution Control (Fuel Restriction) Regulations, it is anticipated that there will be no adverse air quality impact during the construction phase.

3.8.1.2 The operation of the Project would generate insignificant traffic on nearby road networks, and the Access Road would only have limited number of traffic. Therefore, insignificant air quality impact is anticipated on nearby ASRs.

3.8.1.3 The cumulative air quality impact on the proposed air sensitive uses within the Project due to the industrial emission sources (i.e. leachate treatment plant), open road emissions within 500m assessment area and the background PATH concentration have been evaluated. It is anticipated that there will be no adverse air quality impact during the operational phase. Nevertheless, the fresh air intakes of the proposed air sensitive uses in the vicinity of the leachate treatment plant will be planned away from the chimney of the leachate treatment plant as far as practicable.

3.8.1.4 Housekeeping rules adopted in other HKJC stables will be applied to ensure a consistent good practice. Therefore, it is anticipated that there will be no potential odour impact due to the operation of the Project.

4. Noise

4.1 Legislation, Standards and Guidelines

4.1.1 General

4.1.1.1 The relevant legislation, standards and guidelines applicable to the present study for the noise impact assessment of both construction and operational phase include the following:

- Noise Control Ordinance (NCO) (Cap. 400);
- Technical Memorandum (TM) on Noise from Construction Work other than Percussive Piling (GW-TM);
- TM on Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM); and
- Section 1 of Annexes 5 and 13 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM); and
- Chapter 9 of the Hong Kong Planning Standards and Guidelines (HKPSG).

4.1.2 Construction Noise during Non-restricted Hours

4.1.2.1 The NCO provides the statutory framework for noise control in Hong Kong. Assessment procedures and standards are set out in the respective TM promulgated under NCO.

4.1.2.2 For construction, there is no statutory limit on construction noise during normal hours under the NCO and related TMs. There is statutory control on construction noise between the hours 1900 and 0700 (of the next day) from Monday to Saturday and at any time on general holidays (including Sundays) under the NCO. To ensure a better environment, the EIAO-TM promulgated under the EIAO has imposed more stringent criteria. Daytime general construction works (excluding percussive piling) between the hours 0700 and 1900 on any day not being a Sunday or general holidays, i.e. non-restricted hours, is controlled under the EIAO. The EIAO-TM stipulates criteria of 65 - 75dB(A) for daytime construction activities, as shown in **Table 4.1**.

Table 4.1 Noise Standards for Daytime Construction Activities

Uses	Noise Standards[1] [2], Leq (30min) dB(A)
	0700 – 1900 hours on any day not being a Sunday or general holiday
• All domestic premises • Temporary housing accommodation • Hostels • Convalescent homes • Homes for the aged	75
• Places of public worship • Courts of law • Hospitals and medical clinics	70

Uses	Noise Standards[1] [2], Leq (30min) dB(A)
	0700 – 1900 hours on any day not being a Sunday or general holiday
- Educational institutions (including kindergartens and nurseries)	70 65 (During Examination)

Notes:

[1] The above standards apply to uses which rely on opened windows for ventilation and are assessed at 1m from the external facade.

[2] A Construction Noise Permit shall be required for carrying out relevant construction work during restricted hours under the NCO. In case the applicant would like to evaluate whether carrying out relevant construction works during restricted hours under the NCO is feasible or not in the context of programming construction works, reference should be made to relevant technical memoranda issued under the NCO.

4.1.3 Construction Noise during Restricted Hours

4.1.3.1 The NCO also provides statutory controls on general construction works during restricted hours (i.e. 1900 to 0700 hours (of the next day) from Monday to Saturday and at any time on Sundays or public holidays). The use of PME for construction works during restricted hours would require a Construction Noise Permit (CNP). The GW-TM details the procedures adopted by EPD for assessing such application. The granting of a CNP is subject to conditions stated in the CNP and it may be revoked at any time for failure to comply with the permit conditions.

4.1.3.2 Maximum noise levels from construction activities during restricted hours at affected Noise Sensitive Receivers (NSRs) are controlled under the TMs and shall not exceed the specified Acceptable Noise Levels (ANLs). These ANLs are stipulated in accordance with the Area Sensitivity Ratings established for the NSRs. The definitions of Area Sensitivity Ratings “A”, “B” and “C” are summarized in **Table 4.2**, while the ANLs are summarized in **Table 4.3**.

Table 4.2 Area Sensitivity Ratings

Type of Area Containing NSR [1]	Degree to which NSR is Affected by Influencing Factor [1][2]		
	Not Affected	Indirectly Affected	Directly Affected
(i) Rural area, including country parks or village type developments	A	B	B
(ii) Low density residential area consisting of low-rise or isolated high-rise developments	A	B	C
(iii) Urban Area	B	C	C
(iv) Area other than those above	B	B	C

Notes:

[1] Influencing Factors (IF) include any industrial area, major road or the area within the boundary of Hong Kong International Airport.

[2] For the purpose of **Table 4.2**, the following definitions shall apply:

"country park" means an area that is designated as a country park pursuant to section 14 of the Country Parks Ordinance;

"directly affected" means that the NSR is at such a location that noise generated by the IF is readily noticeable at the NSR and is a dominant feature of the noise climate of the NSR;

"indirectly affected" means that the NSR is at such a location that noise generated by the IF, whilst noticeable at the NSR, is not a dominant feature of the noise climate of the NSR;

"not affected" means that the NSR is at such a location that noise generated by the IF is not noticeable at the NSR; and "urban area" means an area of high density, diverse development including a mixture of such elements as industrial activities, major trade or commercial activities and residential premises.

Table 4.3 ANL for Construction Work during Restricted Hours

Time Period	ANLs for Area Sensitive Ratings, dB(A)		
	A	B	C
All days during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day and evening (0700 to 2300 hours)	60	65	70
All days during the night-time (2300 to 0700 hours)	45	50	55

4.1.3.3 Despite any description made in this ER, the issue of CNP for the project construction is subject to the decision of the Noise Control Authority. The Noise Control Authority will consider a well-justified CNP application, once filed, for construction works within restricted hours as guided by the relevant TMs issued under the NCO. The Noise Control Authority will take into account contemporary conditions / situations of adjoining land uses and any previous complaints against construction activities at the site before making a decision in granting a CNP. Nothing in this ER shall bind the Noise Control Authority in making a decision. If a CNP is to be issued, the Noise Control Authority shall include in it any conditions demand. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution under the NCO.

4.1.4 Operational Noise

4.1.4.1 The HKPSG and IND-TM have stipulated the noise standards for various noise sources as shown in **Table 4.4**. It should be noted that the following noise criteria are only applicable to uses that rely on opened windows for ventilation

Table 4.4 Noise Standards for Operational Phase

Common Uses	Noise Standards [1]	
	Road Traffic Noise L10 (1hour) dB(A)	Fixed Noise Sources
• All domestic premises • Temporary housing accommodation • Hostels • Convalescent homes • Homes for the aged	70	5dB(A) below the appropriate ANL shown in the IND-TM, or the prevailing background noise levels (For quiet areas with level 5 dB(A) below the ANL)
• Educational institutions (including kindergartens and nurseries) • Places of public worship • Courts of law	65	
• Hospitals and medical clinics	55	

Note:

[1] The above standards, or equivalent, apply to uses which rely on opened windows for ventilation and are assessed at 1m from the external façade.

4.2 Description of the Environment

4.2.1 Baseline Condition

4.2.1.1 The prevailing noise climate of the Application Site is generally tranquil, except that of the Lower Platform is dominated by the noise from the louvres at the façade of the adjacent data centres (i.e. MEGA Plus and HKCOLO), and audible road traffic noise from Wan Po Road. The operational noise from the existing leachate treatment plant of TKOL II/III is only noticeable near the plant room.

4.3 Noise Sensitive Receivers

4.3.1.1 The assessment area for noise impact is generally defined by a distance of 300m from the boundary of Application Site. Representative NSRs within the assessment area have been identified for evaluation.

4.3.1.2 The existing NSRs are identified by means of topographic maps, aerial photos, land status plans and site inspections. Committed/ Planned NSRs within the assessment area are identified by making reference to relevant documents as listed:

- Approved Tseung Kwan O Outline Zoning Plan (No. S/TKO/32 exhibited on 17 October 2025);
- Approved Clear Water Bay Peninsula South Outline Zoning Plan (No. S/SK-CWBS/2 dated on 9 June 2006);
- Planning Applications under S.16 / S.12a Town Planning Ordinance;
- Development Permission Area Plans and Outline Development Plans by the Planning Department (PlanD);
- Land Sale Programme published by the Lands Department (LandsD); and
- Other relevant published plans, including plans, drawings and applications by the correspondent project proponents.

4.3.1.3 The locations of representative NSRs for noise impact assessment are summarized in **Table 4.5** and are shown in **Figure 4.1**.

Table 4.5 Summary of Representative NSRs

NSR ID	Name	Land Uses [1]	Approximate Nearest Distance from the Application Site (m) [Lower / Middle / Upper Platform] [2]
N01	Le Prestige Lohas Park	Res	195 / 450 / 700
N02	The Beaumount II	Res	385 / 590 / 460
PN01	Proposed Coach Duty Rooms	Res	Within Application Site

Notes:

[1] Res – Residential.

[2] Distance is rounded to the nearest 5m.

4.4 Construction Phase

4.4.1 Impacts Evaluation

4.4.1.1 The major source of construction noise impact would be the operation of powered mechanical equipment (PMEs) for carrying out the following main construction works of the Project:

- Site clearance;
- Site formation;
- Replacement of top soil for areas with horses' direct contact; and
- Construction of buildings and structures.

4.4.1.2 According to the construction methodology envisaged at this stage, the construction activities and its associated tentative PMEs has been identified in **Table 4.6** for the Project. The Contractor shall consider the engineering data available at that time and review and update this tentative construction plant inventory.

Table 4.6 Summary of Possible PME Required for the Project

Activities	Possible PMEs Required [1]		
Site clearance and formation	• Air compressor • Backhoe • Breaker	• Compactor • Dump truck • Excavator	• Generator • Hydraulic crusher • Lorry
Replacement of top soil for areas with horses' direct contact	• Compactor • Excavator	• Lorry	• Generator
Construction of building and structures	• Bar bender and cutter • Concrete lorry mixer • Concrete mixer • Concrete pump	• Dump truck • Generator • Grout mixer • Mobile crane	• Vibrating poker • Grout pump • Lorry

Note:

[1] Quiet equipment or QPME would be adopted where appliable and practicable.

4.4.1.3 The nearest NSR (i.e. N01 Le Prestige Lohas Park) is located at about 190m away from the Application Site, and at about 195m, 450m and 700m from Lower Platform, Middle Platform and Upper Platform respectively. As the Project involves construction of superstructure of only one storey and installation of pipelines utilities, and the scale of site clearance and site formation is not significant, the construction works are not considered massive and extensive. In addition, the construction works will be distributed in the three platforms and therefore longer separation distance. Given the large separation, adverse construction noise impact is not anticipated with the implementation of good site practices as discussed in **Section 4.4.2**.

4.4.2 Noise Control Measures

4.4.2.1 The following noise control measures should be implemented wherever practicable:

- Implementation of good site practices to limit noise emissions at source;
- Use of QPME;
- Use of quiet construction method;
- Use of movable noise barrier and full enclosure for relatively fixed plant; and

- Scheduling of construction works outside school examination periods in critical area.

4.4.2.2 The above recommended noise control measures would need to be implemented in worksite as good practices whenever possible. Reference shall also be made to EPD's recommended pollution control clauses for construction contracts:

- Before the commencement of any work, the Engineer may require the methods of working, plant equipment and sound-reducing measures to be used on the site to be made available for trial demonstration inspection and approval to ensure that they are suitable for the Project;
- The Contractor shall devise, arrange methods of working and carry out the Works in such a manner so as to minimise noise impacts on the surrounding environment, and shall provide experienced personnel with suitable training to ensure that these methods are implemented;
- The Contractor shall, when necessary, apply for a construction noise permit in accordance with the Noise Control (General) Regulations prior to the commencement of the relevant part(s) of the works, display the permit as required and provide a copy to the Engineer; and
- Noise barriers/enclosures shall be designed to meet the requirements given on the EPD's website (https://www.epd.gov.hk/epd/misc/construction_noise/contents/index.php/en/index.html). The location and details of the barriers/enclosures shall be submitted to the Engineer for approval before works commence adjacent to schools and other noise sensitive receivers.

Good Site Management Practices

4.4.2.3 Good site practice and noise management techniques could considerably reduce the noise impact from construction site activities on nearby NSRs. The following measures should be practiced during each phase of construction:

- Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- Machines and plant (such as trucks, cranes) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- Plant known to emit noise strongly in one direction, where possible, be orientated so that the noise is directed away from nearby NSRs;
- Silencers or mufflers on construction equipment should be properly fitted and maintained during the construction works;
- Mobile plant should be sited as far away from NSRs as possible and practicable; and
- Material stockpiles, site office and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

Use of Quality Powered Mechanical Equipment

4.4.2.4 The use of quiet plant associated with the construction works shall be made reference to the PME listed in the TM or QPME and other commonly used PME listed in EPD web pages as far as possible. It is generally known (supported by field measurement) that particular models of construction equipment are quieter than standard types given in the GW-TM. Whilst it is generally considered too restrictive to specify that the Contractor has to use specific models or items of plant, it is reasonable and practicable to set plant noise performance specifications for specific PME so that some flexibility in selection of plant is allowed. A pragmatic approach would be to request that the Contractor independently verifies the noise level of the plant proposed to be used and demonstrates through furnishing of these results, that the plant proposed to be used on the site meets the requirements.

Use of Quiet Construction Method

4.4.2.5 According to EPD's list of good practices and state-of-the-art technologies with the industry, the following is the example of quieter construction methods / equipment that are feasible in the Project. The exact construction methods to be adopted shall be reviewed by the Contractor.

- Use of prefabricated structure to replace in-situ construction as far as practicable.

Use of Movable Noise Barrier and Full Enclosure for Relatively Fixed Plant

4.4.2.6 Movable temporary noise barriers that can be located close to noisy plant and be moved concurrently with the plant along a worksite can be very effective for screening noise from NSRs. A typical design which has been used locally is a wooden framed barrier with a small-cantilevered upper portion of superficial density no less than $7kg/m^2$ on a skid footing with 25mm thick internal sound absorptive lining. This measure is particularly effective for low level zone of NSRs. A cantilevered top cover would be required to achieve screening benefits at upper floors of NSRs.

4.4.2.7 Movable temporary noise barriers shall be used for some PME (e.g. excavator). It is anticipated that suitably designed barriers could achieve at least 5dB(A) reduction for movable plant and 10dB(A) for stationary plant.

4.4.2.8 The use of standard enclosure could be considered to shelter relatively fixed plant including air compressor, generator. These standard enclosures can provide at least 15dB(A) noise reduction.

4.5 Operational Phase (Fixed Noise Sources Impact)

4.5.1 Determination of Noise Criteria

Proposed Noise Sensitive Uses of the Project (i.e. Proposed Coach Duty Rooms)

4.5.1.1 The proposed Coach Duty Rooms (PN01), which is noise sensitive use, is located at the Lower Platform of the Project. It is located at about 160m from Tseung Kwan O InnoPark with numbers of industrial buildings and data centres. Some high-rise residential developments (e.g. Lohas Park) are located further away. The types of area "(i) rural area"; "(ii) low density residential area consisting of low-rise or isolated high-rise developments"; and "(iii) urban area" according to IND-TM cannot reflect the future environs of the Lower Platform and are all not applicable. Thus, the Lower Platform shall fall into type "(iv) area other than those above" according to IND-TM.

4.5.1.2 The Lower Platform is located directly adjacent to Tseung Kwan O InnoPark, of which the land uses zonings are "Other Uses" ("OU") and "Government, Institution or Community" ("GIC"). Nevertheless, Tseung Kwan O InnoPark (previously known as Tseung Kwan O Industrial Estate) is an area that consists of a number of factories or industrial establishments. Therefore, it is considered to be an industrial area for the purpose of IND-TM and is classified as Influencing Factor (IF). As the Lower Platform is directly affected by the part of the IF (i.e. Mega Plus at Tseung Kwan O InnoPark), the Area Sensitivity Rating (ASR) of "C" is assigned to the Lower Platform, including the proposed Coach Duty Rooms. The Acceptable Noise Level (ANL) for ASR of "C" should be 70dB(A) and 60dB(A) for daytime and night-time respectively.

Existing NSRs in the Vicinity of the Project

4.5.1.3 The nearby existing NSR (i.e. N01 Le Prestige Lohas Park) are located at the cluster of high-rise residential buildings with Wan Po Road to its east, and Tseung Kwan O InnoPark to its southeast. The types of area "(i) rural area"; "(ii) low density residential area consisting of low-rise or isolated high-rise developments"; and "(iii) urban area" according to IND-TM according to IND-TM cannot reflect the environs of the existing NSR and are all not applicable. Thus, the existing NSR shall fall into type "(iv) area other than those above" according to IND-TM.

4.5.1.4 The existing NSR is located near Wan Po Road to its east. According to Annual Traffic Census (ATC) for Year 2023, Wan Po Road had an Annual Average Daily Traffic (AADT) of 30,420, which is considered as an IF under IND-TM. For the façade of the existing NSR facing toward the Project is having an open view angle facing Wan Po Road, road traffic noise from Wan Po Road is readily noticeable and is a dominant feature of the noise climate. Therefore, the existing NSR is considered to be directly affected by the IF and hence an ASR of "C" is assigned. The ANL for ASR of "C" should be 70dB(A) and 60dB(A) for daytime and night-time respectively.

4.5.2 Impacts Evaluation

Potential Fixed Noise Sources Impacts on the Proposed Noise Sensitive Uses of the Project (i.e. Proposed Coach Duty Rooms)

4.5.2.1 A desktop study and site visits have been carried out in September 2024 to identify any potential fixed noise sources in the vicinity of the Application Site. The key fixed noise sources include the two data centres (i.e. MEGA Plus and HKCOLO) and the leachate treatment plant of the restored landfill (TKOL II/III). Their locations are indicated in **Figure 4.2**. The relevant information of these key fixed noise sources are summarized in **Table 4.7**. More details are provided in **Appendix 6.1**.

Table 4.7 Key Fixed Noise Sources Identified in the Vicinity of the Project

Location	Identified Noise Sources	Site Observations
MEGA Plus	• Operation: louvres at facades and chiller plants at rooftop • Operation period: full day	• Noticeable at the location of the proposed Coach Duty Rooms • Dominant noise feature near the proposed Coach Duty Rooms
HKCOLO	• Operation: louvres at facades and chiller plants at rooftop • Operation period: full day	• Audible at the nearest boundary of the Application Site • Not noticeable at the location of the proposed Coach Duty Rooms

Location	Identified Noise Sources	Site Observations
Leachate treatment plant of the restored landfill (TKOL II/III)	• Operation: plants within the temporary structure with two sides enclosed • Operation period: full day as advised by EPD	• Audible at the boundary of the leachate treatment plant • Not noticeable at the location of the proposed Coach Duty Rooms as it is significantly screened by the temporary structure, and the structures of other installation of the leachate treatment plant

4.5.2.2 As some of the louvres are located at higher level of the façades of MEGA Plus and HKCOLO, noise measurement at-source is considered impractical. Therefore, noise measurements at the location of the proposed Coach Duty Rooms (PN01) were conducted during daytime, evening time and nighttime to evaluate the potential fixed noise sources impact due to the operation of these key fixed noise sources in the vicinity.

4.5.2.3 Free-field noise measurements were conducted at the location of the proposed Coach Duty Rooms (PN01). The measurement details are provided in **Appendix 6.2**. **Table 4.8** summarises the noise measurement results.

Table 4.8 Result Summary of On-site Measurement on Fixed Noise Sources

Time Period	Measured Noise Level ($L_{eq\ (30mins)}$, dB(A)) [1]	Adjusted Measured Noise Level ($L_{eq\ (30mins)}$, dB(A)) [2]	Noise Criteria ($L_{eq\ (30mins)}$, dB(A))	Compliance
Daytime	53	59	70	Y
Evening Time	50	56	70	Y
Nighttime	49 – 51	55 – 57	60	Y

Notes:

[1] A free-field noise measurement was conducted at 1.2m above-ground level.

[2] Façade correction of 3dB(A) is applied. As tonal characteristic is identified (see **Appendix 6.2**), 3dB(A) tonality correction is applied.

4.5.2.4 The on-site measurement results demonstrated that the proposed Coach Duty Rooms (PN01) would be able to meet the respective fixed noise sources criteria.

Potential Fixed Noise Sources Impacts on the Existing NSR due to the Project

4.5.2.5 Based on the latest information, the Project will only operate during daytime and evening period. No night-time (i.e. 11pm to 7:00am) operation is anticipated.

4.5.2.6 The operation of the Project would involve the use of some fixed plants that would emit noise, these possible fixed noise sources are listed in **Table 4.9**.

Table 4.9 Possible Fixed Noise Sources under the Project

Fixed Noise Sources	Tentative Location	Description
Public announcement (PA) system	• Arena	• With reference to Tuen Mun Public Riding School, the loudspeakers of the PA system will be in small scale and distributed around the paddock. • The loudspeakers would be directional and oriented to the proposed paddocks. • The proposed paddocks are located at the Middle Platform and Upper Platform, which provide large separation distance of more than 450m and 790m respectively from the existing NSRs.

Fixed Noise Sources	Tentative Location	Description
Air conditioning system (e.g. condensers, etc.)	• Stable • Farrier rooms • Administration buildings • Training facilities • Auxiliary facilities	• The size of the facilities with air conditioning system is relatively small and limited to a few storeys. Therefore, the scale of air conditioning system is expected to be relatively small. Chiller plants and cooling towers are not required. • The air conditioning system will be distributed in the Lower, Middle and Upper Platforms, which provide longer separation distance from the existing NSRs (~210m, ~450m and ~660m respectively).
Exhausts of mechanical ventilation system	• E&M plant rooms • Waste management and storage facilities • Storage facilities	• The size of the facilities with mechanical ventilation system is relatively small and limited to a few storeys. Therefore, the scale of air conditioning system is expected to be relatively small.

4.5.2.7 The scale of the fixed noise sources under the Project are expected to be relatively small. In addition, the nearest NSR (i.e. N01 Le Prestige Lohas Park) is located at about 200m away from the Application Site. As these fixed plants will be distributed in the Lower, Middle and Upper Platforms, with provide longer separation distance from the nearest NSR (i.e. ~195m, ~450m and ~700m respectively). Given the small scale of fixed noise sources and sufficient separation distance, adverse fixed noise sources impact on the existing NSR is not anticipated with proper implementation of good design measures as discussed in **Section 4.5.3**.

4.5.2.8 As other noisy equipment (e.g. pumping system of E&M system) to be installed and the noisy activities to be carried out in the farrier rooms are enclosed within the proposed building structures, adverse fixed noise sources impact on the existing NSR is not anticipated.

4.5.2.9 As the scale of the fixed noise sources under the Project are expected to be relatively small and sufficient separation distance is allowed, noise contribution from the operation of the Project is considered minimal. Therefore, cumulative fixed noise sources impact with other existing fixed noise sources on the existing NSR is not anticipated.

4.5.3 Noise Control Measures

4.5.3.1 Possible noise control measures with reference to EPD's "Good Practices on Ventilation System Noise Control" could be considered for the fixed noise sources, for example:

- Quieter equipment;
- Acoustic louvre;
- Barrier; and
- Enclosure, etc.

4.5.3.2 In addition, the loudspeakers of the PA system and exhausts of the mechanical ventilation system will be oriented away from nearby NSR as far as practicable.

4.6 Operational Phase (Road Traffic Noise Impact)

4.6.1 Impacts Evaluation

Potential Road Traffic Noise Impacts on the Proposed Noise Sensitive Uses of the Project (i.e. Proposed Coach Duty Rooms)

4.6.1.1 The proposed Coach Duty Rooms (PN01), which is noise sensitive use, is located at the Lower Platform of the Project. The major roads in its vicinity are Wan Po Road with AADT of 30,420 (Year 2023) and Wan O Road with separation distance of about 160m from the Application Site, and more than 200m from the proposed Coach Duty Rooms . Other roads in its vicinity are Chun Yat Street and Chun Sing Street adjacent to the Application Site, but more than 230m from the proposed Coach Duty Rooms . In addition, the nearby buildings (i.e. MEGA Plus and HKCOLO) also provide some screening to these roads. Therefore, adverse road traffic noise impact on the proposed Coach Duty Rooms is not anticipated.

Potential Road Traffic Noise Impacts on the Existing NSR due to Induced Traffic from the Project

4.6.1.2 The noise climate of the existing NSR (i.e. N01 Le Prestige Lohas Park) is dominated by the road traffic noise from Wan Po Road with AADT of 30,420 (Year 2023). During the operation of the Project, there will be about 445veh/day (two-way) generate / attract to/from the adjacent road network. Comparing with the high existing traffic volume on Wan Po Road, the induced traffic from the Project is insignificant. Therefore, adverse road traffic noise impact due to the induced traffic from the Project on the existing NSR is not anticipated.

Potential Road Traffic Noise Impacts from the Access Road

4.6.1.3 As mentioned in **Section 3.5.1**, the Access Road will serve both the landfill restoration operator and the PRS, with daily traffic of less than 20 veh/day (two-way) and 50 veh/day (two-way) respectively. Therefore, the potential road traffic noise impact from the Access Road is insignificant.

4.6.2 Noise Control Measures

4.6.2.1 During operational phase, no adverse road traffic noise impact is anticipated. Thus, noise control measure is not required.

4.7 Environmental Monitoring and Audit

4.7.1 Construction Phase

4.7.1.1 During construction phase, no adverse noise impact is anticipated with the implementation of control measures. Nevertheless, site audit is recommended for the construction phase to ensure better environment. Regular site audits would be carried out to ensure proper implementation of noise control measures.

4.7.2 Operational Phase

4.7.2.1 During operational phase, no adverse noise impact is anticipated with good design practices for planned fixed noise sources under the Project. EM&A is not required for the operational phase.

4.8 Summary

4.8.1.1 During construction phase, potential sources of noise impact of the Project will be the use of Powered Mechanical Equipment for various construction activities. With proper implementation of the proposed control measures and good site practices including use of Quality Powered Mechanical Equipment (QPME) / quieter construction methods, noise barriers, noise enclosures and locating mobile plant as far away from noise sensitive receivers as possible and practicable, etc., it is anticipated that there will be no adverse noise impact during the construction phase.

4.8.1.2 Potential fixed noise sources impact on the proposed Coach Duty Rooms due to the existing fixed noise sources has been evaluated. Compliance with relevant noise criteria is anticipated. Potential fixed noise sources impact due to the Project on existing noise sensitive receiver (e.g. Le Prestige Lohas Park) has been evaluated. With proper implementation of good design practices, no adverse fixed noise sources impact is anticipated. Therefore, it is anticipated that there will be no adverse fixed noise sources impact during the operational phase.

4.8.1.3 When comparing with the heavily trafficked existing roads (e.g. Wan Po Road), the induced traffic due to the operation of the Project is insignificant. Also, there is only limited number of traffic on the Access Road for the landfill restoration operator and the PRS. Therefore, it is anticipated that there will be no adverse road traffic noise impact during the operational phase.

5. Water Quality

5.1 Legislation, Standards and Guidelines

5.1.1 General

5.1.1.1 The relevant legislation, standards and guidelines applicable to the present study for the water quality impact assessment of both construction and operational phase include the following:

- Water Control Ordinance (WPCO) (Cap. 358);
- Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems (TM-DSS);
- Hong Kong Planning Standards and Guidelines (HKPSG);
- ProPECC PN 2/24 – Construction Site Drainage;
- ProPECC PN 1/23 – Drainage Plans Subject to Comment by the Environmental Protection Department;
- ETWB Technical Circular (Works) (ETWB TCW) No. 5/2005 – Protection of Natural Streams / Rivers from Adverse Impact Arising from Construction Works; and
- Water Supplies Department's (WSD) Target Values of Sea Water Quality for Flushing Supply at Intake Point of Salt Water Pumping Station

5.1.2 Water Pollution Control Ordinance

5.1.2.1 The entire Hong Kong waters are divided into ten Water Control Zones (WCZs) and four supplementary WCZs under the WPCO (Cap. 358). Each WCZ has a designated set of statutory Water Quality Objectives (WQOs) designed to protect the inland and/ or marine environment and its users. The Project is located within the Junk Bay WCZ and the corresponding WQOs are summarised in **Table 5.1**.

Table 5.1 Water Quality Objectives for Junk Bay WCZ

Parameters	Objectives	Sub-Zone
Aesthetic appearance	(a) Waste discharges shall cause no objectionable odours or discolouration of the water.	Whole zone
	(b) Tarry residues, floating wood, articles made of glass, plastic, rubber or of any other substances should be absent.	Whole zone
	(c) Mineral oil should not be visible on the surface. Surfactants should not give rise to a lasting foam.	Whole zone
	(d) There should be no recognisable sewage-derived debris.	Whole zone
	(e) Floating, submerged and semi-submerged objects of a size likely to interfere with the free movement of vessels, or cause damage to vessels, should be absent.	Whole zone

Parameters	Objectives	Sub-Zone
	(f) Waste discharges shall not cause the water to contain substances which settle to form objectionable deposits.	Whole zone
Bacteria	(a) The level of *Escherichia coli* should not exceed 610 per 100 milligrams per litre, calculated as the geometric mean of all samples collected in one calendar year.	Secondary Contact Recreation Subzone & Fish Culture Zones
	(b) The level of *Escherichia coli* should not exceed 1000 per 100 ml, calculated as the running median of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days.	Inland waters
Colour	Waste discharges shall not cause the colour of water to exceed 50 Hazen units.	Inland waters
Dissolved Oxygen	(a) Waste discharges shall not cause the level of dissolved oxygen to fall below 4 mg per litre for 90% of the sampling occasions during the year; values should be calculated as water column average. In addition, the concentration of dissolved oxygen should not be less than 2 milligrams per litre within 2 metres of the seabed for 90% of the sampling occasions during the year.	Marine waters excepting Fish Culture Subzones
	(b) The dissolved oxygen level should not be less than 5 milligrams per litre for 90% of the sampling occasions during the year; values should be calculated as water column average (arithmetic mean of at least 3 measurements at 1 metre below surface, mid-depth and 1 metre above seabed). In addition, the concentration of dissolved oxygen should not be less than 2 milligrams per litre within 2 metres of the seabed for 90% of the sampling occasions during the year.	Fish Culture Subzones
	(c) Waste discharges shall not cause the level of dissolved oxygen to be less than 4 milligrams per litre.	Inland waters
pH	(a) The pH of the water should be within the range of 6.5 - 8.5 units. In addition, waste discharges shall not cause the natural pH range to be extended by more than 0.2 units.	Marine waters
	(b) The pH of the water should be within the range of 6.0 - 9.0 units.	Inland waters
Temperature	Waste discharges shall not cause the natural daily temperature range to change by more than 2.0 °C.	Whole zone
Salinity	Waste discharges shall not cause the natural ambient salinity level to change by more than 10%.	Whole zone
Suspended Solids	(a) Waste discharges shall neither cause the natural ambient level to be raised by 30% nor give rise to accumulation of suspended solids which may adversely affect aquatic communities.	Marine waters
	(b) Waste discharges shall not cause the annual median of suspended solids to exceed 25 milligrams per litre.	Inland waters

Parameters	Objectives	Sub-Zone
Ammonia	The un-ionized ammoniacal nitrogen level should not be more than 0.021 milligram per litre, calculated as the annual average (arithmetic mean), as unionized form.	Whole zone
Nutrients	(a) Nutrients shall not be present in quantities sufficient to cause excessive or nuisance growth of algae or other aquatic plants.	Marine waters
	(b) Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.3 milligram per litre, expressed as annual water column average (arithmetic mean of at least 3 measurements at 1m below surface, mid-depth and 1m above seabed).	Marine waters
5-Day Biochemical Oxygen Demand	Waste discharges shall not cause the 5-day biochemical oxygen demand to exceed 5 milligrams per litre.	Inland waters
Chemical Oxygen Demand	Waste discharges shall not cause the chemical oxygen demand to exceed 30 milligrams per litre.	Inland waters
Dangerous Substances	(a) Waste discharges shall not cause the dangerous substances in marine waters to attain such levels as to produce significant toxic effects in humans, fish or any other aquatic organisms, with due regard to biologically cumulative effects in food chains and to interactions of toxic substances with each other.	Whole zone
	(b) Waste discharges of dangerous substances shall not put a risk to any beneficial uses of the aquatic environment.	Whole zone

Note:

[1] Reference: Junk Bay Water Control Zone Statement of Water Quality Objectives

5.1.3 Technical Memorandum on Standard for Effluents Discharged into Drainage and Sewerage Systems (TM-DSS)

5.1.3.1 Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS) was issued to control the physical, chemical and microbial quality of effluent discharges into foul sewers, storm water drains, inland and coastal waters. Specific limits apply to different discharge areas and they are different between surface waters and sewers. The limits vary with the rate of effluent flow. Any effluent discharge during the construction and operation phases of the development should comply with the relevant standards as stipulated in the TM-DSS.

5.1.4 Hong Kong Planning Standards and Guidelines (HKPSG)

5.1.4.1 Chapter 9 of the HKPSG outlines environmental requirements that need to be considered in land use planning. The recommended guidelines, standards and guidance cover the selection of suitable locations for the developments and sensitive uses, provision of environmental facilities, and design, layout, phasing and operational controls to minimise adverse environmental impacts. It also lists out environmental factors influencing land use planning and recommend buffer distances for land uses.

5.1.4.2 Section 5 under Chapter 9 of HKPSG provides broad guidelines on water quality which includes the principal framework for planning against water pollution. The overall objectives for planning against water pollution are:

a) Achieving and maintaining the quality of inland waters, coastal waters, marine waters and groundwaters so that they can be used for their legitimate purposes;

b) Providing adequate public sewerage, wastewater treatment and disposal facilities for all wastewaters; and

c) Putting in place and enforce water pollution control legislation aimed at safeguarding the health and welfare of the community.

5.1.5 ProPECC PN 2/24 "Construction Site Drainage"

5.1.5.1 Professional Persons Environmental Consultative Committee Practice Notes (ProPECC PN2/24) on Construction Site Drainage provides guidelines for the handling and disposal of construction discharges. This note is applicable for control of site runoff and wastewater generated during the construction phase of the Development.

5.1.6 Practice Note for Professional Persons on Drainage Plans Subject to Comment by the Environmental Protection Department (ProPECC PN 1/23)

5.1.6.1 ProPECC PN 1/23 on drainage plans subject to comment by the EPD, provides guidelines and practices for handling, treatment and disposal of various effluent discharges to stormwater drains and foul sewers during operation phase.

5.1.7 ETWB Technical Circular (Works) (ETWB TCW) No. 5/2005 – Protection of Natural Streams / Rivers from Adverse Impact Arising from Construction Works

5.1.7.1 ETWB TCW No. 5/2005 provides an administrative framework to better protect all natural streams/rivers from the impact of construction works and clarifies and strengthens existing measures for protection of natural streams/rivers from government projects and private developments.

5.1.8 Water Supplies Department's (WSD) Target Values of Sea Water Quality for Flushing Supply at Intake Point of Salt Water Pumping Station

5.1.8.1 The criteria for assessing the water quality impact on the WSD's seawater intakes are based on the Target Values of Sea Water Quality for Flushing Supply at Intake Point of Salt Water Pumping Station (at intake point) issued by the WSD and are summarized under **Table 5.2**.

Table 5.2 WSD's Target values of Sea Water Quality at Intake Point of Salt Water Pumping Stations

Parameter	Target Value
Colour	< 20 Hazen Unit
Turbidity	< 10 Nephelometric Turbidity unit (N.T.U.)
Threshold Odour No.	< 100 odour unit
Ammoniacal Nitrogen	< 1 mg/l
Suspended Solids	< 10 mg/l
Dissolved Oxygen	> 2 mg/l
Biochemical Oxygen Demand	< 10 mg/l
Synthetic Detergents	< 5 mg/l
E. coli	< 20,000 cfu/100 ml

5.2 Description of the Environment

5.2.1 Baseline Water Quality Condition

5.2.1.1 The latest water quality monitoring data in 2023 from EPD's Marine Water Quality in Hong Kong 2023 were adopted to determine the ambient water quality. Details of marine water quality monitoring data from EPD water quality monitoring stations, JM3 and JM4 which are the nearest stations to the Project, are presented in **Table 5.3**. According to the Marine Water Quality in Hong Kong 2023, the water quality of the Junk Bay WCZ has achieved full compliance (100%) with the Water Quality Objectives (WQOs) for the last 24 years. Summary of the marine water quality of the related parameters is presented in **Table 5.3** and the locations of monitoring stations are presented in **Figure 5.1**.

Table 5.3 Summary of Marine Water Quality of Junk Bay WCZ (2023)

Parameters		EPD Monitoring Station	
		JM3	JM4
Temperature (°C)		23.9 (17.7 – 29.8)	23.6 (17.8 – 29.4)
Salinity		32.4 (30.6 – 33.5)	32.8 (32.1 – 33.6)
Dissolved Oxygen (mg/L)	Depth-Average	6.8 (4.9 – 9.8)	6.2 (5.0 – 7.5)
	Bottom	6.3 (4.0 – 11.6)	5.8 (3.5 – 7.9)
Dissolved Oxygen (% Saturation)	Depth-Average	97 (78 - 148)	88 (74 - 100)
	Bottom	90 (63 - 176)	81 (50 - 101)
pH		7.7 (7.1 – 8.1)	7.7 (7.1 – 8.1)
Secchi Disc Depth (m)		2.7 (2.0 – 3.9)	2.8 (1.8 – 3.6)
Turbidity (NTU)		6.5 (1.0 – 35.8)	4.1 (1.6 – 13.3)
Suspended Solids (mg/L)		5.0 (1.6 – 9.2)	5.3 (1.9 – 11.3)
5-day Biochemical Oxygen Demand (mg/L)		0.5 (0.3 – 1.2)	0.4 (0.3 – 0.7)
Ammonia Nitrogen (mg/L)		0.059 (0.033 – 0.098)	0.056 (0.026 – 0.107)
Unionised Ammonia (mg/L)		0.001 (<0.001 – 0.003)	0.001 (<0.001 – 0.003)
Nitrite Nitrogen (mg/L)		0.018 (0.006 – 0.043)	0.019 (0.003 – 0.046)
Nitrate Nitrogen (mg/L)		0.083 (0.030 – 0.177)	0.080 (0.03 – 0.210)

Parameters	EPD Monitoring Station	
	JM3	JM4
Total Inorganic Nitrogen (mg/L)	0.16 (0.10 – 0.28)	0.15 (0.06 – 0.35)
Total Kjeldahl Nitrogen (mg/L)	0.45 (0.16 – 0.79)	0.45 (0.15 – 0.74)
Total Nitrogen (mg/L)	0.55 (0.24 – 0.88)	0.55 (0.21 – 0.93)
Orthophosphate Phosphorus (mg/L)	0.010 (<0.002 – 0.019)	0.013 (0.006 – 0.023)
Total Phosphorus (mg/L)	0.06 (0.05 – 0.12)	0.06 (0.04 – 0.08)
Silica (as SiO_2) (mg/L)	0.60 (0.19 – 1.23)	0.63 (0.17 – 1.23)
Chlorophyll – a (μg/L)	3.3 (0.3 – 10.4)	2.7 (0.3 – 9.5)
E. coli (count/100mL)	67 (5 - 360)	84 (5 - 360)
Faecal Coliforms (count/100mL)	170 (8 - 850)	190 (10 - 1000)

Notes:

[1] Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

[2] Data presented are annual arithmetic means of the depth-averaged results except for E. coli and faecal coliforms. which are annual geometric means.

[3] Data in brackets indicate ranges.

5.3 Water Sensitive Receivers

5.3.1.1 The assessment area for the water quality impact assessment is defined by a distance of 500m from the boundary of the Application Site. Water Sensitive Receivers (WSRs) have been identified in accordance with the HKPSG. There are few channels and watercourses identified in the vicinity of the Application Site, which are considered as the representative WSRs. The details and location of the WSRs within 500m assessment area are presented in **Table 5.4** and **Figure 5.2**.

Table 5.4 Representative Water Sensitive Receivers

WSR ID	Description	Type	Status	Approximate Nearest Distance from the Application Site (m) [Lower / Middle / Upper Platform] [1]
WSR1	Channels along the edge of TKOL II/III Site	Channelized	Active	50 / 375 / 560
WSR2	Channels within TKOL II/III Site	Channelized	Active	10 / 145 / <5

WSR ID	Description	Type	Status	Approximate Nearest Distance from the Application Site (m) [Lower / Middle / Upper Platform] [1]
WSR3	Channels within TKOL II/III Site	Channelized	Active	15 / <5 / <5
WSR4	Channels within TKOL II/III Site	Channelized	Active	645 / 395 / <5
WSR5	Channels within TKOL II/III Site	Channelized	Active	105 / 55 / 115
WSR6	Channels within TKOL II/III Site	Channelized	Active	585 / 290 / 175
WSR7	Channels within TKOL II/III Site	Channelized	Active	255 / 10 / 275
WSR8	Channels within TKOL II/III Site	Channelized	Active	0 / <5 / 545
WSR9	Channels within TKOL II/III Site	Channelized	Active	<5 / 15 / 640
WSR10	Channels along the edge of TKOL II/III Site	Channelized	Active	105 / 65 / 25
WSR11	Watercourse to the north of the Application Site	Natural watercourse	Active	550 / 480 / 45
WSR12	Watercourse to the northeast of the Application Site	Natural watercourse	Active	670 / 495 / 20
WSR13	Watercourse to the northeast of the Application Site	Natural watercourse	Active	790 / 585 / 35
WSR14	Watercourse to the east of the Application Site	Natural watercourse	Active	800 / 550 / 105
WSR15	Watercourse to the south of the Application Site	Natural watercourse	Active	520 / 260 / 380
WSR16	Watercourse to the south of the Application Site	Natural watercourse	Active	210 / 90 / 670
WSR17	Watercourse to the far north south of the Application Site	Natural watercourse	Active	505 / 195 / 150
WSR18	Watercourse to the far south east of the Application Site	Natural watercourse	Active	735 / 515 / 490

WSR ID	Description	Type	Status	Approximate Nearest Distance from the Application Site (m) [Lower / Middle / Upper Platform] [1]
WSR19	Clear Water Bay Country Park	Country Park	Active	550 / 275 / <5

Note:
[1] Distance is rounded to the nearest 5m.

5.4 Construction Phase

5.4.1 General Construction Activities

5.4.1.1 The construction works of the Project are land-based in nature, as discussed in **Section 2.2.2.2**, for example, site clearance, site formation, construction of buildings and structures, etc.

5.4.2 Impacts Evaluation

5.4.2.1 The major pollution sources in construction phase are general construction activities, construction runoff, construction works in close proximity of inland water, sewage from construction workforce and accidental spillage of chemicals. The evaluation of impacts is discussed in the following sections.

Construction Runoff

5.4.2.2 The construction site runoff comprises the following:

- runoff and erosion from site surfaces, earth working areas and stockpiles;
- wash water from dust suppression sprays and wheel washing facilities; and
- fuel, oil, solvents and lubricants from maintenance of construction machinery and equipment.

5.4.2.3 Construction runoff if not properly treated may cause physical, biological and chemical effects. The physical effects include potential blockage of drainage channels and increase of suspended solid (SS) levels in the waterbodies nearby and the Junk Bay WCZ if improperly discharged to open water. Runoff containing significant amounts of concrete and cement-derived material may cause primary chemical effects such as increasing turbidity and discoloration, elevation in pH, and accretion of solids. A number of secondary effects may also result in toxic effects to water biota due to elevated pH values, and reduced decay rates of faecal micro-organisms and photosynthetic rate due to the decreased light penetration.

5.4.2.4 The implementation of measures as specified in the ProPECC PN 2/24 to control construction run-off will be important for preventing runoff with high levels of suspended solids from entering the water environment. With the best management practices as described in **Section 5.4.3**, no adverse water quality impacts are anticipated.

Construction Works in Close Proximity of Inland Water

5.4.2.5 Construction activities may pollute nearby inland waterbodies within and in the vicinity of the construction site through the potential release of construction wastes, which are generally characterized by high concentration of SS and elevated pH. Based on the latest design, there is no construction work at the watercourse. Thus, neither modification, alternation nor removal of the watercourse is required. Hence, with the implementation of adequate construction site drainage as specified in the ProPECC PN 2/24, and ETWB Technical Circular (Works) (ETWB TCW) No. 5/2005 – Protection of Natural Streams / Rivers from Adverse Impact Arising from Construction Works described in **Section 5.4.3**, no adverse water quality impacts are anticipated.

Sewage from Construction Workforce

5.4.2.6 Sewage arising from the on-site construction workforce is likely to cause water pollution if it is discharged improperly. The sewage is characterised by high levels of biochemical oxygen demand (BOD), ammonia, *E. coli* and oil/ grease. The watercourses polluted by sewage would have aesthetic and odour problem and may become hypoxic due to decay of large amount of oxygen demanding material. Given that sufficient temporary sanitary facilities, e.g. portable chemical toilets, and sewage holding tanks will be provided at the construction site and the control measures proposed in **Section 5.4.3**, no adverse water quality impacts are anticipated.

Accidental Spillage of Chemicals

5.4.2.7 The use of chemicals such as engine oil and lubricants, and their storage as waste materials has the potential to cause adverse water quality impacts if spillage occurs and enters the adjacent water bodies. Waste oil may infiltrate the surface soil layer, or discharged into the nearby water environment, increasing hydrocarbon levels. However, adverse impacts can be mitigated by implementing best management and site practices as described in **Section 5.4.3**.

5.4.3 Control Measures

Construction Runoff

5.4.3.1 In accordance with the ProPECC PN 2/24, good site practices should be implemented as far as practicable to control construction site runoff, contaminated surface runoff and drainage from the works areas, and to prevent runoff and drainage water with high levels of SS from entering the nearby water bodies, listed as below:

- At the start of site establishment, perimeter cut-off drains to direct off-site water around the site should be constructed with internal drainage works. Channels (both temporary and permanent drainage pipes and culverts), earth bunds or sand bag barriers should be provided on site to direct stormwater to silt removal facilities;
- Diversion of natural stormwater should be provided as far as possible. The design of temporary on-site drainage should prevent runoff going through site surface, construction machinery and equipment in order to avoid or minimise polluted runoff. Sedimentation tanks with sufficient capacity, constructed from pre-formed individual cells of approximately 6 to 8m^3 capacities, are recommended as a general measure which can be used for settling surface runoff prior to disposal. The system capacity shall be flexible and able to handle multiple inputs from a variety of sources and suited to applications where the influent is pumped;
- The dikes or embankments for flood protection should be implemented around the boundaries of earthwork areas. Temporary ditches should be provided to facilitate the runoff discharge into an appropriate watercourse, through a silt/ sediment trap. The

silt/ sediment traps should be incorporated in the permanent drainage channels to enhance deposition rates;

- The design of efficient silt removal facilities should be based on the guidelines in Appendix A1 of ProPECC PN 2/24. The detailed design of the sand/ silt traps should be undertaken by the contractor prior to the commencement of construction;
- Construction works should be programmed to minimise surface excavation works during the rainy seasons (April to September). All exposed earth areas should be completed and vegetated as soon as possible after earthworks have been completed. If excavation of soil cannot be avoided during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces should be covered by tarpaulin or other means;
- All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly following rainstorms. Deposited silt and grit should be removed regularly and disposed of by spreading evenly over stable, vegetated areas;
- If the excavation of trenches in wet periods is necessary, it should be dug and backfilled in short sections wherever practicable. Water pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities;
- All open stockpiles of construction materials (for example, aggregates, sand and fill material) should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system;
- Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the drainage system and storm runoff being directed into foul sewers;
- Precautions to be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecasted, and actions to be taken during or after rainstorms are summarised in Appendix A2 of ProPECC PN 2/24. Attention should be paid to the control of silty surface runoff during storm events;
- All vehicles and plant should be cleaned before leaving a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facility should be provided at every construction site exit where practicable. Wash-water should have sand and silt settled out and removed at least on a weekly basis to ensure the continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient back fall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains;
- If vehicle and plant services areas, vehicle wash bays, lubrication bays or other activities which have the potential to incur oil leakage or spillage are provided within the site, then the Contractor shall make suitable provisions in accordance with the EPD practice notes, for example but not limited to locating in roofed areas and connecting the drainage for this area to the foul sewer via oil interceptor. Any oil interceptors should be emptied and cleaned regularly to prevent the release of oil and

grease into the storm water drainage system after accidental spillage. A bypass should be provided for oil interceptors to prevent flushing during heavy rain;

- Construction solid waste, debris and rubbish on site should be collected, handled and disposed of properly to avoid water quality impacts;
- All fuel tanks and storage areas should be provided with locks and sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank to prevent spilled fuel oils from reaching water sensitive receivers nearby; and
- Regular environmental audit on the construction site should be carried out to prevent any malpractices. Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the water bodies, marsh and ponds.

5.4.3.2 By adopting the best management practices, it is anticipated that the impacts of general site operation will be reduced to satisfactory levels before discharges, and therefore no adverse water quality impact. The details of best management practices will be highly dependent to actual site condition and Contractor shall apply for a discharge license under WPCO.

Construction Works in Close Proximity of Inland Water

5.4.3.3 The practices outlined in ETWB TC (Works) No. 5/2005 “Protection of natural streams/rivers from adverse impacts arising from construction works” should also be adopted where applicable to minimize the water quality impacts. Relevant measures from the ETWB TC (Works) No. 5/2005 are listed below. With these management practices, no adverse water quality impact is anticipated.

- Construction works close to the inland waters should be carried out in dry season as far as practicable where the flow in the surface channel or stream is low;
- Trenches should be dug and backfilled in short sections. Measures should be taken to minimize the ingress of rainwater into trenches;
- The use of less or smaller construction plants may be specified in areas close to the water courses to reduce the disturbance to the surface water;
- Temporary storage of materials (e.g. equipment, chemicals and fuel) and temporary stockpile of construction materials should be located well away from any watercourses during carrying out of the construction works;
- Stockpiling of construction materials and dusty materials should be covered and located away from any watercourses. Construction debris and spoil should be covered up and / or disposed of as soon as possible to avoid being washed into the nearby water receivers; and
- Proper shoring may need to be erected in order to prevent soil or mud from slipping into the watercourses.

Sewage from Construction Workforce

5.4.3.4 To mitigate the water quality impacts of sewage arising from the on-site construction workers, the following measures should be implemented:

- Sufficient portable chemical toilets shall be provided to serve the construction workers at the construction site to prevent direct disposal of sewage into the water environment. A licensed contractor should be employed to be responsible for appropriate disposal to a suitable government sewage treatment facility offsite and to maintain the cleanliness and operations of the portable toilets; and
- Post notices at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the surrounding environment during the construction phase of the Project.

5.4.3.5 With the implementation of the above control measures, potential water quality impact during construction phase is not anticipated.

Accidental Spillage of Chemicals

5.4.3.6 The Contractor must be registered as a chemical waste producer if chemical wastes are produced from the construction activities. The Waste Disposal Ordinance (Cap. 354) and its subsidiary regulations, in particular the Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C), should be observed and complied with for the control of chemical wastes. The Contractor is also recommended to develop management procedures for the chemicals used and prepare an emergency spillage handling procedure to deal with chemical spillage in case of an accident occurs, a contingency plan for any accidental spillage and heavy rainfall event should also be devised. Since there will be no on-site storage of any pesticides, hence, spillage of pesticides is not anticipated.

5.4.3.7 Any services and maintenance facilities should be located on hard standings within a bunded area, sumps and oil interceptors should be provided. Activities with the potential for accidental leakage and spillage of chemicals, including the maintenance of vehicles and equipment should only be undertaken within areas that are appropriately equipped to control the discharges from these potential accidents. The service and maintenance, and any chemical storage areas should not be positioned near watercourses as a safeguard measure.

5.4.3.8 Disposal of chemical wastes should be carried out in compliance with the Waste Disposal Ordinance. The Code of Practice on the Packaging, Labelling, and Storage of Chemical Wastes published under the Waste Disposal Ordinance details the requirements to deal with chemical wastes. General requirements are given as follows:

- Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling, and transport;
- Chemical waste containers should be suitably labelled, to notify and warn the personnel who are handling the wastes, to avoid accidents; and
- Storage area should be selected at a safe location on-site and adequate space should be allocated to the storage area.

5.5 Operational Phase

5.5.1 Impacts Evaluation

Sewage from Stables, Staff and Visitors

5.5.1.1 The sewage from the proposed stables, staff and visitors of the Project would be properly collected by sewage system and diverted to the public sewerage system. Sewage from stables, e.g. horse urine and after-wash water, will be discharged directly to sewage drainage. A separate discharge licence under the WPCO will be obtained. The requirements under the WPCO will be properly implemented. To minimize potential water quality impact, wastes from stables will also be regularly cleared and stockpiled in the enclosed containers inside the proposed manure handling before collection by licensed waste collector engaged. Other than stables, horses could have activity at open areas but limited to arenas and spelling yards mainly. The manure found in the arenas and spelling yards would be cleared regularly to prevent being flushed to the drainage system during heavy rainfall events. The current management control measures adopted by HKJC has been proven to be effective and sufficient in reducing environmental impacts by urine and manure. Therefore, no adverse water quality impact is anticipated.

5.5.1.2 Based on the current development parameters, the average dry weather flow to be generated from the proposed development is estimated to be about 60m^3/day. The 300mm diameter sewer currently utilised by TKOL II/III and 450mm diameter sewer along Chun Sing Street and Chun Yat Street are identified as possible sewerage connection point. The hydraulic capacity of the sewers downstream to the proposed connections would be sufficient. A separated sewerage impact (SIA) assessment report is submitted to ensure all sewage from the Project could be collected and treated before discharge. Therefore, no adverse water quality impact is anticipated.

Surface Runoff

5.5.1.3 During the operational phase, the Application Site will increase the area of impermeable surfaces and hence the peak surface runoff rates. Polluting substances from the Application Site such as dust and lubricant oil deposited and accumulated on the road surfaces may be washed into the drainage system during rainfall or road surface cleaning.

5.5.1.4 Sand traps may be provided at areas near stables, arenas, lungeing pens, horse walkers to prevent sand from being conveyed into the pipe system.

5.5.1.5 Besides, there will be use of pesticides for pest control within the PRS (e.g. administration buildings, auxiliary facilities, waste management and storage facilities, storage facilities, Coach Duty Rooms, etc) and fertilizer for vegetation (e.g. spelling yards). "Practices provided in Good Agricultural Practices for Crop Production" provided by Agriculture, Fisheries and Conservation Department (AFCD) shall be observed and implemented. To safeguard the safety of horses, pesticides will not be applied to the area with potential direct contact of horses (e.g. arenas, spelling yards, lungeing pens, horse walkers, etc.). Therefore, the area with pesticides application is limited, and thus the amount of pesticides would be limited. Also, the pest control service provider will submit a Pest Control Plan to the Club, to ensure that only the pesticides to be used would be safe to public and the equine population, environmental friendly, registered by AFCD and listed with the registration number. Besides, fertilizers should, as far as possible, be organic in nature, and be applied only to the required areas and at the right time, e.g. not to apply during heavy rainfall, or forecasted heavy rainfall. Both pesticides and fertilizers should be kept in a dry, clean and sheltered place and off of the ground, so they will not get caught in rainwater runoff. The surface runoff may still contain trace amount of chemicals during rainfall event. The surface runoff will be diverted to public drainage system, which will be discharged to Junk Bay, of which the water exchange is sufficient. Therefore, adverse water quality impact is not anticipated.

5.5.1.6 For the livestock rearing buildings (i.e. stables), surface drainage system would be provided for the external areas out of the building footprint to prevent rainwater ingress into the buildings. Therefore, adverse water quality impact is not anticipated.

5.5.1.7 As the surface runoff will be properly collected through drainage system with sand traps, adverse water quality impact is not anticipated with proper implementation of best management practices mentioned in **Section 5.5.2**.

5.5.1.8 In addition, there might be maintenance works to be carried out after operation of the PRS. As the scale of the maintenance works is likely to be much smaller than that of the construction works, adverse water quality impact during the maintenance works is not anticipated. The good site practices as discussed in **Section 5.4.3** is also applicable.

5.5.2 Control Measures

Surface Runoff

5.5.2.1 Potential water quality impact may arise from surface runoff from paved area. Best Management Practices (BMPs) recommended in ProPECC PN1/23 for storm water discharge shall be implemented in order to ensure that the proposed works would not pollute the runoff during operation phase. Examples of the BMPs are shown as follows:

- Exposed surface shall be avoided to minimize soil erosion;
- Where appropriate, sand traps shall be provided to remove the pollutants from runoff/stormwater; and
- Existing surface channel's location within the TKOL II/III will be cleaned, maintained and inspected regularly before and after rainstorm.

5.6 Environmental Monitoring and Audit

5.6.1 Construction Phase

5.6.1.1 During construction phase, no adverse water quality impact is anticipated with the implementation of control measures. Nevertheless, site audit is recommended for the construction phase to ensure better environment. Regular site audits would be carried out to ensure proper implementation of pollution control measures.

5.6.2 Operational Phase

5.6.2.1 During operational phase, no adverse water quality impact is anticipated with the implementation of control measures. Thus, EM&A is not required for the operational phase.

5.7 Summary

5.7.1.1 During construction phase, pollution sources will be surface runoff, sewage from construction workforce and accidental spillage of chemicals. With proper implementation of the proposed control measures recommended in ProPECC PN 2/24, PN 1/23 and ETWB TCW No. 5/2005, e.g. provision of silt removal facilities and portable chemical toilets, etc., it is anticipated that there will be no adverse water quality impact during the construction phase.

5.7.1.2 During the operational phase, pollution sources will be sewage from stables, staff and visitors and surface runoff. Wastewater from waste handling processes and sewage from staff will be properly collected and directly diverted to the public sewerage system. Based on preliminary review, the connection points were identified with sufficient hydraulic capacity. A separate sewerage impact assessment report would be submitted. The surface runoff will also be properly collected by drainage system. With the proper implementation of proposed control measures recommended in ProPECC PN1/23 and "Practices provided in Good Agricultural Practices for Crop Production", it is anticipated that there will be no adverse water quality impact during the operational phase.

5.8 Summary of Sewerage Impact Assessment

5.8.1.1 Source of sewerage arising from the Project includes staffs, visitors and horse cleaning. Two sewerage connection points are identified for the proposed PRS, one at Chung Shing Street/ Chung Yat Street, and another one at manhole S11A currently used by TKOL II/III, and there will be proposed connections within the Application Site. The existing sewerage system downstream to the proposed connection point had been checked to have sufficient capacity. Therefore, no adverse sewerage impact is anticipated due to the proposed development.

6. Waste Management Implications

6.1 Legislation, Standards and Guidelines

6.1.1.1 The relevant legislation, standards and guidelines applicable to the present study for the assessment of waste management implication of both construction and operational phase include the following:

- Waste Disposal Ordinance (Cap. 354);
- Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N);
- Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C);
- Land (Miscellaneous Provisions) Ordinance (Cap. 28); and
- Public Cleansing and Prevention of Nuisances Regulation (Cap. 132BK);
- Relevant guidelines on handling of yard waste on EPD's website (https://www.epd.gov.hk/epd/english/environmentinhk/waste/manage_facility/ypark.html) and Y Park's website (https://www.ypark.hk/zh-hant/); and
- Other relevant guidelines (as listed in **Table 6.1**).

6.1.2 Waste Disposal Ordinance (WDO) (Cap. 354) and Subsidiary Regulations

6.1.2.1 The WDO prohibits any unauthorized disposal of wastes. Construction waste, defined under Cap. 354N of the WDO, refers to a substance, matter or thing which is generated from construction works. It includes all abandoned materials, whether processed or stockpiled or not, before being abandoned, but does not include sludge, screenings or matter removed or generated from desludging, desilting or dredging works.

6.1.2.2 Under the WDO, wastes can only be disposed of at designated waste disposal facilities licensed by EPD. Breach of this Ordinance can lead to a fine and/ or imprisonment. The WDO also stipulates the requirements for issuing licenses for the collection and transportation of wastes.

6.1.3 Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N)

6.1.3.1 Under the Waste Disposal (Charges for Disposal of Construction Waste) Regulation, construction waste delivered to a landfill for disposal must not contain more than 50% by weight of inert material. Construction waste delivered to a sorting facility for disposal must contain more than 50% by weight of inert material, and construction waste delivered to a Public Fill Reception Facilities for disposal must consist entirely of inert material.

6.1.4 Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C)

6.1.4.1 Under the WDO, the Waste Disposal (Chemical Waste) (General) Regulation provides regulations for chemical waste control, and administers the possession, storage, collection, transport and disposal of chemical wastes. EPD has also issued a 'guideline' document, the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992), which details how the Contractor should comply with the regulations on chemical wastes.

6.1.5 Land (Miscellaneous Provisions) Ordinance (Cap. 28)

6.1.5.1 The inert portion of Construction and Demolition (C&D) materials may be taken to public filling facilities including public filling area, public filling barging points and stockpiling areas. These facilities usually form part of land reclamation schemes and are operated by Civil Engineering and Development Department (CEDD). The ordinance requires Dumping Licenses (to be issued by CEDD) to be obtained by individuals or companies, who deliver inert C&D materials to the public filling facilities.

6.1.5.2 Individual licenses and windscreen stickers are issued for each vehicle involved. Public filling areas will accept only inert building debris, soil, rock and broken concrete. The material should, however, be free from marine mud, household refuse, plastic, metal, individual and chemical wastes, animal and vegetable matters and any other materials considered unsuitable by the Filling Supervisor.

6.1.6 Public Cleansing and Prevention of Nuisances Regulation (Cap. 132BK)

6.1.6.1 This regulation provides further control on illegal dumping of litter or waste on unauthorized (unlicensed) sites.

6.1.7 Other Relevant Guidelines

6.1.7.1 This regulation provides further control on illegal dumping of litter or waste on unauthorized (unlicensed) sites. An offence of this regulation would result in a fine and/or imprisonment.

Table 6.1 Other Relevant Documents and Guidelines

Bureau / Department	Documents / Guidelines / Technical Circulars
Development Bureau	• Works Branch Technical Circular (WBTC) No. 2/93, Public Dumps • WBTC No 2/93B, Public Filling Facilities • WBTC No. 16/96, Wet Soil in Public Dumps • WBTC Nos. 4/98 and 4/98A, Use of Public Fill in Reclamation and Earth Filling Project • WBTC No. 12/2000, Fill Management • WBTC No. 19/2001, Metallic Site Hoardings and Signboards • WBTC No. 12/2002, Specification Facilitating the Use of Recycled Aggregates • ETWBTC No. 22/2003 & 22/2003A, Additional Measures to Improve Site Cleanliness and Control Mosquito Breeding on Construction Sites • ETWBTCW No. 19/2005, Environmental Management on Construction Sites • Development Bureau Technical Circular (Works) (DEVB TCW) No. 06/2010, Trip-ticket System for Disposal of Construction and Demolition Material • DEVB TCW No. 08/2010, Enhanced Specification for Site Cleanliness and Tidiness • DEVB TCW No. 09/2011, Enhanced Control Measures for Management of Public Fill
Environment Bureau	• Hong Kong Blueprint for the Sustainable Use of Resources 2035 (2021)
CEDD	• Project Administration Handbook for Civil Engineering Works in 2020, Management of C&D Materials • CEDD TC No. 11/2019, Management of Construction and Demolition Materials
EPD	• Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes • A Guide to the Chemical Waste Control Scheme • A Guide to the Registration of Chemical Waste Producers • Monitoring of Solid Waste in Hong Kong

6.2 Construction Phase

6.2.1 Impacts Evaluation

General

6.2.1.1 The major construction activities of the Project which would potentially result in generation of waste include:

- Site clearance;
- Site formation;
- Replacement of top soil for areas with horses' direct contact;
- Construction of buildings and structures;
- Installation of pipeline and utilities; and
- Temporary site office.

6.2.1.2 A variety of different types of waste would be generated during the construction phase that can be divided into the following distinct categories based on their compositions:

- Inert and non-inert C&D materials;
- Chemical wastes; and
- General refuse.

C&D Materials

6.2.1.3 The major waste source of the Project during construction phase is expected to be C&D materials, generated from site clearance, site formation, replacement of top soil, site excavation and construction of buildings and structures. The estimated amount of different type of wastes to be generated during construction phase is summarized in **Table 6.2**. It should however be noted that these quantities are initial estimates only and would need to be further reviewed and updated as the design progresses.

Table 6.2 Estimated Amount of Different Type of Wastes to be Generated during Construction Phase

Source	Waste Type	Total Generated (m^3)	Total On-site Reused (m^3)	Total Disposed (m^3)	Disposal Location
The Project	Soft inert material [1]	~4,470	~490	~3,980	Tuen Mun Area 38 Fill Bank
The Project	Hard inert C&D material [2]	200	0	200	Tuen Mun Area 38 Fill Bank
The Project	Non-inert C&D material [3]	~8,010	0	~8,010	West New Territories (WENT) Landfill

Notes:

[1] "Soft inert C&D Material" mainly refers to excavated soil, etc.

[2] "Hard inert C&D Material" mainly refers to rock and artificial hard materials (AHM). AHM includes, but not limited to, broken concrete, asphalt, bitumen, granular materials, debris, and rubble, etc.

[3] "Non-inert C&D Material" involved in the Project includes top soil, vegetation, timber and steel. In contrast to public fill, non-inert waste is not suitable for land reclamation and subject to recovery of reusable/ recyclable items, is disposed of at landfills as last resort.

6.2.1.4 Inert soft C&D materials will be reused on-site as far as practicable, while hard inert C&D material and non-inert C&D materials will not be reused on-site as these non-inert materials are not suitable to be reused in site formation and superstructure construction. For non-inert materials, on-site segregation and off-site recycling for recyclables shall be considered as far as practicable and disposal at landfills shall only be considered as a last resort. Timber/ woody materials from site preparation works will be sent to the Yard Waste Recycling Centre in Y-Park for recycling as far as possible.

6.2.1.5 In case of C&D material disposal exceeding 50,000m^3, more detailed waste quantity estimations and the corresponding management options will be documented in the Construction and Demolition Material Management Plan (C&DMMP), which will be prepared during detailed design stage for submission to Public Fill Committee for approval in accordance with Section 4.1.3 "Construction and Demolition Materials" of the Project Administration Handbook for Civil Engineering Works.

6.2.1.6 With proper implementation of good construction site practices recommended in in Section **6.2.2**, the on-site handling and reuse of inert C&D materials would not cause adverse environmental impacts.

Chemical Waste

6.2.1.7 Chemical wastes are likely to be generated from the construction activities and associated facilities may include:

- Scrap batteries or spent acid/ alkali from their maintenance;
- Used paint, engine oils, hydraulic fluids and waste fuel;
- Spent mineral oils/ cleansing fluids from mechanical machinery; and
- Spent solvents/ solutions, some of which may be halogenated, from equipment cleansing activities.

6.2.1.8 Chemical waste may pose serious environmental, health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the Waste Disposal (Chemical Waste) (General) Regulation and the *Code of Practice on the Packaging, Labelling and Storage of Chemical Waste*. These hazards may include:

- Toxic effects to workers;
- Adverse effects on water quality from spills; and
- Fire hazards.

6.2.1.9 The amount of chemical waste as it will be dependent on the Contractor’s on-site maintenance practice and the quantities of plant and vehicles utilised. Nevertheless, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent produced from plant maintenance, will be small and in the order of a few hundred litres per month.

6.2.1.10 Suitable arrangements for the storage, handling, transport and disposal of chemical wastes shall be made in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Waste* published by the EPD. Chemical waste should be collected by a licensed chemical waste collector and to be disposed of at a licensed chemical waste treatment and disposal facility. Wherever possible, opportunities for the reuse and recycling of materials will be taken. Control measures for chemical wastes are detailed in

Section 6.2.2. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts are not expected.

General Refuse

6.2.1.11 The general refuse generated by the construction workforces mainly consists of food waste, waste paper, aluminium cans and waste paper. The general refuse will require off-site disposal.

6.2.1.12 Effective collection of site waste will be required to prevent waste materials being blown around by wind, flushed or leached into the marine environment, or creating an odour nuisance or pest and vermin problem. Waste storage areas shall be well maintained and cleaned regularly. In addition, disposal of waste at sites other than approved waste transfer or disposal facilities shall be prohibited. Recycling and reuse of recyclable materials would be considered prior to disposal.

6.2.1.13 The number of work force (clerical staff and workers) to be employed for the Project is not available at this stage, but it is anticipated to be about 200 - 400 workforce for the Project. Based on the generation rate of 0.65 kg/person/day, the total refuse generated per day would be up to 260kg/day. As mentioned in **Section 2.3**, the duration of construction will be about 3 years. Therefore, the estimated amount of general refuse during construction phase is anticipated to up to 244 tonnes (assuming 26 working days per month). Given the proper implementation of good site practices as detailed in **Section 6.2.2**, adverse environmental impacts are not anticipated.

6.2.2 Control Measures

6.2.2.1 The general practices for construction phase are recommended based on the waste management hierarchy principles. Recommendations of good site practices, waste reduction measures as well as waste transportation, storage and collection are described in following sub-sections.

Good Site Practices

6.2.2.2 Adverse waste management implications are not anticipated, provided that good site practices are strictly implemented. The following good site practices are recommended throughout the construction activities.

- Nomination of an approved personnel, such as a site manager, to be responsible for the implementation of good site practices, arrangements for collection and effective disposal to an appropriate facility, of all waste generated at the site;
- Training of site personnel in site cleanliness, appropriate waste management procedures and concepts of waste reduction, reuse and recycling;
- Provision of sufficient waste disposal points and regular collection for disposal;
- Appropriate measures to minimise windblown litter and dust during transportation of waste by transporting waste in enclosed containers;
- Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors; and
- A Waste Management Plan (WMP) should be prepared as a part of the Environmental Management Plan (EMP) by the Contractor, as recommended in the ETWB TCW No.

19/2005 Environmental Management on Construction Sites. The EMP should be submitted to the Authority's Representative for approval.

Waste Reduction Measures

6.2.2.3 Amount of waste generation can be significantly reduced through good management and control. Waste reduction is best achieved at the planning and design phase, as well as by ensuring the implementation of good site practices. The following recommendations are proposed to achieve reduction:

- Segregate and store different types of waste in different containers, skip or stockpiles to enhance reuse or recycling of materials and their proper disposal;
- Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste;
- Sort out debris from removal works to recover reusable/ recyclable portions (i.e. soil, broken concrete, metal etc.); and
- Provide training to workers on the importance of appropriate waste management procedures, including waste reduction, reuse and recycling.

6.2.2.4 In addition to the above recommendations, specific reduction measures are recommended for the specific waste types so as to minimise environmental impacts during handling, transportation and disposal of waste.

Storage, Collection and Transportation of Waste

6.2.2.5 Storage of waste on site may induce adverse environmental implications if not properly managed. The following recommendation should be implemented to minimise the impacts.

- Non-inert C&D materials (if any) should be handled and stored well to ensure secure containment;
- Stockpiling area should be provided with covers and water spraying system to prevent materials from wind-blown or being washed away; and
- Different locations should be designated to stockpile each material to enhance reuse.

6.2.2.6 The collection and transportation of waste from works area to respective disposal sites may also induce adverse environmental impacts if not properly managed. The following recommendation should be implemented to minimise the impacts:

- Remove waste in timely manner;
- Employ the trucks with cover or enclosed containers for waste transportation;
- Obtain relevant waste disposal permits from the appropriate authorities; and
- Disposal of waste should be done at licensed waste disposal facilities.

6.2.2.7 All dump trucks engaged on site should be equipped with Global Positioning System (GPS) or equivalent automatic system for real time tracking and monitoring of their travel routings and parking locations to prohibit illegal dumping and landfilling of C&D materials.

6.2.2.8 In addition to the above measures, other measures on handling the excavated C&D materials, chemical waste and general refuse from construction phase are recommended in the following subsections.

C&D Materials

6.2.2.9 Wherever practicable, C&D materials should be segregated from other waste to avoid contamination and ensure acceptability at Public Fill Reception Facilities areas or reclamation sites. The following reduction measures should be implemented in handling the C&D materials.

- Maintain temporary stockpiles and reuse excavated fill material for backfilling;
- Carry out on-site sorting;
- Make provisions in the Contract documents to allow and promote the use of recycled aggregates where appropriate; and
- Implement a trip-ticket system in accordance with DEVB TCW No. 6/2010 Trip Ticket System for Disposal of Construction and Demolition Materials, if dumping trucks are required, for each works contract to ensure that the disposal of C&D materials is properly documented and verified.

6.2.2.10 Details of the recommended on-site sorting and reuse of C&D materials is given below.

On-site Sorting of C&D Materials

6.2.2.11 All C&D materials arising from the construction would be sorted on-site to recover the inert C&D materials and reusable and recyclable materials prior to disposal off-site. Non-inert portion of C&D materials should also be reused whenever possible and be disposed of at landfills as a last resort.

6.2.2.12 The Contractor would be responsible for devising a system to work for on-site sorting of C&D materials and promptly remove all sorted and processed material arising from the construction activities to minimise temporary stocking on-site. It is recommended that the system should include the identification of the source of generation, estimated quantity, arrangement for on-site sorting and/ or collection, temporary storage areas, and frequency of collection by recycling Contractors or frequency of removal off-site.

Reuse of C&D Materials

6.2.2.13 It is anticipated that C&D surplus materials would be generated throughout the construction stage. The construction programme shall be reviewed during the detailed design stage to maximise the quantity of on-site reuse of surplus C&D materials whenever opportunity arises.

Use of Standard Formwork, Pre-cast Walls and Planning of Construction Materials Purchasing

6.2.2.14 Standard formwork should also be used as far as practicable in order to minimise the arising of C&D materials. The use of more durable formwork (e.g. metal hoarding), pre-cast walls or plastic facing should be encouraged in order to enhance the possibility of recycling. The purchasing of construction materials should be carefully planned in order to avoid over ordering and wastage.

Provision of Wheel Wash Facilities

6.2.2.15 Wheel wash facilities have to be provided at the site entrance before the trucks leave the works area. Dust disturbance due to the truck transportation to the public road network could be minimised by such arrangement.

Chemical Waste

6.2.2.16 For those processes which generate chemical waste, it may be possible to find alternatives to eliminate the use of chemicals, to reduce the generation quantities or to select a chemical type of less impact on environment, health and safety as far as possible.

6.2.2.17 If chemical waste is produced at the construction site, the Contractors should register with EPD as chemical waste producers and follow the guidelines stated in the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*. Chemical waste should be stored in appropriate containers and collected by a licensed chemical waste collector. Chemical waste (e.g. spent lubricant oil) should be recycled at an appropriate facility as far as possible, while the chemical waste that cannot be recycled should be disposed of at either the Chemical Waste Treatment Centre (CWTC), or another licensed facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

6.2.2.18 Any unused chemicals or those with remaining functional capacity should be collected for reuse as far as practicable.

General Refuse

6.2.2.19 General refuse should be stored in enclosed bins separately from construction and chemical waste. Recycling bins should also be placed to encourage recycling. Preferably enclosed and covered areas should be provided for general refuse collection, and routine cleaning for these areas should also be implemented to keep these areas clean. A reputable waste collector should be employed to remove general refuse on a daily basis. It is expected that such arrangement would minimise potential environmental impacts.

6.3 Operational Phase

6.3.1 Impacts Evaluation

Wastes from Stables

6.3.1.1 Wastes generated from proposed stables mainly consists of bedding paper scraps, horse feed and horse excretion. With reference to the Approved EIA Report for Main Arena of the 2008 Olympic Equestrian Event (AEIAR-097/2006), the predicted daily waste amount produced from a stable that accommodates 216 horses would be approximately 23 tonnes, the predicted daily waste amount from the proposed stables that will only accommodate not more than 100 horses would be approximately 11 tonnes. Wastes from stables are regularly cleared and stockpiled in the enclosed containers inside the proposed manure handling before collection by licensed waste collector engaged by HKJC. The collected stable wastes will be delivered to the Animal Waste Composting Plant (AWCP) in Ngau Tam Mei for further processing.

General Refuse

6.3.1.2 During the operational phase of the Project, general refuse such as waste paper, food waste and plastic would be generated by on-site staff and visitor. The area outside the proposed stables will also be cleaned regularly to ensure they are free from general refuse. The number of on-site staffs and visitors per day shall range from 45 to 50 and 200 to 350 respectively. For conservative assessment, the total number of on-site staff and visitors is assumed to be 400 per day. With general refuse generation rate of 0.65kg/person/day, Municipal Solid Waste (MSW) disposal rate of 1.44kg/person/day and its recovery rate of 33% (reference to Monitoring of Solid Waste in Hong Kong 2023), the amount of general refuse to be generated during the operation phase will be about 2.15kg/person/day, and hence 860kg/day. Recyclable refuse such as paper and plastic arise from maintenance and operational activities should be separated from general refuse and recycled at recycling bins or recycling facilities as far as possible prior to disposal at landfill. With proper collection, storage and disposal as discussed in **Section 6.3.2**, adverse environmental impact is not anticipated.

Chemical Waste

6.3.1.3 Chemical waste will be generated from routine maintenance and servicing activities for emergency generators and other electrical and mechanical equipment during operational phase. Chemical waste, such as waste lubricating oil, waste paint and spent chemicals, are expected to be generated. The chemical waste should be properly handled and treated with special storage arrangements by licensed chemical waste collector according to the Waste Disposal (Chemical Waste) (General) Regulation, as discussed in **Section 6.3.2**. Chemical waste should be collected by a licensed chemical waste collector and to be disposed of at a licensed chemical waste treatment and disposal facility.

6.3.1.4 In addition, there might be maintenance works to be carried out after operation of the PRS. As the scale of the maintenance works is likely to be much smaller than that of the construction works, the amount of wastes generated during the maintenance works is likely be insignificant, in the order of few hundreds litres per month. The good site practices as discussed in **Section 6.2.2** is also applicable.

6.3.2 Control Measures

Wastes from Stables

6.3.2.1 Waste from horse stables (mainly the horse manure) would be collected on a regular basis following HKJC’s sanitary practices including the following:

- Stable waste will be stockpiled in properly enclosed containers;
- Stable waste will be collected by licensed waste collector daily on a regular basis; and
- Briefings would be given to stable staff on the sanitary practices.

6.3.2.2 The current management control measures adopted by existing stables of HKJC has been proven to be effective and sufficient in reducing nuisance and protecting the environment. These measures would be applied for the proposed stables under the Project.

General Refuse

6.3.2.3 General refuse generated by the Project will be properly collected with lidded bins and separated to recyclables and non-recyclable. The general refuse will be stored in enclosed containers to prevent windblown, vermin, water pollution and visual impact before collection by waste contractor.

6.3.2.4 The recyclables would be collected for off-site recycling. Non-recyclable material will be collected by authorised collectors and transferred to appropriate facilities. It is expected that such arrangement would minimise potential environmental impacts.

Chemical Waste

6.3.2.5 Chemical waste will be generated from routine maintenance and servicing activities for emergency generators and other electrical and mechanical equipment during operational phase. The producers should be registered with the EPD as chemical waste producers and follow the guidelines stated in the *Code of Practice on the Packaging, Labelling and Storing of Chemical Waste*.

6.3.2.6 The localised chemical waste storage areas should be located close to the source of waste generation for temporary storage and drum-type containers with proper labelling should be used.

6.3.2.7 Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidising, irritant, toxic, harmful, corrosive, etc.

6.3.2.8 Licensed chemical waste collector should be deployed to transport and dispose of the chemical wastes at the approved CWTC or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

6.4 Environmental Monitoring and Audit

6.4.1 Construction Phase

6.4.1.1 During construction phase, no adverse waste management implications is anticipated with the implementation of control measures. Nevertheless, site audit is recommended for the construction phase to ensure better environment. Regular site audits would be carried out to ensure proper implementation of control measures.

6.4.2 Operational Phase

6.4.2.1 During operational phase, it is anticipated that there will be no adverse waste management implications with the implementation of control measures. Thus, EM&A is not required for the operational phase.

6.5 Summary

6.5.1.1 During construction phase, different types of waste would be generated, including inert and non-inert Construction and Demolition ("C&D") materials, chemical wastes and general refuse. With proper implementation of the proposed good site practices, waste reduction measures and proper storage, collection and transportation of wastes, it is anticipated that there will be no adverse environmental impacts from waste management during the construction phase.

6.5.1.2 During the operational phase, wastes from stables, general refuse, and chemical waste will be properly collected, stored and disposed accordingly. With proper implementation of the proposed control measures, it is anticipated that there will be no adverse environmental impact from waste management during the operational phase.

7. Land Contamination

7.1 Legislation, Standards and Guidelines

7.1.1.1 The relevant legislations, standards and guidelines applicable to the present study for the assessment of land contamination include:

- Practice Guide for Investigation and Remediation of Contaminated Land, EPD, 2011 (Revised in April 2023);
- Guidance Manual for Use of Risk-Based Remediation Goals (RBRGs) for Contaminated Land Management, EPD, 2007 (Revised in April 2023); and
- Guidance Note for Contaminated Land Assessment and Remediation, EPD, 2007 (Revised in April 2023).

7.1.1.2 The EPD's Practice Guide include a summary of the general steps of a detail contamination assessment study. The Guidance Manual introduces risk-based approach in land contamination assessment and presents instructions for comparison of soil and groundwater data to the RBRGs for 54 chemicals of concern commonly found in Hong Kong. Meanwhile, based on the EPD's Guidance Note for Contaminated Land Assessment and Remediation, a contamination assessment evaluation should:

- Provide a clear and detailed account of the present use of the land and the relevant past land history, in relation to possible land contamination;
- Identify areas of potential contamination and associated impacts, risks or hazards; and
- Submit a plan to evaluate the actual contamination conditions for soil and/or groundwater, if required.

7.2 Description of the Environment

7.2.1.1 The historical and present land uses within the works area of the Project have been studied by desktop review, including aerial photographs, topographic maps and relevant information. In order to identify any historical land uses which may have the potential for causing land contamination, the development history within the Application Site has been reviewed with the aid of historical aerial photos between Year 1963 and Year 2023. The historical aerial photos are provided in **Appendix 7.1** and summary of the findings are given in **Table 7.1**.

Table 7.1 Historical Landuse of the Application Site

Year	Description
Year 1963	The Application Site was occupied by open sea, agricultural land and vegetation.
Year 1974	No significant change in land use was observed as compared with that from Year 1963.
Year 1983	No significant change in land use was observed as compared with that from Year 1963.
Year 1993	The Application Site was developed as a landfill. Site office was also observed.
Year 2003	The landfill was restored. The Application Site is occupied by vegetation. Site office, access road, leachate treatment plant and drainage channels were observed.

Year	Description
Year 2013	A concrete pavement was observed at the Upper Platform of the Application Site. A lagoon was also formed near the Lower Platform. No significant change was observed for the rest of the Application Site.
Year 2023	No significant change in land use was observed as compared with that from Year 2013.

7.2.2 Site Survey

7.2.2.1 A site survey was conducted in September 2024 to verify the findings of the desktop review and to identify any other land uses within the Application Site which might have the potential for causing soil and groundwater contamination. The site photos taken on-site was given in **Figure 7.1**. A site walkover checklist is given in **Appendix 7.2**.

7.2.2.2 Majority of the Application Site are covered by vegetation, with some paved area at Lower Platform across the Application Site. A concrete pavement was observed on Upper Platform. Nevertheless, no land contaminating activities were observed. On the Lower Platform, site office, leachate treatment plant and lagoon of TKOL II/III were observed. Nevertheless, the construction works of the Project will not affect these existing restored landfill facilities. Therefore, no land contamination potential from present land uses is anticipated.

7.2.3 Information from EPD

7.2.3.1 EPD is the owner of TKOL II/III, who has maintained the record of chemical waste producers, dangerous good licence, chemical spillage record and incident record. There is a valid chemical waste producer registration record, and also a licence for storage of diesel oils tank for 7,500 L Cat. 5 D.G. Nevertheless, as advised by EPD, there is neither chemical spillage record nor incident record related to land contamination. Therefore, no land contamination potential is anticipated. The correspondence with EPD is provided in **Appendix 7.3**.

7.3 Impacts Evaluation

7.3.1.1 The Project will be constructed on top of a restored landfill. Nevertheless, the construction works of the Project will only affect the top soil (i.e. 500mm only) of the restored landfill. Given the proper restoration works done by EPD, the top soil is unlikely to be contaminated. In addition, as discussed in **Section 7.2**, no other activity with land contamination potential is identified from historical and present land uses within the Application Site. Therefore, no land contamination potential within the Application Site is anticipated.

7.4 Environmental Monitoring and Audit

7.4.1.1 No land contamination potential within the Application Site is anticipated. EM&A is therefore not required.

7.5 Summary

7.5.1.1 Historical and present land uses within the Application Site have been reviewed. No land contaminating activities were identified within the Application Site. In addition, the construction works of the Project will only affect the top soil of the restored landfill. Given the proper restoration works done by EPD, the top soil is unlikely to be contaminated. Therefore, no land contamination potential within the Application Site is anticipated.

8. Ecology

8.1 Legislation, Standards and Guidelines

8.1.1.1 The relevant legislation and associated guidelines applicable to the ecological impact assessment include:

- Environmental Impact Assessment Ordinance (Cap. 499) and the associated Technical Memorandum (EIAO-TM);
- EIAO Guidance Note No. 3/2023 Flexibility and Enforceability of Mitigation Measures Proposed in an Environmental Impact Assessment Report;
- EIAO Guidance Note No. 6/2023 Some Observations on Ecological Assessment from the Environmental Impact Assessment Ordinance Perspective;
- EIAO Guidance Note No. 7/2023 Ecological Baseline Survey for Ecological Assessment;
- EIAO Guidance Note No. 10/2023 Methodologies for Terrestrial and Freshwater Ecological Baseline Surveys;
- Country Parks Ordinance (Cap. 208) and its subsidiary legislation, Country Parks and Special Areas Regulations (Cap. 208A);
- Marine Parks Ordinance (Cap. 476);
- Forests and Countryside Ordinance (Cap. 96) and its subsidiary legislation, the Forestry Regulations (Cap. 96A);
- Wild Animals Protection Ordinance (Cap. 170);
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);
- Town Planning Ordinance (Cap. 131); and
- Hong Kong Planning Standards and Guidelines (HKPSG).

8.1.1.2 This section also makes reference to the following international conventions and national legislation:

- The International Union for Conservation of Nature (IUCN) Red List of Threatened Species;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora ("CITES"). This Convention regulates international trade in animal and plant species considered to be at risk from such trade. The main categories of species relevant to Hong Kong are Appendices I and II. Species listed in Appendix I are species threatened with extinction that are or may be affected by trade; species listed in Appendix II are those that, while not necessarily under current threat of extinction, may become threatened unless trade is subject to strict regulation. Hong Kong's obligations under this Convention are enforced via the Protection of Endangered Species of Animals and Plants Ordinance;
- The Red List of of Threatened Species of the International Union for Conservation of Nature ("IUCN"). This Red List (see http://www.redlist.org) is considered the

authoritative publication to classify species as critically endangered, endangered, vulnerable, or lower-risk; and

- The People's Republic of China National Protection Lists of Important Wild Animals and Plants.

8.2 Criteria of Evaluating Species of Conservation Importance

8.2.1.1 Species of flora and fauna with conservation importance were given special attention. In accordance with Table 3, Annex 8 of the EIAO-TM, the ecological value of species was assessed in terms of protection status, distribution, and rarity. Flora or fauna species protected by the following laws/regulations, listed under the following conventions and/or endemic to Hong Kong will be considered to be species of conservation importance. However, this excludes exotic weeds, escaped cultivars or captive species, vagrants and introduced species which have lower ecological value. Species which are classified by IUCN as Least Concern (LC), Near Threatened (NT), Data Deficient (DD), or Not Evaluated (NE), and not covered by any other laws/regulations/conventions will not be considered of conservation importance in the present Study.

- The International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species;
- China Plant Red Data Book;
- China Species Red List;
- China Red Data Book of Endangered Animals;
- Category I or II protected species in mainland China;
- Threatened Species List of China's Higher Plants (Qin *et al*. 2017);
- Red List of China's Vertebrates;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- Forestry Regulations (Cap. 96A) which are subsidiary legislation of the Forests and Countryside Ordinance (Cap. 96);
- Wild Animals Protection Ordinance (Cap. 170) (except birds as all wild birds are protected under the ordinance but their conservation importance is not equal);
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586);
- PRC Wild Animal Protection Law;
- Plant species considered 'Rare' or 'Very Rare' listed by Corlett *et al*. (2000), or regarded as rare by Yip *et al*. (2010) where applicable; and
- Fauna species considered of concern in Fellowes *et al*. (2002).

8.3 Literature Review

8.3.1.1 The purpose of the literature review is to identify existing information on the habitats and species present within the assessment area. The following literature were reviewed:

- Approved Tseung Kwan O Outline Zoning Plan (No. S/TKO/32 exhibited on 17 October 2025);
- Preliminary Environmental Review Report for Recommended Short-term Infrastructure Provision Option – Tseung Kwan O Stage II/III Landfill;
- Preliminary Environmental Review Report for Recommended Long-term Infrastructure Provision Option – Tseung Kwan O Stage II/III Landfill;
- Feasibility Study for the Development of Public Riding School at Tseung Kwan O and Ma Yau Tong Final Report;
- Methodologies for monitoring fireflies in Hong Kong (Yiu Vor 2020);
- The Terrestrial Biodiversity Survey conducted by HKU;
- Annual reports and other publications of The Hong Kong Bird Watching Society;
- Porcupine! – Newsletter of Division of Ecology & Biodiversity of University of Hong Kong;
- Hong Kong Biodiversity – Newsletter of the Department of Agriculture, Fisheries and Conservation;
- AFCD Hong Kong Biodiversity Database; and
- AFCD Newsletters.

8.4 Ecological Survey Methodology

8.4.1.1 The Study Area is defined as the terrestrial areas within 100m area from the boundary of Application Site, including areas of associated works (e.g. site formation). In view of the ecological sensitivity of the Clear Water Bay Country Park (CWBCP), the Study Area also covers the CWBCP within 300m from the boundary of Application Site (Figure 1 of **Appendix 8.1**).

8.4.1.2 An ecological verification survey was conducted for the habitats, vegetation, mammals, bird species, reptiles and amphibians, butterflies and dragonflies, fireflies, and freshwater communities present within the assessment area. The survey programme is shown in **Table 8.1**. The habitat of the Study Area is mapped based on recent aerial photographs and detailed ground-truthing. The surveys were carried out in June 2024 during the wet season, primarily along the designated transect lines (Figure 2 of **Appendix 8.1**). Observations were also made in areas adjacent to these transect lines during the surveys. The methodology for the ecological surveys adhered to the technical guidelines outlined in Annex 16 of the EIAO-TM, as well as the relevant Guidance Notes (GN 7/2023 and GN 10/2023). Detail survey data is shown in Appendix A to Appendix J of **Appendix 8.1**. Data recorded within the entire Study Area are presented by habitats, while those recorded within the Application Site are also shown in a separate column for easy reference.

Habitat and Vegetation

8.4.1.3 Habitats within the Study Area were mapped based on aerial photos and ground truthing. Walk-over surveys were conducted at representative areas of each habitat type. Vascular plant species in each habitat type were identified and their relative abundance were recorded, with special attention to rare and protected species. Color photographs of all habitats encountered on site and of ecological features of special importance were taken. A habitat map of the Study Area was produced at a suitable scale using GIS software. Nomenclature of vascular plant species followed Hong Kong Herbarium (2021), whilst their rarity in Hong Kong followed Corlett *et al*. (2000) and Yip *et al*. (2010) where applicable.

Mammal

8.4.1.4 Mammals were recorded if sighted during the survey. All sightings, tracks, and signs of mammals found were recorded. As some mammal species, both non-flying and flying (e.g., bats), are nocturnal, night surveys will also be conducted. Nomenclature of mammals followed the Hong Kong Biodiversity Information Hub maintained by Agriculture, Fisheries and Conservation Department (AFCD 2024).

Avifauna

8.4.1.5 The avifauna of each habitat types within the Study Area were recorded during the survey. All avifauna seen or heard were identified and recorded. Signs of breeding (e.g. nests, recently fledged juveniles) if any, were also recorded. As some birds (e.g., owls, nightjars) are nocturnal, night surveys were also conducted. Ornithological nomenclature followed the Hong Kong Biodiversity Information Hub maintained by Agriculture, Fisheries and Conservation Department (AFCD 2024).

Herpetofauna

8.4.1.6 Herpetofauna within the Study Area were recorded during the survey. All reptiles and amphibians sighted were recorded. As herpetofauna are mostly nocturnal, night surveys were carried out. Potential microhabitats of herpetofauna such as wall, fallen logs, litter, Modified Watercourse/nullah, underneath of stones or other materials, artificial container (e.g., pots) were searched during surveys to locate cryptic or secretive herpetofauna species. Amphibians were also identified by their calls during night surveys. Nomenclature followed the Hong Kong Biodiversity Information Hub maintained by Agriculture, Fisheries and Conservation Department (AFCD 2024).

Butterfly and Odonata

8.4.1.7 Butterflies and odonates observed within the Study Area were identified and their abundance recorded by habitat. Butterflies and odonates encountered outside survey transects but within the Study Area were also recorded in order to produce a complete species list. Nomenclature of butterfly and odonate followed the Hong Kong Biodiversity Information Hub maintained by Agriculture, Fisheries and Conservation Department (AFCD 2024).

Firefly

8.4.1.8 Firefly survey were conducted shortly after dusk and in the nighttime by direct observation and active searching along transect and its vicinity within the Study Area, with particular attention given to their potential habitats (vegetation and watercourses). During the survey, lighting devices were switched off and fireflies occurring on both sides of the transect were detected, identified and counted. Active searching of the ground were also carried out during the survey to locate any flightless adults and larvae. Nomenclature followed the Hong Kong Biodiversity Information Hub maintained by Agriculture, Fisheries and Conservation Department (AFCD 2024).

Freshwater Communities

8.4.1.9 Surveys of freshwater communities were undertaken at the stream/watercourse (either natural and man-made) likely to be affected by the Project by means of active searching and direct observation. All freshwater fauna encountered will be identified to the lowest possible taxonomic level, and the nomenclature for fish followed the Hong Kong Biodiversity Information Hub maintained by Agriculture, Fisheries and Conservation Department (AFCD 2024).

Table 8.1 Ecological Survey Programme

Survey	2024
	Jun
Habitat / Vegetation	D
Mammal	D + N
Avifauna	D + N
Herpetofauna	D + N
Butterfly and Odonate	D
Firefly	N
Freshwater Communities	D + N

Note:

[1] D: Day Time; N: Night/evening Time

8.5 Ecological Baseline Conditions

8.5.1 Literature Review

Preliminary Environmental Review Report for Recommended Short-term Infrastructure Provision Option – Tseung Kwan O Stage II/III Landfill

8.5.1.1 Ecological survey had been conducted in June 2021 in this preliminary environmental review. Six habitats had been identified in the area, namely Channels, Developed Area, Mixed Woodland, Plantation, Turfgrass land, and Watercourse, where Turfgrass Land and Plantation being the most common habitat in the area. The ecological value of Turfgrass Land was considered as Low while Plantation was considered as Low to medium. Species of conservation importance had been identified, including four flora species, five avifauna, one herpetofauna, one mammal and two freshwater species. Most of these species were located in the Mixed Woodlands and Natural Watercourse within the CWBCP. Locations of these species are shown in Figure 3a of **Appendix 8.1**.

Preliminary Environmental Review Report for Recommended Long-term Infrastructure Provision Option – Tseung Kwan O Stage II/III Landfill

8.5.1.2 Ecological survey had been conducted in 2021, 2023 and 2024 in this preliminary environmental review. Six habitats had been identified in the area, namely Developed Area, Mixed Woodland, Plantation, Turfgrass Land, Modified Watercourse and Natural Watercourse, where Turfgrass Land and Plantation with low ecological value being the most common habitat in the area. Species of conservation importance had been identified, including four flora species, six avifauna, one herpetofauna, five mammal and two freshwater species. Most of these species were located in the Mixed Woodlands and Natural Watercourse located within the CWBCP and few were located in the Plantation and Turfgrass Land of the Study Area. Locations of these species are shown in Figure 3a of **Appendix 8.1**.

Clear Water Bay Country Park

8.5.1.3 Clear Water Bay Country Park (CWBCP) spans approximately 615 hectares on the Clear Water Bay Peninsula, extending from Hang Hau to Joss House Bay and eastward to Lung Ha Wan (AFCD 2023). CWBCP features diverse habitats, primarily dominated by shrubland and plantations, with smaller areas of woodland and feng shui woods. Common plant species include Ivy Tree (*Schefflera heptaphylla*), Lance-leaved Sterculia (*Sterculia lanceolata*), and various pine species.

8.5.1.4 Fauna within CWBCP includes common bird species such as the Chinese Bulbul (*Pycnonotus sinensis*) and Spotted Dove (*Steptopelia chinensis*), as well as unusual species such as the Chinese Francolin (*Francolinus pintadeanus*) and Black-eared Kite (*Milvus migrans*). Coastal regions near Tai Hang Tun and Lung Ha Wan frequently host Common Gulls (*Larus canus*). The park's abundant flora supports numerous butterfly species, including the Common Mormon (*Papilio polytes*) and Glassy Tiger (*Parantica aglea melanoides*). Mammals like the Wild Boar (*Sus scrofa*) and Masked Palm Civet (*Paguma larvata*) are occasionally observed.

Conservation Area

8.5.1.5 Areas adjoining the Clear Water Bay Country Park around Clear Water Bay Road in the west is zoned Conservation Area (CA). According to the Explanatory Statement for Approved Clear Water Bay Peninsula South Outline Zoning Plan (No. S/SK-CWBS/2), the CA is designated to safeguard the well-vegetated and undisturbed hillslopes extending from the Country Park. It also provides a buffer for the sensitive natural system in the Country Park. The CA is over 450m away from the nearest boundary of the Application Site, and separated by the CWBCP. The Application Site would not encroach into these CAs.

8.5.2 Survey Results

Habitats

8.5.2.1 Seven types of habitats were identified, Developed Area, Mixed Woodland, Modified Watercourse, Natural Watercourse, Plantation, Shrubland and Turfgrass Land, with Mixed Woodland and Turfgrass Land being the dominant habitat. The area of each habitat was calculated, and these are presented in **Table 8.2**. Habitat map and representative photos of the habitats are available in Figure 3 and Figure 4 of **Appendix 8.1**. Plant species and their relative abundance within each habitat are listed in Appendix A of **Appendix 8.1**.

Table 8.2 Size of Habitats within the Study Area

Habitat	Application Site [1] [2] [3]		Study Area [1] [2]	
	Size (ha)	Length (m)	Size (ha)	Length (m)
Developed area	0.25	NA	7.19	NA
Mixed woodland	NA	NA	31.93	NA
Modified watercourse	NA	99	NA	4,261
Natural watercourse	NA	NA	NA	849
Plantation	0.25	NA	11.35	NA

Habitat	Application Site [1] [2] [3]		Study Area [1] [2]	
	Size (ha)	Length (m)	Size (ha)	Length (m)
Shrubland	NA	NA	5.37	NA
Turfgrass land	4.13	NA	19.65	NA
Total	4.63	99	75.49	5,110

Notes:

[1] Habitat sizes / lengths are round-off figures

[2] NA – Not applicable

[3] Including areas of associated works (e.g. site formation)

Habitats within the Study Area

8.5.2.2 Developed Area, Mixed Woodland, Modified Watercourse, Natural Watercourse, Plantation, Shrubland and Turfgrass Land are the seven types of habitats which could be identified within the Study Area. The Study Area was primarily dominated by Mixed Woodland and Turfgrass Land, accounting for 41.5% and 25.6% of the total area respectively.

Developed Area

8.5.2.3 Developed Area was found within the Application Site and to the west of the Application Site. This habitat consisted of anthropogenic structures such as roads and buildings. The Developed Area within the Application Site comprised of roads and the roads were paved with concrete, providing limited space for the growth of vegetation. The existing access road, which will be widened, is also a Developed Area. In general, this habitat was prone to human disturbance and vegetation recorded were mainly weedy species such as *Bidens alba, Eleusine indica* and *Wedelia trilobata*.

Mixed Woodland

8.5.2.4 Mixed Woodland stands were identified near the boundary of the Study Area and were located to the northeast and south of the Application Site. Mixed Woodland was found within CWBCP. Mixed Woodland outside CWBCP was in continuum with Mixed Woodland within CWBCP and they had similar floristic composition. The tree canopies reached 8 to 16 meters. This habitat had been a Plantation and the tall trees were Plantation species such as *Acacia* spp., *Eucalyptus* spp. and *Pinus massoniana*. However, this habitat has been successed to a Mixed Woodland with some pioneer native trees species, such as *Mallotus paniculatus* and *Schefflera heptaphylla*, colonized and reached the canopies. The understorey was mainly consisted of shade-tolerant shrubs such as *Psychotria asiatica* and *Maesa perlarius*, and seedlings the whips of trees. Climbers were also commonly encountered in this habitat, the representative species are *Piper kadsura* and *Millettia dielsiana*.

Modified Watercourse

8.5.2.5 Numerous Modified Watercourse in the Study Area were built within the landfill for the purpose of drainage. Some sections of Modified Watercourses fell within CWBCP. This habitat was completely man-made and paved with concrete. The concrete surface provided limited opportunities for the growth of vegetation, only very few vegetation was found in this habitat.

Natural Watercourse

8.5.2.6 Natural Watercourses were identified within Mixed Woodland outside the Project but within the Study Area. Most watercourses fell within CWBCP. In general, these watercourses were natural with beds composed of stones. Most of them were seasonal watercourses. Hydrophilic species, such as, *Acorus gramineus* and *Pogonatherum crinitum* were commonly encountered in this habitat. Riparian vegetation, such as *Cleistocalyx nervosum* and *Adina pilulifera*, was also abundant along the two sides of the watercourses. Climbers, namely *Pothos chinensis*, were also commonly encountered in this habitat.

Plantation

8.5.2.7 Patches of Plantation were identified on the landfill platforms and at the engineering slopes within Study Area. Some patches of Plantation fall within CWBCP. The canopies of this habitat were mainly composed of exotic Plantation species such as *Eucalyptus* spp., *Acacia* spp. and *Ficus microcarpa*. In general, the understorey was poorly developed and was dominated by weedy species such as *Bidens alba, Panicum maximum* and *Wedelia trilobata*.

Shrubland

8.5.2.8 Patches of Shrubland were found within the Study Area. All of the Shrubland fall within CWBCP. These Shrubland patches were on exposed slopes and subject to frequent hill fire. The canopy of this habitat was mainly open and the structure was simple. The dominated species were shrub and herb species such as *Rhodomyrtus tomentosa* and *Dicranopteris pedata*. In short, this habitat had low structural complexity and supported low flora diversity.

Turfgrass Land

8.5.2.9 Large patches of Turfgrass Land could be found in the landfill and this is the major habitat within the Study Area. Some part of the Turfgrass Land fell within CWBCP. This habitat was dominated by grasses and the representative species were *Ischaemum barbatum*, *Paspalum conjugatum*, *Imperata cylindrica*, *Panicum maximum* and *Wedelia trilobata*.

Habitats within the Application Site

8.5.2.10 Developed Area, Modified Watercourse, Plantation and Turfgrass Land are the four types of habitats which could be identified within the Application Site. The Application Site was primarily dominated by Turfgrass Land.

Developed Area

8.5.2.11 Developed Area within the Application Site comprised of roads and buildings. This habitat was highly disturbed with low ecological interest and mainly comprised landscaping and self-colonized species.

Modified Watercourse

8.5.2.12 Sections of Modified Watercourse were found within the Application Site. This habitat was completely man-made and paved with concrete, in which only sparse vegetation was found.

Plantation

8.5.2.13 Plantation were found highly fragmented and in small strips within the Application Site. This habitat has a simple floristic composition. The canopies of this habitat were composed of exotic Plantation species such as *Acacia confusa* and self-colonized *Leucaena leucocephala*. Native tree species such as *Macaranga tanarius* var. *tomentosa* was also recorded. In general, the understorey was poorly developed and was dominated by weedy species such as *Lantana camara*, *Bidens alba* and *Wedelia trilobata*.

Turfgrass Land

8.5.2.14 Large patches of Turfgrass Land were identified extensively across platform within the Application Site, which covered most of the area of the Application Site. The Turfgrass Land within the Application Site was majorly open area dominated by common ruderal species such as *Eragrostis tenella, Panicum maximum* and *Wedelia trilobata*.

8.5.3 Flora and Fauna within the Study Area and Application Site

Vegetation

8.5.3.1 A total of 302 plant species were recorded within the Study Area, among which 215 and 85 are known to be native and exotic to Hong Kong respectively and the remaining two species are of uncertain origin (Appendix A of **Appendix 8.1**). *Aquilaria sinensis, Commelina paludosa*, *Pavetta hongkongensis* and *Phymatodes longissima* are the four flora species of conservation importance recorded within the Study Area, among which some individuals of all the mentioned were also recorded within CWBCP. Locations of these species of conservation importance within the Study Area are shown in Figure 3b of **Appendix 8.1**.

8.5.3.2 Fourteen individuals of *Aquilaria sinensis* were recorded in the Mixed Woodland and Shrubland outside the Application Site but within the Study Area. Individuals located in the Mixed Woodland and Shrubland are wild and are considered as species of conservation importance, their locations are indicated in Figure 3b of **Appendix 8.1**. Eleven individuals recorded in Mixed Woodland and Shrubland fell within CWBCP. *Aquilaria sinensis* is common in the lowland forests and fung shui woods of Hong Kong (Corlett *et al*. 2000) and was included in the book "Rare and Precious Plants of Hong Kong" (Hu *et al*. 2003). In south China, particularly Hong Kong, it is threatened by illegal felling and over-exploitation and is listed in Appendix II of CITES and protected under Cap. 586 Protection of Endangered Species of Animals and Plants Ordinance in Hong Kong. Moreover, it is included in China Plant Red Data Book (Fu and Chin 1992) and Illustration of Rare & Endangered plant in Guangdong Province (Wu and Hu 1988), and wild individuals are listed in Category II of the List of Wild Plants under State Protection (State Forestry Administration & Ministry of Agriculture 1999). It is also categorized as "Vulnerable" in China Red Data Book (Fu and Chin 1992), the Threatened Species List of China's Higher Plants (Qin *et al*. 2017) and the IUCN Red List (IUCN 2024).

8.5.3.3 Two individuals of *Commelina paludosa* were recorded in Natural Watercourse outside the Application Site but within the Study Area. The species recorded fell within CWBCP. It is rare species in Hong Kong (Corlett *et al*. 2000).

8.5.3.4 Two individuals of *Pavetta hongkongensis* were found in Natural Watercourse outside the Application Site but within the Study Area, which were also found within CWBCP. Another individual was found in Mixed Woodland outside the Application Site but within the Study Area outside CWBCP. It is a shrub or small tree species which is considered common in fung shui woods and lowland forest by Corlett *et al.* (2000). It is protected under Cap. 96 Forests and Countryside Ordinance in Hong Kong.

8.5.3.5 Two individuals of *Phymatodes longissima* were recorded in Natural Watercourse outside the Application Site but within the Study Area. The species recorded fell within CWBCP. It is rare species in Hong Kong (Corlett *et al*. 2000).

8.5.3.6 *Araucaria heterophylla* is cultivated and exotic to Hong Kong, thus, it is not considered of conservation importance, despite being listed as Vulnerable in IUCN Red List.

8.5.3.7 *Canarium pimela*, *Casuarina equisetifolia*, and *Crateva trifoliata* are exotic to Hong Kong, thus, it is not considered of conservation importance, despite being considered rare by Corlett *et al*. (2000).

8.5.3.8 *Coccinia grandis* is cultivated, thus, it is not considered of conservation importance, despite being considered very rare by Corlett *et al*. (2000).

8.5.3.9 *Dalbergia* spp. are listed under Appendix II of CITES and protected under Cap. 586 Protection of Endangered Species of Animals and Plants Ordinance in Hong Kong as species in this genus is facing threat due to the overexploitation for its valuable wood (known as rosewood). In the current study, *Dalbergia benthamii* was recorded. As the recorded Dalbergia is climber which is not relevant to the timber exploitation. In addition, this species is very common in Hong Kong and considered as "common" by Corlett *et al.* (2000). Thus, it is not considered as species of conservation importance in the current Study.

8.5.3.10 *Dimocarpus longan* is exotic to Hong Kong, thus, it is not considered of conservation importance, despite being listed as Vulnerable in China Plant Red Data Book and in Threatened Species List of China's Higher Plants, and listed under Category II in the List of Wild Plants under State Protection (Part 1).

8.5.3.11 *Lagerstroemia speciosa* is cultivated and exotic to Hong Kong, thus, it is not considered of conservation importance, despite being protected under Cap. 96 in Hong Kong.

8.5.3.12 *Michelia x alba* is cultivated and exotic to Hong Kong, thus, it is not considered of conservation importance, despite being protected under Cap. 96 in Hong Kong.

8.5.3.13 *Pinus massoniana* is cultivated, thus, it is not considered of conservation importance, despite being listed as Endangered in China Plant Red Data Book.

8.5.3.14 *Terminalia catappa* is cultivated and exotic to Hong Kong, thus, it is not considered of conservation importance, despite being considered as very rare in Hong Kong (Corlett *et al*. 2000).

Fauna

Avifauna

8.5.3.15 22 species of bird were recorded within the Study Area in total. 11 bird species were recorded within the Application Site, of which one species is of conservation importance, while 21 species were recorded within the Study area outside the Application Site, including four species of conservation importance (Appendix B of **Appendix 8.1**). Most of the recorded species are common and widespread in Hong Kong. No breeding record, nesting or roosting location or behaviour was exhibited by the observed bird species. All wild birds are protected under Cap. 170 Wild Animals Protection Ordinance. List of bird species of conservation importance recorded within the Study Area is presented in **Table 8.14** for further evaluation. The abundance of each avifauna species recorded in each habitat within the Study Area is summed throughout the ecological survey period and tabulated in Appendix B of **Appendix 8.1**. Locations of these species are shown in Figure 3b of **Appendix 8.1**.

8.5.3.16 Four bird species of conservation importance recorded within the Study Area include Crested Serpent Eagle (*Spilornis cheela*), Black Kite (*Milvus migrans*), Collared Scops Owl (*Otus lettia*) and Black-throated Laughingthrush (*Garrulax chinensis*).

Butterfly

8.5.3.17 28 species of butterfly were recorded within the Study Area in total. 15 butterfly species were recorded within the Application Site with no species of conservation importance recorded, while 19 species were recorded within the Study area outside the Application Site, including one species of conservation importance (Appendix C of **Appendix 8.1**).

8.5.3.18 The butterfly species of conservation importance recorded within the Study Area is the Metallic Cerulean (*Jamides alecto*). It was recorded in Natural Watercourse within the Study area outside the Application Site. It is a very rare species found in Victoria Peak, Fung Yuen, Chuen Lung, Mui Wo. Location of this species is shown in Figure 3b of **Appendix 8.1**.

Odonate

8.5.3.19 Seven species of dragonfly were recorded within the Study Area in total. Five dragonfly species were recorded within the Application Site with no species of conservation importance recorded, while seven species were recorded within the Study area outside the Application Site, including one species of conservation importance (Appendix D of **Appendix 8.1**).

8.5.3.20 The odonate species of conservation importance recorded within the Study Area is the Hong Kong Clubtail (*Leptogomphus hongkongensis*). It was recorded in Mixed Woodland within the Study area outside the Application Site. It is considered as Local Concern by Fellowes *et al*. (2002) and dragonfly species of conservation interest under Reels (2019). It is a common species widely distributed in the woodlands adjacent to streams throughout Hong Kong. Location of this conservation importance species is shown in Figure 3b of **Appendix 8.1**.

Firefly

8.5.3.21 A firefly active searching survey was conducted within the Study Area with particular attention given to their potential habitats (such as vegetation and watercourses). Only one firefly species (a doubtfully identified species by Yiu, V. (2024)) was recorded in Natural Watercourse and Mixed Woodland within the Study area outside the Application Site (Appendix E of **Appendix 8.1**). Adult individuals were observed at the North-east Natural Watercourse and adjacent Mixed Woodland habitat, which is about 200m from the nearest works boundary. This firefly species is currently considered as “Species inquirenda” in Hong Kong and is not defined as species of conservation importance. It can be found in several locations such as Tai Po Kau, Shing Mun Reservoir and Tai Po Shan. Apart from the firefly species mentioned, no other firefly species of conservation importance was recorded within the Study Area.

Herpetofauna

8.5.3.22 Six species of reptile were recorded within the Study Area in total. Two reptile species were recorded within the Application Site, while six species were recorded within the Study Area outside the Application Site. No reptile species of conservation importance was recorded within the Study Area (Appendix F of **Appendix 8.1**).

8.5.3.23 Four species of amphibian were recorded within the Study Area in total. Two amphibian species were recorded within the Application Site, while four species were recorded within the Study area outside the Application Site. No amphibian species of conservation importance was recorded within the Study Area (Appendix G of **Appendix 8.1**).

Mammal - Terrestrial species

8.5.3.24 Two terrestrial mammal species were recorded within the Study Area in total. Two mammal species were recorded within the Application Site, while one species was recorded within the Study area outside the Application Site. No mammal species of conservation importance was recorded within the Study Area (Appendix H of **Appendix 8.1**).

Mammal - Bat species

8.5.3.25 Analysing echolocation calls recorded by bat detector (Wildlife Acoustics – Echo Meter Touch 2 PRO) within the Study Area during the surveys, four bat species were identified within the Study Area in total (Appendix I of **Appendix 8.1**). Due to the detection range of Echo Meter Touch 2 Pro and the relatively high habitat heterogeneity observed, it is not considered accurate to determine the exact habitat usage by the bat species recorded by ultrasonic bat detector. All bat species are protected under Cap. 170 Wild Animals Protection Ordinance and are considered as species of conservation importance. No roosting and breeding behaviour were directly observed during the survey period. Bat species recorded within the Study Area include Japanese Pipistrelle (*Pipistrellus abramus*), Least Pipistrelle (*Pipistrellus tenuis*), Lesser Yellow Bat (*Scotophilus kuhlii*) and Lesser Bamboo Bat (*Tylonycteris pachypus*).

Aquatic fauna

8.5.3.26 Nine aquatic fauna species were recorded within the Study Area in total. No aquatic fauna species was recorded within the Application Site, while nine species were recorded within the Study area outside the Application Site (Appendix J of **Appendix 8.1**). Two freshwater crab species, Hong Kong Freshwater Crab (*Nanhaipotamon hongkongense*) and Stream Crab (*Cryptopotamon anacoluthonis*) considered of conservation importance were recorded in Natural Watercourse and Modified Watercourse within the Study Area outside the Application Site. Location of these conservation importance species are shown in Figure 3b of **Appendix 8.1**.

8.6 Evaluation of Habitats and Species

8.6.1.1 The ecological importance of habitats within the Study Area as well as the Application Site was evaluated with reference to the criteria stipulated in Annex 8 of EIAO-TM (**Table 8.3** to **Table 8.12**).

8.6.1.2 With reference to Table 3, Annex 8 of the EIAO-TM, the ecological value of species recorded within the Study Area was assessed in terms of protection/conservation status (e.g. fauna protected under WAPO (except birds), and flora and fauna protected under regional/global legislation/conventions), species distribution (e.g. endemic), and rarity (e.g. rare or restricted).

Table 8.3 Evaluation of Developed Area within the Application Site*

Criterion	Description
Naturalness	Man-made
Size	About 0.25 ha
Diversity	Low floral diversity Low faunal diversity
Rarity	No flora species of conservation importance. No fauna species of conservation importance.
Re-creatability	Easy to re-create
Fragmentation	Fragmented
Ecological linkage	Not functionally linked to habitats of conservation importance
Potential value	Low
Nursery/breeding ground	No significant breeding ground observed.
Age	N/A
Abundance/richness of wildlife	Low abundance
Overall ecological value	Very Low

* Including areas of associated works (e.g. site formation)

Table 8.4 Evaluation of Modified Watercourse within the Application Site*

Criterion	Description
Naturalness	Man-made habitat
Size	About 99 m
Diversity	Very Low floral diversity Low faunal diversity
Rarity	No flora species of conservation importance. No fauna species of conservation importance.
Re-creatability	Easy to re-create
Fragmentation	None
Ecological linkage	No significant linkage with habitats of conservation importance
Potential value	Low
Nursery/breeding ground	No significant breeding ground observed.
Age	N/A
Abundance/richness of wildlife	Very Low abundance
Overall ecological value	Very Low

* Including areas of associated works (e.g. site formation)

Table 8.5 Evaluation of Plantation within the Application Site*

Criterion	Description
Naturalness	Man-made
Size	About 0.25 ha
Diversity	Low floral diversity Low faunal diversity
Rarity	No flora species of conservation importance. No fauna species of conservation importance.
Re-creatability	Medium. It would take several years to mature.
Fragmentation	Fragmented
Ecological linkage	Not functionally linked to habitats of conservation importance

Criterion	Description
Potential value	Low to medium
Nursery/breeding ground	No significant breeding ground observed.
Age	Up to 10 years
Abundance/richness of wildlife	Low fauna abundance.
Overall ecological value	Low

* Including areas of associated works (e.g. site formation)

Table 8.6 Evaluation of Turfgrass Land within the Application Site*

Criterion	Description
Naturalness	Man-made
Size	About 4.13 ha
Diversity	Low floral diversity Low faunal diversity
Rarity	No flora species of conservation importance. Fauna species of conservation importance: Black Kite *Milvus migrans*
Re-creatability	Easy to re-create
Fragmentation	None
Ecological linkage	Not functionally linked to habitats of conservation importance
Potential value	Low
Nursery/breeding ground	No significant record but may provide foraging ground for bird and bat species
Age	N/A
Abundance/richness of wildlife	Low abundance
Overall ecological value	Low

* Including areas of associated works (e.g. site formation)

Table 8.7 Evaluation of Developed Area within the Study Area

Criterion	Description
Naturalness	Man-made
Size	About 7.19 ha
Diversity	Low floral diversity Low faunal diversity
Rarity	Outside CWBCP: No flora species of conservation importance. No fauna species of conservation importance. Within CWBCP: No flora species of conservation importance. No fauna species of conservation importance.
Re-creatability	Easy to re-create
Fragmentation	Fragmented
Ecological linkage	Not functionally linked to habitats of conservation importance
Potential value	Low
Nursery/breeding ground	No significant records.
Age	N/A
Abundance/richness of wildlife	Low abundance
Overall ecological value	Very Low

Table 8.8 Evaluation of Modified Watercourse and Natural Watercourse within the Study Area

Criterion	Description	
	Modified Watercourse	**Natural Watercourse**
Naturalness	Man-made habitat	Natural
Size	About 4261 m	About 849 m
Diversity	Very Low floral diversity Low faunal diversity	Low floral diversity Low faunal diversity
Rarity	Outside CWBCP: No flora species of conservation importance. No fauna species of conservation importance. Within CWBCP: No flora species of conservation importance. Fauna species of conservation importance: Stream Crab *Cryptopotamon anacoluthon*, Hong Kong Freshwater Crab *Nanhaipotamon hongkongense*	Outside CWBCP: No flora species of conservation importance. No fauna species of conservation importance. Within CWBCP: Flora of conservation importance: *Commelina paludosa*, *Pavetta hongkongensis*, *Phymatodes longissimi* Fauna of conservation importance: Stream Crab *Cryptopotamon anacoluthon*, Hong Kong Freshwater Crab *Nanhaipotamon hongkongense*
Re-creatability	Easy to re-create	Low
Fragmentation	None	None
Ecological linkage	Some linkage with the adjacent Natural Watercourse	Functionally linked with the neighboring natural Mixed Woodland and Clear Water Bay Country Park
Potential value	Low	Low to medium
Nursery/breeding ground	Provide breeding habitats for amphibian and aquatic fauna species	Provide breeding habitats for amphibian and aquatic fauna species
Age	N/A	N/A
Abundance/richness of wildlife	Low abundance	Low abundance
Overall ecological value	Low to medium	Medium

Table 8.9 Evaluation of Mixed Woodland within the Study Area

Criterion	Description
Naturalness	Semi-natural
Size	About 31.93 ha
Diversity	Medium floral diversity Medium faunal diversity
Rarity	Outside CWBCP: Flora of conservation importance: *Aquilaria sinensis*, *Pavetta hongkongensis* No fauna species of conservation importance. Within CWBCP: Flora of conservation importance: *Aquilaria sinensis* Fauna of conservation importance: Crested Serpent Eagle *Spilornis cheela*, Black Kite *Milvus migrans*, Collared Scops Owl *Otus lettia*, Black-throated Laughingthrush *Garrulax chinensis*, Metallic Cerulean *Jamides alecto*, Hong Kong Clubtail *Leptogomphus hongkongensis*
Re-creatability	Low. It would take a long time to become woodland
Fragmentation	None
Ecological linkage	Functionally linked to woodland and other natural habitats within Clear Water Bay Country Park
Potential value	Medium. It could become woodland habitat of higher ecological value
Nursery/breeding ground	No significant record but may provide suitable nursery/breeding habitats for bird and terrestrial mammal species
Age	10 – 15 years
Abundance/richness of wildlife	Low to medium fauna abundance.
Overall ecological value	Medium

Table 8.10 Evaluation of Plantation within the Study Area

Criterion	Description
Naturalness	Man-made
Size	About 11.35 ha
Diversity	Low floral diversity Medium faunal diversity
Rarity	Outside CWBCP: No flora species of conservation importance. No fauna species of conservation importance. Within CWBCP: No flora species of conservation importance. No fauna species of conservation importance.
Re-creatability	Medium. It would take several years to mature.
Fragmentation	Fragmented, scattered Plantation habitats within the Study Area
Ecological linkage	Some area of Plantation is linked to neighbouring Mixed Woodland
Potential value	Low to medium
Nursery/breeding ground	No significant breeding ground observed.
Age	Up to 10 years
Abundance/richness of wildlife	Low to medium fauna abundance.
Overall ecological value	Low

Table 8.11 Evaluation of Shrubland within the Study Area

Criterion	Description
Naturalness	Natural
Size	About 5.37 ha
Diversity	Low floral diversity Low faunal diversity
Rarity	Within CWBCP: Flora of conservation importance: *Aquilaria sinensis* No fauna species of conservation importance.
Re-creatability	Medium. It would take several years to mature.
Fragmentation	Limited fragmentation
Ecological linkage	Linked to neighbouring Mixed Woodland
Potential value	Low to medium
Nursery/breeding ground	No significant breeding ground observed.
Age	N/A
Abundance/richness of wildlife	Low abundance
Overall ecological value	Low to medium

Table 8.12 Evaluation of Turfgrass Land within the Study Area

Criterion	Description
Naturalness	Man-made
Size	About 19.65 ha
Diversity	Low floral diversity Low to medium faunal diversity
Rarity	Outside CWBCP: No flora species of conservation importance. No fauna species of conservation importance. Within CWBCP: No flora species of conservation importance. No fauna species of conservation importance.

Criterion	Description
Re-creatability	Easy to re-create
Fragmentation	None
Ecological linkage	Not functionally linked to habitats of conservation importance
Potential value	Low
Nursery/breeding ground	No significant record but may provide foraging ground for bird and bat species
Age	N/A
Abundance/richness of wildlife	Medium abundance
Overall ecological value	Low

8.6.1.3 Species of flora and fauna with conservation importance were given special attention. With reference to Table 3, Annex 8 of the EIAO-TM, the ecological value of species was assessed in terms of protection status, distribution, and rarity. Flora or fauna species protected by the following laws/regulations, listed under the following conventions and/or endemic to Hong Kong, were considered to be species of conservation importance. However, this excludes exotic weeds, escaped cultivars or captive species, vagrants and introduced species which have lower ecological value. Species which are classified by IUCN as Near Threatened (NT), Least Concern (LC), Data Deficient (DD), or Not Evaluated (NE), and not covered by any other laws/regulations/conventions are not considered of conservation importance in the present study. Flora and fauna species of conservation importance recorded within the Study Area were evaluated with reference to EIAO-TM in **Table 8.13** and **Table 8.14**.

Table 8.13 Evaluation of Flora Species of Conservation Importance Recorded within the Study Area

Scientific Name	Conservation/Protection Status [1 2 3 5 6 7 8 9 10]	Distribution[4]	Rarity[4]	Location
Aquilaria sinensis	IUCN Red List of Threatened Species (2024): Vulnerable [7] Appendix II of CITES [3] Threatened Species List of China's Higher Plants: Vulnerable [8] China Plant Red Data Book: Vulnerable [5] Included in Illustrations of Rare & Endangered Plant in Guangdong Province [10] Listed in Rare and Precious Plants of Hong Kong [6] Cap. 586 [1] State Protection (Category II) [9]	Lowland forests and fung shui woods	Common	In Mixed Woodland outside the Application Site but within the Study Area. (Outside CWBCP) In Mixed Woodland outside the Application Site but within the Study Area. (Within CWBCP) In Shrubland outside the Application Site but within the Study Area. (Within CWBCP)
Commelina paludosa	N/A	Streamsides. Tai Mo Shan	Rare	In Natural Watercourse outside the Application Site but within the Study Area. (Within CWBCP)
Pavetta hongkongensis	Cap. 96A [2]	Fung shui woods and lowland forest	Common	In Mixed Woodland outside the Application Site but within the Study Area. (Outside CWBCP) In Natural Watercourse outside the Application Site but within the Study Area. (Within CWBCP)
Phymatodes longissima	N/A	Streamsides. Sai Kung, Wu Kau Tang, Sha Tau Kok, Ho Pui Reservoir, Clear Water Bay, Hei Ling	Rare	In Natural Watercourse outside the Application Site but within the Study Area. (Within CWBCP)

Scientific Name	Conservation/Protection Status 1 2 3 5 6 7 8 9 10	Distribution[4]	Rarity[4]	Location
		Chau and Lamma Island.		

Notes:

[1] Cap. 586 Protection of Endangered Species of Animals and Plants Ordinance

[2] Cap. 96A Forestry Regulations

[3] Convention on International Trade in Endangered Species (CITES) of Wild Flora and Fauna. Appendices I, II and III.

[4] Corlett *et al*. (2000). Hong Kong Vascular Plants: Distribution and Status.

[5] Fu & Chin (1992). China Plant Red Data Book – Rare and Endangered Plants.

[6] Hu *et al*. (2003). 100 Rare and Precious Plants of Hong Kong.

[7] IUCN (2024). The International Union for Conservation of Nature's Red List of Threatened Species (IUCN) Red List Version 2024.

[8] Qin *et al*. (2017). Threatened Species List of China's Higher Plants.

[9] State Forestry Administration & Ministry of Agriculture (1999). List of Wild Plants under State Protection (Part 1)

[10] Wu & Hu (1988). Illustration of Rare & endangered plant in Guangdong Province.

Table 8.14 Evaluation of Fauna Species of Conservation Importance Recorded within the Study Area

Species Name[1]	Conservation Status 2,3,4,5,6,7,8,9	Rarity and Distribution[1]	Location
Bird (Remark: all wild bird species are protected under Cap. 170 Wild Animals Protection Ordinance in Hong Kong)[2]			
Crested Serpent Eagle *Spilornis cheela*	CITES: Appendix II; List of Wild Animals under State Priority Conservation: Class II; Fellowes *et al*. (2002): (LC); Cap. 586	Common resident. Widely distributed in Shrublands on hillsides throughout Hong Kong.	Study Area outside the Application Site: MW (within CWBCP)
Black Kite *Milvus migrans*	CITES: Appendix II; List of Wild Animals under State Priority Conservation: Class II; Fellowes *et al*. (2002): (RC); Cap. 586	Common resident and winter visitor. Widely distributed in Hong Kong.	Application Site: TL (Outside CWBCP); Study Area outside the Application Site: MW (within CWBCP)
Collared Scops Owl *Otus lettia*	CITES: Appendix II; List of Wild Animals under State Priority Conservation: Class II; Cap. 586	Common resident. Widely distributed in Shrubland throughout Hong Kong.	Study Area outside the Application Site: MW (within CWBCP)
Black-throated Laughingthrush *Garrulax chinensis*	List of Wild Animals under State Priority Conservation: Class II	Common resident. Widely distributed in woodland and Shrubland throughout Hong Kong.	Study Area outside the Application Site: MW (within CWBCP)
Butterflies			
Metallic Cerulean Jamides alecto	-	Very Rare. Victoria Peak, Fung Yuen, Chuen Lung, Mui Wo	Study Area outside the Application Site: NWAT (within CWBCP)
Odonate			
Hong Kong Clubtail *Leptogomphus hongkongensis*	Fellowes *et al*. (2002): LC; Reels (2019): Dragonfly species of conservation interest	Common. Widely distributed in the woodlands adjacent to streams throughout Hong Kong.	Study Area outside the Application Site: MW (within CWBCP)
Bat Species (Remark: all bat species are protected under Cap. 170 Wild Animals Protection Ordinance in Hong Kong) [2]			
Japanese Pipistrelle *Pipistrellus abramus*	Cap. 170	Very Common. Widely distributed throughout Hong Kong.	Study Area
Least Pipistrelle *Pipistrellus tenuis*	Cap. 170	Uncommon. Ten-something records found in Nam Chung, Sheung Wo Hang, Lin Ma Hang, Plover Cove Country Park, Yuen Long, Shek Pik,	Study Area

Species Name[1]	Conservation Status [2,3,4,5,6,7,8,9]	Rarity and Distribution[1]	Location
		Deep Water Bay, Ho Pui and Ho Chung.	
Lesser Yellow Bat *Scotophilus kuhlii*	Fellowes *et al*. (2002): (LC); Cap. 170	Uncommon. Fairly widely distributed in countryside areas throughout Hong Kong.	Study Area
Lesser Bamboo Bat *Tylonycteris pachypus*	Fellowes *et al*. (2002): (LC); Cap. 170	Very Common. Fairly widely distributed in countryside areas throughout Hong Kong.	Study Area
Aquatic Fauna			
Hong Kong Freshwater Crab *Nanhaipotamon hongkongense*	Fellowes *et al*. (2002): PGC	Widely distributed within Hong Kong; recorded throughout the New Territories, Hong Kong, Lamma and Lantau Islands	Study Area outside the Application Site: MWAT (within CWBCP), NWAT (within CWBCP)
Stream Crab *Cryptopotamon anacoluthon*	Fellowes *et al*. (2002): PGC; IUCN Red List of Threatened Species (2024): Vulnerable	Widely distributed within Hong Kong; recorded throughout the New Territories, Hong Kong and Lantau Islands	Study Area outside the Application Site: MWAT (within CWBCP), NWAT (within CWBCP)

Notes:

[1] Agriculture, Fisheries and Conservation Department (2024). Species Database of the Hong Kong Biodiversity Information Hub

[2] Cap. 170 Wild Animals Protection Ordinance

[3] Cap. 586 Protection of Endangered Species of Animals and Plants Ordinance

[4] Convention on International Trade in Endangered Species (CITES) of Wild Flora and Fauna. Appendices I, II and III.

[5] Fellowes *et al*. (2002). Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong.

- For conservation status listed by Fellowes *et al*. (2002), letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.

[6] IUCN (2024). The International Union for Conservation of Nature's Red List of Threatened Species (IUCN) Red List Version 2024.

[7] National Forestry and Grassland Administration and the Ministry of Agricultural and Rural Affairs. (2023). List of Wild Animals under State Priority Conservation.

[8] Stanton *et al*. (2017). Distribution of *Cryptopotamon anacoluthon* (Kemp, 1918) (Crustacea: Brachyura: Potamidae), a freshwater crab endemic to Hong Kong.

[9] Stanton *et al*. (2018). Distribution of *Nanhaipotamon hongkongense* (Shen, 1940) (Crustacea: Brachyura: Potamidae), a freshwater crab endemic to Hong Kong.

Abbreviations:

- Conservation Status in Fellowes *et al*. (2002): LC = Local Concern, RC = Regional Concern, PGC = Potential Global Concern
- Habitats: DA = Developed Area; MW = Mixed Woodland; MWAT = Modified Watercourse; NWAT = Natural Watercourse; PL = Plantation; SH = Shrubland; TL = Turfgrass Land

8.7 Construction Phase

8.7.1 Impacts Evaluation – Direct Impacts

Habitat Loss

8.7.1.1 Permanent habitat loss is anticipated from the construction works (e.g. site formation) of the Project (4.63 ha). Habitat involved include Developed Area, Plantation, Turfgrass Land and Modified Watercourse. These habitats are expected to be occupied by permanent structures of the Project (e.g. buildings, paddocks, footpaths, carpark, etc.). The estimated loss of habitat during construction phase is shown on **Table 8.15**.

Table 8.15 Permanent Habitat Loss During Construction Phase

Habitat	Ecological Value	Area (ha) / Length (m)
		Application Site[1]
Developed area	Very Low	0.25 ha
Modified watercourse	Very Low	99 m
Plantation	Low	0.25 ha
Turfgrass land	Low	4.13 ha

Note:

[1] Including areas of associated works (e.g. site formation)

8.7.1.2 The impact due to loss of Developed Area (0.25 ha) is considered as **Insignificant** due to the man-made nature with low species diversity and simple structure.

8.7.1.3 For the area of Turfgrass Land being affected from the works at the Application Site (4.13 ha), it is of low ecological value due to the man-made nature with low species diversity and simple structure. The impact of habitat loss to Turfgrass Land is ranked as **Insignificant**.

8.7.1.4 For the area of Plantation being affected from the works at the Application Site (0.25 ha), it is relatively small in scale and also of low ecological value due to the fragmented nature of the habitat within the Application Site. The area of Plantation within CWBCP close to the Application Site is small in scale and low in ecological value. The potential impact of habitat loss to Plantation is ranked as **Insignificant**.

8.7.1.5 For the area of Modified Watercourse being affected from the works at the Application Site (99m), it is seasonal, small in scale and also of very low ecological value due to its man-made nature and low species diversity. The potential impact of habitat loss to Modified Watercourse is ranked as **Insignificant**.

8.7.2 Impacts Evaluation – Indirect Impact

Water Quality Issue due to Construction Site Runoff

8.7.2.1 During the construction phase, Watercourse near the works areas would potentially be impacted by surface runoff, especially during rainstorm. The surface runoff might be polluted by sedimentation from site surfaces; earth working areas and stockpiles, wash water from dust suppression sprays and wheel washing facilities; and chemicals spillage such as lubrication oils, solvents and petroleum products from maintenance of construction machinery and equipment, and sewage from the construction workforce.

8.7.2.2 Elevated suspended solids levels caused by site runoff could increase the suspended solids load in the water bodies and could decrease dissolved oxygen levels. A lower oxygen level would affect stationary species, whilst mobile species would tend to temporarily avoid the area. The result could be a temporary reduction in aquatic life abundance and/or change in distribution. With proper control of surface runoff as discussed in **Section 5.4.3**, the potential impact on the Watercourse due to runoff is considered **Minor**.

General Construction Disturbance

8.7.2.3 During the construction phase, increased human activity and machinery use at the Application Site will generate additional noise, dust and glare, potentially increase disturbance to nearby habitat, such as the Mixed Woodland. Most habitats are already disturbed by regular maintenance, such that most highly mobile wildlife in vicinity to the Application Site, such as birds and butterflies, will have already avoided or adapted to the disturbance. In general, construction works within country parks shall be conducted at daytime (i.e. 8am to 6pm) on non-public holiday between Mondays and Saturdays. Therefore, the impacts from disturbance are anticipated to be **Minor** with standard environmental controls.

Impact on Sites of Conservation Importance

8.7.2.4 The CWBCP is a site of conservation importance which may experience indirect disturbance during the construction phase. The site boundary of the Upper Platform is partially adjacent to the boundary of the CWBCP. Construction works within in the Application Site will generate additional noise, and dust, which may induce additional disturbance to fauna species within the CWBCP. Although the existing access road to the Upper Platform is already frequently used for landfill restoration works that have caused certain disturbance, given that the access road usage will increase significantly during construction phase, control measures should be implemented to minimize the additional impact on the CWBCP. With suitable control measures in place, the impact on CWBCP is deemed **Minor**.

8.7.2.5 Another site of conservation importance is a Conservation Area located over 450m from the Application Site and is separated by the CWBCP. As such, no significant impact is anticipated to the Conservation Area.

Impact on Species of Conservation Importance

8.7.2.6 Only one avifauna species (Black Kite) was recorded within the Application Site, while four flora and 13 fauna species of conservation importance were recorded outside the Application Site. One aquatic species of conservation importance, *Nanhaipotamon hongkongense*, was recorded in proximity but outside the boundary of the Application Site. Details of these species are available in **Table 8.13** and **Table 8.14**. Since the terrestrial species of conservation importance are highly mobile which enables them to avoid potential disturbance during the construction phase, and measures to control surface runoff in place as mentioned in **Section 5.4.3** to minimize disturbance to aquatic species of conservation importance, disturbance to these species during construction phase is considered **Minor**.

8.7.3 Control Measures

8.7.3.1 General environmental control measures should be adopted during the construction phase to minimize the indirect disturbance caused to nearby sensitive ecological resources. The key measures include the following items:

- Confining the works within the construction site boundary;
- Controlling access of site staff to avoid damage to the vegetation in surrounding areas; and
- Placement of equipment or stockpile in the existing disturbed/urbanized land within the site boundary of the Project to minimize disturbance to vegetated areas.
- The use of quiet plant and EPD's Quality Powered Mechanical Equipment (QPME);
- The use of movable noise barrier;

- The use of temporary noise screening structures or purpose-built temporary noise barriers;
- Installation of site hoarding as temporary noise barrier where construction works will be undertaken; and
- Compliance of control measures stipulated in the ProPECC PN 2/24 "Construction Site Drainage" to minimize water quality impact.

8.7.3.2 Regular site audits and inspections will be undertaken during the construction phase to ensure that the control measures have been properly implemented, all the aboveground works areas do not encroach on the CWBCP and all aboveground construction activities are confined within their boundaries.

8.7.3.3 To miminise light glare impact during the construction phase, construction work should be conducted during daytime as far as possible, and limit the use of artificial lightings to necessary applications such as security and safety measures within the construction site. The incidence angle of artificial lighting should be directed towards areas with necessity of lighting only and away from natural habitats.

8.8 Operational Phase

8.8.1 Impacts Evaluation – Direct Impact

Habitat Loss

8.8.1.1 Operational phase direct impacts would be the habitats lost permanently during the construction, no additional habitat loss will occur during operational phase. Therefore, the potential impacts to the loss of habitats are considered **Insignificant**.

8.8.2 Impacts Evaluation– Indirect Impact

General Operational Disturbance

8.8.2.1 There may be potential disturbances including noise pollution and glare caused by the Project during operational phase. Two out of the three platforms (i.e. Lower and Middle Platforms), which are the major works area of the Project, are located downhill at more than 150 meters away from the ecologically sensitive CWBCP. Therefore, the potential disturbances from the Lower Platform and Middle Platform are considered as minimal.

8.8.2.2 Regarding the Upper Platform located close to the CWBCP, potential noise disturbances are also evaluated. Since the usage of the Upper Platform is restricted to students, coaches and staff of the PRS, while other pedestrian and visitors of the PRS will be located at Lower Platform, with minimal noise disturbance to the CWBCP. Limited traffic is anticipated. In addition, the existing access road has already been utilized by the operators of restored landfill. It is believed that the habitat along the access road would have been adapted to the road traffic noise from the access road. Therefore, potential noise disturbances due to the operation of PRS is considered minimal.

8.8.2.3 Artificial lighting used in the Upper Platform located close to the CWBCP during the night-time operation of the PRS could potentially affect light-sensitive birds, nocturnal mammals, and fireflies. An unnamed species of firefly identified at the Natural Watercourse in CWBCP, which is located at about 200m away from the Application Site. Most of the light will be screened by the dense foliage of the woodland, where most light sensitive wildlife are present. In addition, the operating hour of the PRS is between 7am to 9pm, with roughly 1 hour preparation before and after the operating hour. The lights will be turned off after use. Potential disturbance caused to light-sensitive wildlife by artificial lighting during operation is therefore considered as **Minor**.

8.8.2.4 The western side of the Upper Platform is located at more than 50m away from the CWBCP. As there will be no lighting direct on the CWBCP, and there will be some screening by the woodland in between, potential glare impact is unlikely. The eastern side of the Upper Platform (i.e. the proposed paddock) is located closer to the CWBCP. Therefore, good lighting design measures as discussed in **Section 8.8.3** would be adopted as far as practicable to minimize the ecological impact from glare, while fulfilling the safety requirement as stipulated in relevant ordinances / guidelines (e.g. Public Lighting Design Manual issued by Highways Department). The lowest lighting class suggested for footpaths and cycle tracks in the guideline will be adopted. In addition, the woodland in between could provide screening to the fireflies at about 200m away from the Application Site. Adverse glare impact, particularly to the fireflies, is not anticipated.

8.8.3 Control Measures

8.8.3.1 Since the Project is anticipated to operate during nighttime, the following good design measures shall be adopted for outdoor lighting in the Upper Platform to minimize glare impact on the surrounding habitats and terrestrial fauna.

- Minimize the intensity of artificial lighting as much as possible while fulfilling the safety requirement as stipulated in relevant ordinances / guidelines (e.g. Public Lighting Design Manual issued by Highways Department);
- Using the shortest possible pole height to minimize light spill; and
- Positioning and directing the incidence angle of artificial lighting towards areas with necessity of lighting and away from natural habitats adjacent to the Application Site.

8.8.3.2 The number of proposed lighting along the Access Road would be 38 nos. Based on the latest proposal, and the exact number of new lightings will be further reviewed and reduced, if possible, and alternative lighting designs will also be explored during the detailed design stage to further minimize the potential glare impact. Good design measures have already incorporated in lighting proposal for the Access Road. The operation of the Project will also follow the measures when using the Access Road.

- Warm white color (i.e. 2700K) will be adopted for lights on the Access Road to reduce lighting impact to wild animals;
- Adopt lighting fixtures for Access Road (e.g. installation of glare shield) with relatively narrow beam angle and adjust the incidence angle to reduce light spill outside the Access Road; and
- Pole light on the Access Road will be turned off during non-operating hour under normal operation, except during guard patrol period or in case of emergency.

8.8.3.3 With these measures applied, unnecessary glare impact on light sensitive species, such as nocturnal mammals and fireflies, shall be minimized.

8.9 Environmental Monitoring and Audit

8.9.1 Construction Phase

8.9.1.1 During construction phase, it is anticipated that there will be no adverse ecological impact with the implementation of control measures. Nevertheless, site audit is recommended for the construction phase to ensure better environment. Regular site audits would be carried out to ensure proper implementation of pollution control measures.

8.9.2 Operational Phase

8.9.2.1 During the operational phase, it is anticipated that there will be no adverse ecological impact with the implementation of control measures. Nevertheless, site audit prior to operation commencement is recommended to ensure the recommended measures in minimizing glare impact are properly implemented.

8.10 Summary

8.10.1.1 During the construction phase, habitat loss due to the permanent structures of the Project and temporary habitat loss due to the works areas of the Project are anticipated. Nevertheless, the ecological value of these habitats ranges from “Very Low” to “Low”. The potential impacts on site of conservation importance (e.g. CWBCP and Conservation Area) and species of conservation importance are considered to be insignificant. Given the proper implementation of control measures during construction phase, the indirect disturbance from construction works is anticipated to be minor.

8.10.1.2 During the operational phase, potential disturbance is considered minimal given the nature of the Project. In addition, various control measures have been proposed to minimize the potential glare impact due to the use of artificial lighting. Therefore, it is anticipated that there will be no adverse ecological impact during the operational phase.

8.10.1.3 Summary of potential ecological impacts on the habitats within the Study Area associated with the construction and operation of the Project have been summarised in **Table 8.16 to Table 8.22**.

Table 8.16 Evaluation of Impact Significance to Developed Area within Study Area

Evaluation Criteria	Developed Area
Habitat Quality	Very Low
Species	Within Application Site: No flora and fauna species of conservation importance. Outside Application Site: No flora and fauna species of conservation importance.
Size/Abundance	Permanent loss of 0.25 ha of this habitat from construction of the Project.
Duration	Direct impact of habitat loss (0.25 ha) would be permanent. Indirect impact of disturbance and increased human activities from construction phase would be temporary. Indirect impact of disturbance and increased human activities from operation phase would be permanent.
Reversibility	Permanent habitat loss of 0.25 ha would be irreversible. Disturbance and increased human activities from construction phase would be reversible. Disturbance and increased human activities from operation phase would be irreversible.
Magnitude	Low
Overall Impact Evaluation	Insignificant

Table 8.17 Evaluation of Impact Significance to Plantation within Study Area

Evaluation Criteria	Plantation
Habitat Quality	Very Low
Species	Within Application Site: No flora and fauna species of conservation importance. Outside Application Site: No flora and fauna species of conservation importance.
Size/Abundance	Permanent loss of 0.25 ha of this habitat from construction of the Project.
Duration	Direct impact of habitat loss (0.25 ha) would be permanent. Indirect impact of disturbance and increased human activities from construction phase would be temporary. Indirect impact of disturbance and increased human activities from operation phase would be permanent.
Reversibility	Permanent habitat loss of 0.25 ha would be irreversible. Disturbance and increased human activities from construction phase would be reversible. Disturbance and increased human activities from operation phase would be irreversible.
Magnitude	Low
Overall Impact Evaluation	Insignificant

Table 8.18 Evaluation of Impact Significance to Shrubland within Study Area

Evaluation Criteria	Shrubland
Habitat Quality	Low
Species	Outside Application Site: 1 flora species of conservation importance. No fauna species of conservation importance.
Size/Abundance	This habitat will not be directly affected.
Duration	Indirect impact of disturbance and increased human activities from construction phase would be temporary. Indirect impact of disturbance and increased human activities from operation phase would be permanent.
Reversibility	Disturbance and increased human activities from construction phase would be reversible. Disturbance and increased human activities from operation phase would be irreversible.
Magnitude	Low
Overall Impact Evaluation	Insignificant

Table 8.19 Evaluation of Impact Significance to Turfgrass Land within Study Area

Evaluation Criteria	Turfgrass Land
Habitat Quality	Low
Species	Within Application Site: No flora species of conservation importance. 1 fauna species of conservation importance. Outside Application Site: No flora and fauna species of conservation importance.
Size/Abundance	Permanent loss of 4.13 ha of this habitat from construction of the Project.
Duration	Direct impact of habitat loss (4.13ha) would be permanent. Indirect impact of disturbance and increased human activities from construction phase would be temporary. Indirect impact of disturbance and increased human activities from operation phase would be permanent.

Evaluation Criteria	Turfgrass Land
Reversibility	Permanent habitat loss of 4.13 ha would be irreversible. Disturbance and increased human activities from construction phase would be reversible. Disturbance and increased human activities from operation phase would be irreversible.
Magnitude	Low
Overall Impact Evaluation	Insignificant

Table 8.20 Evaluation of Impact Significance to Mixed Woodland within Study Area

Evaluation Criteria	Mixed Woodland
Habitat Quality	Low to Medium
Species	Outside Application Site: 2 flora species of conservation importance. 6 fauna species of conservation importance.
Size/Abundance	This habitat will not be directly affected.
Duration	Indirect impact of disturbance and increased human activities from construction phase would be temporary. Indirect impact of disturbance and increased human activities from operation phase would be permanent.
Reversibility	Disturbance and increased human activities from construction phase would be reversible. Disturbance and increased human activities from operation phase would be irreversible.
Magnitude	Low
Overall Impact Evaluation	Minor

Table 8.21 Evaluation of Impact Significance to Modified Watercourse within Study Area

Evaluation Criteria	Modified Watercourse
Habitat Quality	Low
Species	Within Application Site: No fauna and flora species of conservation importance. Outside Application Site: No flora species of conservation importance. 2 fauna species of conservation importance.
Size/Abundance	Permanent loss of 99m of this habitat from construction of the Project.
Duration	Direct impact of habitat loss (99m) would be permanent. Indirect impact of disturbance and increased human activities from construction phase would be temporary. Indirect impact of disturbance and increased human activities from operation phase would be permanent.
Reversibility	Permanent habitat loss of 99m would be irreversible. Disturbance and increased human activities from construction phase would be reversible. Disturbance and increased human activities from operation phase would be irreversible.
Magnitude	Very Low
Overall Impact Evaluation	Insignificant

Table 8.22 Evaluation of Impact Significance to Natural Watercourse within Study Area

Evaluation Criteria	Natural Watercourse
Habitat Quality	Low to Medium
Species	Outside Application Site: 3 flora species of conservation importance.

Evaluation Criteria	Natural Watercourse
	2 fauna species of conservation importance.
Size/Abundance	This habitat will not be directly affected.
Duration	Indirect impact of disturbance and increased human activities from construction phase would be temporary. Indirect impact of disturbance and increased human activities from operation phase would be permanent.
Reversibility	Disturbance and increased human activities from construction phase would be reversible. Disturbance and increased human activities from operation phase would be irreversible.
Magnitude	Low
Overall Impact Evaluation	Minor

9. Landscape and Visual

9.1 Landscape Impacts

9.1.1.1 Please refer to Tree Preservation and Removal Proposal, which is included as Appendix 2 in the Supplementary Planning Statement.

9.2 Visual Impacts

9.2.1.1 Please refer to Visual Impact Assessment, which is included as Appendix 5 in the Supplementary Planning Statement.

10. Landfill Gas Hazard

10.1 Legislation, Standards and Guidelines

10.1.1.1 EPD issued two guidance notes regarding the landfill gas hazard assessment, namely:

- Landfill Gas Hazard Assessment Guidance Note (2022) (EPD/TR8/97);
- Landfill Gas Hazard Assessment for Development Adjacent to Landfills (ProPECC PN 3/96);
- Section 1.1(f) in Annex 7 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM);
- Section 3.3 in Annex 19 of the EIAO-TM; and
- The Hong Kong Planning Standards and Guidelines (HKPSG), Chapter 9

10.1.1.2 These guidelines provide an assessment framework for evaluating the risks posed by landfill gas for any development proposed within 250m Landfill Consultation Zone as described under Section 6.5, Chapter 9 of the HKPSG.

10.2 Description of the Environment

10.2.1 Tseung Wan O Stage II/III Restored Landfill (TKOL II/III)

10.2.1.1 TKOL II/III is located underneath the Project (see **Figure 10.1**). It covers an area of 42 hectares, with its boundary defined by hills on three sides. It received waste from 1988 to 1994. A total of approximately 12.6 million tonnes of domestic, commercial and industrial (C&I), construction, chemical, clinical and special wastes were landfilled. The maximum waste depth is about 90m.

10.2.1.2 TKOL II/III was subject to restoration works commissioned by the Government in 1997. A restoration works contract was awarded to a restoration contractor who designed and implemented a system of controls to achieve the contractual limits on environmental emissions and is responsible for the management of installed environmental control facilities and environmental impacts arising from the landfill following completion of the works.

10.2.1.3 TKOL II/III was originally not fully lined and no leachate or gas abstraction system was installed during the landfill operation. The major restoration works regarding the management of landfill gas and leachate under the contract include:

- Placing of a membrane over the waste;
- Placing of soil above the membrane and the installation of a comprehensive surface water drainage system
- Installation of a landfill gas collection and abstraction system;
- Utilization of landfill gas abstracted;
- Treatment of surplus landfill gas in landfill gas flare; and
- Collection and storage of leachate and landfill gas condensate for treatment.

10.2.1.4 The leachate collected is pumped to the Leachate Pre-treatment Works (LPTW) at the landfill for treatment prior to be discharged to sewer leading to the TKO Preliminary Treatment Works (TKOPTW).

10.2.1.5 Active groundwater control in the form of groundwater abstraction wells, were installed at TKOL II/III, upstream of the waste boundary. The wells reduce the ingress of groundwater to the waste and hence minimize leachate generation. Groundwater collected from groundwater extraction wells at TKOL II/III is used in the LPTW and the excess groundwater is discharged to the stormwater drains. Sixteen groundwater wells were monitored quarterly throughout the aftercare period after the completion of landfill restoration works in 1999.

10.2.2 South East New Territories (SENT) Landfill and Tseung Wan O Stage I Restored Landfill (TKOL I)

10.2.2.1 The Project is located at more than 0.5km and 1km from the SENT Landfill and TKOL I, which is outside their 250m consultation zone (see **Figure 10.1**). Potential landfill gas hazard from them is not anticipated.

10.3 Identification of Landfill Gas Generation, Characteristics and Hazards

10.3.1 Landfill Gas Generation

10.3.1.1 When water infiltrates a landfill, it triggers the decomposition of organic materials, leading to the generation of gases. As biodegradation begins, the available oxygen is quickly depleted, and without any replenishment, the waste mass becomes anaerobic. During anaerobic fermentation, methanogens produce methane and carbon dioxide, which are the primary components of landfill gas. Typically, landfill gas consists of approximately 60% methane and 40% carbon dioxide by volume, although these proportions can vary significantly based on site conditions. Additionally, trace amounts of hydrogen sulphide, nitrogen, and gaseous hydrocarbons are present.

10.3.1.2 The rate of degradation and the volume of landfill gas produced per unit of waste can vary greatly due to the high variability in biodegradation settings, waste composition, and individual site characteristics. The generation of landfill gas is influenced by various environmental factors, including temperature, pH, substrate availability, moisture content, and oxygen content.

10.3.2 Landfill Gas Characteristics

10.3.2.1 Landfill gas presents a number of potential hazards as follow:

Methane

10.3.2.2 It is odourless, colourless and typically associated with numerous highly odoriferous compounds in landfill gas which will give some warning of its presence. However, the absence of odour should not be taken to mean that there is no methane – this can only be confirmed by using appropriately calibrated methane detectors. Methane is a flammable gas and will burn when mixed with air between approximately 5% and 15% by volume, the Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL) respectively. A mixture of methane and air with a composition between the LEL and UEL ignited in a confined space could lead to an explosion. Methane is also an asphyxiant.

Carbon Dioxide

10.3.2.3 It is another major component of landfill gas, which could induce asphyxia and adverse health effects at relatively low concentrations. The long-term eight-hour Occupational Exposure Limit (OEL) is 0.5% by volume. Similar to methane, it is also odourless and colourless and can only detected using appropriately calibrated detectors.

Gas Buoyancy

10.3.2.4 Methane is lighter than air whereas carbon dioxide is heavier than air. Typical mixtures of landfill gas are likely to have a density close to or equal to that of air. However, site conditions may result in a ratio of methane to carbon dioxide which may make the gas mixture lighter than air or heavier than air. As a result, landfill gas may be concentrated in the bottoms of trenches or excavations or may rise up and accumulate beneath structures and foundations.

10.3.3 Landfill Gas Hazard

10.3.3.1 Due to the flammability, asphyxiant properties, and gaseous density of landfill gas, there is a potential hazard if the gas migrates from the landfill and accumulates in confined spaces such as building basements, underground car parks, lift shafts, pumping stations, and maintenance chambers. Similarly, temporary structures like site huts and other unventilated enclosures erected during the construction stage may also be exposed to landfill gas hazards. Underground services, including sewer drains, storm drains, and service ducts, can act as pathways for landfill gas, making them susceptible to potential hazards. Additionally, any faults in the geological formation can also serve as pathways for landfill gas.

10.3.4 Landfill Gas Migration

10.3.4.1 Methane migrates along pressure gradients, moving from areas of higher pressure to areas of lower pressure. The primary mechanism for significant methane migration in subsurface unsaturated soils is pressure-driven flow. While diffusion also occurs, its rates are too low to result in unacceptable indoor air concentrations under reasonably likely scenarios.

10.3.4.2 The ability of landfill gas to migrate beyond the waste boundary depends on various factors, including the type of landfill construction details, the presence of gas and leachate control measures, restoration details, and the permeability of the ground through which the gas must travel. Changes in atmospheric pressure can also encourage gas migration.

10.3.4.3 If gas intercepts any buried service routes, especially where the utility has been laid in an open conduit or the trench excavation has been backfilled around the utility line with coarse gravel, these may be susceptible to potential hazards and/or act as preferential gas migration pathways.

10.4 Assessment Criteria

10.4.1.1 In accordance with EPD's Guidance Notes, the risk due to landfill gas shall be evaluated based upon the following three criteria:

Source	the location, nature and likely quantities/concentrations of landfill gas which has the potential to affect the proposed development
Pathway	the nature and length of potential pathways through which landfill gas must pass to reach the proposed development

Target	the elements of the development which are sensitive to the effects of landfill gas

10.4.2 Source

10.4.2.1 The classification of the Source (i.e. the landfill) should be undertaken as follows:

Minor

- Landfill sites at which gas controls have been installed and proven to be effective by comprehensive monitoring which has demonstrated that there is no migration of gas beyond the landfill boundary (or any specific control measures) and at which control of gas does not rely solely on an active gas extraction system or any other single control measures which is vulnerable to failure; or
- Old landfill sites where the maximum concentration of methane within the waste, as measured at several locations across the landfill and on at least four occasions over a period of at least 3 months (preferably longer), is less than 5% by volume (v/v).

Medium

- Landfill site at which some form of gas control has been installed (e.g. lined site or one where vents or barriers have been retrospectively installed) but where there are only limited monitoring data to demonstrate its efficacy to prevent migration of gas; or
- Landfill site where comprehensive monitoring has demonstrated that there is no migration of gas beyond the landfill boundary but where the control of gas relies solely on an active gas extraction system or any other single control system which is vulnerable to failure.

Major

- Recently filled landfill site at which there is little or no control to prevent migration of gas or at which the efficacy of the gas control measures has not been assessed; or
- Any landfill site at which monitoring has demonstrated that there is significant migration of gas beyond the site boundary.

10.4.3 Pathway

10.4.3.1 Generally, three types of pathways are identified for the transmission of landfill gas which are:

- Man-made pathways, e.g. utility connections, stormwater channels, etc.;
- Natural pathways such as rock jointing planes, fissures, and other naturally occurring phenomena which may promote or give rise to the transmission of gas over distances; and
- A combination of the previous categories. An example of the latter may be, for instance, where a specific geological feature promotes gas transmission but which stops short of directly linking the landfill and target. A man-made connection, however, may also co-exist near the edge of the geological feature, in combination with the former, may act to link the two sites. In this instance, careful assessment of the likelihood of the mechanism acting to link the two pathways needs to be undertaken before assigning an appropriate pathway classification.

10.4.3.2 The broad classification of the Pathway should be undertaken as follows:

Very short/direct	Path length of less than 50m for unsaturated permeable strata and fissured rock or less than 100m for man-made conduits

Moderately short/direct	Path length of 50-100m for unsaturated permeable soil or fissured rock or 100-250m for man-made conduits
Long/indirect	Path length of 100-250m for unsaturated permeable soils and fissured rock

10.4.4 Target

10.4.4.1 Different types of target may be broadly classified as follow:

Highly sensitive

- Buildings and structures with ground level or below ground rooms/voids or into which services enter directly from the ground and to which members of the general public have unrestricted access or which contain sources of ignition.
- This would include any developments where there is a possibility of additional structures being erected directly on the ground on an ad hoc basis and thereby without due regard to the potential risks.

Medium sensitivity

- Other buildings, structures or service voids where there is access only by authorised well trained personnel, such as the staff of utility companies, who have been briefed on the potential hazards relating to landfill gas and the specific safety procedures to be followed.
- Deep excavations.

Low sensitivity

- Buildings/structures which are less prone to gas ingress by virtue of their design (such as those with a raised floor slab).
- Shallow excavations.
- Developments which involve essentially outdoor activities but where evolution of gas could pose potential problems.

10.4.4.2 The above categories should be used as a general guide only and particular aspects of a building or development may render it more or less sensitive than indicated. Account should be taken of any particular circumstances when assigning a target to one of the three categories.

10.4.4.3 Following the determination of the categories of source, pathway and target, the overall risk levels are classified in accordance with **Table 10.1**.

Table 10.1 Classification of Risk Categories

Sources	Pathway	Target	Risk Category
Major	Very short/direct	High	Very High
		Medium	High
		Low	Medium
	Moderately short/direct	High	High
		Medium	Medium
		Low	Low
	Long/indirect	High	High

Sources	Pathway	Target	Risk Category
		Medium	Medium
		Low	Low
Medium	Very short/direct	High	High
		Medium	Medium
		Low	Low
	Moderately short/direct	High	High
		Medium	Medium
		Low	Low
	Long/indirect	High	Medium
		Medium	Low
		Low	Very Low
Minor	Very short/direct	High	High
		Medium	Medium
		Low	Low
	Moderately short/direct	High	Medium
		Medium	Low
		Low	Very Low
	Long/indirect	High	Medium
		Medium	Low
		Low	Very Low

10.4.4.4 The potential implications associated with the various qualitative risk categories are summarized in **Table 10.2**.

Table 10.2 General Categorisations of Risks

Category	Level of Risk	Implication
A	Very high (undesirable)	The type of development being proposed is very undesirable and a less sensitive form of development should be considered. At the very least, extensive engineering measures, alarm systems and emergency action plans are likely to be required.
B	High	Significant engineering measures will be required to protect the planned development.
C	Medium	Engineering measures will be required to protect the proposed development.
D	Low	Some precautionary measures will be required to ensure that the planned development is safe.

Category	Level of Risk	Implication
E	Very low (Insignificant)	The risk is so low that no precautionary measures are required.

10.4.4.5 Five generic forms of protection will be used in minimizing the hazards to developments. These generic forms corresponding to the five risk levels are set out in **Table 10.3**. The terms used in **Table 10.3** are defined in **Table 10.4**.

Table 10.3 Generic Protection Measures for Planning Stage Categorisation

Category	Generic Protection Measures
A	For the planned development active control of gas, supported by barriers and detection systems. Another, less sensitive form of development should also be considered.
B	Active control of gas, including barriers and detection systems [1]
C	Use of "semi active" or enhanced passive controls. Detection systems in some situations.
D	Passive control of gas only.
E	No precautionary measures required.

Note:

[1] The gas protection measures required to allow the safe development of Category A risk development will need to be more extensive than those for a Category B risk development.

Table 10.4 Definition of Control Terms

Term	Definition
Active control	Control of gas by mechanical means e.g. ventilation of spaces with air to dilute gas, or extraction of gas from the development site using fans or blowers.
"Semi active" control	Use of wind driven cowls and other devices which assist in the ventilation of gas but do not rely on electrically powered fans.
Passive control	Provision of barriers to the movement of gas e.g. membranes in floors or walls, or in trenches, coupled with high permeability vents such as no-fines gravel in trenches or voids/permeable layers below structures.
Detection systems	Electronic systems based upon, for example, catalytic oxidation or infra-red measurement principles, which can detect low concentrations of gas in the atmosphere and can be linked to alarms and/or telemetry systems.

10.5 Qualitative Risk Assessment in Construction Phase

10.5.1 Assessment Methodology

10.5.1.1 In accordance with the procedures recommended in Landfill Gas Hazard Assessment Guidance Note, the following tasks have been undertaken to allow a full consideration of the potential risk of LFG from the TKOL II/III to the Project.

- Review of background information (including landfill gas monitoring data, if any) and studies related to the TKOL II/III Site;

- Identification of the nature and extent of the sources, including the likely concentrations/amounts of hazardous emissions which might have the potential for causing impacts on the Project;
- Identification of possible pathways through the ground, underground cavities, utilities or groundwater, and the nature of these pathways through which hazardous emissions must traverse if they were to reach the facilities within the Application Site;
- Identification of the potential targets associated with the Project which are sensitive to the impacts of the hazardous emissions;
- Qualitative assessment on the degree of risk which the hazardous emissions may pose to the target for each of the source-pathway-target combinations;
- Design of suitable level of precautionary measures and types of protection measures and emergency procedures for the construction and operation of the development proposed under the Project; and
- Identification of monitoring requirements for assessing the adequacy and performance of the implemented protection measures.

10.5.2 Desktop Study

10.5.2.1 The information and documents which have been used as background materials for the preparation of this assessment include the following:

- Environmental Impact Assessment Report of Desalination Plant at Tseung Kwan O (July 2015); and
- Landfill gas monitoring data for the TKOL II/III – Annual Environmental Audit Report (from 2020 to 2024) provided by EPD.

History of TKOL II/III

10.5.2.2 The TKOL II/III commenced its operation in Year 1988 and ceased operation in Year 1995. The restoration works were implemented and completed in Year 1999 upon the completion as a waste disposal site. It is now in the Aftercare period undertaken by EPD's Restoration Contractor. Regular inspection on LFG, leachate, groundwater, surface water, etc., are carried out by the Contractor on a regular basis.

Restoration Facilities

10.5.2.3 The restoration works at TKOL II/III include a multi-layer capping system (consisting of compacted soil, geomembrane, geonet and geotextile), a landfill gas and leachate extraction, collection and treatment system.

i. Landfill Capping Tunnel

10.5.2.4 According to the as-built drawings of TKOL II/III, the components of the landfill capping layer include the following (from top to bottom):

- An approximately 850mm thick soil layer of general cover, hydroseeded to act as the growing medium;
- A low permeability Linear Low Density Polyethylene (LLDPE) geo-membrane and subsoil drainage later (geocomposite); and

- A 500mm thick final intermediate soil cover.

ii. Landfill Gas Management System

10.5.2.5 Landfill gas management system is in place for all the restored landfills for safety and health reasons. The system included placement of a membrane over the waste to contain the landfill gas, installation of a landfill gas extraction system, utilisation of the landfill gas as a fuel to generate electricity and for leachate treatment, and combustion of the surplus gas in enclosed flares. There is a total of 50 vertical wells to extract landfill gas.

iii. Leachate Management System

10.5.2.6 The leachate collected is pumped to the Leachate Pre-treatment Works (LPTW) at the landfill for treatment prior to be discharged to sewer leading to the TKOPTW. Active groundwater control in the form of groundwater abstraction wells, were installed at TKOL II/III, upstream of the waste boundary. The wells reduce the ingress of groundwater to the wastes and hence minimise leachate generation. Groundwater collected from groundwater extraction wells at TKOL II/III is used in the LPTW and the excess groundwater is discharged to the stormwater drains. Groundwater wells were monitored quarterly throughout the aftercare period which is 30 years from the landfill restoration works completion date.

10.5.3 Source

10.5.3.1 Landfill gas management system was installed to control gas emission and prevent off-site gas migration. 14 monitoring wells were installed outside the boundary of the landfill where landfill gas was monitored (**Appendix 10.1**). The gas monitoring data at these monitoring wells for the past 5 years between January 2020 and December 2024, i.e. the aftercare period of the landfill, has been obtained from EPD and reviewed. The data are tabulated in **Appendix 10.1** and are summarized in **Table 10.5**.

Table 10.5 Summary of Landfill Gas Monitoring Data at TKOL II/III (Jan 2020 to December 2024)

Wells No.	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)	
	Range	Average	Range	Average	Range	Average
DG1	0.0 - 0.0	0.0	0.0 - 5.5	0.9	8.9 - 23.6	18.6
DG2	0.0 - 0.0	0.0	0.0 - 2.8	0.9	16.1 - 23.5	19.6
DG3	0.0 - 0.0	0.0	0.0 - 13.3	5.9	0.0 - 22.7	11.0
DG4	0.0 - 0.0	0.0	0.0 - 7.4	2.1	5.1 - 22.9	17.6
DG5	0.0 - 0.0	0.0	0.0 - 2.7	0.1	18.0 - 22.3	20.4
DG6	0.0 - 0.0	0.0	0.0 - 6.5	0.7	16.9 - 22.2	19.8
DG7	0.0 - 0.0	0.0	0.0 - 5.5	1.0	5.0 - 22.6	18.6
UG1	0.0 - 0.0	0.0	0.0 - 2.2	0.6	17.2 - 22.9	19.8
UG2	0.0 - 0.0	0.0	0.0 - 2.2	0.6	17.3 - 22.7	19.9
UG3	0.0 - 0.0	0.0	0.0 - 1.1	0.4	18.3 - 22.9	20.3
UG4	0.0 - 0.0	0.0	0.0 - 1.3	0.3	18.7 - 23.4	20.4

Wells No.	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)	
	Range	Average	Range	Average	Range	Average
UG5	0.0 - 0.0	0.0	0.0 - 1.8	0.3	18.0 - 23.1	20.3
UG6	0.0 - 0.0	0.0	0.0 - 1.7	0.2	19.2 - 22.7	20.6
UG7	0.0 - 0.0	0.0	0.0 - 2.7	0.2	17.9 - 22.9	20.5
UG8	0.0 - 0.0	0.0	0.0 - 1.4	0.5	17.8 - 22.7	20.2
UG9	0.0 - 0.0	0.0	0.0 - 6.9	2.0	8.3 - 23.6	18.2

10.5.3.2 According to the above monitoring data, nearly zero concentration of methane has been observed in all the monitoring wells of the TKO Stage II/III Restored Landfill from January 2020 and December 2024. As the methane concentration for all monitoring wells is 0.0% v/v, this suggests that the landfill gas migration is under effective control.

10.5.3.3 Under some circumstances, the methane component of landfill gas may be oxidised leaving reduced concentration of oxygen and relatively high concentrations of carbon dioxide and the reduced oxygen concentrations are assumed to be associated with a potential landfill gas presence. As shown in above monitoring data, the average carbon dioxide concentrations ranged from 0.1% to 5.9% v/v across the monitoring wells. Low concentrations (below 5% v/v on average) of carbon dioxide concentrations have been observed in the monitoring wells except for DG3. In accordance with the EPD's Guidance Note, levels of carbon dioxide concentration greater than 5% v/v above background levels in any monitoring well indicates the sign of migration of landfill gas. In the absence of the background carbon dioxide information for comparison, it is assumed on conservative side that the potential of migration of landfill gas cannot be eliminated.

10.5.3.4 Oxygen concentrations ranged from <0.1% to 23.6% v/v across the monitoring wells, which oxygen concentrations in monitoring wells are typically 20% v/v. Low levels of oxygen concentrations were only recorded in DG3, which further support the potential of landfill gas migration. However, as advised by EPD/RLG, there was no any records of landfill oxidation events over the past 5 years.

10.5.3.5 In summary, nearly zero concentration of methane and low concentrations of carbon dioxide was detected in the monitoring wells for the TKO Stage II/III Restored Landfill. This suggests that off-site landfill gas migration in these areas is under effective control. Therefore, it can be regarded as "Minor" source according to EPD's guidance notes. However, elevated carbon dioxide and reduced oxygen levels have been recorded in DG3, which suggest that there might be a potential for off-site migration of landfill gas. Therefore, the source of the TKOL II/III is categorised as "**Medium**" as conservative assessment.

10.5.4 Pathways

Natural Pathways

10.5.4.1 As the Application Site is located right above the TKOL II/III, the potential natural pathway for landfill gas migration is categorized as "**Very Short/Direct**".

Man-made Pathways

10.5.4.2 There are existing water supply, sewerage and drainage systems within the TKOL II/III. Landfill has extraction wells and buried landfill gas extraction pipe works could be found in TKOL II/III. The telecom cable and power supply run along Chun Tat Street and internal access road to the site office. Channel at the eastern side of the TKOL II/III connects to the drainage system which runs along Chun Sing Street. All of the proposed works will be within the landfill site boundary. It is therefore concluded that the potential man-made pathway for landfill gas migration is categorized as “**Very Short/Direct**”.

Combination of Natural and Man-made Pathways

10.5.4.3 The potential pathway of landfill gas migration from the source to the targets of the Project can be a combination of natural strata (i.e. the natural pathways) and subsequently through man-made facilities such as utilities connections (i.e. the man-made pathways).

10.5.4.4 This mode of transmission generally requires a series of events to occur in order for gas to potentially affect the Project. The path length for the migration of landfill gas by a combination of natural and man-made pathways is generally much longer than the direct distance between the source and the target. However, the target is located right atop or adjacent to TKOL II/III. The potential combination of natural and man-made pathway for landfill gas migration is therefore categorized as “**Very Short/Direct**”.

10.5.5 Targets

10.5.5.1 As the Application Site is located right above TKOL II/III, construction works will be undertaken within the Consultation Zone. The construction works associated with the Project include:

- Site clearance;
- Site formation;
- Replacement of top soil for areas with horses’ direct contact;
- Construction of buildings and structures;
- Installation of pipeline and utilities; and
- Temporary site office.

10.5.5.2 During construction phase, excavation may be required and the areas of confined spaces and trenches are especially at a higher risk to the exposure of landfill gas. In addition, indoor construction workers working in buildings and ancillary facilities such as master meter room and pumping rooms may also at risk to the exposure of landfill gas.

10.5.5.3 Nevertheless, during construction phase, the construction site would only be accessible by authorized well-trained personnel who would have been briefed on the potential hazards relating to landfill gas and the specific safety procedures to be followed. As such, the sensitivity of construction workforce is considered as “**Medium Sensitive”**.

10.5.6 Impact Evaluation

10.5.6.1 With all information regarding the sources, pathways and receivers identified in the previous sections, a qualitative assessment of landfill gas hazards during construction phase is summarised in **Table 10.6**.

Table 10.6 Qualitative Risk Assessment of Landfill Gas Hazards During Construction Phase

Source	Pathway	Target	Risk
TKOL II/III as landfill source: **Medium Source**	Natural: **Very Short/Direct** Man-made: **Very Short/Direct** Combined natural and man-made pathway: **Very Short / Direct**	Construction site: **Medium**	**Medium**

10.5.7 Recommended Precautionary and Protective Measures

10.5.7.1 The source-pathway-target analysis as summarized in **Table 10.6** concluded that the overall risk level for construction phase is "**Medium**". With reference to **Table 10.3** and **Table 10.4**, for medium risk targets, engineering measures would be required to protect the construction site which includes the use of "semi-active", enhanced passive gas controls and/or detection systems in some situations.

10.5.7.2 The following sub-sections provide recommendations of precautionary and protective measures for the avoidance of environmental impacts related to landfill gas during the construction phases. Where applicable, specific measures for handling the hazards identified during the construction phase will also be addressed to further reduce the likelihood of incidents and increase the level of the safety to the works.

General Hazards which May Be Encountered

10.5.7.3 All contractors participating in the works should be aware that methane and carbon dioxide are always likely to be present in the soil and rock voids. In addition, the contractors should be aware of the potential hazards and other properties of landfill gas as described in **Section 10.3**.

Outline of Safety Requirements

10.5.7.4 Safety procedures should be implemented to minimize the risks of:

- Fires and explosions;
- Asphyxiation of workers; and
- Toxicity effects.

10.5.7.5 Precautions should be clearly laid down and rigidly adhered to with respect to:

- Trenching and excavation; and
- Creation of confined spaces at, near to or below ground level.

10.5.7.6 In addition, gas detection equipment and appropriate breathing apparatus should be provided and used when entering confined spaces.

Appointment of Safety Officer

10.5.7.7 A safety officer, trained in the use of gas detection equipment and landfill gas related hazards, should be present on site throughout the ground works phase. The Safety Officer should be provided with an intrinsically safe portable instrument, which is appropriately calibrated and able to measure the following gases in the ranges indicated below:

Methane	0-100% LEL and 1-100% v/v

Carbon dioxide	0-100%
Oxygen	0-21%

Safety Measures

10.5.7.8 During all the construction work within / adjacent to landfill sites, the safety measures recommended in Chapter 8 of the Landfill Gas Hazard Assessment Guidance Note should also be strictly followed and the following safety measures should be implemented:

- All personnel who work on site and all visitors to the site should be made aware of the possibility of ignition of gas in the vicinity of the works, the possible presence of contaminated water and the need to avoid physical contact with it;
- Those staff who work in, or have responsibility for "at risk" areas, including all excavation workers, supervisors and engineers working within the construction site, should receive appropriate training on working in areas susceptible to landfill gas, fire and explosion hazards;
- An excavation procedure or code of practice to minimise landfill gas related risk should be devised and carried out by the project proponent;
- No worker should be allowed to work alone at any time in or near to any excavation. At least one other worker should be available to assist with a rescue if needed;
- Smoking and naked flames should be prohibited within confined spaces. "No Smoking" and "No Naked Flame" notices in Chinese and English should be posted prominently around the construction site. Safety notices should be posted warning of the potential hazards;
- Welding, flame-cutting or other hot works should be confined to open areas at least 15m from any trench or excavation;
- Welding, flame-cutting or other hot works may only be carried out in confined spaces when controlled by a "permit to work" procedure, properly authorized by the Safety Officer;
- The permit to work procedure should set down clearly the requirements for continuous monitoring of methane, carbon dioxide and oxygen throughout the period during which the hot works are in progress. The procedure should also require the presence of a competent environmental specialist who shall be responsible for reviewing the gas measurements as they are made, and who shall have executive responsibility for suspending the work in the event of unacceptable or hazardous conditions. Only those workers who are appropriately trained and fully aware of the potentially hazardous conditions which may arise should be permitted to carry out hot works in confined areas;
- Ground level construction plant should be fitted with vertical exhausts at least 0.6m above ground level and with spark arrestors;
- Any electrical equipment, such as motors and extension cords, should be intrinsically safe;
- During piping assembly or conduiting construction, all valves/seals should be closed immediately after installation. As construction progresses, all valves/seals should be

closed as installed to prevent the migration of gases through the pipeline/conduit. All piping / conduiting should be capped at the end of each working day;

- Mobile offices, equipment stores, mess rooms etc. should be located on an area which has been proven to be gas free (by survey with portable gas detectors) and ongoing monitoring should be carried out to ensure that these areas remain gas free. Alternatively, such buildings should be raised clear of the ground. If buildings are raised clear of the ground, a minimum, clear separation distance (as measured from the highest point on the ground surface to the underside of the lowest floor joist) should be 500mm;
- During the construction works, adequate fire extinguishers and breathing apparatus sets should be made available on site and appropriate training given in their use.
- Fire drills should be organised at not less than six monthly intervals; and
- The contractor should formulate a health and safety policy standards and instructions for site personnel to follow.

10.5.7.9 The site constraints for the construction works within the restored landfill imposed by EPD/RLG will be observed (e.g. excavation limit, load limit at platforms and 2m spacing from existing landfill facilities) to prevent damage of existing landfill facilities and facilitate future maintenance works. A safety plan and construction method statement would be submitted to the restoration contractor for coordination. Throughout the construction phase, regular coordination with the restoration contractor will be maintained. As agreed with the restoration contractor, the post-works inspection will be arranged by the restoration contractor.

Monitoring

10.5.7.10 The following monitoring measures should be taken during construction phase:

- Routine monitoring should be carried out in all excavations, manholes, chambers and any other confined spaces that may have been created;
- All measurements in excavations should be made with the monitoring tube located not more than 10 mm from the exposed ground surface;
- Monitoring should be performed properly to make sure that the area is free of landfill gas before any person enter into the area;
- Monitoring shall cover methane, carbon dioxide and oxygen using approximately calibrated portable gas detection equipment; and
- Monitoring frequency and areas to be monitored should be set down prior to commencement of ground-works by the Safety Officer.

For excavations deeper than 1m, measurements should be carried out:

- at the ground surface before excavation commences;
- immediately before any worker enters the excavation area;
- at the beginning of each working day for the entire period the excavation remains open; and

- periodically throughout the working day whilst workers are in the excavation area.

For excavations between 0.3m and 1m deep, measurements should be carried out:

- directly after the excavation has been completed; and
- periodically whilst the excavation remains open.

For excavations less than 0.3m deep, monitoring may be omitted, at the discretion of the Safety Officer or other appropriately competent environmental specialist.

10.5.7.11 In addition, the restoration contractor will carry out routine monitoring and inspection works on the existing landfill facilities regularly during the construction phase.

Actions in the Event of Gas Being Detected

10.5.7.12 Depending on the results of the measurements, actions required will vary and should be set down by the Safety Officer or other appropriately competent environmental specialist. As a minimum these should encompass those actions specified in **Table 10.7** below.

Table 10.7 Actions in the Event of Landfill Gas Being Detected in Excavations

Parameter	Monitoring Result	Action
Oxygen	<19% v/v	- Ventilation to restore oxygen to >19% v/v
	<18% v/v	- Stop work - Evacuate all personnel/prohibit entry - Increase ventilation to restore oxygen level to >19%
Methane	>10% LEL (i.e. >0.5% by volume)	- Post “No Smoking” signs - Prohibit hot works - Ventilate to restore Methane to <10% LEL
	>20% LEL (i.e. >1% by volume)	- Stop work - Evacuate all personnel/prohibit entry - Increase ventilation to restore Methane to <10% LEL
Carbon dioxide	>0.5% v/v	- Ventilate to restore carbon dioxide to <0.5% v/v
	>1.5% v/v	- Stop work - Evacuate all personnel/prohibit entry - Increase ventilation to restore carbon dioxide to <0.5%

Emergency Management

10.5.7.13 To ensure that evacuation procedures are implemented in the event of the trigger levels specified in **Table 10.7** above being exceeded, it is recommended that a person, such as the Safety Officer, is nominated, with deputies, to be responsible for dealing with any emergency which may occur due to landfill gas.

10.5.7.14 In an emergency situation the nominated person, or his deputies, shall have the necessary authority and shall ensure that the confined space is evacuated and the necessary works implemented for reducing the concentrations of gas. The following organizations should also be contacted as appropriate:

- Hong Kong Police Force;
- Fire Services Department; and
- Environmental Protection Department.

10.6 Qualitative Risk Assessment in Operational Phase

10.6.1 Assessment Methodology

10.6.1.1 The assessment methodology on operational phase follows that on the construction phase as discussed in **Section 10.5.1**.

10.6.2 Source

10.6.2.1 The risk level of the source has been assessed in detail in **Section 10.5.3**. The landfill has source of TKOL II/III is classified as "**Medium**".

10.6.3 Pathways

Natural Pathways

10.6.3.1 As the Application Site is located right above the TKOL II/III, the potential natural pathway for landfill gas migration is categorized as "**Very Short/Direct**".

Man-made Pathways

10.6.3.2 Since utilities such as water storage tank, fresh and flushing water pump room would be supplied upon completion of the Project, new underground utilities will have been installed in the Application Site. The underground utilities include but not limited to the power cables, water pipelines and drainage pipelines. In view of the short distance between the source and targets, the potential man-made pathway for landfill gas migration is categorized as **Very Short/Direct**".

Combination of Natural and Man-made Pathways

10.6.3.3 The potential pathway of landfill gas migration from the source to the targets of the Project can be a combination of natural strata (i.e. the natural pathways) and subsequently through man-made facilities such as utilities connections (i.e. the man-made pathways).

10.6.3.4 This mode of transmission generally requires a series of events to occur in order for gas to potentially affect the Project. The path length for the migration of landfill gas by a combination of natural and man-made pathways is generally much longer than the direct distance between the source and the target. However, the target is located right atop or adjacent to TKOL II/III. The potential combination of natural and man-made pathway for landfill gas migration is therefore categorized as "**Very Short/Direct**".

10.6.4 Targets

10.6.4.1 As the Application Site is located right above TKOL II/III, operation will be undertaken within the Consultation Zone. Users and staff associated with the operation of the Project are identified as follows:

- Indoor area;
- Indoor area (with habitation);
- Farrier room; and

- Outdoor Area.

10.6.4.2 Indoor areas where would be occupied by staff or the public during normal working hour such as lecture, viewing lounge, changing room, etc. Underground utilities may entre directly from the ground. The sensitivity of the target is categorised as "**Highly Sensitive**".

10.6.4.3 Indoor areas where habitation would be occurred during such as Coach Duty Rooms and stables. The sensitivity of the target is categorised as "**Highly Sensitive**".

10.6.4.4 For farrier rooms, since naked flame is required for some process with the use of Liquefied Petroleum Gas (LPG), the sensitivity of the target is categorized as "**Highly Sensitive**".

10.6.4.5 For the outdoor open spaces of the Project, release of landfill gas is possible and may pose potential problems to visitors and staff. As landfill gas is likely to be diluted in open area, the sensitivity of the target is categorised as "**Low Sensitive**".

10.6.5 Evaluation of Potential Impacts on Targets

10.6.5.1 With all information regarding the sources, pathways and receivers identified in the previous sections, a qualitative assessment of landfill gas hazards during operational phase is summarised in **Table 10.8**.

Table 10.8 Qualitative Risk Assessment of Landfill Gas Hazards During Operational Phase

Source	Pathway	Target	Risk
TKOL II/III as landfill source: **Medium Source**	Natural: **Very Short/Direct** Man-made: **Very Short/Direct** Combined natural and man-made pathway: **Very Short / Direct**	Indoor areas: **Highly Sensitive**	**High**
		Indoor areas (with habitation): **Highly Sensitive**	**High**
		Farrier room: **Highly Sensitive**	**High**
		Outdoor areas: **Low Sensitive**	**Low**

10.6.5.2 The proposed farrier room is an essential facility at PRS for the well-being of horses and to ensure they receive proper hoof care. The farrier room must be located nearby the stables to minimize horse transport, otherwise, it will cause impact on horses' welfare and affect the operation efficiency. Therefore farrier rooms are needed to be located on the Middle and Upper Platforms. The farrier rooms involve the use of forge to craft and modify horseshoes daily, where naked flame will be involved. Daily use of fire would be required for the operation of farrier room. The operation hour of the farrier room would be 8am to 5pm, which fire would be used around 2 to 4 hours per day within the operation hour. Alternative equipment without the use of naked flame has been explored. Since the temperature for hot-shoeing required a very high temperature (at least 1300 °C) and the current market does not have such practical electrical product, the use of naked flames is required for the daily farrier operations. As use of naked flame is necessary for the operation of the proposed farrier room, preventive and design measures have been proposed and discussed in **Section 10.6.9**.

10.6.5.3 In addition, there will be on-site LPG storage at the farrier room. As confirmed by HKJC, only limited amount of LPG (i.e. around 4 bottles of 13.5L of LPG) will be stored on-site, limited to only a few days' worth of usage. Therefore, there is no bulk LPG storage on-site. The LPG storage will be replenished on a regular basis, ensuring that there is always an adequate supply for the farrier's needs. The storage of LPG will follow the Code of Practice for Hong Kong LPG Industry – Module 1: "LPG Compounds and Cylinder

Stores”. Therefore, the on-site LPG storage will be minimized, and the associated risk will be further minimized by proper implementation of good storage practices.

10.6.5.4 As discussed in **Section 10.5.3**, there is a relatively higher concentration of carbon dioxide at DG3 (i.e. ~5.9% v/v). While the recommended precautions and protective measures proposed in **Section 10.6.6** is considered sufficient to minimize the risk, attention shall be made during the detailed design stage to ensure the finalized set of mitigation measures are sufficient.

10.6.5.5 Besides, there might be maintenance works to be carried out after operation of the PRS. The precautionary and protective measures as discussed in **Section 10.5.7** are applicable to mitigate the potential landfill gas hazards.

10.6.6 Recommended Precautionary and Protective Measures

10.6.6.1 The source-pathway-target analysis as summarized in **Table 10.8** concluded that the overall risk level is “**High**” for the indoor areas, and also “**High**” for the farrier room, in which there would be use of LPG and naked flame. With reference to **Table 10.3** and **Table 10.4**, precautionary measures will be required to ensure that the planned development is safe which includes use of active gas control and gas detection system for implementation of “Alert, Action, and Alarm Level and contingency actions”.

10.6.6.2 For the outdoor area including outdoor carpark and community play area, the overall risk level for operational phases is “**Low**”, which indicates the risk is low that no precautionary measures are required.

10.6.6.3 The following sub-sections provide general advice and recommendations for the avoidance of environmental impacts related to landfill gas during the operational phases. The summary of the recommendations for different targets is given in **Table 10.9**.

Table 10.9 Summary of the recommendations for different targets

Section	Category	Recommendations
Indoor Areas (General) – High Risk		
10.6.7.1	B	Active gas control (e.g. use of mechanical ventilation system)
10.6.7.2 to 10.6.7.3	B	Gas detection system
10.6.7.4 to 10.6.7.5	C	Semi-active gas control (e.g. installation of wind scoops)
10.6.7.7 to 10.6.7.11	D	Gas-proof membrane / Clear void under the structure [1]
10.6.7.12 to 10.6.7.13	D	Compacted high-density concrete
10.6.7.14	D	Ventilation by natural air movement
10.6.7.15	D	Gas vents
10.6.7.16	D	Location of service entry points above ground
10.6.7.17	E	Measures due to power failure
10.6.7.18 to 10.6.7.23	E	Good site management, entry safety procedures
10.6.10	E	Other safety measures and monitoring
Indoor Areas (with Habitation) – High Risk		
-	-	Recommendations proposed for **Indoor Areas (General)**
10.6.8.1	D	Auto-opening windows
10.6.7.17	D	Wind scoops
Farrier rooms – High Risk		
-	-	Recommendations proposed for **Indoor Areas (General)**

Section	Category	Recommendations
10.6.9.4	B	Active gas control (e.g. use of mechanical ventilation system)
10.6.9.5	D	Auto-opening windows
10.6.9.6	B	Use of fire-rated building materials
10.6.9.7	D	Physical separation from other buildings
10.6.9.8	D	Natural ventilation
10.6.9.9	E	Proper storage of LPG
10.6.9.10	E	No unauthorized entry

Note:

[1] Based on current schematic design of the Project, majority of the proposed building would be provided with clear void underneath the structures which is considered as one of the mitigation measures. For proposed buildings that would not be able to provide clear void, gas-proof membrane would be used to avoid the migration of landfill gas from the landfill site to the indoor area.

10.6.6.4 Nevertheless, as the design of the Project is still subject to change during the detailed design stage, a detailed Landfill Gas Hazard Assessment shall be carried out to finalize the proposed landfill gas hazard mitigation measures.

10.6.7 Generic Design Measures

Active Gas Control

10.6.7.1 Active gas control mainly relies on the use of mechanical ventilation system. Mechanical ventilation system makes use of electrical energy to accelerate the dispersion of any accumulated landfill gas. The mechanical ventilation system may or may not integrate with the air conditioning system to control the air temperature.

Gas Detection System

10.6.7.2 Always-on gas detection system would be provided at all rooms, stables and indoor environment such as changing rooms, Coach Duty Rooms , offices, etc. which will be occupied by medium and highly sensitive targets and be involved in the long-term uses. The gas detector is used to monitor the methane, carbon dioxide and oxygen gas concentrations and should be calibrated on a regular basis according to the manufacturers' recommendations. These sensors should detect gas by catalytic oxidation or infra-red techniques and be capable of measuring concentrations of gas in the range 0-100% of LEL.

10.6.7.3 The gas detection system should include an alarm set at the trigger levels as mentioned in **Table 10.10** in order to give warning to the public and evacuate sensitive targets from buildings. The gas detection system will also interlock with the mechanical ventilation system where applicable. In case the gas concentrations exceed the trigger levels, mechanical ventilation system will be operated to restore methane, carbon dioxide and oxygen levels to safe concentrations as soon as possible. In the event of a power failure, the detectors should have an 8-hour battery back-up system, and the procedures should indicate for manual monitoring in the station in the event of prolonged power failure (of longer than 8 hours). **Appendix 10.2** shows the schematic layout of automatic gas detection system.

Table 10.10 Actions in the event of Landfill Gas being detected in the building structure

Parameter	Monitoring Results	Actions
Methane	>10% LEL (i.e. >0.5% v/v)	• Inform EPD, Landfill Contractor and the nominated person (e.g. proposed riding school facility manager);

Parameter	Monitoring Results	Actions
Carbon Dioxide	>0.5% v/v	• Remove all source of ignition from the affected areas of the building; • Ventilate the affected area to restore methane to <10% LEL (<0.5% v/v), carbon dioxide to <0.5% and/or oxygen levels to >19% v/v; • Seek specialist to review the existing precautionary measures to ensure the continuous safety of the occupants.
Oxygen	<19% v/v	
Methane	>20% LEL (i.e. >1% v/v)	• Inform EPD, Landfill Contractor and the nominated person (e.g. proposed riding school facility manager); • Advise and evacuate occupants/prohibit entry to the affected areas of the building; • Remove all source of ignition from the affected areas of the building; • Ventilate the affected area to restore methane to <10% LEL (<0.5% v/v), carbon dioxide to <0.5% and/or oxygen levels to >19% v/v; • Seek specialist to review the existing precautionary measures to ensure the continuous safety of the occupants.
Carbon Dioxide	>1.5% v/v	
Oxygen	<18% v/v	

Semi-active Gas Control

10.6.7.4 Semi-active gas control such as wind scoops are recommended.

10.6.7.5 Wind scoops would be installed to facilities where mechanical ventilation system with air extraction is not provided to facilitate the ventilation. They will be installed on the roof of the ancillary facilities with pipes to extract air from the stables. When wind strikes the wind scoops, the fans of the scoops would move and create negative pressure to extract air in the car park. Electricity supply is not required for wind scoops. This acts as a semi-active control to extract, if any, landfill gas from the indoor facilities.

Passive Gas Control

10.6.7.6 Passive controls involve the use of-compacted high density concrete and ventilation by natural air movement.

i. Gas-Proof Membrane

10.6.7.7 Gas proof membrane may be made use of polymeric membranes such as high-density polyethylene (HDPE) membrane liner. The material of the membrane should consist of a high strength woven fabric with an impermeable coating on both sides with equivalent materials. The permeability of the membrane should meet the requirements stated in the EPD’s guidance note which is 10^{-12} m/s or lower and should possess a long-term stability which will guarantee a lifetime of at least 30 years.

10.6.7.8 To achieve a continuous high integrity barrier to prevent methane and carbon dioxide gas ingress into buildings and structures, the membrane liner should be installed beneath the ground floor slab to form a continuous strip of membrane and around the perimeter edges of the buildings. The membrane should also be applied to the floor and wall of the underground tank, if any, as a continuous sealed layer.

10.6.7.9 As for barriers used to prevent movement of gas through the ground, use may be made of clay (or clay-rich soils), bentonite or polymeric membranes (such as HDPE). A gas barrier used to prevent movement of gas through services may form part of a more extensive barrier to prevent general migration towards the development (see above). The design detail at the point where the service penetrates the membrane is important and, in the case of HDPE membranes, pre-formed shrouds are often available.

10.6.7.10 In the case of water pipes and sewers which are not always fully filled, water traps, such as U-bends, should be provided to effectively seal off the conduit and prevent gas-phase transport. Typically drawing are shown in **Appendix 10.3**.

ii. Clear Void under the structure

10.6.7.11 Creating a clear void beneath the structure, ventilated by natural airflow, serves as an effective measure to prevent landfill gas from migrating to the indoor environment of the proposed development. This design provides preferential pathways for the release of gas, ensuring that any accumulated landfill gas can disperse safely into the atmosphere. Similar to the use of compacted high-density concrete, which slows the movement of gas through building materials, the ventilated void helps prevent gas buildup within the structure. By facilitating natural ventilation, this measure reduces the risk of hazardous concentrations of gas accumulating over time, thereby enhancing the overall safety of the building. **Appendix 10.4** illustrates the design of the clear void and its ventilation pathways.

iii. Compacted High-Density Concrete

10.6.7.12 To increase the resistance to gas permeation to the building, compacted high density concrete should be used for the floors and/or the walls directly in contact with the ground and/or slope of the landfill. Whilst concrete is permeable to gas, the rate of movement of gas through the concrete is slow and any build-up of gas could only occur over a long period of time.

10.6.7.13 By incorporating materials that can withstand high temperatures and resist ignition, the structure minimizes the risk of fire spreading in the event of a gas leak. Fire-tolerant materials act as a barrier, reducing the likelihood of flames coming into contact with any accumulated landfill gas, thereby lowering the chances of an explosion. This proactive approach not only enhances the safety of the facility but also protects the horses and personnel working within it.

iv. Ventilation by Natural Air Movement

10.6.7.14 As the Application Site is located on top of the TKOL II/III, which is situated in the valley surrounded by hills and near the coastline, effective utilisation of natural wind resources can enhance the dispersion of any potential landfill gas in the area. The landfill's location allows for prevailing easterly and southerly winds to flow unobstructed. Openings have been incorporated into the southern and eastern facades of the indoor facility to enhance ventilation, taking advantage of these winds to promote air circulation and mitigate any landfill gas accumulation.

v. Gas Vents

10.6.7.15 Vent pipes or gridded manhole covers may be used to avoid build-up of gas in underground utilities manholes. Venting stacks may be built into inspection chambers or connected to collection pipes within high permeability drainage layers adjacent to gas barriers. A typical vented manhole arrangement and vent pipes is shown in **Appendix 10.5**.

vi. Location of Service Entry Points Above Ground

10.6.7.16 In some cases, it is possible to route service entries into a building above ground level, thereby providing a discontinuity in the gas migration pathway and thus eliminating the risk of gas entry to the building interior. **Appendix 10.6** show the typical service entry above ground and typical surface detail for above ground termination of services within the Consultation Zone respectively.

vii. Measures due to Power Failure

10.6.7.17 For rooms with window provisions that are not occupied overnight, it is recommended to manually open windows or doors to ensure proper ventilation and avoid the inhalation of accumulated landfill gas. For rooms without window provisions, wind scoops will be installed to provide ventilation in case of a power failure.

Good Site Management

10.6.7.18 Proper site management can further reduce the risk of landfill gas. "No Smoking", "No Naked Flame" and "Potential Hazard of Landfill Gas" signs should be posted in the Application Site clearly visible to the public. Site staff will carry out inspection to ensure that no smoking and no naked flame are in place in the Application Site.

10.6.7.19 Flame cooking would be banned in all catering facilities. Electronic cooking devices should be used instead. All electric appliances such as ventilation systems, lighting systems, pumps and switches used within Application Site should be spark-proofed.

Entry Safety Procedures

10.6.7.20 Confined spaces, including water storage tanks, manholes, etc., exist in the Application Site during the operational phase. In confined spaces which is large enough to permit access to, personnel should be subject to entry safety procedures as stipulated in the Factory and Industrial Undertakings (F&IU) (Confined Spaces) Regulation.

10.6.7.21 In accordance with the Regulation, "confined spaces" means any place in which, by virtue of its enclosed nature, there arises a reasonably foreseeable specified risk and without limiting the generality of the foregoing, includes any chamber, tank, vat, pit, well, sewer, tunnel, pipe, flue, boiler, pressure receiver, hatch, caisson, shaft or silo in which "specified risk" arises in which "specified risk" represents:

(a) Serious injury to any person at work arising from a fire or explosion;

(b) The loss of consciousness of any person at work arising from an increase in body temperature;

(c) the loss of consciousness or asphyxiation of any person at work arising from gas, fume, vapour or the lack of oxygen;

(d) the drowning of any person at work arising from an increase in the level of liquid; or

(e) the asphyxiation of any person at work arising from a free flowing solid or the inability to reach a respirable environment due to entrapment by a free flowing solid.

10.6.7.22 The key issues with regards to confined spaces which are at risk of landfill gas build-up are set up below.

- The entry or access point should be clearly marked with a warning notice (in English and Chinese) which states that there is the possibility of flammable and asphyxiating gases accumulating within.
- The warning notice should also give the telephone number of an appropriate competent person who can advise on the safety precautions to be followed before entry and during occupation of the manhole.

- Personnel should be made aware of the dangers of entering confined spaces potentially containing hazardous gases and, where appropriate, should be trained in the use of gas detection equipment.
- Prior to entry, the atmosphere within the chamber should be checked for oxygen, methane and carbon dioxide concentrations. The chamber may then only be entered if oxygen is greater than 18% by volume, methane is less than 10% of the Lower Explosive Limit (LEL), which is equivalent to 0.5% by volume (approximately), and carbon dioxide is less than 0.5% by volume.
- If either carbon dioxide or methane are higher, or oxygen lower, than the values given above, then entry to the chamber should be prohibited and expert advice sought.
- Even if conditions are safe for entry, no worker should be permitted to enter the chamber without having another worker present at the surface. The worker who enters the chamber should wear an appropriate safety/recovery harness and, preferably, should carry a portable methane, carbon dioxide and oxygen meter.

10.6.7.23 In general, when work is being undertaken in confined spaces, sufficient approved resuscitation equipment, breathing apparatus and safety torches should be available. Persons involved in or supervising such work should be trained and practised in the use of such equipment. A permit-to-work system for entry into confined spaces should be developed by an appropriately qualified person and consistently employed.

10.6.8 Additional Design Measures for Proposed Indoor Areas with Habitation

i. Measures due to Power Failure (for Rooms with Habitation)

10.6.8.1 In the event of a power failure, rooms with window provisions that are occupied overnight (e.g. Coach Duty Rooms and stables) will be equipped with auto-opening windows. Alternatively, the security on-site overnight will alert occupants about the power failure and take action to open windows and doors to allow natural ventilation.

10.6.9 Additional Design Measures for Farrier Rooms

10.6.9.1 This Project would require the use of Liquefied Petroleum Gas (LPG) at farrier rooms as it is essential in the horseshoeing process due to its ability to provide high, consistent temperatures required for forging and shaping horseshoes. LPG-powered forges provide the high temperatures needed to heat metal quickly, allowing farriers to manipulate it into the desired shape without unnecessary delays.

10.6.9.2 However, the use of LPG-powered forges could pose landfill gas hazards if proper precautions are not taken. When the leaked landfill gas combined with the open flames generated by LPG forges, this could lead to hazardous situations, including fire outbreaks or even explosions. Therefore, it is crucial to implement adequate ventilation, regular monitoring for gas leaks, and safety protocols to mitigate these risks, ensuring a safe working environment for farriers and the horses they care for.

10.6.9.3 The recommended precautionary and protective measures mentioned in **Section 10.6.5.2** and **Section 10.6.6.4** should be implemented. Moreover, additional measures such as use of active gas control with auto-opening window system, use of fire-rated building material and isolation from other buildings shall be applied at the proposed farrier rooms.

i. Active Gas Control

10.6.9.4 Active gas control mainly relies on the use of mechanical ventilation system. Mechanical ventilation system makes use of electrical energy to accelerate the dispersion of any accumulated landfill gas. The mechanical ventilation system may or may not integrate with the air conditioning system to control the air temperature. The mechanical ventilation system will also be interlocked with the always-on gas detection system to regulate the air flow based on the methane, carbon dioxide and oxygen gas concentration. In case of exceedance of trigger levels in **Table 10.7**. The mechanical ventilation system will be set to operate in full load to reduce the gas concentrations to safe concentrations as soon as possible.

10.6.9.5 In case of power failure, an automatic window system equipped with a rechargeable backup battery would automatically open the windows of the farrier room to allow natural ventilation to avoid accumulation of landfill gas. When the power supply is recovered, trained staff with proper safety precautions have to carry appropriate portable gas meters to the farrier room and confirm the methane, carbon dioxide and oxygen gas levels are well within the safe limit and the mechanical ventilation system is operated normally. A risk assessment would be conducted by qualified staff to ensure the affected areas are safe prior to re-open for access.

ii. Use of Fire-rated Building Materials

10.6.9.6 By incorporating materials that can withstand high temperatures and resist ignition, the structure minimizes the risk of fire spreading in the event of a gas leak. Fire-tolerant materials act as a barrier, reducing the likelihood of flames coming into contact with any accumulated landfill gas, thereby lowering the chances of an explosion. This proactive approach not only enhances the safety of the facility but also protects the horses and personnel working within it.

iii. Physical Separation from Other Buildings

10.6.9.7 By strategically physically separating horseshoeing facilities away from adjacent structures, the risk of fire spreading to nearby buildings is greatly reduced. This separation[4] ensures that, in the event of a fire caused by a landfill gas ignition, the flames have limited opportunities to spread, protecting both the horseshoeing area and surrounding properties. Additionally, proper physical separation facilitates better airflow and natural ventilation, which can help dissipate any accumulated landfill gas before it reaches hazardous concentrations. Together, these measures create a safer environment for both farriers and horses, ensuring that operations can continue with minimal risk.

iv. Natural Ventilation

10.6.9.8 Apart from the above design measures, natural ventilation would be allowed through two large gates at two sides of the farrier room during the use of naked flame.

v. Proper Storage of LPG

10.6.9.9 The storage of LPG will follow the Code of Practice for Hong Kong LPG Industry – Module 1: "LPG Compounds and Cylinder Stores", some measures are extracted below:

- LPG cylinder stores shall be enclosed by walls or an industrial type fence not less than 1.8m high. The floor of the stores shall be level;
- A sterile area of at least 1m shall be provided around the LPG cylinder store and should be conspicuously marked on the floor with yellow lines;

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[4] According to Clause C5.2 of Code of Practice for Fire Safety in Buildings 2011 (2024 Edition) published by Buildings Department, buildings on the same site are regarded as adjoining buildings if they are less than 1.8m apart.

- Drains shall be avoided in the floor area or in the immediate vicinity of the LPG cylinder store;
- Electrical apparatus shall not be installed inside the LPG cylinder store or within the required separation distance outside the LPG cylinder store;
- Warning signs and emergency instructions in both English and Chinese shall be posted near each entrance on the outside wall/fence of the installation. The size of letters/characters of the warning signs, e.g. “No Smoking”, “LPG Highly Flammable” and “LPG Store”, shall be at least of 120mm in height;
- LPG cylinder stores shall be located in a well-ventilated area and shall be easily accessible for transportation of cylinders and emergency services; and
- LPG cylinder stores shall be readily accessible at ground level.

vi. No Unauthorized Entry

10.6.9.10 To safeguard the safety of the farrier room, no unauthorized entry is allowed. Only authorised well trained personnel who would have been briefed on the potential hazards relating to landfill gas and the specific safety procedures to be followed will be accessible to the farrier room. Visitors could only access the farrier room under supervision of the well-trained personnel, and shall be informed of the potential landfill gas hazard, fire and explosion.

vii. Precaution Measures in Daily Operation

10.6.9.11 Apart from the additional measures proposed above, a comprehensive training programme and setup standard working practices/ procedures has been established to ensure that all farriers are well-trained and well-experienced and working in a safe environment, which are listed below:

- Safe Forge Practices/ Safe Work Instruction: to ensure the use and operation of forge safely and in good working order;
- Storage, Operation and Routine Maintenance of Forge Gas Supply: Guide to safe working practice in routine maintenance and emergency work conducted;
- Instruction on the wall: The instruction is clear and straight-forward to ensure the proper use of forge;
- Comprehensive training programme: only HKJC Farriers are allowed to operate the fire forges, who are locally trained under the HKJC 51-month Farrier Training Programme;
- Refresher workshop safety training: Provided every year to all farrier staff; and
- Periodic inspection: Whole setup (fire forges, LPG pipes, LPG store, etc.) are inspected regularly to ensure everything is in order for safety use.

10.6.10 Other Safety Measures and Monitoring

10.6.10.1 On-site staff should be informed of the potential LFG hazards, and appropriate safety procedures should be followed. On-site Safety Officer will be appointed specifically for the operation of the Project. During the operational phase, regular coordination with the restoration contractor will be maintained.

10.6.10.2 In the event of high landfill gas concentrations being detected during the operational phase, actions listed in **Table 10.10** shall be implemented. In addition, an Emergency Action Plan shall be developed and followed by the on-site staff to ensure proper measures would be immediately taken to further minimise the potential risk.

10.6.10.3 Moreover, a Departmental Safety Manager (DSM) would be appointed to identify Occupational Safety and Health (OSH) problems and monitor the implementation of control measures in each riding school. DSM will conduct and prepare a monthly on-site inspection report in each riding school with the designated Safety Representative, who is responsible to implement and oversee the routine OSH works. The Farrier Services Department also has a Farrier Operation and Workshop Officer who will regularly conduct workshop safety inspections and training to all farrier users within the department.

10.6.10.4 In addition, the restoration contractor will carry out routine monitoring and inspection works on the existing landfill facilities regularly during the operational phase.

10.7 Environmental Monitoring and Audit

10.7.1 Construction Phase

10.7.1.1 Periodically during ground-works construction, the works area should be monitored by the On-site Safety Officer for oxygen, methane and carbon dioxide gas concentrations using appropriately calibrated portable gas detection equipment. Routine monitoring should be carried out in all excavations, manholes and any other confined spaces that may have been created. The monitoring requirement of excavations stated in Section 8.25 to 8.27 of the Landfill Gas Hazard Assessment Guidance Note will be followed. All measurements of landfill gas should be recorded and documented by a standard record form to be approved by EPD. The form will detail the location, time of monitoring and equipment used, together with the gas concentrations measured to ensure all relevant data are recorded.

10.7.1.2 Adequate site supervision will be required to ensure that protection measures are implemented and constructed in accordance with the design. In addition, a maintenance and monitoring programme should be established to ensure the continued performance of the implemented protection measures. Safety measures such as gas detection system should be regularly maintained and calibrated (if appropriate). Regular maintenance and calibration shall be properly recorded as one of the good site management measures.

10.7.2 Operational Phase

10.7.2.1 Regular monitoring of landfill gas, including indoor landfill gas monitoring, surface landfill gas emission monitoring and surface water monitoring, should be conducted to verify the effectiveness of the implemented protection measures. Landfill gas monitoring would continuously be undertaken by EPD's landfill operator during the operational phase of the Project at the existing monitoring locations. In addition, always-on gas detection system should be installed at the rooms and indoor environment, such as lecture, changing room and Coach Duty Rooms, etc. which will be occupied by medium and high sensitive targets and be involved in the long-term uses to monitor the methane, carbon dioxide and oxygen gas concentrations. They should also be installed in confined spaces with significant size where entry of person is possible. Exceedance signal generated by the gas detection system would be delivered to the riding school operator, EPD and the existing landfill contractor.

10.7.2.2 Adequate site supervision will be required to ensure that protection measures are implemented and maintained in accordance with the design. In addition, a maintenance and monitoring programme should be established to ensure the continued performance of the implemented protection measures. Safety measures such as gas detection system, mechanical ventilation system, etc. should be regularly maintained and calibrated (if appropriate). Regular maintenance and calibration shall be properly recorded as one of the good site management measures.

10.8 Summary

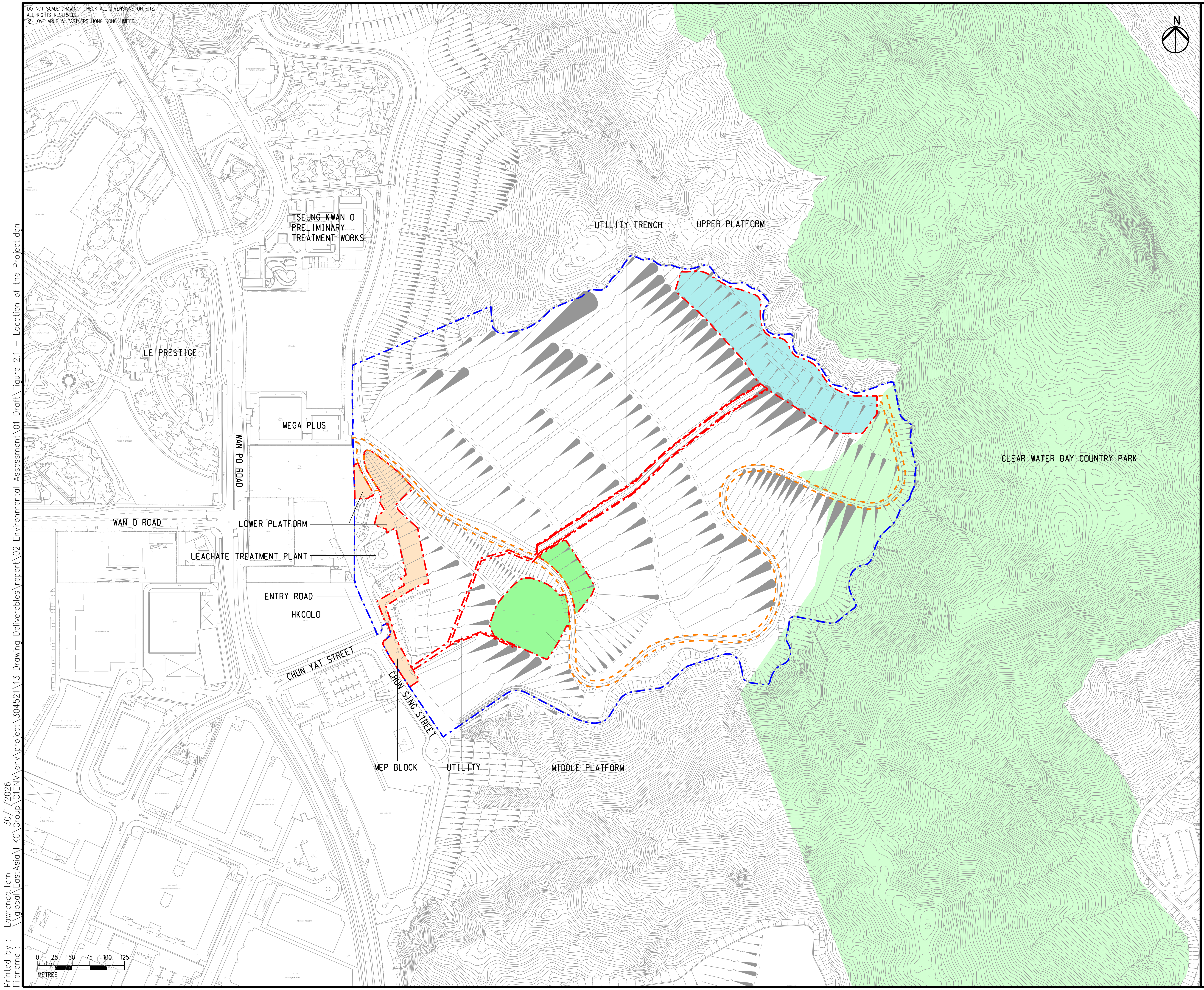
10.8.1 Construction Phase

10.8.1.1 The results of this qualitative risk assessment for landfill gas hazards indicate the risk level from the Project during the construction phase is “**Medium**”. With the implementation of appropriate protective and precautionary measures according to Landfill Gas Hazard Assessment Guidance Note, adverse impacts on the targets are mitigated to acceptable level.

10.8.2 Operational Phase

10.8.2.1 The results of this qualitative risk assessment for LFG hazards indicate the risk level from the Project during the operational phase is from “**Low**” to “**High**”. For the high risk targets such as indoor areas with free public access and medium risk targets such as indoor areas with limited public access, a combination of passive control system, gas detection system and good site management should be provided. Maintenance staff working in the confined spaces should implement entry safety procedures as stipulated in the F&IU (Confined Spaces) Regulation. By the provision of active and semi-active control systems, passive control system, gas detection system, good site management and entry safety procedures, the risk of the targets have been reduced to acceptable levels.

Figures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TSEUNG KWAN O PRELIMINARY TREATMENT WORKS
UTILITY TRENCH
UPPER PLATFORM
LE PRESTIGE
MEGA PLUS
WAN PO ROAD
WAN O ROAD
LOWER PLATFORM
LEACHATE TREATMENT PLANT
ENTRY ROAD
HKCOLO
CHUN YAT STREET
CHUN SING STREET
CLEAR WATER BAY COUNTRY PARK
MEP BLOCK
UTILITY
MIDDLE PLATFORM
0 25 50 75 100 125
METRES

LEGEND

🟥 APPLICATION SITE
🟧 LOWER PLATFORM
🟩 MIDDLE PLATFORM
🟦 UPPER PLATFORM
🟧 ACCESS ROAD (BY EPD)
🟦 BOUNDARY OF TKOL II/III
🟩 CLEAR WATER BAY COUNTRY PARK

Rev	Description	By	Date
B	SECOND ISSUE	GL	06/25
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Consultant

ARUP

Project title

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing title

LOCATION OF THE PROJECT

Drawing no. FIGURE 2.1
Rev. B

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Filename : \\global\EastAsia\HKG\Group\C1ENV\env\project\304521\13 Drawing Deliverables\report\02 Environmental Assessment\01 Draft\Figure 2.1 - Location of the Project.dgn

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Filename : \\global\EastAsia\HKG\Group\C1ENV\env\project\304521\13 Drawing Deliverables\report\02 Environmental Assessment\01 Draft\Figure 3.1 - Assessment Area for Air Quality Impact Assessment and PATH Grids.dgn

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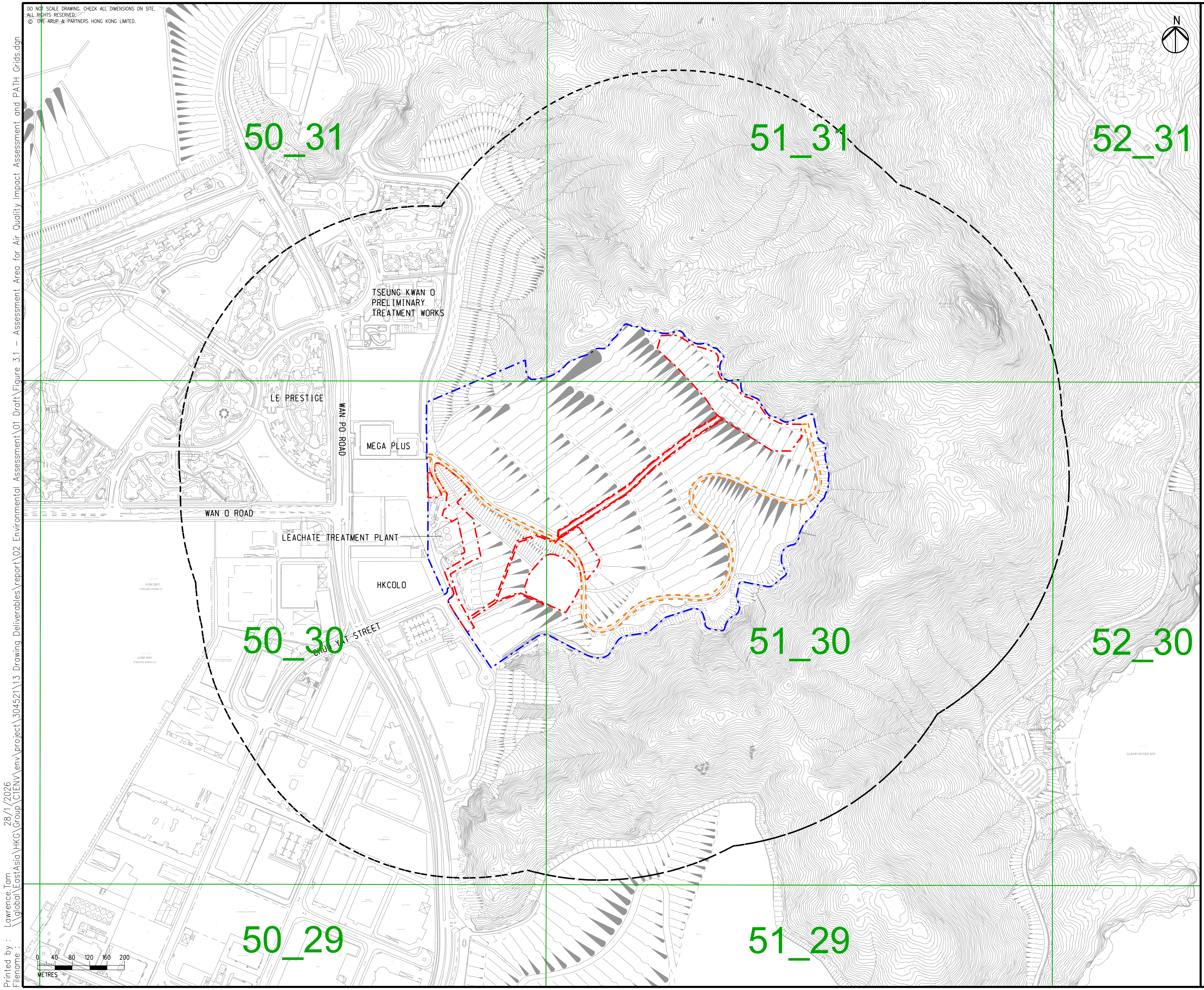
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52_30
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LEGEND

🟥	APPLICATION SITE
🟧	ACCESS ROAD (BY EPD)
🟦	BOUNDARY OF TKOL II/III
⬛	500m ASSESSMENT AREA
51_30	PATH GRIDS

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Drawing title

ASSESSMENT AREA FOR AIR QUALITY IMPACT ASSESSMENT AND PATH GRIDS

Drawing no. FIGURE 3.1
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Filename : \\global\EastAsia\HKG\Group\C1ENV\env\project\304521\13 Drawing Deliverables\report\02 Environmental Assessment\01 Draft\Figure 3.2 - Locations of Air Sensitive Receivers.dgn

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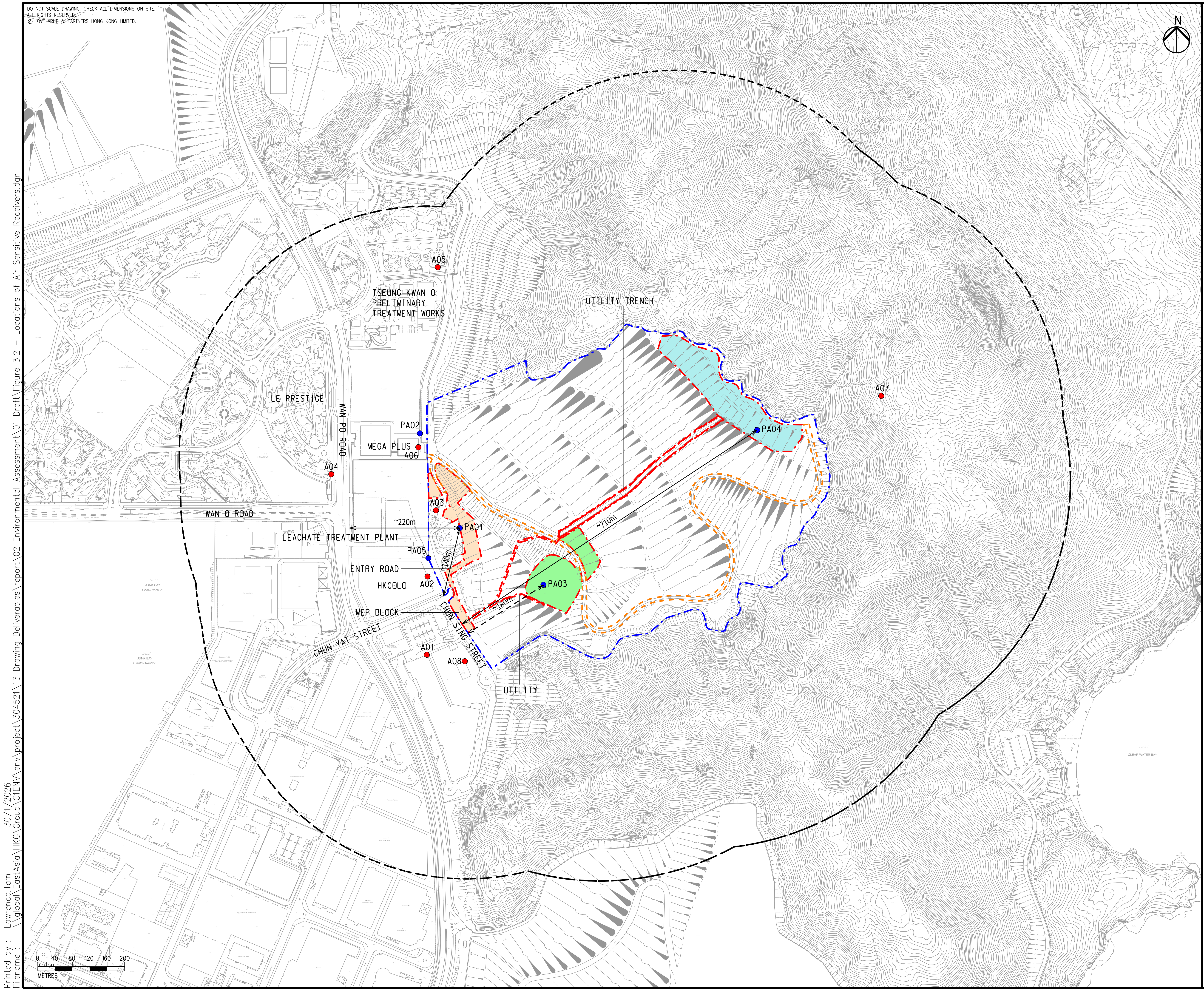
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PA05
140m
ENTRY ROAD
PA03
HKCOLO
A02
180m
MEP BLOCK
CHUN SING STREET
CHUN YAT STREET
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UTILITY
0 40 80 120 160 200
METRES

LEGEND

- ▭ APPLICATION SITE
- 🟧 LOWER PLATFORM
- 🟩 MIDDLE PLATFORM
- 🟦 UPPER PLATFORM
- ▭ ACCESS ROAD (BY EPD)
- ▭ BOUNDARY OF TKOL II/III
- ▭ 500m ASSESSMENT AREA
- ● EXISTING AIR SENSITIVE RECEIVERS
- ● PLANNED AIR SENSITIVE RECEIVERS

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Drawing title

LOCATIONS OF AIR SENSITIVE RECEIVERS

Drawing no. FIGURE 3.2
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Filename : \global\EastAsia\HKG\Group\C1ENV\env\project\304521\13 Drawing Deliverables\report\02 Environmental Assessment\01 Draft\Figure 3.3 - Locations of Key Emission Sources in the Vicinity of the Project.dgn

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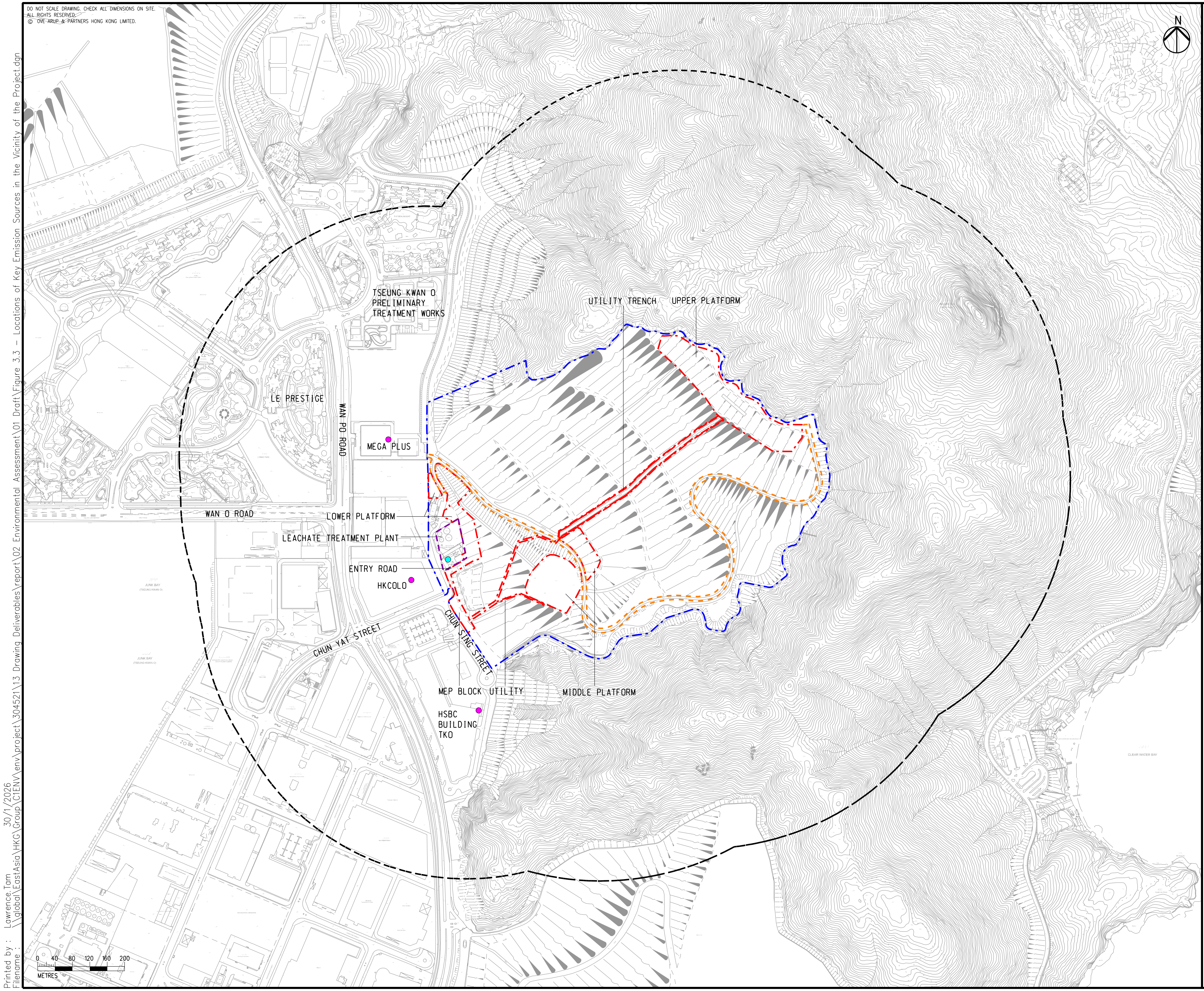
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CLEAR WATER BAY
0
40
80
120
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200
METRES

LEGEND

- 🟥 APPLICATION SITE
- 🟧 ACCESS ROAD (BY EPD)
- ⬛ 500m ASSESSMENT AREA
- 🟪 LEACHATE TREATMENT PLANT
- ● SOURCES UNDER SPECIFIED PROCESS LICENSE
- ● SOURCE FROM EXISTING LEACHATE TREATMENT PLANT

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Drawing title

LOCATIONS OF KEY EMISSION SOURCES IN THE VICINITY OF THE PROJECT

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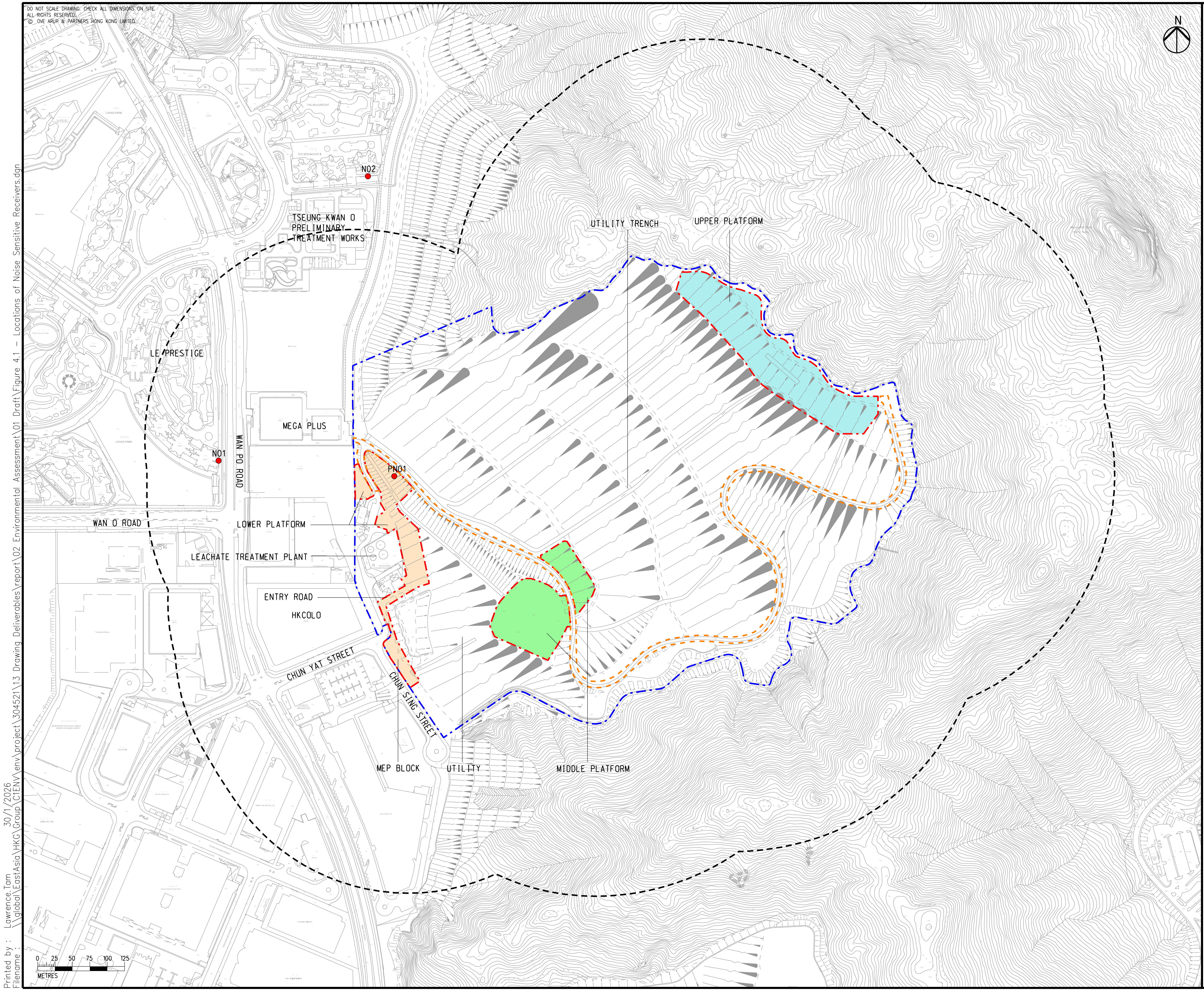
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100
125
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LEGEND

🟥	APPLICATION SITE
🟧	LOWER PLATFORM
🟩	MIDDLE PLATFORM
🟦	UPPER PLATFORM
🟧	ACCESS ROAD (BY EPD)
🟦	BOUNDARY OF TKOL II/III
⬛	300m ASSESSMENT AREA
●	NOISE SENSITIVE RECEIVERS

Rev	Description	By	Date
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Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing title

LOCATIONS OF NOISE SENSITIVE RECEIVERS

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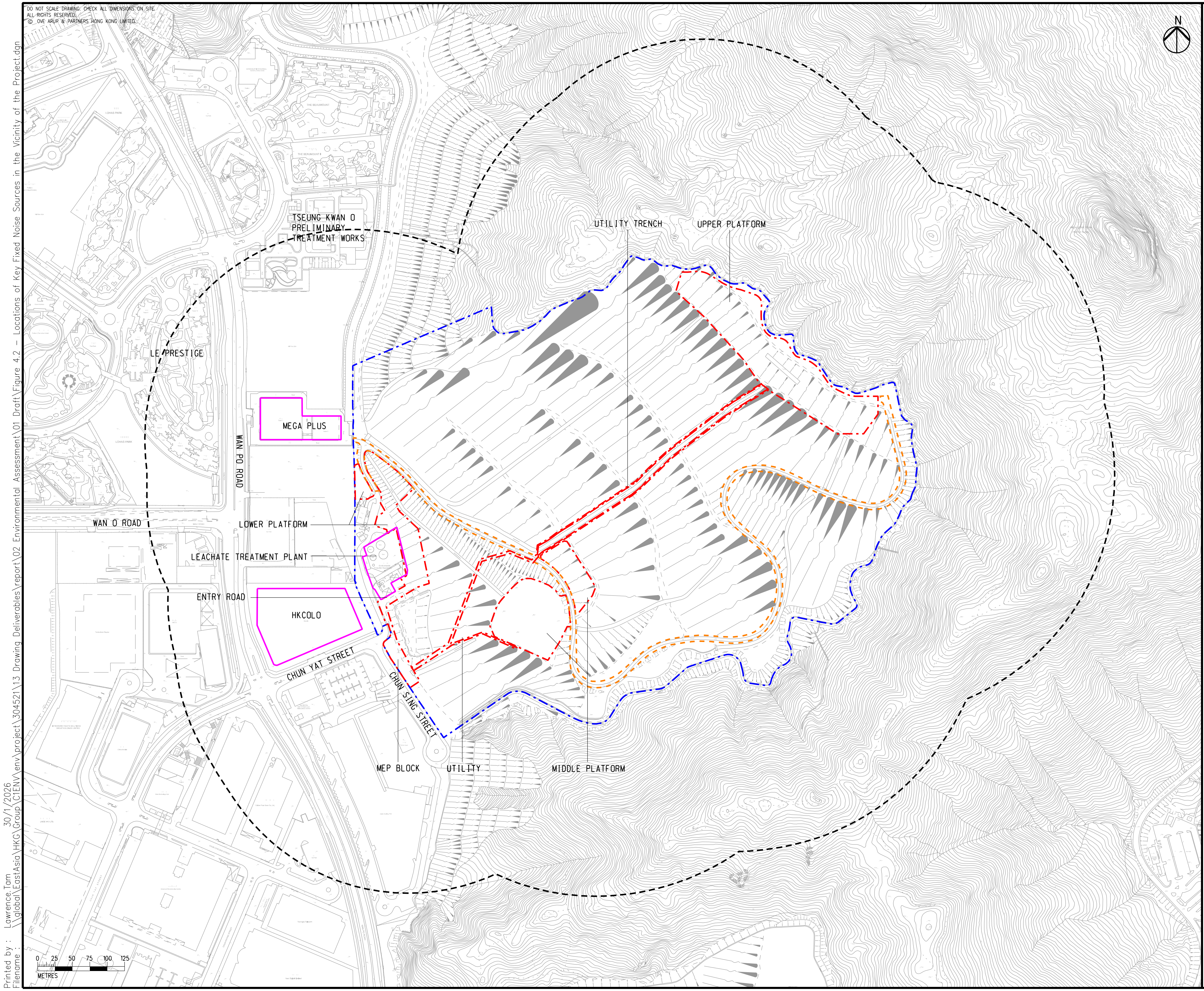
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LOWER PLATFORM
LEACHATE TREATMENT PLANT
ENTRY ROAD
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CHUN YAT STREET
CHUN SING STREET
MEP BLOCK
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MIDDLE PLATFORM
0
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75
100
125
METRES

LEGEND
- 🟥 APPLICATION SITE
- 🟧 ACCESS ROAD (BY EPD)
- 🟦 BOUNDARY OF TKOL II/III
- ⬛ 300m ASSESSMENT AREA
- 🟪 KEY FIXED NOISE SOURCES

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Drawing title
LOCATIONS OF KEY FIXED NOISE SOURCES IN THE VICINITY OF THE PROJECT

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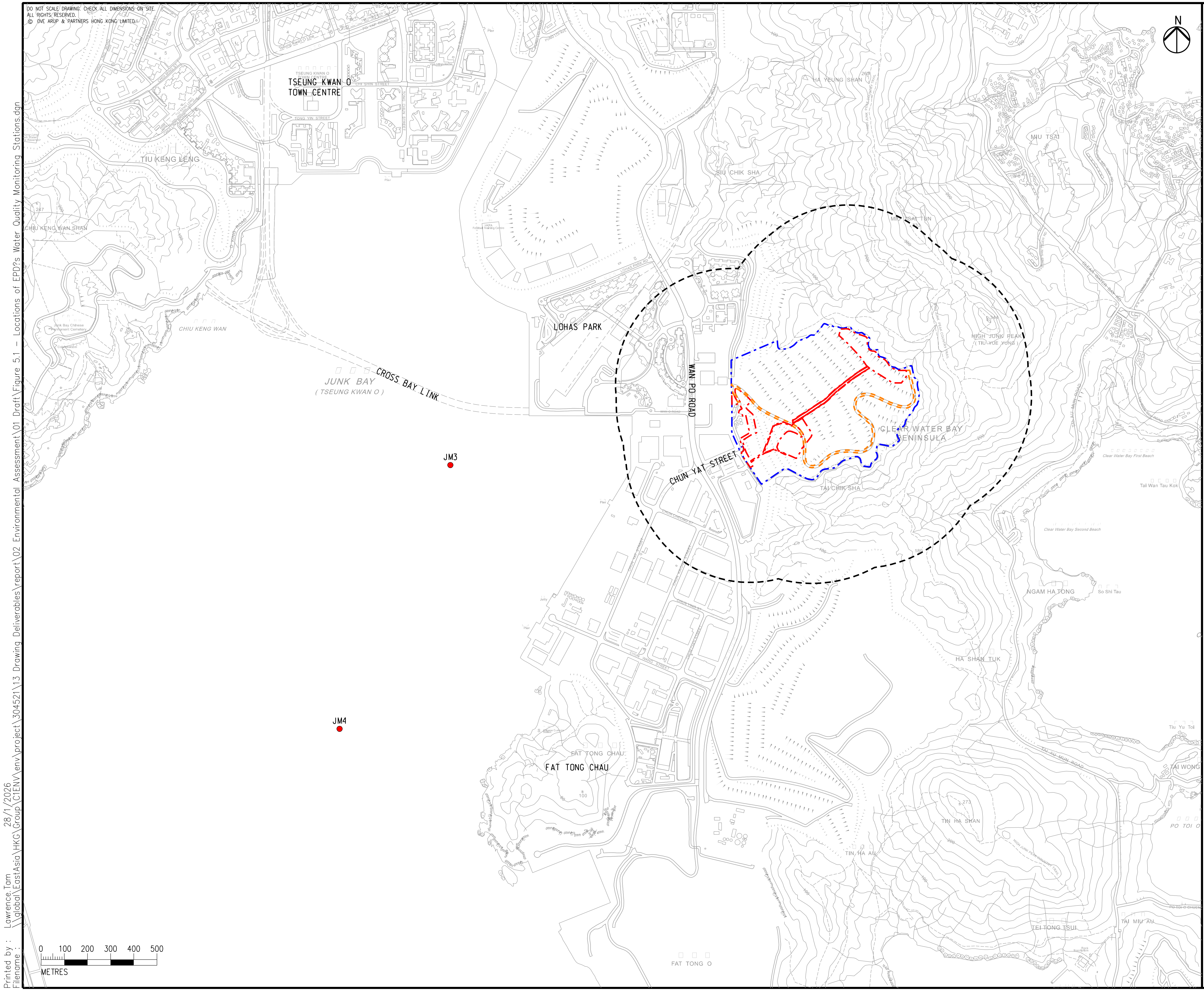
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TSEUNG KWAN O
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(TSEUNG KWAN O)
WAN PO ROAD
CHUN YAT STREET
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JM4
HA YEUNG SHAN
SIU CHIK SHA
MIU TSAI
HIGH JUNK PEAK
(TIU YUE YUNG)
CLEAR WATER BAY
PENINSULA
TAI CHIK SHA
NGAM HA TONG
HA SHAN TUK
FAT TONG CHAU
TIN HA SHAN
TIN HA AU
TEI TONG TSUI
TAI MIU AU
FAT TONG O
0 100 200 300 400 500
METRES

LEGEND
- 🟥 APPLICATION SITE
- 🟧 ACCESS ROAD (BY EPD)
- 🟦 BOUNDARY OF TKOL II/III
- ⬛ 500m ASSESSMENT AREA
- ● MARINE WATER MONITORING STATIONS

Rev	Description	By	Date
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Drawing title

LOCATIONS OF EPD'S WATER QUALITY MONITORING STATIONS

Drawing no.	Rev.
FIGURE 5.1	B

Drawn	Date	Checked	Approved
GL	06/25	TL	FC

Scale AS SHOWN

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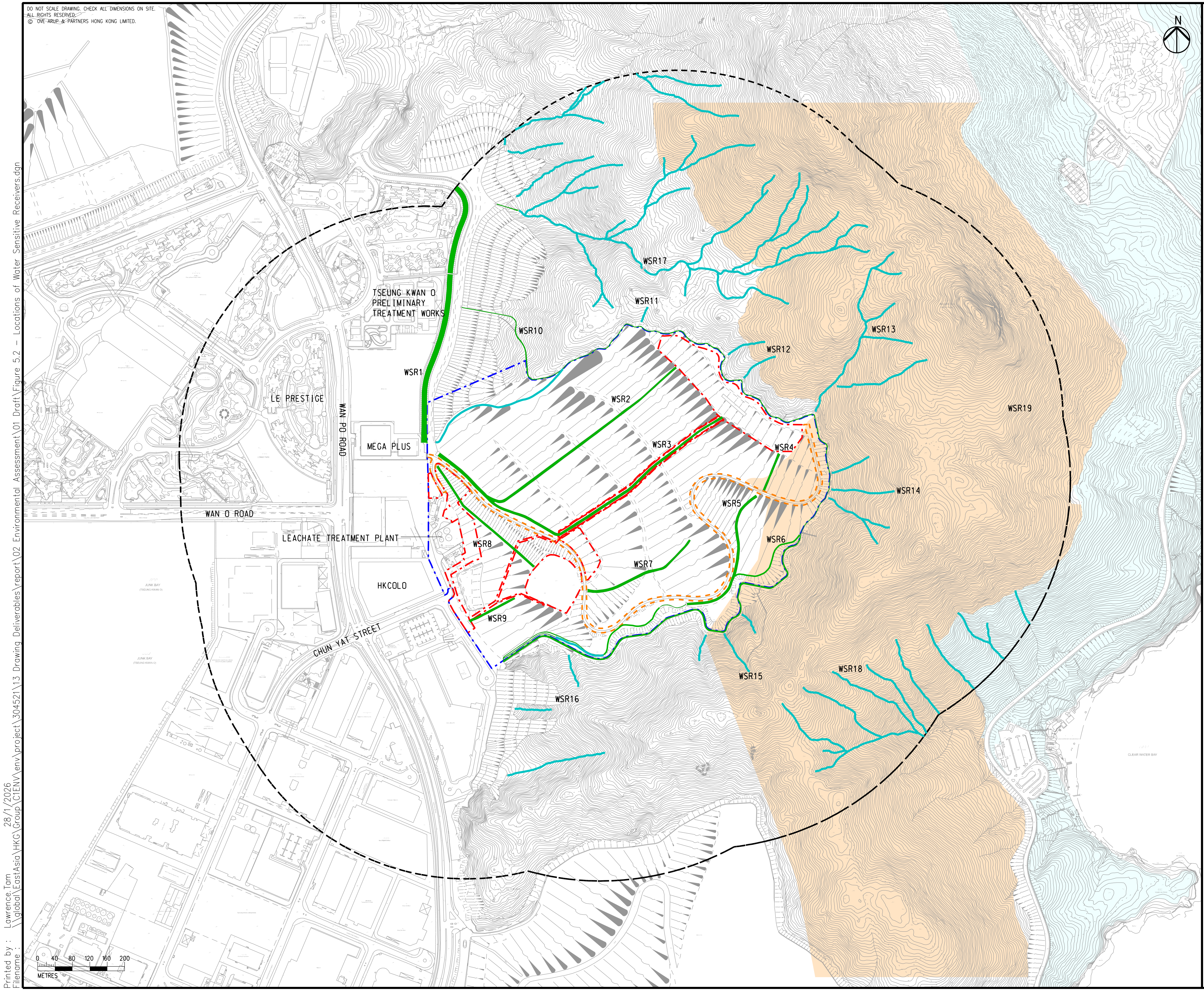
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WSR19
TSEUNG KWAN O PRELIMINARY TREATMENT WORKS
LE PRESTIGE
WAN PO ROAD
MEGA PLUS
WAN O ROAD
LEACHATE TREATMENT PLANT
HKCOLO
CHUN YAT STREET
0 40 80 120 160 200
METRES

LEGEND

🟥	APPLICATION SITE
🟧	ACCESS ROAD (BY EPD)
🟦	BOUNDARY OF TKOL II/III
☐	500m ASSESSMENT AREA
☐	CONSERVATION AREA
🟧	CLEAR WATER BAY COUNTRY PARK
🟩	CHANNELS
🟦	WATERCOURCES

Rev	Description	By	Date
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Drawing title

LOCATIONS OF WATER SENSITIVE RECEIVERS

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FIGURE 5.2		B	
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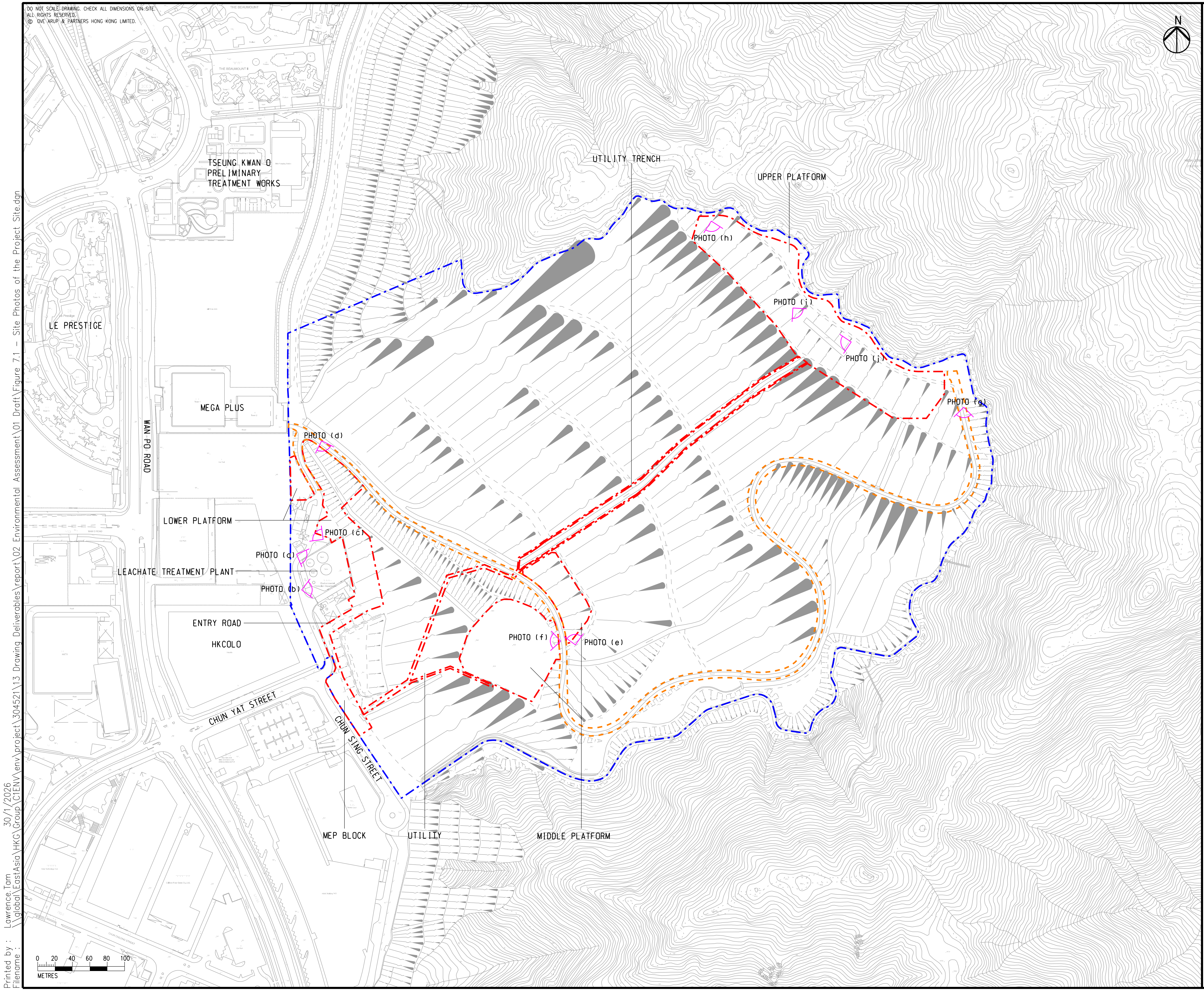
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PHOTO (j)
PHOTO (g)
PHOTO (d)
LOWER PLATFORM
PHOTO (c)
PHOTO (a)
LEACHATE TREATMENT PLANT
PHOTO (b)
ENTRY ROAD
HKCOLO
PHOTO (f)
PHOTO (e)
CHUN YAT STREET
CHUN SING STREET
MEP BLOCK
UTILITY
MIDDLE PLATFORM
0 20 40 60 80 100
METRES

LEGEND
🟥 APPLICATION SITE
🟧 ACCESS ROAD (BY EPD)
🟦 BOUNDARY OF TKOL II/III
▽ VIEW ANGLE

Rev	Description	By	Date
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Drawing title
SITE PHOTOS OF
THE APPLICATION SITE
(SHEET 1 OF 2)

Drawing no.	Rev.
FIGURE 7.1	B

Drawn	Date	Checked	Approved
GL	06/25	TL	FC

Scale	Status
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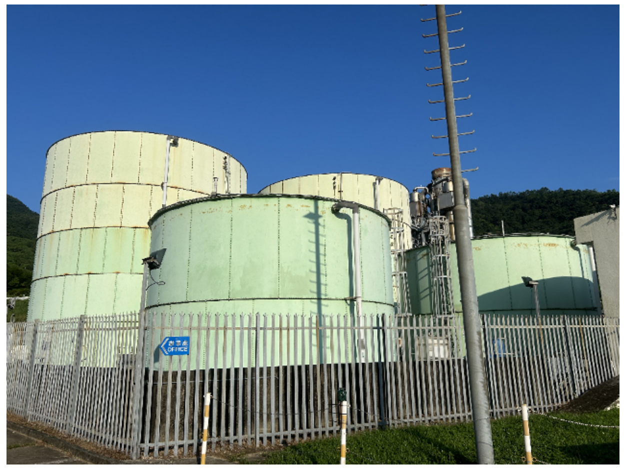
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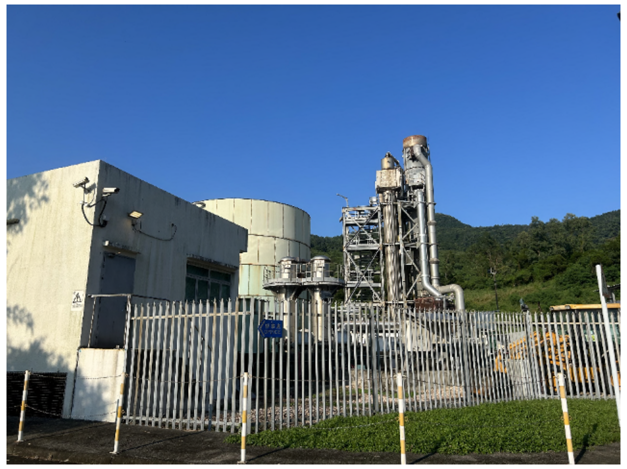
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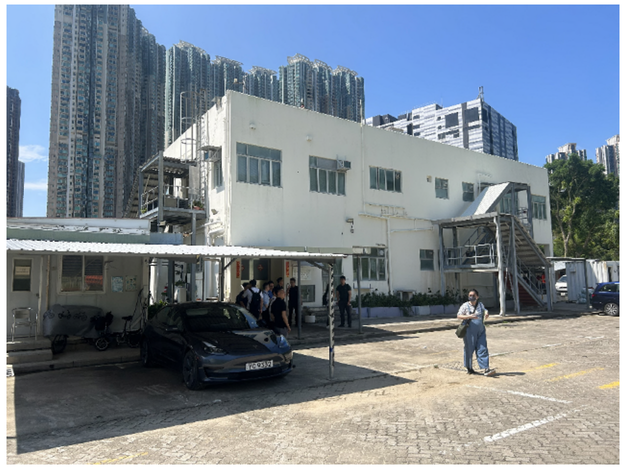
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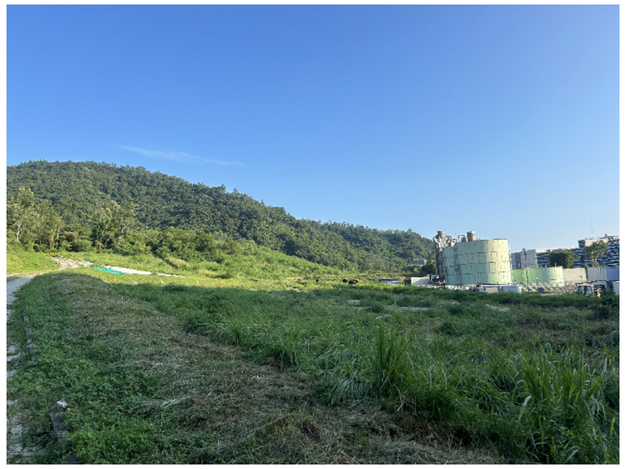
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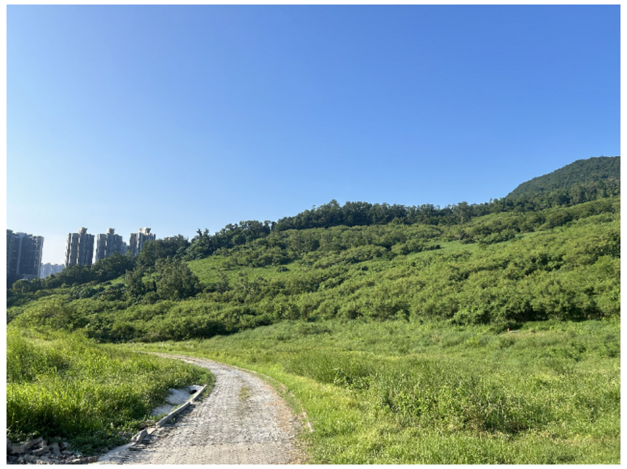
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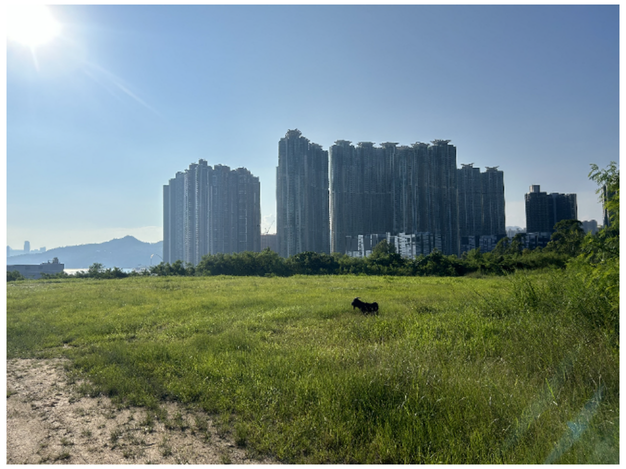
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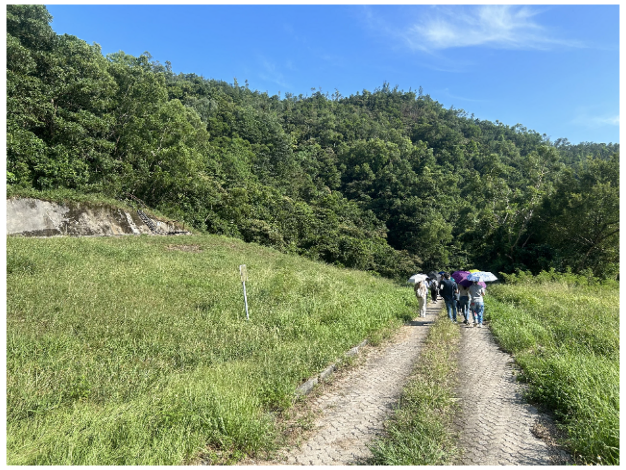
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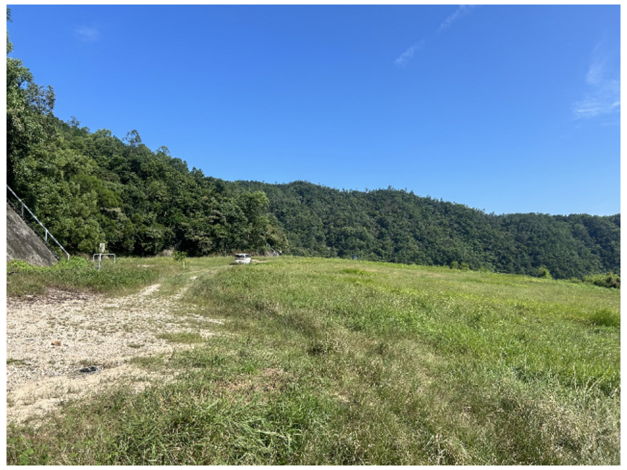
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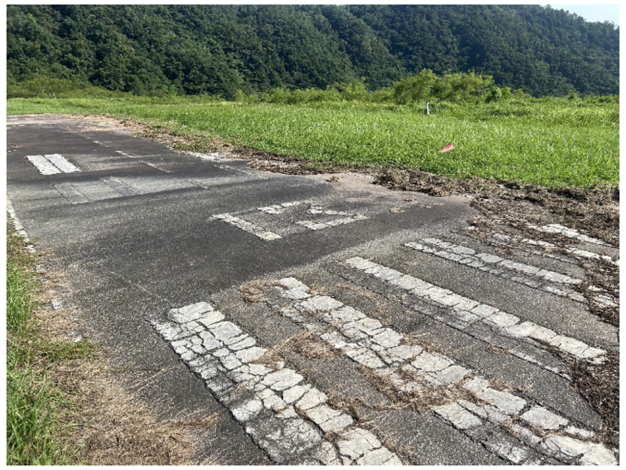
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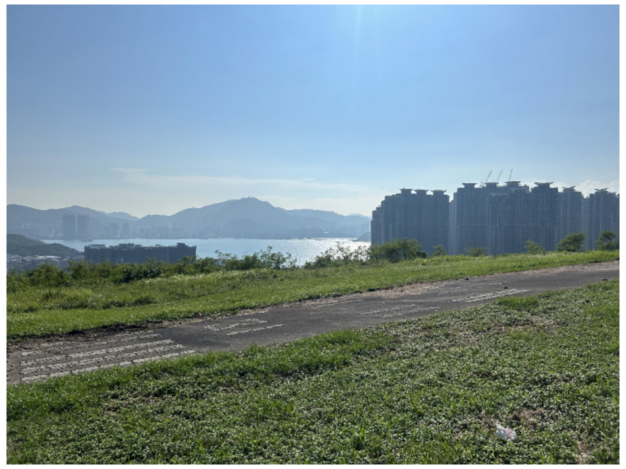
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Rev	Description	By	Date
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ARUP

Project title

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing title

SITE PHOTOS OF
THE APPLICATION SITE
(SHEET 2 OF 2)

Drawing no. FIGURE 7.1a
Rev. A

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Printed by : Lawrence.Tam 28/1/2026
Filename : \\global\EastAsia\HKG\Group\CIENV\env\project\304521\13 Drawing Deliverables\report\02 Environmental Assessment\01 Draft\Figure 7.1 - Site Photos of the Project Site.dgn

Printed by : Lawrence.Tam 28/1/2026
Filename : \\global\EastAsia\HKG\Group\C1ENV\env\project\304521\13 Drawing Deliverables\report\02 Environmental Assessment\01 Draft\Figure 10.1 - Locations and Consultation Zones of Existing Landfill and Restored Landfill.dgn

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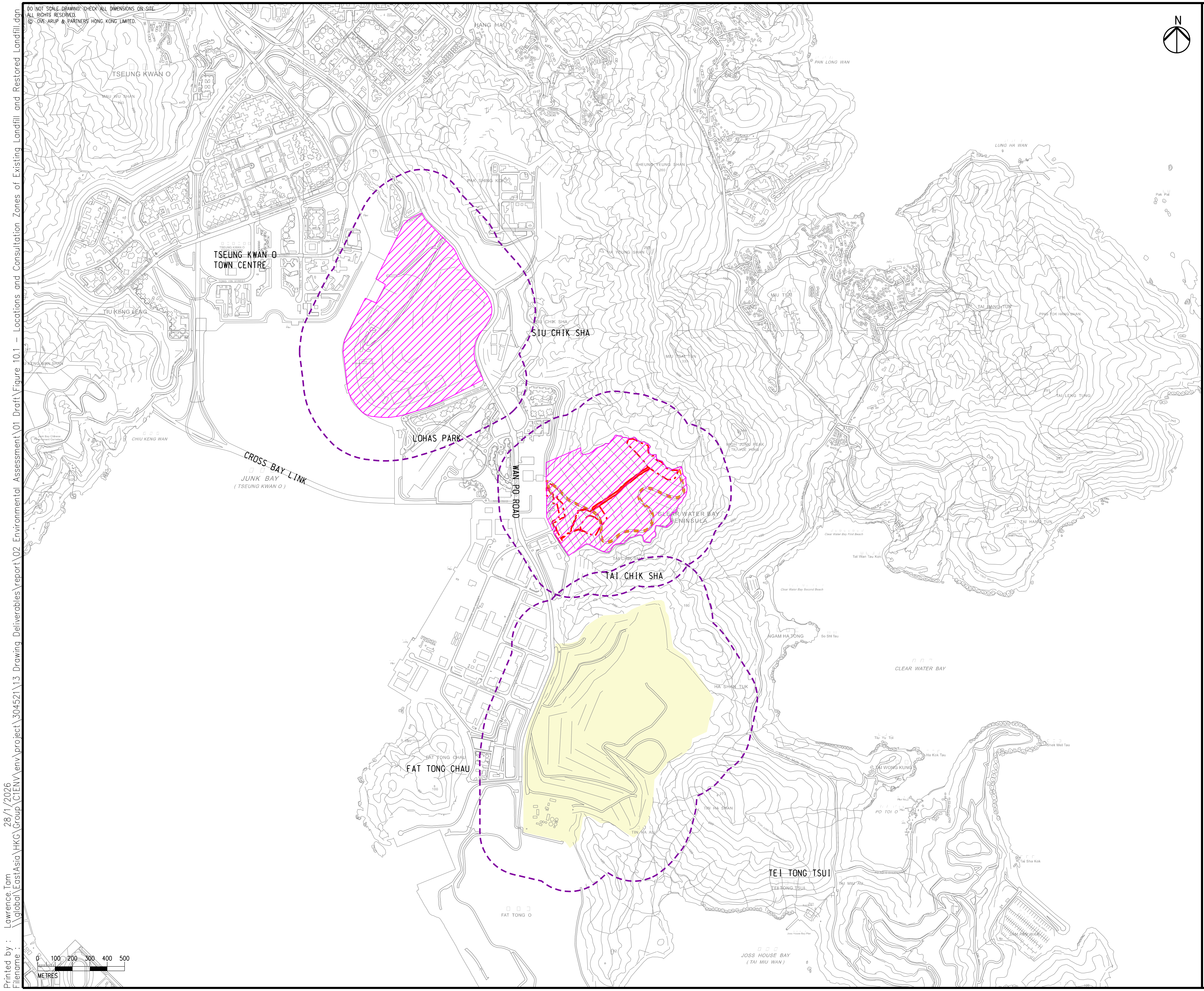
N
HANG HAU
TSEUNG KWAN O
MAU WU SHAN
PAN LONG WAN
SHEUNG YEUNG SHAN
PAK SHING KOK
LUNG HA WAN
TSEUNG KWAN O TOWN CENTRE
HA YEUNG SHAN
TIU KENG LENG
SIU CHIK SHA
MAU TSAI
TAI HANG TUN
LOHAS PARK
CHIU KENG WAN
HIGH JUNK PEAK
CROSS BAY LINK
JUNK BAY
(TSEUNG KWAN O)
WAN PO ROAD
CLEAR WATER BAY PENINSULA
TAI HANG TUN
TAI CHIK SHA
NGAM HA TONG
CLEAR WATER BAY
HA SHAN TUK
FAT TONG CHAU
TIN HA SHAN
TEI TONG TSUI
FAT TONG O
JOSS HOUSE BAY
(TAI MIU WAN)
0 100 200 300 400 500
METRES

LEGEND
🟥 APPLICATION SITE
🟧 ACCESS ROAD (BY EPD)
🟨 EXISTING LANDFILL
▨ RESTORED LANDFILL
🟪 CONSULTATION ZONE

A	FIRST ISSUE	GL	06/25
Rev	Description	By	Date

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Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing title
LOCATIONS AND CONSULTATION ZONES OF EXISTING LANDFILL AND RESTORED LANDFILL IN THE VICINITY OF THE PROJECT

Drawing no.			Rev.
FIGURE 10.1			A
Drawn GL	Date 06/25	Checked TL	Approved FC
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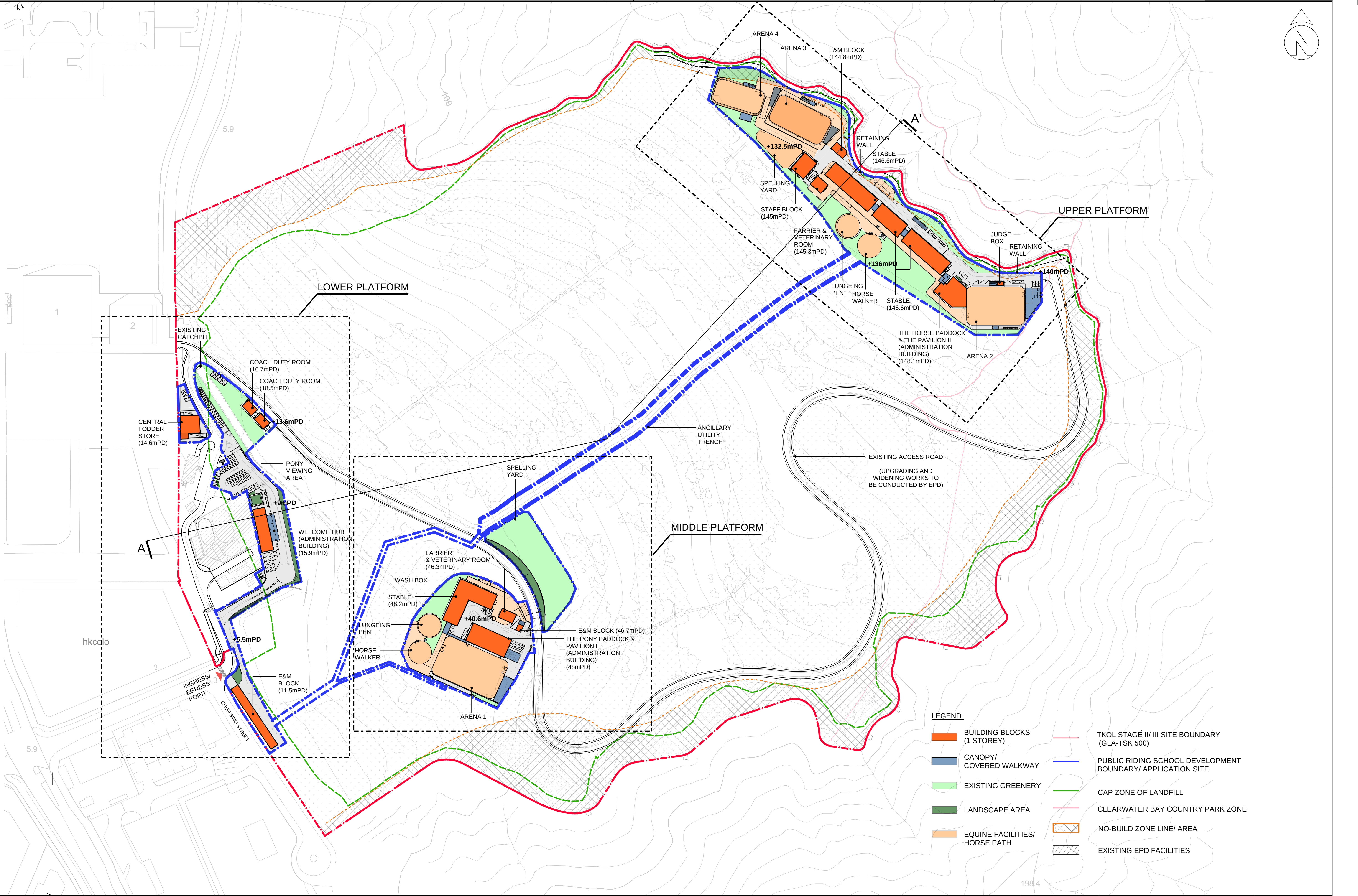
Appendix 2.1

Tentative Master Layout Plan


ARENA 4
ARENA 3
E&M BLOCK (144.8mPD)
A'
RETAINING WALL
STABLE (146.6mPD)
+132.5mPD
SPELLING YARD
STAFF BLOCK (145mPD)
FARRIER & VETERINARY ROOM (145.3mPD)
UPPER PLATFORM
JUDGE BOX
RETAINING WALL
+140mPD
+136mPD
LUNGEING PEN
HORSE WALKER
STABLE (146.6mPD)
THE HORSE PADDOCK & THE PAVILION II (ADMINISTRATION BUILDING) (148.1mPD)
ARENA 2
LOWER PLATFORM
EXISTING CATCHPIT
COACH DUTY ROOM (16.7mPD)
COACH DUTY ROOM (18.5mPD)
+13.6mPD
CENTRAL FODDER STORE (14.6mPD)
PONY VIEWING AREA
+9mPD
WELCOME HUB (ADMINISTRATION BUILDING) (15.9mPD)
A
+5.5mPD
INGRESS/ EGRESS POINT
CHUN SING STREET
E&M BLOCK (11.5mPD)
ANCILLARY UTILITY TRENCH
EXISTING ACCESS ROAD
(UPGRADING AND WIDENING WORKS TO BE CONDUCTED BY EPD)
SPELLING YARD
MIDDLE PLATFORM
FARRIER & VETERINARY ROOM (46.3mPD)
WASH BOX
STABLE (48.2mPD)
+40.6mPD
LUNGEING PEN
HORSE WALKER
E&M BLOCK (46.7mPD)
THE PONY PADDOCK & PAVILION I (ADMINISTRATION BUILDING) (48mPD)
ARENA 1
hkcolo
5.9
100
LEGEND:
BUILDING BLOCKS (1 STOREY)
CANOPY/ COVERED WALKWAY
EXISTING GREENERY
LANDSCAPE AREA
EQUINE FACILITIES/ HORSE PATH
TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY/ APPLICATION SITE
CAP ZONE OF LANDFILL
CLEARWATER BAY COUNTRY PARK ZONE
NO-BUILD ZONE LINE/ AREA
EXISTING EPD FACILITIES
N

WONG TUNG 王董

Title

Indicative Master Layout Plan

Checked	SKW	Drawn	RYT
Rev	0	Date	FEB 2026
Scale 1 : 3000		Figure Appendix 1 (Fig. 1.1)	

Appendix 2.2

Tentative Site Formation Plan for PRS

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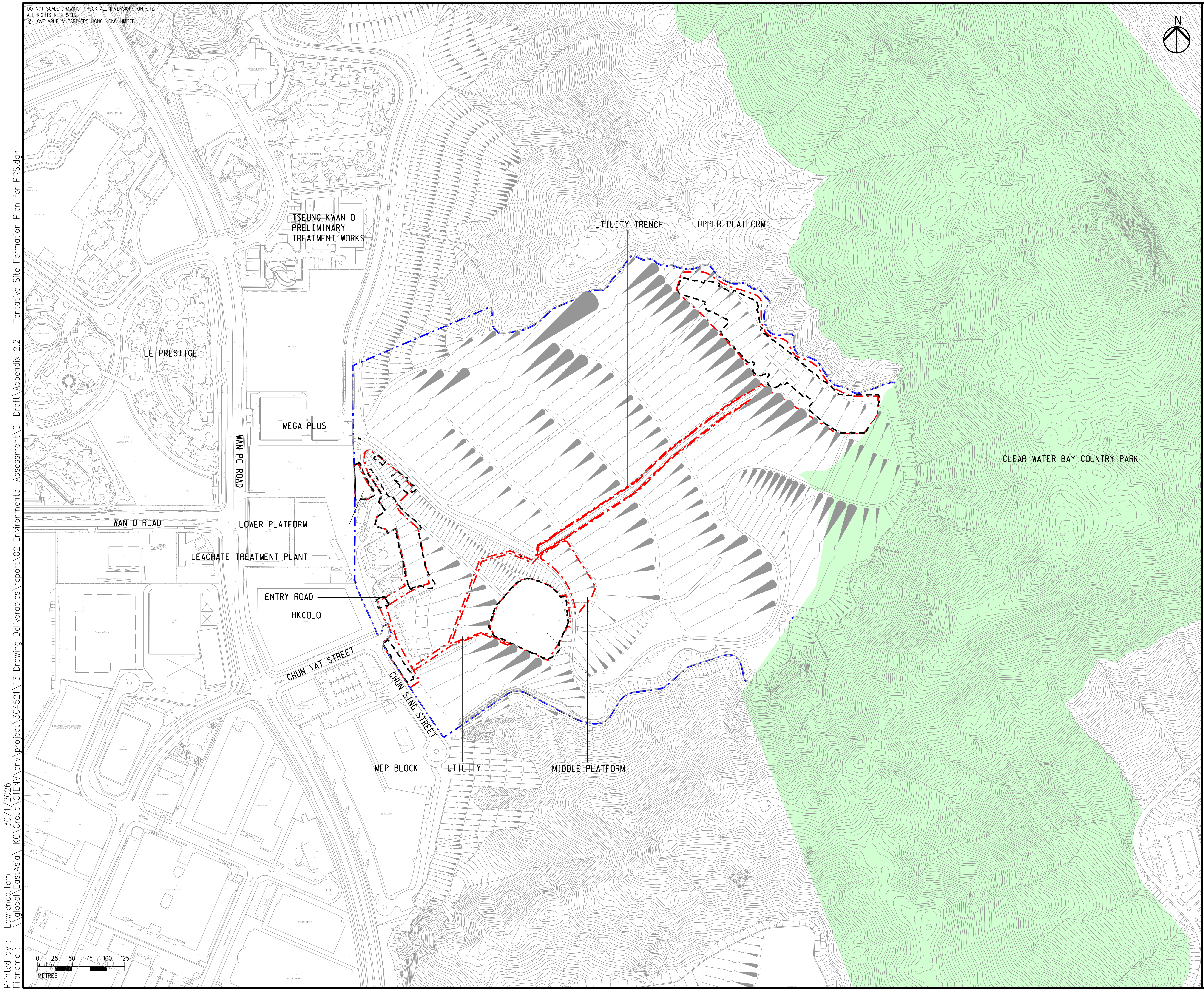
N
TSEUNG KWAN O
PRELIMINARY
TREATMENT WORKS
UTILITY TRENCH
UPPER PLATFORM
LE PRESTIGE
MEGA PLUS
WAN PO ROAD
CLEAR WATER BAY COUNTRY PARK
WAN O ROAD
LOWER PLATFORM
LEACHATE TREATMENT PLANT
ENTRY ROAD
HKCOLO
CHUN YAT STREET
CHUN SING STREET
MEP BLOCK
UTILITY
MIDDLE PLATFORM
0 25 50 75 100 125
METRES

LEGEND

- 🟥 APPLICATION SITE
- ⬛ SITE FORMATION
- 🟦 BOUNDARY OF TKOL II/III
- 🟩 CLEAR WATER BAY COUNTRY PARK

Rev	Description	By	Date
A	FIRST ISSUE	GL	01/26

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Project title

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing title

TENTATIVE SITE FORMATION PLAN FOR PRS

Drawing no.			Rev.
APPENDIX 2.2			A
Drawn GL	Date 01/26	Checked TL	Approved FC
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Appendix 3.1

Stack Gas Monitoring Data of Leachate Treatment Plant

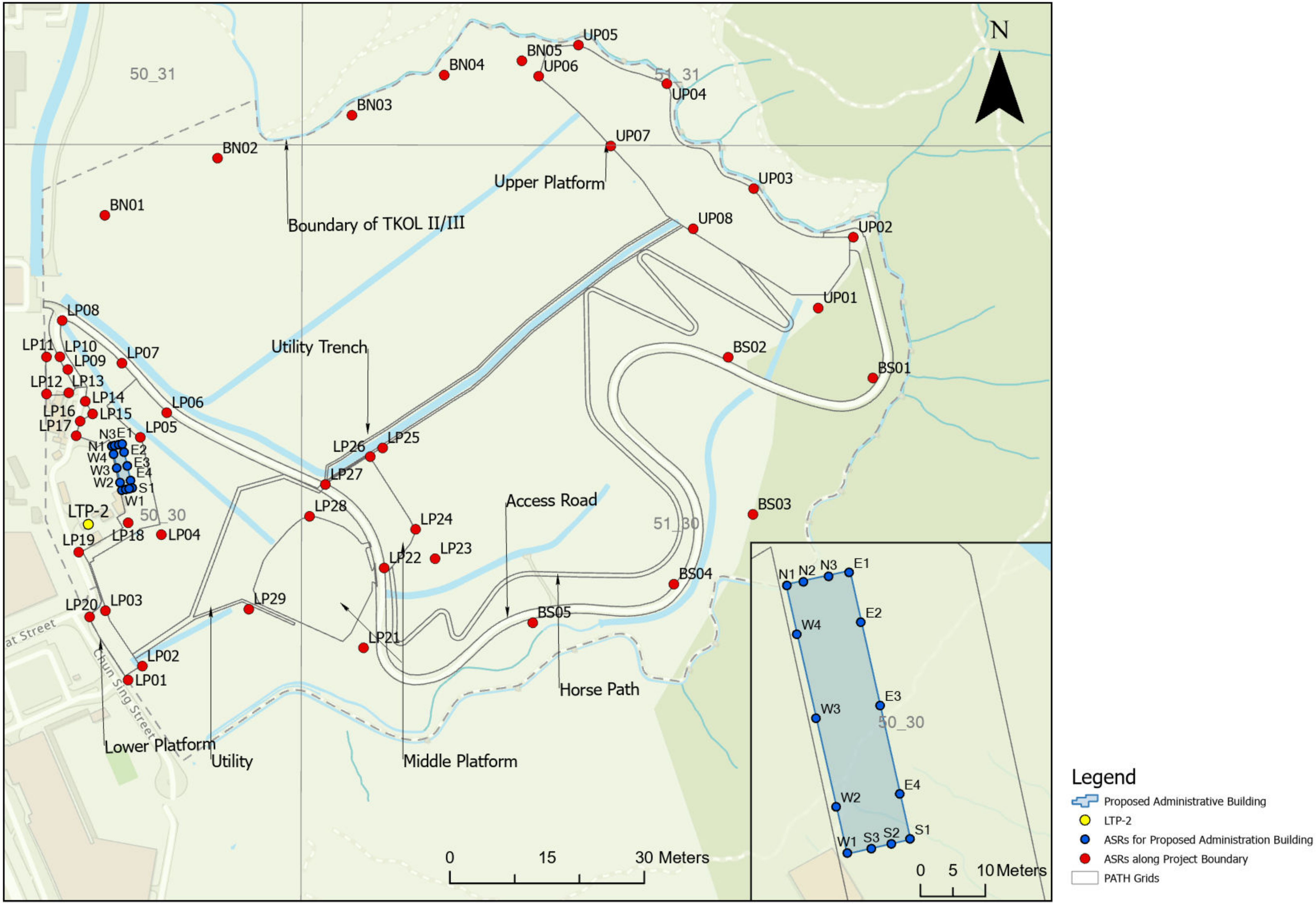
Stack Gas Monitoring Data of Leachate Treatment Plant (Year 2020 to 2024)

Sample location	**Stage II/ III Thermal Oxidiser 1**	**Stage II/ III Thermal Oxidiser 2 (Flare)**	**Stage II/ III Thermal Oxidiser 1 (Flare)**	**Stage II/ III Thermal Oxidiser 2**	**Stage II/ III Thermal Oxidiser 1**	**Stage II/ III Thermal Oxidiser 2 (Flare)**	**Stage II/ III Thermal Oxidiser 1 (Flare)**	**Stage II/ III Thermal Oxidiser 2**	**Stage II/ III Thermal Oxidiser 1**	**Stage II/ III Thermal Oxidiser 2 (Flare)**
Date of sampling	8-Jan-20	14-Jan-20	20-Jan-21	22-Jan-21	24-Jan-22	20-Jan-22	26-Jan-23	19-Jan-23	16-Jan-24	29-Jan-24
Particulates, mg/m^3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1
Fluorine & Its Compounds, mg/m^3 (expressed as hydrogen floride)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.1
Chlorine & Its Compounds, mg/m^3 (expressed as hydrogen chloride)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	<1.0	<0.1	<0.1
Hydrogen Bromide, mg/m^3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.1
Nitrogen Oxides, mg/m^3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Sulphur Dioxide, mg/m^3	<10	<10	<10	<10	<10	<10	<1.0	<1.0	<0.1	<0.1
Hydrogen Sulphide, mg/m^3	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.025	<0.025
Total Non-methane HC, mg C/m^3	6.50	<1.92	<1.86	<1.90	<1.88	<1.86	<1.88	<1.88	<1.90	<1.88
Trichloroethylene, ppbv	<0.4	<0.4	<0.4	1.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Vinyl Chloride, ppbv	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Methylene Chloride, ppbv	2.2	1.8	0.9	8.8	1.2	1.8	0.6	1.1	2.4	3.0
Chloroform, ppbv	<0.4	<0.4	<0.4	0.5	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-dichloroethane, ppbv	<0.4	0.6	<0.4	1.2	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,1,1-trichloroethane, ppbv	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Carbon tetrachloride, ppbv	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Tetrachloroethylene, ppbv	<0.4	<0.4	<0.4	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2-dibromoethane, ppbv	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Benzene, ppbv	1.0	0.9	0.5	1.1	<0.4	0.7	0.7	0.8	<0.4	0.8
Methane, ppmv	4.1	4.0	3.4	3.4	3.6	3.6	3.2	3.4	3.2	3.2
Carbon Monoxide, mg/m^{3}CO	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
Smoke, ringlemann	<1	<1	<1	<1	<1	<1	<1	<1	0.0	0.0

Appendix 3.2

List of Air Sensitive Receivers

Appendix 3.2 List of Air Sensitive Receivers


N
50_31
51_31
50_30
51_30
BN01
BN02
BN03
BN04
BN05
UP01
UP02
UP03
UP04
UP05
UP06
UP07
UP08
BS01
BS02
BS03
BS04
BS05
LP01
LP02
LP03
LP04
LP05
LP06
LP07
LP08
LP09
LP10
LP11
LP12
LP13
LP14
LP15
LP16
LP17
LP18
LP19
LP20
LP21
LP22
LP23
LP24
LP25
LP26
LP27
LP28
LP29
LTP-2
N1
N2
N3
E1
E2
E3
E4
S1
S2
S3
W1
W2
W3
W4
Boundary of TKOL II/III
Upper Platform
Utility Trench
Access Road
Horse Path
Middle Platform
Lower Platform
Utility
Chun Sing Street
at Street
0
15
30 Meters
0
5
10 Meters
Legend
Proposed Administrative Building
LTP-2
ASRs for Proposed Administration Building
ASRs along Project Boundary
PATH Grids

Appendix 3.2 List of Air Sensitive Receivers

Grid	50_30
Number of ASRs:	37
Number of Levels:	3

ASR ID	ASR Description	Land Uses	X-co	Y-co	Z-co	Level, in m avove local ground		
E1	TKO PRS Administration Building	Office	846472	817002	8	1.5	5	10
E2	TKO PRS Administration Building	Office	846474	816994	8	1.5	5	10
E3	TKO PRS Administration Building	Office	846477	816981	8	1.5	5	10
E4	TKO PRS Administration Building	Office	846480	816968	8	1.5	5	10
N1	TKO PRS Administration Building	Office	846463	817000	8	1.5	5	10
N2	TKO PRS Administration Building	Office	846465	817001	8	1.5	5	10
N3	TKO PRS Administration Building	Office	846469	817001	8	1.5	5	10
S1	TKO PRS Administration Building	Office	846482	816961	8	1.5	5	10
S2	TKO PRS Administration Building	Office	846479	816960	7	1.5	5	10
S3	TKO PRS Administration Building	Office	846476	816959	8	1.5	5	10
W1	TKO PRS Administration Building	Office	846472	816959	8	1.5	5	10
W2	TKO PRS Administration Building	Office	846470	816966	7	1.5	5	10
W3	TKO PRS Administration Building	Office	846467	816979	8	1.5	5	10
W4	TKO PRS Administration Building	Office	846464	816992	8	1.5	5	10
BN01	TKO II/III Boundary	Recreational	846456	817216	33	1.5	5	10
BN02	TKO II/III Boundary	Recreational	846562	817270	94	1.5	5	10
LP01	TKO PRS Lower Platform	Recreational	846478	816781	7	1.5	5	10
LP02	TKO PRS Lower Platform	Recreational	846491	816794	7	1.5	5	10
LP03	TKO PRS Lower Platform	Recreational	846456	816846	7	1.5	5	10
LP04	TKO PRS Lower Platform	Recreational	846509	816917	14	1.5	5	10
LP05	TKO PRS Lower Platform	Recreational	846489	817008	12	1.5	5	10
LP06	TKO PRS Lower Platform	Recreational	846514	817031	18	1.5	5	10
LP07	TKO PRS Lower Platform	Recreational	846472	817078	13	1.5	5	10
LP08	TKO PRS Lower Platform	Recreational	846416	817118	8	1.5	5	10
LP09	TKO PRS Lower Platform	Recreational	846421	817072	8	1.5	5	10
LP10	TKO PRS Lower Platform	Recreational	846414	817084	8	1.5	5	10
LP11	TKO PRS Lower Platform	Recreational	846401	817084	7	1.5	5	10
LP12	TKO PRS Lower Platform	Recreational	846401	817049	7	1.5	5	10
LP13	TKO PRS Lower Platform	Recreational	846422	817050	7	1.5	5	10
LP14	TKO PRS Lower Platform	Recreational	846438	817042	8	1.5	5	10
LP15	TKO PRS Lower Platform	Recreational	846444	817030	8	1.5	5	10
LP16	TKO PRS Lower Platform	Recreational	846433	817023	7	1.5	5	10
LP17	TKO PRS Lower Platform	Recreational	846429	817010	7	1.5	5	10
LP18	TKO PRS Lower Platform	Recreational	846478	816928	7	1.5	5	10
LP19	TKO PRS Lower Platform	Recreational	846431	816900	7	1.5	5	10
LP20	TKO PRS Lower Platform	Recreational	846442	816840	6	1.5	5	10
LP29	TKO PRS Middle Platform	Recreational	846591	816847	37	1.5	5	10

Appendix 3.2 List of Air Sensitive Receivers

Grid	51_30
Number of ASRs:	18
Number of Levels:	3

ASR ID	ASR Description	Land Uses	X-co	Y-co	Z-co	Level, in m avove local ground		
BS01	TKO II/III Boundary	Recreational	847175	817064	134	1.5	5	10
BS02	TKO II/III Boundary	Recreational	847040	817083	114	1.5	5	10
BS03	TKO II/III Boundary	Recreational	847063	816936	104	1.5	5	10
BS04	TKO II/III Boundary	Recreational	846989	816870	83	1.5	5	10
BS05	TKO II/III Boundary	Recreational	846857	816834	70	1.5	5	10
LP21	TKO PRS Middle Platform	Recreational	846698	816811	47	1.5	5	10
LP22	TKO PRS Middle Platform	Recreational	846718	816886	41	1.5	5	10
LP23	TKO PRS Middle Platform	Recreational	846765	816894	51	1.5	5	10
LP24	TKO PRS Middle Platform	Recreational	846747	816922	40	1.5	5	10
LP25	TKO PRS Middle Platform	Recreational	846716	816998	40	1.5	5	10
LP26	TKO PRS Middle Platform	Recreational	846705	816990	39	1.5	5	10
LP27	TKO PRS Middle Platform	Recreational	846663	816964	34	1.5	5	10
LP28	TKO PRS Middle Platform	Recreational	846648	816934	39	1.5	5	10
UP01	TKO PRS Upper Platform	Recreational	847124	817129	134	1.5	5	10
UP02	TKO PRS Upper Platform	Recreational	847157	817196	141	1.5	5	10
UP03	TKO PRS Upper Platform	Recreational	847064	817241	141	1.5	5	10
UP07	TKO PRS Upper Platform	Recreational	846930	817281	134	1.5	5	10
UP08	TKO PRS Upper Platform	Recreational	847007	817204	134	1.5	5	10

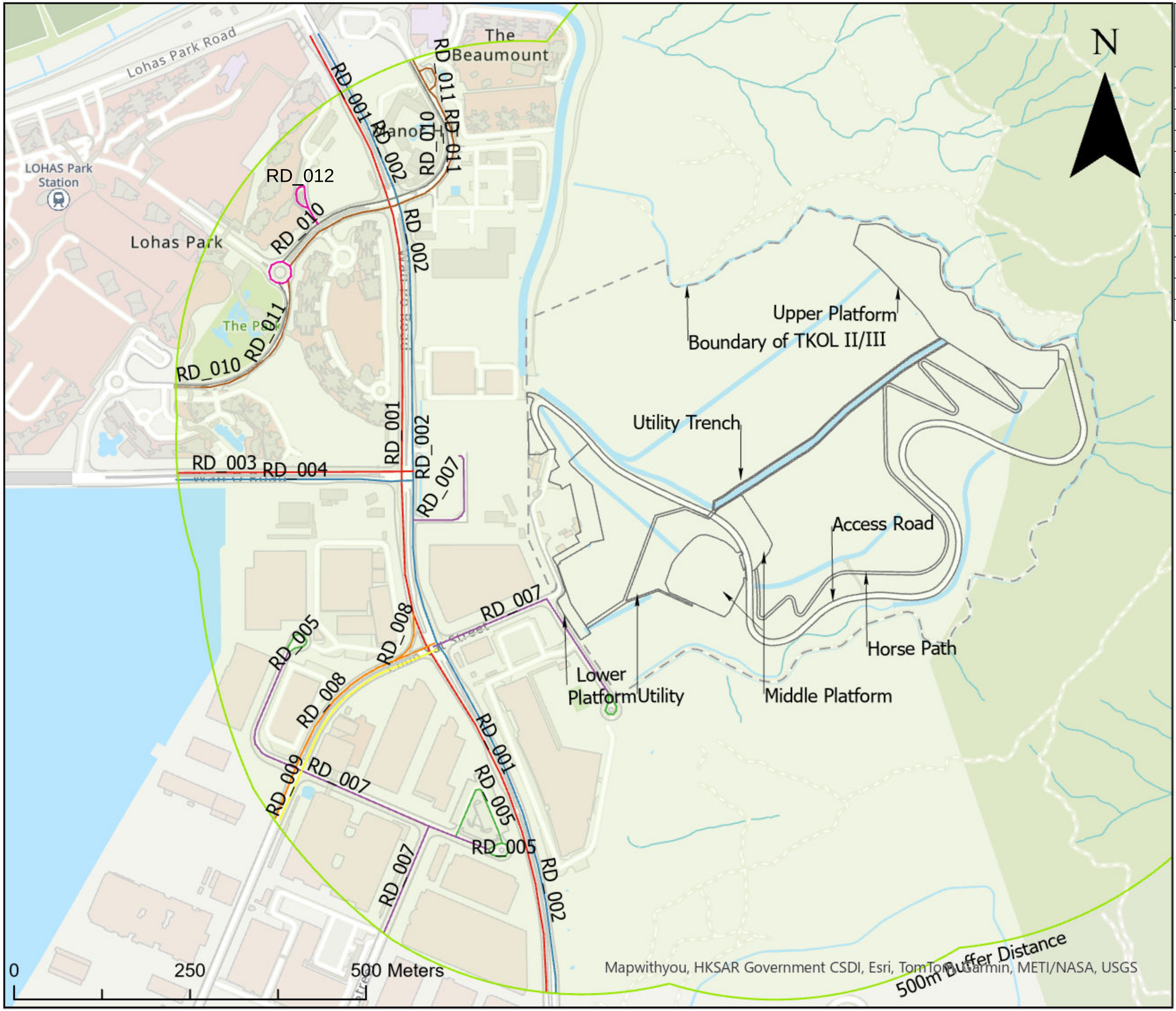
Grid	51_31
Number of ASRs:	6
Number of Levels:	3

ASR ID	ASR Description	Land Uses	X-co	Y-co	Z-co	Level, in m avove local ground		
BN03	TKO II/III Boundary	Recreational	846687	817310	106	1.5	5	10
BN04	TKO II/III Boundary	Recreational	846774	817348	125	1.5	5	10
BN05	TKO II/III Boundary	Recreational	846847	817361	131	1.5	5	10
UP04	TKO PRS Upper Platform	Recreational	846982	817340	139	1.5	5	10
UP05	TKO PRS Upper Platform	Recreational	846900	817376	137	1.5	5	10
UP06	TKO PRS Upper Platform	Recreational	846862	817347	136	1.5	5	10

Appendix 3.3

Calculation of Vehicular Emissions

Appendix 3.3 Calculation of Vehicular Emissions


N
Lohas Park Road
LOHAS Park Station
Lohas Park
The Park
The Beaumount
Manor Hill
RD_001
RD_002
RD_003
RD_004
RD_005
RD_007
RD_008
RD_009
RD_010
RD_011
RD_012
Upper Platform
Boundary of TKOL II/III
Utility Trench
Access Road
Horse Path
Lower Platform
Utility
Middle Platform
0
250
500 Meters
500m Buffer Distance
Mapwithyou, HKSAR Government CSDI, Esri, TomTom, Garmin, METI/NASA, USGS
Legend
500m Assessment Area from Application Site
Existing Open Roads
ID
RD_001
RD_002
RD_003
RD_004
RD_005
RD_007
RD_008
RD_009
RD_010
RD_011
RD_012

Road ID	Corresponding Road ID in TKO137	Shared Road Justification [1]	Direction [2]
RD_001	3	Wan Po Road	WB
RD_002	4	Wan Po Road	EB
RD_003	233	Cross Bay Link	NB
RD_004	234	Cross Bay Link	SB
RD_005	43	Industrial	NB
RD_007	44,43	Industrial	2-way
RD_008	35	Chun Yat St	WB
RD_009	36	Chun Yat St	EB
RD_010	63	Residential	NB
RD_011	64	Residential	SB
RD_012	63,64	Residential	2-way

Notes:

[1] Selected roads in TKO 137 correspond to the same road in the Project or reflect the similar underlying purpose.

[2] EB, WB, NB and SB stand for East-bound, West-bound, North-bound and South-bound, respectively. 2-way refers to combined flow and their average speed is estimated by weighting.

Proportion of local and rural roads within Hong Kong

Region	RoadType [1]	VKT [2]	%
Hong Kong Island	UT/EX/PD/DD	4,627,075	81.1%
	LD	1,075,005	18.9%
Kowloon	UT/EX/PD/DD	7,413,967	85.6%
	LD	1,249,077	14.4%
New Territories	UT/EX/PD/DD/RT	19,371,357	75.1%
	LD/RR	6,432,203	24.9%
Entire Hong Kong	UT/EX/PD/DD/RT	31,412,399	78.2%
	LD/RR	8,756,286	21.8%

Note:

[1] DD - District Distributor; EX - Expressway; LD - Local Distributor; PD - Primary Distributor; RR - Rural Road; RT - Rural Trunk Road; and UT - Urban Trunk Road

[2] Source: The Hong Kong Annual Traffic Census (ATC) 2023 and raw data in computing VKT provided by Transport Department.

Default Scenario

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)
Default Scenario

Road Name	Road ID	Road Type	Speed Limit (km/hr)	Average Speed (km/hr)	Start Emission Estimated by Broad Brush Approach (Y/N)	Hour	Total Vehicles (Veh/hr)	01 - Private Cars	02 - Taxi	03 - Light Goods Vehicles<=2.5t	04 - Light Goods Vehicles 2.5-3.5t	05 - Light Goods Vehicles>3.5t	06 - Medium Goods Vehicles<=15t	07 - Medium Goods Vehicles15-24t	08 - Public Light Buses	09 - Private Light Bus <=3.5t	10 - Private Light Bus >3.5t	11 - Non-franchised Bus<=6.4t	12 - Non-franchised Bus 6.4-15t	13 - Non-franchised Bus 15-24t	14 - Franchised Bus Single Deck	15 - Franchised Bus Double Deck	16 - Motorcycles	17 - Heavy Goods Vehicles>24t	18 - Non-franchised Bus >24t	Total
								PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	HGV9	NFB9	
WAN PO ROAD L	RD_001		70	67.43	Y	0000-0100	825	55.09%	32.17%	0.03%	3.14%	1.13%	0.30%	0.59%	0.21%	0.11%	0.88%	0.29%	0.20%	0.43%	0.03%	1.93%	3.33%	0.16%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.23	Y	0100-0200	562	55.48%	29.93%	0.04%	3.43%	1.23%	0.38%	0.75%	0.22%	0.16%	1.28%	0.42%	0.29%	0.63%	0.03%	1.93%	3.61%	0.20%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.63	Y	0200-0300	430	55.93%	27.60%	0.04%	3.72%	1.33%	0.47%	0.92%	0.24%	0.22%	1.70%	0.55%	0.38%	0.84%	0.03%	1.91%	3.87%	0.24%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.97	Y	0300-0400	322	56.29%	25.31%	0.04%	4.02%	1.44%	0.55%	1.08%	0.26%	0.27%	2.10%	0.69%	0.48%	1.04%	0.03%	1.94%	4.19%	0.28%	0.00%	100%
WAN PO ROAD L	RD_001		70	69.01	Y	0400-0500	304	56.75%	22.90%	0.05%	4.32%	1.55%	0.63%	1.25%	0.28%	0.32%	2.52%	0.82%	0.57%	1.26%	0.03%	1.93%	4.47%	0.33%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.59	Y	0500-0600	428	57.21%	20.46%	0.05%	4.64%	1.67%	0.72%	1.42%	0.30%	0.38%	2.95%	0.97%	0.67%	1.47%	0.03%	1.93%	4.77%	0.37%	0.00%	100%
WAN PO ROAD L	RD_001		70	66.01	Y	0600-0700	1203	57.78%	17.88%	0.05%	4.95%	1.78%	0.82%	1.61%	0.32%	0.44%	3.44%	1.12%	0.77%	1.70%	0.03%	1.88%	5.03%	0.42%	0.00%	100%
WAN PO ROAD L	RD_001		70	61.69	Y	0700-0800	2175	58.27%	15.31%	0.06%	5.27%	1.89%	0.91%	1.79%	0.34%	0.50%	3.90%	1.26%	0.88%	1.93%	0.03%	1.86%	5.33%	0.47%	0.00%	100%
WAN PO ROAD L	RD_001		70	60.02	Y	0800-0900	2369	62.02%	18.97%	0.05%	4.52%	1.62%	0.69%	1.36%	0.21%	0.23%	1.76%	0.88%	0.61%	1.34%	0.04%	1.44%	3.90%	0.36%	0.00%	100%
WAN PO ROAD L	RD_001		70	63.29	Y	0900-1000	1985	56.70%	18.37%	0.08%	7.97%	2.86%	1.45%	2.86%	0.28%	0.17%	1.34%	0.63%	0.44%	0.96%	0.04%	1.85%	3.24%	0.75%	0.00%	100%
WAN PO ROAD L	RD_001		70	63.63	Y	1000-1100	1868	51.60%	23.51%	0.09%	9.09%	3.26%	1.75%	3.44%	0.19%	0.16%	1.24%	0.24%	0.17%	0.36%	0.09%	1.96%	1.96%	0.90%	0.00%	100%
WAN PO ROAD L	RD_001		70	64.00	Y	1100-1200	1775	53.46%	22.41%	0.08%	7.94%	2.85%	1.76%	3.47%	0.32%	0.12%	0.95%	0.37%	0.26%	0.57%	0.02%	1.77%	2.75%	0.91%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.48	Y	1200-1300	714	52.18%	18.10%	0.10%	9.45%	3.39%	2.03%	3.99%	1.32%	0.33%	2.56%	0.67%	0.47%	1.02%	0.08%	1.86%	1.41%	1.04%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.37	Y	1300-1400	727	45.68%	18.87%	0.12%	11.30%	4.06%	2.05%	4.03%	2.03%	0.32%	2.53%	1.18%	0.82%	1.80%	0.10%	2.00%	2.05%	1.05%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.42	Y	1400-1500	736	52.88%	16.39%	0.10%	9.60%	3.45%	2.12%	4.17%	1.25%	0.28%	2.15%	0.54%	0.37%	0.81%	0.05%	1.89%	2.86%	1.09%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.43	Y	1500-1600	735	52.08%	18.73%	0.10%	9.92%	3.56%	2.25%	4.43%	1.17%	0.21%	1.68%	0.22%	0.15%	0.34%	0.04%	1.93%	2.02%	1.16%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.24	Y	1600-1700	795	52.07%	18.00%	0.11%	10.45%	3.75%	1.59%	3.13%	1.19%	0.17%	1.30%	0.68%	0.47%	1.04%	0.05%	2.01%	3.18%	0.82%	0.00%	100%
WAN PO ROAD L	RD_001		70	66.97	Y	1700-1800	925	61.69%	13.27%	0.07%	6.77%	2.43%	0.81%	1.60%	1.51%	0.14%	1.12%	0.72%	0.50%	1.09%	0.03%	1.70%	6.13%	0.42%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.00	Y	1800-1900	937	67.26%	14.87%	0.05%	4.87%	1.75%	0.59%	1.16%	1.58%	0.02%	0.18%	0.48%	0.34%	0.74%	0.01%	1.80%	3.99%	0.30%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.40	Y	1900-2000	821	64.36%	20.35%	0.05%	4.39%	1.58%	0.19%	0.38%	1.60%	0.03%	0.23%	0.49%	0.34%	0.74%	0.09%	2.05%	3.04%	0.10%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.89	Y	2000-2100	667	62.75%	22.92%	0.04%	3.93%	1.41%	0.36%	0.71%	1.25%	0.01%	0.08%	0.43%	0.30%	0.65%	0.04%	2.16%	2.78%	0.18%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.99	Y	2100-2200	636	56.20%	30.32%	0.04%	3.80%	1.36%	0.25%	0.49%	1.49%	0.01%	0.08%	0.33%	0.23%	0.50%	0.03%	2.41%	2.31%	0.13%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.08	Y	2200-2300	618	52.86%	35.44%	0.04%	3.49%	1.25%	0.19%	0.38%	1.12%	0.01%	0.08%	0.03%	0.02%	0.04%	0.03%	2.23%	2.68%	0.10%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.50	Y	2300-0000	478	53.01%	33.24%	0.04%	3.84%	1.38%	0.30%	0.59%	1.23%	0.06%	0.46%	0.15%	0.11%	0.23%	0.03%	2.24%	2.94%	0.15%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.09	Y	0000-0100	278	49.89%	29.14%	0.08%	7.83%	2.81%	0.75%	1.48%	0.73%	0.10%	0.79%	0.26%	0.18%	0.39%	0.03%	2.12%	3.01%	0.39%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.36	Y	0100-0200	192	49.69%	26.80%	0.09%	8.45%	3.03%	0.94%	1.86%	0.79%	0.15%	1.15%	0.37%	0.26%	0.57%	0.03%	2.11%	3.23%	0.49%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.50	Y	0200-0300	148	49.54%	24.45%	0.09%	9.06%	3.25%	1.14%	2.24%	0.84%	0.19%	1.50%	0.49%	0.34%	0.74%	0.03%	2.06%	3.43%	0.59%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.62	Y	0300-0400	112	49.30%	22.16%	0.10%	9.68%	3.48%	1.32%	2.60%	0.91%	0.24%	1.84%	0.60%	0.42%	0.91%	0.03%	2.07%	3.67%	0.68%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.63	Y	0400-0500	107	49.13%	19.83%	0.11%	10.30%	3.70%	1.51%	2.97%	0.96%	0.28%	2.18%	0.71%	0.50%	1.09%	0.03%	2.04%	3.87%	0.78%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.46	Y	0500-0600	153	48.96%	17.51%	0.11%	10.92%	3.92%	1.70%	3.34%	1.02%	0.32%	2.52%	0.83%	0.57%	1.26%	0.03%	2.01%	4.08%	0.87%	0.00%	100%
WAN PO ROAD R	RD_002		70	68.46	Y	0600-0700	434	48.87%	15.12%	0.12%	11.51%	4.13%	1.91%	3.75%	1.07%	0.37%	2.91%	0.94%	0.65%	1.44%	0.03%	1.93%	4.25%	0.98%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.14	Y	0700-0800	794	48.72%	12.80%	0.13%	12.12%	4.35%	2.10%	4.13%	1.12%	0.42%	3.26%	1.06%	0.73%	1.61%	0.03%	1.89%	4.45%	1.08%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.10	Y	0800-0900	838	53.46%	16.35%	0.11%	10.71%	3.85%	1.65%	3.24%	0.72%	0.19%	1.52%	0.76%	0.53%	1.16%	0.04%	1.51%	3.36%	0.85%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.08	Y	0900-1000	783	43.87%	14.21%	0.18%	16.97%	6.09%	3.10%	6.09%	0.87%	0.13%	1.04%	0.49%	0.34%	0.74%	0.04%	1.75%	2.51%	1.59%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.11	Y	1000-1100	761	38.66%	17.61%	0.20%	18.75%	6.73%	3.60%	7.09%	0.56%	0.12%	0.93%	0.18%	0.12%	0.27%	0.08%	1.79%	1.47%	1.85%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.33	Y	1100-1200	710	40.77%	17.09%	0.17%	16.66%	5.98%	3.70%	7.28%	0.95%	0.09%	0.73%	0.28%	0.20%	0.43%	0.02%	1.64%	2.10%	1.90%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.36	Y	1200-1300	1066	56.00%	19.42%	0.07%	7.01%	2.52%	1.51%	2.96%	0.95%	0.35%	2.74%	0.72%	0.50%	1.10%	0.08%	1.79%	1.51%	0.77%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.23	Y	1300-1400	1073	49.58%	20.48%	0.09%	8.48%	3.05%	1.54%	3.03%	1.48%	0.35%	2.75%	1.28%	0.89%	1.95%	0.10%	1.94%	2.22%	0.79%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.27	Y	1400-1500	1098	56.83%	17.61%	0.07%	7.13%	2.56%	1.58%	3.10%	0.90%	0.30%	2.31%	0.58%	0.40%	0.88%	0.05%	1.82%	3.08%	0.81%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.30	Y	1500-1600	1094	56.12%	20.18%	0.08%	7.39%	2.65%	1.68%	3.30%	0.84%	0.23%	1.81%	0.24%	0.17%	0.36%	0.04%	1.87%	2.17%	0.86%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.00	Y	1600-1700	1189	55.83%	19.30%	0.08%	7.75%	2.78%	1.18%	2.32%	0.86%	0.18%	1.39%	0.73%	0.51%	1.11%	0.05%	1.93%	3.41%	0.61%	0.00%	100%
WAN PO ROAD R	RD_002		70	65.45	Y	1700-1800	1417	64.54%	13.89%	0.05%	4.90%	1.76%	0.59%	1.16%	1.06%	0.15%	1.17%	0.75%	0.52%	1.14%	0.03%	1.60%	6.41%	0.30%	0.00%	100%
WAN PO ROAD R	RD_002		70	65.44	Y	1800-1900	1452	69.63%	15.39%	0.04%	3.49%	1.25%	0.42%	0.83%	1.09%	0.02%	0.19%	0.50%	0.35%	0.76%	0.01%	1.67%	4.13%	0.22%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.00	Y	1900-2000	1279	66.22%	20.94%	0.03%	3.12%	1.12%	0.14%	0.27%	1.10%	0.03%	0.24%	0.50%	0.35%	0.76%	0.08%	1.89%	3.13%	0.07%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.75	Y	2000-2100	1040	64.49%	23.55%	0.03%	2.79%	1.00%	0.26%	0.50%	0.86%	0.01%	0.08%	0.44%	0.31%	0.67%	0.04%	1.99%	2.85%	0.13%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.90	Y	2100-2200	992	57.71%	31.14%	0.03%	2.70%	0.97%	0.18%	0.35%	1.02%	0.01%	0.08%	0.34%	0.24%	0.52%	0.03%	2.22%	2.37%	0.09%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.03	Y	2200-2300	968	54.10%	36.27%	0.03%	2.47%	0.89%	0.14%	0.27%	0.76%	0.01%	0.08%	0.03%	0.02%	0.04%	0.03%	2.05%	2.74%	0.07%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.69	Y	2300-0000	746	54.42%	34.12%	0.03%	2.72%	0.98%	0.21%	0.42%	0.85%	0.06%	0.48%	0.16%	0.11%	0.24%	0.03%	2.06%	3.01%	0.11%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0000-0100	369	52.61%	30.72%	0.07%	6.78%	2.43%	0.65%	1.28%	0.00%	0.11%	0.84%	0.27%	0.19%	0.41%	0.00%	0.12%	3.18%	0.33%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0100-0200	254	52.57%	28.36%	0.08%	7.33%	2.63%	0.82%	1.61%	0.00%	0.16%	1.21%	0.39%	0.27%	0.60%	0.00%	0.12%	3.42%	0.42%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0200-0300	196	52.57%	25.94%	0.08%	7.89%	2.83%	0.99%	1.95%	0.00%	0.20%	1.59%	0.52%	0.36%	0.79%	0.00%	0.12%	3.64%	0.51%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0300-0400	148	52.50%	23.60%	0.09%	8.46%	3.04%	1.16%	2.27%	0.00%	0.25%	1.96%	0.64%	0.44%	0.97%	0.00%	0.12%	3.90%	0.59%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0400-0500	140	52.49%	21.18%	0.09%	9.03%	3.24%	1.33%	2.61%	0.00%	0.30%	2.33%	0.76%	0.53%	1.16%	0.00%	0.12%	4.13%	0.68%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0500-0600	200	52.47%	18.77%	0.10%	9.61%	3.45%	1.50%	2.94%	0.00%	0.35%	2.71%	0.89%	0.61%	1.35%	0.00%	0.12%	4.37%	0.77%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0600-0700	566	52.51%	16.25%	0.11%	10.16%	3.65%	1.68%	3.31%	0.00%	0.40%	3.12%	1.01%	0.70%	1.54%	0.00%	0.11%	4.57%	0.86%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0700-0800	1032	52.51%	13.80%	0.11%	10.72%	3.85%	1.86%	3.65%	0.00%	0.45%	3.51%	1.14%	0.79%	1.74%	0.00%	0.11%	4.80%	0.95%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0800-0900	1107	56.78%	17.36%	0.10%	9.34%	3.35%	1.44%	2.82%	0.00%	0.21%	1.61%	0.81%	0.56%	1.23%	0.00%	0.09%	3.57%	0.74%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0900-1000	1002	48.02%	15.56%	0.16%	15.25%	5.48%	2.78%	5.47%	0.00%	0.15%	1.14%	0.53%	0.37%	0.81%	0.00%	0.10%	2.75%	1.43%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1000-1100	969	42.56%	19.39%	0.18%	16.94%	6.08%	3.26%	6.40%	0.00%	0.13%	1.02%	0.20%	0.14%	0.30%	0.00%	0.11%	1.62%	1.67%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1100-1200	907	44.76%	18.76%	0.16%	15.01%	5.39%	3.34%	6.56%	0.00%	0.10%	0.80%	0.31%	0.22%	0.47%	0.00%	0.10%	2.30%	1.71%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1200-1300	1142	57.95%	20.10%	0.07%	6.80%	2.44%	1.46%	2.87%	0.00%	0.36%	2.84%	0.75%	0.52%	1.14%	0.02%	0.36%	1.56%	0.75%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1300-1400	1140	51.74%	21.38%	0.09%	8.30%	2.98%	1.51%	2.96%	0.00%	0.37%	2.87%	1.34%	0.93%	2.04%	0.02%	0.40%	2.32%	0.77%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1400-1500	1176	58.80%	18.22%	0.07%	6.92%	2.49%	1.53%	3.01%	0.00%	0.31%	2.39%	0.59%	0.41%	0.91%	0.01%	0.37%	3.18%	0.79%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1500-1600	1172	58.08%	20.89%	0.07%	7.17%	2.58%	1.63%	3.20%	0.00%	0.24%	1.87%	0.25%	0.17%	0.37%	0.01%	0.38%	2.25%	0.84%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1600-1700	1274	57.78%	19.97%	0.08%	7.52%	2.70%	1.14%	2.25%	0.00%	0.18%	1.44%	0.75%	0.52%	1.15%	0.01%	0.39%	3.53%	0.59%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1700-1800	1525	66.47%	14.30%	0.05%	4.73%	1.70%	0.57%	1.12%	0.00%	0.15%	1.20%	0.77%	0.53%	1.17%	0.01%	0.32%	6.61%	0.29%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1800-1900	1563	71.66%	15.84%	0.04%	3.37%	1.21%	0.41%	0.80%	0.00%	0.02%	0.19%	0.52%	0.36%	0.79%	0.00%	0.34%	4.25%	0.21%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1900-2000	1375	68.26%	21.59%	0.03%	3.02%	1.08%	0.13%	0.26%	0.00%	0.03%	0.24%	0.51%	0.36%	0.78%	0.02%	0.38%	3.23%	0.07%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	2000-2100	1121	66.33%	24.23%	0.03%	2.69%	0.97%	0.25%	0.48%	0.00%	0.01%	0.08%	0.45%	0.32%	0.69%	0.01%	0.40%	2.93%	0.13%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	2100-2200	1066	59.56%	32.13%	0.03%	2.61%	0.94%	0.17%	0.34%	0.00%	0.01%	0.09%	0.35%	0.24%	0.53%	0.01%	0.45%	2.45%	0.09%	0.00%	100%

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)
Default Scenario

Road Name	Road ID	Road Type	Speed Limit (km/hr)	Average Speed (km/hr)	Start Emission Estimated by Broad Brush Approach (Y/N)	Hour	Total Vehicles (Veh/hr)	01 - Private Cars	02 - Taxi	03 - Light Goods Vehicles<=2.5t	04 - Light Goods Vehicles 2.5-3.5t	05 - Light Goods Vehicles>3.5t	06 - Medium Goods Vehicles<=15t	07 - Medium Goods Vehicles15-24t	08 - Public Light Buses	09 - Private Light Bus <=3.5t	10 - Private Light Bus >3.5t	11 - Non-franchised Bus<=6.4t	12 - Non-franchised Bus 6.4-15t	13 - Non-franchised Bus 15-24t	14 - Franchised Bus Single Deck	15 - Franchised Bus Double Deck	16 - Motorcycles	17 - Heavy Goods Vehicles>24t	18 - Non-franchised Bus >24t	Total
								PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	HGV9	NFB9	
CROSS BAY LINK L	RD_003		80	80.00	Y	2200-2300	1044	55.59%	37.27%	0.02%	2.38%	0.85%	0.13%	0.26%	0.00%	0.01%	0.09%	0.03%	0.02%	0.05%	0.01%	0.41%	2.81%	0.07%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	2300-0000	804	55.99%	35.11%	0.03%	2.63%	0.94%	0.20%	0.40%	0.00%	0.06%	0.49%	0.16%	0.11%	0.24%	0.01%	0.42%	3.10%	0.10%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0000-0100	996	57.48%	33.57%	0.02%	1.91%	0.69%	0.18%	0.36%	0.00%	0.12%	0.91%	0.30%	0.21%	0.45%	0.00%	0.23%	3.47%	0.09%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0100-0200	677	58.07%	31.33%	0.02%	2.09%	0.75%	0.23%	0.46%	0.00%	0.17%	1.34%	0.44%	0.30%	0.66%	0.00%	0.23%	3.78%	0.12%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0200-0300	516	58.73%	28.98%	0.02%	2.27%	0.82%	0.29%	0.56%	0.00%	0.23%	1.78%	0.58%	0.40%	0.88%	0.00%	0.23%	4.07%	0.15%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0300-0400	385	59.32%	26.67%	0.03%	2.47%	0.89%	0.34%	0.66%	0.00%	0.28%	2.21%	0.72%	0.50%	1.10%	0.00%	0.23%	4.41%	0.17%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0400-0500	362	60.00%	24.21%	0.03%	2.66%	0.96%	0.39%	0.77%	0.00%	0.34%	2.67%	0.87%	0.60%	1.33%	0.00%	0.23%	4.73%	0.20%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0500-0600	508	60.69%	21.71%	0.03%	2.87%	1.03%	0.45%	0.88%	0.00%	0.40%	3.13%	1.02%	0.71%	1.56%	0.00%	0.23%	5.06%	0.23%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0600-0700	1424	61.48%	19.02%	0.03%	3.07%	1.10%	0.51%	1.00%	0.00%	0.47%	3.66%	1.19%	0.82%	1.81%	0.00%	0.23%	5.35%	0.26%	0.00%	100%
CROSS BAY LINK R	RD_004		80	76.84	Y	0700-0800	2566	62.22%	16.35%	0.03%	3.28%	1.18%	0.57%	1.12%	0.00%	0.53%	4.16%	1.35%	0.94%	2.06%	0.00%	0.23%	5.69%	0.29%	0.00%	100%
CROSS BAY LINK R	RD_004		80	75.32	Y	0800-0900	2832	65.36%	19.99%	0.03%	2.77%	1.00%	0.43%	0.84%	0.00%	0.24%	1.86%	0.93%	0.64%	1.41%	0.00%	0.17%	4.11%	0.22%	0.00%	100%
CROSS BAY LINK R	RD_004		80	79.24	Y	0900-1000	2285	62.05%	20.11%	0.05%	5.08%	1.82%	0.93%	1.82%	0.00%	0.19%	1.47%	0.69%	0.48%	1.05%	0.01%	0.23%	3.55%	0.48%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1000-1100	2124	57.17%	26.05%	0.06%	5.87%	2.11%	1.13%	2.22%	0.00%	0.18%	1.37%	0.26%	0.18%	0.40%	0.01%	0.25%	2.17%	0.58%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1100-1200	2035	58.74%	24.62%	0.05%	5.08%	1.83%	1.13%	2.22%	0.00%	0.13%	1.05%	0.41%	0.28%	0.62%	0.00%	0.22%	3.02%	0.58%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1200-1300	835	56.81%	19.70%	0.08%	7.73%	2.78%	1.66%	3.26%	0.00%	0.36%	2.78%	0.73%	0.51%	1.11%	0.00%	0.10%	1.53%	0.85%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1300-1400	836	50.56%	20.89%	0.10%	9.40%	3.38%	1.71%	3.35%	0.00%	0.36%	2.80%	1.31%	0.91%	1.99%	0.01%	0.11%	2.27%	0.88%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1400-1500	860	57.60%	17.85%	0.08%	7.86%	2.82%	1.74%	3.42%	0.00%	0.30%	2.34%	0.58%	0.40%	0.89%	0.00%	0.10%	3.12%	0.89%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1500-1600	858	56.84%	20.44%	0.08%	8.14%	2.92%	1.85%	3.63%	0.00%	0.23%	1.83%	0.24%	0.17%	0.37%	0.00%	0.10%	2.20%	0.95%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1600-1700	931	56.65%	19.58%	0.09%	8.54%	3.07%	1.30%	2.56%	0.00%	0.18%	1.41%	0.74%	0.51%	1.13%	0.00%	0.11%	3.46%	0.67%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1700-1800	1105	65.74%	14.15%	0.06%	5.43%	1.95%	0.65%	1.28%	0.00%	0.15%	1.19%	0.76%	0.53%	1.16%	0.00%	0.09%	6.53%	0.33%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1800-1900	1128	71.15%	15.73%	0.04%	3.87%	1.39%	0.47%	0.93%	0.00%	0.02%	0.19%	0.51%	0.36%	0.78%	0.00%	0.09%	4.22%	0.24%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1900-2000	990	67.96%	21.49%	0.04%	3.48%	1.25%	0.15%	0.30%	0.00%	0.03%	0.24%	0.51%	0.36%	0.78%	0.00%	0.11%	3.21%	0.08%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	2000-2100	807	66.05%	24.12%	0.03%	3.11%	1.12%	0.28%	0.56%	0.00%	0.01%	0.08%	0.45%	0.31%	0.69%	0.00%	0.11%	2.92%	0.15%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	2100-2200	766	59.36%	32.02%	0.03%	3.02%	1.08%	0.20%	0.39%	0.00%	0.01%	0.09%	0.35%	0.24%	0.53%	0.00%	0.12%	2.44%	0.10%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	2200-2300	750	55.43%	37.16%	0.03%	2.75%	0.99%	0.15%	0.30%	0.00%	0.01%	0.09%	0.03%	0.02%	0.05%	0.00%	0.12%	2.80%	0.08%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	2300-0000	578	55.78%	34.98%	0.03%	3.03%	1.09%	0.24%	0.46%	0.00%	0.06%	0.49%	0.16%	0.11%	0.24%	0.00%	0.12%	3.09%	0.12%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.42	Y	0000-0100	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.48%	98.52%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.61	Y	0100-0200	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.49%	98.51%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.70	Y	0200-0300	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.46%	98.54%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.77	Y	0300-0400	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.52%	98.48%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.79	Y	0400-0500	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.50%	98.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.70	Y	0500-0600	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.50%	98.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.18	Y	0600-0700	7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.38%	98.62%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.54	Y	0700-0800	12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.35%	98.65%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.75	Y	0800-0900	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.40%	97.60%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.66	Y	0900-1000	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.20%	97.80%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.63	Y	1000-1100	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.40%	95.60%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.87	Y	1100-1200	9	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.28%	98.72%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.81	Y	1200-1300	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.25%	95.75%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.69	Y	1300-1400	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.79%	95.21%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.77	Y	1400-1500	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.51%	97.49%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.75	Y	1500-1600	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.17%	97.83%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.59	Y	1600-1700	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.61%	97.39%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.63	Y	1700-1800	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.56%	98.44%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.54	Y	1800-1900	12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.50%	99.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.49	Y	1900-2000	12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.98%	96.02%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.74	Y	2000-2100	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.88%	98.12%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.67	Y	2100-2200	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.34%	98.66%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.80	Y	2200-2300	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.41%	98.59%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.07	Y	2300-0000	7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.44%	98.56%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	29.42	Y	0000-0100	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.48%	98.52%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	30.07	Y	0100-0200	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.49%	98.51%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	29.70	Y	0200-0300	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.46%	98.54%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	31.07	Y	0300-0400	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.52%	98.48%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	29.79	Y	0400-0500	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.50%	98.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	32.07	Y	0500-0600	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.50%	98.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	29.18	Y	0600-0700	7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.38%	98.62%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	33.07	Y	0700-0800	13	4.29%	1.13%	0.01%	0.64%	0.23%	0.11%	0.22%	0.00%	0.04%	0.29%	0.09%	0.06%	0.14%	1.25%	91.06%	0.39%	0.06%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.86	Y	0800-0900	11	5.43%	1.66%	0.01%	0.65%	0.23%	0.10%	0.20%	0.00%	0.02%	0.15%	0.08%	0.05%	0.12%	2.18%	88.73%	0.34%	0.05%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	34.07	Y	0900-1000	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.20%	97.80%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.63	Y	1000-1100	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.40%	95.60%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	35.07	Y	1100-1200	9	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.28%	98.72%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.81	Y	1200-1300	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.25%	95.75%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	36.07	Y	1300-1400	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.79%	95.21%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.77	Y	1400-1500	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.51%	97.49%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	37.07	Y	1500-1600	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.17%	97.83%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.59	Y	1600-1700	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.61%	97.39%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	38.07	Y	1700-1800	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.56%	98.44%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.54	Y	1800-1900	12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.50%	99.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	39.07	Y	1900-2000	12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.98%	96.02%	0.00%	0.00%	0.00%	100%

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)
Default Scenario

Road Name	Road ID	Road Type	Speed Limit (km/hr)	Average Speed (km/hr)	Start Emission Estimated by Broad Brush Approach (Y/N)	Hour	Total Vehicles (Veh/hr)	01 - Private Cars	02 - Taxi	03 - Light Goods Vehicles<=2.5t	04 - Light Goods Vehicles 2.5-3.5t	05 - Light Goods Vehicles>3.5t	06 - Medium Goods Vehicles<=15t	07 - Medium Goods Vehicles15-24t	08 - Public Light Buses	09 - Private Light Bus <=3.5t	10 - Private Light Bus >3.5t	11 - Non-franchised Bus<=6.4t	12 - Non-franchised Bus 6.4-15t	13 - Non-franchised Bus 15-24t	14 - Franchised Bus Single Deck	15 - Franchised Bus Double Deck	16 - Motorcycles	17 - Heavy Goods Vehicles>24t	18 - Non-franchised Bus >24t	Total
								PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	HGV9	NFB9	
INDUSTRIAL ROAD C	RD_007		50	28.74	Y	2000-2100	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.88%	98.12%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	40.07	Y	2100-2200	11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.34%	98.66%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.80	Y	2200-2300	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.41%	98.59%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	41.07	Y	2300-0000	7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.44%	98.56%	0.00%	0.00%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.82	Y	0000-0100	3	14.19%	8.29%	0.07%	6.48%	2.33%	0.62%	1.22%	65.14%	0.03%	0.23%	0.07%	0.05%	0.11%	0.00%	0.00%	0.86%	0.32%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.87	Y	0100-0200	2	13.33%	7.19%	0.07%	6.59%	2.37%	0.74%	1.45%	66.35%	0.04%	0.31%	0.10%	0.07%	0.15%	0.00%	0.00%	0.87%	0.38%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.89	Y	0200-0300	2	12.61%	6.22%	0.07%	6.71%	2.41%	0.84%	1.66%	67.33%	0.05%	0.38%	0.12%	0.09%	0.19%	0.00%	0.00%	0.87%	0.43%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.91	Y	0300-0400	1	11.87%	5.34%	0.07%	6.78%	2.44%	0.93%	1.82%	68.43%	0.06%	0.44%	0.14%	0.10%	0.22%	0.00%	0.00%	0.88%	0.48%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.91	Y	0400-0500	1	11.27%	4.55%	0.07%	6.88%	2.47%	1.01%	1.99%	69.26%	0.06%	0.50%	0.16%	0.11%	0.25%	0.00%	0.00%	0.89%	0.52%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.87	Y	0500-0600	2	10.72%	3.83%	0.07%	6.96%	2.50%	1.08%	2.13%	70.05%	0.07%	0.55%	0.18%	0.13%	0.28%	0.00%	0.00%	0.89%	0.56%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.60	Y	0600-0700	5	10.31%	3.19%	0.07%	7.07%	2.54%	1.17%	2.30%	70.51%	0.08%	0.61%	0.20%	0.14%	0.30%	0.00%	0.00%	0.90%	0.60%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.24	Y	0700-0800	10	9.87%	2.59%	0.07%	7.14%	2.56%	1.24%	2.43%	71.12%	0.08%	0.66%	0.21%	0.15%	0.33%	0.00%	0.00%	0.90%	0.64%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.43	Y	0800-0900	8	14.82%	4.53%	0.09%	8.64%	3.10%	1.33%	2.61%	62.12%	0.05%	0.42%	0.21%	0.15%	0.32%	0.00%	0.00%	0.93%	0.68%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.34	Y	0900-1000	9	10.12%	3.28%	0.12%	11.39%	4.09%	2.08%	4.09%	62.56%	0.03%	0.24%	0.11%	0.08%	0.17%	0.00%	0.00%	0.58%	1.07%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.48	Y	1000-1100	7	11.19%	5.10%	0.16%	15.79%	5.67%	3.04%	5.97%	50.62%	0.03%	0.27%	0.05%	0.04%	0.08%	0.00%	0.00%	0.42%	1.56%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.35	Y	1100-1200	9	8.78%	3.68%	0.11%	10.44%	3.75%	2.32%	4.56%	64.34%	0.02%	0.16%	0.06%	0.04%	0.09%	0.00%	0.00%	0.45%	1.19%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.70	Y	1200-1300	19	27.66%	9.59%	0.07%	6.59%	2.37%	1.42%	2.78%	45.38%	0.17%	1.36%	0.36%	0.25%	0.54%	0.00%	0.00%	0.75%	0.73%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.30	Y	1300-1400	24	19.46%	8.04%	0.07%	6.33%	2.27%	1.15%	2.26%	56.12%	0.14%	1.08%	0.50%	0.35%	0.77%	0.00%	0.00%	0.87%	0.59%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.70	Y	1400-1500	19	28.71%	8.90%	0.07%	6.86%	2.46%	1.52%	2.98%	43.92%	0.15%	1.17%	0.29%	0.20%	0.44%	0.00%	0.00%	1.55%	0.78%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.74	Y	1500-1600	19	29.04%	10.44%	0.08%	7.28%	2.61%	1.65%	3.25%	42.22%	0.12%	0.94%	0.12%	0.09%	0.19%	0.00%	0.00%	1.12%	0.85%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.64	Y	1600-1700	21	28.88%	9.98%	0.08%	7.62%	2.74%	1.16%	2.28%	42.87%	0.09%	0.72%	0.38%	0.26%	0.57%	0.00%	0.00%	1.76%	0.60%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.28	Y	1700-1800	26	31.06%	6.68%	0.05%	4.49%	1.61%	0.54%	1.06%	49.36%	0.07%	0.56%	0.36%	0.25%	0.55%	0.00%	0.00%	3.09%	0.28%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.25	Y	1800-1900	27	33.33%	7.37%	0.03%	3.18%	1.14%	0.39%	0.76%	50.76%	0.01%	0.09%	0.24%	0.17%	0.37%	0.00%	0.00%	1.98%	0.20%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.47	Y	1900-2000	24	31.90%	10.09%	0.03%	2.86%	1.03%	0.13%	0.25%	51.24%	0.01%	0.11%	0.24%	0.17%	0.37%	0.00%	0.00%	1.51%	0.06%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.92	Y	2000-2100	17	34.98%	12.78%	0.03%	2.88%	1.04%	0.26%	0.52%	45.01%	0.01%	0.04%	0.24%	0.17%	0.37%	0.00%	0.00%	1.55%	0.14%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.87	Y	2100-2200	18	28.87%	15.58%	0.03%	2.57%	0.92%	0.17%	0.33%	49.66%	0.01%	0.04%	0.17%	0.12%	0.26%	0.00%	0.00%	1.19%	0.09%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.07	Y	2200-2300	15	30.97%	20.77%	0.03%	2.69%	0.97%	0.15%	0.29%	42.38%	0.01%	0.05%	0.02%	0.01%	0.03%	0.00%	0.00%	1.57%	0.08%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.23	Y	2300-0000	12	29.72%	18.63%	0.03%	2.83%	1.02%	0.22%	0.43%	44.80%	0.03%	0.26%	0.08%	0.06%	0.13%	0.00%	0.00%	1.65%	0.11%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.94	Y	0000-0100	1	1.78%	1.04%	0.09%	8.25%	2.96%	0.79%	1.56%	82.96%	0.00%	0.03%	0.01%	0.01%	0.01%	0.00%	0.00%	0.11%	0.41%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.95	Y	0100-0200	1	1.64%	0.88%	0.09%	8.23%	2.95%	0.92%	1.81%	82.83%	0.00%	0.04%	0.01%	0.01%	0.02%	0.00%	0.00%	0.11%	0.47%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.96	Y	0200-0300	1	1.52%	0.75%	0.09%	8.24%	2.96%	1.04%	2.04%	82.63%	0.01%	0.05%	0.01%	0.01%	0.02%	0.00%	0.00%	0.11%	0.53%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.97	Y	0300-0400	0	1.41%	0.63%	0.09%	8.19%	2.94%	1.12%	2.20%	82.63%	0.01%	0.05%	0.02%	0.01%	0.03%	0.00%	0.00%	0.10%	0.57%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.97	Y	0400-0500	0	1.32%	0.53%	0.09%	8.19%	2.94%	1.20%	2.36%	82.51%	0.01%	0.06%	0.02%	0.01%	0.03%	0.00%	0.00%	0.10%	0.62%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.95	Y	0500-0600	1	1.24%	0.44%	0.09%	8.19%	2.94%	1.27%	2.50%	82.43%	0.01%	0.06%	0.02%	0.01%	0.03%	0.00%	0.00%	0.10%	0.65%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.86	Y	0600-0700	2	1.18%	0.37%	0.09%	8.24%	2.96%	1.37%	2.68%	82.17%	0.01%	0.07%	0.02%	0.02%	0.03%	0.00%	0.00%	0.10%	0.70%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.73	Y	0700-0800	4	1.12%	0.29%	0.09%	8.24%	2.96%	1.43%	2.81%	82.07%	0.01%	0.07%	0.02%	0.02%	0.04%	0.00%	0.00%	0.10%	0.73%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.80	Y	0800-0900	3	1.81%	0.55%	0.11%	10.71%	3.85%	1.65%	3.24%	76.99%	0.01%	0.05%	0.03%	0.02%	0.04%	0.00%	0.00%	0.11%	0.85%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.76	Y	0900-1000	3	1.15%	0.37%	0.14%	13.12%	4.71%	2.39%	4.71%	72.05%	0.00%	0.03%	0.01%	0.01%	0.02%	0.00%	0.00%	0.07%	1.23%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.82	Y	1000-1100	2	1.30%	0.59%	0.20%	18.69%	6.71%	3.59%	7.06%	59.91%	0.00%	0.03%	0.01%	0.00%	0.01%	0.00%	0.00%	0.05%	1.85%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.76	Y	1100-1200	3	0.98%	0.41%	0.12%	11.86%	4.26%	2.64%	5.18%	73.09%	0.00%	0.02%	0.01%	0.00%	0.01%	0.00%	0.00%	0.05%	1.35%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.24	Y	1200-1300	10	2.95%	1.02%	0.05%	4.50%	1.61%	0.97%	1.90%	86.15%	0.02%	0.14%	0.04%	0.03%	0.06%	0.00%	0.00%	0.08%	0.50%	0.00%	100%
CHUN YAT STREET R	RD_009		50	28.85	Y	1300-1400	15	1.75%	0.72%	0.04%	3.65%	1.31%	0.66%	1.30%	89.90%	0.01%	0.10%	0.05%	0.03%	0.07%	0.00%	0.00%	0.08%	0.34%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.25	Y	1400-1500	10	3.13%	0.97%	0.05%	4.78%	1.72%	1.06%	2.08%	85.26%	0.02%	0.13%	0.03%	0.02%	0.05%	0.00%	0.00%	0.17%	0.54%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.29	Y	1500-1600	9	3.24%	1.17%	0.05%	5.21%	1.87%	1.18%	2.33%	84.05%	0.01%	0.10%	0.01%	0.01%	0.02%	0.00%	0.00%	0.13%	0.61%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.22	Y	1600-1700	10	3.21%	1.11%	0.06%	5.43%	1.95%	0.83%	1.63%	84.95%	0.01%	0.08%	0.04%	0.03%	0.06%	0.00%	0.00%	0.20%	0.42%	0.00%	100%
CHUN YAT STREET R	RD_009		50	28.93	Y	1700-1800	14	3.19%	0.69%	0.03%	2.95%	1.06%	0.35%	0.70%	90.35%	0.01%	0.06%	0.04%	0.03%	0.06%	0.00%	0.00%	0.32%	0.18%	0.00%	100%
CHUN YAT STREET R	RD_009		50	28.89	Y	1800-1900	15	3.38%	0.75%	0.02%	2.07%	0.74%	0.25%	0.49%	91.87%	0.00%	0.01%	0.02%	0.02%	0.04%	0.00%	0.00%	0.20%	0.13%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.03	Y	1900-2000	13	3.24%	1.02%	0.02%	1.86%	0.67%	0.08%	0.16%	92.66%	0.00%	0.01%	0.02%	0.02%	0.04%	0.00%	0.00%	0.15%	0.04%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.37	Y	2000-2100	9	3.96%	1.45%	0.02%	2.09%	0.75%	0.19%	0.38%	90.80%	0.00%	0.00%	0.03%	0.02%	0.04%	0.00%	0.00%	0.18%	0.10%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.30	Y	2100-2200	10	3.01%	1.63%	0.02%	1.72%	0.62%	0.11%	0.22%	92.43%	0.00%	0.00%	0.02%	0.01%	0.03%	0.00%	0.00%	0.12%	0.06%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.48	Y	2200-2300	7	3.71%	2.48%	0.02%	2.06%	0.74%	0.11%	0.22%	90.39%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.19%	0.06%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.56	Y	2300-0000	6	3.38%	2.12%	0.02%	2.06%	0.74%	0.16%	0.32%	90.87%	0.00%	0.03%	0.01%	0.01%	0.01%	0.00%	0.00%	0.19%	0.08%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.63	Y	0000-0100	230	56.85%	33.20%	0.03%	2.67%	0.96%	0.26%	0.50%	0.00%	0.12%	0.90%	0.29%	0.20%	0.45%	0.00%	0.00%	3.43%	0.13%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	24.37	Y	0100-0200	156	57.34%	30.93%	0.03%	2.91%	1.05%	0.33%	0.64%	0.00%	0.17%	1.32%	0.43%	0.30%	0.66%	0.00%	0.00%	3.73%	0.17%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	24.74	Y	0200-0300	119	57.89%	28.57%	0.03%	3.17%	1.14%	0.40%	0.78%	0.00%	0.22%	1.76%	0.57%	0.40%	0.87%	0.00%	0.00%	4.01%	0.20%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	25.25	Y	0300-0400	89	58.36%	26.24%	0.04%	3.43%	1.23%	0.47%	0.92%	0.00%	0.28%	2.18%	0.71%	0.49%	1.08%	0.00%	0.00%	4.34%	0.24%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	25.48	Y	0400-0500	84	58.92%	23.78%	0.04%	3.69%	1.33%	0.54%	1.07%	0.00%	0.34%	2.62%	0.86%	0.59%	1.30%	0.00%	0.00%	4.64%	0.28%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	24.71	Y	0500-0600	118	59.49%	21.28%	0.04%	3.97%	1.42%	0.62%	1.21%	0.00%	0.39%	3.07%	1.00%	0.70%	1.53%	0.00%	0.00%	4.96%	0.32%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	22.35	Y	0600-0700	332	60.14%	18.61%	0.04%	4.24%	1.52%	0.70%	1.38%	0.00%	0.46%	3.58%	1.16%	0.81%	1.77%	0.00%	0.00%	5.23%	0.36%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	19.34	Y	0700-0800	599	60.75%	15.96%	0.05%	4.52%	1.62%	0.78%	1.54%	0.00%	0.52%	4.07%	1.32%	0.91%	2.01%	0.00%	0.00%	5.55%	0.40%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	18.90	Y	0800-0900	659	64.08%	19.60%	0.04%	3.84%	1.38%	0.59%	1.16%	0.00%	0.23%	1.82%	0.91%	0.63%	1.39%	0.00%	0.00%	4.03%	0.30%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	19.96	Y	0900-1000	542	59.69%	19.34%	0.07%	6.90%	2.48%	1.26%	2.48%	0.00%	0.18%	1.41%	0.66%	0.46%	1.01%	0.00%	0.00%	3.42%	0.65%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	20.32	Y	1000-1100	507	54.62%	24.88%	0.08%	7.92%	2.84%	1.52%	2.99%	0.00%	0.17%	1.31%	0.25%	0.17%	0.38%	0.00%	0.00%	2.07%	0.78%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	20.60	Y	1100-1200	484	56.34%	23.61%	0.07%	6.88%	2.47%	1.53%	3.01%	0.00%	0.13%	1.01%	0.39%	0.27%	0.60%	0.00%	0.00%	2.90%	0.79%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.32	Y	1200-1300	235	57.83%	20.06%	0.07%	7.07%	2.54%	1.52%	2.99%	0.00%	0.36%	2.83%	0.74%	0.52%	1.13%	0.00%	0.00%	1.56%	0.78%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.26	Y	1300-1400	234	51.60%	21.32%	0.09%	8.62%	3.10%	1.56%	3.08%	0.00%	0.37%	2.86%	1.33%	0.92%	2.03%	0.00%	0.00%	2.32%	0.80%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.26	Y	1400-1500	242	58.66%	18.18%	0.08%	7.19%	2.58%	1.59%	3.13%	0.00%	0.31%	2.39%	0.59%	0.41%	0.90%	0.00%	0.00%	3.18%	0.82%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.28	Y	1500-1600	241	57.93%	20.83%	0.08%	7.45%	2.68%	1.69%	3.33%	0.00%	0.24%	1.87%	0.25%	0.17%	0.37%	0.00%	0.00%	2.24%	0.87%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.06	Y	1600-1700	262	57.67%	19.93%	0.08%	7.81%	2.81%	1.19%	2.34%	0.00%	0.18%	1.43%	0.75%	0.52%	1.15%	0.00%	0.00%	3.52%	0.61%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	22.65	Y	1700-1800	313	66.46%	14.30%	0.05%	4.93%	1.77%	0.59%	1.16%	0.00%	0.15%	1.20%	0.77%	0.53%	1.17%	0.00%	0.00%	6.60%	0.30%	0.00%	100%

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)
Default Scenario

Road Name	Road ID	Road Type	Speed Limit (km/hr)	Average Speed (km/hr)	Start Emission Estimated by Broad Brush Approach (Y/N)	Hour	Total Vehicles (Veh/hr)	01 - Private Cars	02 - Taxi	03 - Light Goods Vehicles<=2.5t	04 - Light Goods Vehicles 2.5-3.5t	05 - Light Goods Vehicles>3.5t	06 - Medium Goods Vehicles<=15t	07 - Medium Goods Vehicles15-24t	08 - Public Light Buses	09 - Private Light Bus <=3.5t	10 - Private Light Bus >3.5t	11 - Non-franchised Bus<=6.4t	12 - Non-franchised Bus 6.4-15t	13 - Non-franchised Bus 15-24t	14 - Franchised Bus Single Deck	15 - Franchised Bus Double Deck	16 - Motorcycles	17 - Heavy Goods Vehicles>24t	18 - Non-franchised Bus >24t	Total
								PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	HGV9	NFB9	
RESIDENTIAL ROAD L	RD_010		50	22.65	Y	1800-1900	320	71.72%	15.86%	0.04%	3.51%	1.26%	0.43%	0.84%	0.00%	0.02%	0.20%	0.52%	0.36%	0.79%	0.00%	0.00%	4.25%	0.22%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.08	Y	1900-2000	281	68.40%	21.63%	0.03%	3.15%	1.13%	0.14%	0.27%	0.00%	0.03%	0.24%	0.52%	0.36%	0.79%	0.00%	0.00%	3.24%	0.07%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.62	Y	2000-2100	229	66.48%	24.28%	0.03%	2.81%	1.01%	0.26%	0.51%	0.00%	0.01%	0.08%	0.46%	0.32%	0.69%	0.00%	0.00%	2.94%	0.13%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.75	Y	2100-2200	218	59.73%	32.22%	0.03%	2.73%	0.98%	0.18%	0.35%	0.00%	0.01%	0.09%	0.35%	0.24%	0.54%	0.00%	0.00%	2.45%	0.09%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.83	Y	2200-2300	213	55.74%	37.37%	0.03%	2.48%	0.89%	0.14%	0.27%	0.00%	0.01%	0.09%	0.03%	0.02%	0.05%	0.00%	0.00%	2.82%	0.07%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	24.31	Y	2300-0000	164	56.13%	35.20%	0.03%	2.74%	0.98%	0.21%	0.42%	0.00%	0.06%	0.49%	0.16%	0.11%	0.24%	0.00%	0.00%	3.11%	0.11%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	25.56	Y	0000-0100	79	51.09%	29.84%	0.07%	6.29%	2.26%	0.60%	1.19%	0.00%	0.10%	0.81%	0.26%	0.18%	0.40%	0.05%	3.44%	3.09%	0.31%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	26.91	Y	0100-0200	54	51.09%	27.56%	0.07%	6.81%	2.45%	0.76%	1.50%	0.00%	0.15%	1.18%	0.38%	0.27%	0.58%	0.05%	3.43%	3.32%	0.39%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	27.59	Y	0200-0300	42	51.15%	25.24%	0.08%	7.34%	2.64%	0.92%	1.82%	0.00%	0.20%	1.55%	0.50%	0.35%	0.77%	0.05%	3.37%	3.54%	0.47%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	28.16	Y	0300-0400	32	51.10%	22.97%	0.08%	7.88%	2.83%	1.08%	2.11%	0.00%	0.24%	1.91%	0.62%	0.43%	0.95%	0.05%	3.40%	3.80%	0.55%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	28.23	Y	0400-0500	30	51.14%	20.64%	0.09%	8.41%	3.02%	1.24%	2.43%	0.00%	0.29%	2.27%	0.74%	0.52%	1.13%	0.05%	3.36%	4.03%	0.63%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	27.45	Y	0500-0600	43	51.17%	18.31%	0.09%	8.96%	3.22%	1.39%	2.74%	0.00%	0.34%	2.64%	0.86%	0.60%	1.32%	0.05%	3.33%	4.26%	0.72%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.54	Y	0600-0700	120	51.31%	15.88%	0.10%	9.48%	3.41%	1.57%	3.09%	0.00%	0.39%	3.05%	0.99%	0.69%	1.51%	0.05%	3.21%	4.46%	0.81%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	23.31	Y	0700-0800	219	51.36%	13.50%	0.10%	10.03%	3.60%	1.74%	3.42%	0.00%	0.44%	3.44%	1.11%	0.77%	1.70%	0.04%	3.16%	4.69%	0.89%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	23.25	Y	0800-0900	234	55.81%	17.07%	0.09%	8.78%	3.15%	1.35%	2.65%	0.00%	0.20%	1.59%	0.79%	0.55%	1.21%	0.06%	2.50%	3.51%	0.69%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	23.34	Y	0900-1000	212	47.25%	15.31%	0.15%	14.34%	5.15%	2.62%	5.15%	0.00%	0.14%	1.12%	0.52%	0.36%	0.80%	0.07%	2.98%	2.70%	1.34%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	23.38	Y	1000-1100	205	41.88%	19.08%	0.17%	15.94%	5.72%	3.06%	6.02%	0.00%	0.13%	1.00%	0.19%	0.13%	0.29%	0.14%	3.06%	1.59%	1.57%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	23.58	Y	1100-1200	191	44.16%	18.51%	0.15%	14.16%	5.08%	3.15%	6.19%	0.00%	0.10%	0.79%	0.31%	0.21%	0.47%	0.04%	2.81%	2.27%	1.62%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.30	Y	1200-1300	136	49.82%	17.28%	0.11%	10.83%	3.89%	2.33%	4.57%	0.00%	0.31%	2.44%	0.64%	0.44%	0.98%	0.16%	3.65%	1.34%	1.19%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.22	Y	1300-1400	139	43.62%	18.02%	0.14%	12.95%	4.65%	2.35%	4.62%	0.00%	0.31%	2.42%	1.13%	0.78%	1.72%	0.20%	3.93%	1.96%	1.21%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.25	Y	1400-1500	141	50.40%	15.62%	0.11%	10.98%	3.94%	2.43%	4.77%	0.00%	0.26%	2.05%	0.51%	0.35%	0.78%	0.10%	3.71%	2.73%	1.25%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.25	Y	1500-1600	141	49.50%	17.80%	0.12%	11.32%	4.06%	2.57%	5.06%	0.00%	0.20%	1.59%	0.21%	0.15%	0.32%	0.08%	3.78%	1.92%	1.32%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.13	Y	1600-1700	152	49.61%	17.15%	0.12%	11.95%	4.29%	1.82%	3.58%	0.00%	0.16%	1.23%	0.65%	0.45%	0.99%	0.11%	3.94%	3.03%	0.93%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.00	Y	1700-1800	173	60.04%	12.92%	0.08%	7.91%	2.84%	0.95%	1.87%	0.00%	0.14%	1.09%	0.70%	0.48%	1.06%	0.05%	3.41%	5.97%	0.49%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.04	Y	1800-1900	174	65.89%	14.57%	0.06%	5.73%	2.06%	0.70%	1.37%	0.00%	0.02%	0.18%	0.47%	0.33%	0.72%	0.02%	3.62%	3.91%	0.36%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.29	Y	1900-2000	153	63.10%	19.95%	0.00	5.16%	1.85%	0.23%	0.45%	0.00%	0.03%	0.23%	0.48%	0.33%	0.72%	0.17%	4.14%	2.98%	0.12%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.61	Y	2000-2100	124	61.28%	22.38%	0.05%	4.61%	1.65%	0.42%	0.83%	0.00%	0.01%	0.08%	0.42%	0.29%	0.64%	0.08%	4.33%	2.71%	0.22%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.67	Y	2100-2200	118	54.93%	29.63%	0.05%	4.46%	1.60%	0.29%	0.58%	0.00%	0.01%	0.08%	0.32%	0.22%	0.49%	0.07%	4.85%	2.26%	0.15%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.73	Y	2200-2300	115	51.64%	34.62%	0.04%	4.09%	1.47%	0.23%	0.45%	0.00%	0.01%	0.08%	0.03%	0.02%	0.04%	0.06%	4.49%	2.61%	0.12%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	25.04	Y	2300-0000	89	51.76%	32.45%	0.05%	4.49%	1.61%	0.35%	0.69%	0.00%	0.06%	0.45%	0.15%	0.10%	0.23%	0.07%	4.50%	2.87%	0.18%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	24.12	Y	0000-0100	309	55.38%	32.34%	0.04%	3.60%	1.29%	0.35%	0.68%	0.00%	0.11%	0.88%	0.28%	0.19%	0.44%	0.01%	0.88%	3.34%	0.18%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	25.02	Y	0100-0200	210	55.73%	30.06%	0.04%	3.91%	1.41%	0.44%	0.86%	0.00%	0.16%	1.28%	0.42%	0.29%	0.64%	0.01%	0.88%	3.62%	0.23%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	25.48	Y	0200-0300	161	56.13%	27.70%	0.04%	4.26%	1.53%	0.54%	1.05%	0.00%	0.21%	1.71%	0.55%	0.39%	0.84%	0.01%	0.88%	3.89%	0.27%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	26.02	Y	0300-0400	121	56.44%	25.38%	0.05%	4.61%	1.65%	0.63%	1.23%	0.00%	0.27%	2.11%	0.69%	0.47%	1.05%	0.01%	0.90%	4.20%	0.32%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	26.20	Y	0400-0500	114	56.87%	22.95%	0.05%	4.93%	1.77%	0.72%	1.43%	0.00%	0.33%	2.53%	0.83%	0.57%	1.26%	0.01%	0.88%	4.48%	0.37%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	25.45	Y	0500-0600	161	57.27%	20.49%	0.05%	5.30%	1.90%	0.83%	1.62%	0.00%	0.38%	2.96%	0.96%	0.67%	1.47%	0.01%	0.89%	4.77%	0.43%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	22.93	Y	0600-0700	452	57.80%	17.89%	0.06%	5.63%	2.02%	0.93%	1.83%	0.00%	0.44%	3.44%	1.11%	0.78%	1.70%	0.01%	0.85%	5.03%	0.48%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	20.40	Y	0700-0800	818	58.24%	15.30%	0.06%	6.00%	2.15%	1.04%	2.04%	0.00%	0.50%	3.90%	1.26%	0.87%	1.93%	0.01%	0.85%	5.32%	0.53%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	20.04	Y	0800-0900	893	61.91%	18.94%	0.05%	5.13%	1.84%	0.79%	1.55%	0.00%	0.22%	1.76%	0.88%	0.61%	1.34%	0.02%	0.66%	3.89%	0.40%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	20.91	Y	0900-1000	754	56.19%	18.21%	0.09%	8.99%	3.23%	1.64%	3.23%	0.00%	0.17%	1.33%	0.62%	0.43%	0.95%	0.02%	0.84%	3.22%	0.84%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	21.20	Y	1000-1100	712	50.95%	23.21%	0.11%	10.23%	3.67%	1.96%	3.86%	0.00%	0.16%	1.22%	0.23%	0.16%	0.35%	0.04%	0.88%	1.93%	1.01%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	21.45	Y	1100-1200	675	52.89%	22.17%	0.09%	8.94%	3.21%	1.99%	3.91%	0.00%	0.12%	0.95%	0.37%	0.25%	0.56%	0.01%	0.80%	2.72%	1.02%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.68	Y	1200-1300	371	54.89%	19.04%	0.08%	8.45%	3.03%	1.82%	3.57%	0.00%	0.34%	2.69%	0.70%	0.49%	1.08%	0.06%	1.34%	1.48%	0.93%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.62	Y	1300-1400	373	48.63%	20.09%	0.11%	10.23%	3.68%	1.85%	3.65%	0.00%	0.35%	2.70%	1.26%	0.87%	1.91%	0.07%	1.46%	2.19%	0.95%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.62	Y	1400-1500	383	55.62%	17.24%	0.09%	8.59%	3.08%	1.90%	3.73%	0.00%	0.29%	2.26%	0.56%	0.39%	0.86%	0.04%	1.37%	3.01%	0.98%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.64	Y	1500-1600	382	54.82%	19.71%	0.09%	8.88%	3.19%	2.01%	3.97%	0.00%	0.23%	1.77%	0.24%	0.16%	0.35%	0.03%	1.40%	2.12%	1.04%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.45	Y	1600-1700	414	54.71%	18.91%	0.09%	9.33%	3.35%	1.42%	2.80%	0.00%	0.17%	1.36%	0.71%	0.49%	1.09%	0.04%	1.45%	3.34%	0.73%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.13	Y	1700-1800	486	64.17%	13.81%	0.06%	5.99%	2.15%	0.72%	1.41%	0.00%	0.15%	1.16%	0.75%	0.51%	1.13%	0.02%	1.21%	6.38%	0.37%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.14	Y	1800-1900	494	69.67%	15.41%	0.05%	4.29%	1.54%	0.53%	1.03%	0.00%	0.02%	0.19%	0.50%	0.35%	0.77%	0.01%	1.28%	4.13%	0.27%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.51	Y	1900-2000	434	66.53%	21.04%	0.04%	3.86%	1.38%	0.17%	0.33%	0.00%	0.03%	0.24%	0.51%	0.35%	0.77%	0.06%	1.46%	3.15%	0.09%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.97	Y	2000-2100	353	64.65%	23.61%	0.04%	3.44%	1.23%	0.32%	0.62%	0.00%	0.01%	0.08%	0.45%	0.31%	0.67%	0.03%	1.52%	2.86%	0.16%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	24.08	Y	2100-2200	336	58.04%	31.31%	0.04%	3.34%	1.20%	0.22%	0.43%	0.00%	0.01%	0.09%	0.34%	0.23%	0.52%	0.02%	1.70%	2.38%	0.11%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	24.15	Y	2200-2300	328	54.30%	36.41%	0.03%	3.04%	1.09%	0.17%	0.33%	0.00%	0.01%	0.09%	0.03%	0.02%	0.05%	0.02%	1.57%	2.75%	0.09%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	24.57	Y	2300-0000	253	54.59%	34.23%	0.04%	3.36%	1.20%	0.26%	0.51%	0.00%	0.06%	0.48%	0.16%	0.11%	0.24%	0.02%	1.58%	3.03%	0.13%	0.00%	100%

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)

Road ID	Segment ID	X coordinate of endpoint 1	Y coordinate of endpoint 1	X coordinate of endpoint 2	Y coordinate of endpoint 2	Road height (mAG)	Physical Road width (m)	Road elevation (m)	Barrier 1 width (m)	Barrier 1 height (m)	Barrier 1 DCL (m)	Barrier 2 width (m)	Barrier 2 height (m)	Barrier 2 DCL (m)	Portal ID
RD_001	RD_001_001	846256.09	816775.06	846251.03	816786.06		8.95								
RD_001	RD_001_002	846251.03	816786.06	846237.20	816820.49		8.19								
RD_001	RD_001_003	846208.48	817387.39	846176.50	817480.43		11.10								
RD_001	RD_001_004	846176.50	817480.43	846159.88	817513.75		7.47								
RD_001	RD_001_005	846159.88	817513.75	846135.30	817560.20		8.96								
RD_001	RD_001_006	846220.28	817010.50	846221.54	817135.41		20.34								
RD_001	RD_001_007	846221.54	817135.41	846220.52	817287.67		8.03								
RD_001	RD_001_008	846220.52	817287.67	846216.88	817341.15		9.69								
RD_001	RD_001_009	846216.88	817341.15	846208.50	817387.10		13.13								
RD_001	RD_001_010	846237.20	816820.49	846225.31	816877.40		8.36								
RD_001	RD_001_011	846225.31	816877.40	846220.28	817010.50		20.07								
RD_001	RD_001_012	846426.03	816285.66	846425.71	816300.05		5.78								
RD_001	RD_001_013	846425.71	816300.05	846422.27	816365.72		6.14								
RD_001	RD_001_014	846422.27	816365.72	846410.47	816437.91		6.80								
RD_001	RD_001_015	846410.47	816437.91	846399.00	816484.63		7.03								
RD_001	RD_001_016	846399.00	816484.63	846391.05	816512.53		6.97								
RD_001	RD_001_017	846391.05	816512.53	846372.88	816564.34		6.85								
RD_001	RD_001_018	846372.88	816564.34	846360.49	816593.90		7.10								
RD_001	RD_001_019	846360.49	816593.90	846325.82	816662.86		7.48								
RD_001	RD_001_020	846325.82	816662.86	846269.29	816753.74		7.80								
RD_001	RD_001_021	846269.29	816753.74	846256.24	816774.91		9.58								
RD_002	RD_002_001	846146.00	817566.10	846170.80	817518.63		7.90								
RD_002	RD_002_002	846229.14	817340.94	846231.42	817322.34		7.21								
RD_002	RD_002_003	846231.42	817322.34	846234.36	817233.09		8.15								
RD_002	RD_002_004	846234.36	817233.09	846236.12	817053.37		11.30								
RD_002	RD_002_005	846236.12	817053.37	846236.98	817010.85		11.18								
RD_002	RD_002_006	846270.25	816780.30	846283.10	816761.50		19.09								
RD_002	RD_002_007	846283.10	816761.50	846346.03	816646.16		8.15								
RD_002	RD_002_008	846346.03	816646.16	846368.12	816599.77		7.00								
RD_002	RD_002_009	846368.12	816599.77	846392.68	816538.00		7.49								
RD_002	RD_002_010	846392.68	816538.00	846413.96	816464.60		7.51								
RD_002	RD_002_011	846413.96	816464.60	846425.33	816411.12		6.94								
RD_002	RD_002_012	846425.33	816411.12	846439.11	816304.27		7.62								
RD_002	RD_002_013	846439.11	816304.27	846439.63	816284.34		8.69								
RD_002	RD_002_014	846236.60	816954.48	846236.52	816915.50		7.65								
RD_002	RD_002_015	846236.52	816915.50	846240.67	816870.21		7.40								
RD_002	RD_002_016	846240.67	816870.21	846251.93	816830.14		10.68								
RD_002	RD_002_017	846251.93	816830.14	846265.97	816791.83		15.84								
RD_002	RD_002_018	846265.97	816791.83	846270.29	816780.18		23.24								
RD_002	RD_002_019	846236.98	817010.85	846236.60	816954.48		8.14								
RD_002	RD_002_020	846219.60	817392.56	846220.45	817389.75		7.97								
RD_002	RD_002_021	846208.35	817428.50	846219.60	817392.56		10.18								
RD_002	RD_002_022	846170.66	817518.55	846208.50	817428.46		10.02								
RD_002	RD_002_023	846220.13	817390.26	846229.12	817341.15		6.90								
RD_003	RD_003_001	846044.89	817022.52	846207.70	817023.45		10.30		12.61	6.369	5.65				
RD_003	RD_003_002	846207.70	817023.45	846236.58	817024.03		11.82								
RD_003	RD_003_003	846044.89	817022.52	846207.70	817023.45		10.30		12.61	6.369	5.65				
RD_003	RD_003_004	845901.54	817021.71	846044.89	817022.52		7.30		9.60	5.668	4.65				
RD_004	RD_004_001	846220.28	817010.50	846205.03	817009.39		21.71								
RD_004	RD_004_002	846205.03	817009.39	846163.09	817012.68		7.30								
RD_004	RD_004_003	846163.09	817012.68	845992.44	817012.46		7.30								
RD_004	RD_004_004	845992.44	817012.46	845900.52	817011.85		7.30								
RD_004	RD_004_005	846220.28	817010.50	846236.98	817010.85		20.63								
RD_005	RD_005_001	846298.11	816506.73	846325.57	816570.51		17.76								
RD_005	RD_005_002	846325.57	816570.51	846331.14	816571.84		22.78								
RD_005	RD_005_003	846331.14	816571.84	846333.41	816570.74		24.29								
RD_005	RD_005_004	846333.41	816570.74	846357.97	816512.06		18.38								
RD_005	RD_005_005	846357.97	816512.06	846363.24	816495.35		11.45								
RD_005	RD_005_006	846344.10	816486.73	846357.05	816494.01		11.86								
RD_005	RD_005_007	846357.05	816494.01	846363.24	816495.35		11.42								
RD_005	RD_005_008	846058.85	816765.57	846058.64	816773.10		7.95								
RD_005	RD_005_009	846058.64	816773.10	846068.22	816790.49		6.77								
RD_005	RD_005_010	846068.22	816790.49	846075.43	816792.71		9.52								
RD_005	RD_005_011	846075.43	816792.71	846081.30	816790.94		11.11								
RD_005	RD_005_012	846081.30	816790.94	846085.43	816782.64		11.52								
RD_005	RD_005_013	846085.43	816782.64	846084.30	816778.09		11.30								
RD_005	RD_005_014	846084.30	816778.09	846080.18	816774.88		11.35								
RD_005	RD_005_015	846080.18	816774.88	846068.85	816772.44		11.12								
RD_005	RD_005_016	846068.85	816772.44	846059.35	816765.84		10.32								
RD_005	RD_005_017	846363.24	816495.35	846369.42	816493.25		10.77								
RD_005	RD_005_018	846369.42	816493.25	846372.93	816486.49		9.35								
RD_005	RD_005_019	846372.93	816486.49	846372.31	816482.95		10.04								
RD_005	RD_005_020	846372.31	816482.95	846367.78	816476.97		10.52								
RD_005	RD_005_021	846367.78	816476.97	846359.02	816476.08		10.47								
RD_005	RD_005_022	846359.02	816476.08	846349.85	816478.40		8.92								
RD_005	RD_005_023	846349.85	816478.40	846346.76	816480.50		8.20								
RD_005	RD_005_024	846346.76	816480.50	846343.97	816486.36		11.48								
RD_005	RD_005_025	846513.24	816710.49	846525.62	816689.57		10.60								
RD_005	RD_005_026	846525.62	816689.57	846525.11	816683.48		10.07								
RD_005	RD_005_027	846525.11	816683.48	846520.99	816678.38		8.07								
RD_005	RD_005_028	846520.99	816678.38	846513.88	816678.71		8.22								
RD_005	RD_005_029	846513.88	816678.71	846509.86	816683.69		9.50								
RD_005	RD_005_030	846509.86	816683.69	846514.49	816697.43		11.47								
RD_005	RD_005_031	846514.49	816697.43	846513.24	816710.49		10.91								
RD_007	RD_007_001	846426.39	816842.54	846513.24	816710.49		9.76								
RD_007	RD_007_002	846236.60	816954.48	846292.35	816954.63		7.25								
RD_007	RD_007_003	846292.35	816954.63	846299.46	816956.18		8.29								
RD_007	RD_007_004	846299.46	816956.18	846305.23	816960.73		13.50								
RD_007	RD_007_005	846305.23	816960.73	846309.24	816967.59		13.15								
RD_007	RD_007_006	846309.24	816967.59	846308.47	817041.12		9.27								
RD_007	RD_007_007	846308.47	817041.12	846305.48	817045.33		12.41								
RD_007	RD_007_008	846305.48	817045.33	846301.87	817045.88		18.97								
RD_007	RD_007_009	846426.39	816842.54	846266.19	816774.89		20.53								
RD_007	RD_007_010	846073.39	816600.36	846259.45	816519.31		22.85								
RD_007	RD_007_011	846296.76	816504.61	846259.45	816519.31		14.55								
RD_007	RD_007_012	846058.85	816765.57	846016.25	816666.10		10.23								
RD_007	RD_007_013	846016.25	816666.10	846012.76	816656.35		10.25								
RD_007	RD_007_014	846012.76	816656.35	846011.11	816645.28		10.67								
RD_007	RD_007_015	846011.11	816645.28	846012.46	816636.42		10.74								
RD_007	RD_007_016	846012.46	816636.42	846021.95	816623.69		12.09								
RD_007	RD_007_017	846021.95	816623.69	846028.03	816619.71		12.87								
RD_007	RD_007_018	846028.03	816619.71	846073.39	816600.36		21.66								
RD_007	RD_007_019	846343.97	816486.36	846296.76	816504.61		14.20								
RD_007	RD_007_020	846195.61	816368.96	846259.09	816519.27		13.79								
RD_008	RD_008_001	846210.76	816755.03	846225.80	816766.67		5.73								
RD_008	RD_008_002	846225.80	816766.67	846232.59	816774.87		5.35								
RD_008	RD_008_003	846232.59	816774.87	846237.63	816790.37		5.55								
RD_008	RD_008_004	846237.63	816790.37	846237.20	816820.49		7.28								
RD_008	RD_008_005	846210.76	816755.03	846247.33	816770.12		5.82								
RD_008	RD_008_006	846247.33	816770.11	846266.22	816779.06		18.05								
RD_008	RD_008_007	846041.05	816531.17	846076.26	816617.97		6.73								
RD_008	RD_008_008	846076.26	816617.97	846097.56	816661.83		7.52								
RD_008	RD_008_009	846097.56	816661.83	846124.85	816698.95		7.33								
RD_008	RD_008_010	846124.85	816698.95	846149.36	816721.11		7.04								
RD_008	RD_008_011	846149.36	816721.11	846166.25	816732.97		6.99								
RD_008	RD_008_012	846166.25	816732.97	846186.34	816744.61		6.93								
RD_008	RD_008_013	846186.34	816744.61	846210.76	816755.03		6.70								
RD_009	RD_009_001	846269.72	816770.53	846251.25	816762.03		20.75								
RD_009	RD_009_002	846251.25	816762.03	846194.59	816738.63		7.17								

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)

Road ID	Segment ID	X coordinate of endpoint 1	Y coordinate of endpoint 1	X coordinate of endpoint 2	Y coordinate of endpoint 2	Road height (mAG)	Physical Road width (m)	Road elevation (m)	Barrier 1 width (m)	Barrier 1 height (m)	Barrier 1 DCL (m)	Barrier 2 width (m)	Barrier 2 height (m)	Barrier 2 DCL (m)	Portal ID
RD_009	RD_009_003	846194.59	816738.63	846178.31	816730.10		6.42								
RD_009	RD_009_004	846178.31	816730.10	846137.83	816699.84		6.33								
RD_009	RD_009_005	846137.83	816699.84	846126.81	816687.98		6.48								
RD_009	RD_009_006	846126.81	816687.98	846110.75	816665.49		6.97								
RD_009	RD_009_007	846110.75	816665.49	846100.46	816647.55		6.97								
RD_009	RD_009_008	846100.46	816647.55	846085.54	816613.88		7.08								
RD_009	RD_009_009	846085.54	816613.88	846047.39	816528.28		7.66								
RD_010	RD_010_001	846101.34	817375.08	846123.59	817389.26		7.07								
RD_010	RD_010_002	846123.59	817389.26	846147.49	817398.91		6.39								
RD_010	RD_010_003	846147.49	817398.91	846207.10	817411.48		17.75								
RD_010	RD_010_004	846051.60	817321.78	846092.27	817368.31		10.09								
RD_010	RD_010_005	846092.27	817368.31	846101.34	817375.08		7.19								
RD_010	RD_010_006	846207.26	817411.53	846254.53	817429.32		17.43								
RD_010	RD_010_007	846254.53	817429.32	846266.17	817438.52		6.21								
RD_010	RD_010_008	846266.17	817438.52	846276.98	817452.04		6.53								
RD_010	RD_010_009	846276.98	817452.04	846285.21	817472.64		6.73								
RD_010	RD_010_010	846285.21	817472.64	846287.58	817486.15		6.88								
RD_010	RD_010_011	846287.58	817486.15	846283.64	817510.95		6.39								
RD_010	RD_010_012	846283.64	817510.95	846280.86	817518.70		6.04								
RD_010	RD_010_013	846280.86	817518.70	846262.49	817551.58		6.14								
RD_010	RD_010_014	846262.49	817551.58	846232.90	817605.59		6.15								
RD_010	RD_010_015	845898.06	817146.95	845940.52	817146.20		4.78								
RD_010	RD_010_016	845940.52	817146.20	845971.33	817152.64		4.58								
RD_010	RD_010_017	845971.33	817152.64	845988.64	817159.96		3.50								
RD_010	RD_010_018	845988.64	817159.96	846002.23	817167.94		3.50								
RD_010	RD_010_019	846002.23	817167.94	846016.86	817178.91		3.50								
RD_010	RD_010_020	846016.86	817178.91	846031.48	817194.42		3.50								
RD_010	RD_010_021	846031.48	817194.42	846043.32	817212.48		3.89								
RD_010	RD_010_022	846043.32	817212.48	846051.04	817229.54		4.51								
RD_010	RD_010_023	846051.04	817229.54	846055.97	817247.59		4.85								
RD_010	RD_010_024	846055.97	817247.59	846057.92	817262.98		5.21								
RD_010	RD_010_025	846057.92	817262.98	846054.10	817278.26		4.91								
RD_010	RD_010_026	846054.10	817278.26	846045.95	817291.77		8.11								
RD_011	RD_011_001	846209.77	817401.07	846164.60	817392.17		17.11								
RD_011	RD_011_002	846164.60	817392.17	846146.36	817386.84		6.32								
RD_011	RD_011_003	846146.36	817386.84	846137.91	817383.85		6.73								
RD_011	RD_011_004	846137.91	817383.85	846116.80	817371.65		8.11								
RD_011	RD_011_005	846116.80	817371.65	846102.68	817364.11		7.00								
RD_011	RD_011_006	846102.68	817364.11	846088.68	817349.49		6.00								
RD_011	RD_011_007	846088.68	817349.49	846061.60	817315.70		9.95								
RD_011	RD_011_008	846237.11	817607.37	846245.05	817591.98		15.00								
RD_011	RD_011_009	846264.76	817559.77	846269.09	817555.13		9.45								
RD_011	RD_011_010	846269.09	817555.13	846289.52	817513.28		7.22								
RD_011	RD_011_011	846289.52	817513.28	846294.99	817487.26		9.01								
RD_011	RD_011_012	846294.99	817487.26	846292.84	817472.53		7.98								
RD_011	RD_011_013	846292.84	817472.53	846282.65	817448.05		6.32								
RD_011	RD_011_014	846282.65	817448.05	846274.31	817436.86		7.00								
RD_011	RD_011_015	846274.31	817436.86	846263.60	817426.45		11.31								
RD_011	RD_011_016	846263.60	817426.45	846252.89	817418.69		11.35								
RD_011	RD_011_017	846252.89	817418.69	846210.05	817401.13		17.52								
RD_011	RD_011_018	846245.05	817591.98	846259.50	817565.31		14.28								
RD_011	RD_011_019	846259.50	817565.31	846264.76	817559.77		13.18								
RD_011	RD_011_020	846059.24	817296.32	846061.73	817276.16		7.05								
RD_011	RD_011_021	846061.73	817276.16	846061.33	817259.22		3.60								
RD_011	RD_011_022	846061.33	817259.22	846056.70	817235.41		3.50								
RD_011	RD_011_023	846056.70	817235.41	846049.61	817214.59		5.06								
RD_011	RD_011_024	846049.61	817214.59	846041.78	817200.08		6.86								
RD_011	RD_011_025	846041.78	817200.08	846031.59	817187.11		5.28								
RD_011	RD_011_026	846031.59	817187.11	846002.34	817163.62		4.43								
RD_011	RD_011_027	846002.34	817163.62	845974.63	817149.65		7.32								
RD_011	RD_011_028	845974.63	817149.65	845948.46	817143.54		10.15								
RD_011	RD_011_029	845948.46	817143.54	845923.62	817142.53		6.51								
RD_011	RD_011_030	845923.62	817142.53	845897.96	817143.29		3.50								
RD_011	RD_011_031	846245.05	817591.98	846255.56	817597.09		11.10								
RD_011	RD_011_032	846255.56	817597.09	846262.98	817595.87		7.07								
RD_011	RD_011_033	846262.98	817595.87	846268.86	817583.81		6.99								
RD_011	RD_011_034	846268.86	817583.81	846268.97	817579.93		7.07								
RD_011	RD_011_035	846268.97	817579.93	846267.63	817572.07		6.40								
RD_011	RD_011_036	846267.63	817572.07	846259.50	817565.31		10.09								
RD_012	RD_012_001	846101.34	817375.08	846087.93	817397.77		8.74								
RD_012	RD_012_002	846087.93	817397.77	846077.21	817401.75		6.46								
RD_012	RD_012_003	846077.21	817401.75	846071.74	817408.39		5.10								
RD_012	RD_012_004	846071.74	817408.39	846070.50	817418.46		6.28								
RD_012	RD_012_005	846070.50	817418.46	846071.94	817424.67		5.85								
RD_012	RD_012_006	846071.94	817424.67	846075.54	817428.21		8.45								
RD_012	RD_012_007	846075.54	817428.21	846082.14	817428.99		10.19								
RD_012	RD_012_008	846082.14	817428.99	846083.49	817412.16		7.76								
RD_012	RD_012_009	846083.49	817412.16	846087.93	817397.77		7.81								
RD_012	RD_012_010	846045.95	817291.77	846042.14	817292.21		10.27								
RD_012	RD_012_011	846042.14	817292.21	846034.72	817297.19		8.06								
RD_012	RD_012_012	846034.72	817297.19	846032.13	817307.37		10.49								
RD_012	RD_012_013	846039.13	817318.78	846043.77	817321.11		11.74								
RD_012	RD_012_014	846043.77	817321.11	846051.60	817321.78		12.14								
RD_012	RD_012_015	846032.13	817307.37	846035.53	817316.90		12.26								
RD_012	RD_012_016	846035.53	817316.90	846039.13	817318.78		12.07								
RD_012	RD_012_017	846051.60	817321.78	846061.60	817315.70		13.35								
RD_012	RD_012_018	846061.60	817315.70	846063.25	817310.38		11.02								
RD_012	RD_012_019	846063.25	817310.38	846063.05	817301.08		8.33								
RD_012	RD_012_020	846063.05	817301.08	846059.24	817296.32		8.87								
RD_012	RD_012_021	846059.24	817296.32	846056.46	817292.99		12.12								
RD_012	RD_012_022	846056.46	817292.99	846051.21	817291.11		15.05								
RD_012	RD_012_023	846051.21	817291.11	846045.95	817291.77		14.05								

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)

Start Profile	01 - Private Cars	02 - Taxi	03 - Light Goods Vehicles<=2.5t	04 - Light Goods Vehicles 2.5-3.5t	05 - Light Goods Vehicles>3.5t	06 - Medium Goods Vehicles<=15t	07 - Medium Goods Vehicles15-24t	08 - Public Light Buses	09 - Private Light Bus <=3.5t	10 - Private Light Bus >3.5t	11 - Non-franchised Bus<=6.4t	12 - Non-franchised Bus 6.4-15t	13 - Non-franchised Bus 15-24t	14 - Franchised Bus Single Deck	15 - Franchised Bus Double Deck	16 - Motorcycles	17 - Heavy Goods Vehicles>24t	18 - Non-franchised Bus >24t
	PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	HGV9	NFB9
Y	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Emission (Tonne Per Year)

Year 2030 (traffic year 2041)	AnnualHourMin	MonthlyHourMin	MonthlyHourAverage
NO2	1.47	1.38	1.30
NO	11.45	10.44	9.59
NOX	12.91	-	10.89
PM25	0.31	-	-
PM10	0.34	-	-

Road Segments

Road Name	Road ID	X coordinate of endpoint 1	Y coordinate of endpoint 1	X coordinate of endpoint 2	Y coordinate of endpoint 2	Grid (I,J)	Vehicle height (m)	Release height (m)	Szinit (m)	Width (m)	Elevation (m)
WAN PO ROAD L	RD_001_001	846256.09	816775.06	846251.03	816786.06	50,30	1.8	1.5	1.4	15.0	7
WAN PO ROAD L	RD_001_002	846251.03	816786.06	846237.20	816820.49	50,30	1.8	1.5	1.4	14.2	7
WAN PO ROAD L	RD_001_003	846208.48	817387.39	846176.50	817480.43	50,31	1.8	1.5	1.4	17.1	7
WAN PO ROAD L	RD_001_004	846176.50	817480.43	846159.88	817513.75	50,31	1.8	1.5	1.4	13.5	7
WAN PO ROAD L	RD_001_005	846159.88	817513.75	846135.30	817560.20	50,31	1.8	1.5	1.4	15.0	7
WAN PO ROAD L	RD_001_006	846220.28	817010.50	846221.54	817135.41	50,30	1.8	1.5	1.4	26.3	8
WAN PO ROAD L	RD_001_007	846221.54	817135.41	846220.52	817287.67	50,30	1.8	1.5	1.4	14.0	8
WAN PO ROAD L	RD_001_008	846220.52	817287.67	846216.88	817341.15	50,31	1.8	1.5	1.4	15.7	6
WAN PO ROAD L	RD_001_009	846216.88	817341.15	846208.50	817387.10	50,31	1.8	1.5	1.4	19.1	6
WAN PO ROAD L	RD_001_010	846237.20	816820.49	846225.31	816877.40	50,30	1.8	1.5	1.4	14.4	7
WAN PO ROAD L	RD_001_011	846225.31	816877.40	846220.28	817010.50	50,30	1.8	1.5	1.4	26.1	6
WAN PO ROAD L	RD_001_012	846426.03	816285.66	846425.71	816300.05	50,30	1.8	1.5	1.4	11.8	7
WAN PO ROAD L	RD_001_013	846425.71	816300.05	846422.27	816365.72	50,30	1.8	1.5	1.4	12.1	7
WAN PO ROAD L	RD_001_014	846422.27	816365.72	846410.47	816437.91	50,30	1.8	1.5	1.4	12.8	7
WAN PO ROAD L	RD_001_015	846410.47	816437.91	846399.00	816484.63	50,30	1.8	1.5	1.4	13.0	7
WAN PO ROAD L	RD_001_016	846399.00	816484.63	846391.05	816512.53	50,30	1.8	1.5	1.4	13.0	7
WAN PO ROAD L	RD_001_017	846391.05	816512.53	846372.88	816564.34	50,30	1.8	1.5	1.4	12.8	6
WAN PO ROAD L	RD_001_018	846372.88	816564.34	846360.49	816593.90	50,30	1.8	1.5	1.4	13.1	6
WAN PO ROAD L	RD_001_019	846360.49	816593.90	846325.82	816662.86	50,30	1.8	1.5	1.4	13.5	6
WAN PO ROAD L	RD_001_020	846325.82	816662.86	846269.29	816753.74	50,30	1.8	1.5	1.4	13.8	7
WAN PO ROAD L	RD_001_021	846269.29	816753.74	846256.24	816774.91	50,30	1.8	1.5	1.4	15.6	7
WAN PO ROAD R	RD_002_001	846146.00	817566.10	846170.80	817518.63	50,31	1.8	1.5	1.4	13.9	7
WAN PO ROAD R	RD_002_002	846229.14	817340.94	846231.42	817322.34	50,31	1.8	1.5	1.4	13.2	6
WAN PO ROAD R	RD_002_003	846231.42	817322.34	846234.36	817233.09	50,30	1.8	1.5	1.4	14.1	7
WAN PO ROAD R	RD_002_004	846234.36	817233.09	846236.12	817053.37	50,30	1.8	1.5	1.4	17.3	9
WAN PO ROAD R	RD_002_005	846236.12	817053.37	846236.98	817010.84	50,30	1.8	1.5	1.4	17.2	7
WAN PO ROAD R	RD_002_006	846270.25	816780.30	846283.10	816761.50	50,30	1.8	1.5	1.4	25.1	7
WAN PO ROAD R	RD_002_007	846283.10	816761.50	846346.03	816646.16	50,30	1.8	1.5	1.4	14.2	6
WAN PO ROAD R	RD_002_008	846346.03	816646.16	846368.12	816599.77	50,30	1.8	1.5	1.4	13.0	6
WAN PO ROAD R	RD_002_009	846368.12	816599.77	846392.68	816538.00	50,30	1.8	1.5	1.4	13.5	7
WAN PO ROAD R	RD_002_010	846392.68	816538.00	846413.96	816464.60	50,30	1.8	1.5	1.4	13.5	7
WAN PO ROAD R	RD_002_011	846413.96	816464.60	846425.33	816411.12	50,30	1.8	1.5	1.4	12.9	8
WAN PO ROAD R	RD_002_012	846425.33	816411.12	846439.11	816304.27	50,30	1.8	1.5	1.4	13.6	7
WAN PO ROAD R	RD_002_013	846439.11	816304.27	846439.63	816284.34	50,30	1.8	1.5	1.4	14.7	7
WAN PO ROAD R	RD_002_014	846236.60	816954.48	846236.52	816915.50	50,30	1.8	1.5	1.4	13.6	6
WAN PO ROAD R	RD_002_015	846236.52	816915.50	846240.67	816870.21	50,30	1.8	1.5	1.4	13.4	6
WAN PO ROAD R	RD_002_016	846240.67	816870.21	846251.93	816830.14	50,30	1.8	1.5	1.4	16.7	6
WAN PO ROAD R	RD_002_017	846251.93	816830.14	846265.97	816791.83	50,30	1.8	1.5	1.4	21.8	6
WAN PO ROAD R	RD_002_018	846265.97	816791.83	846270.29	816780.18	50,30	1.8	1.5	1.4	29.2	7
WAN PO ROAD R	RD_002_019	846236.98	817010.84	846236.60	816954.48	50,30	1.8	1.5	1.4	14.1	7
WAN PO ROAD R	RD_002_020	846219.60	817392.56	846220.45	817389.75	50,31	1.8	1.5	1.4	14.0	7
WAN PO ROAD R	RD_002_021	846208.35	817428.50	846219.60	817392.56	50,31	1.8	1.5	1.4	16.2	7
WAN PO ROAD R	RD_002_022	846170.66	817518.55	846208.50	817428.46	50,31	1.8	1.5	1.4	16.0	7
WAN PO ROAD R	RD_002_023	846220.13	817390.26	846229.12	817341.15	50,31	1.8	1.5	1.4	12.9	7
CROSS BAY LINK L	RD_003_001	846044.82	817036.32	846207.63	817037.25	50,30	1.8	6.4	0.0	13.8	7
CROSS BAY LINK L	RD_003_002	846207.70	817023.45	846236.58	817024.03	50,30	1.8	1.5	1.4	17.8	7
CROSS BAY LINK L	RD_003_003	846044.82	817036.32	846207.63	817037.25	50,30	1.8	6.4	0.0	13.8	7
CROSS BAY LINK L	RD_003_004	845901.49	817032.26	846044.84	817033.08	50,30	1.8	5.7	0.0	11.3	7
CROSS BAY LINK R	RD_004_001	846220.28	817010.50	846205.03	817009.39	50,30	1.7	1.4	1.3	27.7	7
CROSS BAY LINK R	RD_004_002	846205.03	817009.39	846163.09	817012.68	50,30	1.7	1.4	1.3	13.3	7
CROSS BAY LINK R	RD_004_003	846163.09	817012.68	845992.44	817012.46	50,30	1.7	1.4	1.3	13.3	6
CROSS BAY LINK R	RD_004_004	845992.44	817012.46	845900.52	817011.85	50,30	1.7	1.4	1.3	13.3	7
CROSS BAY LINK R	RD_004_005	846220.28	817010.50	846236.98	817010.84	50,30	1.7	1.4	1.3	26.6	7
INDUSTRIAL ROAD L	RD_005_001	846298.11	816506.73	846325.57	816570.51	50,30	4.4	3.7	3.5	23.8	6
INDUSTRIAL ROAD L	RD_005_002	846325.57	816570.51	846331.14	816571.84	50,30	4.4	3.7	3.5	28.8	6
INDUSTRIAL ROAD L	RD_005_003	846331.14	816571.84	846333.41	816570.74	50,30	4.4	3.7	3.5	30.3	6
INDUSTRIAL ROAD L	RD_005_004	846333.41	816570.74	846357.97	816512.06	50,30	4.4	3.7	3.5	24.4	6
INDUSTRIAL ROAD L	RD_005_005	846357.97	816512.06	846363.24	816495.35	50,30	4.4	3.7	3.5	17.4	6
INDUSTRIAL ROAD L	RD_005_006	846344.10	816486.73	846357.05	816494.01	50,30	4.4	3.7	3.5	17.9	6
INDUSTRIAL ROAD L	RD_005_007	846357.05	816494.01	846363.24	816495.35	50,30	4.4	3.7	3.5	17.4	6
INDUSTRIAL ROAD L	RD_005_008	846058.85	816765.57	846058.64	816773.10	50,30	4.4	3.7	3.5	13.9	5
INDUSTRIAL ROAD L	RD_005_009	846058.64	816773.10	846068.22	816790.49	50,30	4.4	3.7	3.5	12.8	5
INDUSTRIAL ROAD L	RD_005_010	846068.22	816790.49	846075.43	816792.71	50,30	4.4	3.7	3.5	15.5	6
INDUSTRIAL ROAD L	RD_005_011	846075.43	816792.71	846081.30	816790.94	50,30	4.4	3.7	3.5	17.1	6
INDUSTRIAL ROAD L	RD_005_012	846081.30	816790.94	846085.43	816782.64	50,30	4.4	3.7	3.5	17.5	6
INDUSTRIAL ROAD L	RD_005_013	846085.43	816782.64	846084.30	816778.09	50,30	4.4	3.7	3.5	17.3	6
INDUSTRIAL ROAD L	RD_005_014	846084.30	816778.09	846080.18	816774.88	50,30	4.4	3.7	3.5	17.3	6
INDUSTRIAL ROAD L	RD_005_015	846080.18	816774.88	846068.85	816772.44	50,30	4.4	3.7	3.5	17.1	5
INDUSTRIAL ROAD L	RD_005_016	846068.85	816772.44	846059.35	816765.84	50,30	4.4	3.7	3.5	16.3	5
INDUSTRIAL ROAD L	RD_005_017	846363.24	816495.35	846369.42	816493.25	50,30	4.4	3.7	3.5	16.8	6
INDUSTRIAL ROAD L	RD_005_018	846369.42	816493.25	846372.93	816486.49	50,30	4.4	3.7	3.5	15.4	6

Road Name	Road ID	X coordinate of endpoint 1	Y coordinate of endpoint 1	X coordinate of endpoint 2	Y coordinate of endpoint 2	Grid (I,J)	Vehicle height (m)	Release height (m)	Szinit (m)	Width (m)	Elevation (m)
INDUSTRIAL ROAD L	RD_005_019	846372.93	816486.49	846372.31	816482.95	50,30	4.4	3.7	3.5	16.0	6
INDUSTRIAL ROAD L	RD_005_020	846372.31	816482.95	846367.78	816476.97	50,30	4.4	3.7	3.5	16.5	6
INDUSTRIAL ROAD L	RD_005_021	846367.78	816476.97	846359.02	816476.08	50,30	4.4	3.7	3.5	16.5	6
INDUSTRIAL ROAD L	RD_005_022	846359.02	816476.08	846349.85	816478.40	50,30	4.4	3.7	3.5	14.9	6
INDUSTRIAL ROAD L	RD_005_023	846349.85	816478.40	846346.76	816480.50	50,30	4.4	3.7	3.5	14.2	6
INDUSTRIAL ROAD L	RD_005_024	846346.76	816480.50	846343.97	816486.36	50,30	4.4	3.7	3.5	17.5	6
INDUSTRIAL ROAD L	RD_005_025	846513.24	816710.49	846525.62	816689.57	50,30	4.4	3.7	3.5	16.6	7
INDUSTRIAL ROAD L	RD_005_026	846525.62	816689.57	846525.11	816683.48	50,30	4.4	3.7	3.5	16.1	7
INDUSTRIAL ROAD L	RD_005_027	846525.11	816683.48	846520.99	816678.38	50,30	4.4	3.7	3.5	14.1	7
INDUSTRIAL ROAD L	RD_005_028	846520.99	816678.38	846513.88	816678.71	50,30	4.4	3.7	3.5	14.2	7
INDUSTRIAL ROAD L	RD_005_029	846513.88	816678.71	846509.86	816683.69	50,30	4.4	3.7	3.5	15.5	7
INDUSTRIAL ROAD L	RD_005_030	846509.86	816683.69	846514.49	816697.43	50,30	4.4	3.7	3.5	17.5	7
INDUSTRIAL ROAD L	RD_005_031	846514.49	816697.43	846513.24	816710.49	50,30	4.4	3.7	3.5	16.9	7
INDUSTRIAL ROAD C	RD_007_001	846426.39	816842.54	846513.24	816710.49	50,30	4.4	3.7	3.4	15.8	6
INDUSTRIAL ROAD C	RD_007_002	846236.60	816954.48	846292.35	816954.63	50,30	4.4	3.7	3.4	13.2	6
INDUSTRIAL ROAD C	RD_007_003	846292.35	816954.63	846299.46	816956.18	50,30	4.4	3.7	3.4	14.3	6
INDUSTRIAL ROAD C	RD_007_004	846299.46	816956.18	846305.23	816960.73	50,30	4.4	3.7	3.4	19.5	6
INDUSTRIAL ROAD C	RD_007_005	846305.23	816960.73	846309.24	816967.59	50,30	4.4	3.7	3.4	19.1	6
INDUSTRIAL ROAD C	RD_007_006	846309.24	816967.59	846308.47	817041.12	50,30	4.4	3.7	3.4	15.3	7
INDUSTRIAL ROAD C	RD_007_007	846308.47	817041.12	846305.48	817045.33	50,30	4.4	3.7	3.4	18.4	6
INDUSTRIAL ROAD C	RD_007_008	846305.48	817045.33	846301.87	817045.88	50,30	4.4	3.7	3.4	25.0	6
INDUSTRIAL ROAD C	RD_007_009	846426.39	816842.54	846266.19	816774.89	50,30	4.4	3.7	3.4	26.5	6
INDUSTRIAL ROAD C	RD_007_010	846073.39	816600.36	846259.45	816519.31	50,30	4.4	3.7	3.4	28.9	5
INDUSTRIAL ROAD C	RD_007_011	846296.76	816504.61	846259.45	816519.31	50,30	4.4	3.7	3.4	20.5	6
INDUSTRIAL ROAD C	RD_007_012	846058.85	816765.57	846016.25	816666.10	50,30	4.4	3.7	3.4	16.2	5
INDUSTRIAL ROAD C	RD_007_013	846016.25	816666.10	846012.76	816656.35	50,30	4.4	3.7	3.4	16.2	5
INDUSTRIAL ROAD C	RD_007_014	846012.76	816656.35	846011.11	816645.28	50,30	4.4	3.7	3.4	16.7	5
INDUSTRIAL ROAD C	RD_007_015	846011.11	816645.28	846012.46	816636.42	50,30	4.4	3.7	3.4	16.7	6
INDUSTRIAL ROAD C	RD_007_016	846012.46	816636.42	846021.95	816623.69	50,30	4.4	3.7	3.4	18.1	5
INDUSTRIAL ROAD C	RD_007_017	846021.95	816623.69	846028.03	816619.71	50,30	4.4	3.7	3.4	18.9	5
INDUSTRIAL ROAD C	RD_007_018	846028.03	816619.71	846073.39	816600.36	50,30	4.4	3.7	3.4	27.7	5
INDUSTRIAL ROAD C	RD_007_019	846343.97	816486.36	846296.76	816504.61	50,30	4.4	3.7	3.4	20.2	6
INDUSTRIAL ROAD C	RD_007_020	846195.61	816368.96	846259.09	816519.27	50,30	4.4	3.7	3.4	19.8	5
CHUN YAT STREET L	RD_008_001	846210.76	816755.03	846225.80	816766.67	50,30	2.4	2.1	1.9	11.7	7
CHUN YAT STREET L	RD_008_002	846225.80	816766.67	846232.59	816774.87	50,30	2.4	2.1	1.9	11.4	7
CHUN YAT STREET L	RD_008_003	846232.59	816774.87	846237.63	816790.37	50,30	2.4	2.1	1.9	11.5	7
CHUN YAT STREET L	RD_008_004	846237.63	816790.37	846237.20	816820.49	50,30	2.4	2.1	1.9	13.3	7
CHUN YAT STREET L	RD_008_005	846210.76	816755.03	846247.33	816770.11	50,30	2.4	2.1	1.9	11.8	7
CHUN YAT STREET L	RD_008_006	846247.33	816770.11	846266.22	816779.06	50,30	2.4	2.1	1.9	24.1	7
CHUN YAT STREET L	RD_008_007	846041.05	816531.17	846076.26	816617.97	50,30	2.4	2.1	1.9	12.7	5
CHUN YAT STREET L	RD_008_008	846076.26	816617.97	846097.56	816661.83	50,30	2.4	2.1	1.9	13.5	5
CHUN YAT STREET L	RD_008_009	846097.56	816661.83	846124.85	816698.95	50,30	2.4	2.1	1.9	13.3	5
CHUN YAT STREET L	RD_008_010	846124.85	816698.95	846149.36	816721.11	50,30	2.4	2.1	1.9	13.0	5
CHUN YAT STREET L	RD_008_011	846149.36	816721.11	846166.25	816732.97	50,30	2.4	2.1	1.9	13.0	6
CHUN YAT STREET L	RD_008_012	846166.25	816732.97	846186.34	816744.61	50,30	2.4	2.1	1.9	12.9	6
CHUN YAT STREET L	RD_008_013	846186.34	816744.61	846210.76	816755.03	50,30	2.4	2.1	1.9	12.7	6
CHUN YAT STREET R	RD_009_001	846269.72	816770.53	846251.25	816762.03	50,30	2.9	2.5	2.3	26.7	7
CHUN YAT STREET R	RD_009_002	846251.25	816762.03	846194.59	816738.63	50,30	2.9	2.5	2.3	13.2	7
CHUN YAT STREET R	RD_009_003	846194.59	816738.63	846178.31	816730.10	50,30	2.9	2.5	2.3	12.4	6
CHUN YAT STREET R	RD_009_004	846178.31	816730.10	846137.83	816699.84	50,30	2.9	2.5	2.3	12.3	5
CHUN YAT STREET R	RD_009_005	846137.83	816699.84	846126.81	816687.98	50,30	2.9	2.5	2.3	12.5	5
CHUN YAT STREET R	RD_009_006	846126.81	816687.98	846110.75	816665.49	50,30	2.9	2.5	2.3	13.0	5
CHUN YAT STREET R	RD_009_007	846110.75	816665.49	846100.46	816647.55	50,30	2.9	2.5	2.3	13.0	5
CHUN YAT STREET R	RD_009_008	846100.46	816647.55	846085.54	816613.88	50,30	2.9	2.5	2.3	13.1	5
CHUN YAT STREET R	RD_009_009	846085.54	816613.88	846047.39	816528.28	50,30	2.9	2.5	2.3	13.7	5
RESIDENTIAL ROAD L	RD_010_001	846101.34	817375.08	846123.59	817389.26	50,31	1.7	1.5	1.3	13.1	7
RESIDENTIAL ROAD L	RD_010_002	846123.59	817389.26	846147.49	817398.91	50,31	1.7	1.5	1.3	12.4	7
RESIDENTIAL ROAD L	RD_010_003	846147.49	817398.91	846207.10	817411.48	50,31	1.7	1.5	1.3	23.7	6
RESIDENTIAL ROAD L	RD_010_004	846051.60	817321.78	846092.27	817368.31	50,31	1.7	1.5	1.3	16.1	7
RESIDENTIAL ROAD L	RD_010_005	846092.27	817368.31	846101.34	817375.08	50,31	1.7	1.5	1.3	13.2	7
RESIDENTIAL ROAD L	RD_010_006	846207.26	817411.53	846254.53	817429.32	50,31	1.7	1.5	1.3	23.4	7
RESIDENTIAL ROAD L	RD_010_007	846254.53	817429.32	846266.17	817438.52	50,31	1.7	1.5	1.3	12.2	7
RESIDENTIAL ROAD L	RD_010_008	846266.17	817438.52	846276.98	817452.04	50,31	1.7	1.5	1.3	12.5	7
RESIDENTIAL ROAD L	RD_010_009	846276.98	817452.04	846285.21	817472.64	50,31	1.7	1.5	1.3	12.7	7
RESIDENTIAL ROAD L	RD_010_010	846285.21	817472.64	846287.58	817486.15	50,31	1.7	1.5	1.3	12.9	7
RESIDENTIAL ROAD L	RD_010_011	846287.58	817486.15	846283.64	817510.95	50,31	1.7	1.5	1.3	12.4	6
RESIDENTIAL ROAD L	RD_010_012	846283.64	817510.95	846280.86	817518.70	50,31	1.7	1.5	1.3	12.0	7
RESIDENTIAL ROAD L	RD_010_013	846280.86	817518.70	846262.49	817551.58	50,31	1.7	1.5	1.3	12.1	6
RESIDENTIAL ROAD L	RD_010_014	846262.49	817551.58	846232.90	817605.59	50,31	1.7	1.5	1.3	12.2	6
RESIDENTIAL ROAD L	RD_010_015	845898.06	817146.95	845940.52	817146.20	50,30	1.7	1.5	1.3	10.8	5
RESIDENTIAL ROAD L	RD_010_016	845940.52	817146.20	845971.33	817152.64	50,30	1.7	1.5	1.3	10.6	6
RESIDENTIAL ROAD L	RD_010_017	845971.33	817152.64	845988.64	817159.96	50,30	1.7	1.5	1.3	9.5	6

Road Name	Road ID	X coordinate of endpoint 1	Y coordinate of endpoint 1	X coordinate of endpoint 2	Y coordinate of endpoint 2	Grid (I,J)	Vehicle height (m)	Release height (m)	Szinit (m)	Width (m)	Elevation (m)
RESIDENTIAL ROAD L	RD_010_018	845988.64	817159.96	846002.23	817167.94	50,30	1.7	1.5	1.3	9.5	7
RESIDENTIAL ROAD L	RD_010_019	846002.23	817167.94	846016.86	817178.91	50,30	1.7	1.5	1.3	9.5	7
RESIDENTIAL ROAD L	RD_010_020	846016.86	817178.91	846031.48	817194.42	50,30	1.7	1.5	1.3	9.5	7
RESIDENTIAL ROAD L	RD_010_021	846031.48	817194.42	846043.32	817212.48	50,30	1.7	1.5	1.3	9.9	8
RESIDENTIAL ROAD L	RD_010_022	846043.32	817212.48	846051.04	817229.54	50,30	1.7	1.5	1.3	10.5	7
RESIDENTIAL ROAD L	RD_010_023	846051.04	817229.54	846055.97	817247.59	50,30	1.7	1.5	1.3	10.9	7
RESIDENTIAL ROAD L	RD_010_024	846055.97	817247.59	846057.92	817262.98	50,30	1.7	1.5	1.3	11.2	7
RESIDENTIAL ROAD L	RD_010_025	846057.92	817262.98	846054.10	817278.26	50,30	1.7	1.5	1.3	10.9	8
RESIDENTIAL ROAD L	RD_010_026	846054.10	817278.26	846045.95	817291.77	50,31	1.7	1.5	1.3	14.1	7
RESIDENTIAL ROAD R	RD_011_001	846209.77	817401.07	846164.60	817392.17	50,31	1.9	1.6	1.5	23.1	6
RESIDENTIAL ROAD R	RD_011_002	846164.60	817392.17	846146.36	817386.84	50,31	1.9	1.6	1.5	12.3	6
RESIDENTIAL ROAD R	RD_011_003	846146.36	817386.84	846137.91	817383.85	50,31	1.9	1.6	1.5	12.7	7
RESIDENTIAL ROAD R	RD_011_004	846137.91	817383.85	846116.80	817371.65	50,31	1.9	1.6	1.5	14.1	7
RESIDENTIAL ROAD R	RD_011_005	846116.80	817371.65	846102.68	817364.11	50,31	1.9	1.6	1.5	13.0	7
RESIDENTIAL ROAD R	RD_011_006	846102.68	817364.11	846088.68	817349.49	50,31	1.9	1.6	1.5	12.0	7
RESIDENTIAL ROAD R	RD_011_007	846088.68	817349.49	846061.60	817315.70	50,31	1.9	1.6	1.5	16.0	7
RESIDENTIAL ROAD R	RD_011_008	846237.11	817607.37	846245.05	817591.98	50,31	1.9	1.6	1.5	21.0	6
RESIDENTIAL ROAD R	RD_011_009	846264.76	817559.77	846269.09	817555.13	50,31	1.9	1.6	1.5	15.5	6
RESIDENTIAL ROAD R	RD_011_010	846269.09	817555.13	846289.52	817513.28	50,31	1.9	1.6	1.5	13.2	7
RESIDENTIAL ROAD R	RD_011_011	846289.52	817513.28	846294.99	817487.26	50,31	1.9	1.6	1.5	15.0	7
RESIDENTIAL ROAD R	RD_011_012	846294.99	817487.26	846292.84	817472.53	50,31	1.9	1.6	1.5	14.0	7
RESIDENTIAL ROAD R	RD_011_013	846292.84	817472.53	846282.65	817448.05	50,31	1.9	1.6	1.5	12.3	7
RESIDENTIAL ROAD R	RD_011_014	846282.65	817448.05	846274.31	817436.86	50,31	1.9	1.6	1.5	13.0	7
RESIDENTIAL ROAD R	RD_011_015	846274.31	817436.86	846263.60	817426.45	50,31	1.9	1.6	1.5	17.3	7
RESIDENTIAL ROAD R	RD_011_016	846263.60	817426.45	846252.89	817418.69	50,31	1.9	1.6	1.5	17.3	7
RESIDENTIAL ROAD R	RD_011_017	846252.89	817418.69	846210.05	817401.13	50,31	1.9	1.6	1.5	23.5	7
RESIDENTIAL ROAD R	RD_011_018	846245.05	817591.98	846259.50	817565.31	50,31	1.9	1.6	1.5	20.3	6
RESIDENTIAL ROAD R	RD_011_019	846259.50	817565.31	846264.76	817559.77	50,31	1.9	1.6	1.5	19.2	6
RESIDENTIAL ROAD R	RD_011_020	846059.24	817296.32	846061.73	817276.16	50,31	1.9	1.6	1.5	13.1	7
RESIDENTIAL ROAD R	RD_011_021	846061.73	817276.16	846061.33	817259.22	50,30	1.9	1.6	1.5	9.6	7
RESIDENTIAL ROAD R	RD_011_022	846061.33	817259.22	846056.70	817235.41	50,30	1.9	1.6	1.5	9.5	7
RESIDENTIAL ROAD R	RD_011_023	846056.70	817235.41	846049.61	817214.59	50,30	1.9	1.6	1.5	11.1	7
RESIDENTIAL ROAD R	RD_011_024	846049.61	817214.59	846041.78	817200.08	50,30	1.9	1.6	1.5	12.9	7
RESIDENTIAL ROAD R	RD_011_025	846041.78	817200.08	846031.59	817187.11	50,30	1.9	1.6	1.5	11.3	7
RESIDENTIAL ROAD R	RD_011_026	846031.59	817187.11	846002.34	817163.62	50,30	1.9	1.6	1.5	10.4	7
RESIDENTIAL ROAD R	RD_011_027	846002.34	817163.62	845974.63	817149.65	50,30	1.9	1.6	1.5	13.3	6
RESIDENTIAL ROAD R	RD_011_028	845974.63	817149.65	845948.46	817143.54	50,30	1.9	1.6	1.5	16.2	6
RESIDENTIAL ROAD R	RD_011_029	845948.46	817143.54	845923.62	817142.53	50,30	1.9	1.6	1.5	12.5	6
RESIDENTIAL ROAD R	RD_011_030	845923.62	817142.53	845897.96	817143.29	50,30	1.9	1.6	1.5	9.5	5
RESIDENTIAL ROAD R	RD_011_031	846245.05	817591.98	846255.56	817597.09	50,31	1.9	1.6	1.5	17.1	6
RESIDENTIAL ROAD R	RD_011_032	846255.56	817597.09	846262.98	817595.87	50,31	1.9	1.6	1.5	13.1	6
RESIDENTIAL ROAD R	RD_011_033	846262.98	817595.87	846268.86	817583.81	50,31	1.9	1.6	1.5	13.0	6
RESIDENTIAL ROAD R	RD_011_034	846268.86	817583.81	846268.97	817579.93	50,31	1.9	1.6	1.5	13.1	6
RESIDENTIAL ROAD R	RD_011_035	846268.97	817579.93	846267.63	817572.07	50,31	1.9	1.6	1.5	12.4	6
RESIDENTIAL ROAD R	RD_011_036	846267.63	817572.07	846259.50	817565.31	50,31	1.9	1.6	1.5	16.1	6
RESIDENTIAL ROAD C	RD_012_001	846101.34	817375.08	846087.93	817397.77	50,31	1.8	1.5	1.4	14.7	7
RESIDENTIAL ROAD C	RD_012_002	846087.93	817397.77	846077.21	817401.75	50,31	1.8	1.5	1.4	12.5	7
RESIDENTIAL ROAD C	RD_012_003	846077.21	817401.75	846071.74	817408.39	50,31	1.8	1.5	1.4	11.1	7
RESIDENTIAL ROAD C	RD_012_004	846071.74	817408.39	846070.50	817418.46	50,31	1.8	1.5	1.4	12.3	7
RESIDENTIAL ROAD C	RD_012_005	846070.50	817418.46	846071.94	817424.67	50,31	1.8	1.5	1.4	11.8	7
RESIDENTIAL ROAD C	RD_012_006	846071.94	817424.67	846075.54	817428.21	50,31	1.8	1.5	1.4	14.4	7
RESIDENTIAL ROAD C	RD_012_007	846075.54	817428.21	846082.14	817428.99	50,31	1.8	1.5	1.4	16.2	7
RESIDENTIAL ROAD C	RD_012_008	846082.14	817428.99	846083.49	817412.16	50,31	1.8	1.5	1.4	13.8	7
RESIDENTIAL ROAD C	RD_012_009	846083.49	817412.16	846087.93	817397.77	50,31	1.8	1.5	1.4	13.8	7
RESIDENTIAL ROAD C	RD_012_010	846045.95	817291.77	846042.14	817292.21	50,31	1.8	1.5	1.4	16.3	7
RESIDENTIAL ROAD C	RD_012_011	846042.14	817292.21	846034.72	817297.19	50,31	1.8	1.5	1.4	14.1	7
RESIDENTIAL ROAD C	RD_012_012	846034.72	817297.19	846032.13	817307.37	50,31	1.8	1.5	1.4	16.5	7
RESIDENTIAL ROAD C	RD_012_013	846039.13	817318.78	846043.77	817321.11	50,31	1.8	1.5	1.4	17.7	7
RESIDENTIAL ROAD C	RD_012_014	846043.77	817321.11	846051.60	817321.78	50,31	1.8	1.5	1.4	18.1	7
RESIDENTIAL ROAD C	RD_012_015	846032.13	817307.37	846035.53	817316.90	50,31	1.8	1.5	1.4	18.3	8
RESIDENTIAL ROAD C	RD_012_016	846035.53	817316.90	846039.13	817318.78	50,31	1.8	1.5	1.4	18.1	8
RESIDENTIAL ROAD C	RD_012_017	846051.60	817321.78	846061.60	817315.70	50,31	1.8	1.5	1.4	19.3	7
RESIDENTIAL ROAD C	RD_012_018	846061.60	817315.70	846063.25	817310.38	50,31	1.8	1.5	1.4	17.0	7
RESIDENTIAL ROAD C	RD_012_019	846063.25	817310.38	846063.05	817301.08	50,31	1.8	1.5	1.4	14.3	7
RESIDENTIAL ROAD C	RD_012_020	846063.05	817301.08	846059.24	817296.32	50,31	1.8	1.5	1.4	14.9	7
RESIDENTIAL ROAD C	RD_012_021	846059.24	817296.32	846056.46	817292.99	50,31	1.8	1.5	1.4	18.1	7
RESIDENTIAL ROAD C	RD_012_022	846056.46	817292.99	846051.21	817291.11	50,31	1.8	1.5	1.4	21.0	7
RESIDENTIAL ROAD C	RD_012_023	846051.21	817291.11	846045.95	817291.77	50,31	1.8	1.5	1.4	20.1	7

Met Summary

Grid (I,J)	Hour	Annual Minimum		Month Minimum																							
		Temperature	RH	January		February		March		April		May		June		July		August		September		October		November		December	
				Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH
50,30	0000-0100	13	30	13	41	16	65	17	75	21	78	21	70	26	72	26	76	27	72	25	36	22	40	17	46	13	30
50,30	0100-0200	12	30	13	42	16	63	17	76	21	76	21	74	26	78	27	74	27	75	24	39	22	52	17	47	12	30
50,30	0200-0300	12	30	12	42	16	62	17	75	21	72	21	74	26	82	27	73	25	77	24	39	22	56	16	45	12	30
50,30	0300-0400	11	29	12	41	16	60	17	69	21	73	20	73	25	82	27	71	26	78	23	41	21	56	16	46	11	29
50,30	0400-0500	11	29	12	40	16	59	17	67	21	75	21	72	25	82	27	72	26	76	23	43	21	57	15	46	11	29
50,30	0500-0600	10	29	11	43	16	61	17	67	20	77	21	71	24	77	27	73	26	75	23	43	21	57	15	48	10	29
50,30	0600-0700	10	28	11	45	15	66	17	59	20	76	21	68	24	66	27	77	26	76	23	44	20	51	15	47	10	28
50,30	0700-0800	11	30	12	48	16	67	17	49	20	74	21	60	24	67	27	70	26	68	23	40	21	47	16	44	11	30
50,30	0800-0900	12	30	13	49	15	66	18	48	20	69	22	60	25	61	27	66	27	63	24	36	22	44	17	44	12	30
50,30	0900-1000	13	29	14	46	16	63	18	47	20	67	22	54	25	59	27	62	28	54	25	32	23	42	18	43	13	29
50,30	1000-1100	14	27	14	41	17	61	19	46	20	61	22	58	25	61	27	58	27	51	26	30	24	41	19	41	14	27
50,30	1100-1200	15	25	15	37	19	59	19	50	20	59	22	59	26	56	25	52	28	48	27	30	24	41	20	38	15	25
50,30	1200-1300	15	23	16	35	19	57	19	51	21	59	23	58	27	50	27	57	27	47	27	27	24	43	20	38	15	23
50,30	1300-1400	16	22	16	33	19	54	18	55	21	61	22	58	28	47	28	56	26	49	27	28	24	42	20	37	16	22
50,30	1400-1500	16	22	16	34	20	55	18	54	21	60	22	60	27	51	26	58	27	45	28	27	25	42	20	36	16	22
50,30	1500-1600	16	23	16	41	19	54	18	57	21	62	22	59	28	55	26	60	26	54	27	26	25	45	20	38	16	23
50,30	1600-1700	16	24	16	43	19	58	18	60	21	65	22	63	26	55	26	64	27	59	27	27	25	47	20	38	16	24
50,30	1700-1800	16	25	16	48	20	66	18	62	21	69	22	65	27	53	28	65	27	62	27	26	24	47	19	44	16	25
50,30	1800-1900	16	23	16	50	20	70	18	68	21	73	22	67	27	63	27	66	27	66	27	26	24	52	19	36	17	23
50,30	1900-2000	14	23	16	53	17	73	18	73	21	72	22	75	27	68	27	68	28	66	27	29	24	55	19	37	14	23
50,30	2000-2100	14	26	16	54	17	77	18	75	20	75	22	77	26	73	27	71	27	68	26	28	24	59	19	39	14	26
50,30	2100-2200	13	26	15	51	17	77	18	75	21	76	22	75	26	75	27	71	27	70	26	31	24	59	19	40	13	26
50,30	2200-2300	14	28	16	44	16	78	18	73	21	79	22	73	26	76	26	71	25	64	26	31	23	39	18	41	14	28
50,30	2300-0000	13	28	15	41	15	78	18	70	21	80	22	71	26	77	26	74	26	73	25	33	23	39	17	44	13	28
50,31	0000-0100	12	30	13	41	16	65	17	75	20	78	21	71	26	72	26	77	27	74	24	36	22	40	17	46	12	30
50,31	0100-0200	12	30	12	42	16	63	17	77	21	77	21	74	26	78	26	74	26	75	24	39	21	53	17	47	12	30
50,31	0200-0300	11	30	12	42	16	62	17	76	20	72	21	76	26	83	27	74	25	76	24	40	21	57	16	45	11	30
50,31	0300-0400	11	29	12	41	15	61	16	70	20	73	20	75	25	83	27	72	26	78	23	41	21	57	15	46	11	29
50,31	0400-0500	11	29	11	40	15	59	16	67	20	75	20	73	24	83	27	73	26	77	23	43	21	57	15	47	11	29
50,31	0500-0600	10	28	11	42	15	61	16	67	20	78	21	73	24	78	27	74	26	77	23	43	20	57	15	48	10	28
50,31	0600-0700	10	28	11	45	15	66	16	60	20	77	20	70	24	67	27	78	26	78	23	44	20	52	15	47	10	28
50,31	0700-0800	10	29	11	48	15	67	17	50	20	73	21	59	24	67	27	71	26	70	23	40	20	48	15	44	10	29
50,31	0800-0900	12	31	13	49	15	67	18	48	20	68	22	60	25	62	27	67	26	62	24	36	22	45	17	43	12	31
50,31	0900-1000	13	29	13	46	16	63	18	47	20	66	22	55	25	59	27	61	28	54	25	33	23	43	18	42	13	29
50,31	1000-1100	14	27	14	41	17	61	19	46	20	61	22	58	25	60	27	57	28	50	26	30	24	41	18	41	14	27
50,31	1100-1200	15	24	15	37	18	60	19	50	20	58	22	59	26	55	25	51	28	48	26	30	24	41	19	38	15	24
50,31	1200-1300	15	22	16	36	19	57	18	51	20	58	22	58	27	49	26	55	26	46	27	28	24	42	20	38	15	22
50,31	1300-1400	15	22	16	33	19	54	18	54	20	60	22	57	28	46	27	55	26	46	27	28	24	41	20	37	15	22
50,31	1400-1500	15	22	16	34	19	55	18	54	21	59	22	59	27	49	26	58	26	43	28	27	25	42	20	37	15	22
50,31	1500-1600	16	23	16	41	19	54	18	56	21	61	22	59	28	54	26	59	26	52	27	27	25	43	20	38	16	23
50,31	1600-1700	16	24	16	43	19	57	18	60	20	64	22	63	26	53	26	62	26	58	27	28	24	47	19	38	16	24
50,31	1700-1800	16	25	16	48	19	67	18	62	20	67	22	65	27	53	28	66	27	63	27	25	24	46	19	44	16	26
50,31	1800-1900	15	23	15	51	19	70	18	69	20	72	22	68	27	63	27	66	26	67	26	26	24	50	19	36	16	23
50,31	1900-2000	14	23	15	54	17	74	18	74	20	72	21	76	26	67	27	69	27	66	26	29	24	55	19	37	14	23
50,31	2000-2100	13	26	15	54	17	78	18	76	20	74	21	79	26	73	27	71	26	68	26	28	24	60	19	39	13	26
50,31	2100-2200	13	26	15	51	17	79	18	75	20	76	22	76	25	75	26	72	27	70	26	32	24	60	18	41	13	26
50,31	2200-2300	13	27	15	45	16	79	17	74	20	80	21	73	26	76	26	71	25	65	25	31	23	40	17	41	13	27
50,31	2300-0000	13	28	15	41	15	79	17	71	20	80	21	72	26	77	26	75	26	73	25	34	22	39	17	44	13	28

Met Summary

Grid (I,J)	Hour	Month Average																							
		January		February		March		April		May		June		July		August		September		October		November		December	
		Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH
50,30	0000-0100	18	80	21	89	21	88	24	90	25	90	28	88	29	83	28	85	27	76	26	70	21	71	17	73
50,30	0100-0200	18	80	21	89	21	88	24	90	25	91	28	89	29	83	28	86	27	77	25	71	21	70	17	73
50,30	0200-0300	18	80	21	89	21	89	24	90	25	91	28	90	29	84	28	87	27	77	25	72	20	70	17	72
50,30	0300-0400	18	79	20	89	21	88	24	90	25	91	28	90	29	84	28	88	27	77	25	73	20	69	17	71
50,30	0400-0500	18	79	20	90	21	88	24	91	25	91	28	90	28	84	28	88	26	77	25	74	20	70	17	70
50,30	0500-0600	17	79	20	90	21	88	24	92	25	91	28	90	28	85	28	88	26	77	24	75	20	70	16	70
50,30	0600-0700	17	80	20	91	21	87	24	90	25	88	28	87	29	83	28	85	26	76	24	74	19	69	16	69
50,30	0700-0800	17	78	20	88	21	83	25	85	26	84	28	84	29	79	29	81	27	72	25	71	20	66	17	67
50,30	0800-0900	18	75	21	83	22	79	26	81	26	81	29	80	30	76	29	77	28	68	26	67	21	63	18	64
50,30	0900-1000	19	73	22	79	23	76	26	78	27	78	30	76	30	74	30	72	28	64	26	64	22	60	18	61
50,30	1000-1100	19	70	22	77	23	73	27	75	27	77	30	75	31	70	31	69	29	62	27	62	23	57	19	59
50,30	1100-1200	20	68	23	75	23	72	27	73	27	75	30	73	31	69	31	68	30	60	27	60	23	55	20	58
50,30	1200-1300	20	67	23	73	23	72	27	72	28	75	30	72	31	68	31	68	30	59	27	59	24	54	20	57
50,30	1300-1400	20	67	23	73	24	72	27	72	27	75	31	72	31	69	31	69	30	59	27	59	24	55	20	56
50,30	1400-1500	21	67	23	73	24	72	27	73	28	74	31	73	31	69	31	69	30	60	28	59	24	56	21	56
50,30	1500-1600	21	68	23	74	24	73	27	74	28	75	30	74	31	70	31	71	30	61	27	60	24	58	21	57
50,30	1600-1700	20	70	23	76	23	75	26	76	27	78	30	74	31	73	30	73	30	63	27	62	23	62	20	60
50,30	1700-1800	20	73	22	80	23	78	26	80	27	81	30	76	30	75	30	76	29	64	27	65	23	65	20	64
50,30	1800-1900	20	75	22	82	23	81	25	83	27	84	29	79	30	77	30	79	29	66	27	66	23	66	20	66
50,30	1900-2000	20	76	22	84	22	82	25	84	26	85	29	80	30	78	29	79	29	67	27	69	23	67	19	67
50,30	2000-2100	19	79	21	87	22	84	25	87	26	88	29	84	29	81	29	82	28	69	26	70	22	68	19	70
50,30	2100-2200	19	79	21	88	22	86	25	88	26	89	28	85	29	82	29	83	28	71	26	71	22	69	18	72
50,30	2200-2300	19	78	21	89	22	87	25	89	26	90	28	86	29	83	29	84	28	72	26	71	22	70	18	72
50,30	2300-0000	19	79	21	90	22	87	24	90	25	90	28	86	29	83	29	85	28	73	26	72	21	72	18	73
50,31	0000-0100	18	81	20	90	21	89	24	91	25	91	28	88	29	84	28	86	27	77	25	71	21	72	17	74
50,31	0100-0200	18	80	20	89	21	89	24	91	25	91	28	89	29	84	28	87	27	78	25	72	21	71	17	74
50,31	0200-0300	18	80	20	90	21	89	24	91	25	92	28	90	28	84	28	88	26	78	25	73	20	71	17	73
50,31	0300-0400	17	80	20	90	21	89	24	91	25	92	28	91	28	85	28	88	26	78	24	74	20	70	16	72
50,31	0400-0500	17	80	20	90	21	89	24	91	25	91	27	91	28	85	28	89	26	78	24	75	20	70	16	71
50,31	0500-0600	17	80	20	91	21	88	24	92	25	91	27	90	28	86	28	88	26	78	24	76	19	71	16	70
50,31	0600-0700	17	80	20	91	21	88	24	90	25	89	28	87	28	84	28	86	26	77	24	75	19	70	16	69
50,31	0700-0800	17	78	20	88	21	83	25	86	26	85	28	84	29	79	29	81	27	73	25	71	20	66	16	67
50,31	0800-0900	18	75	21	84	22	79	25	81	26	81	29	80	30	76	29	77	28	68	25	68	21	63	17	64
50,31	0900-1000	19	73	22	79	22	76	26	78	27	78	29	76	30	73	30	73	28	65	26	65	22	60	18	61
50,31	1000-1100	19	70	22	77	23	73	27	74	27	76	30	74	31	70	31	69	29	61	27	61	22	57	19	59
50,31	1100-1200	20	68	23	74	23	72	27	73	27	75	30	73	31	69	31	67	30	59	27	60	23	54	20	58
50,31	1200-1300	20	66	23	73	23	72	27	72	28	74	30	71	31	68	31	67	30	58	27	59	24	53	20	57
50,31	1300-1400	20	66	23	72	24	71	27	72	28	74	31	71	31	68	31	68	30	59	27	59	24	54	20	56
50,31	1400-1500	21	67	23	73	24	71	27	72	28	74	30	73	31	68	31	69	30	59	27	58	24	55	21	56
50,31	1500-1600	21	68	23	74	24	72	27	73	28	75	30	73	31	70	31	70	30	62	27	60	24	59	21	57
50,31	1600-1700	20	71	23	76	23	75	26	76	27	78	30	74	31	72	30	73	29	63	27	63	23	62	20	60
50,31	1700-1800	20	74	22	80	23	78	26	79	27	81	30	76	30	75	30	76	29	64	27	65	23	65	19	65
50,31	1800-1900	20	75	22	83	22	81	25	83	26	84	29	79	30	77	29	80	29	67	26	67	23	66	19	67
50,31	1900-2000	20	77	21	85	22	83	25	84	26	86	29	81	30	78	29	80	29	67	26	69	22	68	19	68
50,31	2000-2100	19	80	21	88	22	85	25	87	26	89	29	84	29	81	29	82	28	70	26	71	22	70	18	71
50,31	2100-2200	19	80	21	89	22	86	25	88	25	90	28	86	29	82	29	84	28	72	26	72	22	70	18	73
50,31	2200-2300	19	79	21	90	21	87	24	89	25	90	28	86	29	83	28	85	28	73	25	72	21	71	17	73
50,31	2300-0000	19	79	21	91	21	87	24	90	25	91	28	87	29	84	28	85	27	74	25	72	21	73	17	73

Composite Emission Rate (January 2030)

Road Name	Road ID	Hour	NO2 Emission						NO Emission						NOX Emission		
			MonthlyHourMin			MonthlyHourAverage			MonthlyHourMin			MonthlyHourAverage			MonthlyHourAverage		
			g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour
WAN PO ROAD L	RD_001	0000-0100	0.0255212	3.53E-07	2.806E-05	0.0238192	3.295E-07	2.619E-05	0.316797	4.382E-06	0.0003484	0.2822531	3.904E-06	0.0003104	0.3060723	4.234E-06	0.0003366
WAN PO ROAD L	RD_001	0100-0200	0.0287083	2.705E-07	2.15E-05	0.0268731	2.532E-07	2.013E-05	0.3220872	3.035E-06	0.0002413	0.2881845	2.715E-06	0.0002159	0.3150576	2.969E-06	0.000236
WAN PO ROAD L	RD_001	0200-0300	0.0320063	2.307E-07	1.834E-05	0.0299702	2.16E-07	1.717E-05	0.3281997	2.366E-06	0.0001881	0.2928821	2.111E-06	0.0001678	0.3228523	2.327E-06	0.000185
WAN PO ROAD L	RD_001	0300-0400	0.035456	1.914E-07	1.522E-05	0.0333303	1.799E-07	1.43E-05	0.3362338	1.815E-06	0.0001443	0.3024528	1.633E-06	0.0001298	0.3357831	1.813E-06	0.0001441
WAN PO ROAD L	RD_001	0400-0500	0.0388968	1.982E-07	1.576E-05	0.0365476	1.862E-07	1.48E-05	0.3420542	1.743E-06	0.0001385	0.3083363	1.571E-06	0.0001249	0.344884	1.757E-06	0.0001397
WAN PO ROAD L	RD_001	0500-0600	0.0423975	3.042E-07	2.419E-05	0.0400798	2.876E-07	2.286E-05	0.3488207	2.503E-06	0.000199	0.317695	2.28E-06	0.0001812	0.3577748	2.567E-06	0.0002041
WAN PO ROAD L	RD_001	0600-0700	0.0460369	9.286E-07	7.382E-05	0.0435446	8.783E-07	6.982E-05	0.3519535	7.099E-06	0.0005644	0.3220831	6.497E-06	0.0005165	0.3656277	7.375E-06	0.0005863
WAN PO ROAD L	RD_001	0700-0800	0.0500028	1.823E-06	0.0001449	0.0476254	1.736E-06	0.000138	0.3567955	1.301E-05	0.0010342	0.3310599	1.207E-05	0.0009596	0.3786852	1.381E-05	0.0010976
WAN PO ROAD L	RD_001	0800-0900	0.03685	1.463E-06	0.0001163	0.0349915	1.39E-06	0.0001105	0.2935081	1.166E-05	0.0009266	0.269944	1.072E-05	0.0008522	0.3049355	1.211E-05	0.0009627
WAN PO ROAD L	RD_001	0900-1000	0.0490759	1.633E-06	0.0001298	0.0467561	1.556E-06	0.0001237	0.356076	1.185E-05	0.0009418	0.3293279	1.096E-05	0.0008711	0.376084	1.251E-05	0.0009948
WAN PO ROAD L	RD_001	1000-1100	0.0510696	1.599E-06	0.0001271	0.0486653	1.524E-06	0.0001212	0.3811835	1.194E-05	0.000949	0.351842	1.102E-05	0.000876	0.4005073	1.254E-05	0.0009971
WAN PO ROAD L	RD_001	1100-1200	0.0499193	1.486E-06	0.0001181	0.0473934	1.41E-06	0.0001121	0.3632222	1.081E-05	0.0008593	0.3333393	9.92E-06	0.0007886	0.3807327	1.133E-05	0.0009007
WAN PO ROAD L	RD_001	1200-1300	0.0613458	7.343E-07	5.837E-05	0.0584771	6.999E-07	5.564E-05	0.3921357	4.694E-06	0.0003731	0.3651771	4.371E-06	0.0003475	0.4236543	5.071E-06	0.0004031
WAN PO ROAD L	RD_001	1300-1400	0.0699732	8.527E-07	6.779E-05	0.0665589	8.111E-07	6.448E-05	0.4363394	5.317E-06	0.0004227	0.4055824	4.942E-06	0.0003929	0.4721413	5.754E-06	0.0004574
WAN PO ROAD L	RD_001	1400-1500	0.0609221	7.517E-07	5.976E-05	0.0577121	7.121E-07	5.661E-05	0.3924011	4.841E-06	0.0003849	0.3624497	4.472E-06	0.0003555	0.4201618	5.184E-06	0.0004121
WAN PO ROAD L	RD_001	1500-1600	0.0590218	7.272E-07	5.781E-05	0.0561778	6.921E-07	5.502E-05	0.3906815	4.813E-06	0.0003826	0.362426	4.465E-06	0.000355	0.4186038	5.157E-06	0.00041
WAN PO ROAD L	RD_001	1600-1700	0.0546966	7.29E-07	5.796E-05	0.0522467	6.964E-07	5.536E-05	0.3822212	5.094E-06	0.000405	0.3568006	4.756E-06	0.0003781	0.4090473	5.452E-06	0.0004334
WAN PO ROAD L	RD_001	1700-1800	0.0393246	6.098E-07	4.848E-05	0.0374946	5.814E-07	4.622E-05	0.3058421	4.743E-06	0.000377	0.2850696	4.42E-06	0.0003514	0.3225642	5.002E-06	0.0003976
WAN PO ROAD L	RD_001	1800-1900	0.0308295	4.842E-07	3.849E-05	0.0292896	4.6E-07	3.657E-05	0.2797777	4.394E-06	0.0003493	0.2597953	4.08E-06	0.0003244	0.2890849	4.54E-06	0.0003609
WAN PO ROAD L	RD_001	1900-2000	0.0266929	3.674E-07	2.921E-05	0.0253131	3.484E-07	2.77E-05	0.2905808	4E-06	0.000318	0.2688632	3.701E-06	0.0002942	0.2941763	4.049E-06	0.0003219
WAN PO ROAD L	RD_001	2000-2100	0.0277843	3.107E-07	2.47E-05	0.0265317	2.967E-07	2.358E-05	0.3035825	3.394E-06	0.0002699	0.2828928	3.163E-06	0.0002515	0.3094245	3.46E-06	0.000275
WAN PO ROAD L	RD_001	2100-2200	0.0272122	2.901E-07	2.306E-05	0.0257771	2.748E-07	2.184E-05	0.3364347	3.586E-06	0.0002851	0.3083387	3.287E-06	0.0002613	0.3341158	3.562E-06	0.0002831
WAN PO ROAD L	RD_001	2200-2300	0.0225829	2.339E-07	1.86E-05	0.02125	2.201E-07	1.75E-05	0.3240582	3.357E-06	0.0002669	0.2948105	3.054E-06	0.0002428	0.3160605	3.274E-06	0.0002603
WAN PO ROAD L	RD_001	2300-0000	0.0264055	2.116E-07	1.682E-05	0.0247586	1.984E-07	1.577E-05	0.3363012	2.695E-06	0.0002142	0.3029212	2.427E-06	0.000193	0.3276798	2.626E-06	0.0002087
WAN PO ROAD R	RD_002	0000-0100	0.037018	1.881E-07	1.377E-05	0.0347839	1.767E-07	1.294E-05	0.3618857	1.839E-06	0.0001346	0.3264986	1.659E-06	0.0001215	0.3612825	1.836E-06	0.0001344
WAN PO ROAD R	RD_002	0100-0200	0.0418071	1.468E-07	1.075E-05	0.0394036	1.383E-07	1.013E-05	0.3723204	1.307E-06	9.57E-05	0.33735	1.184E-06	8.671E-05	0.3767536	1.323E-06	9.684E-05
WAN PO ROAD R	RD_002	0200-0300	0.0465157	1.258E-07	9.213E-06	0.0438022	1.185E-07	8.676E-06	0.3812686	1.031E-06	7.552E-05	0.3447622	9.326E-07	6.829E-05	0.3885643	1.051E-06	7.696E-05
WAN PO ROAD R	RD_002	0300-0400	0.0512751	1.05E-07	7.688E-06	0.048419	9.915E-08	7.26E-06	0.3927192	8.042E-07	5.888E-05	0.3575863	7.323E-07	5.361E-05	0.4060054	8.314E-07	6.087E-05
WAN PO ROAD R	RD_002	0400-0500	0.055996	1.095E-07	8.019E-06	0.0528823	1.034E-07	7.573E-06	0.4020119	7.863E-07	5.757E-05	0.3667343	7.173E-07	5.252E-05	0.4196166	8.208E-07	6.009E-05
WAN PO ROAD R	RD_002	0500-0600	0.0607028	1.697E-07	1.243E-05	0.0576079	1.611E-07	1.179E-05	0.4118907	1.152E-06	8.433E-05	0.379226	1.06E-06	7.764E-05	0.4368339	1.222E-06	8.944E-05
WAN PO ROAD R	RD_002	0600-0700	0.0654799	5.194E-07	3.803E-05	0.0621808	4.933E-07	3.612E-05	0.4172178	3.31E-06	0.0002423	0.3857273	3.06E-06	0.000224	0.4479081	3.553E-06	0.0002602
WAN PO ROAD R	RD_002	0700-0800	0.0698869	1.014E-06	7.428E-05	0.0668543	9.704E-07	7.105E-05	0.4227947	6.137E-06	0.0004493	0.3957069	5.744E-06	0.0004206	0.4625612	6.714E-06	0.0004916
WAN PO ROAD R	RD_002	0800-0900	0.0542184	8.307E-07	6.082E-05	0.0518279	7.941E-07	5.814E-05	0.3520346	5.394E-06	0.0003949	0.3275091	5.018E-06	0.0003674	0.379337	5.812E-06	0.0004255
WAN PO ROAD R	RD_002	0900-1000	0.0776949	1.112E-06	8.144E-05	0.0742776	1.063E-06	7.786E-05	0.4413593	6.319E-06	0.0004626	0.4127775	5.909E-06	0.0004327	0.4870551	6.973E-06	0.0005105
WAN PO ROAD R	RD_002	1000-1100	0.0835551	1.163E-06	8.512E-05	0.0799206	1.112E-06	8.142E-05	0.471766	6.564E-06	0.0004806	0.4408533	6.134E-06	0.0004491	0.5207739	7.246E-06	0.0005305
WAN PO ROAD R	RD_002	1100-1200	0.0830852	1.078E-06	7.895E-05	0.0791548	1.027E-06	7.522E-05	0.4592318	5.96E-06	0.0004364	0.4270703	5.543E-06	0.0004058	0.5062251	6.57E-06	0.0004811
WAN PO ROAD R	RD_002	1200-1300	0.0520092	1.014E-06	7.421E-05	0.0495354	9.654E-07	7.068E-05	0.357858	6.974E-06	0.0005106	0.3319653	6.469E-06	0.0004737	0.3815007	7.435E-06	0.0005444
WAN PO ROAD R	RD_002	1300-1400	0.060886	1.194E-06	8.745E-05	0.0578641	1.135E-06	8.311E-05	0.4034271	7.914E-06	0.0005794	0.3737156	7.331E-06	0.0005368	0.4315797	8.466E-06	0.0006199
WAN PO ROAD R	RD_002	1400-1500	0.0512172	1.028E-06	7.528E-05	0.0484409	9.725E-07	7.12E-05	0.3569432	7.166E-06	0.0005247	0.3282971	6.591E-06	0.0004826	0.376738	7.563E-06	0.0005538
WAN PO ROAD R	RD_002	1500-1600	0.0486615	9.731E-07	7.125E-05	0.0462522	9.25E-07	6.772E-05	0.3540187	7.08E-06	0.0005184	0.327012	6.54E-06	0.0004788	0.3732642	7.465E-06	0.0005465
WAN PO ROAD R	RD_002	1600-1700	0.0465494	1.012E-06	7.41E-05	0.0444069	9.655E-07	7.069E-05	0.3512848	7.637E-06	0.0005592	0.3268046	7.105E-06	0.0005202	0.3712115	8.071E-06	0.0005909
WAN PO ROAD R	RD_002	1700-1800	0.0340816	8.831E-07	6.466E-05	0.0324512	8.408E-07	6.156E-05	0.2827729	7.327E-06	0.0005364	0.2627829	6.809E-06	0.0004985	0.2952341	7.65E-06	0.0005601
WAN PO ROAD R	RD_002	1800-1900	0.0263783	7.001E-07	5.126E-05	0.0250854	6.658E-07	4.875E-05	0.2575345	6.836E-06	0.0005005	0.2382628	6.324E-06	0.000463	0.2633482	6.99E-06	0.0005118
WAN PO ROAD R	RD_002	1900-2000	0.0236446	5.528E-07	4.048E-05	0.0224655	5.252E-07	3.846E-05	0.2709351	6.334E-06	0.0004638	0.2498737	5.842E-06	0.0004277	0.2723392	6.367E-06	0.0004662
WAN PO ROAD R	RD_002	2000-2100	0.0242887	4.618E-07	3.381E-05	0.0231742	4.406E-07	3.226E-05	0.2825192	5.372E-06	0.0003933	0.2624274	4.99E-06	0.0003653	0.2856016	5.43E-06	0.0003976
WAN PO ROAD R	RD_002	2100-2200	0.0240427	4.36E-07	3.192E-05	0.0227147	4.119E-07	3.016E-05	0.315458	5.721E-06	0.0004189	0.2879832	5.223E-06	0.0003824	0.3106979	5.635E-06	0.0004126
WAN PO ROAD R	RD_002	2200-2300	0.0197292	3.491E-07	2.556E-05	0.0185409	3.281E-07	2.402E-05	0.305092	5.399E-06	0.0003953	0.2764173	4.892E-06	0.0003582	0.2949582	5.22E-06	0.0003822
WAN PO ROAD R	RD_002	2300-0000	0.0230506	3.144E-07	2.302E-05	0.021556	2.94E-07	2.153E-05	0.3154815	4.303E-06	0.0003151	0.2828126	3.857E-06	0.0002824	0.3043686	4.151E-06	0.000304
CROSS BAY LINK L	RD_003	0000-0100	0.0242335	1.866E-07	4.452E-06	0.0224274	1.727E-07	4.12E-06	0.2053419	1.581E-06	3.772E-05	0.1758952	1.354E-06	3.231E-05	0.1983226	1.527E-06	3.643E-05
CROSS BAY LINK L	RD_003	0100-0200	0.0287112	1.521E-07	3.63E-06	0.0267376	1.417E-07	3.381E-06	0.2145647	1.137E-06	2.713E-05	0.1859966	9.856E-07	2.352E-05	0.2127342	1.127E-06	2.69E-05
CROSS BAY LINK L	RD_003	0200-0300	0.0334601	1.368E-07	3.264E-06	0.0311491	1.274E-07	3.039E-06	0.2268131	9.274E-07	2.213E-05	0.1962094	8.022E-07	1.914E-05	0.2273585	9.296E-07	2.218E-05
CROSS BAY LINK L	RD_003	0300-0400	0.0379301	1.171E-07	2.795E-06	0.0354379	1.094E-07	2.611E-06	0.2362457	7.294E-07	1.741E-05	0.2064972	6.376E-07	1.521E-05	0.2419351	7.47E-07	1.782E-05
CROSS BAY LINK L	RD_003	0400-0500	0.0425378	1.242E-07	2.964E-06	0.0398214	1.163E-07	2.775E-06	0.2459317	7.182E-07	1.714E-05	0.2166697	6.328E-07	1.51E-05	0.2564911	7.491E-07	1.787E-05
CROSS BAY LINK L	RD_003	0500-0600	0.0471398	1.967E-07	4.694E-06	0.0444666	1.856E-07	4.428E-06	0.2568007	1.072E-06	2.557E-05	0.2299181	9.595E-07	2.29E-05	0.2743847	1.145E-06	2.732E-05
CROSS BAY LINK L	RD_003	0600-0700	0.05182	6.118E-07	1.46E-05	0.0489752	5.782E-07	1.38E-05	0.2652087	3.131E-06	7.472E-05	0.2393017	2.825E-06	6.742E-05	0.2882768	3.404E-06	8.122E-05

Road Name	Road ID	Hour	NO2 Emission						NO Emission						NOX Emission		
			MonthlyHourMin			MonthlyHourAverage			MonthlyHourMin			MonthlyHourAverage			MonthlyHourAverage		
			g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour
CROSS BAY LINK L	RD_003	0700-0800	0.056228	1.211E-06	2.889E-05	0.0535943	1.154E-06	2.753E-05	0.2719535	5.855E-06	0.0001397	0.2503402	5.39E-06	0.0001286	0.3039345	6.544E-06	0.0001561
CROSS BAY LINK L	RD_003	0800-0900	0.0425003	9.817E-07	2.343E-05	0.0404719	9.349E-07	2.231E-05	0.2294015	5.299E-06	0.0001264	0.2088791	4.825E-06	0.0001151	0.249351	5.76E-06	0.0001374
CROSS BAY LINK L	RD_003	0900-1000	0.0627219	1.311E-06	3.129E-05	0.0598445	1.251E-06	2.985E-05	0.2935551	6.137E-06	0.0001464	0.2705732	5.657E-06	0.000135	0.3304177	6.908E-06	0.0001648
CROSS BAY LINK L	RD_003	1000-1100	0.0678066	1.371E-06	3.271E-05	0.0646874	1.308E-06	3.121E-05	0.3202329	6.474E-06	0.0001545	0.2944437	5.953E-06	0.000142	0.3591312	7.261E-06	0.0001733
CROSS BAY LINK L	RD_003	1100-1200	0.067804	1.283E-06	3.061E-05	0.06446	1.22E-06	2.91E-05	0.3172655	6.003E-06	0.0001432	0.2905478	5.498E-06	0.0001312	0.3550078	6.718E-06	0.0001603
CROSS BAY LINK L	RD_003	1200-1300	0.0432255	1.03E-06	2.457E-05	0.0410111	9.771E-07	2.331E-05	0.2434978	5.801E-06	0.0001384	0.2217836	5.284E-06	0.0001261	0.2627947	6.261E-06	0.0001494
CROSS BAY LINK L	RD_003	1300-1400	0.0513963	1.223E-06	2.918E-05	0.0487008	1.159E-06	2.765E-05	0.2791711	6.642E-06	0.0001585	0.2543432	6.051E-06	0.0001444	0.303044	7.21E-06	0.000172
CROSS BAY LINK L	RD_003	1400-1500	0.0423004	1.038E-06	2.477E-05	0.0398581	9.78E-07	2.334E-05	0.241235	5.919E-06	0.0001412	0.2176224	5.34E-06	0.0001274	0.2574805	6.318E-06	0.0001508
CROSS BAY LINK L	RD_003	1500-1600	0.0395099	9.661E-07	2.305E-05	0.0374046	9.147E-07	2.183E-05	0.235895	5.768E-06	0.0001376	0.2134867	5.22E-06	0.0001246	0.2508913	6.135E-06	0.0001464
CROSS BAY LINK L	RD_003	1600-1700	0.0373722	9.934E-07	2.37E-05	0.0355184	9.441E-07	2.253E-05	0.2303154	6.122E-06	0.0001461	0.2101675	5.587E-06	0.0001333	0.2456859	6.531E-06	0.0001558
CROSS BAY LINK L	RD_003	1700-1800	0.0263732	8.391E-07	2.002E-05	0.024992	7.951E-07	1.897E-05	0.1813628	5.77E-06	0.0001377	0.1651987	5.256E-06	0.0001254	0.1901907	6.051E-06	0.0001444
CROSS BAY LINK L	RD_003	1800-1900	0.0186073	6.069E-07	1.448E-05	0.0175494	5.724E-07	1.366E-05	0.152966	4.989E-06	0.000119	0.1379172	4.498E-06	0.0001073	0.1554666	5.07E-06	0.000121
CROSS BAY LINK L	RD_003	1900-2000	0.0149865	4.299E-07	1.026E-05	0.0140374	4.027E-07	9.608E-06	0.1538518	4.413E-06	0.0001053	0.1373357	3.94E-06	9.4E-05	0.1513731	4.342E-06	0.0001036
CROSS BAY LINK L	RD_003	2000-2100	0.015604	3.65E-07	8.709E-06	0.0147157	3.442E-07	8.213E-06	0.1619115	3.787E-06	9.036E-05	0.1461681	3.419E-06	8.158E-05	0.1608838	3.763E-06	8.979E-05
CROSS BAY LINK L	RD_003	2100-2200	0.0143608	3.194E-07	7.622E-06	0.0133204	2.963E-07	7.069E-06	0.1821085	4.05E-06	9.665E-05	0.1592392	3.542E-06	8.451E-05	0.1725596	3.838E-06	9.158E-05
CROSS BAY LINK L	RD_003	2200-2300	0.0108649	2.367E-07	5.647E-06	0.0099549	2.168E-07	5.174E-06	0.1813568	3.95E-06	9.426E-05	0.1577629	3.436E-06	8.2E-05	0.1677178	3.653E-06	8.717E-05
CROSS BAY LINK L	RD_003	2300-0000	0.0140026	2.349E-07	5.604E-06	0.012789	2.145E-07	5.119E-06	0.1914349	3.211E-06	7.662E-05	0.1636674	2.745E-06	6.551E-05	0.1764564	2.96E-06	7.062E-05
CROSS BAY LINK R	RD_004	0000-0100	0.0143775	2.721E-07	4.82E-06	0.0130327	2.467E-07	4.369E-06	0.1833437	3.47E-06	6.147E-05	0.1539094	2.913E-06	5.16E-05	0.1669421	3.16E-06	5.597E-05
CROSS BAY LINK R	RD_004	0100-0200	0.0171515	2.207E-07	3.908E-06	0.015702	2.02E-07	3.578E-06	0.1871348	2.408E-06	4.264E-05	0.1587491	2.042E-06	3.618E-05	0.1744512	2.244E-06	3.975E-05
CROSS BAY LINK R	RD_004	0200-0300	0.0202066	1.981E-07	3.51E-06	0.0185073	1.815E-07	3.214E-06	0.194048	1.903E-06	3.37E-05	0.1636692	1.605E-06	2.843E-05	0.1821764	1.786E-06	3.164E-05
CROSS BAY LINK R	RD_004	0300-0400	0.0230866	1.689E-07	2.992E-06	0.021274	1.557E-07	2.757E-06	0.1982735	1.451E-06	2.57E-05	0.1689508	1.236E-06	2.19E-05	0.1902248	1.392E-06	2.465E-05
CROSS BAY LINK R	RD_004	0400-0500	0.0261104	1.796E-07	3.182E-06	0.0241568	1.662E-07	2.943E-06	0.2026174	1.394E-06	2.469E-05	0.1740528	1.197E-06	2.121E-05	0.1982096	1.364E-06	2.415E-05
CROSS BAY LINK R	RD_004	0500-0600	0.0292538	2.824E-07	5.003E-06	0.0273197	2.638E-07	4.672E-06	0.2085368	2.013E-06	3.566E-05	0.1823413	1.76E-06	3.118E-05	0.209661	2.024E-06	3.585E-05
CROSS BAY LINK R	RD_004	0600-0700	0.0325462	8.808E-07	1.56E-05	0.0304801	8.249E-07	1.461E-05	0.2123229	5.746E-06	0.0001018	0.1873676	5.071E-06	8.982E-05	0.2178477	5.896E-06	0.0001044
CROSS BAY LINK R	RD_004	0700-0800	0.0356844	1.74E-06	3.082E-05	0.033785	1.648E-06	2.918E-05	0.2143925	1.046E-05	0.0001852	0.1938705	9.455E-06	0.0001675	0.2276555	1.11E-05	0.0001966
CROSS BAY LINK R	RD_004	0800-0900	0.024899	1.34E-06	2.374E-05	0.0234501	1.262E-06	2.236E-05	0.1791661	9.643E-06	0.0001708	0.1595463	8.587E-06	0.0001521	0.1829964	9.849E-06	0.0001745
CROSS BAY LINK R	RD_004	0900-1000	0.0310474	1.348E-06	2.388E-05	0.0293819	1.276E-06	2.26E-05	0.2021565	8.78E-06	0.0001555	0.1811668	7.868E-06	0.0001394	0.2105487	9.144E-06	0.000162
CROSS BAY LINK R	RD_004	1000-1100	0.0307387	1.241E-06	2.198E-05	0.0290365	1.172E-06	2.076E-05	0.2157651	8.711E-06	0.0001543	0.1916751	7.738E-06	0.0001371	0.2207116	8.91E-06	0.0001578
CROSS BAY LINK R	RD_004	1100-1200	0.0306664	1.186E-06	2.1E-05	0.0288567	1.116E-06	1.976E-05	0.2103712	8.135E-06	0.0001441	0.1861097	7.196E-06	0.0001275	0.2149664	8.312E-06	0.0001472
CROSS BAY LINK R	RD_004	1200-1300	0.0452277	7.177E-07	1.271E-05	0.0429094	6.809E-07	1.206E-05	0.2348953	3.727E-06	6.602E-05	0.2134813	3.387E-06	6E-05	0.2563907	4.068E-06	7.206E-05
CROSS BAY LINK R	RD_004	1300-1400	0.0533338	8.476E-07	1.501E-05	0.0505313	8.031E-07	1.423E-05	0.2686413	4.27E-06	7.563E-05	0.2442198	3.881E-06	6.875E-05	0.294751	4.685E-06	8.298E-05
CROSS BAY LINK R	RD_004	1400-1500	0.0444566	7.266E-07	1.287E-05	0.0418896	6.846E-07	1.213E-05	0.2326725	3.803E-06	6.735E-05	0.2093798	3.422E-06	6.061E-05	0.2512694	4.106E-06	7.274E-05
CROSS BAY LINK R	RD_004	1500-1600	0.0418943	6.831E-07	1.21E-05	0.0396676	6.468E-07	1.146E-05	0.2274794	3.709E-06	6.57E-05	0.205383	3.349E-06	5.932E-05	0.2450506	3.996E-06	7.077E-05
CROSS BAY LINK R	RD_004	1600-1700	0.0389256	6.887E-07	1.22E-05	0.0369897	6.545E-07	1.159E-05	0.2192963	3.88E-06	6.873E-05	0.1995033	3.53E-06	6.253E-05	0.236493	4.184E-06	7.412E-05
CROSS BAY LINK R	RD_004	1700-1800	0.0269039	5.65E-07	1.001E-05	0.0254831	5.352E-07	9.479E-06	0.1701276	3.573E-06	6.328E-05	0.1542774	3.24E-06	5.739E-05	0.1797605	3.775E-06	6.687E-05
CROSS BAY LINK R	RD_004	1800-1900	0.0186875	4.006E-07	7.095E-06	0.0176061	3.774E-07	6.685E-06	0.1393224	2.986E-06	5.29E-05	0.1246654	2.672E-06	4.733E-05	0.1422714	3.05E-06	5.402E-05
CROSS BAY LINK R	RD_004	1900-2000	0.0143543	2.701E-07	4.783E-06	0.0134036	2.522E-07	4.467E-06	0.1366006	2.57E-06	4.552E-05	0.1205727	2.268E-06	4.018E-05	0.1339764	2.521E-06	4.465E-05
CROSS BAY LINK R	RD_004	2000-2100	0.0150502	2.308E-07	4.088E-06	0.0141593	2.171E-07	3.846E-06	0.1439776	2.208E-06	3.911E-05	0.128705	1.974E-06	3.496E-05	0.1428644	2.191E-06	3.881E-05
CROSS BAY LINK R	RD_004	2100-2200	0.0134878	1.963E-07	3.477E-06	0.0124527	1.813E-07	3.21E-06	0.1606876	2.339E-06	4.143E-05	0.1384718	2.015E-06	3.57E-05	0.1509244	2.197E-06	3.891E-05
CROSS BAY LINK R	RD_004	2200-2300	0.0100902	1.438E-07	2.548E-06	0.0091851	1.309E-07	2.319E-06	0.1624279	2.315E-06	4.101E-05	0.1394391	1.988E-06	3.521E-05	0.1486243	2.119E-06	3.753E-05
CROSS BAY LINK R	RD_004	2300-0000	0.0134038	1.472E-07	2.608E-06	0.0121867	1.339E-07	2.371E-06	0.1723771	1.894E-06	3.354E-05	0.1453046	1.596E-06	2.827E-05	0.1574912	1.73E-06	3.064E-05
INDUSTRIAL ROAD L	RD_005	0000-0100	0.5651605	4.106E-08	1.117E-06	0.5426715	3.943E-08	1.073E-06	8.6536005	6.288E-07	1.71E-05	8.2325329	5.982E-07	1.627E-05	8.7752043	6.376E-07	1.734E-05
INDUSTRIAL ROAD L	RD_005	0100-0200	0.5585427	2.435E-08	6.623E-07	0.5371515	2.342E-08	6.37E-07	8.535918	3.721E-07	1.012E-05	8.1322955	3.545E-07	9.643E-06	8.669447	3.78E-07	1.028E-05
INDUSTRIAL ROAD L	RD_005	0200-0300	0.5594827	1.626E-08	4.423E-07	0.5371937	1.561E-08	4.247E-07	8.5535769	2.486E-07	6.762E-06	8.1340379	2.364E-07	6.43E-06	8.6712315	2.52E-07	6.855E-06
INDUSTRIAL ROAD L	RD_005	0300-0400	0.5596923	1.627E-08	4.425E-07	0.5375078	1.562E-08	4.249E-07	8.5552453	2.486E-07	6.763E-06	8.1386618	2.365E-07	6.434E-06	8.6761697	2.522E-07	6.859E-06
INDUSTRIAL ROAD L	RD_005	0400-0500	0.5600204	1.628E-08	4.427E-07	0.5375359	1.562E-08	4.249E-07	8.5619087	2.488E-07	6.769E-06	8.1398247	2.366E-07	6.435E-06	8.6773606	2.522E-07	6.86E-06
INDUSTRIAL ROAD L	RD_005	0500-0600	0.5599204	1.627E-08	4.426E-07	0.5397254	1.569E-08	4.267E-07	8.5608222	2.488E-07	6.768E-06	8.1806672	2.378E-07	6.467E-06	8.7203926	2.534E-07	6.894E-06
INDUSTRIAL ROAD L	RD_005	0600-0700	0.5658053	5.756E-08	1.566E-06	0.5451005	5.545E-08	1.508E-06	8.66979	8.819E-07	2.399E-05	8.2809754	8.424E-07	2.291E-05	8.826076	8.978E-07	2.442E-05
INDUSTRIAL ROAD L	RD_005	0700-0800	0.5641564	9.838E-08	2.676E-06	0.5460388	9.522E-08	2.59E-06	8.6384818	1.506E-06	4.097E-05	8.2982932	1.447E-06	3.936E-05	8.844332	1.542E-06	4.195E-05
INDUSTRIAL ROAD L	RD_005	0800-0900	0.561224	8.156E-08	2.218E-06	0.5436632	7.9E-08	2.149E-06	8.5492873	1.242E-06	3.379E-05	8.2197081	1.194E-06	3.249E-05	8.7633713	1.273E-06	3.464E-05
INDUSTRIAL ROAD L	RD_005	0900-1000	0.5615152	8.976E-08	2.441E-06	0.5426538	8.674E-08	2.359E-06	8.5604195	1.368E-06	3.722E-05	8.2069341	1.312E-06	3.568E-05	8.7495879	1.399E-06	3.804E-05
INDUSTRIAL ROAD L	RD_005	1000-1100	0.5599631	8.951E-08	2.435E-06	0.5409447	8.647E-08	2.352E-06	8.4562556	1.352E-06	3.677E-05	8.1034564	1.295E-06	3.523E-05	8.6444011	1.382E-06	3.759E-05
INDUSTRIAL ROAD L	RD_005	1100-1200	0.565057	7.39E-08	2.01E-06	0.5440466	7.115E-08	1.935E-06	8.6581579	1.132E-06	3.08E-05	8.2648955	1.081E-06	2.94E-05	8.8089421	1.152E-06	3.134E-05
INDUSTRIAL ROAD L	RD_005	1200-1300	0.5604799	8.145E-08	2.215E-06	0.5404646	7.854E-08	2.136E-06	8.4717245	1.231E-06	3.349E-05	8.0990477	1.177E-06	3.201E-05	8.6395124	1.255E-06	3.415E-05
INDUSTRIAL ROAD L	RD_005	1300-1400	0.5604694	8.145E-08	2.215E-06	0.5397047	7.843E-08	2.133E-06	8.4526146	1.228E-06	3.341E-05	8.0671829	1.172E-06	3.189E-05	8.6068876	1.251E-06	3.402E-05
INDUSTRIAL ROAD L	RD_005	1400-1500	0.5634425	8.188E-08	2.227E-06	0.5406332	7.856E-08	2.137E-06	8.5865872	1.248E-06	3.394E-05	8.1594192	1.186E-06	3.225E-05	8.7000524	1.264E-06	3.439E-05

Road Name	Road ID	Hour	NO2 Emission						NO Emission						NOX Emission		
			MonthlyHourMin			MonthlyHourAverage			MonthlyHourMin			MonthlyHourAverage			MonthlyHourAverage		
			g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour
INDUSTRIAL ROAD L	RD_005	1500-1600	0.5612614	8.156E-08	2.219E-06	0.5405133	7.855E-08	2.137E-06	8.5568551	1.243E-06	3.382E-05	8.1693372	1.187E-06	3.229E-05	8.7098505	1.266E-06	3.443E-05
INDUSTRIAL ROAD L	RD_005	1600-1700	0.5598237	8.949E-08	2.434E-06	0.5411881	8.651E-08	2.353E-06	8.5153716	1.361E-06	3.702E-05	8.1676733	1.306E-06	3.551E-05	8.7088614	1.392E-06	3.787E-05
INDUSTRIAL ROAD L	RD_005	1700-1800	0.5594705	8.943E-08	2.433E-06	0.5411672	8.651E-08	2.353E-06	8.5433687	1.366E-06	3.715E-05	8.200942	1.311E-06	3.566E-05	8.7421092	1.397E-06	3.801E-05
INDUSTRIAL ROAD L	RD_005	1800-1900	0.5602177	9.769E-08	2.657E-06	0.5416487	9.445E-08	2.569E-06	8.5935237	1.499E-06	4.076E-05	8.2439137	1.438E-06	3.91E-05	8.7855624	1.532E-06	4.167E-05
INDUSTRIAL ROAD L	RD_005	1900-2000	0.5604814	9.774E-08	2.659E-06	0.5422202	9.455E-08	2.572E-06	8.4721854	1.477E-06	4.019E-05	8.1339663	1.418E-06	3.858E-05	8.6761865	1.513E-06	4.115E-05
INDUSTRIAL ROAD L	RD_005	2000-2100	0.5566189	8.089E-08	2.2E-06	0.5402223	7.85E-08	2.135E-06	8.4802171	1.232E-06	3.352E-05	8.1727279	1.188E-06	3.23E-05	8.7129502	1.266E-06	3.444E-05
INDUSTRIAL ROAD L	RD_005	2100-2200	0.5598913	8.95E-08	2.434E-06	0.5409757	8.648E-08	2.352E-06	8.5588978	1.368E-06	3.721E-05	8.2043261	1.311E-06	3.567E-05	8.7453017	1.398E-06	3.802E-05
INDUSTRIAL ROAD L	RD_005	2200-2300	0.5611835	8.155E-08	2.218E-06	0.5413752	7.867E-08	2.14E-06	8.5817327	1.247E-06	3.392E-05	8.2090384	1.193E-06	3.245E-05	8.7504136	1.272E-06	3.459E-05
INDUSTRIAL ROAD L	RD_005	2300-0000	0.5633282	5.73E-08	1.559E-06	0.5408362	5.502E-08	1.496E-06	8.6210515	8.77E-07	2.385E-05	8.1984746	8.34E-07	2.268E-05	8.7393107	8.89E-07	2.418E-05
INDUSTRIAL ROAD C	RD_007	0000-0100	0.5651605	3.714E-08	3.28E-06	0.5426715	3.566E-08	3.149E-06	8.6536005	5.686E-07	5.022E-05	8.2325329	5.41E-07	4.777E-05	8.7752043	5.766E-07	5.092E-05
INDUSTRIAL ROAD C	RD_007	0100-0200	0.5585427	2.202E-08	1.945E-06	0.5371515	2.118E-08	1.87E-06	8.535918	3.365E-07	2.972E-05	8.1322955	3.206E-07	2.832E-05	8.669447	3.418E-07	3.019E-05
INDUSTRIAL ROAD C	RD_007	0200-0300	0.5594827	1.471E-08	1.299E-06	0.5371937	1.412E-08	1.247E-06	8.5535769	2.248E-07	1.985E-05	8.1340379	2.138E-07	1.888E-05	8.6712315	2.279E-07	2.013E-05
INDUSTRIAL ROAD C	RD_007	0300-0400	0.5537877	1.456E-08	1.285E-06	0.5323048	1.399E-08	1.236E-06	8.4503746	2.221E-07	1.962E-05	8.0447711	2.115E-07	1.867E-05	8.5770759	2.254E-07	1.991E-05
INDUSTRIAL ROAD C	RD_007	0400-0500	0.5600204	1.472E-08	1.3E-06	0.5375359	1.413E-08	1.248E-06	8.5619087	2.25E-07	1.987E-05	8.1398247	2.14E-07	1.889E-05	8.6773606	2.281E-07	2.014E-05
INDUSTRIAL ROAD C	RD_007	0500-0600	0.5486129	1.442E-08	1.273E-06	0.5294194	1.392E-08	1.229E-06	8.3566897	2.197E-07	1.94E-05	7.9964247	2.102E-07	1.856E-05	8.5258441	2.241E-07	1.979E-05
INDUSTRIAL ROAD C	RD_007	0600-0700	0.5658053	5.205E-08	4.597E-06	0.5451005	5.015E-08	4.429E-06	8.66979	7.976E-07	7.044E-05	8.2809754	7.618E-07	6.728E-05	8.826076	8.12E-07	7.171E-05
INDUSTRIAL ROAD C	RD_007	0700-0800	0.5054119	8.635E-08	7.626E-06	0.4901134	8.374E-08	7.395E-06	7.6267804	1.303E-06	0.0001151	7.3421818	1.254E-06	0.0001108	7.8322952	1.338E-06	0.0001182
INDUSTRIAL ROAD C	RD_007	0800-0900	0.5154684	7.452E-08	6.581E-06	0.4991612	7.216E-08	6.373E-06	7.8018124	1.128E-06	9.961E-05	7.4990209	1.084E-06	9.574E-05	7.9981821	1.156E-06	0.0001021
INDUSTRIAL ROAD C	RD_007	0900-1000	0.534391	7.725E-08	6.823E-06	0.5179318	7.488E-08	6.612E-06	8.0737447	1.167E-06	0.0001031	7.7639729	1.122E-06	9.912E-05	8.2819047	1.197E-06	0.0001057
INDUSTRIAL ROAD C	RD_007	1000-1100	0.5599631	8.095E-08	7.149E-06	0.5409447	7.82E-08	6.906E-06	8.4562556	1.222E-06	0.000108	8.1034564	1.171E-06	0.0001035	8.6444011	1.25E-06	0.0001104
INDUSTRIAL ROAD C	RD_007	1100-1200	0.5331403	6.306E-08	5.569E-06	0.5153312	6.095E-08	5.383E-06	8.0800957	9.557E-07	8.44E-05	7.7435187	9.159E-07	8.089E-05	8.25885	9.769E-07	8.627E-05
INDUSTRIAL ROAD C	RD_007	1200-1300	0.5604799	7.366E-08	6.505E-06	0.5404646	7.103E-08	6.273E-06	8.4717245	1.113E-06	9.832E-05	8.0990477	1.064E-06	9.4E-05	8.6395124	1.135E-06	0.0001003
INDUSTRIAL ROAD C	RD_007	1300-1400	0.5241976	6.889E-08	6.084E-06	0.5069425	6.662E-08	5.884E-06	7.8099743	1.026E-06	9.064E-05	7.4879392	9.841E-07	8.691E-05	7.9948816	1.051E-06	9.279E-05
INDUSTRIAL ROAD C	RD_007	1400-1500	0.5634425	7.405E-08	6.539E-06	0.5406332	7.105E-08	6.275E-06	8.5865872	1.128E-06	9.966E-05	8.1594192	1.072E-06	9.47E-05	8.7000524	1.143E-06	0.000101
INDUSTRIAL ROAD C	RD_007	1500-1600	0.5215289	6.854E-08	6.053E-06	0.5047829	6.634E-08	5.859E-06	7.8379807	1.03E-06	9.097E-05	7.521267	9.885E-07	8.729E-05	8.0260499	1.055E-06	9.315E-05
INDUSTRIAL ROAD C	RD_007	1600-1700	0.5598237	8.093E-08	7.147E-06	0.5411881	7.824E-08	6.909E-06	8.5153716	1.231E-06	0.0001087	8.1676733	1.181E-06	0.0001043	8.7088614	1.259E-06	0.0001112
INDUSTRIAL ROAD C	RD_007	1700-1800	0.5165471	7.468E-08	6.595E-06	0.5020438	7.258E-08	6.41E-06	7.7612376	1.122E-06	9.909E-05	7.4875496	1.082E-06	9.559E-05	7.9895934	1.155E-06	0.000102
INDUSTRIAL ROAD C	RD_007	1800-1900	0.5602177	8.835E-08	7.802E-06	0.5416487	8.542E-08	7.544E-06	8.5935237	1.355E-06	0.0001197	8.2439137	1.3E-06	0.0001148	8.7855624	1.386E-06	0.0001224
INDUSTRIAL ROAD C	RD_007	1900-2000	0.5079098	8.01E-08	7.074E-06	0.4942486	7.795E-08	6.884E-06	7.5338738	1.188E-06	0.0001049	7.2769224	1.148E-06	0.0001013	7.7711709	1.226E-06	0.0001082
INDUSTRIAL ROAD C	RD_007	2000-2100	0.5566189	7.315E-08	6.46E-06	0.5402223	7.1E-08	6.27E-06	8.4802171	1.115E-06	9.842E-05	8.1727279	1.074E-06	9.485E-05	8.7129502	1.145E-06	0.0001011
INDUSTRIAL ROAD C	RD_007	2100-2200	0.5100698	7.374E-08	6.512E-06	0.4956569	7.166E-08	6.328E-06	7.6457864	1.105E-06	9.761E-05	7.3740267	1.066E-06	9.414E-05	7.8696836	1.138E-06	0.0001005
INDUSTRIAL ROAD C	RD_007	2200-2300	0.5611835	7.375E-08	6.513E-06	0.5413752	7.115E-08	6.283E-06	8.5817327	1.128E-06	9.96E-05	8.2090384	1.079E-06	9.528E-05	8.7504136	1.15E-06	0.0001016
INDUSTRIAL ROAD C	RD_007	2300-0000	0.5094051	4.686E-08	4.139E-06	0.492616	4.532E-08	4.002E-06	7.6311862	7.02E-07	6.2E-05	7.3139307	6.729E-07	5.942E-05	7.8065467	7.182E-07	6.342E-05
CHUN YAT STREET L	RD_008	0000-0100	0.11939	7.474E-09	1.535E-07	0.1095572	6.859E-09	1.408E-07	0.661508	4.141E-08	8.504E-07	0.5794257	3.627E-08	7.449E-07	0.6889829	4.313E-08	8.858E-07
CHUN YAT STREET L	RD_008	0100-0200	0.124046	5.177E-09	1.063E-07	0.1140593	4.76E-09	9.776E-08	0.6750957	2.818E-08	5.786E-07	0.5932883	2.476E-08	5.085E-07	0.7073476	2.952E-08	6.062E-07
CHUN YAT STREET L	RD_008	0200-0300	0.1286978	5.37E-09	1.103E-07	0.117984	4.923E-09	1.011E-07	0.6935288	2.894E-08	5.942E-07	0.605339	2.526E-08	5.187E-07	0.723323	3.018E-08	6.198E-07
CHUN YAT STREET L	RD_008	0300-0400	0.1325798	2.766E-09	5.681E-08	0.1216934	2.539E-09	5.214E-08	0.7061576	1.473E-08	3.026E-07	0.6178177	1.289E-08	2.647E-07	0.7395111	1.543E-08	3.169E-07
CHUN YAT STREET L	RD_008	0400-0500	0.1361539	2.841E-09	5.834E-08	0.124858	2.605E-09	5.35E-08	0.7173195	1.497E-08	3.073E-07	0.6276419	1.31E-08	2.689E-07	0.7524999	1.57E-08	3.224E-07
CHUN YAT STREET L	RD_008	0500-0600	0.1392852	5.813E-09	1.194E-07	0.1289126	5.38E-09	1.105E-07	0.7295871	3.045E-08	6.252E-07	0.6461166	2.696E-08	5.537E-07	0.7750292	3.234E-08	6.642E-07
CHUN YAT STREET L	RD_008	0600-0700	0.1419474	1.481E-08	3.041E-07	0.1314925	1.372E-08	2.817E-07	0.7361049	7.679E-08	1.577E-06	0.6528675	6.811E-08	1.399E-06	0.78436	8.182E-08	1.68E-06
CHUN YAT STREET L	RD_008	0700-0800	0.146475	3.056E-08	6.276E-07	0.1369112	2.857E-08	5.866E-07	0.7476811	1.56E-07	3.203E-06	0.674273	1.407E-07	2.889E-06	0.8111842	1.692E-07	3.476E-06
CHUN YAT STREET L	RD_008	0800-0900	0.1372285	2.291E-08	4.704E-07	0.1284365	2.144E-08	4.403E-07	0.7017289	1.171E-07	2.405E-06	0.6339963	1.058E-07	2.173E-06	0.7624328	1.273E-07	2.614E-06
CHUN YAT STREET L	RD_008	0900-1000	0.1563189	2.936E-08	6.029E-07	0.1458656	2.74E-08	5.626E-07	0.7658326	1.438E-07	2.954E-06	0.6913144	1.298E-07	2.666E-06	0.83718	1.572E-07	3.229E-06
CHUN YAT STREET L	RD_008	1000-1100	0.1678531	2.451E-08	5.034E-07	0.1567941	2.29E-08	4.703E-07	0.7954527	1.162E-07	2.386E-06	0.721314	1.053E-07	2.163E-06	0.8781081	1.282E-07	2.634E-06
CHUN YAT STREET L	RD_008	1100-1200	0.1625181	3.052E-08	6.267E-07	0.150623	2.828E-08	5.808E-07	0.7879773	1.48E-07	3.038E-06	0.7055531	1.325E-07	2.721E-06	0.8561761	1.608E-07	3.301E-06
CHUN YAT STREET L	RD_008	1200-1300	0.117862	4.674E-08	9.598E-07	0.1093639	4.337E-08	8.906E-07	0.5972105	2.368E-07	4.863E-06	0.5347508	2.12E-07	4.354E-06	0.6441147	2.554E-07	5.245E-06
CHUN YAT STREET L	RD_008	1300-1400	0.1313206	6.576E-08	1.35E-06	0.1213545	6.077E-08	1.248E-06	0.6684358	3.347E-07	6.874E-06	0.5957572	2.983E-07	6.127E-06	0.7171117	3.591E-07	7.375E-06
CHUN YAT STREET L	RD_008	1400-1500	0.1171316	4.644E-08	9.536E-07	0.1076454	4.268E-08	8.764E-07	0.5923784	2.349E-07	4.823E-06	0.5226325	2.072E-07	4.255E-06	0.6302779	2.499E-07	5.131E-06
CHUN YAT STREET L	RD_008	1500-1600	0.1141855	4.527E-08	9.296E-07	0.105771	4.193E-08	8.611E-07	0.5815502	2.306E-07	4.735E-06	0.5176337	2.052E-07	4.214E-06	0.6234047	2.472E-07	5.075E-06
CHUN YAT STREET L	RD_008	1600-1700	0.1084202	4.75E-08	9.755E-07	0.1010886	4.429E-08	9.095E-07	0.5661357	2.48E-07	5.094E-06	0.5094667	2.232E-07	4.584E-06	0.6105553	2.675E-07	5.493E-06
CHUN YAT STREET L	RD_008	1700-1800	0.0994104	5.394E-08	1.108E-06	0.0925905	5.024E-08	1.032E-06	0.5346503	2.901E-07	5.957E-06	0.4799007	2.604E-07	5.347E-06	0.5724912	3.106E-07	6.379E-06
CHUN YAT STREET L	RD_008	1800-1900	0.0924056	5.207E-08	1.069E-06	0.0858552	4.838E-08	9.935E-07	0.5090488	2.868E-07	5.891E-06	0.4548213	2.563E-07	5.263E-06	0.5406766	3.047E-07	6.257E-06
CHUN YAT STREET L	RD_008	1900-2000	0.0868065	4.347E-08	8.927E-07	0.0807495	4.044E-08	8.304E-07	0.4989356	2.499E-07	5.131E-06	0.445272	2.23E-07	4.579E-06	0.5260215	2.634E-07	5.41E-06
CHUN YAT STREET L	RD_008	2000-2100	0.0795694	2.823E-08	5.797E-07	0.0744487	2.641E-08	5.424E-07	0.4657155	1.652E-07	3.393E-06	0.420342	1.491E-07	3.063E-06	0.4947907	1.755E-07	3.605E-06
CHUN YAT STREET L	RD_008	2100-2200	0.0833688	3.132E-08	6.431E-07	0.0771844	2.899E-08	5.954E-07	0.50539	1.898E-07	3.898E-06	0.4466365	1.678E-07	3.445E-06	0.5238209	1.968E-07	4.041E-06
CHUN YAT STREET L	RD_008	2200-2300	0.0716934	2.244E-08	4.609E-07	0.0660974	2.069E-08	4.249E-07	0.4692747	1.469E-07	3.017E-06	0.4130176	1.293E-07	2.655E-06	0.479115	1.5E-07	3.08E-06

Road Name	Road ID	Hour	NO2 Emission						NO Emission						NOX Emission		
			MonthlyHourMin			MonthlyHourAverage			MonthlyHourMin			MonthlyHourAverage			MonthlyHourAverage		
			g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour
CHUN YAT STREET L	RD_008	2300-0000	0.0788025	1.973E-08	4.052E-07	0.0719054	1.8E-08	3.697E-07	0.4973038	1.245E-07	2.557E-06	0.4303506	1.078E-07	2.213E-06	0.502256	1.258E-07	2.583E-06
CHUN YAT STREET R	RD_009	0000-0100	0.1483597	2.972E-09	5.128E-08	0.1363548	2.731E-09	4.713E-08	0.7808855	1.564E-08	2.699E-07	0.6885028	1.379E-08	2.38E-07	0.8248575	1.652E-08	2.851E-07
CHUN YAT STREET R	RD_009	0100-0200	0.1506401	3.017E-09	5.207E-08	0.1386841	2.778E-09	4.793E-08	0.7863217	1.575E-08	2.718E-07	0.6948116	1.392E-08	2.402E-07	0.8334958	1.669E-08	2.881E-07
CHUN YAT STREET R	RD_009	0200-0300	0.1534029	3.073E-09	5.302E-08	0.1407921	2.82E-09	4.866E-08	0.7983196	1.599E-08	2.759E-07	0.7004574	1.403E-08	2.421E-07	0.8412495	1.685E-08	2.908E-07
CHUN YAT STREET R	RD_009	0300-0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHUN YAT STREET R	RD_009	0400-0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHUN YAT STREET R	RD_009	0500-0600	0.1583602	3.171E-09	5.472E-08	0.1466445	2.936E-09	5.067E-08	0.81564	1.633E-08	2.818E-07	0.7243265	1.45E-08	2.503E-07	0.870971	1.744E-08	3.009E-07
CHUN YAT STREET R	RD_009	0600-0700	0.1597769	6.4E-09	1.104E-07	0.1480699	5.932E-09	1.024E-07	0.8179618	3.277E-08	5.654E-07	0.7270825	2.913E-08	5.026E-07	0.8751524	3.506E-08	6.05E-07
CHUN YAT STREET R	RD_009	0700-0800	0.1599498	1.281E-08	2.211E-07	0.1496872	1.199E-08	2.069E-07	0.8118875	6.504E-08	1.122E-06	0.7331886	5.874E-08	1.014E-06	0.8828757	7.073E-08	1.22E-06
CHUN YAT STREET R	RD_009	0800-0900	0.1610178	9.676E-09	1.67E-07	0.1508516	9.065E-09	1.564E-07	0.8061784	4.845E-08	8.36E-07	0.7308332	4.392E-08	7.579E-07	0.8816849	5.298E-08	9.143E-07
CHUN YAT STREET R	RD_009	0900-1000	0.1733299	1.042E-08	1.797E-07	0.1618784	9.727E-09	1.679E-07	0.8367606	5.028E-08	8.676E-07	0.7572558	4.55E-08	7.852E-07	0.9191341	5.523E-08	9.531E-07
CHUN YAT STREET R	RD_009	1000-1100	0.1919188	7.687E-09	1.327E-07	0.1795183	7.191E-09	1.241E-07	0.8864987	3.551E-08	6.127E-07	0.8071038	3.233E-08	5.579E-07	0.9866221	3.952E-08	6.82E-07
CHUN YAT STREET R	RD_009	1100-1200	0.1788886	1.075E-08	1.854E-07	0.1660209	9.973E-09	1.721E-07	0.8527454	5.122E-08	8.84E-07	0.7656673	4.599E-08	7.937E-07	0.9316882	5.597E-08	9.658E-07
CHUN YAT STREET R	RD_009	1200-1300	0.1532266	3.069E-08	5.297E-07	0.1419927	2.844E-08	4.908E-07	0.7816945	1.566E-07	2.702E-06	0.6989405	1.4E-07	2.416E-06	0.8409333	1.685E-07	2.907E-06
CHUN YAT STREET R	RD_009	1300-1400	0.1508621	4.533E-08	7.821E-07	0.1393205	4.186E-08	7.223E-07	0.7818986	2.349E-07	4.054E-06	0.6954538	2.089E-07	3.606E-06	0.8347743	2.508E-07	4.328E-06
CHUN YAT STREET R	RD_009	1400-1500	0.1544581	3.094E-08	5.339E-07	0.1417159	2.838E-08	4.898E-07	0.7849966	1.572E-07	2.713E-06	0.6904871	1.383E-07	2.387E-06	0.832203	1.667E-07	2.876E-06
CHUN YAT STREET R	RD_009	1500-1600	0.1543023	2.781E-08	4.799E-07	0.1427383	2.573E-08	4.439E-07	0.778962	1.404E-07	2.423E-06	0.6922915	1.248E-07	2.153E-06	0.8350298	1.505E-07	2.597E-06
CHUN YAT STREET R	RD_009	1600-1700	0.1483315	2.971E-08	5.127E-07	0.1381958	2.768E-08	4.777E-07	0.7625913	1.527E-07	2.636E-06	0.6861158	1.374E-07	2.371E-06	0.8243116	1.651E-07	2.849E-06
CHUN YAT STREET R	RD_009	1700-1800	0.1404805	3.94E-08	6.798E-07	0.1308683	3.67E-08	6.333E-07	0.737714	2.069E-07	3.57E-06	0.6625478	1.858E-07	3.206E-06	0.7934161	2.225E-07	3.84E-06
CHUN YAT STREET R	RD_009	1800-1900	0.1381755	4.151E-08	7.162E-07	0.1284644	3.859E-08	6.659E-07	0.7294122	2.191E-07	3.781E-06	0.65359	1.963E-07	3.388E-06	0.7820544	2.349E-07	4.054E-06
CHUN YAT STREET R	RD_009	1900-2000	0.1348023	3.509E-08	6.056E-07	0.125611	3.27E-08	5.643E-07	0.7188976	1.872E-07	3.23E-06	0.6452616	1.68E-07	2.899E-06	0.7708725	2.007E-07	3.463E-06
CHUN YAT STREET R	RD_009	2000-2100	0.1348106	2.43E-08	4.194E-07	0.1263206	2.277E-08	3.929E-07	0.7155899	1.29E-07	2.226E-06	0.6501771	1.172E-07	2.023E-06	0.7764977	1.4E-07	2.415E-06
CHUN YAT STREET R	RD_009	2100-2200	0.1358936	2.722E-08	4.696E-07	0.1261243	2.526E-08	4.359E-07	0.7304749	1.463E-07	2.525E-06	0.652492	1.307E-07	2.255E-06	0.7786162	1.559E-07	2.691E-06
CHUN YAT STREET R	RD_009	2200-2300	0.1341469	1.88E-08	3.245E-07	0.1241643	1.741E-08	3.003E-07	0.7237875	1.015E-07	1.751E-06	0.646373	9.061E-08	1.564E-06	0.7705373	1.08E-07	1.864E-06
CHUN YAT STREET R	RD_009	2300-0000	0.1347889	1.62E-08	2.795E-07	0.1235404	1.485E-08	2.562E-07	0.7295527	8.767E-08	1.513E-06	0.6407912	7.7E-08	1.329E-06	0.7643316	9.185E-08	1.585E-06
RESIDENTIAL ROAD L	RD_010	0000-0100	0.0263878	1.216E-07	4.197E-06	0.0234244	1.079E-07	3.725E-06	0.2934844	1.352E-06	4.667E-05	0.2403738	1.107E-06	3.823E-05	0.2637982	1.215E-06	4.195E-05
RESIDENTIAL ROAD L	RD_010	0100-0200	0.0321183	1.004E-07	3.465E-06	0.0287324	8.98E-08	3.1E-06	0.3050642	9.534E-07	3.291E-05	0.2506771	7.835E-07	2.704E-05	0.2794095	8.733E-07	3.014E-05
RESIDENTIAL ROAD L	RD_010	0200-0300	0.0368608	8.788E-08	3.034E-06	0.0331221	7.897E-08	2.726E-06	0.3078218	7.339E-07	2.533E-05	0.2544373	6.066E-07	2.094E-05	0.2875594	6.856E-07	2.367E-05
RESIDENTIAL ROAD L	RD_010	0300-0400	0.0423593	7.553E-08	2.607E-06	0.03852	6.868E-08	2.371E-06	0.3168689	5.65E-07	1.95E-05	0.2681611	4.781E-07	1.651E-05	0.3066811	5.468E-07	1.888E-05
RESIDENTIAL ROAD L	RD_010	0400-0500	0.0483379	8.134E-08	2.808E-06	0.0439159	7.39E-08	2.551E-06	0.3285777	5.529E-07	1.909E-05	0.2779408	4.677E-07	1.614E-05	0.3218568	5.416E-07	1.87E-05
RESIDENTIAL ROAD L	RD_010	0500-0600	0.0541032	1.279E-07	4.415E-06	0.0495426	1.171E-07	4.043E-06	0.3374702	7.977E-07	2.754E-05	0.2897499	6.849E-07	2.364E-05	0.3392925	8.02E-07	2.769E-05
RESIDENTIAL ROAD L	RD_010	0600-0700	0.0656116	4.364E-07	1.506E-05	0.0602599	4.008E-07	1.383E-05	0.3716046	2.471E-06	8.531E-05	0.3225134	2.145E-06	7.404E-05	0.3827733	2.546E-06	8.788E-05
RESIDENTIAL ROAD L	RD_010	0700-0800	0.0794648	9.535E-07	3.292E-05	0.0735412	8.824E-07	3.046E-05	0.4119907	4.944E-06	0.0001707	0.3644281	4.373E-06	0.000151	0.4379693	5.255E-06	0.0001814
RESIDENTIAL ROAD L	RD_010	0800-0900	0.0565388	7.464E-07	2.577E-05	0.0523022	6.905E-07	2.383E-05	0.3466672	4.576E-06	0.000158	0.3045303	4.02E-06	0.0001388	0.3568325	4.711E-06	0.0001626
RESIDENTIAL ROAD L	RD_010	0900-1000	0.0736417	7.996E-07	2.76E-05	0.067914	7.375E-07	2.546E-05	0.4113792	4.467E-06	0.0001542	0.3614889	3.925E-06	0.0001355	0.4294029	4.663E-06	0.000161
RESIDENTIAL ROAD L	RD_010	1000-1100	0.07492	7.608E-07	2.626E-05	0.0691932	7.026E-07	2.425E-05	0.4457908	4.527E-06	0.0001563	0.3919427	3.98E-06	0.0001374	0.4611359	4.683E-06	0.0001616
RESIDENTIAL ROAD L	RD_010	1100-1200	0.0726184	7.041E-07	2.43E-05	0.0667848	6.475E-07	2.235E-05	0.4207618	4.08E-06	0.0001408	0.3676009	3.564E-06	0.000123	0.4343857	4.212E-06	0.0001454
RESIDENTIAL ROAD L	RD_010	1200-1300	0.0789687	3.718E-07	1.283E-05	0.0732267	3.447E-07	1.19E-05	0.4083655	1.922E-06	6.636E-05	0.3647381	1.717E-06	5.927E-05	0.4379648	2.062E-06	7.117E-05
RESIDENTIAL ROAD L	RD_010	1300-1400	0.0949097	4.449E-07	1.536E-05	0.0877419	4.113E-07	1.42E-05	0.4750926	2.227E-06	7.688E-05	0.4237688	1.986E-06	6.857E-05	0.5115107	2.398E-06	8.277E-05
RESIDENTIAL ROAD L	RD_010	1400-1500	0.0772481	3.745E-07	1.293E-05	0.0707761	3.431E-07	1.185E-05	0.4014773	1.946E-06	6.719E-05	0.3532771	1.713E-06	5.913E-05	0.4240532	2.056E-06	7.097E-05
RESIDENTIAL ROAD L	RD_010	1500-1600	0.0719259	3.472E-07	1.199E-05	0.0663668	3.204E-07	1.106E-05	0.393104	1.898E-06	6.551E-05	0.3476681	1.678E-06	5.794E-05	0.4140348	1.999E-06	6.9E-05
RESIDENTIAL ROAD L	RD_010	1600-1700	0.0682224	3.58E-07	1.236E-05	0.0633089	3.322E-07	1.147E-05	0.383203	2.011E-06	6.942E-05	0.3418007	1.794E-06	6.192E-05	0.4051097	2.126E-06	7.339E-05
RESIDENTIAL ROAD L	RD_010	1700-1800	0.0467004	2.928E-07	1.011E-05	0.043274	2.713E-07	9.365E-06	0.2840299	1.781E-06	6.146E-05	0.2527427	1.584E-06	5.469E-05	0.2960167	1.856E-06	6.406E-05
RESIDENTIAL ROAD L	RD_010	1800-1900	0.0324119	2.078E-07	7.174E-06	0.0298061	1.911E-07	6.597E-06	0.2326092	1.491E-06	5.148E-05	0.2025482	1.299E-06	4.483E-05	0.2323543	1.49E-06	5.143E-05
RESIDENTIAL ROAD L	RD_010	1900-2000	0.0250101	1.408E-07	4.86E-06	0.0228114	1.284E-07	4.433E-06	0.2289725	1.289E-06	4.449E-05	0.1960419	1.104E-06	3.809E-05	0.2188533	1.232E-06	4.253E-05
RESIDENTIAL ROAD L	RD_010	2000-2100	0.0253235	1.162E-07	4.011E-06	0.0232525	1.067E-07	3.683E-06	0.2346926	1.077E-06	3.717E-05	0.2031682	9.321E-07	3.218E-05	0.2264207	1.039E-06	3.586E-05
RESIDENTIAL ROAD L	RD_010	2100-2200	0.0224252	9.792E-08	3.38E-06	0.020254	8.844E-08	3.053E-06	0.2607214	1.138E-06	3.93E-05	0.2199055	9.602E-07	3.315E-05	0.2401595	1.049E-06	3.62E-05
RESIDENTIAL ROAD L	RD_010	2200-2300	0.0160814	6.862E-08	2.369E-06	0.0141687	6.046E-08	2.087E-06	0.2652316	1.132E-06	3.907E-05	0.2198625	9.382E-07	3.239E-05	0.2340312	9.987E-07	3.447E-05
RESIDENTIAL ROAD L	RD_010	2300-0000	0.021743	7.143E-08	2.466E-06	0.0192176	6.313E-08	2.179E-06	0.2786753	9.154E-07	3.16E-05	0.229642	7.544E-07	2.604E-05	0.2488596	8.175E-07	2.822E-05
RESIDENTIAL ROAD R	RD_011	0000-0100	0.0591495	8.717E-08	3.551E-06	0.0545293	8.036E-08	3.273E-06	0.6398424	9.43E-07	3.841E-05	0.5718796	8.428E-07	3.433E-05	0.6264089	9.232E-07	3.76E-05
RESIDENTIAL ROAD R	RD_011	0100-0200	0.0651971	6.569E-08	2.676E-06	0.0602124	6.066E-08	2.471E-06	0.6450125	6.499E-07	2.647E-05	0.5773246	5.817E-07	2.369E-05	0.637537	6.423E-07	2.616E-05
RESIDENTIAL ROAD R	RD_011	0200-0300	0.0707417	5.543E-08	2.258E-06	0.0653889	5.124E-08	2.087E-06	0.6446355	5.051E-07	2.058E-05	0.5779906	4.529E-07	1.845E-05	0.6433795	5.042E-07	2.054E-05
RESIDENTIAL ROAD R	RD_011	0300-0400	0.0778453	4.648E-08	1.893E-06	0.0723884	4.322E-08	1.761E-06	0.6625294	3.956E-07	1.611E-05	0.6007464	3.587E-07	1.461E-05	0.6731349	4.019E-07	1.637E-05
RESIDENTIAL ROAD R	RD_011	0400-0500	0.0849842	4.757E-08	1.938E-06	0.0788444	4.413E-08	1.798E-06	0.6775292	3.792E-07	1.545E-05	0.6130181	3.431E-07	1.398E-05	0.6918625	3.873E-07	1.577E-05
RESIDENTIAL ROAD R	RD_011	0500-0600	0.0938409	7.529E-08	3.067E-06	0.0873443	7.008E-08	2.855E-06	0.7030422	5.641E-07	2.298E-05	0.6401457	5.136E-07	2.092E-05	0.72749	5.837E-07	2.378E-05
RESIDENTIAL ROAD R	RD_011	0600-0700	0.105628	2.365E-07	9.634E-06	0.0983834	2.203E-07	8.973E-06	0.7366328	1.649E-06	6.718E-05	0.6730302	1.507E-06	6.138E-05	0.7714135	1.727E-06	7.036E-05

Road Name	Road ID	Hour	NO2 Emission						NO Emission						NOX Emission		
			MonthlyHourMin			MonthlyHourAverage			MonthlyHourMin			MonthlyHourAverage			MonthlyHourAverage		
			g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour
RESIDENTIAL ROAD R	RD_011	0700-0800	0.1187928	4.854E-07	1.977E-05	0.1112572	4.546E-07	1.852E-05	0.7794845	3.185E-06	0.0001297	0.7187855	2.937E-06	0.0001196	0.8300427	3.392E-06	0.0001381
RESIDENTIAL ROAD R	RD_011	0800-0900	0.0910225	3.974E-07	1.619E-05	0.0854191	3.73E-07	1.519E-05	0.6443412	2.813E-06	0.0001146	0.5926251	2.588E-06	0.0001054	0.6780441	2.961E-06	0.0001206
RESIDENTIAL ROAD R	RD_011	0900-1000	0.1305706	5.165E-07	2.104E-05	0.121905	4.822E-07	1.964E-05	0.8243863	3.261E-06	0.0001328	0.7575148	2.997E-06	0.0001221	0.8794198	3.479E-06	0.0001417
RESIDENTIAL ROAD R	RD_011	1000-1100	0.1399235	5.351E-07	2.179E-05	0.1308655	5.004E-07	2.038E-05	0.8842756	3.381E-06	0.0001377	0.8137914	3.112E-06	0.0001268	0.9446569	3.612E-06	0.0001471
RESIDENTIAL ROAD R	RD_011	1100-1200	0.1345557	4.796E-07	1.954E-05	0.1252427	4.464E-07	1.818E-05	0.8256267	2.943E-06	0.0001199	0.7553798	2.693E-06	0.0001097	0.8806226	3.139E-06	0.0001279
RESIDENTIAL ROAD R	RD_011	1200-1300	0.1233485	3.13E-07	1.275E-05	0.1154651	2.93E-07	1.193E-05	0.8261518	2.096E-06	8.538E-05	0.7640734	1.939E-06	7.896E-05	0.8795384	2.232E-06	9.09E-05
RESIDENTIAL ROAD R	RD_011	1300-1400	0.1394396	3.617E-07	1.473E-05	0.1300702	3.374E-07	1.374E-05	0.9158595	2.376E-06	9.677E-05	0.84438	2.19E-06	8.921E-05	0.9744502	2.528E-06	0.000103
RESIDENTIAL ROAD R	RD_011	1400-1500	0.123161	3.24E-07	1.32E-05	0.1140893	3.001E-07	1.223E-05	0.8285677	2.18E-06	8.879E-05	0.7578332	1.994E-06	8.121E-05	0.8719225	2.294E-06	9.343E-05
RESIDENTIAL ROAD R	RD_011	1500-1600	0.1200997	3.16E-07	1.287E-05	0.1120443	2.948E-07	1.201E-05	0.8288003	2.181E-06	8.882E-05	0.7626586	2.007E-06	8.173E-05	0.8747029	2.301E-06	9.374E-05
RESIDENTIAL ROAD R	RD_011	1600-1700	0.1109707	3.148E-07	1.282E-05	0.1040753	2.952E-07	1.202E-05	0.8161006	2.315E-06	9.429E-05	0.7559749	2.144E-06	8.734E-05	0.8600502	2.44E-06	9.937E-05
RESIDENTIAL ROAD R	RD_011	1700-1800	0.0787074	2.541E-07	1.035E-05	0.0738579	2.384E-07	9.711E-06	0.6425603	2.074E-06	8.449E-05	0.5957105	1.923E-06	7.833E-05	0.6695684	2.161E-06	8.804E-05
RESIDENTIAL ROAD R	RD_011	1800-1900	0.0629892	2.045E-07	8.331E-06	0.0590454	1.917E-07	7.809E-06	0.5990243	1.945E-06	7.923E-05	0.5528031	1.795E-06	7.311E-05	0.6118486	1.987E-06	8.092E-05
RESIDENTIAL ROAD R	RD_011	1900-2000	0.0548695	1.566E-07	6.38E-06	0.0514701	1.469E-07	5.985E-06	0.6299705	1.798E-06	7.325E-05	0.5800383	1.656E-06	6.744E-05	0.6315084	1.803E-06	7.343E-05
RESIDENTIAL ROAD R	RD_011	2000-2100	0.0567621	1.313E-07	5.35E-06	0.0535151	1.238E-07	5.044E-06	0.6457737	1.494E-06	6.086E-05	0.5982723	1.384E-06	5.638E-05	0.6517874	1.508E-06	6.143E-05
RESIDENTIAL ROAD R	RD_011	2100-2200	0.0558162	1.229E-07	5.005E-06	0.0523402	1.152E-07	4.694E-06	0.7126258	1.569E-06	6.391E-05	0.6534985	1.439E-06	5.86E-05	0.7058388	1.554E-06	6.33E-05
RESIDENTIAL ROAD R	RD_011	2200-2300	0.0473247	1.016E-07	4.136E-06	0.0441092	9.465E-08	3.855E-06	0.6836713	1.467E-06	5.976E-05	0.6201743	1.331E-06	5.421E-05	0.6642835	1.425E-06	5.806E-05
RESIDENTIAL ROAD R	RD_011	2300-0000	0.0541775	8.998E-08	3.665E-06	0.0502178	8.34E-08	3.397E-06	0.7036338	1.169E-06	4.76E-05	0.6346457	1.054E-06	4.293E-05	0.6848634	1.137E-06	4.633E-05
RESIDENTIAL ROAD C	RD_012	0000-0100	0.0354379	1.979E-07	2.244E-06	0.031949	1.785E-07	2.023E-06	0.3888228	2.172E-06	2.462E-05	0.3306736	1.847E-06	2.094E-05	0.3626226	2.025E-06	2.296E-05
RESIDENTIAL ROAD C	RD_012	0100-0200	0.0408481	1.551E-07	1.758E-06	0.0369468	1.403E-07	1.59E-06	0.3956109	1.502E-06	1.703E-05	0.3362372	1.277E-06	1.447E-05	0.3731841	1.417E-06	1.606E-05
RESIDENTIAL ROAD C	RD_012	0200-0300	0.0469419	1.366E-07	1.549E-06	0.0426343	1.241E-07	1.407E-06	0.4057793	1.181E-06	1.339E-05	0.3475092	1.012E-06	1.147E-05	0.3901436	1.136E-06	1.287E-05
RESIDENTIAL ROAD C	RD_012	0300-0400	0.0518903	1.135E-07	1.287E-06	0.0477128	1.044E-07	1.183E-06	0.4100343	8.97E-07	1.017E-05	0.3596738	7.868E-07	8.92E-06	0.4073866	8.912E-07	1.01E-05
RESIDENTIAL ROAD C	RD_012	0400-0500	0.0581508	1.198E-07	1.359E-06	0.0533346	1.099E-07	1.246E-06	0.4235518	8.729E-07	9.896E-06	0.3695949	7.617E-07	8.635E-06	0.4229295	8.716E-07	9.881E-06
RESIDENTIAL ROAD C	RD_012	0500-0600	0.0659299	1.919E-07	2.176E-06	0.0606779	1.766E-07	2.002E-06	0.4431308	1.29E-06	1.462E-05	0.3899582	1.135E-06	1.287E-05	0.450636	1.312E-06	1.487E-05
RESIDENTIAL ROAD C	RD_012	0600-0700	0.0763405	6.238E-07	7.072E-06	0.0704898	5.76E-07	6.53E-06	0.4706271	3.846E-06	4.36E-05	0.417661	3.413E-06	3.869E-05	0.4881508	3.989E-06	4.522E-05
RESIDENTIAL ROAD C	RD_012	0700-0800	0.091111	1.347E-06	1.527E-05	0.0844981	1.25E-06	1.417E-05	0.5196493	7.685E-06	8.712E-05	0.4665899	6.9E-06	7.822E-05	0.551088	8.149E-06	9.239E-05
RESIDENTIAL ROAD C	RD_012	0800-0900	0.0663933	1.072E-06	1.215E-05	0.0617099	9.963E-07	1.129E-05	0.4307232	6.954E-06	7.883E-05	0.3856624	6.226E-06	7.059E-05	0.4473723	7.222E-06	8.188E-05
RESIDENTIAL ROAD C	RD_012	0900-1000	0.0902856	1.231E-06	1.395E-05	0.0835597	1.139E-06	1.291E-05	0.5328795	7.264E-06	8.236E-05	0.476448	6.495E-06	7.363E-05	0.5600077	7.634E-06	8.655E-05
RESIDENTIAL ROAD C	RD_012	1000-1100	0.094377	1.215E-06	1.377E-05	0.0876433	1.128E-06	1.279E-05	0.5765405	7.419E-06	8.411E-05	0.5176275	6.661E-06	7.552E-05	0.6052708	7.789E-06	8.831E-05
RESIDENTIAL ROAD C	RD_012	1100-1200	0.093601	1.142E-06	1.295E-05	0.0864516	1.055E-06	1.196E-05	0.5541114	6.762E-06	7.666E-05	0.4939577	6.028E-06	6.834E-05	0.5804094	7.083E-06	8.03E-05
RESIDENTIAL ROAD C	RD_012	1200-1300	0.0937975	6.291E-07	7.132E-06	0.0874913	5.868E-07	6.652E-06	0.5544924	3.719E-06	4.216E-05	0.5055868	3.391E-06	3.844E-05	0.593078	3.978E-06	4.509E-05
RESIDENTIAL ROAD C	RD_012	1300-1400	0.1098184	7.406E-07	8.396E-06	0.1020476	6.882E-07	7.802E-06	0.63149	4.258E-06	4.828E-05	0.5740388	3.871E-06	4.389E-05	0.6760864	4.559E-06	5.169E-05
RESIDENTIAL ROAD C	RD_012	1400-1500	0.0927804	6.424E-07	7.283E-06	0.0855074	5.921E-07	6.712E-06	0.5521876	3.823E-06	4.335E-05	0.4965437	3.438E-06	3.898E-05	0.5820511	4.03E-06	4.569E-05
RESIDENTIAL ROAD C	RD_012	1500-1600	0.0884214	6.106E-07	6.923E-06	0.0820902	5.669E-07	6.427E-06	0.547583	3.782E-06	4.287E-05	0.495272	3.42E-06	3.878E-05	0.5773622	3.987E-06	4.52E-05
RESIDENTIAL ROAD C	RD_012	1600-1700	0.0849921	6.361E-07	7.212E-06	0.0792024	5.928E-07	6.72E-06	0.5491485	4.11E-06	4.659E-05	0.4997878	3.741E-06	4.241E-05	0.5789902	4.333E-06	4.913E-05
RESIDENTIAL ROAD C	RD_012	1700-1800	0.0588008	5.166E-07	5.856E-06	0.054771	4.812E-07	5.455E-06	0.4167293	3.661E-06	4.15E-05	0.3791032	3.33E-06	3.776E-05	0.4338741	3.812E-06	4.321E-05
RESIDENTIAL ROAD C	RD_012	1800-1900	0.0437783	3.91E-07	4.433E-06	0.040594	3.626E-07	4.111E-06	0.3672664	3.281E-06	3.719E-05	0.3299025	2.947E-06	3.341E-05	0.3704965	3.309E-06	3.752E-05
RESIDENTIAL ROAD C	RD_012	1900-2000	0.0351699	2.759E-07	3.128E-06	0.0325039	2.55E-07	2.891E-06	0.3681574	2.888E-06	3.275E-05	0.3281927	2.575E-06	2.919E-05	0.3606966	2.83E-06	3.208E-05
RESIDENTIAL ROAD C	RD_012	2000-2100	0.0368685	2.353E-07	2.668E-06	0.0342612	2.187E-07	2.479E-06	0.3851801	2.458E-06	2.787E-05	0.3456604	2.206E-06	2.501E-05	0.3799216	2.425E-06	2.749E-05
RESIDENTIAL ROAD C	RD_012	2100-2200	0.0345554	2.099E-07	2.379E-06	0.031877	1.936E-07	2.195E-06	0.4243523	2.577E-06	2.922E-05	0.376183	2.285E-06	2.59E-05	0.40806	2.478E-06	2.81E-05
RESIDENTIAL ROAD C	RD_012	2200-2300	0.0274036	1.625E-07	1.842E-06	0.0249272	1.478E-07	1.676E-06	0.418349	2.481E-06	2.813E-05	0.3639934	2.159E-06	2.447E-05	0.3889205	2.306E-06	2.615E-05
RESIDENTIAL ROAD C	RD_012	2300-0000	0.0327863	1.5E-07	1.7E-06	0.0298442	1.365E-07	1.547E-06	0.424133	1.94E-06	2.199E-05	0.3688432	1.687E-06	1.913E-05	0.3986873	1.823E-06	2.067E-05

Doubled Traffic Scenario

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)
Doubled Traffic Scenario

Road Name	Road ID	Road Type	Speed Limit (km/hr)	Average Speed (km/hr)	Start Emission Estimated by Broad Brush Approach (Y/N)	Hour	Total Vehicles (Veh/hr)	01 - Private Cars	02 - Taxi	03 - Light Goods Vehicles<=2.5t	04 - Light Goods Vehicles 2.5-3.5t	05 - Light Goods Vehicles>3.5t	06 - Medium Goods Vehicles<=15t	07 - Medium Goods Vehicles15-24t	08 - Public Light Buses	09 - Private Light Bus <=3.5t	10 - Private Light Bus >3.5t	11 - Non-franchised Bus<=6.4t	12 - Non-franchised Bus 6.4-15t	13 - Non-franchised Bus 15-24t	14 - Franchised Bus Single Deck	15 - Franchised Bus Double Deck	16 - Motorcycles	17 - Heavy Goods Vehicles>24t	18 - Non-franchised Bus >24t	Total
								PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	HGV9	NFB9	
WAN PO ROAD L	RD_001		70	67.43	Y	0000-0100	1650	55.09%	32.17%	0.03%	3.14%	1.13%	0.30%	0.59%	0.21%	0.11%	0.88%	0.29%	0.20%	0.43%	0.03%	1.93%	3.33%	0.16%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.23	Y	0100-0200	1124	55.48%	29.93%	0.04%	3.43%	1.23%	0.38%	0.75%	0.22%	0.16%	1.28%	0.42%	0.29%	0.63%	0.03%	1.93%	3.61%	0.20%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.63	Y	0200-0300	860	55.93%	27.60%	0.04%	3.72%	1.33%	0.47%	0.92%	0.24%	0.22%	1.70%	0.55%	0.38%	0.84%	0.03%	1.91%	3.87%	0.24%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.97	Y	0300-0400	644	56.29%	25.31%	0.04%	4.02%	1.44%	0.55%	1.08%	0.26%	0.27%	2.10%	0.69%	0.48%	1.04%	0.03%	1.94%	4.19%	0.28%	0.00%	100%
WAN PO ROAD L	RD_001		70	69.01	Y	0400-0500	608	56.75%	22.90%	0.05%	4.32%	1.55%	0.63%	1.25%	0.28%	0.32%	2.52%	0.82%	0.57%	1.26%	0.03%	1.93%	4.47%	0.33%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.59	Y	0500-0600	856	57.21%	20.46%	0.05%	4.64%	1.67%	0.72%	1.42%	0.30%	0.38%	2.95%	0.97%	0.67%	1.47%	0.03%	1.93%	4.77%	0.37%	0.00%	100%
WAN PO ROAD L	RD_001		70	66.01	Y	0600-0700	2406	57.78%	17.88%	0.05%	4.95%	1.78%	0.82%	1.61%	0.32%	0.44%	3.44%	1.12%	0.77%	1.70%	0.03%	1.88%	5.03%	0.42%	0.00%	100%
WAN PO ROAD L	RD_001		70	61.69	Y	0700-0800	4350	58.27%	15.31%	0.06%	5.27%	1.89%	0.91%	1.79%	0.34%	0.50%	3.90%	1.26%	0.88%	1.93%	0.03%	1.86%	5.33%	0.47%	0.00%	100%
WAN PO ROAD L	RD_001		70	60.02	Y	0800-0900	4738	62.02%	18.97%	0.05%	4.52%	1.62%	0.69%	1.36%	0.21%	0.23%	1.76%	0.88%	0.61%	1.34%	0.04%	1.44%	3.90%	0.36%	0.00%	100%
WAN PO ROAD L	RD_001		70	63.29	Y	0900-1000	3970	56.70%	18.37%	0.08%	7.97%	2.86%	1.45%	2.86%	0.28%	0.17%	1.34%	0.63%	0.44%	0.96%	0.04%	1.85%	3.24%	0.75%	0.00%	100%
WAN PO ROAD L	RD_001		70	63.63	Y	1000-1100	3736	51.60%	23.51%	0.09%	9.09%	3.26%	1.75%	3.44%	0.19%	0.16%	1.24%	0.24%	0.17%	0.36%	0.09%	1.96%	1.96%	0.90%	0.00%	100%
WAN PO ROAD L	RD_001		70	64.00	Y	1100-1200	3550	53.46%	22.41%	0.08%	7.94%	2.85%	1.76%	3.47%	0.32%	0.12%	0.95%	0.37%	0.26%	0.57%	0.02%	1.77%	2.75%	0.91%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.48	Y	1200-1300	1428	52.18%	18.10%	0.10%	9.45%	3.39%	2.03%	3.99%	1.32%	0.33%	2.56%	0.67%	0.47%	1.02%	0.08%	1.86%	1.41%	1.04%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.37	Y	1300-1400	1454	45.68%	18.87%	0.12%	11.30%	4.06%	2.05%	4.03%	2.03%	0.32%	2.53%	1.18%	0.82%	1.80%	0.10%	2.00%	2.05%	1.05%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.42	Y	1400-1500	1472	52.88%	16.39%	0.10%	9.60%	3.45%	2.12%	4.17%	1.25%	0.28%	2.15%	0.54%	0.37%	0.81%	0.05%	1.89%	2.86%	1.09%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.43	Y	1500-1600	1470	52.08%	18.73%	0.10%	9.92%	3.56%	2.25%	4.43%	1.17%	0.21%	1.68%	0.22%	0.15%	0.34%	0.04%	1.93%	2.02%	1.16%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.24	Y	1600-1700	1590	52.07%	18.00%	0.11%	10.45%	3.75%	1.59%	3.13%	1.19%	0.17%	1.30%	0.68%	0.47%	1.04%	0.05%	2.01%	3.18%	0.82%	0.00%	100%
WAN PO ROAD L	RD_001		70	66.97	Y	1700-1800	1850	61.69%	13.27%	0.07%	6.77%	2.43%	0.81%	1.60%	1.51%	0.14%	1.12%	0.72%	0.50%	1.09%	0.03%	1.70%	6.13%	0.42%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.00	Y	1800-1900	1874	67.26%	14.87%	0.05%	4.87%	1.75%	0.59%	1.16%	1.58%	0.02%	0.18%	0.48%	0.34%	0.74%	0.01%	1.80%	3.99%	0.30%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.40	Y	1900-2000	1642	64.36%	20.35%	0.05%	4.39%	1.58%	0.19%	0.38%	1.60%	0.03%	0.23%	0.49%	0.34%	0.74%	0.09%	2.05%	3.04%	0.10%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.89	Y	2000-2100	1334	62.75%	22.92%	0.04%	3.93%	1.41%	0.36%	0.71%	1.25%	0.01%	0.08%	0.43%	0.30%	0.65%	0.04%	2.16%	2.78%	0.18%	0.00%	100%
WAN PO ROAD L	RD_001		70	67.99	Y	2100-2200	1272	56.20%	30.32%	0.04%	3.80%	1.36%	0.25%	0.49%	1.49%	0.01%	0.08%	0.33%	0.23%	0.50%	0.03%	2.41%	2.31%	0.13%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.08	Y	2200-2300	1236	52.86%	35.44%	0.04%	3.49%	1.25%	0.19%	0.38%	1.12%	0.01%	0.08%	0.03%	0.02%	0.04%	0.03%	2.23%	2.68%	0.10%	0.00%	100%
WAN PO ROAD L	RD_001		70	68.50	Y	2300-0000	956	53.01%	33.24%	0.04%	3.84%	1.38%	0.30%	0.59%	1.23%	0.06%	0.46%	0.15%	0.11%	0.23%	0.03%	2.24%	2.94%	0.15%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.09	Y	0000-0100	556	49.89%	29.14%	0.08%	7.83%	2.81%	0.75%	1.48%	0.73%	0.10%	0.79%	0.26%	0.18%	0.39%	0.03%	2.12%	3.01%	0.39%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.36	Y	0100-0200	384	49.69%	26.80%	0.09%	8.45%	3.03%	0.94%	1.86%	0.79%	0.15%	1.15%	0.37%	0.26%	0.57%	0.03%	2.11%	3.23%	0.49%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.50	Y	0200-0300	296	49.54%	24.45%	0.09%	9.06%	3.25%	1.14%	2.24%	0.84%	0.19%	1.50%	0.49%	0.34%	0.74%	0.03%	2.06%	3.43%	0.59%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.62	Y	0300-0400	224	49.30%	22.16%	0.10%	9.68%	3.48%	1.32%	2.60%	0.91%	0.24%	1.84%	0.60%	0.42%	0.91%	0.03%	2.07%	3.67%	0.68%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.63	Y	0400-0500	214	49.13%	19.83%	0.11%	10.30%	3.70%	1.51%	2.97%	0.96%	0.28%	2.18%	0.71%	0.50%	1.09%	0.03%	2.04%	3.87%	0.78%	0.00%	100%
WAN PO ROAD R	RD_002		70	69.46	Y	0500-0600	306	48.96%	17.51%	0.11%	10.92%	3.92%	1.70%	3.34%	1.02%	0.32%	2.52%	0.83%	0.57%	1.26%	0.03%	2.01%	4.08%	0.87%	0.00%	100%
WAN PO ROAD R	RD_002		70	68.46	Y	0600-0700	868	48.87%	15.12%	0.12%	11.51%	4.13%	1.91%	3.75%	1.07%	0.37%	2.91%	0.94%	0.65%	1.44%	0.03%	1.93%	4.25%	0.98%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.14	Y	0700-0800	1588	48.72%	12.80%	0.13%	12.12%	4.35%	2.10%	4.13%	1.12%	0.42%	3.26%	1.06%	0.73%	1.61%	0.03%	1.89%	4.45%	1.08%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.10	Y	0800-0900	1676	53.46%	16.35%	0.11%	10.71%	3.85%	1.65%	3.24%	0.72%	0.19%	1.52%	0.76%	0.53%	1.16%	0.04%	1.51%	3.36%	0.85%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.08	Y	0900-1000	1566	43.87%	14.21%	0.18%	16.97%	6.09%	3.10%	6.09%	0.87%	0.13%	1.04%	0.49%	0.34%	0.74%	0.04%	1.75%	2.51%	1.59%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.11	Y	1000-1100	1522	38.66%	17.61%	0.20%	18.75%	6.73%	3.60%	7.09%	0.56%	0.12%	0.93%	0.18%	0.12%	0.27%	0.08%	1.79%	1.47%	1.85%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.33	Y	1100-1200	1420	40.77%	17.09%	0.17%	16.66%	5.98%	3.70%	7.28%	0.95%	0.09%	0.73%	0.28%	0.20%	0.43%	0.02%	1.64%	2.10%	1.90%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.36	Y	1200-1300	2132	56.00%	19.42%	0.07%	7.01%	2.52%	1.51%	2.96%	0.95%	0.35%	2.74%	0.72%	0.50%	1.10%	0.08%	1.79%	1.51%	0.77%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.23	Y	1300-1400	2146	49.58%	20.48%	0.09%	8.48%	3.05%	1.54%	3.03%	1.48%	0.35%	2.75%	1.28%	0.89%	1.95%	0.10%	1.94%	2.22%	0.79%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.27	Y	1400-1500	2196	56.83%	17.61%	0.07%	7.13%	2.56%	1.58%	3.10%	0.90%	0.30%	2.31%	0.58%	0.40%	0.88%	0.05%	1.82%	3.08%	0.81%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.30	Y	1500-1600	2188	56.12%	20.18%	0.08%	7.39%	2.65%	1.68%	3.30%	0.84%	0.23%	1.81%	0.24%	0.17%	0.36%	0.04%	1.87%	2.17%	0.86%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.00	Y	1600-1700	2378	55.83%	19.30%	0.08%	7.75%	2.78%	1.18%	2.32%	0.86%	0.18%	1.39%	0.73%	0.51%	1.11%	0.05%	1.93%	3.41%	0.61%	0.00%	100%
WAN PO ROAD R	RD_002		70	65.45	Y	1700-1800	2834	64.54%	13.89%	0.05%	4.90%	1.76%	0.59%	1.16%	1.06%	0.15%	1.17%	0.75%	0.52%	1.14%	0.03%	1.60%	6.41%	0.30%	0.00%	100%
WAN PO ROAD R	RD_002		70	65.44	Y	1800-1900	2904	69.63%	15.39%	0.04%	3.49%	1.25%	0.42%	0.83%	1.09%	0.02%	0.19%	0.50%	0.35%	0.76%	0.01%	1.67%	4.13%	0.22%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.00	Y	1900-2000	2558	66.22%	20.94%	0.03%	3.12%	1.12%	0.14%	0.27%	1.10%	0.03%	0.24%	0.50%	0.35%	0.76%	0.08%	1.89%	3.13%	0.07%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.75	Y	2000-2100	2080	64.49%	23.55%	0.03%	2.79%	1.00%	0.26%	0.50%	0.86%	0.01%	0.08%	0.44%	0.31%	0.67%	0.04%	1.99%	2.85%	0.13%	0.00%	100%
WAN PO ROAD R	RD_002		70	66.90	Y	2100-2200	1984	57.71%	31.14%	0.03%	2.70%	0.97%	0.18%	0.35%	1.02%	0.01%	0.08%	0.34%	0.24%	0.52%	0.03%	2.22%	2.37%	0.09%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.03	Y	2200-2300	1936	54.10%	36.27%	0.03%	2.47%	0.89%	0.14%	0.27%	0.76%	0.01%	0.08%	0.03%	0.02%	0.04%	0.03%	2.05%	2.74%	0.07%	0.00%	100%
WAN PO ROAD R	RD_002		70	67.69	Y	2300-0000	1492	54.42%	34.12%	0.03%	2.72%	0.98%	0.21%	0.42%	0.85%	0.06%	0.48%	0.16%	0.11%	0.24%	0.03%	2.06%	3.01%	0.11%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0000-0100	738	52.61%	30.72%	0.07%	6.78%	2.43%	0.65%	1.28%	0.00%	0.11%	0.84%	0.27%	0.19%	0.41%	0.00%	0.12%	3.18%	0.33%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0100-0200	508	52.57%	28.36%	0.08%	7.33%	2.63%	0.82%	1.61%	0.00%	0.16%	1.21%	0.39%	0.27%	0.60%	0.00%	0.12%	3.42%	0.42%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0200-0300	392	52.57%	25.94%	0.08%	7.89%	2.83%	0.99%	1.95%	0.00%	0.20%	1.59%	0.52%	0.36%	0.79%	0.00%	0.12%	3.64%	0.51%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0300-0400	296	52.50%	23.60%	0.09%	8.46%	3.04%	1.16%	2.27%	0.00%	0.25%	1.96%	0.64%	0.44%	0.97%	0.00%	0.12%	3.90%	0.59%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0400-0500	280	52.49%	21.18%	0.09%	9.03%	3.24%	1.33%	2.61%	0.00%	0.30%	2.33%	0.76%	0.53%	1.16%	0.00%	0.12%	4.13%	0.68%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0500-0600	400	52.47%	18.77%	0.10%	9.61%	3.45%	1.50%	2.94%	0.00%	0.35%	2.71%	0.89%	0.61%	1.35%	0.00%	0.12%	4.37%	0.77%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0600-0700	1132	52.51%	16.25%	0.11%	10.16%	3.65%	1.68%	3.31%	0.00%	0.40%	3.12%	1.01%	0.70%	1.54%	0.00%	0.11%	4.57%	0.86%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0700-0800	2064	52.51%	13.80%	0.11%	10.72%	3.85%	1.86%	3.65%	0.00%	0.45%	3.51%	1.14%	0.79%	1.74%	0.00%	0.11%	4.80%	0.95%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0800-0900	2214	56.78%	17.36%	0.10%	9.34%	3.35%	1.44%	2.82%	0.00%	0.21%	1.61%	0.81%	0.56%	1.23%	0.00%	0.09%	3.57%	0.74%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	0900-1000	2004	48.02%	15.56%	0.16%	15.25%	5.48%	2.78%	5.47%	0.00%	0.15%	1.14%	0.53%	0.37%	0.81%	0.00%	0.10%	2.75%	1.43%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1000-1100	1938	42.56%	19.39%	0.18%	16.94%	6.08%	3.26%	6.40%	0.00%	0.13%	1.02%	0.20%	0.14%	0.30%	0.00%	0.11%	1.62%	1.67%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1100-1200	1814	44.76%	18.76%	0.16%	15.01%	5.39%	3.34%	6.56%	0.00%	0.10%	0.80%	0.31%	0.22%	0.47%	0.00%	0.10%	2.30%	1.71%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1200-1300	2284	57.95%	20.10%	0.07%	6.80%	2.44%	1.46%	2.87%	0.00%	0.36%	2.84%	0.75%	0.52%	1.14%	0.02%	0.36%	1.56%	0.75%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1300-1400	2280	51.74%	21.38%	0.09%	8.30%	2.98%	1.51%	2.96%	0.00%	0.37%	2.87%	1.34%	0.93%	2.04%	0.02%	0.40%	2.32%	0.77%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1400-1500	2352	58.80%	18.22%	0.07%	6.92%	2.49%	1.53%	3.01%	0.00%	0.31%	2.39%	0.59%	0.41%	0.91%	0.01%	0.37%	3.18%	0.79%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1500-1600	2344	58.08%	20.89%	0.07%	7.17%	2.58%	1.63%	3.20%	0.00%	0.24%	1.87%	0.25%	0.17%	0.37%	0.01%	0.38%	2.25%	0.84%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1600-1700	2548	57.78%	19.97%	0.08%	7.52%	2.70%	1.14%	2.25%	0.00%	0.18%	1.44%	0.75%	0.52%	1.15%	0.01%	0.39%	3.53%	0.59%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1700-1800	3050	66.47%	14.30%	0.05%	4.73%	1.70%	0.57%	1.12%	0.00%	0.15%	1.20%	0.77%	0.53%	1.17%	0.01%	0.32%	6.61%	0.29%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1800-1900	3126	71.66%	15.84%	0.04%	3.37%	1.21%	0.41%	0.80%	0.00%	0.02%	0.19%	0.52%	0.36%	0.79%	0.00%	0.34%	4.25%	0.21%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	1900-2000	2750	68.26%	21.59%	0.03%	3.02%	1.08%	0.13%	0.26%	0.00%	0.03%	0.24%	0.51%	0.36%	0.78%	0.02%	0.38%	3.23%	0.07%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	2000-2100	2242	66.33%	24.23%	0.03%	2.69%	0.97%	0.25%	0.48%	0.00%	0.01%	0.08%	0.45%	0.32%	0.69%	0.01%	0.40%	2.93%	0.13%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	2100-2200	2132	59.56%	32.13%	0.03%	2.61%	0.94%	0.17%	0.34%	0.00%	0.01%	0.09%	0.35%	0.24%	0.53%	0.01%	0.45%	2.45%	0.09%	0.00%	100%

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)
Doubled Traffic Scenario

Road Name	Road ID	Road Type	Speed Limit (km/hr)	Average Speed (km/hr)	Start Emission Estimated by Broad Brush Approach (Y/N)	Hour	Total Vehicles (Veh/hr)	01 - Private Cars	02 - Taxi	03 - Light Goods Vehicles<=2.5t	04 - Light Goods Vehicles 2.5-3.5t	05 - Light Goods Vehicles>3.5t	06 - Medium Goods Vehicles<=15t	07 - Medium Goods Vehicles15-24t	08 - Public Light Buses	09 - Private Light Bus <=3.5t	10 - Private Light Bus >3.5t	11 - Non-franchised Bus<=6.4t	12 - Non-franchised Bus 6.4-15t	13 - Non-franchised Bus 15-24t	14 - Franchised Bus Single Deck	15 - Franchised Bus Double Deck	16 - Motorcycles	17 - Heavy Goods Vehicles>24t	18 - Non-franchised Bus >24t	Total
								PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	HGV9	NFB9	
CROSS BAY LINK L	RD_003		80	80.00	Y	2200-2300	2088	55.59%	37.27%	0.02%	2.38%	0.85%	0.13%	0.26%	0.00%	0.01%	0.09%	0.03%	0.02%	0.05%	0.01%	0.41%	2.81%	0.07%	0.00%	100%
CROSS BAY LINK L	RD_003		80	80.00	Y	2300-0000	1608	55.99%	35.11%	0.03%	2.63%	0.94%	0.20%	0.40%	0.00%	0.06%	0.49%	0.16%	0.11%	0.24%	0.01%	0.42%	3.10%	0.10%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0000-0100	1992	57.48%	33.57%	0.02%	1.91%	0.69%	0.18%	0.36%	0.00%	0.12%	0.91%	0.30%	0.21%	0.45%	0.00%	0.23%	3.47%	0.09%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0100-0200	1354	58.07%	31.33%	0.02%	2.09%	0.75%	0.23%	0.46%	0.00%	0.17%	1.34%	0.44%	0.30%	0.66%	0.00%	0.23%	3.78%	0.12%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0200-0300	1032	58.73%	28.98%	0.02%	2.27%	0.82%	0.29%	0.56%	0.00%	0.23%	1.78%	0.58%	0.40%	0.88%	0.00%	0.23%	4.07%	0.15%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0300-0400	770	59.32%	26.67%	0.03%	2.47%	0.89%	0.34%	0.66%	0.00%	0.28%	2.21%	0.72%	0.50%	1.10%	0.00%	0.23%	4.41%	0.17%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0400-0500	724	60.00%	24.21%	0.03%	2.66%	0.96%	0.39%	0.77%	0.00%	0.34%	2.67%	0.87%	0.60%	1.33%	0.00%	0.23%	4.73%	0.20%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0500-0600	1016	60.69%	21.71%	0.03%	2.87%	1.03%	0.45%	0.88%	0.00%	0.40%	3.13%	1.02%	0.71%	1.56%	0.00%	0.23%	5.06%	0.23%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	0600-0700	2848	61.48%	19.02%	0.03%	3.07%	1.10%	0.51%	1.00%	0.00%	0.47%	3.66%	1.19%	0.82%	1.81%	0.00%	0.23%	5.35%	0.26%	0.00%	100%
CROSS BAY LINK R	RD_004		80	76.84	Y	0700-0800	5132	62.22%	16.35%	0.03%	3.28%	1.18%	0.57%	1.12%	0.00%	0.53%	4.16%	1.35%	0.94%	2.06%	0.00%	0.23%	5.69%	0.29%	0.00%	100%
CROSS BAY LINK R	RD_004		80	75.32	Y	0800-0900	5664	65.36%	19.99%	0.03%	2.77%	1.00%	0.43%	0.84%	0.00%	0.24%	1.86%	0.93%	0.64%	1.41%	0.00%	0.17%	4.11%	0.22%	0.00%	100%
CROSS BAY LINK R	RD_004		80	79.24	Y	0900-1000	4570	62.05%	20.11%	0.05%	5.08%	1.82%	0.93%	1.82%	0.00%	0.19%	1.47%	0.69%	0.48%	1.05%	0.01%	0.23%	3.55%	0.48%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1000-1100	4248	57.17%	26.05%	0.06%	5.87%	2.11%	1.13%	2.22%	0.00%	0.18%	1.37%	0.26%	0.18%	0.40%	0.01%	0.25%	2.17%	0.58%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1100-1200	4070	58.74%	24.62%	0.05%	5.08%	1.83%	1.13%	2.22%	0.00%	0.13%	1.05%	0.41%	0.28%	0.62%	0.00%	0.22%	3.02%	0.58%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1200-1300	1670	56.81%	19.70%	0.08%	7.73%	2.78%	1.66%	3.26%	0.00%	0.36%	2.78%	0.73%	0.51%	1.11%	0.00%	0.10%	1.53%	0.85%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1300-1400	1672	50.56%	20.89%	0.10%	9.40%	3.38%	1.71%	3.35%	0.00%	0.36%	2.80%	1.31%	0.91%	1.99%	0.01%	0.11%	2.27%	0.88%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1400-1500	1720	57.60%	17.85%	0.08%	7.86%	2.82%	1.74%	3.42%	0.00%	0.30%	2.34%	0.58%	0.40%	0.89%	0.00%	0.10%	3.12%	0.89%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1500-1600	1716	56.84%	20.44%	0.08%	8.14%	2.92%	1.85%	3.63%	0.00%	0.23%	1.83%	0.24%	0.17%	0.37%	0.00%	0.10%	2.20%	0.95%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1600-1700	1862	56.65%	19.58%	0.09%	8.54%	3.07%	1.30%	2.56%	0.00%	0.18%	1.41%	0.74%	0.51%	1.13%	0.00%	0.11%	3.46%	0.67%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1700-1800	2210	65.74%	14.15%	0.06%	5.43%	1.95%	0.65%	1.28%	0.00%	0.15%	1.19%	0.76%	0.53%	1.16%	0.00%	0.09%	6.53%	0.33%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1800-1900	2256	71.15%	15.73%	0.04%	3.87%	1.39%	0.47%	0.93%	0.00%	0.02%	0.19%	0.51%	0.36%	0.78%	0.00%	0.09%	4.22%	0.24%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	1900-2000	1980	67.96%	21.49%	0.04%	3.48%	1.25%	0.15%	0.30%	0.00%	0.03%	0.24%	0.51%	0.36%	0.78%	0.00%	0.11%	3.21%	0.08%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	2000-2100	1614	66.05%	24.12%	0.03%	3.11%	1.12%	0.28%	0.56%	0.00%	0.01%	0.08%	0.45%	0.31%	0.69%	0.00%	0.11%	2.92%	0.15%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	2100-2200	1532	59.36%	32.02%	0.03%	3.02%	1.08%	0.20%	0.39%	0.00%	0.01%	0.09%	0.35%	0.24%	0.53%	0.00%	0.12%	2.44%	0.10%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	2200-2300	1500	55.43%	37.16%	0.03%	2.75%	0.99%	0.15%	0.30%	0.00%	0.01%	0.09%	0.03%	0.02%	0.05%	0.00%	0.12%	2.80%	0.08%	0.00%	100%
CROSS BAY LINK R	RD_004		80	80.00	Y	2300-0000	1156	55.78%	34.98%	0.03%	3.03%	1.09%	0.24%	0.46%	0.00%	0.06%	0.49%	0.16%	0.11%	0.24%	0.00%	0.12%	3.09%	0.12%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.42	Y	0000-0100	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.48%	98.52%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.61	Y	0100-0200	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.49%	98.51%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.70	Y	0200-0300	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.46%	98.54%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.77	Y	0300-0400	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.52%	98.48%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.79	Y	0400-0500	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.50%	98.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.70	Y	0500-0600	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.50%	98.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.18	Y	0600-0700	14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.38%	98.62%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.54	Y	0700-0800	24	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.35%	98.65%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.75	Y	0800-0900	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.40%	97.60%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.66	Y	0900-1000	22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.20%	97.80%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.63	Y	1000-1100	22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.40%	95.60%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.87	Y	1100-1200	18	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.28%	98.72%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.81	Y	1200-1300	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.25%	95.75%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.69	Y	1300-1400	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.79%	95.21%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.77	Y	1400-1500	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.51%	97.49%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.75	Y	1500-1600	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.17%	97.83%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.59	Y	1600-1700	22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.61%	97.39%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.63	Y	1700-1800	22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.56%	98.44%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.54	Y	1800-1900	24	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.50%	99.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.49	Y	1900-2000	24	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.98%	96.02%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.74	Y	2000-2100	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.88%	98.12%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.67	Y	2100-2200	22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.34%	98.66%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	28.80	Y	2200-2300	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.41%	98.59%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD L	RD_005		50	29.07	Y	2300-0000	14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.44%	98.56%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	29.42	Y	0000-0100	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.48%	98.52%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	30.07	Y	0100-0200	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.49%	98.51%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	29.70	Y	0200-0300	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.46%	98.54%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	31.07	Y	0300-0400	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.52%	98.48%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	29.79	Y	0400-0500	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.50%	98.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	32.07	Y	0500-0600	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.50%	98.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	29.18	Y	0600-0700	14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.38%	98.62%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	33.07	Y	0700-0800	26	4.29%	1.13%	0.01%	0.64%	0.23%	0.11%	0.22%	0.00%	0.04%	0.29%	0.09%	0.06%	0.14%	1.25%	91.06%	0.39%	0.06%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.86	Y	0800-0900	22	5.43%	1.66%	0.01%	0.65%	0.23%	0.10%	0.20%	0.00%	0.02%	0.15%	0.08%	0.05%	0.12%	2.18%	88.73%	0.34%	0.05%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	34.07	Y	0900-1000	22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.20%	97.80%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.63	Y	1000-1100	22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.40%	95.60%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	35.07	Y	1100-1200	18	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.28%	98.72%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.81	Y	1200-1300	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.25%	95.75%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	36.07	Y	1300-1400	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.79%	95.21%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.77	Y	1400-1500	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.51%	97.49%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	37.07	Y	1500-1600	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.17%	97.83%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.59	Y	1600-1700	22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.61%	97.39%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	38.07	Y	1700-1800	22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.56%	98.44%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.54	Y	1800-1900	24	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.50%	99.50%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	39.07	Y	1900-2000	24	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.98%	96.02%	0.00%	0.00%	0.00%	100%

Road Name	Road ID	Road Type	Speed Limit (km/hr)	Average Speed (km/hr)	Start Emission Estimated by Broad Brush Approach (Y/N)	Hour	Total Vehicles (Veh/hr)	01 - Private Cars	02 - Taxi	03 - Light Goods Vehicles<=2.5t	04 - Light Goods Vehicles 2.5-3.5t	05 - Light Goods Vehicles>3.5t	06 - Medium Goods Vehicles<=15t	07 - Medium Goods Vehicles15-24t	08 - Public Light Buses	09 - Private Light Bus <=3.5t	10 - Private Light Bus >3.5t	11 - Non-franchised Bus<=6.4t	12 - Non-franchised Bus 6.4-15t	13 - Non-franchised Bus 15-24t	14 - Franchised Bus Single Deck	15 - Franchised Bus Double Deck	16 - Motorcycles	17 - Heavy Goods Vehicles>24t	18 - Non-franchised Bus >24t	Total
								PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	HGV9	NFB9	
INDUSTRIAL ROAD C	RD_007		50	28.74	Y	2000-2100	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.88%	98.12%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	40.07	Y	2100-2200	22	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.34%	98.66%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	28.80	Y	2200-2300	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.41%	98.59%	0.00%	0.00%	0.00%	100%
INDUSTRIAL ROAD C	RD_007		50	41.07	Y	2300-0000	14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.44%	98.56%	0.00%	0.00%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.82	Y	0000-0100	6	14.19%	8.29%	0.07%	6.48%	2.33%	0.62%	1.22%	65.14%	0.03%	0.23%	0.07%	0.05%	0.11%	0.00%	0.00%	0.86%	0.32%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.87	Y	0100-0200	4	13.33%	7.19%	0.07%	6.59%	2.37%	0.74%	1.45%	66.35%	0.04%	0.31%	0.10%	0.07%	0.15%	0.00%	0.00%	0.87%	0.38%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.89	Y	0200-0300	4	12.61%	6.22%	0.07%	6.71%	2.41%	0.84%	1.66%	67.33%	0.05%	0.38%	0.12%	0.09%	0.19%	0.00%	0.00%	0.87%	0.43%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.91	Y	0300-0400	2	11.87%	5.34%	0.07%	6.78%	2.44%	0.93%	1.82%	68.43%	0.06%	0.44%	0.14%	0.10%	0.22%	0.00%	0.00%	0.88%	0.48%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.91	Y	0400-0500	2	11.27%	4.55%	0.07%	6.88%	2.47%	1.01%	1.99%	69.26%	0.06%	0.50%	0.16%	0.11%	0.25%	0.00%	0.00%	0.89%	0.52%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.87	Y	0500-0600	4	10.72%	3.83%	0.07%	6.96%	2.50%	1.08%	2.13%	70.05%	0.07%	0.55%	0.18%	0.13%	0.28%	0.00%	0.00%	0.89%	0.56%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.60	Y	0600-0700	10	10.31%	3.19%	0.07%	7.07%	2.54%	1.17%	2.30%	70.51%	0.08%	0.61%	0.20%	0.14%	0.30%	0.00%	0.00%	0.90%	0.60%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.24	Y	0700-0800	20	9.87%	2.59%	0.07%	7.14%	2.56%	1.24%	2.43%	71.12%	0.08%	0.66%	0.21%	0.15%	0.33%	0.00%	0.00%	0.90%	0.64%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.43	Y	0800-0900	16	14.82%	4.53%	0.09%	8.64%	3.10%	1.33%	2.61%	62.12%	0.05%	0.42%	0.21%	0.15%	0.32%	0.00%	0.00%	0.93%	0.68%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.34	Y	0900-1000	18	10.12%	3.28%	0.12%	11.39%	4.09%	2.08%	4.09%	62.56%	0.03%	0.24%	0.11%	0.08%	0.17%	0.00%	0.00%	0.58%	1.07%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.48	Y	1000-1100	14	11.19%	5.10%	0.16%	15.79%	5.67%	3.04%	5.97%	50.62%	0.03%	0.27%	0.05%	0.04%	0.08%	0.00%	0.00%	0.42%	1.56%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.35	Y	1100-1200	18	8.78%	3.68%	0.11%	10.44%	3.75%	2.32%	4.56%	64.34%	0.02%	0.16%	0.06%	0.04%	0.09%	0.00%	0.00%	0.45%	1.19%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.70	Y	1200-1300	38	27.66%	9.59%	0.07%	6.59%	2.37%	1.42%	2.78%	45.38%	0.17%	1.36%	0.36%	0.25%	0.54%	0.00%	0.00%	0.75%	0.73%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.30	Y	1300-1400	48	19.46%	8.04%	0.07%	6.33%	2.27%	1.15%	2.26%	56.12%	0.14%	1.08%	0.50%	0.35%	0.77%	0.00%	0.00%	0.87%	0.59%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.70	Y	1400-1500	38	28.71%	8.90%	0.07%	6.86%	2.46%	1.52%	2.98%	43.92%	0.15%	1.17%	0.29%	0.20%	0.44%	0.00%	0.00%	1.55%	0.78%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.74	Y	1500-1600	38	29.04%	10.44%	0.08%	7.28%	2.61%	1.65%	3.25%	42.22%	0.12%	0.94%	0.12%	0.09%	0.19%	0.00%	0.00%	1.12%	0.85%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.64	Y	1600-1700	42	28.88%	9.98%	0.08%	7.62%	2.74%	1.16%	2.28%	42.87%	0.09%	0.72%	0.38%	0.26%	0.57%	0.00%	0.00%	1.76%	0.60%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.28	Y	1700-1800	52	31.06%	6.68%	0.05%	4.49%	1.61%	0.54%	1.06%	49.36%	0.07%	0.56%	0.36%	0.25%	0.55%	0.00%	0.00%	3.09%	0.28%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.25	Y	1800-1900	54	33.33%	7.37%	0.03%	3.18%	1.14%	0.39%	0.76%	50.76%	0.01%	0.09%	0.24%	0.17%	0.37%	0.00%	0.00%	1.98%	0.20%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.47	Y	1900-2000	48	31.90%	10.09%	0.03%	2.86%	1.03%	0.13%	0.25%	51.24%	0.01%	0.11%	0.24%	0.17%	0.37%	0.00%	0.00%	1.51%	0.06%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.92	Y	2000-2100	34	34.98%	12.78%	0.03%	2.88%	1.04%	0.26%	0.52%	45.01%	0.01%	0.04%	0.24%	0.17%	0.37%	0.00%	0.00%	1.55%	0.14%	0.00%	100%
CHUN YAT STREET L	RD_008		50	28.87	Y	2100-2200	36	28.87%	15.58%	0.03%	2.57%	0.92%	0.17%	0.33%	49.66%	0.01%	0.04%	0.17%	0.12%	0.26%	0.00%	0.00%	1.19%	0.09%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.07	Y	2200-2300	30	30.97%	20.77%	0.03%	2.69%	0.97%	0.15%	0.29%	42.38%	0.01%	0.05%	0.02%	0.01%	0.03%	0.00%	0.00%	1.57%	0.08%	0.00%	100%
CHUN YAT STREET L	RD_008		50	29.23	Y	2300-0000	24	29.72%	18.63%	0.03%	2.83%	1.02%	0.22%	0.43%	44.80%	0.03%	0.26%	0.08%	0.06%	0.13%	0.00%	0.00%	1.65%	0.11%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.94	Y	0000-0100	2	1.78%	1.04%	0.09%	8.25%	2.96%	0.79%	1.56%	82.96%	0.00%	0.03%	0.01%	0.01%	0.01%	0.00%	0.00%	0.11%	0.41%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.95	Y	0100-0200	2	1.64%	0.88%	0.09%	8.23%	2.95%	0.92%	1.81%	82.83%	0.00%	0.04%	0.01%	0.01%	0.02%	0.00%	0.00%	0.11%	0.47%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.96	Y	0200-0300	2	1.52%	0.75%	0.09%	8.24%	2.96%	1.04%	2.04%	82.63%	0.01%	0.05%	0.01%	0.01%	0.02%	0.00%	0.00%	0.11%	0.53%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.97	Y	0300-0400	0	1.41%	0.63%	0.09%	8.19%	2.94%	1.12%	2.20%	82.63%	0.01%	0.05%	0.02%	0.01%	0.03%	0.00%	0.00%	0.10%	0.57%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.97	Y	0400-0500	0	1.32%	0.53%	0.09%	8.19%	2.94%	1.20%	2.36%	82.51%	0.01%	0.06%	0.02%	0.01%	0.03%	0.00%	0.00%	0.10%	0.62%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.95	Y	0500-0600	2	1.24%	0.44%	0.09%	8.19%	2.94%	1.27%	2.50%	82.43%	0.01%	0.06%	0.02%	0.01%	0.03%	0.00%	0.00%	0.10%	0.65%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.86	Y	0600-0700	4	1.18%	0.37%	0.09%	8.24%	2.96%	1.37%	2.68%	82.17%	0.01%	0.07%	0.02%	0.02%	0.03%	0.00%	0.00%	0.10%	0.70%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.73	Y	0700-0800	8	1.12%	0.29%	0.09%	8.24%	2.96%	1.43%	2.81%	82.07%	0.01%	0.07%	0.02%	0.02%	0.04%	0.00%	0.00%	0.10%	0.73%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.80	Y	0800-0900	6	1.81%	0.55%	0.11%	10.71%	3.85%	1.65%	3.24%	76.99%	0.01%	0.05%	0.03%	0.02%	0.04%	0.00%	0.00%	0.11%	0.85%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.76	Y	0900-1000	6	1.15%	0.37%	0.14%	13.12%	4.71%	2.39%	4.71%	72.05%	0.00%	0.03%	0.01%	0.01%	0.02%	0.00%	0.00%	0.07%	1.23%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.82	Y	1000-1100	4	1.30%	0.59%	0.20%	18.69%	6.71%	3.59%	7.06%	59.91%	0.00%	0.03%	0.01%	0.00%	0.01%	0.00%	0.00%	0.05%	1.85%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.76	Y	1100-1200	6	0.98%	0.41%	0.12%	11.86%	4.26%	2.64%	5.18%	73.09%	0.00%	0.02%	0.01%	0.00%	0.01%	0.00%	0.00%	0.05%	1.35%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.24	Y	1200-1300	20	2.95%	1.02%	0.05%	4.50%	1.61%	0.97%	1.90%	86.15%	0.02%	0.14%	0.04%	0.03%	0.06%	0.00%	0.00%	0.08%	0.50%	0.00%	100%
CHUN YAT STREET R	RD_009		50	28.85	Y	1300-1400	30	1.75%	0.72%	0.04%	3.65%	1.31%	0.66%	1.30%	89.90%	0.01%	0.10%	0.05%	0.03%	0.07%	0.00%	0.00%	0.08%	0.34%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.25	Y	1400-1500	20	3.13%	0.97%	0.05%	4.78%	1.72%	1.06%	2.08%	85.26%	0.02%	0.13%	0.03%	0.02%	0.05%	0.00%	0.00%	0.17%	0.54%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.29	Y	1500-1600	18	3.24%	1.17%	0.05%	5.21%	1.87%	1.18%	2.33%	84.05%	0.01%	0.10%	0.01%	0.01%	0.02%	0.00%	0.00%	0.13%	0.61%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.22	Y	1600-1700	20	3.21%	1.11%	0.06%	5.43%	1.95%	0.83%	1.63%	84.95%	0.01%	0.08%	0.04%	0.03%	0.06%	0.00%	0.00%	0.20%	0.42%	0.00%	100%
CHUN YAT STREET R	RD_009		50	28.93	Y	1700-1800	28	3.19%	0.69%	0.03%	2.95%	1.06%	0.35%	0.70%	90.35%	0.01%	0.06%	0.04%	0.03%	0.06%	0.00%	0.00%	0.32%	0.18%	0.00%	100%
CHUN YAT STREET R	RD_009		50	28.89	Y	1800-1900	30	3.38%	0.75%	0.02%	2.07%	0.74%	0.25%	0.49%	91.87%	0.00%	0.01%	0.02%	0.02%	0.04%	0.00%	0.00%	0.20%	0.13%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.03	Y	1900-2000	26	3.24%	1.02%	0.02%	1.86%	0.67%	0.08%	0.16%	92.66%	0.00%	0.01%	0.02%	0.02%	0.04%	0.00%	0.00%	0.15%	0.04%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.37	Y	2000-2100	18	3.96%	1.45%	0.02%	2.09%	0.75%	0.19%	0.38%	90.80%	0.00%	0.00%	0.03%	0.02%	0.04%	0.00%	0.00%	0.18%	0.10%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.30	Y	2100-2200	20	3.01%	1.63%	0.02%	1.72%	0.62%	0.11%	0.22%	92.43%	0.00%	0.00%	0.02%	0.01%	0.03%	0.00%	0.00%	0.12%	0.06%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.48	Y	2200-2300	14	3.71%	2.48%	0.02%	2.06%	0.74%	0.11%	0.22%	90.39%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.19%	0.06%	0.00%	100%
CHUN YAT STREET R	RD_009		50	29.56	Y	2300-0000	12	3.38%	2.12%	0.02%	2.06%	0.74%	0.16%	0.32%	90.87%	0.00%	0.03%	0.01%	0.01%	0.01%	0.00%	0.00%	0.19%	0.08%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.63	Y	0000-0100	460	56.85%	33.20%	0.03%	2.67%	0.96%	0.26%	0.50%	0.00%	0.12%	0.90%	0.29%	0.20%	0.45%	0.00%	0.00%	3.43%	0.13%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	24.37	Y	0100-0200	312	57.34%	30.93%	0.03%	2.91%	1.05%	0.33%	0.64%	0.00%	0.17%	1.32%	0.43%	0.30%	0.66%	0.00%	0.00%	3.73%	0.17%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	24.74	Y	0200-0300	238	57.89%	28.57%	0.03%	3.17%	1.14%	0.40%	0.78%	0.00%	0.22%	1.76%	0.57%	0.40%	0.87%	0.00%	0.00%	4.01%	0.20%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	25.25	Y	0300-0400	178	58.36%	26.24%	0.04%	3.43%	1.23%	0.47%	0.92%	0.00%	0.28%	2.18%	0.71%	0.49%	1.08%	0.00%	0.00%	4.34%	0.24%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	25.48	Y	0400-0500	168	58.92%	23.78%	0.04%	3.69%	1.33%	0.54%	1.07%	0.00%	0.34%	2.62%	0.86%	0.59%	1.30%	0.00%	0.00%	4.64%	0.28%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	24.71	Y	0500-0600	236	59.49%	21.28%	0.04%	3.97%	1.42%	0.62%	1.21%	0.00%	0.39%	3.07%	1.00%	0.70%	1.53%	0.00%	0.00%	4.96%	0.32%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	22.35	Y	0600-0700	664	60.14%	18.61%	0.04%	4.24%	1.52%	0.70%	1.38%	0.00%	0.46%	3.58%	1.16%	0.81%	1.77%	0.00%	0.00%	5.23%	0.36%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	19.34	Y	0700-0800	1198	60.75%	15.96%	0.05%	4.52%	1.62%	0.78%	1.54%	0.00%	0.52%	4.07%	1.32%	0.91%	2.01%	0.00%	0.00%	5.55%	0.40%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	18.90	Y	0800-0900	1318	64.08%	19.60%	0.04%	3.84%	1.38%	0.59%	1.16%	0.00%	0.23%	1.82%	0.91%	0.63%	1.39%	0.00%	0.00%	4.03%	0.30%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	19.96	Y	0900-1000	1084	59.69%	19.34%	0.07%	6.90%	2.48%	1.26%	2.48%	0.00%	0.18%	1.41%	0.66%	0.46%	1.01%	0.00%	0.00%	3.42%	0.65%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	20.32	Y	1000-1100	1014	54.62%	24.88%	0.08%	7.92%	2.84%	1.52%	2.99%	0.00%	0.17%	1.31%	0.25%	0.17%	0.38%	0.00%	0.00%	2.07%	0.78%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	20.60	Y	1100-1200	968	56.34%	23.61%	0.07%	6.88%	2.47%	1.53%	3.01%	0.00%	0.13%	1.01%	0.39%	0.27%	0.60%	0.00%	0.00%	2.90%	0.79%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.32	Y	1200-1300	470	57.83%	20.06%	0.07%	7.07%	2.54%	1.52%	2.99%	0.00%	0.36%	2.83%	0.74%	0.52%	1.13%	0.00%	0.00%	1.56%	0.78%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.26	Y	1300-1400	468	51.60%	21.32%	0.09%	8.62%	3.10%	1.56%	3.08%	0.00%	0.37%	2.86%	1.33%	0.92%	2.03%	0.00%	0.00%	2.32%	0.80%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.26	Y	1400-1500	484	58.66%	18.18%	0.08%	7.19%	2.58%	1.59%	3.13%	0.00%	0.31%	2.39%	0.59%	0.41%	0.90%	0.00%	0.00%	3.18%	0.82%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.28	Y	1500-1600	482	57.93%	20.83%	0.08%	7.45%	2.68%	1.69%	3.33%	0.00%	0.24%	1.87%	0.25%	0.17%	0.37%	0.00%	0.00%	2.24%	0.87%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.06	Y	1600-1700	524	57.67%	19.93%	0.08%	7.81%	2.81%	1.19%	2.34%	0.00%	0.18%	1.43%	0.75%	0.52%	1.15%	0.00%	0.00%	3.52%	0.61%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	22.65	Y	1700-1800	626	66.46%	14.30%	0.05%	4.93%	1.77%	0.59%	1.16%	0.00%	0.15%	1.20%	0.77%	0.53%	1.17%	0.00%	0.00%	6.60%	0.30%	0.00%	100%

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)
Doubled Traffic Scenario

Road Name	Road ID	Road Type	Speed Limit (km/hr)	Average Speed (km/hr)	Start Emission Estimated by Broad Brush Approach (Y/N)	Hour	Total Vehicles (Veh/hr)	01 - Private Cars	02 - Taxi	03 - Light Goods Vehicles<=2.5t	04 - Light Goods Vehicles 2.5-3.5t	05 - Light Goods Vehicles>3.5t	06 - Medium Goods Vehicles<=15t	07 - Medium Goods Vehicles15-24t	08 - Public Light Buses	09 - Private Light Bus <=3.5t	10 - Private Light Bus >3.5t	11 - Non-franchised Bus<=6.4t	12 - Non-franchised Bus 6.4-15t	13 - Non-franchised Bus 15-24t	14 - Franchised Bus Single Deck	15 - Franchised Bus Double Deck	16 - Motorcycles	17 - Heavy Goods Vehicles>24t	18 - Non-franchised Bus >24t	Total
								PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	HGV9	NFB9	
RESIDENTIAL ROAD L	RD_010		50	22.65	Y	1800-1900	640	71.72%	15.86%	0.04%	3.51%	1.26%	0.43%	0.84%	0.00%	0.02%	0.20%	0.52%	0.36%	0.79%	0.00%	0.00%	4.25%	0.22%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.08	Y	1900-2000	562	68.40%	21.63%	0.03%	3.15%	1.13%	0.14%	0.27%	0.00%	0.03%	0.24%	0.52%	0.36%	0.79%	0.00%	0.00%	3.24%	0.07%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.62	Y	2000-2100	458	66.48%	24.28%	0.03%	2.81%	1.01%	0.26%	0.51%	0.00%	0.01%	0.08%	0.46%	0.32%	0.69%	0.00%	0.00%	2.94%	0.13%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.75	Y	2100-2200	436	59.73%	32.22%	0.03%	2.73%	0.98%	0.18%	0.35%	0.00%	0.01%	0.09%	0.35%	0.24%	0.54%	0.00%	0.00%	2.45%	0.09%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	23.83	Y	2200-2300	426	55.74%	37.37%	0.03%	2.48%	0.89%	0.14%	0.27%	0.00%	0.01%	0.09%	0.03%	0.02%	0.05%	0.00%	0.00%	2.82%	0.07%	0.00%	100%
RESIDENTIAL ROAD L	RD_010		50	24.31	Y	2300-0000	328	56.13%	35.20%	0.03%	2.74%	0.98%	0.21%	0.42%	0.00%	0.06%	0.49%	0.16%	0.11%	0.24%	0.00%	0.00%	3.11%	0.11%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	25.56	Y	0000-0100	158	51.09%	29.84%	0.07%	6.29%	2.26%	0.60%	1.19%	0.00%	0.10%	0.81%	0.26%	0.18%	0.40%	0.05%	3.44%	3.09%	0.31%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	26.91	Y	0100-0200	108	51.09%	27.56%	0.07%	6.81%	2.45%	0.76%	1.50%	0.00%	0.15%	1.18%	0.38%	0.27%	0.58%	0.05%	3.43%	3.32%	0.39%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	27.59	Y	0200-0300	84	51.15%	25.24%	0.08%	7.34%	2.64%	0.92%	1.82%	0.00%	0.20%	1.55%	0.50%	0.35%	0.77%	0.05%	3.37%	3.54%	0.47%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	28.16	Y	0300-0400	64	51.10%	22.97%	0.08%	7.88%	2.83%	1.08%	2.11%	0.00%	0.24%	1.91%	0.62%	0.43%	0.95%	0.05%	3.40%	3.80%	0.55%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	28.23	Y	0400-0500	60	51.14%	20.64%	0.09%	8.41%	3.02%	1.24%	2.43%	0.00%	0.29%	2.27%	0.74%	0.52%	1.13%	0.05%	3.36%	4.03%	0.63%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	27.45	Y	0500-0600	86	51.17%	18.31%	0.09%	8.96%	3.22%	1.39%	2.74%	0.00%	0.34%	2.64%	0.86%	0.60%	1.32%	0.05%	3.33%	4.26%	0.72%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.54	Y	0600-0700	240	51.31%	15.88%	0.10%	9.48%	3.41%	1.57%	3.09%	0.00%	0.39%	3.05%	0.99%	0.69%	1.51%	0.05%	3.21%	4.46%	0.81%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	23.31	Y	0700-0800	438	51.36%	13.50%	0.10%	10.03%	3.60%	1.74%	3.42%	0.00%	0.44%	3.44%	1.11%	0.77%	1.70%	0.04%	3.16%	4.69%	0.89%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	23.25	Y	0800-0900	468	55.81%	17.07%	0.09%	8.78%	3.15%	1.35%	2.65%	0.00%	0.20%	1.59%	0.79%	0.55%	1.21%	0.06%	2.50%	3.51%	0.69%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	23.34	Y	0900-1000	424	47.25%	15.31%	0.15%	14.34%	5.15%	2.62%	5.15%	0.00%	0.14%	1.12%	0.52%	0.36%	0.80%	0.07%	2.98%	2.70%	1.34%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	23.38	Y	1000-1100	410	41.88%	19.08%	0.17%	15.94%	5.72%	3.06%	6.02%	0.00%	0.13%	1.00%	0.19%	0.13%	0.29%	0.14%	3.06%	1.59%	1.57%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	23.58	Y	1100-1200	382	44.16%	18.51%	0.15%	14.16%	5.08%	3.15%	6.19%	0.00%	0.10%	0.79%	0.31%	0.21%	0.47%	0.04%	2.81%	2.27%	1.62%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.30	Y	1200-1300	272	49.82%	17.28%	0.11%	10.83%	3.89%	2.33%	4.57%	0.00%	0.31%	2.44%	0.64%	0.44%	0.98%	0.16%	3.65%	1.34%	1.19%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.22	Y	1300-1400	278	43.62%	18.02%	0.14%	12.95%	4.65%	2.35%	4.62%	0.00%	0.31%	2.42%	1.13%	0.78%	1.72%	0.20%	3.93%	1.96%	1.21%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.25	Y	1400-1500	282	50.40%	15.62%	0.11%	10.98%	3.94%	2.43%	4.77%	0.00%	0.26%	2.05%	0.51%	0.35%	0.78%	0.10%	3.71%	2.73%	1.25%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.25	Y	1500-1600	282	49.50%	17.80%	0.12%	11.32%	4.06%	2.57%	5.06%	0.00%	0.20%	1.59%	0.21%	0.15%	0.32%	0.08%	3.78%	1.92%	1.32%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.13	Y	1600-1700	304	49.61%	17.15%	0.12%	11.95%	4.29%	1.82%	3.58%	0.00%	0.16%	1.23%	0.65%	0.45%	0.99%	0.11%	3.94%	3.03%	0.93%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.00	Y	1700-1800	346	60.04%	12.92%	0.08%	7.91%	2.84%	0.95%	1.87%	0.00%	0.14%	1.09%	0.70%	0.48%	1.06%	0.05%	3.41%	5.97%	0.49%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.04	Y	1800-1900	348	65.89%	14.57%	0.06%	5.73%	2.06%	0.70%	1.37%	0.00%	0.02%	0.18%	0.47%	0.33%	0.72%	0.02%	3.62%	3.91%	0.36%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.29	Y	1900-2000	306	63.10%	19.95%	0.00	5.16%	1.85%	0.23%	0.45%	0.00%	0.03%	0.23%	0.48%	0.33%	0.72%	0.17%	4.14%	2.98%	0.12%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.61	Y	2000-2100	248	61.28%	22.38%	0.05%	4.61%	1.65%	0.42%	0.83%	0.00%	0.01%	0.08%	0.42%	0.29%	0.64%	0.08%	4.33%	2.71%	0.22%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.67	Y	2100-2200	236	54.93%	29.63%	0.05%	4.46%	1.60%	0.29%	0.58%	0.00%	0.01%	0.08%	0.32%	0.22%	0.49%	0.07%	4.85%	2.26%	0.15%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	24.73	Y	2200-2300	230	51.64%	34.62%	0.04%	4.09%	1.47%	0.23%	0.45%	0.00%	0.01%	0.08%	0.03%	0.02%	0.04%	0.06%	4.49%	2.61%	0.12%	0.00%	100%
RESIDENTIAL ROAD R	RD_011		50	25.04	Y	2300-0000	178	51.76%	32.45%	0.05%	4.49%	1.61%	0.35%	0.69%	0.00%	0.06%	0.45%	0.15%	0.10%	0.23%	0.07%	4.50%	2.87%	0.18%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	24.12	Y	0000-0100	618	55.38%	32.34%	0.04%	3.60%	1.29%	0.35%	0.68%	0.00%	0.11%	0.88%	0.28%	0.19%	0.44%	0.01%	0.88%	3.34%	0.18%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	25.02	Y	0100-0200	420	55.73%	30.06%	0.04%	3.91%	1.41%	0.44%	0.86%	0.00%	0.16%	1.28%	0.42%	0.29%	0.64%	0.01%	0.88%	3.62%	0.23%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	25.48	Y	0200-0300	322	56.13%	27.70%	0.04%	4.26%	1.53%	0.54%	1.05%	0.00%	0.21%	1.71%	0.55%	0.39%	0.84%	0.01%	0.88%	3.89%	0.27%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	26.02	Y	0300-0400	242	56.44%	25.38%	0.05%	4.61%	1.65%	0.63%	1.23%	0.00%	0.27%	2.11%	0.69%	0.47%	1.05%	0.01%	0.90%	4.20%	0.32%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	26.20	Y	0400-0500	228	56.87%	22.95%	0.05%	4.93%	1.77%	0.72%	1.43%	0.00%	0.33%	2.53%	0.83%	0.57%	1.26%	0.01%	0.88%	4.48%	0.37%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	25.45	Y	0500-0600	322	57.27%	20.49%	0.05%	5.30%	1.90%	0.83%	1.62%	0.00%	0.38%	2.96%	0.96%	0.67%	1.47%	0.01%	0.89%	4.77%	0.43%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	22.93	Y	0600-0700	904	57.80%	17.89%	0.06%	5.63%	2.02%	0.93%	1.83%	0.00%	0.44%	3.44%	1.11%	0.78%	1.70%	0.01%	0.85%	5.03%	0.48%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	20.40	Y	0700-0800	1636	58.24%	15.30%	0.06%	6.00%	2.15%	1.04%	2.04%	0.00%	0.50%	3.90%	1.26%	0.87%	1.93%	0.01%	0.85%	5.32%	0.53%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	20.04	Y	0800-0900	1786	61.91%	18.94%	0.05%	5.13%	1.84%	0.79%	1.55%	0.00%	0.22%	1.76%	0.88%	0.61%	1.34%	0.02%	0.66%	3.89%	0.40%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	20.91	Y	0900-1000	1508	56.19%	18.21%	0.09%	8.99%	3.23%	1.64%	3.23%	0.00%	0.17%	1.33%	0.62%	0.43%	0.95%	0.02%	0.84%	3.22%	0.84%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	21.20	Y	1000-1100	1424	50.95%	23.21%	0.11%	10.23%	3.67%	1.96%	3.86%	0.00%	0.16%	1.22%	0.23%	0.16%	0.35%	0.04%	0.88%	1.93%	1.01%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	21.45	Y	1100-1200	1350	52.89%	22.17%	0.09%	8.94%	3.21%	1.99%	3.91%	0.00%	0.12%	0.95%	0.37%	0.25%	0.56%	0.01%	0.80%	2.72%	1.02%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.68	Y	1200-1300	742	54.89%	19.04%	0.08%	8.45%	3.03%	1.82%	3.57%	0.00%	0.34%	2.69%	0.70%	0.49%	1.08%	0.06%	1.34%	1.48%	0.93%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.62	Y	1300-1400	746	48.63%	20.09%	0.11%	10.23%	3.68%	1.85%	3.65%	0.00%	0.35%	2.70%	1.26%	0.87%	1.91%	0.07%	1.46%	2.19%	0.95%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.62	Y	1400-1500	766	55.62%	17.24%	0.09%	8.59%	3.08%	1.90%	3.73%	0.00%	0.29%	2.26%	0.56%	0.39%	0.86%	0.04%	1.37%	3.01%	0.98%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.64	Y	1500-1600	764	54.82%	19.71%	0.09%	8.88%	3.19%	2.01%	3.97%	0.00%	0.23%	1.77%	0.24%	0.16%	0.35%	0.03%	1.40%	2.12%	1.04%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.45	Y	1600-1700	828	54.71%	18.91%	0.09%	9.33%	3.35%	1.42%	2.80%	0.00%	0.17%	1.36%	0.71%	0.49%	1.09%	0.04%	1.45%	3.34%	0.73%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.13	Y	1700-1800	972	64.17%	13.81%	0.06%	5.99%	2.15%	0.72%	1.41%	0.00%	0.15%	1.16%	0.75%	0.51%	1.13%	0.02%	1.21%	6.38%	0.37%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.14	Y	1800-1900	988	69.67%	15.41%	0.05%	4.29%	1.54%	0.53%	1.03%	0.00%	0.02%	0.19%	0.50%	0.35%	0.77%	0.01%	1.28%	4.13%	0.27%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.51	Y	1900-2000	868	66.53%	21.04%	0.04%	3.86%	1.38%	0.17%	0.33%	0.00%	0.03%	0.24%	0.51%	0.35%	0.77%	0.06%	1.46%	3.15%	0.09%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	23.97	Y	2000-2100	706	64.65%	23.61%	0.04%	3.44%	1.23%	0.32%	0.62%	0.00%	0.01%	0.08%	0.45%	0.31%	0.67%	0.03%	1.52%	2.86%	0.16%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	24.08	Y	2100-2200	672	58.04%	31.31%	0.04%	3.34%	1.20%	0.22%	0.43%	0.00%	0.01%	0.09%	0.34%	0.23%	0.52%	0.02%	1.70%	2.38%	0.11%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	24.15	Y	2200-2300	656	54.30%	36.41%	0.03%	3.04%	1.09%	0.17%	0.33%	0.00%	0.01%	0.09%	0.03%	0.02%	0.05%	0.02%	1.57%	2.75%	0.09%	0.00%	100%
RESIDENTIAL ROAD C	RD_012		50	24.57	Y	2300-0000	506	54.59%	34.23%	0.04%	3.36%	1.20%	0.26%	0.51%	0.00%	0.06%	0.48%	0.16%	0.11%	0.24%	0.02%	1.58%	3.03%	0.13%	0.00%	100%

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)

Road ID	Segment ID	X coordinate of endpoint 1	Y coordinate of endpoint 1	X coordinate of endpoint 2	Y coordinate of endpoint 2	Road height (mAG)	Physical Road width (m)	Road elevation (m)	Barrier 1 width (m)	Barrier 1 height (m)	Barrier 1 DCL (m)	Barrier 2 width (m)	Barrier 2 height (m)	Barrier 2 DCL (m)	Portal ID
RD_001	RD_001_001	846256.09	816775.06	846251.03	816786.06		8.95								
RD_001	RD_001_002	846251.03	816786.06	846237.20	816820.49		8.19								
RD_001	RD_001_003	846208.48	817387.39	846176.50	817480.43		11.10								
RD_001	RD_001_004	846176.50	817480.43	846159.88	817513.75		7.47								
RD_001	RD_001_005	846159.88	817513.75	846135.30	817560.20		8.96								
RD_001	RD_001_006	846220.28	817010.50	846221.54	817135.41		20.34								
RD_001	RD_001_007	846221.54	817135.41	846220.52	817287.67		8.03								
RD_001	RD_001_008	846220.52	817287.67	846216.88	817341.15		9.69								
RD_001	RD_001_009	846216.88	817341.15	846208.50	817387.10		13.13								
RD_001	RD_001_010	846237.20	816820.49	846225.31	816877.40		8.36								
RD_001	RD_001_011	846225.31	816877.40	846220.28	817010.50		20.07								
RD_001	RD_001_012	846426.03	816285.66	846425.71	816300.05		5.78								
RD_001	RD_001_013	846425.71	816300.05	846422.27	816365.72		6.14								
RD_001	RD_001_014	846422.27	816365.72	846410.47	816437.91		6.80								
RD_001	RD_001_015	846410.47	816437.91	846399.00	816484.63		7.03								
RD_001	RD_001_016	846399.00	816484.63	846391.05	816512.53		6.97								
RD_001	RD_001_017	846391.05	816512.53	846372.88	816564.34		6.85								
RD_001	RD_001_018	846372.88	816564.34	846360.49	816593.90		7.10								
RD_001	RD_001_019	846360.49	816593.90	846325.82	816662.86		7.48								
RD_001	RD_001_020	846325.82	816662.86	846269.29	816753.74		7.80								
RD_001	RD_001_021	846269.29	816753.74	846256.24	816774.91		9.58								
RD_002	RD_002_001	846146.00	817566.10	846170.80	817518.63		7.90								
RD_002	RD_002_002	846229.14	817340.94	846231.42	817322.34		7.21								
RD_002	RD_002_003	846231.42	817322.34	846234.36	817233.09		8.15								
RD_002	RD_002_004	846234.36	817233.09	846236.12	817053.37		11.30								
RD_002	RD_002_005	846236.12	817053.37	846236.98	817010.85		11.18								
RD_002	RD_002_006	846270.25	816780.30	846283.10	816761.50		19.09								
RD_002	RD_002_007	846283.10	816761.50	846346.03	816646.16		8.15								
RD_002	RD_002_008	846346.03	816646.16	846368.12	816599.77		7.00								
RD_002	RD_002_009	846368.12	816599.77	846392.68	816538.00		7.49								
RD_002	RD_002_010	846392.68	816538.00	846413.96	816464.60		7.51								
RD_002	RD_002_011	846413.96	816464.60	846425.33	816411.12		6.94								
RD_002	RD_002_012	846425.33	816411.12	846439.11	816304.27		7.62								
RD_002	RD_002_013	846439.11	816304.27	846439.63	816284.34		8.69								
RD_002	RD_002_014	846236.60	816954.48	846236.52	816915.50		7.65								
RD_002	RD_002_015	846236.52	816915.50	846240.67	816870.21		7.40								
RD_002	RD_002_016	846240.67	816870.21	846251.93	816830.14		10.68								
RD_002	RD_002_017	846251.93	816830.14	846265.97	816791.83		15.84								
RD_002	RD_002_018	846265.97	816791.83	846270.29	816780.18		23.24								
RD_002	RD_002_019	846236.98	817010.85	846236.60	816954.48		8.14								
RD_002	RD_002_020	846219.60	817392.56	846220.45	817389.75		7.97								
RD_002	RD_002_021	846208.35	817428.50	846219.60	817392.56		10.18								
RD_002	RD_002_022	846170.66	817518.55	846208.50	817428.46		10.02								
RD_002	RD_002_023	846220.13	817390.26	846229.12	817341.15		6.90								
RD_003	RD_003_001	846044.89	817022.52	846207.70	817023.45		10.30		12.61	6.369	5.65				
RD_003	RD_003_002	846207.70	817023.45	846236.58	817024.03		11.82								
RD_003	RD_003_003	846044.89	817022.52	846207.70	817023.45		10.30		12.61	6.369	5.65				
RD_003	RD_003_004	845901.54	817021.71	846044.89	817022.52		7.30		9.60	5.668	4.65				
RD_004	RD_004_001	846220.28	817010.50	846205.03	817009.39		21.71								
RD_004	RD_004_002	846205.03	817009.39	846163.09	817012.68		7.30								
RD_004	RD_004_003	846163.09	817012.68	845992.44	817012.46		7.30								
RD_004	RD_004_004	845992.44	817012.46	845900.52	817011.85		7.30								
RD_004	RD_004_005	846220.28	817010.50	846236.98	817010.85		20.63								
RD_005	RD_005_001	846298.11	816506.73	846325.57	816570.51		17.76								
RD_005	RD_005_002	846325.57	816570.51	846331.14	816571.84		22.78								
RD_005	RD_005_003	846331.14	816571.84	846333.41	816570.74		24.29								
RD_005	RD_005_004	846333.41	816570.74	846357.97	816512.06		18.38								
RD_005	RD_005_005	846357.97	816512.06	846363.24	816495.35		11.45								
RD_005	RD_005_006	846344.10	816486.73	846357.05	816494.01		11.86								
RD_005	RD_005_007	846357.05	816494.01	846363.24	816495.35		11.42								
RD_005	RD_005_008	846058.85	816765.57	846058.64	816773.10		7.95								
RD_005	RD_005_009	846058.64	816773.10	846068.22	816790.49		6.77								
RD_005	RD_005_010	846068.22	816790.49	846075.43	816792.71		9.52								
RD_005	RD_005_011	846075.43	816792.71	846081.30	816790.94		11.11								
RD_005	RD_005_012	846081.30	816790.94	846085.43	816782.64		11.52								
RD_005	RD_005_013	846085.43	816782.64	846084.30	816778.09		11.30								
RD_005	RD_005_014	846084.30	816778.09	846080.18	816774.88		11.35								
RD_005	RD_005_015	846080.18	816774.88	846068.85	816772.44		11.12								
RD_005	RD_005_016	846068.85	816772.44	846059.35	816765.84		10.32								
RD_005	RD_005_017	846363.24	816495.35	846369.42	816493.25		10.77								
RD_005	RD_005_018	846369.42	816493.25	846372.93	816486.49		9.35								
RD_005	RD_005_019	846372.93	816486.49	846372.31	816482.95		10.04								
RD_005	RD_005_020	846372.31	816482.95	846367.78	816476.97		10.52								
RD_005	RD_005_021	846367.78	816476.97	846359.02	816476.08		10.47								
RD_005	RD_005_022	846359.02	816476.08	846349.85	816478.40		8.92								
RD_005	RD_005_023	846349.85	816478.40	846346.76	816480.50		8.20								
RD_005	RD_005_024	846346.76	816480.50	846343.97	816486.36		11.48								
RD_005	RD_005_025	846513.24	816710.49	846525.62	816689.57		10.60								
RD_005	RD_005_026	846525.62	816689.57	846525.11	816683.48		10.07								
RD_005	RD_005_027	846525.11	816683.48	846520.99	816678.38		8.07								
RD_005	RD_005_028	846520.99	816678.38	846513.88	816678.71		8.22								
RD_005	RD_005_029	846513.88	816678.71	846509.86	816683.69		9.50								
RD_005	RD_005_030	846509.86	816683.69	846514.49	816697.43		11.47								
RD_005	RD_005_031	846514.49	816697.43	846513.24	816710.49		10.91								
RD_007	RD_007_001	846426.39	816842.54	846513.24	816710.49		9.76								
RD_007	RD_007_002	846236.60	816954.48	846292.35	816954.63		7.25								
RD_007	RD_007_003	846292.35	816954.63	846299.46	816956.18		8.29								
RD_007	RD_007_004	846299.46	816956.18	846305.23	816960.73		13.50								
RD_007	RD_007_005	846305.23	816960.73	846309.24	816967.59		13.15								
RD_007	RD_007_006	846309.24	816967.59	846308.47	817041.12		9.27								
RD_007	RD_007_007	846308.47	817041.12	846305.48	817045.33		12.41								
RD_007	RD_007_008	846305.48	817045.33	846301.87	817045.88		18.97								
RD_007	RD_007_009	846426.39	816842.54	846266.19	816774.89		20.53								
RD_007	RD_007_010	846073.39	816600.36	846259.45	816519.31		22.85								
RD_007	RD_007_011	846296.76	816504.61	846259.45	816519.31		14.55								
RD_007	RD_007_012	846058.85	816765.57	846016.25	816666.10		10.23								
RD_007	RD_007_013	846016.25	816666.10	846012.76	816656.35		10.25								
RD_007	RD_007_014	846012.76	816656.35	846011.11	816645.28		10.67								
RD_007	RD_007_015	846011.11	816645.28	846012.46	816636.42		10.74								
RD_007	RD_007_016	846012.46	816636.42	846021.95	816623.69		12.09								
RD_007	RD_007_017	846021.95	816623.69	846028.03	816619.71		12.87								
RD_007	RD_007_018	846028.03	816619.71	846073.39	816600.36		21.66								
RD_007	RD_007_019	846343.97	816486.36	846296.76	816504.61		14.20								
RD_007	RD_007_020	846195.61	816368.96	846259.09	816519.27		13.79								
RD_008	RD_008_001	846210.76	816755.03	846225.80	816766.67		5.73								
RD_008	RD_008_002	846225.80	816766.67	846232.59	816774.87		5.35								
RD_008	RD_008_003	846232.59	816774.87	846237.63	816790.37		5.55								
RD_008	RD_008_004	846237.63	816790.37	846237.20	816820.49		7.28								
RD_008	RD_008_005	846210.76	816755.03	846247.33	816770.12		5.82								
RD_008	RD_008_006	846247.33	816770.11	846266.22	816779.06		18.05								
RD_008	RD_008_007	846041.05	816531.17	846076.26	816617.97		6.73								
RD_008	RD_008_008	846076.26	816617.97	846097.56	816661.83		7.52								
RD_008	RD_008_009	846097.56	816661.83	846124.85	816698.95		7.33								
RD_008	RD_008_010	846124.85	816698.95	846149.36	816721.11		7.04								
RD_008	RD_008_011	846149.36	816721.11	846166.25	816732.97		6.99								
RD_008	RD_008_012	846166.25	816732.97	846186.34	816744.61		6.93								
RD_008	RD_008_013	846186.34	816744.61	846210.76	816755.03		6.70								
RD_009	RD_009_001	846269.72	816770.53	846251.25	816762.03		20.75								
RD_009	RD_009_002	846251.25	816762.03	846194.59	816738.63		7.17								

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)

Road ID	Segment ID	X coordinate of endpoint 1	Y coordinate of endpoint 1	X coordinate of endpoint 2	Y coordinate of endpoint 2	Road height (mAG)	Physical Road width (m)	Road elevation (m)	Barrier 1 width (m)	Barrier 1 height (m)	Barrier 1 DCL (m)	Barrier 2 width (m)	Barrier 2 height (m)	Barrier 2 DCL (m)	Portal ID
RD_009	RD_009_003	846194.59	816738.63	846178.31	816730.10		6.42								
RD_009	RD_009_004	846178.31	816730.10	846137.83	816699.84		6.33								
RD_009	RD_009_005	846137.83	816699.84	846126.81	816687.98		6.48								
RD_009	RD_009_006	846126.81	816687.98	846110.75	816665.49		6.97								
RD_009	RD_009_007	846110.75	816665.49	846100.46	816647.55		6.97								
RD_009	RD_009_008	846100.46	816647.55	846085.54	816613.88		7.08								
RD_009	RD_009_009	846085.54	816613.88	846047.39	816528.28		7.66								
RD_010	RD_010_001	846101.34	817375.08	846123.59	817389.26		7.07								
RD_010	RD_010_002	846123.59	817389.26	846147.49	817398.91		6.39								
RD_010	RD_010_003	846147.49	817398.91	846207.10	817411.48		17.75								
RD_010	RD_010_004	846051.60	817321.78	846092.27	817368.31		10.09								
RD_010	RD_010_005	846092.27	817368.31	846101.34	817375.08		7.19								
RD_010	RD_010_006	846207.26	817411.53	846254.53	817429.32		17.43								
RD_010	RD_010_007	846254.53	817429.32	846266.17	817438.52		6.21								
RD_010	RD_010_008	846266.17	817438.52	846276.98	817452.04		6.53								
RD_010	RD_010_009	846276.98	817452.04	846285.21	817472.64		6.73								
RD_010	RD_010_010	846285.21	817472.64	846287.58	817486.15		6.88								
RD_010	RD_010_011	846287.58	817486.15	846283.64	817510.95		6.39								
RD_010	RD_010_012	846283.64	817510.95	846280.86	817518.70		6.04								
RD_010	RD_010_013	846280.86	817518.70	846262.49	817551.58		6.14								
RD_010	RD_010_014	846262.49	817551.58	846232.90	817605.59		6.15								
RD_010	RD_010_015	845898.06	817146.95	845940.52	817146.20		4.78								
RD_010	RD_010_016	845940.52	817146.20	845971.33	817152.64		4.58								
RD_010	RD_010_017	845971.33	817152.64	845988.64	817159.96		3.50								
RD_010	RD_010_018	845988.64	817159.96	846002.23	817167.94		3.50								
RD_010	RD_010_019	846002.23	817167.94	846016.86	817178.91		3.50								
RD_010	RD_010_020	846016.86	817178.91	846031.48	817194.42		3.50								
RD_010	RD_010_021	846031.48	817194.42	846043.32	817212.48		3.89								
RD_010	RD_010_022	846043.32	817212.48	846051.04	817229.54		4.51								
RD_010	RD_010_023	846051.04	817229.54	846055.97	817247.59		4.85								
RD_010	RD_010_024	846055.97	817247.59	846057.92	817262.98		5.21								
RD_010	RD_010_025	846057.92	817262.98	846054.10	817278.26		4.91								
RD_010	RD_010_026	846054.10	817278.26	846045.95	817291.77		8.11								
RD_011	RD_011_001	846209.77	817401.07	846164.60	817392.17		17.11								
RD_011	RD_011_002	846164.60	817392.17	846146.36	817386.84		6.32								
RD_011	RD_011_003	846146.36	817386.84	846137.91	817383.85		6.73								
RD_011	RD_011_004	846137.91	817383.85	846116.80	817371.65		8.11								
RD_011	RD_011_005	846116.80	817371.65	846102.68	817364.11		7.00								
RD_011	RD_011_006	846102.68	817364.11	846088.68	817349.49		6.00								
RD_011	RD_011_007	846088.68	817349.49	846061.60	817315.70		9.95								
RD_011	RD_011_008	846237.11	817607.37	846245.05	817591.98		15.00								
RD_011	RD_011_009	846264.76	817559.77	846269.09	817555.13		9.45								
RD_011	RD_011_010	846269.09	817555.13	846289.52	817513.28		7.22								
RD_011	RD_011_011	846289.52	817513.28	846294.99	817487.26		9.01								
RD_011	RD_011_012	846294.99	817487.26	846292.84	817472.53		7.98								
RD_011	RD_011_013	846292.84	817472.53	846282.65	817448.05		6.32								
RD_011	RD_011_014	846282.65	817448.05	846274.31	817436.86		7.00								
RD_011	RD_011_015	846274.31	817436.86	846263.60	817426.45		11.31								
RD_011	RD_011_016	846263.60	817426.45	846252.89	817418.69		11.35								
RD_011	RD_011_017	846252.89	817418.69	846210.05	817401.13		17.52								
RD_011	RD_011_018	846245.05	817591.98	846259.50	817565.31		14.28								
RD_011	RD_011_019	846259.50	817565.31	846264.76	817559.77		13.18								
RD_011	RD_011_020	846059.24	817296.32	846061.73	817276.16		7.05								
RD_011	RD_011_021	846061.73	817276.16	846061.33	817259.22		3.60								
RD_011	RD_011_022	846061.33	817259.22	846056.70	817235.41		3.50								
RD_011	RD_011_023	846056.70	817235.41	846049.61	817214.59		5.06								
RD_011	RD_011_024	846049.61	817214.59	846041.78	817200.08		6.86								
RD_011	RD_011_025	846041.78	817200.08	846031.59	817187.11		5.28								
RD_011	RD_011_026	846031.59	817187.11	846002.34	817163.62		4.43								
RD_011	RD_011_027	846002.34	817163.62	845974.63	817149.65		7.32								
RD_011	RD_011_028	845974.63	817149.65	845948.46	817143.54		10.15								
RD_011	RD_011_029	845948.46	817143.54	845923.62	817142.53		6.51								
RD_011	RD_011_030	845923.62	817142.53	845897.96	817143.29		3.50								
RD_011	RD_011_031	846245.05	817591.98	846255.56	817597.09		11.10								
RD_011	RD_011_032	846255.56	817597.09	846262.98	817595.87		7.07								
RD_011	RD_011_033	846262.98	817595.87	846268.86	817583.81		6.99								
RD_011	RD_011_034	846268.86	817583.81	846268.97	817579.93		7.07								
RD_011	RD_011_035	846268.97	817579.93	846267.63	817572.07		6.40								
RD_011	RD_011_036	846267.63	817572.07	846259.50	817565.31		10.09								
RD_012	RD_012_001	846101.34	817375.08	846087.93	817397.77		8.74								
RD_012	RD_012_002	846087.93	817397.77	846077.21	817401.75		6.46								
RD_012	RD_012_003	846077.21	817401.75	846071.74	817408.39		5.10								
RD_012	RD_012_004	846071.74	817408.39	846070.50	817418.46		6.28								
RD_012	RD_012_005	846070.50	817418.46	846071.94	817424.67		5.85								
RD_012	RD_012_006	846071.94	817424.67	846075.54	817428.21		8.45								
RD_012	RD_012_007	846075.54	817428.21	846082.14	817428.99		10.19								
RD_012	RD_012_008	846082.14	817428.99	846083.49	817412.16		7.76								
RD_012	RD_012_009	846083.49	817412.16	846087.93	817397.77		7.81								
RD_012	RD_012_010	846045.95	817291.77	846042.14	817292.21		10.27								
RD_012	RD_012_011	846042.14	817292.21	846034.72	817297.19		8.06								
RD_012	RD_012_012	846034.72	817297.19	846032.13	817307.37		10.49								
RD_012	RD_012_013	846039.13	817318.78	846043.77	817321.11		11.74								
RD_012	RD_012_014	846043.77	817321.11	846051.60	817321.78		12.14								
RD_012	RD_012_015	846032.13	817307.37	846035.53	817316.90		12.26								
RD_012	RD_012_016	846035.53	817316.90	846039.13	817318.78		12.07								
RD_012	RD_012_017	846051.60	817321.78	846061.60	817315.70		13.35								
RD_012	RD_012_018	846061.60	817315.70	846063.25	817310.38		11.02								
RD_012	RD_012_019	846063.25	817310.38	846063.05	817301.08		8.33								
RD_012	RD_012_020	846063.05	817301.08	846059.24	817296.32		8.87								
RD_012	RD_012_021	846059.24	817296.32	846056.46	817292.99		12.12								
RD_012	RD_012_022	846056.46	817292.99	846051.21	817291.11		15.05								
RD_012	RD_012_023	846051.21	817291.11	846045.95	817291.77		14.05								

Appendix 3.3 Calculation of Vehicular Emissions
Traffic Data and Road Segments (Year 2041)

Start Profile	01 - Private Cars	02 - Taxi	03 - Light Goods Vehicles<=2.5t	04 - Light Goods Vehicles 2.5-3.5t	05 - Light Goods Vehicles>3.5t	06 - Medium Goods Vehicles<=15t	07 - Medium Goods Vehicles15-24t	08 - Public Light Buses	09 - Private Light Bus <=3.5t	10 - Private Light Bus >3.5t	11 - Non-franchised Bus<=6.4t	12 - Non-franchised Bus 6.4-15t	13 - Non-franchised Bus 15-24t	14 - Franchised Bus Single Deck	15 - Franchised Bus Double Deck	16 - Motorcycles	17 - Heavy Goods Vehicles>24t	18 - Non-franchised Bus >24t
	PC	TAXI	LGV3	LGV4	LGV6	HGV7	HGV8	PLB	PV4	PV5	NFB6	NFB7	NFB8	FBSD	FBDD	MC	HGV9	NFB9
Y	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Emission (Tonne Per Year)

Year 2030 (traffic year 2041)	AnnualHourMin	MonthlyHourMin	MonthlyHourAverage
NO2	2.93	2.77	2.60
NO	22.89	20.87	19.19
NOX	25.82	-	21.79
PM25	0.62	-	-
PM10	0.67	-	-

Road Segments

Road Name	Road ID	X coordinate of endpoint 1	Y coordinate of endpoint 1	X coordinate of endpoint 2	Y coordinate of endpoint 2	Grid (I,J)	Vehicle height (m)	Release height (m)	Szinit (m)	Width (m)	Elevation (m)
WAN PO ROAD L	RD_001_001	846256.09	816775.06	846251.03	816786.06	50,30	1.8	1.53	1.42	14.95	7
WAN PO ROAD L	RD_001_002	846251.03	816786.06	846237.20	816820.49	50,30	1.8	1.53	1.42	14.19	7
WAN PO ROAD L	RD_001_003	846208.48	817387.39	846176.50	817480.43	50,31	1.8	1.53	1.42	17.10	7
WAN PO ROAD L	RD_001_004	846176.50	817480.43	846159.88	817513.75	50,31	1.8	1.53	1.42	13.47	7
WAN PO ROAD L	RD_001_005	846159.88	817513.75	846135.30	817560.20	50,31	1.8	1.53	1.42	14.96	7
WAN PO ROAD L	RD_001_006	846220.28	817010.50	846221.54	817135.41	50,30	1.8	1.53	1.42	26.34	8
WAN PO ROAD L	RD_001_007	846221.54	817135.41	846220.52	817287.67	50,30	1.8	1.53	1.42	14.03	8
WAN PO ROAD L	RD_001_008	846220.52	817287.67	846216.88	817341.15	50,31	1.8	1.53	1.42	15.69	6
WAN PO ROAD L	RD_001_009	846216.88	817341.15	846208.50	817387.10	50,31	1.8	1.53	1.42	19.13	6
WAN PO ROAD L	RD_001_010	846237.20	816820.49	846225.31	816877.40	50,30	1.8	1.53	1.42	14.36	7
WAN PO ROAD L	RD_001_011	846225.31	816877.40	846220.28	817010.50	50,30	1.8	1.53	1.42	26.07	6
WAN PO ROAD L	RD_001_012	846426.03	816285.66	846425.71	816300.05	50,30	1.8	1.53	1.42	11.78	7
WAN PO ROAD L	RD_001_013	846425.71	816300.05	846422.27	816365.72	50,30	1.8	1.53	1.42	12.14	7
WAN PO ROAD L	RD_001_014	846422.27	816365.72	846410.47	816437.91	50,30	1.8	1.53	1.42	12.80	7
WAN PO ROAD L	RD_001_015	846410.47	816437.91	846399.00	816484.63	50,30	1.8	1.53	1.42	13.03	7
WAN PO ROAD L	RD_001_016	846399.00	816484.63	846391.05	816512.53	50,30	1.8	1.53	1.42	12.97	7
WAN PO ROAD L	RD_001_017	846391.05	816512.53	846372.88	816564.34	50,30	1.8	1.53	1.42	12.85	6
WAN PO ROAD L	RD_001_018	846372.88	816564.34	846360.49	816593.90	50,30	1.8	1.53	1.42	13.10	6
WAN PO ROAD L	RD_001_019	846360.49	816593.90	846325.82	816662.86	50,30	1.8	1.53	1.42	13.48	6
WAN PO ROAD L	RD_001_020	846325.82	816662.86	846269.29	816753.74	50,30	1.8	1.53	1.42	13.80	7
WAN PO ROAD L	RD_001_021	846269.29	816753.74	846256.24	816774.91	50,30	1.8	1.53	1.42	15.58	7
WAN PO ROAD R	RD_002_001	846146.00	817566.10	846170.80	817518.63	50,31	1.8	1.54	1.44	13.90	7
WAN PO ROAD R	RD_002_002	846229.14	817340.94	846231.42	817322.34	50,31	1.8	1.54	1.44	13.21	6
WAN PO ROAD R	RD_002_003	846231.42	817322.34	846234.36	817233.09	50,30	1.8	1.54	1.44	14.15	7
WAN PO ROAD R	RD_002_004	846234.36	817233.09	846236.12	817053.37	50,30	1.8	1.54	1.44	17.30	9
WAN PO ROAD R	RD_002_005	846236.12	817053.37	846236.98	817010.84	50,30	1.8	1.54	1.44	17.18	7
WAN PO ROAD R	RD_002_006	846270.25	816780.30	846283.10	816761.50	50,30	1.8	1.54	1.44	25.09	7
WAN PO ROAD R	RD_002_007	846283.10	816761.50	846346.03	816646.16	50,30	1.8	1.54	1.44	14.15	6
WAN PO ROAD R	RD_002_008	846346.03	816646.16	846368.12	816599.77	50,30	1.8	1.54	1.44	13.00	6
WAN PO ROAD R	RD_002_009	846368.12	816599.77	846392.68	816538.00	50,30	1.8	1.54	1.44	13.49	7
WAN PO ROAD R	RD_002_010	846392.68	816538.00	846413.96	816464.60	50,30	1.8	1.54	1.44	13.51	7
WAN PO ROAD R	RD_002_011	846413.96	816464.60	846425.33	816411.12	50,30	1.8	1.54	1.44	12.94	8
WAN PO ROAD R	RD_002_012	846425.33	816411.12	846439.11	816304.27	50,30	1.8	1.54	1.44	13.62	7
WAN PO ROAD R	RD_002_013	846439.11	816304.27	846439.63	816284.34	50,30	1.8	1.54	1.44	14.69	7
WAN PO ROAD R	RD_002_014	846236.60	816954.48	846236.52	816915.50	50,30	1.8	1.54	1.44	13.65	6
WAN PO ROAD R	RD_002_015	846236.52	816915.50	846240.67	816870.21	50,30	1.8	1.54	1.44	13.40	6
WAN PO ROAD R	RD_002_016	846240.67	816870.21	846251.93	816830.14	50,30	1.8	1.54	1.44	16.68	6
WAN PO ROAD R	RD_002_017	846251.93	816830.14	846265.97	816791.83	50,30	1.8	1.54	1.44	21.84	6
WAN PO ROAD R	RD_002_018	846265.97	816791.83	846270.29	816780.18	50,30	1.8	1.54	1.44	29.24	7
WAN PO ROAD R	RD_002_019	846236.98	817010.84	846236.60	816954.48	50,30	1.8	1.54	1.44	14.14	7
WAN PO ROAD R	RD_002_020	846219.60	817392.56	846220.45	817389.75	50,31	1.8	1.54	1.44	13.97	7
WAN PO ROAD R	RD_002_021	846208.35	817428.50	846219.60	817392.56	50,31	1.8	1.54	1.44	16.18	7
WAN PO ROAD R	RD_002_022	846170.66	817518.55	846208.50	817428.46	50,31	1.8	1.54	1.44	16.02	7
WAN PO ROAD R	RD_002_023	846220.13	817390.26	846229.12	817341.15	50,31	1.8	1.54	1.44	12.90	7
CROSS BAY LINK L	RD_003_001	846044.82	817036.32	846207.63	817037.25	50,30	1.8	6.37	0.00	13.80	7
CROSS BAY LINK L	RD_003_002	846207.70	817023.45	846236.58	817024.03	50,30	1.8	1.49	1.39	17.82	7
CROSS BAY LINK L	RD_003_003	846044.82	817036.32	846207.63	817037.25	50,30	1.8	6.37	0.00	13.80	7
CROSS BAY LINK L	RD_003_004	845901.49	817032.26	846044.84	817033.08	50,30	1.8	5.67	0.00	11.30	7
CROSS BAY LINK R	RD_004_001	846220.28	817010.50	846205.03	817009.39	50,30	1.7	1.44	1.34	27.71	7
CROSS BAY LINK R	RD_004_002	846205.03	817009.39	846163.09	817012.68	50,30	1.7	1.44	1.34	13.30	7
CROSS BAY LINK R	RD_004_003	846163.09	817012.68	845992.44	817012.46	50,30	1.7	1.44	1.34	13.30	6
CROSS BAY LINK R	RD_004_004	845992.44	817012.46	845900.52	817011.85	50,30	1.7	1.44	1.34	13.30	7
CROSS BAY LINK R	RD_004_005	846220.28	817010.50	846236.98	817010.84	50,30	1.7	1.44	1.34	26.63	7
INDUSTRIAL ROAD L	RD_005_001	846298.11	816506.73	846325.57	816570.51	50,30	4.4	3.72	3.46	23.76	6
INDUSTRIAL ROAD L	RD_005_002	846325.57	816570.51	846331.14	816571.84	50,30	4.4	3.72	3.46	28.78	6
INDUSTRIAL ROAD L	RD_005_003	846331.14	816571.84	846333.41	816570.74	50,30	4.4	3.72	3.46	30.29	6
INDUSTRIAL ROAD L	RD_005_004	846333.41	816570.74	846357.97	816512.06	50,30	4.4	3.72	3.46	24.38	6
INDUSTRIAL ROAD L	RD_005_005	846357.97	816512.06	846363.24	816495.35	50,30	4.4	3.72	3.46	17.45	6
INDUSTRIAL ROAD L	RD_005_006	846344.10	816486.73	846357.05	816494.01	50,30	4.4	3.72	3.46	17.86	6
INDUSTRIAL ROAD L	RD_005_007	846357.05	816494.01	846363.24	816495.35	50,30	4.4	3.72	3.46	17.42	6
INDUSTRIAL ROAD L	RD_005_008	846058.85	816765.57	846058.64	816773.10	50,30	4.4	3.72	3.46	13.95	5
INDUSTRIAL ROAD L	RD_005_009	846058.64	816773.10	846068.22	816790.49	50,30	4.4	3.72	3.46	12.77	5
INDUSTRIAL ROAD L	RD_005_010	846068.22	816790.49	846075.43	816792.71	50,30	4.4	3.72	3.46	15.52	6
INDUSTRIAL ROAD L	RD_005_011	846075.43	816792.71	846081.30	816790.94	50,30	4.4	3.72	3.46	17.11	6
INDUSTRIAL ROAD L	RD_005_012	846081.30	816790.94	846085.43	816782.64	50,30	4.4	3.72	3.46	17.52	6
INDUSTRIAL ROAD L	RD_005_013	846085.43	816782.64	846084.30	816778.09	50,30	4.4	3.72	3.46	17.30	6
INDUSTRIAL ROAD L	RD_005_014	846084.30	816778.09	846080.18	816774.88	50,30	4.4	3.72	3.46	17.35	6
INDUSTRIAL ROAD L	RD_005_015	846080.18	816774.88	846068.85	816772.44	50,30	4.4	3.72	3.46	17.12	5
INDUSTRIAL ROAD L	RD_005_016	846068.85	816772.44	846059.35	816765.84	50,30	4.4	3.72	3.46	16.32	5
INDUSTRIAL ROAD L	RD_005_017	846363.24	816495.35	846369.42	816493.25	50,30	4.4	3.72	3.46	16.77	6
INDUSTRIAL ROAD L	RD_005_018	846369.42	816493.25	846372.93	816486.49	50,30	4.4	3.72	3.46	15.35	6

Road Name	Road ID	X coordinate of endpoint 1	Y coordinate of endpoint 1	X coordinate of endpoint 2	Y coordinate of endpoint 2	Grid (I,J)	Vehicle height (m)	Release height (m)	Szinit (m)	Width (m)	Elevation (m)
INDUSTRIAL ROAD L	RD_005_019	846372.93	816486.49	846372.31	816482.95	50,30	4.4	3.72	3.46	16.04	6
INDUSTRIAL ROAD L	RD_005_020	846372.31	816482.95	846367.78	816476.97	50,30	4.4	3.72	3.46	16.52	6
INDUSTRIAL ROAD L	RD_005_021	846367.78	816476.97	846359.02	816476.08	50,30	4.4	3.72	3.46	16.47	6
INDUSTRIAL ROAD L	RD_005_022	846359.02	816476.08	846349.85	816478.40	50,30	4.4	3.72	3.46	14.92	6
INDUSTRIAL ROAD L	RD_005_023	846349.85	816478.40	846346.76	816480.50	50,30	4.4	3.72	3.46	14.20	6
INDUSTRIAL ROAD L	RD_005_024	846346.76	816480.50	846343.97	816486.36	50,30	4.4	3.72	3.46	17.48	6
INDUSTRIAL ROAD L	RD_005_025	846513.24	816710.49	846525.62	816689.57	50,30	4.4	3.72	3.46	16.60	7
INDUSTRIAL ROAD L	RD_005_026	846525.62	816689.57	846525.11	816683.48	50,30	4.4	3.72	3.46	16.07	7
INDUSTRIAL ROAD L	RD_005_027	846525.11	816683.48	846520.99	816678.38	50,30	4.4	3.72	3.46	14.07	7
INDUSTRIAL ROAD L	RD_005_028	846520.99	816678.38	846513.88	816678.71	50,30	4.4	3.72	3.46	14.22	7
INDUSTRIAL ROAD L	RD_005_029	846513.88	816678.71	846509.86	816683.69	50,30	4.4	3.72	3.46	15.50	7
INDUSTRIAL ROAD L	RD_005_030	846509.86	816683.69	846514.49	816697.43	50,30	4.4	3.72	3.46	17.47	7
INDUSTRIAL ROAD L	RD_005_031	846514.49	816697.43	846513.24	816710.49	50,30	4.4	3.72	3.46	16.91	7
INDUSTRIAL ROAD C	RD_007_001	846426.39	816842.54	846513.24	816710.49	50,30	4.4	3.70	3.44	15.76	6
INDUSTRIAL ROAD C	RD_007_002	846236.60	816954.48	846292.35	816954.63	50,30	4.4	3.70	3.44	13.25	6
INDUSTRIAL ROAD C	RD_007_003	846292.35	816954.63	846299.46	816956.18	50,30	4.4	3.70	3.44	14.29	6
INDUSTRIAL ROAD C	RD_007_004	846299.46	816956.18	846305.23	816960.73	50,30	4.4	3.70	3.44	19.50	6
INDUSTRIAL ROAD C	RD_007_005	846305.23	816960.73	846309.24	816967.59	50,30	4.4	3.70	3.44	19.15	6
INDUSTRIAL ROAD C	RD_007_006	846309.24	816967.59	846308.47	817041.12	50,30	4.4	3.70	3.44	15.27	7
INDUSTRIAL ROAD C	RD_007_007	846308.47	817041.12	846305.48	817045.33	50,30	4.4	3.70	3.44	18.41	6
INDUSTRIAL ROAD C	RD_007_008	846305.48	817045.33	846301.87	817045.88	50,30	4.4	3.70	3.44	24.97	6
INDUSTRIAL ROAD C	RD_007_009	846426.39	816842.54	846266.19	816774.89	50,30	4.4	3.70	3.44	26.53	6
INDUSTRIAL ROAD C	RD_007_010	846073.39	816600.36	846259.45	816519.31	50,30	4.4	3.70	3.44	28.85	5
INDUSTRIAL ROAD C	RD_007_011	846296.76	816504.61	846259.45	816519.31	50,30	4.4	3.70	3.44	20.55	6
INDUSTRIAL ROAD C	RD_007_012	846058.85	816765.57	846016.25	816666.10	50,30	4.4	3.70	3.44	16.23	5
INDUSTRIAL ROAD C	RD_007_013	846016.25	816666.10	846012.76	816656.35	50,30	4.4	3.70	3.44	16.25	5
INDUSTRIAL ROAD C	RD_007_014	846012.76	816656.35	846011.11	816645.28	50,30	4.4	3.70	3.44	16.67	5
INDUSTRIAL ROAD C	RD_007_015	846011.11	816645.28	846012.46	816636.42	50,30	4.4	3.70	3.44	16.74	6
INDUSTRIAL ROAD C	RD_007_016	846012.46	816636.42	846021.95	816623.69	50,30	4.4	3.70	3.44	18.09	5
INDUSTRIAL ROAD C	RD_007_017	846021.95	816623.69	846028.03	816619.71	50,30	4.4	3.70	3.44	18.87	5
INDUSTRIAL ROAD C	RD_007_018	846028.03	816619.71	846073.39	816600.36	50,30	4.4	3.70	3.44	27.66	5
INDUSTRIAL ROAD C	RD_007_019	846343.97	816486.36	846296.76	816504.61	50,30	4.4	3.70	3.44	20.20	6
INDUSTRIAL ROAD C	RD_007_020	846195.61	816368.96	846259.09	816519.27	50,30	4.4	3.70	3.44	19.79	5
CHUN YAT STREET L	RD_008_001	846210.76	816755.03	846225.80	816766.67	50,30	2.4	2.06	1.92	11.73	7
CHUN YAT STREET L	RD_008_002	846225.80	816766.67	846232.59	816774.87	50,30	2.4	2.06	1.92	11.35	7
CHUN YAT STREET L	RD_008_003	846232.59	816774.87	846237.63	816790.37	50,30	2.4	2.06	1.92	11.55	7
CHUN YAT STREET L	RD_008_004	846237.63	816790.37	846237.20	816820.49	50,30	2.4	2.06	1.92	13.28	7
CHUN YAT STREET L	RD_008_005	846210.76	816755.03	846247.33	816770.11	50,30	2.4	2.06	1.92	11.82	7
CHUN YAT STREET L	RD_008_006	846247.33	816770.11	846266.22	816779.06	50,30	2.4	2.06	1.92	24.05	7
CHUN YAT STREET L	RD_008_007	846041.05	816531.17	846076.26	816617.97	50,30	2.4	2.06	1.92	12.73	5
CHUN YAT STREET L	RD_008_008	846076.26	816617.97	846097.56	816661.83	50,30	2.4	2.06	1.92	13.52	5
CHUN YAT STREET L	RD_008_009	846097.56	816661.83	846124.85	816698.95	50,30	2.4	2.06	1.92	13.33	5
CHUN YAT STREET L	RD_008_010	846124.85	816698.95	846149.36	816721.11	50,30	2.4	2.06	1.92	13.04	5
CHUN YAT STREET L	RD_008_011	846149.36	816721.11	846166.25	816732.97	50,30	2.4	2.06	1.92	12.99	6
CHUN YAT STREET L	RD_008_012	846166.25	816732.97	846186.34	816744.61	50,30	2.4	2.06	1.92	12.93	6
CHUN YAT STREET L	RD_008_013	846186.34	816744.61	846210.76	816755.03	50,30	2.4	2.06	1.92	12.70	6
CHUN YAT STREET R	RD_009_001	846269.72	816770.53	846251.25	816762.03	50,30	2.9	2.48	2.31	26.75	7
CHUN YAT STREET R	RD_009_002	846251.25	816762.03	846194.59	816738.63	50,30	2.9	2.48	2.31	13.17	7
CHUN YAT STREET R	RD_009_003	846194.59	816738.63	846178.31	816730.10	50,30	2.9	2.48	2.31	12.42	6
CHUN YAT STREET R	RD_009_004	846178.31	816730.10	846137.83	816699.84	50,30	2.9	2.48	2.31	12.33	5
CHUN YAT STREET R	RD_009_005	846137.83	816699.84	846126.81	816687.98	50,30	2.9	2.48	2.31	12.48	5
CHUN YAT STREET R	RD_009_006	846126.81	816687.98	846110.75	816665.49	50,30	2.9	2.48	2.31	12.97	5
CHUN YAT STREET R	RD_009_007	846110.75	816665.49	846100.46	816647.55	50,30	2.9	2.48	2.31	12.97	5
CHUN YAT STREET R	RD_009_008	846100.46	816647.55	846085.54	816613.88	50,30	2.9	2.48	2.31	13.08	5
CHUN YAT STREET R	RD_009_009	846085.54	816613.88	846047.39	816528.28	50,30	2.9	2.48	2.31	13.66	5
RESIDENTIAL ROAD L	RD_010_001	846101.34	817375.08	846123.59	817389.26	50,31	1.7	1.45	1.35	13.07	7
RESIDENTIAL ROAD L	RD_010_002	846123.59	817389.26	846147.49	817398.91	50,31	1.7	1.45	1.35	12.39	7
RESIDENTIAL ROAD L	RD_010_003	846147.49	817398.91	846207.10	817411.48	50,31	1.7	1.45	1.35	23.75	6
RESIDENTIAL ROAD L	RD_010_004	846051.60	817321.78	846092.27	817368.31	50,31	1.7	1.45	1.35	16.09	7
RESIDENTIAL ROAD L	RD_010_005	846092.27	817368.31	846101.34	817375.08	50,31	1.7	1.45	1.35	13.19	7
RESIDENTIAL ROAD L	RD_010_006	846207.26	817411.53	846254.53	817429.32	50,31	1.7	1.45	1.35	23.43	7
RESIDENTIAL ROAD L	RD_010_007	846254.53	817429.32	846266.17	817438.52	50,31	1.7	1.45	1.35	12.21	7
RESIDENTIAL ROAD L	RD_010_008	846266.17	817438.52	846276.98	817452.04	50,31	1.7	1.45	1.35	12.53	7
RESIDENTIAL ROAD L	RD_010_009	846276.98	817452.04	846285.21	817472.64	50,31	1.7	1.45	1.35	12.73	7
RESIDENTIAL ROAD L	RD_010_010	846285.21	817472.64	846287.58	817486.15	50,31	1.7	1.45	1.35	12.88	7
RESIDENTIAL ROAD L	RD_010_011	846287.58	817486.15	846283.64	817510.95	50,31	1.7	1.45	1.35	12.39	6
RESIDENTIAL ROAD L	RD_010_012	846283.64	817510.95	846280.86	817518.70	50,31	1.7	1.45	1.35	12.04	7
RESIDENTIAL ROAD L	RD_010_013	846280.86	817518.70	846262.49	817551.58	50,31	1.7	1.45	1.35	12.14	6
RESIDENTIAL ROAD L	RD_010_014	846262.49	817551.58	846232.90	817605.59	50,31	1.7	1.45	1.35	12.15	6
RESIDENTIAL ROAD L	RD_010_015	845898.06	817146.95	845940.52	817146.20	50,30	1.7	1.45	1.35	10.78	5
RESIDENTIAL ROAD L	RD_010_016	845940.52	817146.20	845971.33	817152.64	50,30	1.7	1.45	1.35	10.58	6
RESIDENTIAL ROAD L	RD_010_017	845971.33	817152.64	845988.64	817159.96	50,30	1.7	1.45	1.35	9.50	6

Road Name	Road ID	X coordinate of endpoint 1	Y coordinate of endpoint 1	X coordinate of endpoint 2	Y coordinate of endpoint 2	Grid (I,J)	Vehicle height (m)	Release height (m)	Szinit (m)	Width (m)	Elevation (m)
RESIDENTIAL ROAD L	RD_010_018	845988.64	817159.96	846002.23	817167.94	50,30	1.7	1.45	1.35	9.50	7
RESIDENTIAL ROAD L	RD_010_019	846002.23	817167.94	846016.86	817178.91	50,30	1.7	1.45	1.35	9.50	7
RESIDENTIAL ROAD L	RD_010_020	846016.86	817178.91	846031.48	817194.42	50,30	1.7	1.45	1.35	9.50	7
RESIDENTIAL ROAD L	RD_010_021	846031.48	817194.42	846043.32	817212.48	50,30	1.7	1.45	1.35	9.89	8
RESIDENTIAL ROAD L	RD_010_022	846043.32	817212.48	846051.04	817229.54	50,30	1.7	1.45	1.35	10.51	7
RESIDENTIAL ROAD L	RD_010_023	846051.04	817229.54	846055.97	817247.59	50,30	1.7	1.45	1.35	10.85	7
RESIDENTIAL ROAD L	RD_010_024	846055.97	817247.59	846057.92	817262.98	50,30	1.7	1.45	1.35	11.21	7
RESIDENTIAL ROAD L	RD_010_025	846057.92	817262.98	846054.10	817278.26	50,30	1.7	1.45	1.35	10.91	8
RESIDENTIAL ROAD L	RD_010_026	846054.10	817278.26	846045.95	817291.77	50,31	1.7	1.45	1.35	14.11	7
RESIDENTIAL ROAD R	RD_011_001	846209.77	817401.07	846164.60	817392.17	50,31	1.9	1.62	1.50	23.11	6
RESIDENTIAL ROAD R	RD_011_002	846164.60	817392.17	846146.36	817386.84	50,31	1.9	1.62	1.50	12.32	6
RESIDENTIAL ROAD R	RD_011_003	846146.36	817386.84	846137.91	817383.85	50,31	1.9	1.62	1.50	12.73	7
RESIDENTIAL ROAD R	RD_011_004	846137.91	817383.85	846116.80	817371.65	50,31	1.9	1.62	1.50	14.11	7
RESIDENTIAL ROAD R	RD_011_005	846116.80	817371.65	846102.68	817364.11	50,31	1.9	1.62	1.50	13.00	7
RESIDENTIAL ROAD R	RD_011_006	846102.68	817364.11	846088.68	817349.49	50,31	1.9	1.62	1.50	12.00	7
RESIDENTIAL ROAD R	RD_011_007	846088.68	817349.49	846061.60	817315.70	50,31	1.9	1.62	1.50	15.95	7
RESIDENTIAL ROAD R	RD_011_008	846237.11	817607.37	846245.05	817591.98	50,31	1.9	1.62	1.50	21.00	6
RESIDENTIAL ROAD R	RD_011_009	846264.76	817559.77	846269.09	817555.13	50,31	1.9	1.62	1.50	15.45	6
RESIDENTIAL ROAD R	RD_011_010	846269.09	817555.13	846289.52	817513.28	50,31	1.9	1.62	1.50	13.22	7
RESIDENTIAL ROAD R	RD_011_011	846289.52	817513.28	846294.99	817487.26	50,31	1.9	1.62	1.50	15.01	7
RESIDENTIAL ROAD R	RD_011_012	846294.99	817487.26	846292.84	817472.53	50,31	1.9	1.62	1.50	13.98	7
RESIDENTIAL ROAD R	RD_011_013	846292.84	817472.53	846282.65	817448.05	50,31	1.9	1.62	1.50	12.32	7
RESIDENTIAL ROAD R	RD_011_014	846282.65	817448.05	846274.31	817436.86	50,31	1.9	1.62	1.50	13.00	7
RESIDENTIAL ROAD R	RD_011_015	846274.31	817436.86	846263.60	817426.45	50,31	1.9	1.62	1.50	17.31	7
RESIDENTIAL ROAD R	RD_011_016	846263.60	817426.45	846252.89	817418.69	50,31	1.9	1.62	1.50	17.35	7
RESIDENTIAL ROAD R	RD_011_017	846252.89	817418.69	846210.05	817401.13	50,31	1.9	1.62	1.50	23.52	7
RESIDENTIAL ROAD R	RD_011_018	846245.05	817591.98	846259.50	817565.31	50,31	1.9	1.62	1.50	20.28	6
RESIDENTIAL ROAD R	RD_011_019	846259.50	817565.31	846264.76	817559.77	50,31	1.9	1.62	1.50	19.18	6
RESIDENTIAL ROAD R	RD_011_020	846059.24	817296.32	846061.73	817276.16	50,31	1.9	1.62	1.50	13.05	7
RESIDENTIAL ROAD R	RD_011_021	846061.73	817276.16	846061.33	817259.22	50,30	1.9	1.62	1.50	9.60	7
RESIDENTIAL ROAD R	RD_011_022	846061.33	817259.22	846056.70	817235.41	50,30	1.9	1.62	1.50	9.50	7
RESIDENTIAL ROAD R	RD_011_023	846056.70	817235.41	846049.61	817214.59	50,30	1.9	1.62	1.50	11.06	7
RESIDENTIAL ROAD R	RD_011_024	846049.61	817214.59	846041.78	817200.08	50,30	1.9	1.62	1.50	12.86	7
RESIDENTIAL ROAD R	RD_011_025	846041.78	817200.08	846031.59	817187.11	50,30	1.9	1.62	1.50	11.28	7
RESIDENTIAL ROAD R	RD_011_026	846031.59	817187.11	846002.34	817163.62	50,30	1.9	1.62	1.50	10.43	7
RESIDENTIAL ROAD R	RD_011_027	846002.34	817163.62	845974.63	817149.65	50,30	1.9	1.62	1.50	13.32	6
RESIDENTIAL ROAD R	RD_011_028	845974.63	817149.65	845948.46	817143.54	50,30	1.9	1.62	1.50	16.15	6
RESIDENTIAL ROAD R	RD_011_029	845948.46	817143.54	845923.62	817142.53	50,30	1.9	1.62	1.50	12.51	6
RESIDENTIAL ROAD R	RD_011_030	845923.62	817142.53	845897.96	817143.29	50,30	1.9	1.62	1.50	9.50	5
RESIDENTIAL ROAD R	RD_011_031	846245.05	817591.98	846255.56	817597.09	50,31	1.9	1.62	1.50	17.10	6
RESIDENTIAL ROAD R	RD_011_032	846255.56	817597.09	846262.98	817595.87	50,31	1.9	1.62	1.50	13.07	6
RESIDENTIAL ROAD R	RD_011_033	846262.98	817595.87	846268.86	817583.81	50,31	1.9	1.62	1.50	12.99	6
RESIDENTIAL ROAD R	RD_011_034	846268.86	817583.81	846268.97	817579.93	50,31	1.9	1.62	1.50	13.07	6
RESIDENTIAL ROAD R	RD_011_035	846268.97	817579.93	846267.63	817572.07	50,31	1.9	1.62	1.50	12.40	6
RESIDENTIAL ROAD R	RD_011_036	846267.63	817572.07	846259.50	817565.31	50,31	1.9	1.62	1.50	16.09	6
RESIDENTIAL ROAD C	RD_012_001	846101.34	817375.08	846087.93	817397.77	50,31	1.8	1.50	1.40	14.74	7
RESIDENTIAL ROAD C	RD_012_002	846087.93	817397.77	846077.21	817401.75	50,31	1.8	1.50	1.40	12.46	7
RESIDENTIAL ROAD C	RD_012_003	846077.21	817401.75	846071.74	817408.39	50,31	1.8	1.50	1.40	11.10	7
RESIDENTIAL ROAD C	RD_012_004	846071.74	817408.39	846070.50	817418.46	50,31	1.8	1.50	1.40	12.28	7
RESIDENTIAL ROAD C	RD_012_005	846070.50	817418.46	846071.94	817424.67	50,31	1.8	1.50	1.40	11.85	7
RESIDENTIAL ROAD C	RD_012_006	846071.94	817424.67	846075.54	817428.21	50,31	1.8	1.50	1.40	14.45	7
RESIDENTIAL ROAD C	RD_012_007	846075.54	817428.21	846082.14	817428.99	50,31	1.8	1.50	1.40	16.19	7
RESIDENTIAL ROAD C	RD_012_008	846082.14	817428.99	846083.49	817412.16	50,31	1.8	1.50	1.40	13.76	7
RESIDENTIAL ROAD C	RD_012_009	846083.49	817412.16	846087.93	817397.77	50,31	1.8	1.50	1.40	13.81	7
RESIDENTIAL ROAD C	RD_012_010	846045.95	817291.77	846042.14	817292.21	50,31	1.8	1.50	1.40	16.27	7
RESIDENTIAL ROAD C	RD_012_011	846042.14	817292.21	846034.72	817297.19	50,31	1.8	1.50	1.40	14.06	7
RESIDENTIAL ROAD C	RD_012_012	846034.72	817297.19	846032.13	817307.37	50,31	1.8	1.50	1.40	16.49	7
RESIDENTIAL ROAD C	RD_012_013	846039.13	817318.78	846043.77	817321.11	50,31	1.8	1.50	1.40	17.74	7
RESIDENTIAL ROAD C	RD_012_014	846043.77	817321.11	846051.60	817321.78	50,31	1.8	1.50	1.40	18.14	7
RESIDENTIAL ROAD C	RD_012_015	846032.13	817307.37	846035.53	817316.90	50,31	1.8	1.50	1.40	18.26	8
RESIDENTIAL ROAD C	RD_012_016	846035.53	817316.90	846039.13	817318.78	50,31	1.8	1.50	1.40	18.07	8
RESIDENTIAL ROAD C	RD_012_017	846051.60	817321.78	846061.60	817315.70	50,31	1.8	1.50	1.40	19.35	7
RESIDENTIAL ROAD C	RD_012_018	846061.60	817315.70	846063.25	817310.38	50,31	1.8	1.50	1.40	17.02	7
RESIDENTIAL ROAD C	RD_012_019	846063.25	817310.38	846063.05	817301.08	50,31	1.8	1.50	1.40	14.33	7
RESIDENTIAL ROAD C	RD_012_020	846063.05	817301.08	846059.24	817296.32	50,31	1.8	1.50	1.40	14.87	7
RESIDENTIAL ROAD C	RD_012_021	846059.24	817296.32	846056.46	817292.99	50,31	1.8	1.50	1.40	18.12	7
RESIDENTIAL ROAD C	RD_012_022	846056.46	817292.99	846051.21	817291.11	50,31	1.8	1.50	1.40	21.05	7
RESIDENTIAL ROAD C	RD_012_023	846051.21	817291.11	846045.95	817291.77	50,31	1.8	1.50	1.40	20.05	7

Met Summary

Grid (I,J)	Hour	Annual Minimum		Month Minimum																							
		Temperature	RH	January		February		March		April		May		June		July		August		September		October		November		December	
				Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH
50,30	0000-0100	13	30	13	41	16	65	17	75	21	78	21	70	26	72	26	76	27	72	25	36	22	40	17	46	13	30
50,30	0100-0200	12	30	13	42	16	63	17	76	21	76	21	74	26	78	27	74	27	75	24	39	22	52	17	47	12	30
50,30	0200-0300	12	30	12	42	16	62	17	75	21	72	21	74	26	82	27	73	25	77	24	39	22	56	16	45	12	30
50,30	0300-0400	11	29	12	41	16	60	17	69	21	73	20	73	25	82	27	71	26	78	23	41	21	56	16	46	11	29
50,30	0400-0500	11	29	12	40	16	59	17	67	21	75	21	72	25	82	27	72	26	76	23	43	21	57	15	46	11	29
50,30	0500-0600	10	29	11	43	16	61	17	67	20	77	21	71	24	77	27	73	26	75	23	43	21	57	15	48	10	29
50,30	0600-0700	10	28	11	45	15	66	17	59	20	76	21	68	24	66	27	77	26	76	23	44	20	51	15	47	10	28
50,30	0700-0800	11	30	12	48	16	67	17	49	20	74	21	60	24	67	27	70	26	68	23	40	21	47	16	44	11	30
50,30	0800-0900	12	30	13	49	15	66	18	48	20	69	22	60	25	61	27	66	27	63	24	36	22	44	17	44	12	30
50,30	0900-1000	13	29	14	46	16	63	18	47	20	67	22	54	25	59	27	62	28	54	25	32	23	42	18	43	13	29
50,30	1000-1100	14	27	14	41	17	61	19	46	20	61	22	58	25	61	27	58	27	51	26	30	24	41	19	41	14	27
50,30	1100-1200	15	25	15	37	19	59	19	50	20	59	22	59	26	56	25	52	28	48	27	30	24	41	20	38	15	25
50,30	1200-1300	15	23	16	35	19	57	19	51	21	59	23	58	27	50	27	57	27	47	27	27	24	43	20	38	15	23
50,30	1300-1400	16	22	16	33	19	54	18	55	21	61	22	58	28	47	28	56	26	49	27	28	24	42	20	37	16	22
50,30	1400-1500	16	22	16	34	20	55	18	54	21	60	22	60	27	51	26	58	27	45	28	27	25	42	20	36	16	22
50,30	1500-1600	16	23	16	41	19	54	18	57	21	62	22	59	28	55	26	60	26	54	27	26	25	45	20	38	16	23
50,30	1600-1700	16	24	16	43	19	58	18	60	21	65	22	63	26	55	26	64	27	59	27	27	25	47	20	38	16	24
50,30	1700-1800	16	25	16	48	20	66	18	62	21	69	22	65	27	53	28	65	27	62	27	26	24	47	19	44	16	25
50,30	1800-1900	16	23	16	50	20	70	18	68	21	73	22	67	27	63	27	66	27	66	27	26	24	52	19	36	17	23
50,30	1900-2000	14	23	16	53	17	73	18	73	21	72	22	75	27	68	27	68	28	66	27	29	24	55	19	37	14	23
50,30	2000-2100	14	26	16	54	17	77	18	75	20	75	22	77	26	73	27	71	27	68	26	28	24	59	19	39	14	26
50,30	2100-2200	13	26	15	51	17	77	18	75	21	76	22	75	26	75	27	71	27	70	26	31	24	59	19	40	13	26
50,30	2200-2300	14	28	16	44	16	78	18	73	21	79	22	73	26	76	26	71	25	64	26	31	23	39	18	41	14	28
50,30	2300-0000	13	28	15	41	15	78	18	70	21	80	22	71	26	77	26	74	26	73	25	33	23	39	17	44	13	28
50,31	0000-0100	12	30	13	41	16	65	17	75	20	78	21	71	26	72	26	77	27	74	24	36	22	40	17	46	12	30
50,31	0100-0200	12	30	12	42	16	63	17	77	21	77	21	74	26	78	26	74	26	75	24	39	21	53	17	47	12	30
50,31	0200-0300	11	30	12	42	16	62	17	76	20	72	21	76	26	83	27	74	25	76	24	40	21	57	16	45	11	30
50,31	0300-0400	11	29	12	41	15	61	16	70	20	73	20	75	25	83	27	72	26	78	23	41	21	57	15	46	11	29
50,31	0400-0500	11	29	11	40	15	59	16	67	20	75	20	73	24	83	27	73	26	77	23	43	21	57	15	47	11	29
50,31	0500-0600	10	28	11	42	15	61	16	67	20	78	21	73	24	78	27	74	26	77	23	43	20	57	15	48	10	28
50,31	0600-0700	10	28	11	45	15	66	16	60	20	77	20	70	24	67	27	78	26	78	23	44	20	52	15	47	10	28
50,31	0700-0800	10	29	11	48	15	67	17	50	20	73	21	59	24	67	27	71	26	70	23	40	20	48	15	44	10	29
50,31	0800-0900	12	31	13	49	15	67	18	48	20	68	22	60	25	62	27	67	26	62	24	36	22	45	17	43	12	31
50,31	0900-1000	13	29	13	46	16	63	18	47	20	66	22	55	25	59	27	61	28	54	25	33	23	43	18	42	13	29
50,31	1000-1100	14	27	14	41	17	61	19	46	20	61	22	58	25	60	27	57	28	50	26	30	24	41	18	41	14	27
50,31	1100-1200	15	24	15	37	18	60	19	50	20	58	22	59	26	55	25	51	28	48	26	30	24	41	19	38	15	24
50,31	1200-1300	15	22	16	36	19	57	18	51	20	58	22	58	27	49	26	55	26	46	27	28	24	42	20	38	15	22
50,31	1300-1400	15	22	16	33	19	54	18	54	20	60	22	57	28	46	27	55	26	46	27	28	24	41	20	37	15	22
50,31	1400-1500	15	22	16	34	19	55	18	54	21	59	22	59	27	49	26	58	26	43	28	27	25	42	20	37	15	22
50,31	1500-1600	16	23	16	41	19	54	18	56	21	61	22	59	28	54	26	59	26	52	27	27	25	43	20	38	16	23
50,31	1600-1700	16	24	16	43	19	57	18	60	20	64	22	63	26	53	26	62	26	58	27	28	24	47	19	38	16	24
50,31	1700-1800	16	25	16	48	19	67	18	62	20	67	22	65	27	53	28	66	27	63	27	25	24	46	19	44	16	26
50,31	1800-1900	15	23	15	51	19	70	18	69	20	72	22	68	27	63	27	66	26	67	26	26	24	50	19	36	16	23
50,31	1900-2000	14	23	15	54	17	74	18	74	20	72	21	76	26	67	27	69	27	66	26	29	24	55	19	37	14	23
50,31	2000-2100	13	26	15	54	17	78	18	76	20	74	21	79	26	73	27	71	26	68	26	28	24	60	19	39	13	26
50,31	2100-2200	13	26	15	51	17	79	18	75	20	76	22	76	25	75	26	72	27	70	26	32	24	60	18	41	13	26
50,31	2200-2300	13	27	15	45	16	79	17	74	20	80	21	73	26	76	26	71	25	65	25	31	23	40	17	41	13	27
50,31	2300-0000	13	28	15	41	15	79	17	71	20	80	21	72	26	77	26	75	26	73	25	34	22	39	17	44	13	28

Met Summary

Grid (I,J)	Hour	Month Average																							
		January		February		March		April		May		June		July		August		September		October		November		December	
		Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH	Temperature	RH
50,30	0000-0100	18	80	21	89	21	88	24	90	25	90	28	88	29	83	28	85	27	76	26	70	21	71	17	73
50,30	0100-0200	18	80	21	89	21	88	24	90	25	91	28	89	29	83	28	86	27	77	25	71	21	70	17	73
50,30	0200-0300	18	80	21	89	21	89	24	90	25	91	28	90	29	84	28	87	27	77	25	72	20	70	17	72
50,30	0300-0400	18	79	20	89	21	88	24	90	25	91	28	90	29	84	28	88	27	77	25	73	20	69	17	71
50,30	0400-0500	18	79	20	90	21	88	24	91	25	91	28	90	28	84	28	88	26	77	25	74	20	70	17	70
50,30	0500-0600	17	79	20	90	21	88	24	92	25	91	28	90	28	85	28	88	26	77	24	75	20	70	16	70
50,30	0600-0700	17	80	20	91	21	87	24	90	25	88	28	87	29	83	28	85	26	76	24	74	19	69	16	69
50,30	0700-0800	17	78	20	88	21	83	25	85	26	84	28	84	29	79	29	81	27	72	25	71	20	66	17	67
50,30	0800-0900	18	75	21	83	22	79	26	81	26	81	29	80	30	76	29	77	28	68	26	67	21	63	18	64
50,30	0900-1000	19	73	22	79	23	76	26	78	27	78	30	76	30	74	30	72	28	64	26	64	22	60	18	61
50,30	1000-1100	19	70	22	77	23	73	27	75	27	77	30	75	31	70	31	69	29	62	27	62	23	57	19	59
50,30	1100-1200	20	68	23	75	23	72	27	73	27	75	30	73	31	69	31	68	30	60	27	60	23	55	20	58
50,30	1200-1300	20	67	23	73	23	72	27	72	28	75	30	72	31	68	31	68	30	59	27	59	24	54	20	57
50,30	1300-1400	20	67	23	73	24	72	27	72	27	75	31	72	31	69	31	69	30	59	27	59	24	55	20	56
50,30	1400-1500	21	67	23	73	24	72	27	73	28	74	31	73	31	69	31	69	30	60	28	59	24	56	21	56
50,30	1500-1600	21	68	23	74	24	73	27	74	28	75	30	74	31	70	31	71	30	61	27	60	24	58	21	57
50,30	1600-1700	20	70	23	76	23	75	26	76	27	78	30	74	31	73	30	73	30	63	27	62	23	62	20	60
50,30	1700-1800	20	73	22	80	23	78	26	80	27	81	30	76	30	75	30	76	29	64	27	65	23	65	20	64
50,30	1800-1900	20	75	22	82	23	81	25	83	27	84	29	79	30	77	30	79	29	66	27	66	23	66	20	66
50,30	1900-2000	20	76	22	84	22	82	25	84	26	85	29	80	30	78	29	79	29	67	27	69	23	67	19	67
50,30	2000-2100	19	79	21	87	22	84	25	87	26	88	29	84	29	81	29	82	28	69	26	70	22	68	19	70
50,30	2100-2200	19	79	21	88	22	86	25	88	26	89	28	85	29	82	29	83	28	71	26	71	22	69	18	72
50,30	2200-2300	19	78	21	89	22	87	25	89	26	90	28	86	29	83	29	84	28	72	26	71	22	70	18	72
50,30	2300-0000	19	79	21	90	22	87	24	90	25	90	28	86	29	83	29	85	28	73	26	72	21	72	18	73
50,31	0000-0100	18	81	20	90	21	89	24	91	25	91	28	88	29	84	28	86	27	77	25	71	21	72	17	74
50,31	0100-0200	18	80	20	89	21	89	24	91	25	91	28	89	29	84	28	87	27	78	25	72	21	71	17	74
50,31	0200-0300	18	80	20	90	21	89	24	91	25	92	28	90	28	84	28	88	26	78	25	73	20	71	17	73
50,31	0300-0400	17	80	20	90	21	89	24	91	25	92	28	91	28	85	28	88	26	78	24	74	20	70	16	72
50,31	0400-0500	17	80	20	90	21	89	24	91	25	91	27	91	28	85	28	89	26	78	24	75	20	70	16	71
50,31	0500-0600	17	80	20	91	21	88	24	92	25	91	27	90	28	86	28	88	26	78	24	76	19	71	16	70
50,31	0600-0700	17	80	20	91	21	88	24	90	25	89	28	87	28	84	28	86	26	77	24	75	19	70	16	69
50,31	0700-0800	17	78	20	88	21	83	25	86	26	85	28	84	29	79	29	81	27	73	25	71	20	66	16	67
50,31	0800-0900	18	75	21	84	22	79	25	81	26	81	29	80	30	76	29	77	28	68	25	68	21	63	17	64
50,31	0900-1000	19	73	22	79	22	76	26	78	27	78	29	76	30	73	30	73	28	65	26	65	22	60	18	61
50,31	1000-1100	19	70	22	77	23	73	27	74	27	76	30	74	31	70	31	69	29	61	27	61	22	57	19	59
50,31	1100-1200	20	68	23	74	23	72	27	73	27	75	30	73	31	69	31	67	30	59	27	60	23	54	20	58
50,31	1200-1300	20	66	23	73	23	72	27	72	28	74	30	71	31	68	31	67	30	58	27	59	24	53	20	57
50,31	1300-1400	20	66	23	72	24	71	27	72	28	74	31	71	31	68	31	68	30	59	27	59	24	54	20	56
50,31	1400-1500	21	67	23	73	24	71	27	72	28	74	30	73	31	68	31	69	30	59	27	58	24	55	21	56
50,31	1500-1600	21	68	23	74	24	72	27	73	28	75	30	73	31	70	31	70	30	62	27	60	24	59	21	57
50,31	1600-1700	20	71	23	76	23	75	26	76	27	78	30	74	31	72	30	73	29	63	27	63	23	62	20	60
50,31	1700-1800	20	74	22	80	23	78	26	79	27	81	30	76	30	75	30	76	29	64	27	65	23	65	19	65
50,31	1800-1900	20	75	22	83	22	81	25	83	26	84	29	79	30	77	29	80	29	67	26	67	23	66	19	67
50,31	1900-2000	20	77	21	85	22	83	25	84	26	86	29	81	30	78	29	80	29	67	26	69	22	68	19	68
50,31	2000-2100	19	80	21	88	22	85	25	87	26	89	29	84	29	81	29	82	28	70	26	71	22	70	18	71
50,31	2100-2200	19	80	21	89	22	86	25	88	25	90	28	86	29	82	29	84	28	72	26	72	22	70	18	73
50,31	2200-2300	19	79	21	90	21	87	24	89	25	90	28	86	29	83	28	85	28	73	25	72	21	71	17	73
50,31	2300-0000	19	79	21	91	21	87	24	90	25	91	28	87	29	84	28	85	27	74	25	72	21	73	17	73

Composite Emission Rate (January 2030)

Road Name	Road ID	Hour	NO2 Emission						NO Emission						NOX Emission		
			MonthlyHourMin			MonthlyHourAverage			MonthlyHourMin			MonthlyHourAverage			MonthlyHourAverage		
			g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour
WAN PO ROAD L	RD_001	0000-0100	0.0255212	7.061E-07	5.613E-05	0.0238192	6.59E-07	5.239E-05	0.316797	8.764E-06	0.0006967	0.2822531	7.809E-06	0.0006208	0.3060723	8.468E-06	0.0006732
WAN PO ROAD L	RD_001	0100-0200	0.0287083	5.41E-07	4.301E-05	0.0268731	5.064E-07	4.026E-05	0.3220872	6.07E-06	0.0004825	0.2881845	5.431E-06	0.0004317	0.3150576	5.937E-06	0.000472
WAN PO ROAD L	RD_001	0200-0300	0.0320063	4.614E-07	3.668E-05	0.0299702	4.32E-07	3.435E-05	0.3281997	4.731E-06	0.0003761	0.2928821	4.222E-06	0.0003356	0.3228523	4.654E-06	0.00037
WAN PO ROAD L	RD_001	0300-0400	0.035456	3.828E-07	3.043E-05	0.0333303	3.599E-07	2.861E-05	0.3362338	3.63E-06	0.0002886	0.3024528	3.266E-06	0.0002596	0.3357831	3.625E-06	0.0002882
WAN PO ROAD L	RD_001	0400-0500	0.0388968	3.964E-07	3.151E-05	0.0365476	3.724E-07	2.961E-05	0.3420542	3.486E-06	0.0002771	0.3083363	3.142E-06	0.0002498	0.344884	3.514E-06	0.0002794
WAN PO ROAD L	RD_001	0500-0600	0.0423975	6.085E-07	4.837E-05	0.0400798	5.752E-07	4.573E-05	0.3488207	5.006E-06	0.000398	0.317695	4.559E-06	0.0003625	0.3577748	5.135E-06	0.0004082
WAN PO ROAD L	RD_001	0600-0700	0.0460369	1.857E-06	0.0001476	0.0435446	1.757E-06	0.0001396	0.3519535	1.42E-05	0.0011287	0.3220831	1.299E-05	0.0010329	0.3656277	1.475E-05	0.0011726
WAN PO ROAD L	RD_001	0700-0800	0.0500028	3.646E-06	0.0002899	0.0476254	3.473E-06	0.0002761	0.3567955	2.602E-05	0.0020684	0.3310599	2.414E-05	0.0019192	0.3786852	2.761E-05	0.0021953
WAN PO ROAD L	RD_001	0800-0900	0.03685	2.927E-06	0.0002327	0.0349915	2.779E-06	0.0002209	0.2935081	2.331E-05	0.0018533	0.269944	2.144E-05	0.0017045	0.3049355	2.422E-05	0.0019254
WAN PO ROAD L	RD_001	0900-1000	0.0490759	3.266E-06	0.0002596	0.0467561	3.111E-06	0.0002473	0.356076	2.37E-05	0.0018837	0.3293279	2.192E-05	0.0017422	0.376084	2.503E-05	0.0019895
WAN PO ROAD L	RD_001	1000-1100	0.0510696	3.199E-06	0.0002543	0.0486653	3.048E-06	0.0002423	0.3811835	2.388E-05	0.001898	0.351842	2.204E-05	0.0017519	0.4005073	2.509E-05	0.0019943
WAN PO ROAD L	RD_001	1100-1200	0.0499193	2.971E-06	0.0002362	0.0473934	2.821E-06	0.0002242	0.3632222	2.162E-05	0.0017186	0.3333393	1.984E-05	0.0015772	0.3807327	2.266E-05	0.0018014
WAN PO ROAD L	RD_001	1200-1300	0.0613458	1.469E-06	0.0001167	0.0584771	1.4E-06	0.0001113	0.3921357	9.387E-06	0.0007463	0.3651771	8.742E-06	0.000695	0.4236543	1.014E-05	0.0008062
WAN PO ROAD L	RD_001	1300-1400	0.0699732	1.705E-06	0.0001356	0.0665589	1.622E-06	0.000129	0.4363394	1.063E-05	0.0008454	0.4055824	9.885E-06	0.0007858	0.4721413	1.151E-05	0.0009148
WAN PO ROAD L	RD_001	1400-1500	0.0609221	1.503E-06	0.0001195	0.0577121	1.424E-06	0.0001132	0.3924011	9.683E-06	0.0007698	0.3624497	8.944E-06	0.000711	0.4201618	1.037E-05	0.0008242
WAN PO ROAD L	RD_001	1500-1600	0.0590218	1.454E-06	0.0001156	0.0561778	1.384E-06	0.00011	0.3906815	9.627E-06	0.0007653	0.362426	8.93E-06	0.0007099	0.4186038	1.031E-05	0.00082
WAN PO ROAD L	RD_001	1600-1700	0.0546966	1.458E-06	0.0001159	0.0522467	1.393E-06	0.0001107	0.3822212	1.019E-05	0.00081	0.3568006	9.511E-06	0.0007561	0.4090473	1.09E-05	0.0008668
WAN PO ROAD L	RD_001	1700-1800	0.0393246	1.22E-06	9.695E-05	0.0374946	1.163E-06	9.244E-05	0.3058421	9.485E-06	0.000754	0.2850696	8.841E-06	0.0007028	0.3225642	1E-05	0.0007953
WAN PO ROAD L	RD_001	1800-1900	0.0308295	9.684E-07	7.699E-05	0.0292896	9.2E-07	7.314E-05	0.2797777	8.788E-06	0.0006987	0.2597953	8.161E-06	0.0006488	0.2890849	9.081E-06	0.0007219
WAN PO ROAD L	RD_001	1900-2000	0.0266929	7.348E-07	5.842E-05	0.0253131	6.968E-07	5.54E-05	0.2905808	7.999E-06	0.0006359	0.2688632	7.401E-06	0.0005884	0.2941763	8.098E-06	0.0006438
WAN PO ROAD L	RD_001	2000-2100	0.0277843	6.213E-07	4.939E-05	0.0265317	5.933E-07	4.717E-05	0.3035825	6.789E-06	0.0005397	0.2828928	6.326E-06	0.0005029	0.3094245	6.92E-06	0.0005501
WAN PO ROAD L	RD_001	2100-2200	0.0272122	5.801E-07	4.612E-05	0.0257771	5.495E-07	4.369E-05	0.3364347	7.173E-06	0.0005702	0.3083387	6.574E-06	0.0005226	0.3341158	7.123E-06	0.0005663
WAN PO ROAD L	RD_001	2200-2300	0.0225829	4.679E-07	3.719E-05	0.02125	4.403E-07	3.5E-05	0.3240582	6.714E-06	0.0005337	0.2948105	6.108E-06	0.0004856	0.3160605	6.548E-06	0.0005206
WAN PO ROAD L	RD_001	2300-0000	0.0264055	4.232E-07	3.364E-05	0.0247586	3.968E-07	3.154E-05	0.3363012	5.39E-06	0.0004285	0.3029212	4.855E-06	0.0003859	0.3276798	5.251E-06	0.0004175
WAN PO ROAD R	RD_002	0000-0100	0.037018	3.762E-07	2.754E-05	0.0347839	3.535E-07	2.588E-05	0.3618857	3.678E-06	0.0002693	0.3264986	3.318E-06	0.0002429	0.3612825	3.672E-06	0.0002688
WAN PO ROAD R	RD_002	0100-0200	0.0418071	2.935E-07	2.149E-05	0.0394036	2.766E-07	2.026E-05	0.3723204	2.614E-06	0.0001914	0.33735	2.369E-06	0.0001734	0.3767536	2.645E-06	0.0001937
WAN PO ROAD R	RD_002	0200-0300	0.0465157	2.517E-07	1.843E-05	0.0438022	2.37E-07	1.735E-05	0.3812686	2.063E-06	0.000151	0.3447622	1.865E-06	0.0001366	0.3885643	2.102E-06	0.0001539
WAN PO ROAD R	RD_002	0300-0400	0.0512751	2.1E-07	1.538E-05	0.048419	1.983E-07	1.452E-05	0.3927192	1.608E-06	0.0001178	0.3575863	1.465E-06	0.0001072	0.4060054	1.663E-06	0.0001217
WAN PO ROAD R	RD_002	0400-0500	0.055996	2.191E-07	1.604E-05	0.0528823	2.069E-07	1.515E-05	0.4020119	1.573E-06	0.0001151	0.3667343	1.435E-06	0.000105	0.4196166	1.642E-06	0.0001202
WAN PO ROAD R	RD_002	0500-0600	0.0607028	3.395E-07	2.486E-05	0.0576079	3.222E-07	2.359E-05	0.4118907	2.304E-06	0.0001687	0.379226	2.121E-06	0.0001553	0.4368339	2.443E-06	0.0001789
WAN PO ROAD R	RD_002	0600-0700	0.0654799	1.039E-06	7.606E-05	0.0621808	9.865E-07	7.223E-05	0.4172178	6.619E-06	0.0004847	0.3857273	6.12E-06	0.0004481	0.4479081	7.106E-06	0.0005203
WAN PO ROAD R	RD_002	0700-0800	0.0698869	2.029E-06	0.0001486	0.0668543	1.941E-06	0.0001421	0.4227947	1.227E-05	0.0008987	0.3957069	1.149E-05	0.0008411	0.4625612	1.343E-05	0.0009832
WAN PO ROAD R	RD_002	0800-0900	0.0542184	1.661E-06	0.0001216	0.0518279	1.588E-06	0.0001163	0.3520346	1.079E-05	0.0007898	0.3275091	1.004E-05	0.0007348	0.379337	1.162E-05	0.0008511
WAN PO ROAD R	RD_002	0900-1000	0.0776949	2.225E-06	0.0001629	0.0742776	2.127E-06	0.0001557	0.4413593	1.264E-05	0.0009253	0.4127775	1.182E-05	0.0008653	0.4870551	1.395E-05	0.001021
WAN PO ROAD R	RD_002	1000-1100	0.0835551	2.325E-06	0.0001702	0.0799206	2.224E-06	0.0001628	0.471766	1.313E-05	0.0009612	0.4408533	1.227E-05	0.0008982	0.5207739	1.449E-05	0.0010611
WAN PO ROAD R	RD_002	1100-1200	0.0830852	2.157E-06	0.0001579	0.0791548	2.055E-06	0.0001504	0.4592318	1.192E-05	0.0008728	0.4270703	1.109E-05	0.0008117	0.5062251	1.314E-05	0.0009621
WAN PO ROAD R	RD_002	1200-1300	0.0520092	2.027E-06	0.0001484	0.0495354	1.931E-06	0.0001414	0.357858	1.395E-05	0.0010212	0.3319653	1.294E-05	0.0009474	0.3815007	1.487E-05	0.0010887
WAN PO ROAD R	RD_002	1300-1400	0.060886	2.389E-06	0.0001749	0.0578641	2.27E-06	0.0001662	0.4034271	1.583E-05	0.0011589	0.3737156	1.466E-05	0.0010735	0.4315797	1.693E-05	0.0012397
WAN PO ROAD R	RD_002	1400-1500	0.0512172	2.056E-06	0.0001506	0.0484409	1.945E-06	0.0001424	0.3569432	1.433E-05	0.0010493	0.3282971	1.318E-05	0.0009651	0.376738	1.513E-05	0.0011075
WAN PO ROAD R	RD_002	1500-1600	0.0486615	1.946E-06	0.0001425	0.0462522	1.85E-06	0.0001354	0.3540187	1.416E-05	0.0010367	0.327012	1.308E-05	0.0009576	0.3732642	1.493E-05	0.0010931
WAN PO ROAD R	RD_002	1600-1700	0.0465494	2.024E-06	0.0001482	0.0444069	1.931E-06	0.0001414	0.3512848	1.527E-05	0.0011184	0.3268046	1.421E-05	0.0010404	0.3712115	1.614E-05	0.0011818
WAN PO ROAD R	RD_002	1700-1800	0.0340816	1.766E-06	0.0001293	0.0324512	1.682E-06	0.0001231	0.2827729	1.465E-05	0.0010729	0.2627829	1.362E-05	0.0009971	0.2952341	1.53E-05	0.0011202
WAN PO ROAD R	RD_002	1800-1900	0.0263783	1.4E-06	0.0001025	0.0250854	1.332E-06	9.75E-05	0.2575345	1.367E-05	0.001001	0.2382628	1.265E-05	0.0009261	0.2633482	1.398E-05	0.0010236
WAN PO ROAD R	RD_002	1900-2000	0.0236446	1.106E-06	8.095E-05	0.0224655	1.05E-06	7.691E-05	0.2709351	1.267E-05	0.0009276	0.2498737	1.168E-05	0.0008555	0.2723392	1.273E-05	0.0009324
WAN PO ROAD R	RD_002	2000-2100	0.0242887	9.236E-07	6.762E-05	0.0231742	8.812E-07	6.452E-05	0.2825192	1.074E-05	0.0007866	0.2624274	9.979E-06	0.0007306	0.2856016	1.086E-05	0.0007952
WAN PO ROAD R	RD_002	2100-2200	0.0240427	8.721E-07	6.385E-05	0.0227147	8.239E-07	6.032E-05	0.315458	1.144E-05	0.0008378	0.2879832	1.045E-05	0.0007648	0.3106979	1.127E-05	0.0008251
WAN PO ROAD R	RD_002	2200-2300	0.0197292	6.983E-07	5.113E-05	0.0185409	6.562E-07	4.805E-05	0.305092	1.08E-05	0.0007906	0.2764173	9.783E-06	0.0007163	0.2949582	1.044E-05	0.0007644
WAN PO ROAD R	RD_002	2300-0000	0.0230506	6.288E-07	4.604E-05	0.021556	5.88E-07	4.305E-05	0.3154815	8.606E-06	0.0006301	0.2828126	7.715E-06	0.0005649	0.3043686	8.303E-06	0.0006079
CROSS BAY LINK L	RD_003	0000-0100	0.0242335	3.731E-07	8.903E-06	0.0224274	3.453E-07	8.239E-06	0.2053419	3.162E-06	7.544E-05	0.1758952	2.708E-06	6.462E-05	0.1983226	3.053E-06	7.286E-05
CROSS BAY LINK L	RD_003	0100-0200	0.0287112	3.043E-07	7.261E-06	0.0267376	2.834E-07	6.762E-06	0.2145647	2.274E-06	5.426E-05	0.1859966	1.971E-06	4.704E-05	0.2127342	2.255E-06	5.38E-05
CROSS BAY LINK L	RD_003	0200-0300	0.0334601	2.736E-07	6.529E-06	0.0311491	2.547E-07	6.078E-06	0.2268131	1.855E-06	4.426E-05	0.1962094	1.604E-06	3.828E-05	0.2273585	1.859E-06	4.436E-05
CROSS BAY LINK L	RD_003	0300-0400	0.0379301	2.342E-07	5.589E-06	0.0354379	2.188E-07	5.222E-06	0.2362457	1.459E-06	3.481E-05	0.2064972	1.275E-06	3.043E-05	0.2419351	1.494E-06	3.565E-05
CROSS BAY LINK L	RD_003	0400-0500	0.0425378	2.485E-07	5.929E-06	0.0398214	2.326E-07	5.55E-06	0.2459317	1.436E-06	3.428E-05	0.2166697	1.266E-06	3.02E-05	0.2564911	1.498E-06	3.575E-05
CROSS BAY LINK L	RD_003	0500-0600	0.0471398	3.935E-07	9.389E-06	0.0444666	3.711E-07	8.856E-06	0.2568007	2.143E-06	5.115E-05	0.2299181	1.919E-06	4.579E-05	0.2743847	2.29E-06	5.465E-05
CROSS BAY LINK L	RD_003	0600-0700	0.05182	1.224E-06	2.92E-05	0.0489752	1.156E-06	2.76E-05	0.2652087	6.263E-06	0.0001494	0.2393017	5.651E-06	0.0001348	0.2882768	6.807E-06	0.0001624

Appendix 3.3 Calculation of Vehicular Emissions
Doubled Traffic Scenario

Road Name	Road ID	Hour	NO2 Emission						NO Emission						NOX Emission		
			MonthlyHourMin			MonthlyHourAverage			MonthlyHourMin			MonthlyHourAverage			MonthlyHourAverage		
			g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour
CROSS BAY LINK L	RD_003	0700-0800	0.056228	2.421E-06	5.777E-05	0.0535943	2.308E-06	5.507E-05	0.2719535	1.171E-05	0.0002794	0.2503402	1.078E-05	0.0002572	0.3039345	1.309E-05	0.0003123
CROSS BAY LINK L	RD_003	0800-0900	0.0425003	1.963E-06	4.685E-05	0.0404719	1.87E-06	4.462E-05	0.2294015	1.06E-05	0.0002529	0.2088791	9.65E-06	0.0002303	0.249351	1.152E-05	0.0002749
CROSS BAY LINK L	RD_003	0900-1000	0.0627219	2.623E-06	6.258E-05	0.0598445	2.502E-06	5.971E-05	0.2935551	1.227E-05	0.0002929	0.2705732	1.131E-05	0.00027	0.3304177	1.382E-05	0.0003297
CROSS BAY LINK L	RD_003	1000-1100	0.0678066	2.742E-06	6.542E-05	0.0646874	2.616E-06	6.241E-05	0.3202329	1.295E-05	0.000309	0.2944437	1.191E-05	0.0002841	0.3591312	1.452E-05	0.0003465
CROSS BAY LINK L	RD_003	1100-1200	0.067804	2.566E-06	6.123E-05	0.06446	2.439E-06	5.821E-05	0.3172655	1.201E-05	0.0002865	0.2905478	1.1E-05	0.0002624	0.3550078	1.344E-05	0.0003206
CROSS BAY LINK L	RD_003	1200-1300	0.0432255	2.06E-06	4.915E-05	0.0410111	1.954E-06	4.663E-05	0.2434978	1.16E-05	0.0002769	0.2217836	1.057E-05	0.0002522	0.2627947	1.252E-05	0.0002988
CROSS BAY LINK L	RD_003	1300-1400	0.0513963	2.445E-06	5.835E-05	0.0487008	2.317E-06	5.529E-05	0.2791711	1.328E-05	0.000317	0.2543432	1.21E-05	0.0002888	0.303044	1.442E-05	0.0003441
CROSS BAY LINK L	RD_003	1400-1500	0.0423004	2.076E-06	4.953E-05	0.0398581	1.956E-06	4.667E-05	0.241235	1.184E-05	0.0002825	0.2176224	1.068E-05	0.0002548	0.2574805	1.264E-05	0.0003015
CROSS BAY LINK L	RD_003	1500-1600	0.0395099	1.932E-06	4.611E-05	0.0374046	1.829E-06	4.365E-05	0.235895	1.154E-05	0.0002753	0.2134867	1.044E-05	0.0002491	0.2508913	1.227E-05	0.0002928
CROSS BAY LINK L	RD_003	1600-1700	0.0373722	1.987E-06	4.741E-05	0.0355184	1.888E-06	4.506E-05	0.2303154	1.224E-05	0.0002922	0.2101675	1.117E-05	0.0002666	0.2456859	1.306E-05	0.0003117
CROSS BAY LINK L	RD_003	1700-1800	0.0263732	1.678E-06	4.004E-05	0.024992	1.59E-06	3.795E-05	0.1813628	1.154E-05	0.0002754	0.1651987	1.051E-05	0.0002508	0.1901907	1.21E-05	0.0002888
CROSS BAY LINK L	RD_003	1800-1900	0.0186073	1.214E-06	2.896E-05	0.0175494	1.145E-06	2.732E-05	0.152966	9.978E-06	0.0002381	0.1379172	8.996E-06	0.0002147	0.1554666	1.014E-05	0.000242
CROSS BAY LINK L	RD_003	1900-2000	0.0149865	8.598E-07	2.052E-05	0.0140374	8.054E-07	1.922E-05	0.1538518	8.827E-06	0.0002106	0.1373357	7.879E-06	0.000188	0.1513731	8.685E-06	0.0002072
CROSS BAY LINK L	RD_003	2000-2100	0.015604	7.299E-07	1.742E-05	0.0147157	6.884E-07	1.643E-05	0.1619115	7.574E-06	0.0001807	0.1461681	6.838E-06	0.0001632	0.1608838	7.526E-06	0.0001796
CROSS BAY LINK L	RD_003	2100-2200	0.0143608	6.388E-07	1.524E-05	0.0133204	5.925E-07	1.414E-05	0.1821085	8.101E-06	0.0001933	0.1592392	7.083E-06	0.000169	0.1725596	7.676E-06	0.0001832
CROSS BAY LINK L	RD_003	2200-2300	0.0108649	4.733E-07	1.129E-05	0.0099549	4.337E-07	1.035E-05	0.1813568	7.901E-06	0.0001885	0.1577629	6.873E-06	0.000164	0.1677178	7.307E-06	0.0001743
CROSS BAY LINK L	RD_003	2300-0000	0.0140026	4.697E-07	1.121E-05	0.012789	4.29E-07	1.024E-05	0.1914349	6.422E-06	0.0001532	0.1636674	5.491E-06	0.000131	0.1764564	5.92E-06	0.0001412
CROSS BAY LINK R	RD_004	0000-0100	0.0143775	5.443E-07	9.64E-06	0.0130327	4.934E-07	8.739E-06	0.1833437	6.94E-06	0.0001229	0.1539094	5.826E-06	0.0001032	0.1669421	6.32E-06	0.0001119
CROSS BAY LINK R	RD_004	0100-0200	0.0171515	4.413E-07	7.817E-06	0.015702	4.04E-07	7.156E-06	0.1871348	4.815E-06	8.529E-05	0.1587491	4.085E-06	7.235E-05	0.1744512	4.489E-06	7.951E-05
CROSS BAY LINK R	RD_004	0200-0300	0.0202066	3.963E-07	7.019E-06	0.0185073	3.63E-07	6.429E-06	0.194048	3.806E-06	6.741E-05	0.1636692	3.21E-06	5.685E-05	0.1821764	3.573E-06	6.328E-05
CROSS BAY LINK R	RD_004	0300-0400	0.0230866	3.379E-07	5.984E-06	0.021274	3.113E-07	5.514E-06	0.1982735	2.902E-06	5.139E-05	0.1689508	2.472E-06	4.379E-05	0.1902248	2.784E-06	4.931E-05
CROSS BAY LINK R	RD_004	0400-0500	0.0261104	3.592E-07	6.363E-06	0.0241568	3.324E-07	5.887E-06	0.2026174	2.788E-06	4.938E-05	0.1740528	2.395E-06	4.242E-05	0.1982096	2.727E-06	4.83E-05
CROSS BAY LINK R	RD_004	0500-0600	0.0292538	5.649E-07	1.001E-05	0.0273197	5.275E-07	9.344E-06	0.2085368	4.027E-06	7.132E-05	0.1823413	3.521E-06	6.236E-05	0.209661	4.048E-06	7.171E-05
CROSS BAY LINK R	RD_004	0600-0700	0.0325462	1.762E-06	3.12E-05	0.0304801	1.65E-06	2.922E-05	0.2123229	1.149E-05	0.0002036	0.1873676	1.014E-05	0.0001796	0.2178477	1.179E-05	0.0002089
CROSS BAY LINK R	RD_004	0700-0800	0.0356844	3.48E-06	6.165E-05	0.033785	3.295E-06	5.837E-05	0.2143925	2.091E-05	0.0003704	0.1938705	1.891E-05	0.0003349	0.2276555	2.22E-05	0.0003933
CROSS BAY LINK R	RD_004	0800-0900	0.024899	2.68E-06	4.747E-05	0.0234501	2.524E-06	4.471E-05	0.1791661	1.929E-05	0.0003416	0.1595463	1.717E-05	0.0003042	0.1829964	1.97E-05	0.0003489
CROSS BAY LINK R	RD_004	0900-1000	0.0310474	2.697E-06	4.777E-05	0.0293819	2.552E-06	4.521E-05	0.2021565	1.756E-05	0.000311	0.1811668	1.574E-05	0.0002787	0.2105487	1.829E-05	0.0003239
CROSS BAY LINK R	RD_004	1000-1100	0.0307387	2.482E-06	4.396E-05	0.0290365	2.344E-06	4.153E-05	0.2157651	1.742E-05	0.0003086	0.1916751	1.548E-05	0.0002741	0.2207116	1.782E-05	0.0003157
CROSS BAY LINK R	RD_004	1100-1200	0.0306664	2.372E-06	4.201E-05	0.0288567	2.232E-06	3.953E-05	0.2103712	1.627E-05	0.0002882	0.1861097	1.439E-05	0.0002549	0.2149664	1.662E-05	0.0002945
CROSS BAY LINK R	RD_004	1200-1300	0.0452277	1.435E-06	2.542E-05	0.0429094	1.362E-06	2.412E-05	0.2348953	7.455E-06	0.000132	0.2134813	6.775E-06	0.00012	0.2563907	8.137E-06	0.0001441
CROSS BAY LINK R	RD_004	1300-1400	0.0533338	1.695E-06	3.003E-05	0.0505313	1.606E-06	2.845E-05	0.2686413	8.539E-06	0.0001513	0.2442198	7.763E-06	0.0001375	0.294751	9.369E-06	0.000166
CROSS BAY LINK R	RD_004	1400-1500	0.0444566	1.453E-06	2.574E-05	0.0418896	1.369E-06	2.425E-05	0.2326725	7.605E-06	0.0001347	0.2093798	6.844E-06	0.0001212	0.2512694	8.213E-06	0.0001455
CROSS BAY LINK R	RD_004	1500-1600	0.0418943	1.366E-06	2.42E-05	0.0396676	1.294E-06	2.291E-05	0.2274794	7.418E-06	0.0001314	0.205383	6.698E-06	0.0001186	0.2450506	7.991E-06	0.0001415
CROSS BAY LINK R	RD_004	1600-1700	0.0389256	1.377E-06	2.44E-05	0.0369897	1.309E-06	2.319E-05	0.2192963	7.76E-06	0.0001375	0.1995033	7.06E-06	0.0001251	0.236493	8.369E-06	0.0001482
CROSS BAY LINK R	RD_004	1700-1800	0.0269039	1.13E-06	2.002E-05	0.0254831	1.07E-06	1.896E-05	0.1701276	7.146E-06	0.0001266	0.1542774	6.48E-06	0.0001148	0.1797605	7.55E-06	0.0001337
CROSS BAY LINK R	RD_004	1800-1900	0.0186875	8.012E-07	1.419E-05	0.0176061	7.548E-07	1.337E-05	0.1393224	5.973E-06	0.0001058	0.1246654	5.345E-06	9.467E-05	0.1422714	6.099E-06	0.000108
CROSS BAY LINK R	RD_004	1900-2000	0.0143543	5.401E-07	9.567E-06	0.0134036	5.043E-07	8.933E-06	0.1366006	5.14E-06	9.104E-05	0.1205727	4.537E-06	8.036E-05	0.1339764	5.041E-06	8.929E-05
CROSS BAY LINK R	RD_004	2000-2100	0.0150502	4.616E-07	8.176E-06	0.0141593	4.343E-07	7.692E-06	0.1439776	4.416E-06	7.822E-05	0.128705	3.948E-06	6.992E-05	0.1428644	4.382E-06	7.761E-05
CROSS BAY LINK R	RD_004	2100-2200	0.0134878	3.926E-07	6.955E-06	0.0124527	3.625E-07	6.421E-06	0.1606876	4.678E-06	8.285E-05	0.1384718	4.031E-06	7.14E-05	0.1509244	4.393E-06	7.782E-05
CROSS BAY LINK R	RD_004	2200-2300	0.0100902	2.877E-07	5.096E-06	0.0091851	2.619E-07	4.638E-06	0.1624279	4.631E-06	8.203E-05	0.1394391	3.976E-06	7.042E-05	0.1486243	4.237E-06	7.506E-05
CROSS BAY LINK R	RD_004	2300-0000	0.0134038	2.945E-07	5.216E-06	0.0121867	2.677E-07	4.742E-06	0.1723771	3.787E-06	6.708E-05	0.1453046	3.192E-06	5.655E-05	0.1574912	3.46E-06	6.129E-05
INDUSTRIAL ROAD L	RD_005	0000-0100	0.5651605	8.213E-08	2.234E-06	0.5426715	7.886E-08	2.145E-06	8.6536005	1.258E-06	3.421E-05	8.2325329	1.196E-06	3.254E-05	8.7752043	1.275E-06	3.469E-05
INDUSTRIAL ROAD L	RD_005	0100-0200	0.5585427	4.87E-08	1.325E-06	0.5371515	4.683E-08	1.274E-06	8.535918	7.443E-07	2.024E-05	8.1322955	7.091E-07	1.929E-05	8.669447	7.559E-07	2.056E-05
INDUSTRIAL ROAD L	RD_005	0200-0300	0.5594827	3.252E-08	8.846E-07	0.5371937	3.123E-08	8.494E-07	8.5535769	4.972E-07	1.352E-05	8.1340379	4.728E-07	1.286E-05	8.6712315	5.04E-07	1.371E-05
INDUSTRIAL ROAD L	RD_005	0300-0400	0.5596923	3.253E-08	8.849E-07	0.5375078	3.124E-08	8.499E-07	8.5552453	4.973E-07	1.353E-05	8.1386618	4.731E-07	1.287E-05	8.6761697	5.043E-07	1.372E-05
INDUSTRIAL ROAD L	RD_005	0400-0500	0.5600204	3.255E-08	8.854E-07	0.5375359	3.125E-08	8.499E-07	8.5619087	4.977E-07	1.354E-05	8.1398247	4.731E-07	1.287E-05	8.6773606	5.044E-07	1.372E-05
INDUSTRIAL ROAD L	RD_005	0500-0600	0.5599204	3.255E-08	8.853E-07	0.5397254	3.137E-08	8.534E-07	8.5608222	4.976E-07	1.354E-05	8.1806672	4.755E-07	1.293E-05	8.7203926	5.069E-07	1.379E-05
INDUSTRIAL ROAD L	RD_005	0600-0700	0.5658053	1.151E-07	3.131E-06	0.5451005	1.109E-07	3.016E-06	8.66979	1.764E-06	4.798E-05	8.2809754	1.685E-06	4.583E-05	8.826076	1.796E-06	4.884E-05
INDUSTRIAL ROAD L	RD_005	0700-0800	0.5641564	1.968E-07	5.352E-06	0.5460388	1.904E-07	5.18E-06	8.6384818	3.013E-06	8.195E-05	8.2982932	2.894E-06	7.872E-05	8.844332	3.085E-06	8.39E-05
INDUSTRIAL ROAD L	RD_005	0800-0900	0.561224	1.631E-07	4.437E-06	0.5436632	1.58E-07	4.298E-06	8.5492873	2.485E-06	6.759E-05	8.2197081	2.389E-06	6.498E-05	8.7633713	2.547E-06	6.928E-05
INDUSTRIAL ROAD L	RD_005	0900-1000	0.5615152	1.795E-07	4.883E-06	0.5426538	1.735E-07	4.719E-06	8.5604195	2.737E-06	7.444E-05	8.2069341	2.624E-06	7.137E-05	8.7495879	2.797E-06	7.609E-05
INDUSTRIAL ROAD L	RD_005	1000-1100	0.5599631	1.79E-07	4.869E-06	0.5409447	1.729E-07	4.704E-06	8.4562556	2.703E-06	7.354E-05	8.1034564	2.591E-06	7.047E-05	8.6444011	2.764E-06	7.517E-05
INDUSTRIAL ROAD L	RD_005	1100-1200	0.565057	1.478E-07	4.02E-06	0.5440466	1.423E-07	3.871E-06	8.6581579	2.265E-06	6.16E-05	8.2648955	2.162E-06	5.88E-05	8.8089421	2.304E-06	6.267E-05
INDUSTRIAL ROAD L	RD_005	1200-1300	0.5604799	1.629E-07	4.431E-06	0.5404646	1.571E-07	4.273E-06	8.4717245	2.462E-06	6.697E-05	8.0990477	2.354E-06	6.403E-05	8.6395124	2.511E-06	6.83E-05
INDUSTRIAL ROAD L	RD_005	1300-1400	0.5604694	1.629E-07	4.431E-06	0.5397047	1.569E-07	4.267E-06	8.4526146	2.457E-06	6.682E-05	8.0671829	2.345E-06	6.377E-05	8.6068876	2.501E-06	6.804E-05
INDUSTRIAL ROAD L	RD_005	1400-1500	0.5634425	1.638E-07	4.454E-06	0.5406332	1.571E-07	4.274E-06	8.5865872	2.496E-06	6.788E-05	8.1594192	2.371E-06	6.45E-05	8.7000524	2.529E-06	6.878E-05

Road Name	Road ID	Hour	NO2 Emission						NO Emission						NOX Emission		
			MonthlyHourMin			MonthlyHourAverage			MonthlyHourMin			MonthlyHourAverage			MonthlyHourAverage		
			g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour
INDUSTRIAL ROAD L	RD_005	1500-1600	0.5612614	1.631E-07	4.437E-06	0.5405133	1.571E-07	4.273E-06	8.5568551	2.487E-06	6.765E-05	8.1693372	2.374E-06	6.458E-05	8.7098505	2.531E-06	6.886E-05
INDUSTRIAL ROAD L	RD_005	1600-1700	0.5598237	1.79E-07	4.868E-06	0.5411881	1.73E-07	4.706E-06	8.5153716	2.722E-06	7.405E-05	8.1676733	2.611E-06	7.103E-05	8.7088614	2.784E-06	7.573E-05
INDUSTRIAL ROAD L	RD_005	1700-1800	0.5594705	1.789E-07	4.865E-06	0.5411672	1.73E-07	4.706E-06	8.5433687	2.731E-06	7.429E-05	8.200942	2.622E-06	7.132E-05	8.7421092	2.795E-06	7.602E-05
INDUSTRIAL ROAD L	RD_005	1800-1900	0.5602177	1.954E-07	5.315E-06	0.5416487	1.889E-07	5.138E-06	8.5935237	2.997E-06	8.152E-05	8.2439137	2.875E-06	7.821E-05	8.7855624	3.064E-06	8.334E-05
INDUSTRIAL ROAD L	RD_005	1900-2000	0.5604814	1.955E-07	5.317E-06	0.5422202	1.891E-07	5.144E-06	8.4721854	2.955E-06	8.037E-05	8.1339663	2.837E-06	7.716E-05	8.6761865	3.026E-06	8.231E-05
INDUSTRIAL ROAD L	RD_005	2000-2100	0.5566189	1.618E-07	4.4E-06	0.5402223	1.57E-07	4.271E-06	8.4802171	2.465E-06	6.704E-05	8.1727279	2.375E-06	6.461E-05	8.7129502	2.532E-06	6.888E-05
INDUSTRIAL ROAD L	RD_005	2100-2200	0.5598913	1.79E-07	4.869E-06	0.5409757	1.73E-07	4.704E-06	8.5588978	2.736E-06	7.443E-05	8.2043261	2.623E-06	7.135E-05	8.7453017	2.796E-06	7.605E-05
INDUSTRIAL ROAD L	RD_005	2200-2300	0.5611835	1.631E-07	4.436E-06	0.5413752	1.573E-07	4.28E-06	8.5817327	2.494E-06	6.784E-05	8.2090384	2.386E-06	6.49E-05	8.7504136	2.543E-06	6.918E-05
INDUSTRIAL ROAD L	RD_005	2300-0000	0.5633282	1.146E-07	3.117E-06	0.5408362	1.1E-07	2.993E-06	8.6210515	1.754E-06	4.771E-05	8.1984746	1.668E-06	4.537E-05	8.7393107	1.778E-06	4.836E-05
INDUSTRIAL ROAD C	RD_007	0000-0100	0.5651605	7.428E-08	6.559E-06	0.5426715	7.132E-08	6.298E-06	8.6536005	1.137E-06	0.0001004	8.2325329	1.082E-06	9.555E-05	8.7752043	1.153E-06	0.0001018
INDUSTRIAL ROAD C	RD_007	0100-0200	0.5585427	4.404E-08	3.89E-06	0.5371515	4.236E-08	3.741E-06	8.535918	6.731E-07	5.944E-05	8.1322955	6.413E-07	5.663E-05	8.669447	6.836E-07	6.037E-05
INDUSTRIAL ROAD C	RD_007	0200-0300	0.5594827	2.941E-08	2.597E-06	0.5371937	2.824E-08	2.494E-06	8.5535769	4.497E-07	3.971E-05	8.1340379	4.276E-07	3.776E-05	8.6712315	4.558E-07	4.026E-05
INDUSTRIAL ROAD C	RD_007	0300-0400	0.5537877	2.911E-08	2.571E-06	0.5323048	2.798E-08	2.471E-06	8.4503746	4.442E-07	3.923E-05	8.0447711	4.229E-07	3.735E-05	8.5770759	4.509E-07	3.982E-05
INDUSTRIAL ROAD C	RD_007	0400-0500	0.5600204	2.944E-08	2.6E-06	0.5375359	2.826E-08	2.496E-06	8.5619087	4.501E-07	3.975E-05	8.1398247	4.279E-07	3.779E-05	8.6773606	4.562E-07	4.028E-05
INDUSTRIAL ROAD C	RD_007	0500-0600	0.5486129	2.884E-08	2.547E-06	0.5294194	2.783E-08	2.458E-06	8.3566897	4.393E-07	3.88E-05	7.9964247	4.204E-07	3.712E-05	8.5258441	4.482E-07	3.958E-05
INDUSTRIAL ROAD C	RD_007	0600-0700	0.5658053	1.041E-07	9.194E-06	0.5451005	1.003E-07	8.857E-06	8.66979	1.595E-06	0.0001409	8.2809754	1.524E-06	0.0001346	8.826076	1.624E-06	0.0001434
INDUSTRIAL ROAD C	RD_007	0700-0800	0.5054119	1.727E-07	1.525E-05	0.4901134	1.675E-07	1.479E-05	7.6267804	2.606E-06	0.0002301	7.3421818	2.509E-06	0.0002216	7.8322952	2.676E-06	0.0002363
INDUSTRIAL ROAD C	RD_007	0800-0900	0.5154684	1.49E-07	1.316E-05	0.4991612	1.443E-07	1.275E-05	7.8018124	2.256E-06	0.0001992	7.4990209	2.168E-06	0.0001915	7.9981821	2.313E-06	0.0002042
INDUSTRIAL ROAD C	RD_007	0900-1000	0.534391	1.545E-07	1.365E-05	0.5179318	1.498E-07	1.322E-05	8.0737447	2.334E-06	0.0002062	7.7639729	2.245E-06	0.0001982	8.2819047	2.395E-06	0.0002115
INDUSTRIAL ROAD C	RD_007	1000-1100	0.5599631	1.619E-07	1.43E-05	0.5409447	1.564E-07	1.381E-05	8.4562556	2.445E-06	0.0002159	8.1034564	2.343E-06	0.0002069	8.6444011	2.499E-06	0.0002207
INDUSTRIAL ROAD C	RD_007	1100-1200	0.5331403	1.261E-07	1.114E-05	0.5153312	1.219E-07	1.077E-05	8.0800957	1.911E-06	0.0001688	7.7435187	1.832E-06	0.0001618	8.25885	1.954E-06	0.0001725
INDUSTRIAL ROAD C	RD_007	1200-1300	0.5604799	1.473E-07	1.301E-05	0.5404646	1.421E-07	1.255E-05	8.4717245	2.227E-06	0.0001966	8.0990477	2.129E-06	0.000188	8.6395124	2.271E-06	0.0002005
INDUSTRIAL ROAD C	RD_007	1300-1400	0.5241976	1.378E-07	1.217E-05	0.5069425	1.332E-07	1.177E-05	7.8099743	2.053E-06	0.0001813	7.4879392	1.968E-06	0.0001738	7.9948816	2.101E-06	0.0001856
INDUSTRIAL ROAD C	RD_007	1400-1500	0.5634425	1.481E-07	1.308E-05	0.5406332	1.421E-07	1.255E-05	8.5865872	2.257E-06	0.0001993	8.1594192	2.145E-06	0.0001894	8.7000524	2.287E-06	0.0002019
INDUSTRIAL ROAD C	RD_007	1500-1600	0.5215289	1.371E-07	1.211E-05	0.5047829	1.327E-07	1.172E-05	7.8379807	2.06E-06	0.0001819	7.521267	1.977E-06	0.0001746	8.0260499	2.11E-06	0.0001863
INDUSTRIAL ROAD C	RD_007	1600-1700	0.5598237	1.619E-07	1.429E-05	0.5411881	1.565E-07	1.382E-05	8.5153716	2.462E-06	0.0002174	8.1676733	2.362E-06	0.0002086	8.7088614	2.518E-06	0.0002224
INDUSTRIAL ROAD C	RD_007	1700-1800	0.5165471	1.494E-07	1.319E-05	0.5020438	1.452E-07	1.282E-05	7.7612376	2.244E-06	0.0001982	7.4875496	2.165E-06	0.0001912	7.9895934	2.31E-06	0.000204
INDUSTRIAL ROAD C	RD_007	1800-1900	0.5602177	1.767E-07	1.56E-05	0.5416487	1.708E-07	1.509E-05	8.5935237	2.711E-06	0.0002394	8.2439137	2.6E-06	0.0002296	8.7855624	2.771E-06	0.0002447
INDUSTRIAL ROAD C	RD_007	1900-2000	0.5079098	1.602E-07	1.415E-05	0.4942486	1.559E-07	1.377E-05	7.5338738	2.376E-06	0.0002099	7.2769224	2.295E-06	0.0002027	7.7711709	2.451E-06	0.0002165
INDUSTRIAL ROAD C	RD_007	2000-2100	0.5566189	1.463E-07	1.292E-05	0.5402223	1.42E-07	1.254E-05	8.4802171	2.229E-06	0.0001968	8.1727279	2.148E-06	0.0001897	8.7129502	2.29E-06	0.0002022
INDUSTRIAL ROAD C	RD_007	2100-2200	0.5100698	1.475E-07	1.302E-05	0.4956569	1.433E-07	1.266E-05	7.6457864	2.211E-06	0.0001952	7.3740267	2.132E-06	0.0001883	7.8696836	2.275E-06	0.0002009
INDUSTRIAL ROAD C	RD_007	2200-2300	0.5611835	1.475E-07	1.303E-05	0.5413752	1.423E-07	1.257E-05	8.5817327	2.256E-06	0.0001992	8.2090384	2.158E-06	0.0001906	8.7504136	2.3E-06	0.0002031
INDUSTRIAL ROAD C	RD_007	2300-0000	0.5094051	9.373E-08	8.277E-06	0.492616	9.064E-08	8.004E-06	7.6311862	1.404E-06	0.000124	7.3139307	1.346E-06	0.0001188	7.8065467	1.436E-06	0.0001268
CHUN YAT STREET L	RD_008	0000-0100	0.11939	1.495E-08	3.07E-07	0.1095572	1.372E-08	2.817E-07	0.661508	8.283E-08	1.701E-06	0.5794257	7.255E-08	1.49E-06	0.6889829	8.627E-08	1.772E-06
CHUN YAT STREET L	RD_008	0100-0200	0.124046	1.035E-08	2.126E-07	0.1140593	9.521E-09	1.955E-07	0.6750957	5.635E-08	1.157E-06	0.5932883	4.952E-08	1.017E-06	0.7073476	5.904E-08	1.212E-06
CHUN YAT STREET L	RD_008	0200-0300	0.1286978	1.074E-08	2.205E-07	0.117984	9.845E-09	2.022E-07	0.6935288	5.787E-08	1.188E-06	0.605339	5.051E-08	1.037E-06	0.723323	6.036E-08	1.24E-06
CHUN YAT STREET L	RD_008	0300-0400	0.1325798	5.533E-09	1.136E-07	0.1216934	5.079E-09	1.043E-07	0.7061576	2.947E-08	6.052E-07	0.6178177	2.578E-08	5.295E-07	0.7395111	3.086E-08	6.338E-07
CHUN YAT STREET L	RD_008	0400-0500	0.1361539	5.681E-09	1.167E-07	0.124858	5.21E-09	1.07E-07	0.7173195	2.993E-08	6.147E-07	0.6276419	2.619E-08	5.378E-07	0.7524999	3.14E-08	6.448E-07
CHUN YAT STREET L	RD_008	0500-0600	0.1392852	1.163E-08	2.387E-07	0.1289126	1.076E-08	2.21E-07	0.7295871	6.089E-08	1.25E-06	0.6461166	5.393E-08	1.107E-06	0.7750292	6.469E-08	1.328E-06
CHUN YAT STREET L	RD_008	0600-0700	0.1419474	2.962E-08	6.082E-07	0.1314925	2.743E-08	5.634E-07	0.7361049	1.536E-07	3.154E-06	0.6528675	1.362E-07	2.797E-06	0.78436	1.636E-07	3.361E-06
CHUN YAT STREET L	RD_008	0700-0800	0.146475	6.112E-08	1.255E-06	0.1369112	5.713E-08	1.173E-06	0.7476811	3.12E-07	6.407E-06	0.674273	2.814E-07	5.778E-06	0.8111842	3.385E-07	6.951E-06
CHUN YAT STREET L	RD_008	0800-0900	0.1372285	4.581E-08	9.408E-07	0.1284365	4.288E-08	8.805E-07	0.7017289	2.343E-07	4.811E-06	0.6339963	2.117E-07	4.347E-06	0.7624328	2.545E-07	5.227E-06
CHUN YAT STREET L	RD_008	0900-1000	0.1563189	5.872E-08	1.206E-06	0.1458656	5.479E-08	1.125E-06	0.7658326	2.877E-07	5.907E-06	0.6913144	2.597E-07	5.333E-06	0.83718	3.145E-07	6.458E-06
CHUN YAT STREET L	RD_008	1000-1100	0.1678531	4.903E-08	1.007E-06	0.1567941	4.58E-08	9.405E-07	0.7954527	2.323E-07	4.771E-06	0.721314	2.107E-07	4.327E-06	0.8781081	2.565E-07	5.267E-06
CHUN YAT STREET L	RD_008	1100-1200	0.1625181	6.103E-08	1.253E-06	0.150623	5.657E-08	1.162E-06	0.7879773	2.959E-07	6.077E-06	0.7055531	2.65E-07	5.441E-06	0.8561761	3.215E-07	6.603E-06
CHUN YAT STREET L	RD_008	1200-1300	0.117862	9.347E-08	1.92E-06	0.1093639	8.673E-08	1.781E-06	0.5972105	4.736E-07	9.726E-06	0.5347508	4.241E-07	8.709E-06	0.6441147	5.108E-07	1.049E-05
CHUN YAT STREET L	RD_008	1300-1400	0.1313206	1.315E-07	2.701E-06	0.1213545	1.215E-07	2.496E-06	0.6684358	6.695E-07	1.375E-05	0.5957572	5.967E-07	1.225E-05	0.7171117	7.182E-07	1.475E-05
CHUN YAT STREET L	RD_008	1400-1500	0.1171316	9.287E-08	1.907E-06	0.1076454	8.535E-08	1.753E-06	0.5923784	4.697E-07	9.646E-06	0.5226325	4.144E-07	8.51E-06	0.6302779	4.998E-07	1.026E-05
CHUN YAT STREET L	RD_008	1500-1600	0.1141855	9.054E-08	1.859E-06	0.105771	8.387E-08	1.722E-06	0.5815502	4.611E-07	9.469E-06	0.5176337	4.104E-07	8.429E-06	0.6234047	4.943E-07	1.015E-05
CHUN YAT STREET L	RD_008	1600-1700	0.1084202	9.501E-08	1.951E-06	0.1010886	8.858E-08	1.819E-06	0.5661357	4.961E-07	1.019E-05	0.5094667	4.464E-07	9.168E-06	0.6105553	5.35E-07	1.099E-05
CHUN YAT STREET L	RD_008	1700-1800	0.0994104	1.079E-07	2.215E-06	0.0925905	1.005E-07	2.063E-06	0.5346503	5.802E-07	1.191E-05	0.4799007	5.208E-07	1.069E-05	0.5724912	6.212E-07	1.276E-05
CHUN YAT STREET L	RD_008	1800-1900	0.0924056	1.041E-07	2.139E-06	0.0858552	9.676E-08	1.987E-06	0.5090488	5.737E-07	1.178E-05	0.4548213	5.126E-07	1.053E-05	0.5406766	6.093E-07	1.251E-05
CHUN YAT STREET L	RD_008	1900-2000	0.0868065	8.694E-08	1.785E-06	0.0807495	8.088E-08	1.661E-06	0.4989356	4.997E-07	1.026E-05	0.445272	4.46E-07	9.158E-06	0.5260215	5.268E-07	1.082E-05
CHUN YAT STREET L	RD_008	2000-2100	0.0795694	5.646E-08	1.159E-06	0.0744487	5.283E-08	1.085E-06	0.4657155	3.305E-07	6.786E-06	0.420342	2.983E-07	6.125E-06	0.4947907	3.511E-07	7.21E-06
CHUN YAT STREET L	RD_008	2100-2200	0.0833688	6.263E-08	1.286E-06	0.0771844	5.798E-08	1.191E-06	0.50539	3.797E-07	7.797E-06	0.4466365	3.355E-07	6.89E-06	0.5238209	3.935E-07	8.081E-06
CHUN YAT STREET L	RD_008	2200-2300	0.0716934	4.489E-08	9.218E-07	0.0660974	4.138E-08	8.498E-07	0.4692747	2.938E-07	6.034E-06	0.4130176	2.586E-07	5.31E-06	0.479115	3E-07	6.16E-06

Road Name	Road ID	Hour	NO2 Emission						NO Emission						NOX Emission		
			MonthlyHourMin			MonthlyHourAverage			MonthlyHourMin			MonthlyHourAverage			MonthlyHourAverage		
			g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour
CHUN YAT STREET L	RD_008	2300-0000	0.0788025	3.946E-08	8.104E-07	0.0719054	3.601E-08	7.395E-07	0.4973038	2.49E-07	5.114E-06	0.4303506	2.155E-07	4.426E-06	0.502256	2.515E-07	5.165E-06
CHUN YAT STREET R	RD_009	0000-0100	0.1483597	5.943E-09	1.026E-07	0.1363548	5.462E-09	9.426E-08	0.7808855	3.128E-08	5.398E-07	0.6885028	2.758E-08	4.759E-07	0.8248575	3.304E-08	5.702E-07
CHUN YAT STREET R	RD_009	0100-0200	0.1506401	6.034E-09	1.041E-07	0.1386841	5.556E-09	9.587E-08	0.7863217	3.15E-08	5.436E-07	0.6948116	2.783E-08	4.803E-07	0.8334958	3.339E-08	5.762E-07
CHUN YAT STREET R	RD_009	0200-0300	0.1534029	6.145E-09	1.06E-07	0.1407921	5.64E-09	9.733E-08	0.7983196	3.198E-08	5.519E-07	0.7004574	2.806E-08	4.842E-07	0.8412495	3.37E-08	5.815E-07
CHUN YAT STREET R	RD_009	0300-0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHUN YAT STREET R	RD_009	0400-0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHUN YAT STREET R	RD_009	0500-0600	0.1583602	6.342E-09	1.094E-07	0.1466445	5.873E-09	1.013E-07	0.81564	3.266E-08	5.637E-07	0.7243265	2.901E-08	5.006E-07	0.870971	3.488E-08	6.019E-07
CHUN YAT STREET R	RD_009	0600-0700	0.1597769	1.28E-08	2.209E-07	0.1480699	1.186E-08	2.047E-07	0.8179618	6.553E-08	1.131E-06	0.7270825	5.825E-08	1.005E-06	0.8751524	7.012E-08	1.21E-06
CHUN YAT STREET R	RD_009	0700-0800	0.1599498	2.563E-08	4.422E-07	0.1496872	2.398E-08	4.139E-07	0.8118875	1.301E-07	2.245E-06	0.7331886	1.175E-07	2.027E-06	0.8828757	1.415E-07	2.441E-06
CHUN YAT STREET R	RD_009	0800-0900	0.1610178	1.935E-08	3.34E-07	0.1508516	1.813E-08	3.129E-07	0.8061784	9.689E-08	1.672E-06	0.7308332	8.784E-08	1.516E-06	0.8816849	1.06E-07	1.829E-06
CHUN YAT STREET R	RD_009	0900-1000	0.1733299	2.083E-08	3.595E-07	0.1618784	1.945E-08	3.357E-07	0.8367606	1.006E-07	1.735E-06	0.7572558	9.1E-08	1.57E-06	0.9191341	1.105E-07	1.906E-06
CHUN YAT STREET R	RD_009	1000-1100	0.1919188	1.537E-08	2.653E-07	0.1795183	1.438E-08	2.482E-07	0.8864987	7.102E-08	1.225E-06	0.8071038	6.466E-08	1.116E-06	0.9866221	7.904E-08	1.364E-06
CHUN YAT STREET R	RD_009	1100-1200	0.1788886	2.149E-08	3.709E-07	0.1660209	1.995E-08	3.442E-07	0.8527454	1.024E-07	1.768E-06	0.7656673	9.199E-08	1.587E-06	0.9316882	1.119E-07	1.932E-06
CHUN YAT STREET R	RD_009	1200-1300	0.1532266	6.139E-08	1.059E-06	0.1419927	5.689E-08	9.817E-07	0.7816945	3.132E-07	5.404E-06	0.6989405	2.8E-07	4.832E-06	0.8409333	3.369E-07	5.814E-06
CHUN YAT STREET R	RD_009	1300-1400	0.1508621	9.065E-08	1.564E-06	0.1393205	8.372E-08	1.445E-06	0.7818986	4.698E-07	8.108E-06	0.6954538	4.179E-07	7.211E-06	0.8347743	5.016E-07	8.656E-06
CHUN YAT STREET R	RD_009	1400-1500	0.1544581	6.187E-08	1.068E-06	0.1417159	5.677E-08	9.796E-07	0.7849966	3.145E-07	5.426E-06	0.6904871	2.766E-07	4.773E-06	0.832203	3.334E-07	5.753E-06
CHUN YAT STREET R	RD_009	1500-1600	0.1543023	5.562E-08	9.598E-07	0.1427383	5.145E-08	8.879E-07	0.778962	2.808E-07	4.845E-06	0.6922915	2.495E-07	4.306E-06	0.8350298	3.01E-07	5.194E-06
CHUN YAT STREET R	RD_009	1600-1700	0.1483315	5.942E-08	1.025E-06	0.1381958	5.536E-08	9.553E-07	0.7625913	3.055E-07	5.272E-06	0.6861158	2.749E-07	4.743E-06	0.8243116	3.302E-07	5.698E-06
CHUN YAT STREET R	RD_009	1700-1800	0.1404805	7.879E-08	1.36E-06	0.1308683	7.34E-08	1.267E-06	0.737714	4.138E-07	7.14E-06	0.6625478	3.716E-07	6.413E-06	0.7934161	4.45E-07	7.679E-06
CHUN YAT STREET R	RD_009	1800-1900	0.1381755	8.301E-08	1.432E-06	0.1284644	7.718E-08	1.332E-06	0.7294122	4.382E-07	7.562E-06	0.65359	3.927E-07	6.776E-06	0.7820544	4.698E-07	8.108E-06
CHUN YAT STREET R	RD_009	1900-2000	0.1348023	7.019E-08	1.211E-06	0.125611	6.54E-08	1.129E-06	0.7188976	3.743E-07	6.459E-06	0.6452616	3.36E-07	5.797E-06	0.7708725	4.014E-07	6.926E-06
CHUN YAT STREET R	RD_009	2000-2100	0.1348106	4.86E-08	8.387E-07	0.1263206	4.554E-08	7.859E-07	0.7155899	2.58E-07	4.452E-06	0.6501771	2.344E-07	4.045E-06	0.7764977	2.8E-07	4.831E-06
CHUN YAT STREET R	RD_009	2100-2200	0.1358936	5.443E-08	9.393E-07	0.1261243	5.052E-08	8.718E-07	0.7304749	2.926E-07	5.049E-06	0.652492	2.614E-07	4.51E-06	0.7786162	3.119E-07	5.382E-06
CHUN YAT STREET R	RD_009	2200-2300	0.1341469	3.761E-08	6.49E-07	0.1241643	3.481E-08	6.007E-07	0.7237875	2.029E-07	3.502E-06	0.646373	1.812E-07	3.127E-06	0.7705373	2.16E-07	3.728E-06
CHUN YAT STREET R	RD_009	2300-0000	0.1347889	3.239E-08	5.59E-07	0.1235404	2.969E-08	5.123E-07	0.7295527	1.753E-07	3.026E-06	0.6407912	1.54E-07	2.657E-06	0.7643316	1.837E-07	3.17E-06
RESIDENTIAL ROAD L	RD_010	0000-0100	0.0263878	2.431E-07	8.393E-06	0.0234244	2.158E-07	7.45E-06	0.2934844	2.704E-06	9.335E-05	0.2403738	2.215E-06	7.645E-05	0.2637982	2.431E-06	8.39E-05
RESIDENTIAL ROAD L	RD_010	0100-0200	0.0321183	2.008E-07	6.93E-06	0.0287324	1.796E-07	6.2E-06	0.3050642	1.907E-06	6.582E-05	0.2506771	1.567E-06	5.409E-05	0.2794095	1.747E-06	6.029E-05
RESIDENTIAL ROAD L	RD_010	0200-0300	0.0368608	1.758E-07	6.067E-06	0.0331221	1.579E-07	5.452E-06	0.3078218	1.468E-06	5.067E-05	0.2544373	1.213E-06	4.188E-05	0.2875594	1.371E-06	4.733E-05
RESIDENTIAL ROAD L	RD_010	0300-0400	0.0423593	1.511E-07	5.215E-06	0.03852	1.374E-07	4.742E-06	0.3168689	1.13E-06	3.901E-05	0.2681611	9.563E-07	3.301E-05	0.3066811	1.094E-06	3.775E-05
RESIDENTIAL ROAD L	RD_010	0400-0500	0.0483379	1.627E-07	5.616E-06	0.0439159	1.478E-07	5.102E-06	0.3285777	1.106E-06	3.817E-05	0.2779408	9.354E-07	3.229E-05	0.3218568	1.083E-06	3.739E-05
RESIDENTIAL ROAD L	RD_010	0500-0600	0.0541032	2.558E-07	8.829E-06	0.0495426	2.342E-07	8.085E-06	0.3374702	1.595E-06	5.507E-05	0.2897499	1.37E-06	4.729E-05	0.3392925	1.604E-06	5.537E-05
RESIDENTIAL ROAD L	RD_010	0600-0700	0.0656116	8.727E-07	3.013E-05	0.0602599	8.015E-07	2.767E-05	0.3716046	4.943E-06	0.0001706	0.3225134	4.29E-06	0.0001481	0.3827733	5.091E-06	0.0001758
RESIDENTIAL ROAD L	RD_010	0700-0800	0.0794648	1.907E-06	6.583E-05	0.0735412	1.765E-06	6.092E-05	0.4119907	9.887E-06	0.0003413	0.3644281	8.746E-06	0.0003019	0.4379693	1.051E-05	0.0003628
RESIDENTIAL ROAD L	RD_010	0800-0900	0.0565388	1.493E-06	5.153E-05	0.0523022	1.381E-06	4.767E-05	0.3466672	9.153E-06	0.000316	0.3045303	8.04E-06	0.0002776	0.3568325	9.421E-06	0.0003252
RESIDENTIAL ROAD L	RD_010	0900-1000	0.0736417	1.599E-06	5.521E-05	0.067914	1.475E-06	5.091E-05	0.4113792	8.934E-06	0.0003084	0.3614889	7.851E-06	0.000271	0.4294029	9.325E-06	0.0003219
RESIDENTIAL ROAD L	RD_010	1000-1100	0.07492	1.522E-06	5.252E-05	0.0691932	1.405E-06	4.851E-05	0.4457908	9.053E-06	0.0003125	0.3919427	7.96E-06	0.0002748	0.4611359	9.365E-06	0.0003233
RESIDENTIAL ROAD L	RD_010	1100-1200	0.0726184	1.408E-06	4.861E-05	0.0667848	1.295E-06	4.47E-05	0.4207618	8.159E-06	0.0002817	0.3676009	7.128E-06	0.0002461	0.4343857	8.423E-06	0.0002908
RESIDENTIAL ROAD L	RD_010	1200-1300	0.0789687	7.435E-07	2.567E-05	0.0732267	6.894E-07	2.38E-05	0.4083655	3.845E-06	0.0001327	0.3647381	3.434E-06	0.0001185	0.4379648	4.124E-06	0.0001423
RESIDENTIAL ROAD L	RD_010	1300-1400	0.0949097	8.898E-07	3.072E-05	0.0877419	8.226E-07	2.84E-05	0.4750926	4.454E-06	0.0001538	0.4237688	3.973E-06	0.0001371	0.5115107	4.795E-06	0.0001655
RESIDENTIAL ROAD L	RD_010	1400-1500	0.0772481	7.49E-07	2.586E-05	0.0707761	6.863E-07	2.369E-05	0.4014773	3.893E-06	0.0001344	0.3532771	3.426E-06	0.0001183	0.4240532	4.112E-06	0.0001419
RESIDENTIAL ROAD L	RD_010	1500-1600	0.0719259	6.945E-07	2.397E-05	0.0663668	6.408E-07	2.212E-05	0.393104	3.796E-06	0.000131	0.3476681	3.357E-06	0.0001159	0.4140348	3.998E-06	0.000138
RESIDENTIAL ROAD L	RD_010	1600-1700	0.0682224	7.161E-07	2.472E-05	0.0633089	6.645E-07	2.294E-05	0.383203	4.022E-06	0.0001388	0.3418007	3.588E-06	0.0001238	0.4051097	4.252E-06	0.0001468
RESIDENTIAL ROAD L	RD_010	1700-1800	0.0467004	5.855E-07	2.021E-05	0.043274	5.426E-07	1.873E-05	0.2840299	3.561E-06	0.0001229	0.2527427	3.169E-06	0.0001094	0.2960167	3.711E-06	0.0001281
RESIDENTIAL ROAD L	RD_010	1800-1900	0.0324119	4.156E-07	1.435E-05	0.0298061	3.822E-07	1.319E-05	0.2326092	2.983E-06	0.000103	0.2025482	2.597E-06	8.966E-05	0.2323543	2.98E-06	0.0001029
RESIDENTIAL ROAD L	RD_010	1900-2000	0.0250101	2.816E-07	9.72E-06	0.0228114	2.568E-07	8.865E-06	0.2289725	2.578E-06	8.899E-05	0.1960419	2.207E-06	7.619E-05	0.2188533	2.464E-06	8.505E-05
RESIDENTIAL ROAD L	RD_010	2000-2100	0.0253235	2.324E-07	8.021E-06	0.0232525	2.134E-07	7.365E-06	0.2346926	2.153E-06	7.434E-05	0.2031682	1.864E-06	6.435E-05	0.2264207	2.078E-06	7.172E-05
RESIDENTIAL ROAD L	RD_010	2100-2200	0.0224252	1.958E-07	6.761E-06	0.020254	1.769E-07	6.106E-06	0.2607214	2.277E-06	7.86E-05	0.2199055	1.92E-06	6.629E-05	0.2401595	2.097E-06	7.24E-05
RESIDENTIAL ROAD L	RD_010	2200-2300	0.0160814	1.372E-07	4.738E-06	0.0141687	1.209E-07	4.174E-06	0.2652316	2.264E-06	7.814E-05	0.2198625	1.876E-06	6.477E-05	0.2340312	1.997E-06	6.895E-05
RESIDENTIAL ROAD L	RD_010	2300-0000	0.021743	1.429E-07	4.931E-06	0.0192176	1.263E-07	4.358E-06	0.2786753	1.831E-06	6.32E-05	0.229642	1.509E-06	5.208E-05	0.2488596	1.635E-06	5.644E-05
RESIDENTIAL ROAD R	RD_011	0000-0100	0.0591495	1.743E-07	7.102E-06	0.0545293	1.607E-07	6.547E-06	0.6398424	1.886E-06	7.682E-05	0.5718796	1.686E-06	6.866E-05	0.6264089	1.846E-06	7.521E-05
RESIDENTIAL ROAD R	RD_011	0100-0200	0.0651971	1.314E-07	5.351E-06	0.0602124	1.213E-07	4.942E-06	0.6450125	1.3E-06	5.294E-05	0.5773246	1.163E-06	4.738E-05	0.637537	1.285E-06	5.233E-05
RESIDENTIAL ROAD R	RD_011	0200-0300	0.0707417	1.109E-07	4.516E-06	0.0653889	1.025E-07	4.174E-06	0.6446355	1.01E-06	4.115E-05	0.5779906	9.058E-07	3.69E-05	0.6433795	1.008E-06	4.107E-05
RESIDENTIAL ROAD R	RD_011	0300-0400	0.0778453	9.296E-08	3.787E-06	0.0723884	8.645E-08	3.521E-06	0.6625294	7.912E-07	3.223E-05	0.6007464	7.174E-07	2.922E-05	0.6731349	8.039E-07	3.274E-05
RESIDENTIAL ROAD R	RD_011	0400-0500	0.0849842	9.514E-08	3.875E-06	0.0788444	8.826E-08	3.595E-06	0.6775292	7.585E-07	3.089E-05	0.6130181	6.862E-07	2.795E-05	0.6918625	7.745E-07	3.155E-05
RESIDENTIAL ROAD R	RD_011	0500-0600	0.0938409	1.506E-07	6.134E-06	0.0873443	1.402E-07	5.709E-06	0.7030422	1.128E-06	4.595E-05	0.6401457	1.027E-06	4.184E-05	0.72749	1.167E-06	4.755E-05
RESIDENTIAL ROAD R	RD_011	0600-0700	0.105628	4.73E-07	1.927E-05	0.0983834	4.406E-07	1.795E-05	0.7366328	3.299E-06	0.0001344	0.6730302	3.014E-06	0.0001228	0.7714135	3.455E-06	0.0001407

Road Name	Road ID	Hour	NO2 Emission						NO Emission						NOX Emission		
			MonthlyHourMin			MonthlyHourAverage			MonthlyHourMin			MonthlyHourAverage			MonthlyHourAverage		
			g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour	g/km/veh	g/s/m2	tonne/hour
RESIDENTIAL ROAD R	RD_011	0700-0800	0.1187928	9.708E-07	3.954E-05	0.1112572	9.092E-07	3.703E-05	0.7794845	6.37E-06	0.0002595	0.7187855	5.874E-06	0.0002393	0.8300427	6.783E-06	0.0002763
RESIDENTIAL ROAD R	RD_011	0800-0900	0.0910225	7.949E-07	3.238E-05	0.0854191	7.459E-07	3.038E-05	0.6443412	5.627E-06	0.0002292	0.5926251	5.175E-06	0.0002108	0.6780441	5.921E-06	0.0002412
RESIDENTIAL ROAD R	RD_011	0900-1000	0.1305706	1.033E-06	4.208E-05	0.121905	9.645E-07	3.928E-05	0.8243863	6.522E-06	0.0002657	0.7575148	5.993E-06	0.0002441	0.8794198	6.958E-06	0.0002834
RESIDENTIAL ROAD R	RD_011	1000-1100	0.1399235	1.07E-06	4.359E-05	0.1308655	1.001E-06	4.077E-05	0.8842756	6.763E-06	0.0002755	0.8137914	6.224E-06	0.0002535	0.9446569	7.225E-06	0.0002943
RESIDENTIAL ROAD R	RD_011	1100-1200	0.1345557	9.593E-07	3.907E-05	0.1252427	8.929E-07	3.637E-05	0.8256267	5.886E-06	0.0002398	0.7553798	5.385E-06	0.0002194	0.8806226	6.278E-06	0.0002557
RESIDENTIAL ROAD R	RD_011	1200-1300	0.1233485	6.259E-07	2.549E-05	0.1154651	5.859E-07	2.387E-05	0.8261518	4.192E-06	0.0001708	0.7640734	3.877E-06	0.0001579	0.8795384	4.463E-06	0.0001818
RESIDENTIAL ROAD R	RD_011	1300-1400	0.1394396	7.234E-07	2.947E-05	0.1300702	6.748E-07	2.749E-05	0.9158595	4.751E-06	0.0001935	0.84438	4.38E-06	0.0001784	0.9744502	5.055E-06	0.0002059
RESIDENTIAL ROAD R	RD_011	1400-1500	0.123161	6.48E-07	2.639E-05	0.1140893	6.003E-07	2.445E-05	0.8285677	4.359E-06	0.0001776	0.7578332	3.987E-06	0.0001624	0.8719225	4.588E-06	0.0001869
RESIDENTIAL ROAD R	RD_011	1500-1600	0.1200997	6.32E-07	2.574E-05	0.1120443	5.896E-07	2.401E-05	0.8288003	4.361E-06	0.0001776	0.7626586	4.013E-06	0.0001635	0.8747029	4.603E-06	0.0001875
RESIDENTIAL ROAD R	RD_011	1600-1700	0.1109707	6.295E-07	2.564E-05	0.1040753	5.904E-07	2.405E-05	0.8161006	4.63E-06	0.0001886	0.7559749	4.289E-06	0.0001747	0.8600502	4.879E-06	0.0001987
RESIDENTIAL ROAD R	RD_011	1700-1800	0.0787074	5.081E-07	2.07E-05	0.0738579	4.768E-07	1.942E-05	0.6425603	4.148E-06	0.000169	0.5957105	3.846E-06	0.0001567	0.6695684	4.323E-06	0.0001761
RESIDENTIAL ROAD R	RD_011	1800-1900	0.0629892	4.091E-07	1.666E-05	0.0590454	3.834E-07	1.562E-05	0.5990243	3.89E-06	0.0001585	0.5528031	3.59E-06	0.0001462	0.6118486	3.973E-06	0.0001618
RESIDENTIAL ROAD R	RD_011	1900-2000	0.0548695	3.133E-07	1.276E-05	0.0514701	2.939E-07	1.197E-05	0.6299705	3.597E-06	0.0001465	0.5800383	3.312E-06	0.0001349	0.6315084	3.605E-06	0.0001469
RESIDENTIAL ROAD R	RD_011	2000-2100	0.0567621	2.627E-07	1.07E-05	0.0535151	2.476E-07	1.009E-05	0.6457737	2.988E-06	0.0001217	0.5982723	2.769E-06	0.0001128	0.6517874	3.016E-06	0.0001229
RESIDENTIAL ROAD R	RD_011	2100-2200	0.0558162	2.458E-07	1.001E-05	0.0523402	2.305E-07	9.387E-06	0.7126258	3.138E-06	0.0001278	0.6534985	2.877E-06	0.0001172	0.7058388	3.108E-06	0.0001266
RESIDENTIAL ROAD R	RD_011	2200-2300	0.0473247	2.031E-07	8.273E-06	0.0441092	1.893E-07	7.711E-06	0.6836713	2.934E-06	0.0001195	0.6201743	2.662E-06	0.0001084	0.6642835	2.851E-06	0.0001161
RESIDENTIAL ROAD R	RD_011	2300-0000	0.0541775	1.8E-07	7.33E-06	0.0502178	1.668E-07	6.794E-06	0.7036338	2.337E-06	9.52E-05	0.6346457	2.108E-06	8.587E-05	0.6848634	2.275E-06	9.266E-05
RESIDENTIAL ROAD C	RD_012	0000-0100	0.0354379	3.959E-07	4.488E-06	0.031949	3.569E-07	4.046E-06	0.3888228	4.344E-06	4.924E-05	0.3306736	3.694E-06	4.188E-05	0.3626226	4.051E-06	4.592E-05
RESIDENTIAL ROAD C	RD_012	0100-0200	0.0408481	3.102E-07	3.516E-06	0.0369468	2.806E-07	3.181E-06	0.3956109	3.004E-06	3.406E-05	0.3362372	2.553E-06	2.895E-05	0.3731841	2.834E-06	3.213E-05
RESIDENTIAL ROAD C	RD_012	0200-0300	0.0469419	2.733E-07	3.098E-06	0.0426343	2.482E-07	2.814E-06	0.4057793	2.362E-06	2.678E-05	0.3475092	2.023E-06	2.294E-05	0.3901436	2.271E-06	2.575E-05
RESIDENTIAL ROAD C	RD_012	0300-0400	0.0518903	2.27E-07	2.574E-06	0.0477128	2.088E-07	2.367E-06	0.4100343	1.794E-06	2.034E-05	0.3596738	1.574E-06	1.784E-05	0.4073866	1.782E-06	2.021E-05
RESIDENTIAL ROAD C	RD_012	0400-0500	0.0581508	2.397E-07	2.717E-06	0.0533346	2.198E-07	2.492E-06	0.4235518	1.746E-06	1.979E-05	0.3695949	1.523E-06	1.727E-05	0.4229295	1.743E-06	1.976E-05
RESIDENTIAL ROAD C	RD_012	0500-0600	0.0659299	3.838E-07	4.351E-06	0.0606779	3.532E-07	4.004E-06	0.4431308	2.58E-06	2.924E-05	0.3899582	2.27E-06	2.574E-05	0.450636	2.623E-06	2.974E-05
RESIDENTIAL ROAD C	RD_012	0600-0700	0.0763405	1.248E-06	1.414E-05	0.0704898	1.152E-06	1.306E-05	0.4706271	7.691E-06	8.72E-05	0.417661	6.826E-06	7.738E-05	0.4881508	7.978E-06	9.044E-05
RESIDENTIAL ROAD C	RD_012	0700-0800	0.091111	2.695E-06	3.055E-05	0.0844981	2.499E-06	2.833E-05	0.5196493	1.537E-05	0.0001742	0.4665899	1.38E-05	0.0001564	0.551088	1.63E-05	0.0001848
RESIDENTIAL ROAD C	RD_012	0800-0900	0.0663933	2.144E-06	2.43E-05	0.0617099	1.993E-06	2.259E-05	0.4307232	1.391E-05	0.0001577	0.3856624	1.245E-05	0.0001412	0.4473723	1.444E-05	0.0001638
RESIDENTIAL ROAD C	RD_012	0900-1000	0.0902856	2.462E-06	2.791E-05	0.0835597	2.278E-06	2.583E-05	0.5328795	1.453E-05	0.0001647	0.476448	1.299E-05	0.0001473	0.5600077	1.527E-05	0.0001731
RESIDENTIAL ROAD C	RD_012	1000-1100	0.094377	2.429E-06	2.754E-05	0.0876433	2.256E-06	2.557E-05	0.5765405	1.484E-05	0.0001682	0.5176275	1.332E-05	0.000151	0.6052708	1.558E-05	0.0001766
RESIDENTIAL ROAD C	RD_012	1100-1200	0.093601	2.285E-06	2.59E-05	0.0864516	2.11E-06	2.392E-05	0.5541114	1.352E-05	0.0001533	0.4939577	1.206E-05	0.0001367	0.5804094	1.417E-05	0.0001606
RESIDENTIAL ROAD C	RD_012	1200-1300	0.0937975	1.258E-06	1.426E-05	0.0874913	1.174E-06	1.33E-05	0.5544924	7.438E-06	8.432E-05	0.5055868	6.782E-06	7.688E-05	0.593078	7.955E-06	9.019E-05
RESIDENTIAL ROAD C	RD_012	1300-1400	0.1098184	1.481E-06	1.679E-05	0.1020476	1.376E-06	1.56E-05	0.63149	8.517E-06	9.656E-05	0.5740388	7.742E-06	8.777E-05	0.6760864	9.118E-06	0.0001034
RESIDENTIAL ROAD C	RD_012	1400-1500	0.0927804	1.285E-06	1.457E-05	0.0855074	1.184E-06	1.342E-05	0.5521876	7.647E-06	8.669E-05	0.4965437	6.876E-06	7.796E-05	0.5820511	8.061E-06	9.138E-05
RESIDENTIAL ROAD C	RD_012	1500-1600	0.0884214	1.221E-06	1.385E-05	0.0820902	1.134E-06	1.285E-05	0.547583	7.563E-06	8.574E-05	0.495272	6.841E-06	7.755E-05	0.5773622	7.975E-06	9.041E-05
RESIDENTIAL ROAD C	RD_012	1600-1700	0.0849921	1.272E-06	1.442E-05	0.0792024	1.186E-06	1.344E-05	0.5491485	8.22E-06	9.319E-05	0.4997878	7.481E-06	8.481E-05	0.5789902	8.667E-06	9.825E-05
RESIDENTIAL ROAD C	RD_012	1700-1800	0.0588008	1.033E-06	1.171E-05	0.054771	9.623E-07	1.091E-05	0.4167293	7.322E-06	8.301E-05	0.3791032	6.661E-06	7.551E-05	0.4338741	7.623E-06	8.642E-05
RESIDENTIAL ROAD C	RD_012	1800-1900	0.0437783	7.821E-07	8.866E-06	0.040594	7.252E-07	8.221E-06	0.3672664	6.561E-06	7.438E-05	0.3299025	5.894E-06	6.681E-05	0.3704965	6.619E-06	7.504E-05
RESIDENTIAL ROAD C	RD_012	1900-2000	0.0351699	5.519E-07	6.257E-06	0.0325039	5.1E-07	5.782E-06	0.3681574	5.777E-06	6.549E-05	0.3281927	5.15E-06	5.838E-05	0.3606966	5.66E-06	6.417E-05
RESIDENTIAL ROAD C	RD_012	2000-2100	0.0368685	4.706E-07	5.335E-06	0.0342612	4.373E-07	4.958E-06	0.3851801	4.917E-06	5.574E-05	0.3456604	4.412E-06	5.002E-05	0.3799216	4.849E-06	5.498E-05
RESIDENTIAL ROAD C	RD_012	2100-2200	0.0345554	4.198E-07	4.759E-06	0.031877	3.872E-07	4.39E-06	0.4243523	5.155E-06	5.844E-05	0.376183	4.57E-06	5.181E-05	0.40806	4.957E-06	5.62E-05
RESIDENTIAL ROAD C	RD_012	2200-2300	0.0274036	3.25E-07	3.685E-06	0.0249272	2.956E-07	3.352E-06	0.418349	4.962E-06	5.625E-05	0.3639934	4.317E-06	4.894E-05	0.3889205	4.613E-06	5.229E-05
RESIDENTIAL ROAD C	RD_012	2300-0000	0.0327863	2.999E-07	3.4E-06	0.0298442	2.73E-07	3.095E-06	0.424133	3.88E-06	4.398E-05	0.3688432	3.374E-06	3.825E-05	0.3986873	3.647E-06	4.135E-05

Appendix 3.4

Calculation of Existing Industrial Chimney Emissions

Detailed Calculation of Nox,RSP, FSP and CO Emissions from LTP-2 of TKOL II/III

Emission from Landfill Gas Consumption [1]

Max. landfill gas consumption rate in LTP-2 of TKOL II/III (past 5 years) = 1044 m^3/hr[1]

Secondary NOx emission from flare system 650 $kg/10^6$ scm Methane [2]
Secondary PM emission from flare system 270 $kg/10^6$ scm Methane [2]
Secondary CO emission from flare system 920 $kg/10^6$ scm Methane [2]

Standard Conditions (US standard) [3]:
60 F
= 15.6 C
= 288.6 K

Assume LFG at typical ambient temperature:
25 C
= 298 K
Therefore,
1 m^3 at 25°C
= 0.96830723 scm

Landfill gas to be flared in Flare System 1044 m^3/hr [1]
= 522 m^3/hr Methane, (50% Methane content in LFG) [1]
= 505.4564 scm/hr
= 0.1404045 scm/s
NOx Emission = **0.09126 g/s**
PM (RSP/FSP) Emission [4] = **0.03791 g/s**
CO Emission = **0.12917 g/s**

Release Height of Chimney at LTP-2 Flare = 18.5 m [1]
Exit Temperature of Chimney at LTP-2 Flare = 353 K [3]
Internal Diameter of Chimney at LTP-2 Flare = 3.5 m [1]
Exit Velocity of Chimney at LTP-2 Flare = 15.0 m/s [3]

Note:

[1] Information provided by TKOL II/III operator. Landfill gas and diesel are consumed for the leachate treatment plant and landfill gas generator as provided by the operator.

[2] Information is made reference to approved EIA Study for Tuen Mun Bypass (AEIAR-256/2023) and Table 2.4-4 of USEPA AP-42 Fifth Edition.

[3] Information is made reference to Appendix 3.5 of the approved EIA report of West New Territories (WENT) Landfill Extension (AEIAR-147/2009) and Appendix 3.8 of the approved EIA report for Tuen Mun Bypass (AERAR-256/2023). No exit temperature and velocity information was provided by the operator; it is assumed to be the same as the Pillar Point Valley landfill flare.

[4] According to Table2.4-4 of USEPA AP-42 Fifth Edition, the emission factor can be used for RSP and FSP.

	SO2		
Flaring H2S concentration (in ppm) in raw LFG	36	ppm	(USEPA AP-42, Section 2.4, Table 2.4-1,
Molecular weight of H2S	34		
Flowrate of LFG	1044	m3/hr	
Conc of H2S (in g/m3) in raw LFG @ 83.8oC	0.04	g/m3	(ppm x MW / (22.414x(273+83.8)/(273)) / 1000)
Mass of H2S	0.012	g/s	(conc of H2S (in g/m3) x LFG flowrate)
Mole ratio of H2S / SO2		(2H2S + 3O2 ---> 2SO2 + 2H2O)	
molecular weight of SO2 64 Mass of SO2	0.023	g/s	(mass of H2S x (64 / 34)}
Exhaust flowrate at 850oC	519541	m3/hr	
Emission concentration of SO2 at exhaust (850oC)	**0.16**	mg/m3	(mass of SO2 / exhaust flowrate)
Exhaust Temperature	850		
Raw Leachate Temeperature	83.8		

	Benzene		
Flaring concentration (in ppbv) in raw LFG	1.1		(Information provided by TKOL II/III operator)
Molecular weight	78.11		
Flowrate of LFG	1044	m3/hr	
Conc (in g/m3) in raw LFG @ 83.8oC	0.004	g/m3	
Mass	0.001	g/s	
Exhaust flowrate at 850oC	519541	m3/hr	
Emission concentration at exhaust (850oC)	**3.50**	mg/m3	

Appendix 3.5

Surface Parameters for AERMOD Meteorological Data

Summary of Defaut Albedo, Brown Ratio and Surface Roughness from AERMET

Code	Color Sample	Hong Kong Planning Department Classification	Roughness	Albedo	Bowen Ratio
1	🟫	Private Residential	1	0.18	1.5
2	🟥	Public Residential	1	0.18	1.5
3	🟫	Rural Settlement	0.375	0.165	0.9
11	🟥	Commercial/Business and Office	1	0.18	1.5
21	🟪	Industrial Land	0.7	0.18	1.5
22	🟪	Industrial Estates/Science and Technology Parks	0.7	0.18	1.5
23	🟦	Warehouse and Open Storage	0.7	0.18	1.5
31	🟦	Government, Institutional and Community Facilities	0.7	0.18	1.5
32	🟩	Open Space and Recreation	0.04	0.15	1
41	🟨	Roads and Transport Facilities	0.7	0.18	1.5
42	⬛	Railways	0.7	0.18	1.5
43	⬜	Airport	0.07	0.18	1.5
44	🟪	Port Facilities	0.7	0.18	1.5
51	🟨	Cemeteries/Funeral Facilities	0.7	0.18	1.5
52	🟧	Utilities	0.7	0.18	1.5
53		Vacant Land/Construction in Progress	0.2	0.18	1
54	🟧	Others	0.2	0.18	1
61	🟩	Agricultural Land	0.1575	0.18	0.55
62	🟦	Fish Ponds/Gei Wais	0.001	0.1	0.1
71	🟩	Woodland	1.05	0.1625	0.75
72	🟩	Shrubland	0.3	0.18	1.25
73	🟩	Grassland	0.065	0.185	0.8
74	🟥	Mangrove/Swamp	0.065	0.14	0.225
81	🟦	Badland	0.15	0.1625	0.75
83	🟪	Rocky Shore	0.05	0.2	4.75
91	🟦	Reservoirs	0.001	0.1	0.1
92	🟦	Streams and Nullahs	0.001	0.1	0.1
99	🟥	SZ Residential *	1	0.18	1.5
0		Open Sea *	0.001	0.1	0.1

* Non-PlanD Land Utilization categories

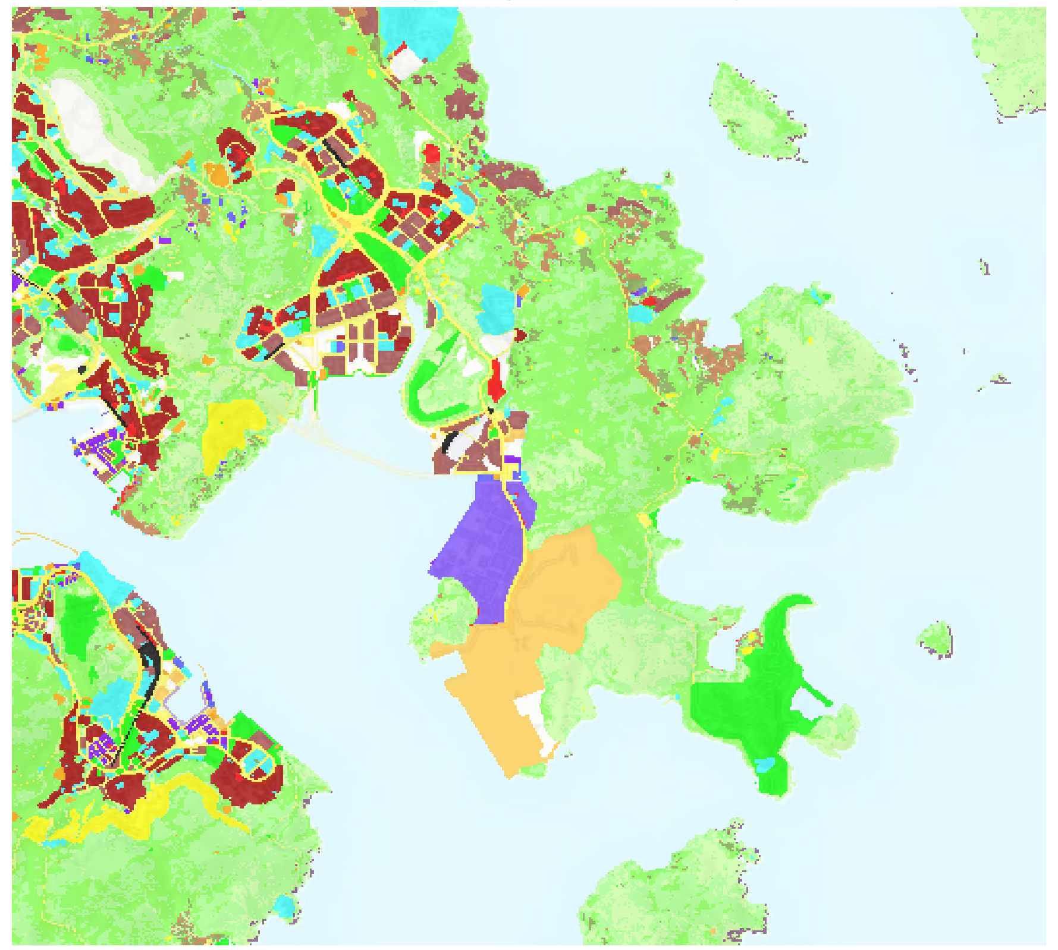
Summary of Albedo and Bowen Ratio for the Study Area

Grid 5030

Code	Color Sample	Hong Kong Plannir	Roughness	Albedo	Bowen Ratio	Grid Count	Percent	Albedo x Percent	b^n/Sn
1	🟫	Private Residential	1	0.18	1.5	18520	1.85%	0.0033336	1.007537479
2	🟥	Public Residential	1	0.18	1.5	30882	3.09%	0.00555876	1.012600297
3	🟫	Rural Settlement	0.375	0.165	0.9	10374	1.04%	0.00171171	0.998907587
11	🟥	Commercial/Busin	1	0.18	1.5	2650	0.27%	0.000477	1.00107506
21	🟪	Industrial Land	0.7	0.18	1.5	2364	0.24%	0.00042552	1.000958979
22	🟪	Industrial Estates/	0.7	0.18	1.5	8562	0.86%	0.00154116	1.003477625
23	🟦	Warehouse and O	0.7	0.18	1.5	1222	0.12%	0.00021996	1.000495601
31	🟦	Government, Instit	0.7	0.18	1.5	21765	2.18%	0.0039177	1.008864003
32	🟩	Open Space and R	0.04	0.15	1	24831	2.48%	0.00372465	1
41	🟨	Roads and Transpo	0.7	0.18	1.5	32742	3.27%	0.00589356	1.013364252
42	⬛	Railways	0.7	0.18	1.5	1467	0.15%	0.00026406	1.000594994
43	⬜	Airport	0.07	0.18	1.5	0	0.00%	0	1
44	🟪	Port Facilities	0.7	0.18	1.5	271	0.03%	0.00004878	1.000109887
51	🟨	Cemeteries/Funer	0.7	0.18	1.5	8684	0.87%	0.00156312	1.003527265
52	🟧	Utilities	0.7	0.18	1.5	3123	0.31%	0.00056214	1.00126707
53	⬜	Vacant Land/Const	0.2	0.18	1	15661	1.57%	0.00281898	1
54	🟧	Others	0.2	0.18	1	20932	2.09%	0.00376776	1
61	🟩	Agricultural Land	0.1575	0.18	0.55	8555	0.86%	0.0015399	0.994898561
62	🟦	Fish Ponds/Gei Wa	0.001	0.1	0.1	0	0.00%	0	1
71	🟩	Woodland	1.05	0.1625	0.75	136088	13.61%	0.0221143	0.961606382
72	🟩	Shrubland	0.3	0.18	1.25	92812	9.28%	0.01670616	1.020926348
73	🟩	Grassland	0.065	0.185	0.8	72324	7.23%	0.01337994	0.983990896
74	🟪	Mangrove/Swamp	0.065	0.14	0.225	17	0.00%	0.00000238	0.999974642
81	🟪	Badland	0.15	0.1625	0.75	0	0.00%	0	1
83	🟪	Rocky Shore	0.05	0.2	4.75	1742	0.17%	0.0003484	1.002717975
91	🟦	Reservoirs	0.001	0.1	0.1	0	0.00%	0	1
92	🟦	Streams and Nulla	0.001	0.1	0.1	275	0.03%	0.0000275	0.99936699
99	🟥	SZ Residential *	1	0.18	1.5	0	0.00%	0	1
0	⬜	Open Sea *	0.001	0.1	0.1	484137	48.41%	0.0484137	0.32799181
				0.138361	**0.332913**	1000000			

* Non-PlanD Land Utilization categories

Center: X=846465, Y=816995, Z=8.0; Met Year=2019;



Land Utilization in Hong Kong 2023

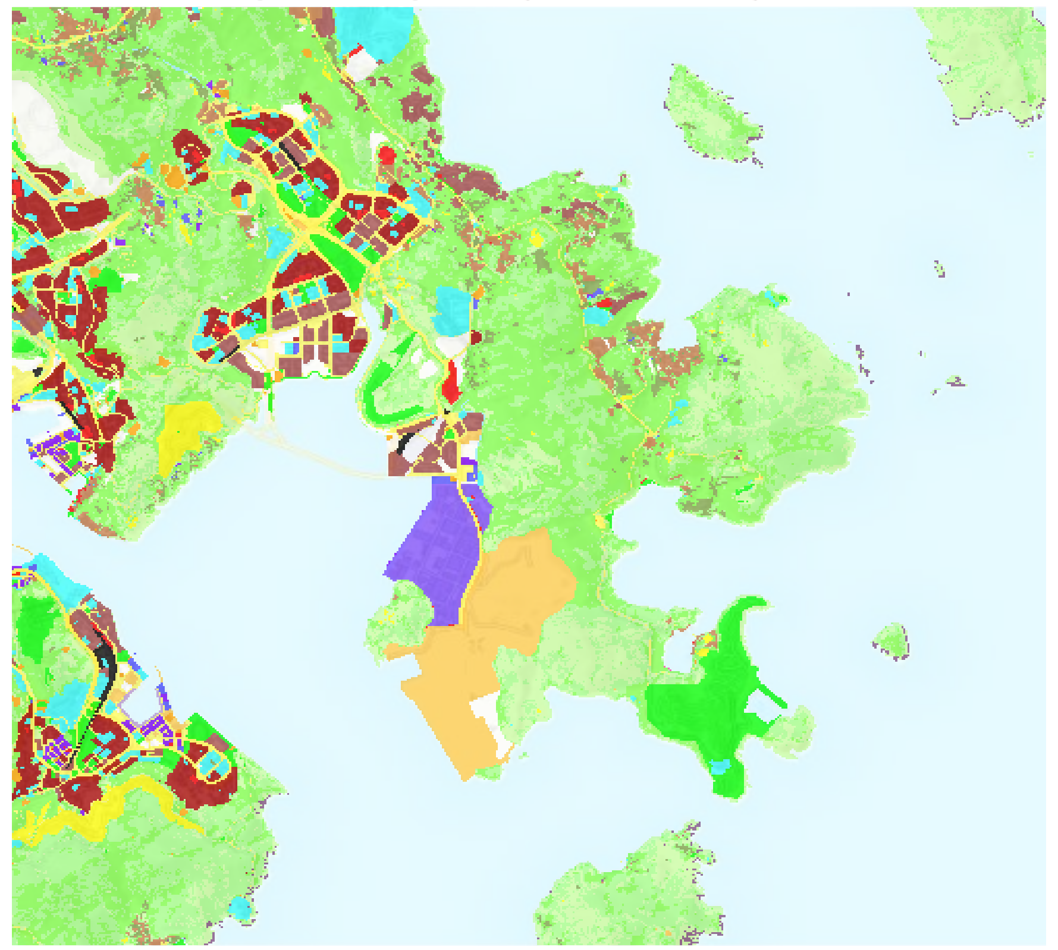
Summary of Albedo and Bowen Ratio for the Study Area

Grid 5130

Code	Color Sample	Hong Kong Plannir	Roughness	Albedo	Bowen Ratio	Grid Count	Percent	Albedo x Percent	b^n/Sn
1	🟫	Private Residential	1	0.18	1.5	16289	1.63%	0.00293202	1.00662648
2	🟥	Public Residential	1	0.18	1.5	26439	2.64%	0.00475902	1.010777758
3	🟫	Rural Settlement	0.375	0.165	0.9	10157	1.02%	0.001675905	0.998930426
11	🟥	Commercial/Busin	1	0.18	1.5	2502	0.25%	0.00045036	1.001014988
21	🟪	Industrial Land	0.7	0.18	1.5	2121	0.21%	0.00038178	1.000860361
22	🟪	Industrial Estates/	0.7	0.18	1.5	8562	0.86%	0.00154116	1.003477625
23	🟦	Warehouse and O	0.7	0.18	1.5	1222	0.12%	0.00021996	1.000495601
31	🟦	Government, Instit	0.7	0.18	1.5	19570	1.96%	0.0035226	1.007966517
32	🟩	Open Space and R	0.04	0.15	1	23600	2.36%	0.00354	1
41	🟨	Roads and Transpo	0.7	0.18	1.5	28166	2.82%	0.00506988	1.011485791
42	⬛	Railways	0.7	0.18	1.5	1405	0.14%	0.0002529	1.000569841
43	⬜	Airport	0.07	0.18	1.5	0	0.00%	0	1
44	🟪	Port Facilities	0.7	0.18	1.5	271	0.03%	0.00004878	1.000109887
51	🟨	Cemeteries/Funer	0.7	0.18	1.5	8154	0.82%	0.00146772	1.003311634
52	🟧	Utilities	0.7	0.18	1.5	2583	0.26%	0.00046494	1.001047865
53	⬜	Vacant Land/Const	0.2	0.18	1	14395	1.44%	0.0025911	1
54	🟧	Others	0.2	0.18	1	20806	2.08%	0.00374508	1
61	🟩	Agricultural Land	0.1575	0.18	0.55	8540	0.85%	0.0015372	0.994907483
62	🟦	Fish Ponds/Gei Wa	0.001	0.1	0.1	0	0.00%	0	1
71	🟩	Woodland	1.05	0.1625	0.75	125594	12.56%	0.020409025	0.964513797
72	🟩	Shrubland	0.3	0.18	1.25	90057	9.01%	0.01621026	1.020298916
73	🟩	Grassland	0.065	0.185	0.8	72884	7.29%	0.01348354	0.983867944
74	🟪	Mangrove/Swamp	0.065	0.14	0.225	17	0.00%	0.00000238	0.999974642
81	🟪	Badland	0.15	0.1625	0.75	0	0.00%	0	1
83	🟪	Rocky Shore	0.05	0.2	4.75	1875	0.19%	0.000375	1.002925793
91	🟦	Reservoirs	0.001	0.1	0.1	0	0.00%	0	1
92	🟦	Streams and Nulla	0.001	0.1	0.1	272	0.03%	0.0000272	0.999373893
99	🟥	SZ Residential *	1	0.18	1.5	0	0.00%	0	1
0	⬜	Open Sea *	0.001	0.1	0.1	514519	51.45%	0.0514519	0.305830645
				0.136160	**0.309321**	1000000			

* Non-PlanD Land Utilization categories

Center: X=846895, Y=817015, Z=92.0; Met Year=2019;



Land Utilization in Hong Kong 2023

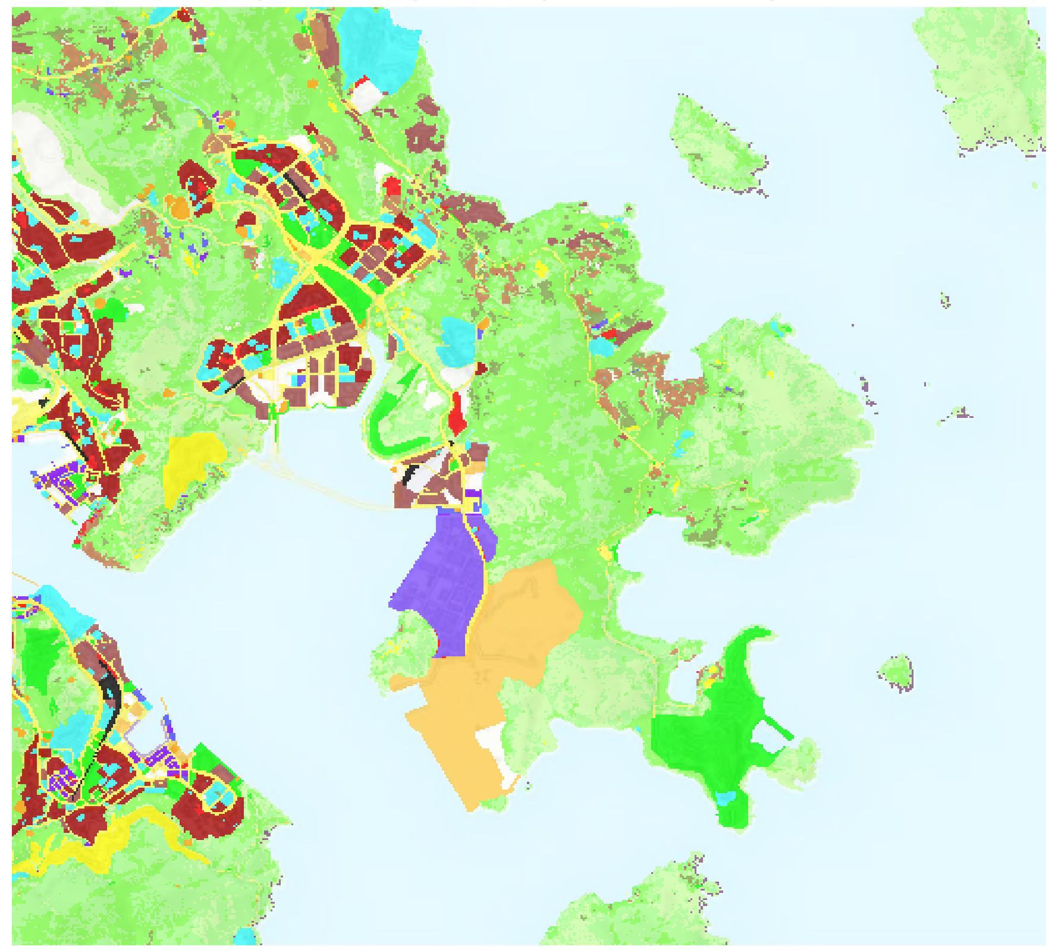
Summary of Albedo and Bowen Ratio for the Study Area

Grid 5131

Code	Color Sample	Hong Kong Plannir	Roughness	Albedo	Bowen Ratio	Grid Count	Percent	Albedo x Percent	b^n/Sn
1	🟫	Private Residential	1	0.18	1.5	17146	1.71%	0.00308628	1.006976327
2	🟥	Public Residential	1	0.18	1.5	26953	2.70%	0.00485154	1.010988435
3	🟫	Rural Settlement	0.375	0.165	0.9	10418	1.04%	0.00171897	0.998902956
11	🟥	Commercial/Busin	1	0.18	1.5	2514	0.25%	0.00045252	1.001019859
21	🟪	Industrial Land	0.7	0.18	1.5	2148	0.21%	0.00038664	1.000871318
22	🟪	Industrial Estates/	0.7	0.18	1.5	8562	0.86%	0.00154116	1.003477625
23	🟦	Warehouse and O	0.7	0.18	1.5	1234	0.12%	0.00022212	1.000500469
31	🟦	Government, Instit	0.7	0.18	1.5	22098	2.21%	0.00397764	1.009000229
32	🟩	Open Space and R	0.04	0.15	1	23727	2.37%	0.00355905	1
41	🟨	Roads and Transpo	0.7	0.18	1.5	29099	2.91%	0.00523782	1.011868508
42	⬛	Railways	0.7	0.18	1.5	1410	0.14%	0.0002538	1.000571869
43	⬜	Airport	0.07	0.18	1.5	0	0.00%	0	1
44	🟪	Port Facilities	0.7	0.18	1.5	271	0.03%	0.00004878	1.000109887
51	🟨	Cemeteries/Funer	0.7	0.18	1.5	8253	0.83%	0.00148554	1.003351909
52	🟧	Utilities	0.7	0.18	1.5	2699	0.27%	0.00048582	1.001094949
53	⬜	Vacant Land/Const	0.2	0.18	1	14715	1.47%	0.0026487	1
54	🟧	Others	0.2	0.18	1	20784	2.08%	0.00374112	1
61	🟩	Agricultural Land	0.1575	0.18	0.55	8721	0.87%	0.00156978	0.994799831
62	🟦	Fish Ponds/Gei Wa	0.001	0.1	0.1	0	0.00%	0	1
71	🟩	Woodland	1.05	0.1625	0.75	129505	12.95%	0.021044563	0.963429209
72	🟩	Shrubland	0.3	0.18	1.25	88552	8.86%	0.01593936	1.019956325
73	🟩	Grassland	0.065	0.185	0.8	71932	7.19%	0.01330742	0.984076971
74	🟪	Mangrove/Swamp	0.065	0.14	0.225	16	0.00%	0.00000224	0.999976134
81	🟪	Badland	0.15	0.1625	0.75	0	0.00%	0	1
83	🟪	Rocky Shore	0.05	0.2	4.75	1487	0.15%	0.0002974	1.002319647
91	🟦	Reservoirs	0.001	0.1	0.1	0	0.00%	0	1
92	🟦	Streams and Nulla	0.001	0.1	0.1	260	0.03%	0.000026	0.999401507
99	🟥	SZ Residential *	1	0.18	1.5	0	0.00%	0	1
0	⬜	Open Sea *	0.001	0.1	0.1	507496	50.75%	0.0507496	0.310816453
				0.136634	**0.314399**	1000000			

* Non-PlanD Land Utilization categories

Center: X=846845, Y=817345, Z=133.0; Met Year=2019;



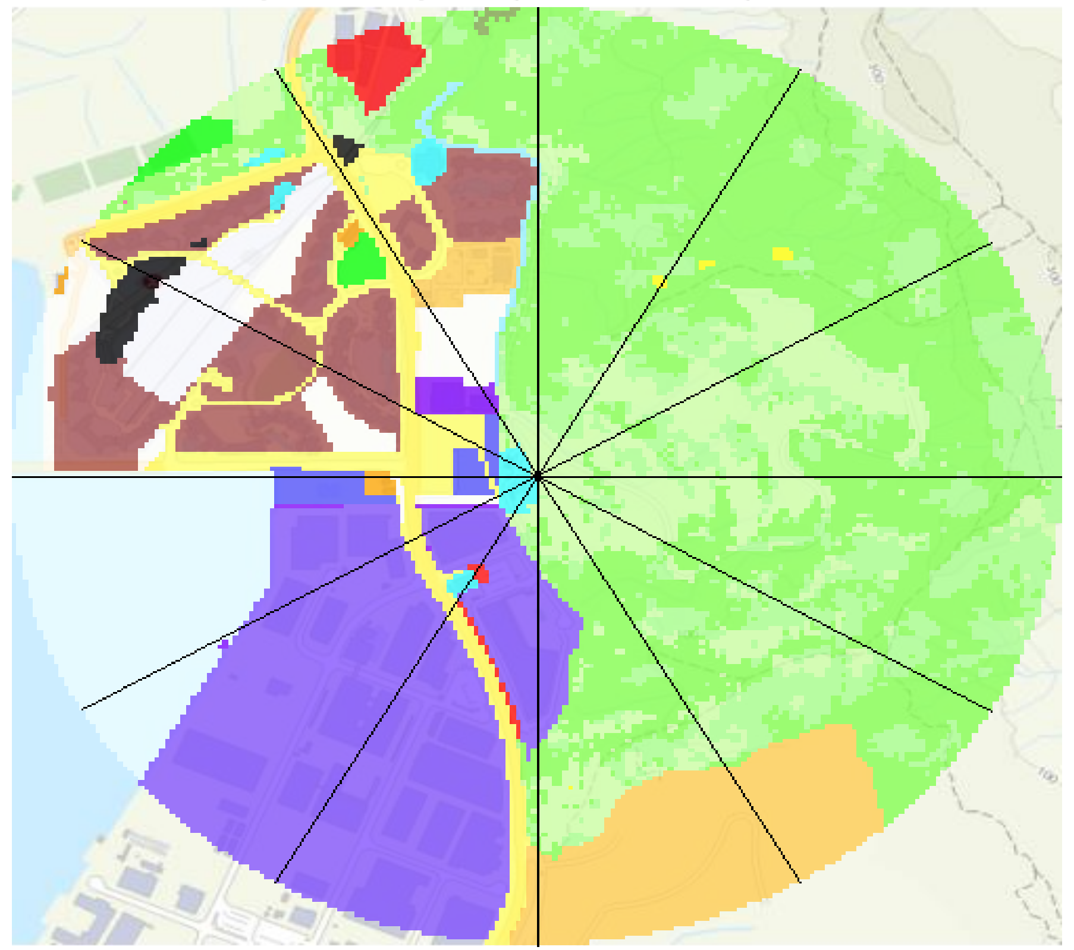
Land Utilization in Hong Kong 2023

Summary of Surface Roughness for the Study Area

Grid 5030

Angle	Group	Inverse-distance S	Roughness
0	0 - 30	5.176452751	**0.539240**
30	30 - 60	5.31768931	**0.326367**
60	60 - 90	5.176452751	**0.238790**
90	90 - 120	5.176452751	**0.282057**
120	120 - 150	5.31768931	**0.282656**
150	150 - 180	5.176452751	**0.295148**
180	180 - 210	5.176452751	**0.622226**
210	210 - 240	5.31768931	**0.442254**
240	240 - 270	5.176452751	**0.031018**
270	270 - 300	5.176452751	**0.470432**
300	300 - 330	5.31768931	**0.470665**
330	330 - 360	5.176452751	**0.325237**

Center: X=846465, Y=816995, Z=8.0; Met Year=2019;



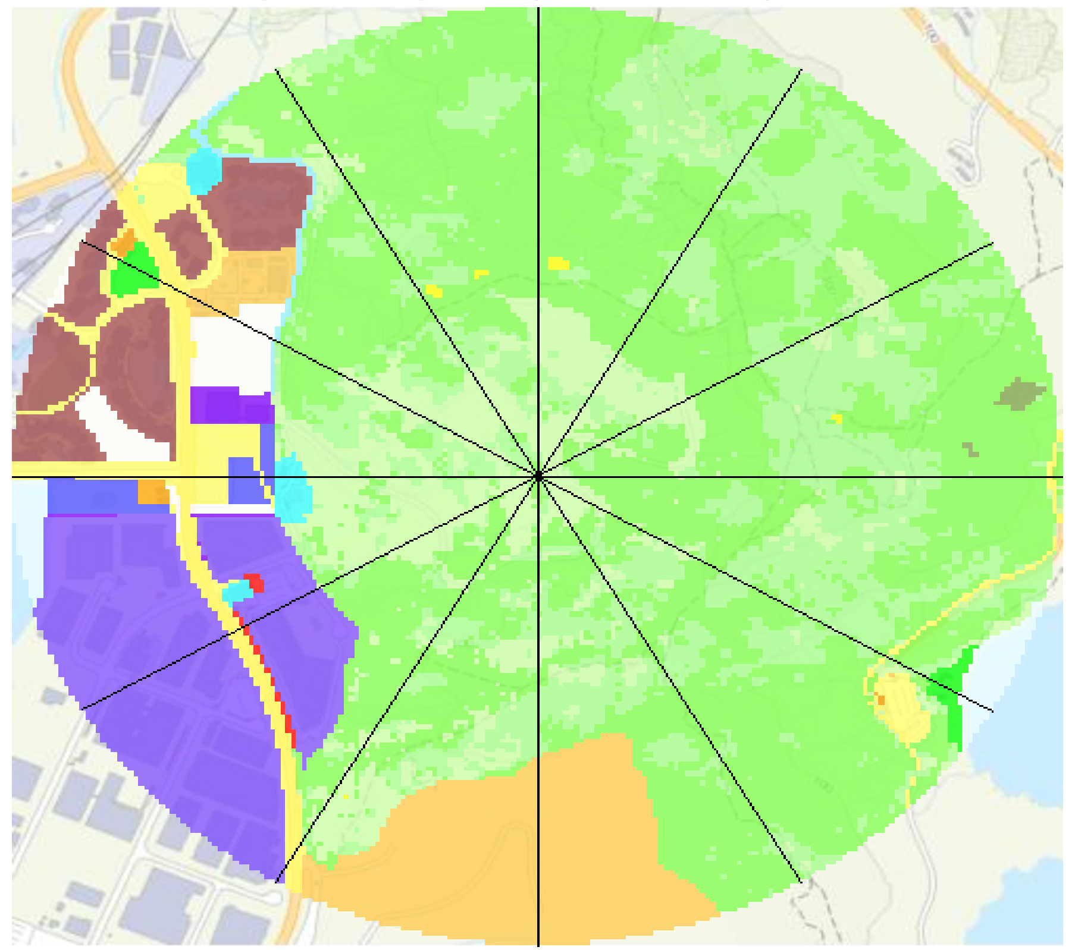
Land Utilization in Hong Kong 2023

Summary of Surface Roughness for the Study Area

Grid 5130

Angle	Group	Inverse-distance S	Roughness
0	0 - 30	5.176452751	**0.375839**
30	30 - 60	5.31768931	**0.405741**
60	60 - 90	5.176452751	**0.487093**
90	90 - 120	5.176452751	**0.399789**
120	120 - 150	5.31768931	**0.480704**
150	150 - 180	5.176452751	**0.389047**
180	180 - 210	5.176452751	**0.287708**
210	210 - 240	5.31768931	**0.515966**
240	240 - 270	5.176452751	**0.240821**
270	270 - 300	5.176452751	**0.319714**
300	300 - 330	5.31768931	**0.345665**
330	330 - 360	5.176452751	**0.498716**

Center: X=846895, Y=817015, Z=92.0; Met Year=2019;



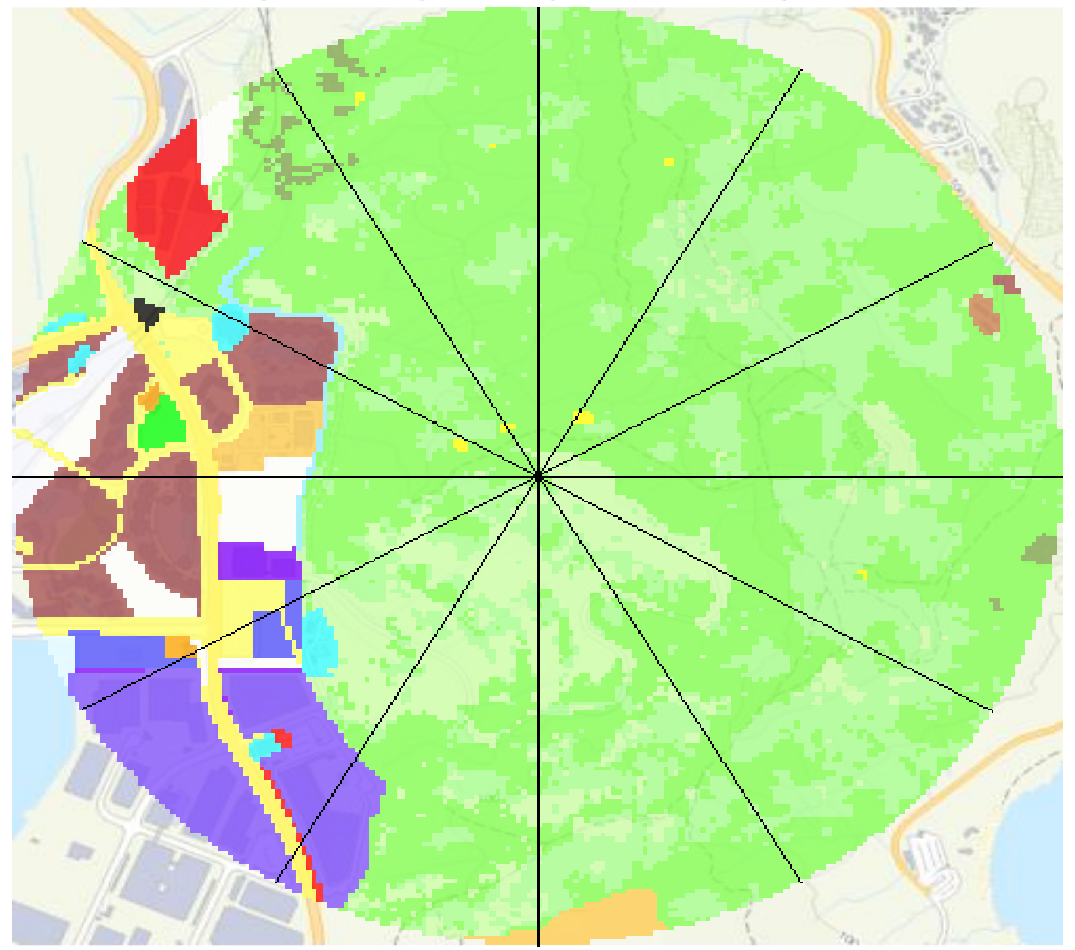
Land Utilization in Hong Kong 2023

Summary of Surface Roughness for the Study Area

Grid 5131

Angle	Group	Inverse-distance S	Roughness
0	0 - 30	5.176452751	**0.771263**
30	30 - 60	5.31768931	**0.542639**
60	60 - 90	5.176452751	**0.535156**
90	90 - 120	5.176452751	**0.414535**
120	120 - 150	5.31768931	**0.351774**
150	150 - 180	5.176452751	**0.310298**
180	180 - 210	5.176452751	**0.265950**
210	210 - 240	5.31768931	**0.328399**
240	240 - 270	5.176452751	**0.524291**
270	270 - 300	5.176452751	**0.565151**
300	300 - 330	5.31768931	**0.589672**
330	330 - 360	5.176452751	**0.837751**

Center: X=846845, Y=817345, Z=133.0; Met Year=2019;



Land Utilization in Hong Kong 2023

Appendix 3.6

Detailed Operational Air Quality Assessment Results for Default Traffic Scenario

Detailed Air Quality Impact Assessment Results - Default Scenario

Annual Averaged NO_2 Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Annual Averaged NO_2 Concentration at different elevation of ASR in metre, $\mu g / m^3$		
							1.5	5	10
Hong Kong AQO Criterion					**40**				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	11	11	11
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	10	10	10
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	9	9	9
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	9	9	9
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	9	9	9
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	10	10	10
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	10	10	10
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	10	10	10
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	10	10	10
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	10	10	10
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	11	11	12
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	11	11	12
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	11	11	12
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	11	11	12
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	12	12	11
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	11	11	11
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	11	11	11
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	11	11	11
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	11	11	12
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	11	11	11
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	11	11	11
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	11	11	11
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	11	11	11
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	11	11	11
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	11	11	11
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	11	11	11
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	11	11	11
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	11	11	11
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	11	11	11
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	11	11	11
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	11	11	11
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	11	11	11
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	11	11	11
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	12	12	11
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	10	10	10
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	10	10	10
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	10	10	10
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	10	10	10
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	10	10	10
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	10	10	10
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	10	10	10
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	10	10	10
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	11	10	10
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	11	11	12
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	11	11	12
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	11	11	12
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	11	11	11
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	11	11	11
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	11	11	11
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	10	10	10
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	10	10	10
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	10	10	10
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	9	9	9
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	9	9	9
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	9	9	9
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	10	10	10
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	10	10	10
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	11	11	11
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	11	11	12
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	11	11	12
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	11	11	12

Detailed Air Quality Impact Assessment Results - Default Scenario

19th highest 1-hour NO_2 Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	19th highest 1hr NO_2 Concentration at different elevation of ASR in metre, µg / m^3		
							1.5	5	10
Hong Kong AQO Criterion					200 (18)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	62	62	61
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	61	61	61
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	55	55	55
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	55	55	55
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	55	55	55
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	56	57	56
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	56	56	57
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	56	57	58
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	57	58	59
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	58	56	57
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	65	64	66
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	65	64	68
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	65	64	68
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	65	64	65
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	71	68	66
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	70	67	66
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	69	67	65
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	65	67	90
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	64	65	70
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	66	70	70
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	66	63	66
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	70	70	65
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	72	69	65
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	72	69	65
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	73	71	65
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	73	69	65
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	71	68	65
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	68	65	67
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	67	65	66
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	68	66	65
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	68	65	65
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	65	64	65
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	66	65	63
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	70	70	66
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	58	59	56
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	59	56	56
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	59	56	57
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	58	58	56
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	57	56	56
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	57	56	56
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	57	59	56
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	59	57	58
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	63	62	62
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	65	64	66
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	65	64	66
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	65	64	66
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	65	64	64
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	65	64	64
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	65	64	64
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	56	56	58
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	56	56	58
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	56	57	56
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	55	55	55
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	55	55	55
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	55	55	55
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	56	58	57
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	56	58	58
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	65	64	64
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	65	64	65
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	65	64	66
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	65	64	66

Detailed Air Quality Impact Assessment Results - Default Scenario

10th highest 24-hour NO_2 Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	10th highest 24hr NO_2 Concentration at different elevation of ASR in metre, μg / m^3		
							1.5	5	10
Hong Kong AQO Criterion					120 (9)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	24	23	23
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	22	22	22
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	21	20	21
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	20	20	20
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	20	20	20
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	20	21	20
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	20	20	21
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	20	21	21
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	20	21	21
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	20	20	21
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	25	25	26
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	25	25	26
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	25	25	26
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	25	25	26
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	26	26	24
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	26	25	24
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	26	25	24
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	25	24	25
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	25	25	27
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	25	25	25
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	25	25	24
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	26	25	25
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	26	25	25
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	26	25	25
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	26	26	25
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	26	25	25
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	26	25	25
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	25	25	25
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	25	25	25
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	25	25	25
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	25	25	25
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	25	25	24
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	25	25	24
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	27	26	25
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	21	21	20
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	21	20	20
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	21	20	21
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	21	20	20
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	21	20	20
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	21	20	20
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	21	21	20
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	21	20	21
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	23	23	23
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	25	25	25
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	25	25	26
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	25	25	26
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	25	25	25
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	25	25	25
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	25	25	25
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	20	20	21
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	20	20	21
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	20	21	20
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	20	20	20
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	20	20	20
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	20	21	20
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	20	21	20
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	20	21	20
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	25	25	25
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	25	25	25
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	25	25	26
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	25	25	26

Detailed Air Quality Impact Assessment Results - Default Scenario

Annual Averaged RSP Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Annual Averaged RSP Concentration at different elevation of ASR in metre, μg / m3		
							1.5	5	10
Hong Kong AQO Criterion					**30**				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	19	19	19
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	19	19	19
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	19	19	19
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	19	19	19
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	19	19	19
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	19	19	19
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	19	19	19
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	19	19	19
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	19	19	19
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	19	19	19
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	19	19	19
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	19	19	19
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	19	19	19
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	19	19	19
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	19	19	19
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	19	19	19
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	19	19	19
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	19	19	19
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	19	19	19
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	19	19	19
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	19	19	19
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	19	19	19
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	19	19	19
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	19	19	19
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	19	19	19
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	19	19	19
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	19	19	19
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	19	19	19
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	19	19	19
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	19	19	19
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	19	19	19
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	19	19	19
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	19	19	19
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	19	19	19
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	19	19	19
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	19	19	19
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	19	19	19
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	19	19	19
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	19	19	19
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	19	19	19
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	19	19	19
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	19	19	19
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	19	19	19
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	19	19	19
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	19	19	19
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	19	19	19
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	19	19	19
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	19	19	19
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	19	19	19
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	19	19	19
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	19	19	19
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	19	19	19
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	19	19	19
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	19	19	19
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	19	19	19
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	19	19	19
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	19	19	19
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	19	19	19
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	19	19	19
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	19	19	19
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	19	19	19

Detailed Air Quality Impact Assessment Results - Default Scenario

10th Highest 24-hour RSP Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	10th highest 24hr RSP Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Hong Kong AQO Criterion					75 (9)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	50	50	50
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	50	50	50
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	50	50	50
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	50	50	50
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	50	50	50
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	51	51	51
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	51	51	51
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	51	51	51
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	51	51	51
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	51	51	51
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	50	50	50
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	50	50	50
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	50	50	50
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	50	50	50
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	50	50	50
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	50	50	50
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	50	50	50
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	50	50	50
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	50	50	50
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	50	50	50
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	50	50	50
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	50	50	50
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	50	50	50
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	50	50	50
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	50	50	50
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	50	50	50
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	50	50	50
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	50	50	50
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	50	50	50
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	50	50	50
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	50	50	50
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	50	50	50
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	50	50	50
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	50	50	50
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	51	51	51
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	51	51	51
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	51	51	51
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	51	51	51
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	51	51	51
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	51	51	51
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	51	51	51
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	51	51	51
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	50	50	50
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	50	50	50
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	50	50	50
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	50	50	50
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	50	50	50
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	50	50	50
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	50	50	50
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	51	51	51
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	51	51	51
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	51	51	51
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	50	50	50
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	50	50	50
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	50	50	50
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	51	51	51
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	51	51	51
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	50	50	50
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	50	50	50
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	50	50	50
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	50	50	50

Detailed Air Quality Impact Assessment Results - Default Scenario

Annual Averaged FSP Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Annual Averaged FSP Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Hong Kong AQO Criterion					**15**				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	11	11	11
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	11	11	11
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	11	11	11
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	11	11	11
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	11	11	11
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	11	11	11
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	11	11	11
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	11	11	11
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	11	11	11
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	11	11	11
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	11	11	12
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	11	11	12
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	11	11	12
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	11	11	12
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	11	11	11
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	11	11	11
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	11	11	11
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	11	11	11
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	11	11	12
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	11	11	12
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	11	11	11
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	11	11	11
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	11	11	11
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	11	11	11
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	11	11	11
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	11	11	11
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	11	11	11
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	11	11	11
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	11	11	11
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	11	11	11
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	11	11	11
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	11	11	11
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	11	11	11
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	11	11	11
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	11	11	11
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	11	11	11
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	11	11	11
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	11	11	11
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	11	11	11
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	11	11	11
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	11	11	11
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	11	11	11
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	11	11	11
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	11	11	12
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	11	11	12
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	11	11	12
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	11	11	11
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	11	11	11
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	11	11	11
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	11	11	11
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	11	11	11
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	11	11	11
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	11	11	11
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	11	11	11
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	11	11	11
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	11	11	11
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	11	11	11
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	11	11	11
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	11	11	11
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	11	11	12
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	11	11	12

Detailed Air Quality Impact Assessment Results - Default Scenario

19th highest 24-hour FSP Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	19th highest 24hr FSP Concentration at different elevation of ASR in metre, μg / m3		
							1.5	5	10
Hong Kong AQO Criterion					37.5 (18)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	28	28	28
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	28	28	28
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	28	28	28
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	28	28	28
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	28	28	28
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	29	29	29
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	29	29	29
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	29	29	29
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	29	29	29
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	29	29	29
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	28	28	28
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	28	28	28
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	28	28	28
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	28	28	28
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	28	28	28
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	28	28	28
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	28	28	28
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	28	28	28
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	28	28	29
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	28	28	29
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	28	28	28
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	28	28	28
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	28	28	28
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	28	28	28
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	28	28	28
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	28	28	28
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	28	28	28
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	28	28	28
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	28	28	28
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	28	28	28
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	28	28	28
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	28	28	28
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	28	28	28
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	28	28	28
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	29	29	29
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	29	29	29
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	29	29	29
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	29	29	29
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	29	29	29
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	29	29	29
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	29	29	29
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	29	29	29
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	28	28	28
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	28	28	28
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	28	28	28
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	28	28	28
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	28	28	28
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	28	28	28
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	28	28	28
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	29	29	29
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	29	29	29
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	29	29	29
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	28	28	28
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	28	28	28
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	28	28	28
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	29	29	29
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	29	29	29
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	28	28	28
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	28	28	28
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	28	28	28
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	28	28	28

Detailed Air Quality Impact Assessment Results - Default Scenario

4th Highest 24-hour SO2 Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	4th highest 24hr SO2 Concentration at different elevation of ASR in metre, μg / m3		
							1.5	5	10
Hong Kong AQO Criterion					40 (3)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	7	7	7
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	7	7	7
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	7	7	7
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	7	7	7
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	7	7	7
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	7	7	7
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	7	7	7
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	7	7	7
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	7	7	7
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	7	7	7
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	7	7	7
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	7	7	7
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	7	7	7
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	7	7	7
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	7	7	7
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	7	7	7
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	7	7	7
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	7	7	7
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	7	7	7
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	7	7	7
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	7	7	7
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	7	7	7
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	7	7	7
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	7	7	7
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	7	7	7
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	7	7	7
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	7	7	7
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	7	7	7
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	7	7	7
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	7	7	7
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	7	7	7
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	7	7	7
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	7	7	7
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	7	7	7
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	7	7	7
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	7	7	7
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	7	7	7
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	7	7	7
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	7	7	7
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	7	7	7
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	7	7	7
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	7	7	7
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	7	7	7
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	7	7	7
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	7	7	7
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	7	7	7
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	7	7	7
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	7	7	7
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	7	7	7
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	7	7	7
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	7	7	7
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	7	7	7
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	7	7	7
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	7	7	7
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	7	7	7
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	7	7	7
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	7	7	7
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	7	7	7
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	7	7	7
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	7	7	7
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	7	7	7

Detailed Air Quality Impact Assessment Results - Default Scenario

Maximum 10-minute SO_2 Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 10min SO_2 Concentration at different elevation of ASR in metre, μg / m^3		
							1.5	5	10
Hong Kong AQO Criterion					500 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	23	23	23
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	23	23	23
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	23	23	23
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	23	23	23
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	23	23	23
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	23	23	23
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	23	23	23
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	23	23	23
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	23	23	23
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	23	23	23
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	23	23	23
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	23	23	23
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	23	23	23
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	23	23	23
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	23	23	23
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	23	23	23
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	23	23	23
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	23	23	28
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	23	23	23
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	23	23	23
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	23	23	23
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	23	23	23
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	23	23	23
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	23	23	23
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	23	23	23
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	23	23	23
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	23	23	23
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	23	23	23
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	23	23	23
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	23	23	23
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	23	23	23
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	23	23	23
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	23	23	23
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	23	23	23
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	23	23	23
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	23	23	23
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	23	23	23
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	23	23	23
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	23	23	23
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	23	23	23
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	23	23	23
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	23	23	23
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	23	23	23
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	23	23	23
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	23	23	23
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	23	23	23
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	23	23	23
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	23	23	23
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	23	23	23
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	23	23	23
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	23	23	23
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	23	23	23
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	23	23	23
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	23	23	23
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	23	23	23
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	23	23	23
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	23	23	23
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	23	23	23
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	23	23	23
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	23	23	23
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	23	23	23

Detailed Air Quality Impact Assessment Results - Default Scenario

Maximum 24-hour CO Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 24hr CO Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Hong Kong AQO Criterion					4000 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	445	445	445
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	445	445	445
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	442	442	442
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	442	442	442
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	442	442	442
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	446	446	446
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	446	446	446
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	446	446	446
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	446	446	446
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	446	446	446
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	445	445	445
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	445	445	445
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	445	445	445
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	445	445	445
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	445	445	445
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	445	445	446
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	445	445	445
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	445	445	445
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	445	445	445
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	445	445	445
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	445	445	445
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	445	445	445
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	445	445	445
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	445	445	445
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	445	445	445
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	445	445	445
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	445	445	445
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	445	445	445
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	445	445	445
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	445	445	445
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	445	445	445
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	445	445	445
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	445	445	445
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	446	446	446
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	446	446	446
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	446	446	446
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	446	446	446
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	446	446	446
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	446	446	446
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	446	446	446
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	446	446	446
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	446	446	446
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	445	445	445
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	445	445	445
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	445	445	445
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	445	445	445
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	445	445	445
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	445	445	445
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	445	445	445
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	446	446	446
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	446	446	446
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	446	446	446
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	442	442	442
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	442	442	442
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	442	442	442
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	446	446	446
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	446	446	446
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	445	445	445
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	445	445	445
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	445	445	445
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	445	445	445

Detailed Air Quality Impact Assessment Results - Default Scenario

Maximum 8-hour CO Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 8hr CO Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Hong Kong AQO Criterion					10000 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	480	480	480
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	480	480	480
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	476	476	476
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	476	476	476
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	476	476	476
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	481	481	481
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	481	481	481
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	481	481	481
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	481	481	481
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	481	481	481
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	480	480	480
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	480	480	480
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	480	480	480
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	480	480	480
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	480	480	480
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	480	480	480
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	480	480	480
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	480	480	480
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	480	480	480
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	480	480	480
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	480	480	480
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	480	480	480
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	480	480	480
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	480	480	480
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	480	480	480
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	480	480	480
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	480	480	480
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	480	480	480
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	480	480	480
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	480	480	480
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	480	480	480
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	480	480	480
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	480	480	480
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	480	480	480
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	481	481	481
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	481	481	481
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	481	481	481
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	481	481	481
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	481	481	481
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	481	481	481
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	481	481	481
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	481	481	481
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	480	480	480
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	480	480	480
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	480	480	480
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	480	480	480
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	480	480	480
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	480	480	480
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	480	480	480
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	481	481	481
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	481	481	481
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	481	481	481
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	476	476	476
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	476	476	476
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	476	476	476
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	481	481	481
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	481	481	481
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	480	480	480
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	480	480	480
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	480	480	480
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	480	480	480

Detailed Air Quality Impact Assessment Results - Default Scenario

Maximum 1-hour CO Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 1hr CO Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Hong Kong AQO Criterion					30000 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	515	515	515
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	515	515	515
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	511	511	511
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	511	511	511
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	511	511	511
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	510	510	510
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	510	510	510
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	510	510	510
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	510	510	510
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	510	510	510
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	515	515	515
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	515	515	515
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	515	515	515
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	515	515	515
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	517	517	516
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	516	516	516
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	518	518	519
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	515	515	515
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	515	515	515
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	515	515	515
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	515	515	515
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	515	515	515
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	515	515	515
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	515	515	515
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	515	515	515
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	515	515	515
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	515	515	515
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	515	515	515
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	515	515	515
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	515	515	515
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	515	515	515
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	515	515	515
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	515	515	515
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	519	519	521
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	510	510	510
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	510	510	510
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	510	510	510
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	510	510	510
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	510	510	510
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	510	510	510
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	510	510	510
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	510	510	510
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	515	515	515
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	515	515	515
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	515	515	515
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	515	515	515
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	515	515	515
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	515	515	515
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	515	515	515
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	510	510	510
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	510	510	510
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	510	510	510
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	511	511	511
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	511	511	511
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	511	511	511
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	510	510	510
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	510	510	510
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	515	515	515
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	515	515	515
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	515	515	515
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	515	515	515

Detailed Air Quality Impact Assessment Results - Default Scenario

Maximum 1-hour Benzene Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 1hr benzene concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Non-AQO Criterion					27 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	2	2	2
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	2	2	2
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	2	2	2
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	2	2	2
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	2	2	2
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	2	2	2
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	2	2	2
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	2	2	2
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	2	2	2
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	2	2	2
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	2	2	2
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	2	2	2
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	2	2	2
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	2	2	2
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	2	2	2
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	2	2	2
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	2	2	2
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	2	2	3
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	2	2	3
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	2	2	3
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	2	2	2
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	2	2	2
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	2	2	2
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	2	2	2
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	2	2	2
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	2	2	2
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	2	2	2
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	2	2	2
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	2	2	2
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	2	2	2
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	2	2	2
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	2	2	2
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	2	2	2
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	2	2	2
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	2	2	2
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	2	2	2
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	2	2	2
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	2	2	2
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	2	2	2
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	2	2	2
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	2	2	2
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	2	2	2
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	2	2	2
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	2	2	2
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	2	2	2
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	2	2	2
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	2	2	2
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	2	2	2
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	2	2	2
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	2	2	2
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	2	2	2
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	2	2	2
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	2	2	2
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	2	2	2
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	2	2	2
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	2	2	2
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	2	2	2
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	2	2	2
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	2	2	2
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	2	2	2
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	2	2	2

Detailed Air Quality Impact Assessment Results - Default Scenario

Maximum 8-hour Benzene Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 8hr benzene concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Non-AQO Criterion					3 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	2	2	2
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	2	2	2
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	2	2	2
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	2	2	2
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	2	2	2
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	2	2	2
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	2	2	2
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	2	2	2
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	2	2	2
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	2	2	2
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	2	2	2
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	2	2	2
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	2	2	2
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	2	2	2
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	2	2	2
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	2	2	2
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	2	2	2
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	2	2	2
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	2	2	2
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	2	2	2
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	2	2	2
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	2	2	2
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	2	2	2
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	2	2	2
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	2	2	2
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	2	2	2
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	2	2	2
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	2	2	2
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	2	2	2
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	2	2	2
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	2	2	2
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	2	2	2
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	2	2	2
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	2	2	2
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	2	2	2
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	2	2	2
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	2	2	2
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	2	2	2
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	2	2	2
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	2	2	2
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	2	2	2
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	2	2	2
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	2	2	2
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	2	2	2
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	2	2	2
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	2	2	2
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	2	2	2
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	2	2	2
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	2	2	2
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	2	2	2
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	2	2	2
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	2	2	2
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	2	2	2
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	2	2	2
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	2	2	2
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	2	2	2
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	2	2	2
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	2	2	2
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	2	2	2
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	2	2	2
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	2	2	2

Detailed Air Quality Impact Assessment Results - Default Scenario

Maximum 24-hour Benzene Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 24hr benzene conencentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Non-AQO Criterion					**3 (0)**				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	1	1	1
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	1	1	1
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	1	1	1
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	1	1	1
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	1	1	1
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	1	1	1
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	1	1	1
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	1	1	1
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	1	1	1
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	1	1	1
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	1	1	1
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	1	1	1
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	1	1	1
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	1	1	1
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	1	1	1
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	1	1	1
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	1	1	1
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	1	1	1
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	1	1	1
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	1	1	1
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	1	1	1
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	1	1	1
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	1	1	1
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	1	1	1
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	1	1	1
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	1	1	1
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	1	1	1
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	1	1	1
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	1	1	1
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	1	1	1
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	1	1	1
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	1	1	1
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	1	1	1
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	1	1	1
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	1	1	1
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	1	1	1
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	1	1	1
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	1	1	1
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	1	1	1
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	1	1	1
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	1	1	1
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	1	1	1
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	1	1	1
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	1	1	1
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	1	1	1
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	1	1	1
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	1	1	1
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	1	1	1
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	1	1	1
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	1	1	1
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	1	1	1
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	1	1	1
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	1	1	1
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	1	1	1
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	1	1	1
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	1	1	1
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	1	1	1
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	1	1	1
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	1	1	1
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	1	1	1
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	1	1	1

Appendix 3.7

Detailed Operational Air Quality Assessment Results with Doubled Traffic Emission

Detailed Air Quality Impact Assessment Results - Doubled Traffic

Annual Averaged NO_2 Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Annual Averaged NO_2 Concentration at different elevation of ASR in metre, $\mu g / m^3$		
							1.5	5	10
Hong Kong AQO Criterion					**40**				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	11	11	11
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	11	11	11
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	9	9	9
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	9	9	9
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	9	9	9
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	10	10	10
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	10	10	10
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	10	10	10
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	10	10	10
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	10	10	10
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	12	12	12
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	12	12	12
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	12	12	12
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	12	12	12
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	13	13	12
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	12	12	12
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	13	12	12
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	11	11	11
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	12	12	12
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	12	12	12
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	12	12	12
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	12	12	12
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	12	12	12
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	12	12	12
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	12	12	12
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	12	12	12
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	12	12	12
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	12	12	12
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	12	12	12
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	12	12	12
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	12	12	12
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	12	12	11
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	12	12	12
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	13	13	12
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	10	10	10
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	10	10	10
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	10	10	10
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	10	10	10
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	10	10	10
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	10	10	10
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	10	10	10
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	10	10	10
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	11	11	11
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	12	12	12
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	12	12	12
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	12	12	12
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	11	11	12
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	12	11	12
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	12	11	12
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	10	10	10
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	10	10	10
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	10	10	10
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	9	9	9
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	9	9	9
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	9	9	9
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	10	10	10
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	10	10	10
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	12	11	12
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	12	12	12
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	12	12	12
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	12	12	12

Detailed Air Quality Impact Assessment Results - Doubled Traffic

19th Highest 1-hour NO_2 Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	19th highest 1hr NO_2 Concentration at different elevation of ASR in metre, $\mu g / m^3$		
							1.5	5	10
Hong Kong AQO Criterion					200 (18)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	63	63	62
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	61	61	61
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	55	55	55
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	55	55	55
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	55	55	55
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	57	58	57
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	57	57	58
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	57	59	59
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	58	59	59
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	59	57	58
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	77	75	72
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	75	75	73
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	75	74	74
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	75	73	70
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	89	81	73
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	80	77	73
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	81	75	72
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	72	73	93
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	75	70	76
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	70	74	74
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	77	71	70
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	86	79	71
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	86	83	73
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	86	79	73
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	89	83	74
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	90	84	75
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	87	82	73
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	83	77	72
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	81	75	72
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	82	79	72
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	80	75	71
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	74	72	68
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	78	75	70
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	87	84	73
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	59	59	57
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	59	57	57
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	59	57	58
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	59	59	57
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	59	57	57
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	59	57	57
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	59	59	57
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	59	58	59
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	64	63	63
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	78	75	71
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	77	75	72
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	77	75	72
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	75	71	68
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	75	73	68
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	75	71	68
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	57	57	59
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	57	57	59
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	57	58	57
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	55	55	55
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	55	55	55
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	55	55	55
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	57	59	58
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	57	59	59
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	75	71	68
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	75	73	68
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	75	74	70
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	76	75	71

Detailed Air Quality Impact Assessment Results - Doubled Traffic

10th highest 24-hour NO_2 Concentration

							10th highest 24hr NO_2 Concentration at different elevation of ASR in metre, μg / m^3		
ASRID	**Building Name**	**X**	**Y**	**Z**	**Lowest Assessment Height (mAG)**	**Highest Assessment Height (mAG)**	**1.5**	**5**	**10**
Hong Kong AQO Criterion					**120 (9)**				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	25	25	24
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	23	23	23
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	21	21	21
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	21	21	21
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	21	21	21
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	20	22	20
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	21	20	22
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	21	22	21
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	21	21	22
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	21	20	21
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	28	27	27
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	27	27	28
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	27	27	28
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	27	27	28
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	32	30	26
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	30	28	26
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	31	29	26
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	26	26	27
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	27	27	29
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	27	27	27
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	28	27	26
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	29	29	27
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	29	29	27
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	29	29	27
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	30	29	27
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	30	29	27
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	29	29	27
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	29	28	27
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	29	28	27
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	29	28	27
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	29	28	27
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	27	27	25
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	28	28	26
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	34	32	27
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	21	22	20
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	22	20	21
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	21	21	22
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	22	21	20
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	22	20	21
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	22	21	20
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	22	21	21
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	22	21	21
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	24	24	24
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	28	27	27
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	28	27	27
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	28	27	27
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	26	27	27
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	27	27	27
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	27	27	27
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	20	21	22
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	20	21	21
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	21	22	21
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	21	21	21
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	21	21	21
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	21	21	21
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	21	22	21
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	21	22	21
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	27	27	26
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	27	27	27
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	27	27	28
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	27	27	28

Detailed Air Quality Impact Assessment Results - Doubled Traffic

Annual Averaged RSP Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Annual Averaged RSP Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Hong Kong AQO Criterion					30				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	19	19	19
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	19	19	19
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	19	19	19
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	19	19	19
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	19	19	19
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	19	19	19
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	19	19	19
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	19	19	19
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	19	19	19
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	19	19	19
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	19	19	19
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	19	19	19
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	19	19	19
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	19	19	19
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	19	19	19
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	19	19	19
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	19	19	19
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	19	19	19
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	19	19	19
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	19	19	19
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	19	19	19
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	19	19	19
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	19	19	19
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	19	19	19
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	19	19	19
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	19	19	19
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	19	19	19
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	19	19	19
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	19	19	19
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	19	19	19
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	19	19	19
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	19	19	19
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	19	19	19
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	19	19	19
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	19	19	19
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	19	19	19
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	19	19	19
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	19	19	19
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	19	19	19
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	19	19	19
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	19	19	19
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	19	19	19
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	19	19	19
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	19	19	19
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	19	19	19
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	19	19	19
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	19	19	19
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	19	19	19
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	19	19	19
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	19	19	19
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	19	19	19
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	19	19	19
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	19	19	19
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	19	19	19
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	19	19	19
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	19	19	19
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	19	19	19
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	19	19	19
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	19	19	19
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	19	19	19
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	19	19	19

Detailed Air Quality Impact Assessment Results - Doubled Traffic

10th highest 24-hour RSP Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	10th highest 24hr RSP Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Hong Kong AQO Criterion					**75 (9)**				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	50	50	50
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	50	50	50
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	50	50	50
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	50	50	50
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	50	50	50
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	51	51	51
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	51	51	51
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	51	51	51
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	51	51	51
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	51	51	51
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	50	50	50
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	50	50	50
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	50	50	50
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	50	50	50
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	50	50	50
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	50	50	50
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	50	50	50
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	50	50	50
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	50	50	50
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	50	50	50
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	50	50	50
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	50	50	50
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	50	50	50
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	50	50	50
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	50	50	50
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	50	50	50
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	50	50	50
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	50	50	50
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	50	50	50
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	50	50	50
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	50	50	50
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	50	50	50
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	50	50	50
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	50	50	50
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	51	51	51
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	51	51	51
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	51	51	51
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	51	51	51
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	51	51	51
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	51	51	51
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	51	51	51
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	51	51	51
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	50	50	50
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	50	50	50
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	50	50	50
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	50	50	50
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	50	50	50
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	50	50	50
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	50	50	50
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	51	51	51
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	51	51	51
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	51	51	51
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	50	50	50
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	50	50	50
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	50	50	50
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	51	51	51
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	51	51	51
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	50	50	50
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	50	50	50
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	50	50	50
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	50	50	50

Detailed Air Quality Impact Assessment Results - Doubled Traffic

Annual Averaged FSP Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Annual Averaged FSP Concentration at different elevation of ASR in metre, μg / m3		
							1.5	5	10
Hong Kong AQO Criterion					15				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	11	11	11
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	11	11	11
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	11	11	11
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	11	11	11
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	11	11	11
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	11	11	11
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	11	11	11
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	11	11	11
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	11	11	11
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	11	11	11
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	11	11	12
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	11	11	12
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	11	11	12
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	11	11	12
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	11	11	11
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	11	11	11
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	11	11	11
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	11	11	11
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	11	11	12
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	11	11	12
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	11	11	11
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	11	11	11
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	11	11	11
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	11	11	11
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	11	11	11
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	11	11	11
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	11	11	11
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	11	11	11
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	11	11	11
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	11	11	11
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	11	11	11
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	11	11	11
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	11	11	11
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	11	11	11
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	11	11	11
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	11	11	11
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	11	11	11
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	11	11	11
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	11	11	11
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	11	11	11
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	11	11	11
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	11	11	11
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	11	11	11
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	11	11	12
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	11	11	12
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	11	11	12
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	11	11	11
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	11	11	11
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	11	11	11
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	11	11	11
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	11	11	11
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	11	11	11
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	11	11	11
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	11	11	11
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	11	11	11
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	11	11	11
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	11	11	11
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	11	11	11
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	11	11	12
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	11	11	12
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	11	11	12

Detailed Air Quality Impact Assessment Results - Doubled Traffic

19th Highest 24-hour FSP Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	19th highest 24hr FSP Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
	Hong Kong AQO Criterion					37.5 (18)			
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	28	28	28
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	28	28	28
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	28	28	28
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	28	28	28
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	28	28	28
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	29	29	29
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	29	29	29
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	29	29	29
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	29	29	29
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	29	29	29
E1	TKO PRS Administrative Building	846472	817002	8	1.5	10	28	28	28
E2	TKO PRS Administrative Building	846474	816994	8	1.5	10	28	28	28
E3	TKO PRS Administrative Building	846477	816981	8	1.5	10	28	28	28
E4	TKO PRS Administrative Building	846480	816968	8	1.5	10	28	28	28
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	28	28	28
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	28	28	28
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	28	28	28
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	28	28	28
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	28	28	29
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	28	28	29
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	28	28	28
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	28	28	28
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	28	28	28
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	28	28	28
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	28	28	28
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	28	28	28
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	28	28	28
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	28	28	28
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	28	28	28
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	28	28	28
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	28	28	28
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	28	28	28
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	28	28	28
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	28	28	28
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	29	29	29
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	29	29	29
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	29	29	29
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	29	29	29
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	29	29	29
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	29	29	29
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	29	29	29
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	29	29	29
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	28	28	28
N1	TKO PRS Administrative Building	846463	817000	8	1.5	10	28	28	28
N2	TKO PRS Administrative Building	846465	817001	8	1.5	10	28	28	28
N3	TKO PRS Administrative Building	846469	817001	8	1.5	10	28	28	28
S1	TKO PRS Administrative Building	846482	816961	8	1.5	10	28	28	28
S2	TKO PRS Administrative Building	846479	816960	7	1.5	10	28	28	28
S3	TKO PRS Administrative Building	846476	816959	8	1.5	10	28	28	28
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	29	29	29
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	29	29	29
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	29	29	29
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	28	28	28
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	28	28	28
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	28	28	28
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	29	29	29
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	29	29	29
W1	TKO PRS Administrative Building	846472	816959	8	1.5	10	28	28	28
W2	TKO PRS Administrative Building	846470	816966	7	1.5	10	28	28	28
W3	TKO PRS Administrative Building	846467	816979	8	1.5	10	28	28	28
W4	TKO PRS Administrative Building	846464	816992	8	1.5	10	28	28	28

Detailed Air Quality Impact Assessment Results - Doubled Traffic

4th Highest 24-hour SO2 Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	4th highest 24hr SO2 Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Hong Kong AQO Criterion							40 (3)		
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	7	7	7
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	7	7	7
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	7	7	7
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	7	7	7
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	7	7	7
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	7	7	7
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	7	7	7
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	7	7	7
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	7	7	7
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	7	7	7
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	7	7	7
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	7	7	7
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	7	7	7
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	7	7	7
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	7	7	7
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	7	7	7
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	7	7	7
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	7	7	7
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	7	7	7
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	7	7	7
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	7	7	7
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	7	7	7
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	7	7	7
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	7	7	7
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	7	7	7
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	7	7	7
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	7	7	7
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	7	7	7
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	7	7	7
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	7	7	7
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	7	7	7
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	7	7	7
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	7	7	7
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	7	7	7
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	7	7	7
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	7	7	7
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	7	7	7
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	7	7	7
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	7	7	7
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	7	7	7
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	7	7	7
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	7	7	7
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	7	7	7
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	7	7	7
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	7	7	7
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	7	7	7
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	7	7	7
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	7	7	7
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	7	7	7
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	7	7	7
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	7	7	7
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	7	7	7
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	7	7	7
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	7	7	7
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	7	7	7
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	7	7	7
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	7	7	7
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	7	7	7
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	7	7	7
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	7	7	7
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	7	7	7

Detailed Air Quality Impact Assessment Results - Doubled Traffic

Maximum 10-minute SO2 Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 10min SO_2 Concentration at different elevation of ASR in metre, μg / m^3		
							1.5	5	10
	Hong Kong AQO Criterion					500 (0)			
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	23	23	23
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	23	23	23
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	23	23	23
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	23	23	23
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	23	23	23
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	23	23	23
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	23	23	23
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	23	23	23
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	23	23	23
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	23	23	23
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	23	23	23
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	23	23	23
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	23	23	23
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	23	23	23
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	23	23	23
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	23	23	23
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	23	23	23
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	23	23	28
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	23	23	23
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	23	23	23
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	23	23	23
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	23	23	23
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	23	23	23
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	23	23	23
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	23	23	23
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	23	23	23
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	23	23	23
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	23	23	23
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	23	23	23
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	23	23	23
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	23	23	23
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	23	23	23
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	23	23	23
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	23	23	23
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	23	23	23
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	23	23	23
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	23	23	23
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	23	23	23
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	23	23	23
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	23	23	23
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	23	23	23
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	23	23	23
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	23	23	23
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	23	23	23
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	23	23	23
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	23	23	23
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	23	23	23
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	23	23	23
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	23	23	23
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	23	23	23
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	23	23	23
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	23	23	23
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	23	23	23
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	23	23	23
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	23	23	23
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	23	23	23
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	23	23	23
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	23	23	23
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	23	23	23
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	23	23	23
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	23	23	23

Detailed Air Quality Impact Assessment Results - Doubled Traffic

Maximum 24-hour CO Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 24hr CO Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Hong Kong AQO Criterion					4000 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	445	445	445
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	445	445	445
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	442	442	442
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	442	442	442
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	442	442	442
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	446	446	446
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	446	446	446
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	446	446	446
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	446	446	446
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	446	446	446
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	445	445	445
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	445	445	445
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	445	445	445
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	445	445	445
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	445	445	445
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	445	445	446
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	445	445	445
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	445	445	445
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	445	445	445
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	445	445	445
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	445	445	445
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	445	445	445
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	445	445	445
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	445	445	445
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	445	445	445
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	445	445	445
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	445	445	445
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	445	445	445
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	445	445	445
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	445	445	445
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	445	445	445
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	445	445	445
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	445	445	445
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	446	446	446
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	446	446	446
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	446	446	446
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	446	446	446
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	446	446	446
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	446	446	446
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	446	446	446
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	446	446	446
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	446	446	446
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	445	445	445
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	445	445	445
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	445	445	445
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	445	445	445
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	445	445	445
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	445	445	445
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	445	445	445
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	446	446	446
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	446	446	446
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	446	446	446
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	442	442	442
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	442	442	442
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	442	442	442
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	446	446	446
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	446	446	446
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	445	445	445
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	445	445	445
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	445	445	445
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	445	445	445

Detailed Air Quality Impact Assessment Results - Doubled Traffic

Maximum 8-hour CO Concentration

							Maximum 8hr CO Concentration at different elevation of ASR in metre, µg / m3		
ASRID	**Building Name**	**X**	**Y**	**Z**	**Lowest Assessment Height (mAG)**	**Highest Assessment Height (mAG)**	**1.5**	**5**	**10**
Hong Kong AQO Criterion					**10000 (0)**				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	480	480	480
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	480	480	480
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	476	476	476
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	476	476	476
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	476	476	476
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	481	481	481
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	481	481	481
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	481	481	481
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	481	481	481
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	481	481	481
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	480	480	480
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	480	480	480
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	480	480	480
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	480	480	480
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	480	480	480
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	480	480	480
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	480	480	480
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	480	480	480
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	480	480	480
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	480	480	480
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	480	480	480
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	480	480	480
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	480	480	480
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	480	480	480
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	480	480	480
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	480	480	480
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	480	480	480
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	480	480	480
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	480	480	480
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	480	480	480
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	480	480	480
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	480	480	480
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	480	480	480
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	480	480	480
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	481	481	481
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	481	481	481
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	481	481	481
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	481	481	481
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	481	481	481
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	481	481	481
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	481	481	481
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	481	481	481
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	480	480	480
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	480	480	480
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	480	480	480
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	480	480	480
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	480	480	480
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	480	480	480
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	480	480	480
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	481	481	481
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	481	481	481
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	481	481	481
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	476	476	476
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	476	476	476
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	476	476	476
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	481	481	481
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	481	481	481
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	480	480	480
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	480	480	480
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	480	480	480
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	480	480	480

Detailed Air Quality Impact Assessment Results - Doubled Traffic

Maximum 1-hour CO Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 1hr CO Concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Hong Kong AQO Criterion					30000 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	515	515	515
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	515	515	515
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	511	511	511
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	511	511	511
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	511	511	511
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	510	510	510
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	510	510	510
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	510	510	510
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	510	510	510
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	510	510	510
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	515	515	515
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	515	515	515
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	515	515	515
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	515	515	515
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	517	517	516
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	516	516	516
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	518	518	519
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	515	515	515
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	515	515	515
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	515	515	515
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	515	515	515
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	515	515	515
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	515	515	515
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	515	515	515
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	515	515	515
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	515	515	515
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	515	515	515
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	515	515	515
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	515	515	515
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	515	515	515
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	515	515	515
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	515	515	515
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	515	515	515
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	519	519	521
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	510	510	510
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	510	510	510
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	510	510	510
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	510	510	510
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	510	510	510
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	510	510	510
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	510	510	510
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	510	510	510
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	515	515	515
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	515	515	515
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	515	515	515
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	515	515	515
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	515	515	515
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	515	515	515
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	515	515	515
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	510	510	510
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	510	510	510
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	510	510	510
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	511	511	511
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	511	511	511
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	511	511	511
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	510	510	510
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	510	510	510
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	515	515	515
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	515	515	515
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	515	515	515
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	515	515	515

Detailed Air Quality Impact Assessment Results - Doubled Traffic

Maximum 1-hour Benzene Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 1hr benzene concentration at different elevation of ASR in metre, μg / m3		
							1.5	5	10
Non-AQO Criterion					27 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	2	2	2
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	2	2	2
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	2	2	2
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	2	2	2
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	2	2	2
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	2	2	2
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	2	2	2
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	2	2	2
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	2	2	2
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	2	2	2
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	2	2	2
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	2	2	2
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	2	2	2
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	2	2	2
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	2	2	2
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	2	2	2
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	2	2	2
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	2	2	3
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	2	2	3
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	2	2	3
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	2	2	2
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	2	2	2
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	2	2	2
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	2	2	2
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	2	2	2
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	2	2	2
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	2	2	2
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	2	2	2
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	2	2	2
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	2	2	2
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	2	2	2
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	2	2	2
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	2	2	2
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	2	2	2
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	2	2	2
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	2	2	2
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	2	2	2
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	2	2	2
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	2	2	2
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	2	2	2
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	2	2	2
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	2	2	2
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	2	2	2
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	2	2	2
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	2	2	2
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	2	2	2
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	2	2	2
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	2	2	2
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	2	2	2
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	2	2	2
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	2	2	2
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	2	2	2
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	2	2	2
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	2	2	2
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	2	2	2
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	2	2	2
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	2	2	2
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	2	2	2
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	2	2	2
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	2	2	2
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	2	2	2

Detailed Air Quality Impact Assessment Results - Doubled Traffic

Maximum 8-hour Benzene Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 8hr benzene concentration at different elevation of ASR in metre, µg / m3		
							1.5	5	10
Non-AQO Criterion					3 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	2	2	2
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	2	2	2
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	2	2	2
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	2	2	2
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	2	2	2
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	2	2	2
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	2	2	2
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	2	2	2
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	2	2	2
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	2	2	2
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	2	2	2
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	2	2	2
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	2	2	2
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	2	2	2
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	2	2	2
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	2	2	2
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	2	2	2
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	2	2	2
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	2	2	2
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	2	2	2
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	2	2	2
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	2	2	2
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	2	2	2
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	2	2	2
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	2	2	2
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	2	2	2
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	2	2	2
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	2	2	2
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	2	2	2
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	2	2	2
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	2	2	2
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	2	2	2
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	2	2	2
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	2	2	2
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	2	2	2
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	2	2	2
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	2	2	2
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	2	2	2
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	2	2	2
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	2	2	2
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	2	2	2
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	2	2	2
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	2	2	2
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	2	2	2
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	2	2	2
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	2	2	2
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	2	2	2
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	2	2	2
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	2	2	2
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	2	2	2
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	2	2	2
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	2	2	2
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	2	2	2
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	2	2	2
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	2	2	2
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	2	2	2
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	2	2	2
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	2	2	2
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	2	2	2
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	2	2	2
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	2	2	2

Detailed Air Quality Impact Assessment Results - Doubled Traffic

Maximum 24-hour Benzene Concentration

ASRID	Building Name	X	Y	Z	Lowest Assessment Height (mAG)	Highest Assessment Height (mAG)	Maximum 24hr benzene conenentration at different elevation of ASR in metre, μg / m3		
							1.5	5	10
Non-AQO Criterion					3 (0)				
BN01	TKOL-II/III Boundary	846456	817216	33	1.5	10	1	1	1
BN02	TKOL-II/III Boundary	846562	817270	94	1.5	10	1	1	1
BN03	TKOL-II/III Boundary	846687	817310	106	1.5	10	1	1	1
BN04	TKOL-II/III Boundary	846774	817348	125	1.5	10	1	1	1
BN05	TKOL-II/III Boundary	846847	817361	131	1.5	10	1	1	1
BS01	TKOL-II/III Boundary	847175	817064	134	1.5	10	1	1	1
BS02	TKOL-II/III Boundary	847040	817083	114	1.5	10	1	1	1
BS03	TKOL-II/III Boundary	847063	816936	104	1.5	10	1	1	1
BS04	TKOL-II/III Boundary	846989	816870	83	1.5	10	1	1	1
BS05	TKOL-II/III Boundary	846857	816834	70	1.5	10	1	1	1
E1	TKO PRS Administration Building	846472	817002	8	1.5	10	1	1	1
E2	TKO PRS Administration Building	846474	816994	8	1.5	10	1	1	1
E3	TKO PRS Administration Building	846477	816981	8	1.5	10	1	1	1
E4	TKO PRS Administration Building	846480	816968	8	1.5	10	1	1	1
LP01	TKO PRS Lower Platform	846478	816781	7	1.5	10	1	1	1
LP02	TKO PRS Lower Platform	846491	816794	7	1.5	10	1	1	1
LP03	TKO PRS Lower Platform	846456	816846	7	1.5	10	1	1	1
LP04	TKO PRS Lower Platform	846509	816917	14	1.5	10	1	1	1
LP05	TKO PRS Lower Platform	846489	817008	12	1.5	10	1	1	1
LP06	TKO PRS Lower Platform	846514	817031	18	1.5	10	1	1	1
LP07	TKO PRS Lower Platform	846472	817078	13	1.5	10	1	1	1
LP08	TKO PRS Lower Platform	846416	817118	8	1.5	10	1	1	1
LP09	TKO PRS Lower Platform	846421	817072	8	1.5	10	1	1	1
LP10	TKO PRS Lower Platform	846414	817084	8	1.5	10	1	1	1
LP11	TKO PRS Lower Platform	846401	817084	7	1.5	10	1	1	1
LP12	TKO PRS Lower Platform	846401	817049	7	1.5	10	1	1	1
LP13	TKO PRS Lower Platform	846422	817050	7	1.5	10	1	1	1
LP14	TKO PRS Lower Platform	846438	817042	8	1.5	10	1	1	1
LP15	TKO PRS Lower Platform	846444	817030	8	1.5	10	1	1	1
LP16	TKO PRS Lower Platform	846433	817023	7	1.5	10	1	1	1
LP17	TKO PRS Lower Platform	846429	817010	7	1.5	10	1	1	1
LP18	TKO PRS Lower Platform	846478	816928	7	1.5	10	1	1	1
LP19	TKO PRS Lower Platform	846431	816900	7	1.5	10	1	1	1
LP20	TKO PRS Lower Platform	846442	816840	6	1.5	10	1	1	1
LP21	TKO PRS Middle Platform	846698	816811	47	1.5	10	1	1	1
LP22	TKO PRS Middle Platform	846718	816886	41	1.5	10	1	1	1
LP23	TKO PRS Middle Platform	846765	816894	51	1.5	10	1	1	1
LP24	TKO PRS Middle Platform	846747	816922	40	1.5	10	1	1	1
LP25	TKO PRS Middle Platform	846716	816998	40	1.5	10	1	1	1
LP26	TKO PRS Middle Platform	846705	816990	39	1.5	10	1	1	1
LP27	TKO PRS Middle Platform	846663	816964	34	1.5	10	1	1	1
LP28	TKO PRS Middle Platform	846648	816934	39	1.5	10	1	1	1
LP29	TKO PRS Middle Platform	846591	816847	37	1.5	10	1	1	1
N1	TKO PRS Administration Building	846463	817000	8	1.5	10	1	1	1
N2	TKO PRS Administration Building	846465	817001	8	1.5	10	1	1	1
N3	TKO PRS Administration Building	846469	817001	8	1.5	10	1	1	1
S1	TKO PRS Administration Building	846482	816961	8	1.5	10	1	1	1
S2	TKO PRS Administration Building	846479	816960	7	1.5	10	1	1	1
S3	TKO PRS Administration Building	846476	816959	8	1.5	10	1	1	1
UP01	TKO PRS Upper Platform	847124	817129	134	1.5	10	1	1	1
UP02	TKO PRS Upper Platform	847157	817196	141	1.5	10	1	1	1
UP03	TKO PRS Upper Platform	847064	817241	141	1.5	10	1	1	1
UP04	TKO PRS Upper Platform	846982	817340	139	1.5	10	1	1	1
UP05	TKO PRS Upper Platform	846900	817376	137	1.5	10	1	1	1
UP06	TKO PRS Upper Platform	846862	817347	136	1.5	10	1	1	1
UP07	TKO PRS Upper Platform	846930	817281	134	1.5	10	1	1	1
UP08	TKO PRS Upper Platform	847007	817204	134	1.5	10	1	1	1
W1	TKO PRS Administration Building	846472	816959	8	1.5	10	1	1	1
W2	TKO PRS Administration Building	846470	816966	7	1.5	10	1	1	1
W3	TKO PRS Administration Building	846467	816979	8	1.5	10	1	1	1
W4	TKO PRS Administration Building	846464	816992	8	1.5	10	1	1	1

Appendix 3.8

(Not Used)

Appendix 3.9

Odour Patrol Record

Tseung Kwan O Restoration Landfills
Odour Patrol Monitoring Summary for TKOL & II/III

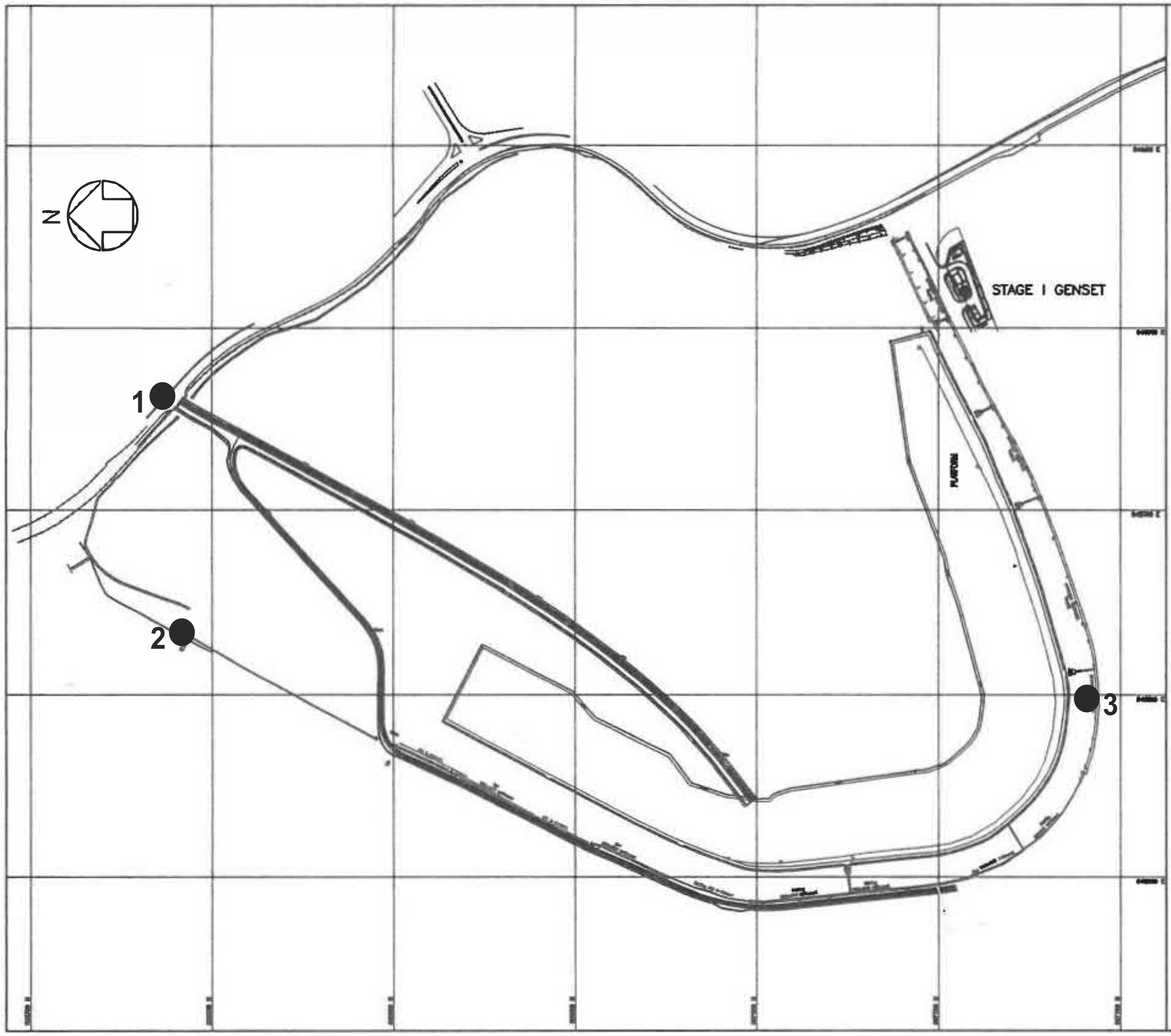
Inspection Date:	06/01/2020		05/02/2020		09/03/2020		06/04/2020		05/05/2020		04/06/2020		02/07/2020		06/08/2020		01/09/2020		05/10/2020		03/11/2020		01/12/2020		08/01/2021		01/02/2021	
Location	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity
Western of TKO II/III	9:50	0	9:50	0	9:50	0	9:50	0	9:45	0	9:45	0	9:45	0	9:55	0	9:45	0	10:15	0	9:50	0	9:35	0	10:05	0	10:05	0
+140mPD platform of TKO II/III	9:20	0	9:35	0	9:25	0	9:25	0	9:15	0	9:20	0	9:20	0	9:30	0	9:15	0	9:35	0	9:20	0	9:05	0	9:35	0	9:35	0
TKO I along Wan Po Road	11:15	0	10:35	0	11:00	0	11:00	0	11:10	0	11:15	0	11:25	0	11:05	0	11:10	0	11:40	0	11:25	0	11:10	0	11:20	0	11:25	0
Near Oscar By The Sea of TKO I	10:20	0	10:10	0	10:15	0	10:35	0	10:10	0	10:15	0	10:15	0	10:25	0	10:15	0	10:45	0	10:25	0	10:10	0	10:30	0	10:35	0
Southern of TKO I	10:50	0	10:25	0	10:35	0	10:10	0	10:40	0	10:45	0	11:00	0	10:45	0	10:45	0	11:10	0	10:50	0	10:40	0	10:55	0	11:00	0

Inspection Date:	04/03/2021		01/04/2021		13/05/2021		01/06/2021		06/07/2021		03/08/2021		03/09/2021		05/10/2021		09/11/2021		01/12/2021		04/01/2022		16/02/2022		18/03/2022		25/04/2022	
Location	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity
Western of TKO II/III	9:50	0	9:20	0	9:20	0	10:00	0	14:15	0	10:05	0	10:05	0	10:05	0	9:55	0	10:20	0	10:05	0	10:05	0	10:05	0	9:40	0
+140mPD platform of TKO II/III	9:20	0	8:55	0	9:45	0	9:35	0	15:00	0	9:35	0	9:25	0	9:25	0	9:20	0	9:30	0	9:25	0	9:25	0	9:15	0	9:15	0
TKO I along Wan Po Road	11:15	0	10:25	0	11:05	0	10:55	0	14:50	0	11:00	0	11:00	0	11:00	0	11:20	0	11:25	0	11:25	0	11:05	0	11:05	0	10:00	0
Near Oscar By The Sea of TKO I	10:20	0	9:45	0	10:15	0	10:15	0	14:30	0	10:15	0	10:15	0	10:15	0	10:10	0	10:35	0	10:45	0	10:25	0	10:50	0	10:30	0
Southern of TKO I	10:55	0	10:05	0	10:40	0	10:35	0	14:45	0	10:45	0	10:40	0	10:45	0	11:00	0	10:55	0	11:10	0	10:50	0	11:25	0	11:15	0

Inspection Date:	19/05/2022		17/06/2022		26/07/2022		16/08/2022		13/09/2022		11/10/2022		11/11/2022		02/12/2022		04/01/2023		08/02/2023		06/03/2023		03/04/2023		04/05/2023		05/06/2023	
Location	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity
Western of TKO II/III	10:00	0	9:30	0	9:00	0	9:45	0	9:50	0	9:50	0	13:50	0	11:45	0	12:15	0	9:50	0	9:45	0	9:40	0	9:45	0	9:35	0
+140mPD platform of TKO II/III	9:15	0	9:15	0	8:45	0	9:20	0	9:25	0	9:30	0	13:40	0	9:30	0	9:00	0	9:20	0	9:10	0	9:00	0	9:10	0	9:10	0
TKO I along Wan Po Road	10:30	0	10:15	0	9:45	0	10:00	0	10:10	0	10:10	0	10:00	0	10:15	0	10:00	0	10:45	0	10:35	0	10:40	0	10:45	0	10:45	0
Near Oscar By The Sea of TKO I	10:50	0	11:00	0	10:30	0	10:30	0	10:40	0	10:30	0	9:30	0	10:45	0	10:30	0	11:20	0	11:10	0	11:15	0	11:10	0	11:00	0
Southern of TKO I	11:20	0	11:30	0	11:00	0	11:00	0	11:05	0	10:45	0	10:45	0	11:25	0	10:55	0	11:00	0	11:30	0	11:35	0	11:30	0	11:15	0

Inspection Date:	19/07/2023		03/08/2023		04/09/2023		12/10/2023		06/11/2023		08/12/2023		05/01/2024		07/02/2024		07/03/2024		05/04/2024		20/05/2024		05/06/2024		10/07/2024		14/08/2024		09/09/2024	
Location	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity	Time	Intensity
Western of TKO II/III	11:40	0	11:40	0	11:30	0	9:45	0	9:45	0	10:00	0	9:30	0	9:30	0	9:30	0	9:30	0	9:00	0	9:20	0	11:20	0	10:00	0	10:00	0
+140mPD platform of TKO II/III	11:50	0	9:15	0	9:00	0	9:15	0	11:45	0	9:15	0	9:10	0	9:10	0	9:10	0	9:10	0	10:30	0	9:05	0	11:30	0	9:50	0	11:00	0
TKO I along Wan Po Road	11:00	0	10:30	0	11:00	0	11:15	0	11:00	0	11:15	0	10:45	0	10:45	0	9:55	0	10:30	0	9:30	0	9:40	0	9:50	0	10:50	0	9:35	0
Near Oscar By The Sea of TKO I	10:15	0	10:00	0	10:00	0	10:20	0	10:15	0	11:00	0	10:30	0	10:30	0	10:40	0	10:00	0	9:45	0	10:25	0	10:40	0	11:15	0	10:45	0
Southern of TKO I	10:40	0	11:00	0	9:30	0	10:00	0	11:30	0	11:30	0	11:00	0	11:00	0	10:50	0	10:50	0	10:15	0	10:45	0	10:50	0	11:30	0	10:50	0

Notes:
Odour intensity
0: Not Detected (No odour Perceived or an odour so weak that it cannot be easily characterised or described)
1: Slight (Identifiable odour, Slight)
2: Moderate (Identifiable odour, Moderate)
3: Strong (Identifiable odour, Strong)
4: Extreme (Severe odour)


N
STAGE I GENSET
PLATFORM
1
2
3

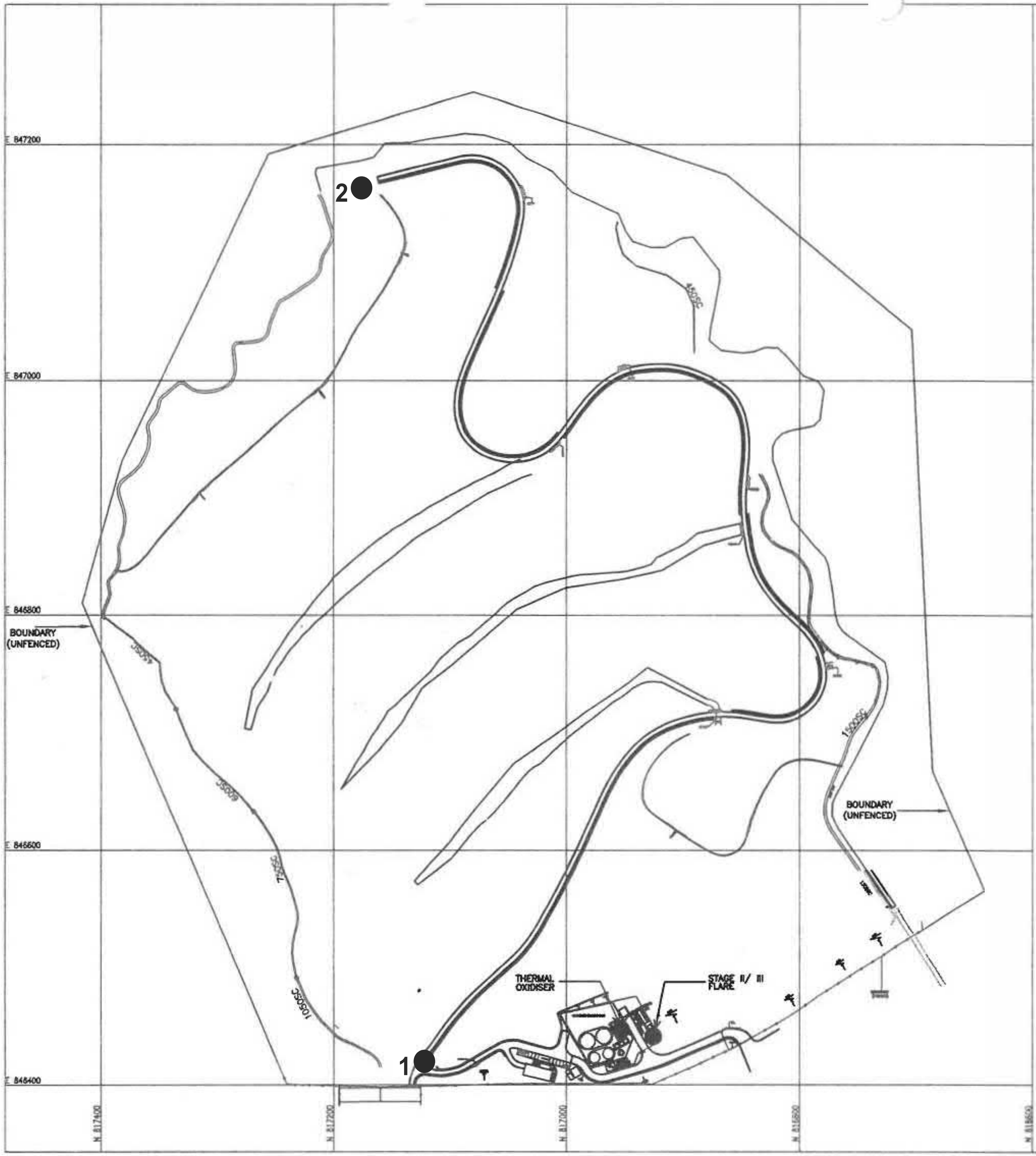
● MONITORING LOCATION

1. TKOL-I along Wan Po Road
2. Near Oscar by the Sea TKOL-I
3. Southern of TKOL-I

TSEUNG KWAN O
LANDFILLS RESTORATION
(STAGE I)

Odour Patrol Monitoring

PROFORMA MDS-TKOL-009
(STAGE I)


E 847200
E 847000
E 846800
E 846600
E 846400
N 817400
N 817200
N 817000
N 816800
N 816600
BOUNDARY (UNFENCED)
BOUNDARY (UNFENCED)
THERMAL OXIDISER
STAGE II/ III FLARE
1
2

● MONITORING LOCATION

1. Western of TKOL-II/III
2. +140mPD platform of TKOL-II/III

TSEUNG KWAN O
LANDFILLS RESTORATION
(STAGE II/III)

Odour Patrol Monitoring

PROFORMA MDS-TKOL-009
(STAGE II/III)

Lawrence Tam

From: PK LEUNG/EPD <pkleung@epd.gov.hk>
Sent: Monday, 28 April 2025 11:45 am
To: Lawrence Tam
Cc: Toby Lung; HKG C1EnvFile; Edmund YK CHOI/EPD; YL KO/EPD
Subject: Re: Enquiry on Odour Complaint Record at Tseung Kwan O Stage II/III Landfill

You don't often get email from pkleung@epd.gov.hk. Learn why this is important

Dear Mr. Tam,

There was no odour complaint for TKO Restored Landfill Stage II/III in the past five years. Thank you.

Regards,
Rebecca Leung
Regional Office (East) / EPD
Tel: 2117 7523

From: Lawrence Tam <Lawrence.Tam@arup.com>
Sent: Friday, April 25, 2025 4:59 PM
To: Edmund YK CHOI/EPD <edmundykchoi@epd.gov.hk>
Cc: E[RE]41/EPD <e-re41@epd.hksarg>; Toby Lung <toby.lung@arup.com>; HKG C1EnvFile <HKG.C1EnvFile@arup.com>
Subject: RE: Enquiry on Odour Complaint Record at Tseung Kwan O Stage II/III Landfill

Dear Mr. Choi,

I attempted to reach you today but was unsuccessful. Could you kindly provide the odour complaint records as requested?

Thank you.

Regards,
Lawrence Tam
Assistant Consultant | Consulting

Arup
Level 5, Festival Walk, 80 Tat Chee Avenue
Kowloon Tong, Kowloon, Hong Kong
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t +852 2528 3031
arup.com

Follow Arup on LinkedIn Twitter Instagram YouTube Facebook WeChat Weibo

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From: Lawrence Tam <Lawrence.Tam@arup.com>
Sent: Thursday, April 10, 2025 10:15 AM
To: Edmund YK CHOI/EPD <edmundykchoi@epd.gov.hk>
Cc: E[RE]41/EPD <e-re41@epd.hksarg>; Toby Lung <toby.lung@arup.com>; HKG C1EnvFile

<HKG.C1EnvFile@arup.com>
Subject: RE: Enquiry on Odour Complaint Record at Tseung Kwan O Stage II/III Landfill

Dear Mr. Choi,

We are currently working on a project at TKOL II/III for the Hong Kong Jockey Club. We have submitted a preliminary environmental review (PER) report, and Environmental Assessment team requested the odour complaint record in the past five years.

Thank you.

Regards,
Lawrence

From: Edmund YK CHOI/EPD <edmundykchoi@epd.gov.hk>
Sent: Wednesday, April 9, 2025 4:28 PM
To: Lawrence Tam <Lawrence.Tam@arup.com>
Cc: E[RE]41/EPD <e-re41@epd.hksarg>
Subject: Fw: Enquiry on Odour Complaint Record at Tseung Kwan O Stage II/III Landfill

> You don't often get email from edmundykchoi@epd.gov.hk. Learn why this is important

Dear Lawrence,

Please advise the purpose of your enquiry. Thanks.

Best regards,

Edmund Choi
I(RE)47
Environmental Protection Inspector
Environmental Protection Department

Tel: 2117 7536

From: Lawrence Tam <Lawrence.Tam@arup.com>
Sent: Monday, April 7, 2025 11:20 AM
To: SC LO/EPD <sclo@epd.gov.hk>
Cc: Toby Lung <toby.lung@arup.com>; HKG C1EnvFile <HKG.C1EnvFile@arup.com>
Subject: Enquiry on Odour Complaint Record at Tseung Kwan O Stage II/III Landfill

Dear Mr. Lo,

As per our tele-conversation today, we would like to make an enquiry on the odour complaint record of the past five years at Tseung Kwan O Stage II/III Landfill.

Should you have any queries, please contact me at 2908 4227.

Thank you.

Lawrence Tam
Assistant Consultant | Consulting

Arup
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t +852 2528 3031
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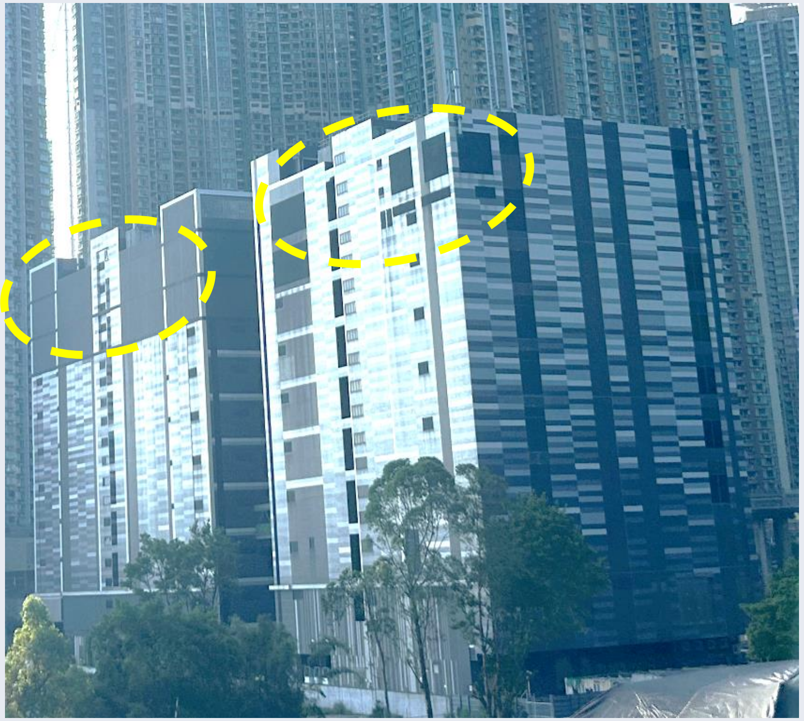
Appendix 6.1

Site Survey Record for Fixed Noise Sources

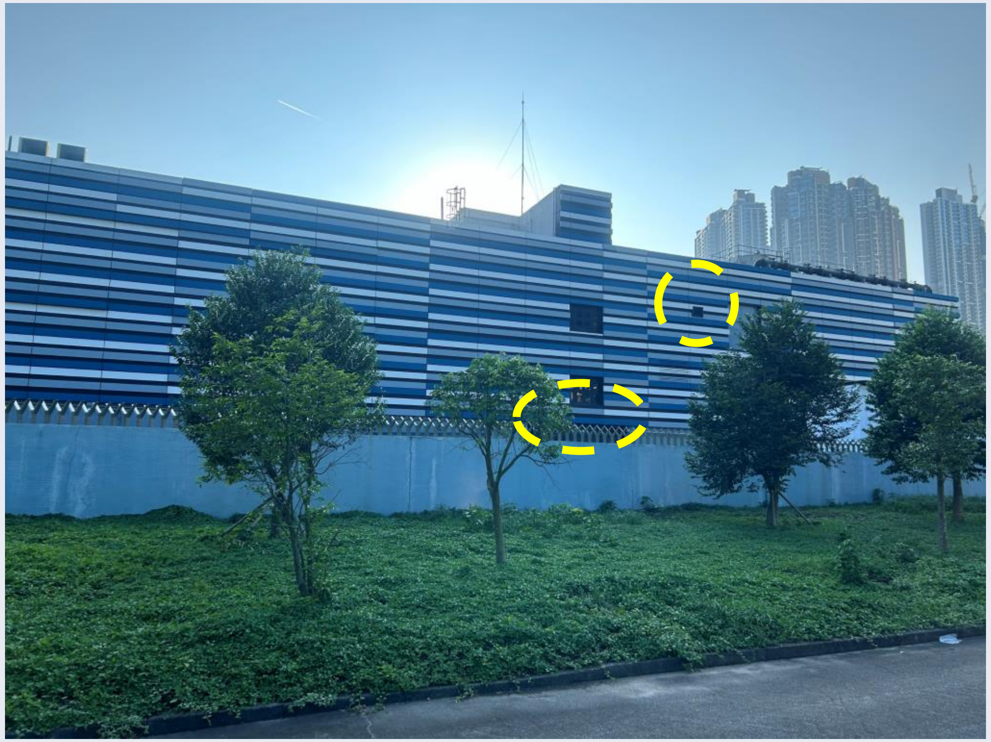
Site Survey Record for Fixed Noise Sources

Name	Date of observation	Type of industrial operation	Noisy activities /sources based on site observation and/or employees information	Site record and/or information provided by operators / employees
MEGA Plus	10 Sep 2024, 27 Sep 2024, 30 Sep 2024	Data Centre	Louvres at facades and chiller plants at rooftop	• Based on site observation, it is in a full day operation. • Noticeable at the location of the proposed Coach Duty Rooms • Dominant noise feature near the proposed Coach Duty Rooms



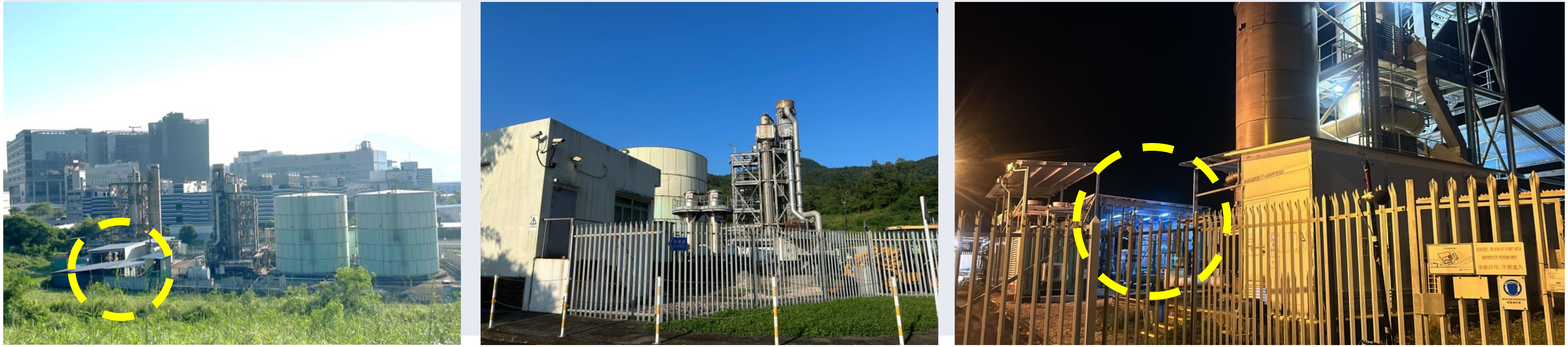
Site Survey Record for Fixed Noise Sources

Name	Date of observation	Type of industrial operation	Noisy activities /sources based on site observation and/or employees information	Site record and/or information provided by operators / employees
HKCOLO	10 Sep 2024, 27 Sep 2024, 30 Sep 2024	Data Centre	Louvres at facades and chiller plants at rooftop	• Based on site observation, it is in a full day operation. • Audible at the nearest boundary of the Project Site • Not noticeable at the location of the proposed Coach Duty Rooms



Site Survey Record for Fixed Noise Sources

Name	Date of observation	Type of industrial operation	Noisy activities /sources based on site observation and/or employees information	Site record and/or information provided by operators / employees
Leachate treatment plant of the restored landfill (TKOL II/III)	10 Sep 2024, 27 Sep 2024, 30 Sep 2024	Treatment plant	Operation of plants within the temporary structures with two sides enclosed	• Based on information provided by EPD, the operation hour is subject to wet/dry season, generally 3-5 full days operation per week. • Audible at the boundary of the leachate treatment plant • Not noticeable at the location of the proposed Coach Duty Rooms as it is significantly screened by the temporary structure, and the structures of other installation of the leachate treatment plant



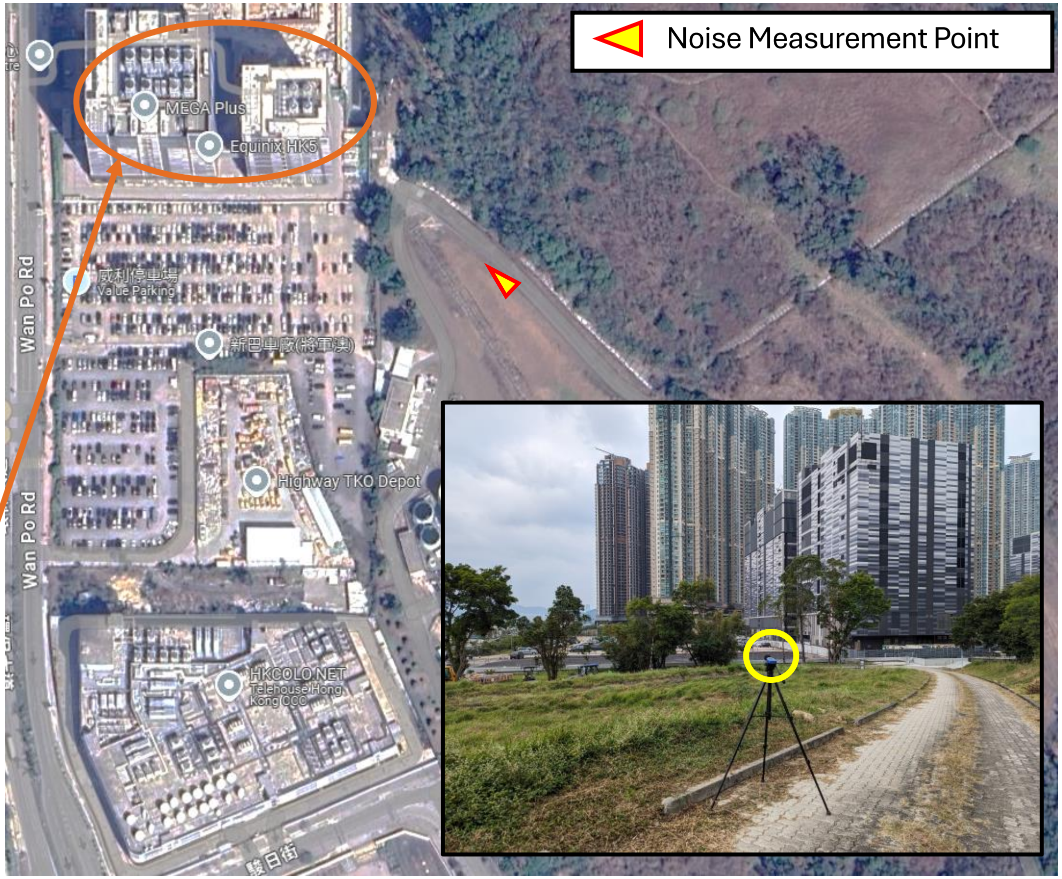
Appendix 6.2

On-site Measurement on Fixed Noise Sources

On-site Noise Measurement at the Proposed Staff Quarters

- 1.2m above-ground
- Free-field noise measurement
- Tonal characteristic identified
- Measurement Period:

Time Period	Measurement Period
Daytime	0930 – 1030 (on 5 December 2024)
Evening Time	2200 – 2300 (on 22 November 2024)
Nighttime	2300 – 1200 (on 23 November 2024)


◁ Noise Measurement Point
MEGA Plus
Equinix HK5
威利停車場
Value Parking
新巴車廠(將軍澳)
Highway TKO Depot
HKCOLO.NET
Telehouse Hong Kong CCC
Wan Po Rd
Wan Po Rd
駿日街

TONAL CORRECTION FOR MEASURED 1/3 OCTAVE NOISE LEVELS - SINGLE BAND

Max. TONAL CORR.= 3

DATE : March-25
JOB NO.: 304521
PROJECT: Tseung Kwan O Public Riding School

Address: 374
Date of measurement: 30/09/2024
Time of measurement: 9:33 am

MEASURED NOISE LEVELS :

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	58.2	60	56.4	60.7	55.3	52.6	52.2	53.8	51.5	46.9	48.6	52.4	48.4	46.5	47	47.6	45.4	44.4	41.5	39.6	38.7	36.3	33.7	31.7	28.2	25.4	22.3	18.8	14.5	8.7
A-Weighting, dB	-44.7	-39.4	-34.6	-30.2	-26.2	-22.5	-19.1	-16.1	-13.4	-10.9	-8.6	-6.6	-4.8	-3.2	-1.9	-0.8	0.0	0.6	1.0	1.2	1.3	1.2	1.0	0.5	-0.1	-1.1	-2.5	-4.3	-6.6	-9.3
A-WT Lp, dB	13.5	20.6	21.8	30.5	29.1	30.1	33.1	37.7	38.1	36.0	40.0	45.8	43.6	43.3	45.1	46.8	45.4	45.0	42.5	40.8	40.0	37.5	34.7	32.2	28.1	24.3	19.8	14.5	7.9	-0.6

A-Wt Sound Pr. Level = 54.9 dB(A)

CORRECTION FOR TONALITY

CORRECTION (a) : MAX = 60.7

Max - X < 15

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	58.2	60.0	56.4	60.7	55.3	52.6	52.2	53.8	51.5	46.9	48.6	52.4	48.4	46.5	47.0	47.6	45.4	44.4	41.5	39.6	38.7	36.3	33.7	31.7	28.2	25.4	22.3	18.8	14.5	8.7
	58.2	60.0	56.4	60.7	55.3	52.6	52.2	53.8	51.5	46.9	48.6	52.4	48.4	46.5	47.0	47.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CORRECTION (b) :

X - adjacent bands >1

	0	60.0	0	60.7	0	0	0	53.8	0	0	0	52.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CORRECTION (c) :

X - mean of adjacent bands >3

	0	2.7	0	4.9	0	0	0	2.0	0	0	0	3.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ftone=	0	0	0	4.9	0	0	0	0	0	0	0	3.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TONAL CORRECTION :

dB(A)		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	

TONAL CORR.= **3** dB(A)

TONAL CORRECTION FOR MEASURED 1/3 OCTAVE NOISE LEVELS - PAIR OF BANDS

DATE : March-25
JOB NO.: 304521
PROJECT: Tseung Kwan O Public Riding School

MEASURED NOISE LEVELS :

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	58.2	60.0	56.4	60.7	55.3	52.6	52.2	53.8	51.5	46.9	48.6	52.4	48.4	46.5	47.0	47.6	45.4	44.4	41.5	39.6	38.7	36.3	33.7	31.7	28.2	25.4	22.3	18.8	14.5	8.7
A-Weighting, dB	-44.7	-39.4	-34.6	-30.2	-26.2	-22.5	-19.1	-16.1	-13.4	-10.9	-8.6	-6.6	-4.8	-3.2	-1.9	-0.8	0.0	0.6	1.0	1.2	1.3	1.2	1.0	0.5	-0.1	-1.1	-2.5	-4.3	-6.6	-9.3
A-WT Lp, dB	13.5	20.6	21.8	30.5	29.1	30.1	33.1	37.7	38.1	36.0	40.0	45.8	43.6	43.3	45.1	46.8	45.4	45.0	42.5	40.8	40.0	37.5	34.7	32.2	28.1	24.3	19.8	14.5	7.9	-0.6

A-Wt Sound Pr. Level = 54.9 dB(A)

CORRECTION FOR TONALITY

CORRECTION (a) : MAX = 60.7

Max - Max of Xs < 15

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	58.2	60.0	56.4	60.7	55.3	52.6	52.2	53.8	51.5	46.9	48.6	52.4	48.4	46.5	47.0	47.6	45.4	44.4	41.5	39.6	38.7	36.3	33.7	31.7	28.2	25.4	22.3	18.8	14.5	8.7
Ave. Lp of pair	0	58.2	58.6	58.0	54.0	52.4	53.0	52.7	49.2	47.8	50.5	50.4	47.5	46.8	47.3	46.5	44.9	43.0	40.6	39.2	37.5	35.0	32.7	30.0	26.8	23.9	20.6	16.7	11.6	0
	0	58.2	58.6	58.0	54.0	52.4	53.0	52.7	49.2	47.8	50.5	50.4	47.5	46.8	47.3	46.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CORRECTION (b) :																														
Mean of X - adjacent bands >1																														
	0	0	0	58.0	0	0	0	0	0	0	50.5	50.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CORRECTION (c) :																														
Mean of X - mean of adjacent bands >3																														
	0	0	0	3.5	0	0	0	0	0	0	2.9	2.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ftone=	0	0	0	3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TONAL CORRECTION : **Pair of 1/3 octave bands starting with, Hz**

	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k
dB(A)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

TONAL CORR.= **0** dB(A)

TONAL CORRECTION FOR MEASURED 1/3 OCTAVE NOISE LEVELS - SINGLE BAND

Max. TONAL CORR.= 3

DATE : March-25
JOB NO.: 304521
PROJECT: Tseung Kwan O Public Riding School

Address: 313
Date of measurement: 27/09/2024
Time of measurement: 10:02 pm

MEASURED NOISE LEVELS :

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	56.4	53.9	52.6	56.9	53.3	53.7	51.6	53	54.5	47.8	48.9	52.4	48.1	46.2	46.3	47.5	45.4	43.8	41.5	40.4	40.4	44.8	39	35.9	39.9	34.8	30.7	26.8	21.3	13.2
A-Weighting, dB	-44.7	-39.4	-34.6	-30.2	-26.2	-22.5	-19.1	-16.1	-13.4	-10.9	-8.6	-6.6	-4.8	-3.2	-1.9	-0.8	0.0	0.6	1.0	1.2	1.3	1.2	1.0	0.5	-0.1	-1.1	-2.5	-4.3	-6.6	-9.3
A-WT Lp, dB	11.7	14.5	18.0	26.7	27.1	31.2	32.5	36.9	41.1	36.9	40.3	45.8	43.3	43.0	44.4	46.7	45.4	44.4	42.5	41.6	41.7	46.0	40.0	36.4	39.8	33.7	28.2	22.5	14.7	3.9

A-Wt Sound Pr. Level = 55.7 dB(A)

CORRECTION FOR TONALITY

CORRECTION (a) : MAX = 56.9

Max - X < 15

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	56.4	53.9	52.6	56.9	53.3	53.7	51.6	53.0	54.5	47.8	48.9	52.4	48.1	46.2	46.3	47.5	45.4	43.8	41.5	40.4	40.4	44.8	39.0	35.9	39.9	34.8	30.7	26.8	21.3	13.2
	56.4	53.9	52.6	56.9	53.3	53.7	51.6	53.0	54.5	47.8	48.9	52.4	48.1	46.2	46.3	47.5	45.4	43.8	0	0	0	44.8	0	0	0	0	0	0	0	0

CORRECTION (b) :

X - adjacent bands >1

0	0	0	56.9	0	0	0	0	54.5	0	0	52.4	0	0	0	47.5	0	0	0	0	0	44.8	0	0	0	0	0	0	0	0

CORRECTION (c) :

X - mean of adjacent bands >3

	0	0	0	4.0	0	0	0	0	4.1	0	0	3.9	0	0	0	1.7	0	0	0	0	0	5.1	0	0	0	0	0	0	0	0
Ftone=	0	0	0	4.0	0	0	0	0	4.1	0	0	3.9	0	0	0	0	0	0	0	0	0	5.1	0	0	0	0	0	0	0	0

TONAL CORRECTION :

dB(A)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

TONAL CORR.= 3 dB(A)

TONAL CORRECTION FOR MEASURED 1/3 OCTAVE NOISE LEVELS - PAIR OF BANDS

DATE : March-25
JOB NO.: 304521
PROJECT: Tseung Kwan O Public Riding School

MEASURED NOISE LEVELS :

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	56.4	53.9	52.6	56.9	53.3	53.7	51.6	53.0	54.5	47.8	48.9	52.4	48.1	46.2	46.3	47.5	45.4	43.8	41.5	40.4	40.4	44.8	39.0	35.9	39.9	34.8	30.7	26.8	21.3	13.2
A-Weighting, dB	-44.7	-39.4	-34.6	-30.2	-26.2	-22.5	-19.1	-16.1	-13.4	-10.9	-8.6	-6.6	-4.8	-3.2	-1.9	-0.8	0.0	0.6	1.0	1.2	1.3	1.2	1.0	0.5	-0.1	-1.1	-2.5	-4.3	-6.6	-9.3
A-WT Lp, dB	11.7	14.5	18.0	26.7	27.1	31.2	32.5	36.9	41.1	36.9	40.3	45.8	43.3	43.0	44.4	46.7	45.4	44.4	42.5	41.6	41.7	46.0	40.0	36.4	39.8	33.7	28.2	22.5	14.7	3.9

A-Wt Sound Pr. Level = 55.7 dB(A)

CORRECTION FOR TONALITY

CORRECTION (a) : MAX = 56.9

Max - Max of Xs < 15

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	56.4	53.9	52.6	56.9	53.3	53.7	51.6	53.0	54.5	47.8	48.9	52.4	48.1	46.2	46.3	47.5	45.4	43.8	41.5	40.4	40.4	44.8	39.0	35.9	39.9	34.8	30.7	26.8	21.3	13.2
Ave. Lp of pair	0	53.3	54.8	55.1	53.5	52.7	52.3	53.8	51.2	48.4	50.7	50.3	47.2	46.3	46.9	46.5	44.6	42.7	41.0	40.4	42.6	41.9	37.5	37.9	37.4	32.8	28.8	24.1	17.3	0
	0	53.3	54.8	55.1	53.5	52.7	52.3	53.8	51.2	48.4	50.7	50.3	47.2	46.3	46.9	46.5	44.6	42.7	0	0	42.6	41.9	0	0	0	0	0	0	0	0
CORRECTION (b) :																														
Mean of X - adjacent bands >1																														
	0	0	0	55.1	0	0	0	53.8	0	0	50.7	50.3	0	0	0	0	0	0	0	0	42.6	41.9	0	0	0	0	0	0	0	0
CORRECTION (c) :																														
Mean of X - mean of adjacent bands >3																														
	0	0	0	1.9	0	0	0	4.1	0	0	2.7	2.7	0	0	0	0	0	0	0	0	2.9	3.8	0	0	0	0	0	0	0	0
Ftone=	0	0	0	0	0	0	0	4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	0	0	0	0	0	0	0	0

TONAL CORRECTION :

Pair of 1/3 octave bands starting with, Hz

	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k
dB(A)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**

TONAL CORR.= **3** dB(A)

TONAL CORRECTION FOR MEASURED 1/3 OCTAVE NOISE LEVELS - SINGLE BAND

Max. TONAL CORR.= 3

DATE : March-25
JOB NO.: 304521
PROJECT: Tseung Kwan O Public Riding School

Address: 2489
Date of measurement: 28/09/2024
Time of measurement: 01:41 am

MEASURED NOISE LEVELS :

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	60.6	57.5	53.1	59.3	55.4	52.7	51.8	53.6	50.1	45.2	47.1	51.6	48.6	46.5	46.5	47.7	44.5	42.3	40.7	39.5	39	41.3	36.2	34.3	34.8	33.8	30.6	25.7	19.5	11.4
A-Weighting, dB	-44.7	-39.4	-34.6	-30.2	-26.2	-22.5	-19.1	-16.1	-13.4	-10.9	-8.6	-6.6	-4.8	-3.2	-1.9	-0.8	0.0	0.6	1.0	1.2	1.3	1.2	1.0	0.5	-0.1	-1.1	-2.5	-4.3	-6.6	-9.3
A-WT Lp, dB	15.9	18.1	18.5	29.1	29.2	30.2	32.7	37.5	36.7	34.3	38.5	45.0	43.8	43.3	44.6	46.9	44.5	42.9	41.7	40.7	40.3	42.5	37.2	34.8	34.7	32.7	28.1	21.4	12.9	2.1

A-Wt Sound Pr. Level = 54.7 dB(A)

CORRECTION FOR TONALITY

CORRECTION (a) : MAX = 59.3

Max - X < 15

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	60.6	57.5	53.1	59.3	55.4	52.7	51.8	53.6	50.1	45.2	47.1	51.6	48.6	46.5	46.5	47.7	44.5	42.3	40.7	39.5	39.0	41.3	36.2	34.3	34.8	33.8	30.6	25.7	19.5	11.4
	60.6	57.5	53.1	59.3	55.4	52.7	51.8	53.6	50.1	45.2	47.1	51.6	48.6	46.5	46.5	47.7	44.5	0	0	0	0	0	0	0	0	0	0	0	0	0

CORRECTION (b) :

X - adjacent bands >1

	0	0	0	59.3	0	0	0	53.6	0	0	0	51.6	0	0	0	47.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CORRECTION (c) :

X - mean of adjacent bands >3

	0	0	0	5.1	0	0	0	2.7	0	0	0	3.8	0	0	0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ftone=	0	0	0	5.1	0	0	0	0	0	0	0	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TONAL CORRECTION :

dB(A)		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	

TONAL CORR.= **3** dB(A)

TONAL CORRECTION FOR MEASURED 1/3 OCTAVE NOISE LEVELS - PAIR OF BANDS

DATE : March-25
JOB NO.: 304521
PROJECT: Tseung Kwan O Public Riding School

MEASURED NOISE LEVELS :

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	60.6	57.5	53.1	59.3	55.4	52.7	51.8	53.6	50.1	45.2	47.1	51.6	48.6	46.5	46.5	47.7	44.5	42.3	40.7	39.5	39.0	41.3	36.2	34.3	34.8	33.8	30.6	25.7	19.5	11.4
A-Weighting, dB	-44.7	-39.4	-34.6	-30.2	-26.2	-22.5	-19.1	-16.1	-13.4	-10.9	-8.6	-6.6	-4.8	-3.2	-1.9	-0.8	0.0	0.6	1.0	1.2	1.3	1.2	1.0	0.5	-0.1	-1.1	-2.5	-4.3	-6.6	-9.3
A-WT Lp, dB	15.9	18.1	18.5	29.1	29.2	30.2	32.7	37.5	36.7	34.3	38.5	45.0	43.8	43.3	44.6	46.9	44.5	42.9	41.7	40.7	40.3	42.5	37.2	34.8	34.7	32.7	28.1	21.4	12.9	2.1

A-Wt Sound Pr. Level = 54.7 dB(A)

CORRECTION FOR TONALITY

CORRECTION (a) : MAX = 59.3

Max - Max of Xs < 15

Freq, Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k	20k
Lp, dB	60.6	57.5	53.1	59.3	55.4	52.7	51.8	53.6	50.1	45.2	47.1	51.6	48.6	46.5	46.5	47.7	44.5	42.3	40.7	39.5	39.0	41.3	36.2	34.3	34.8	33.8	30.6	25.7	19.5	11.4
Ave. Lp of pair	0	55.3	56.2	57.4	54.1	52.3	52.7	51.9	47.7	46.2	49.4	50.1	47.6	46.5	47.1	46.1	43.4	41.5	40.1	39.3	40.2	38.8	35.3	34.6	34.3	32.2	28.2	22.6	15.5	0
	0	55.3	56.2	57.4	54.1	52.3	52.7	51.9	47.7	46.2	49.4	50.1	47.6	46.5	47.1	46.1	43.4	0	0	0	0	0	0	0	0	0	0	0	0	0
CORRECTION (b) :																														
Mean of X - adjacent bands >1																														
	0	0	0	57.4	0	0	0	0	0	0	0	50.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CORRECTION (c) :																														
Mean of X - mean of adjacent bands >3																														
	0	0	0	4.4	0	0	0	0	0	0	0	3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ftone=	0	0	0	4.4	0	0	0	0	0	0	0	3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TONAL CORRECTION : **Pair of 1/3 octave bands starting with, Hz**

	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k
dB(A)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

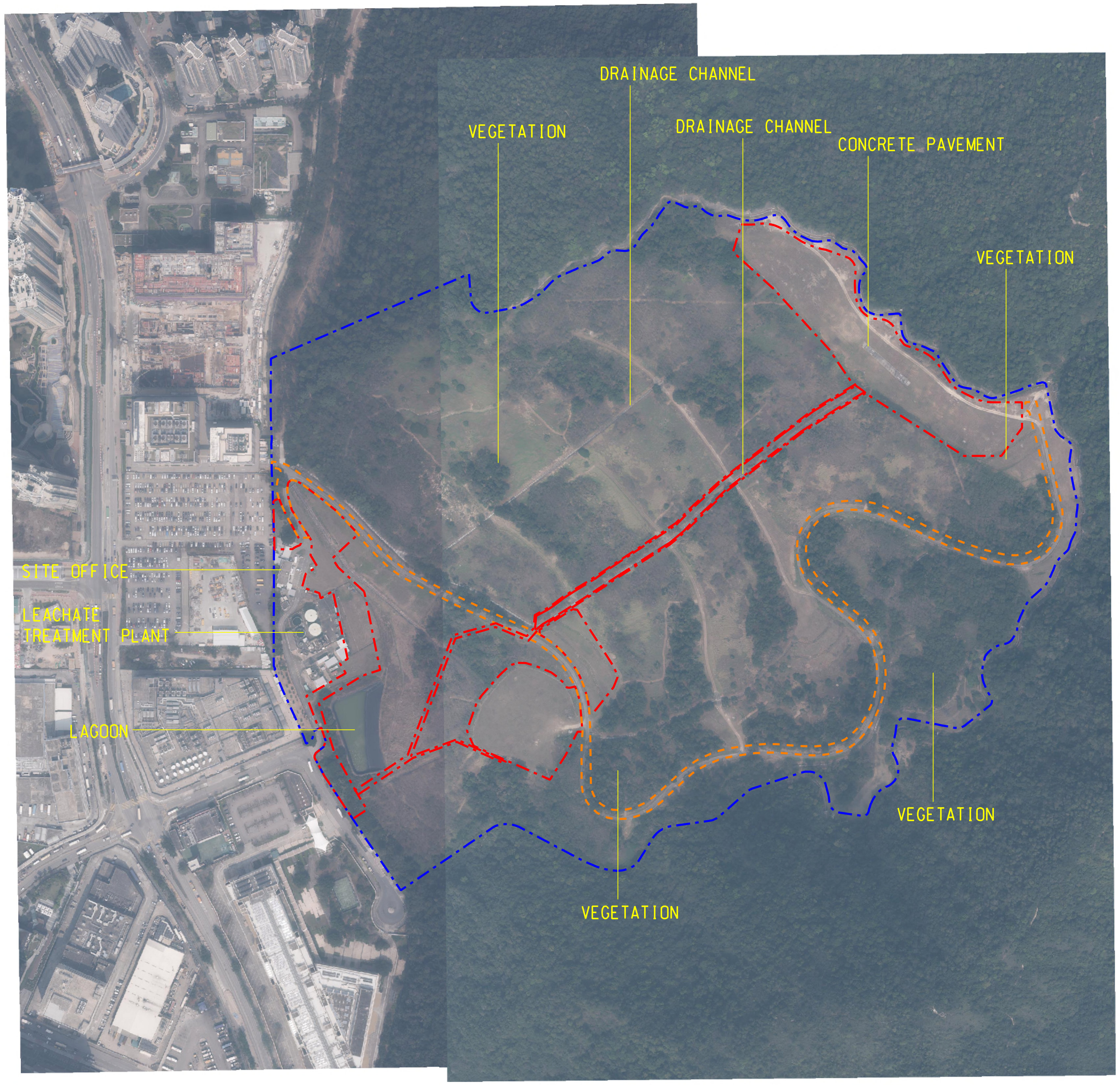
TONAL CORR.= **3** dB(A)

Appendix 7.1

Historical Aerial Photos

APPENDIX 7.1
HISTORICAL AERIAL PHOTOS - YEAR 2023

N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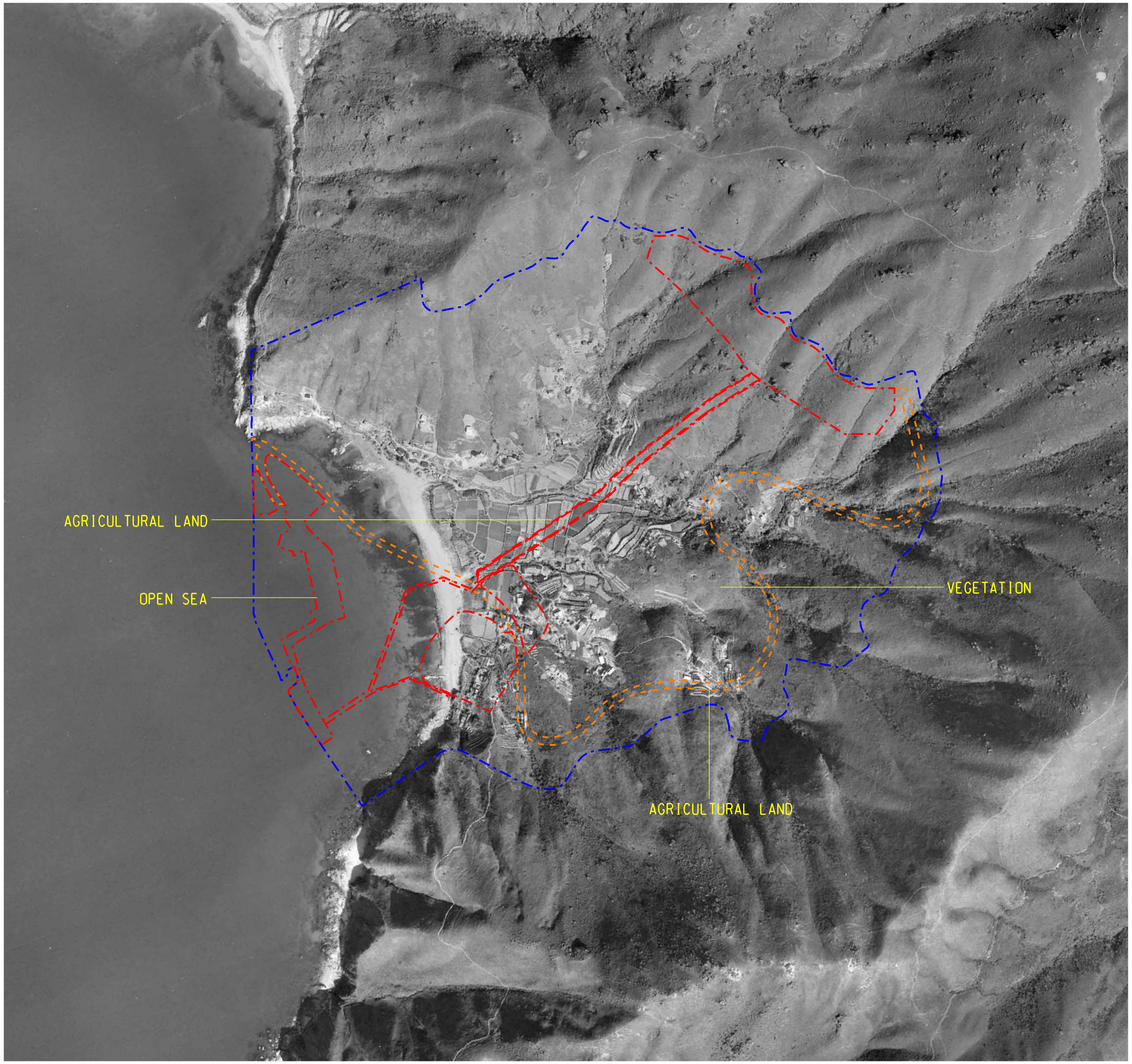
VEGETATION
DRAINAGE CHANNEL
CONCRETE PAVEMENT
VEGETATION
SITE OFFICE
LEACHATE TREATMENT PLANT
LAGOON
VEGETATION
VEGETATION

0 25 50 75 100 125
METRES

LEGEND
- PROJECT SITE
- ACCESS ROAD (BY EPD)
- BOUNDARY OF TKOL II/III

Printed by : $DATE$
Filename : $FILE$

APPENDIX 7.1
HISTORICAL AERIAL PHOTOS - YEAR 1963


AGRICULTURAL LAND
OPEN SEA
VEGETATION
AGRICULTURAL LAND

N

LEGEND
PROJECT SITE
ACCESS ROAD (BY EPD)
BOUNDARY OF TKOL II/III

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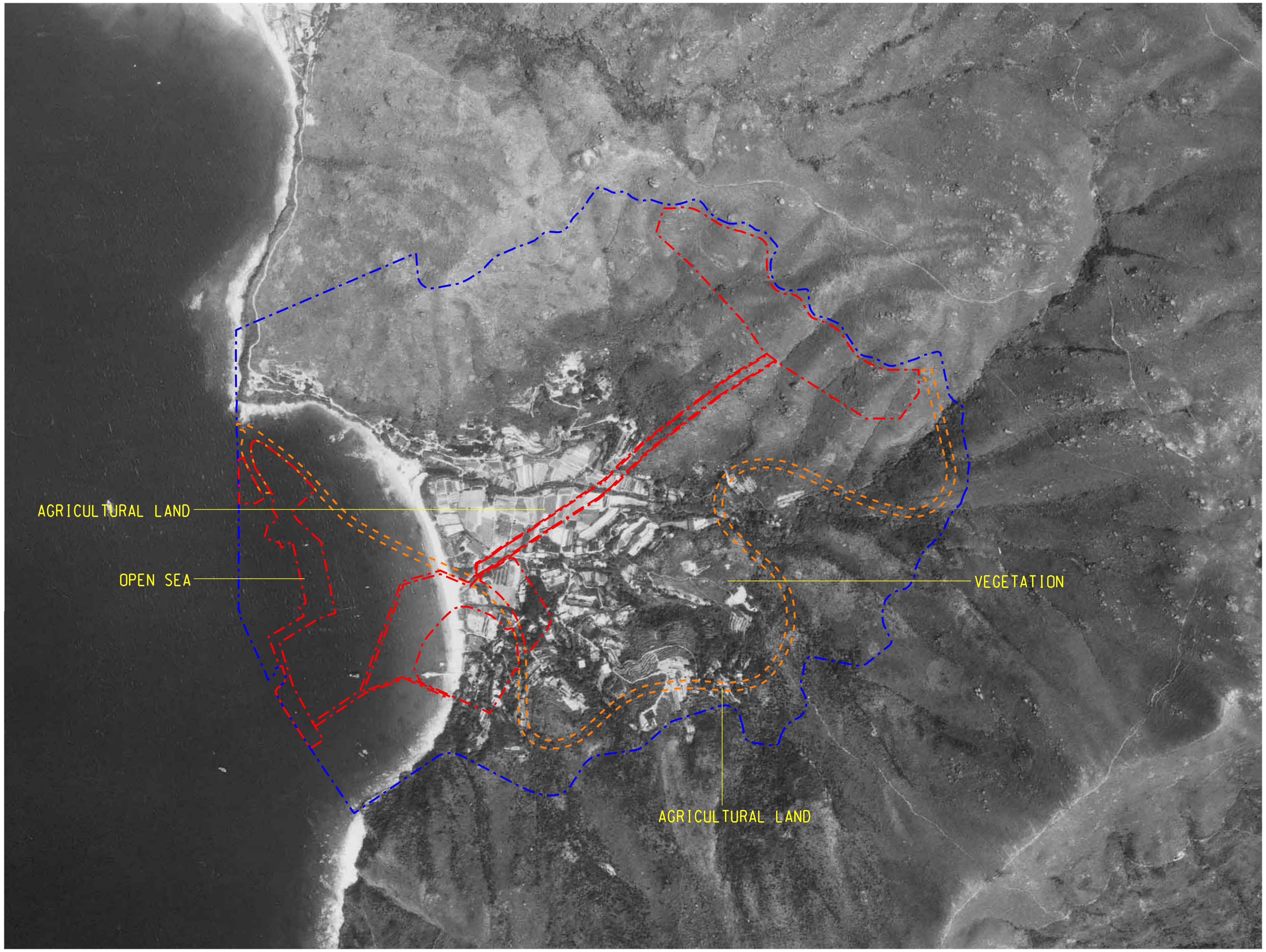
METRES

Printed by : $DATE$
Filename : $FILE$

APPENDIX 7.1
HISTORICAL AERIAL PHOTOS - YEAR 1974

N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OPEN SEA
VEGETATION
AGRICULTURAL LAND

0 25 50 75 100 125
METRES

LEGEND

- PROJECT SITE
- ACCESS ROAD (BY EPD)
- BOUNDARY OF TKOL II/III

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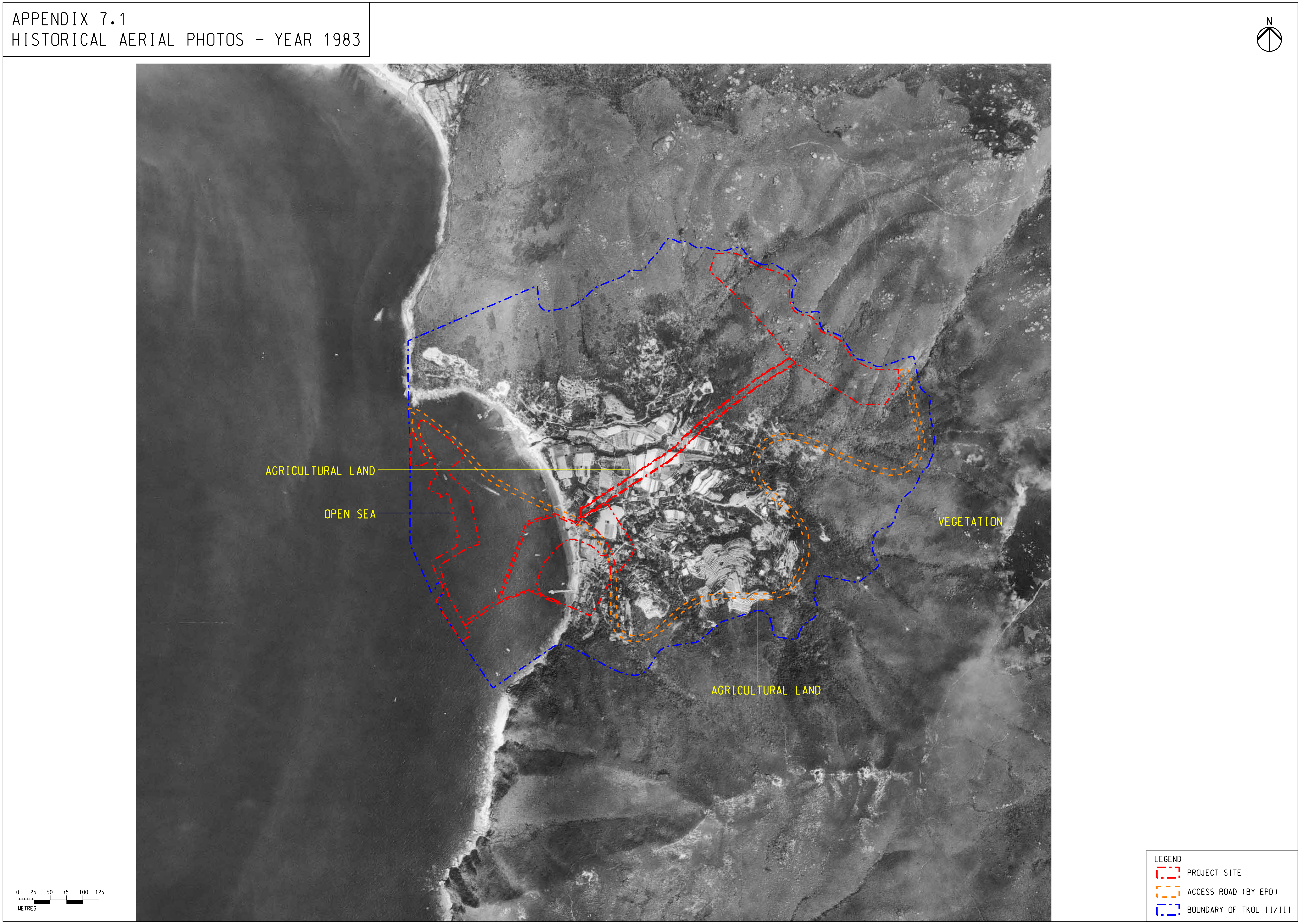
Filename : $FILE$

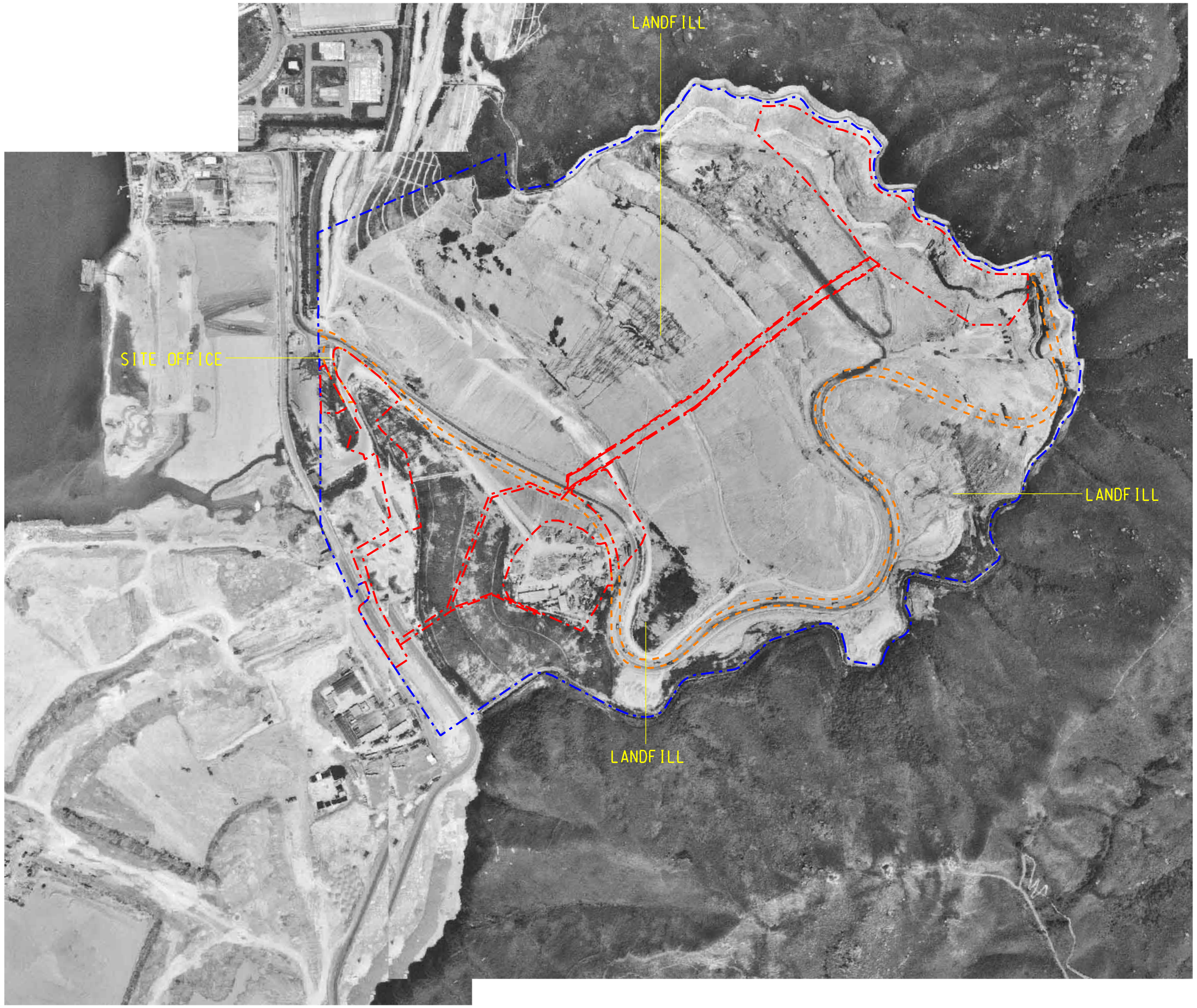
APPENDIX 7.1
HISTORICAL AERIAL PHOTOS - YEAR 1983


N
AGRICULTURAL LAND
OPEN SEA
VEGETATION
AGRICULTURAL LAND
0 25 50 75 100 125
METRES
LEGEND
PROJECT SITE
ACCESS ROAD (BY EPD)
BOUNDARY OF TKOL II/III

Printed by : $DATE$
Filename : $FILE$

APPENDIX 7.1
HISTORICAL AERIAL PHOTOS - YEAR 1993

N


LANDFILL
SITE OFFICE
LANDFILL
LANDFILL

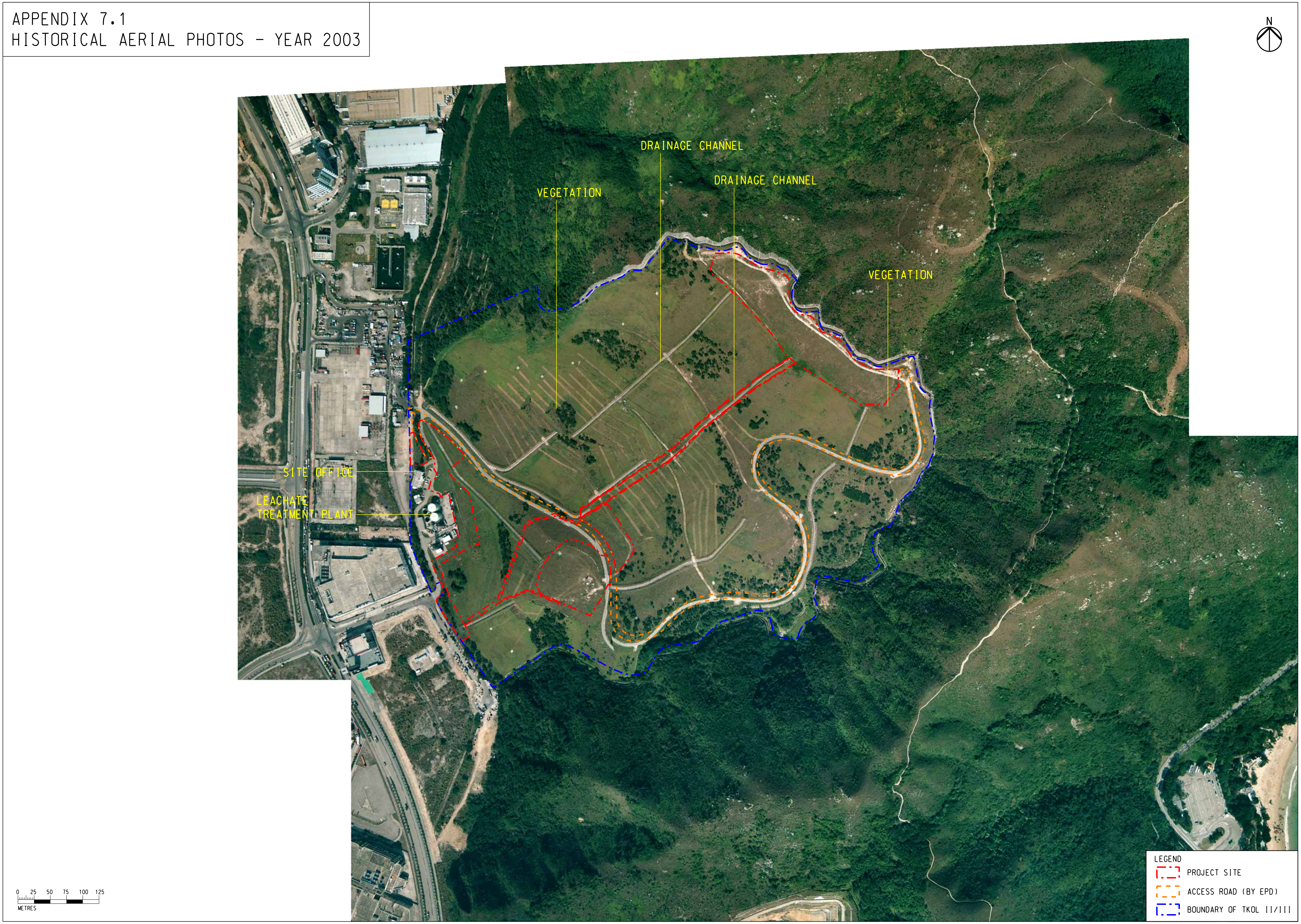
0 25 50 75 100 125
METRES

LEGEND

🟥 PROJECT SITE
🟧 ACCESS ROAD (BY EPD)
🟦 BOUNDARY OF TKOL II/III

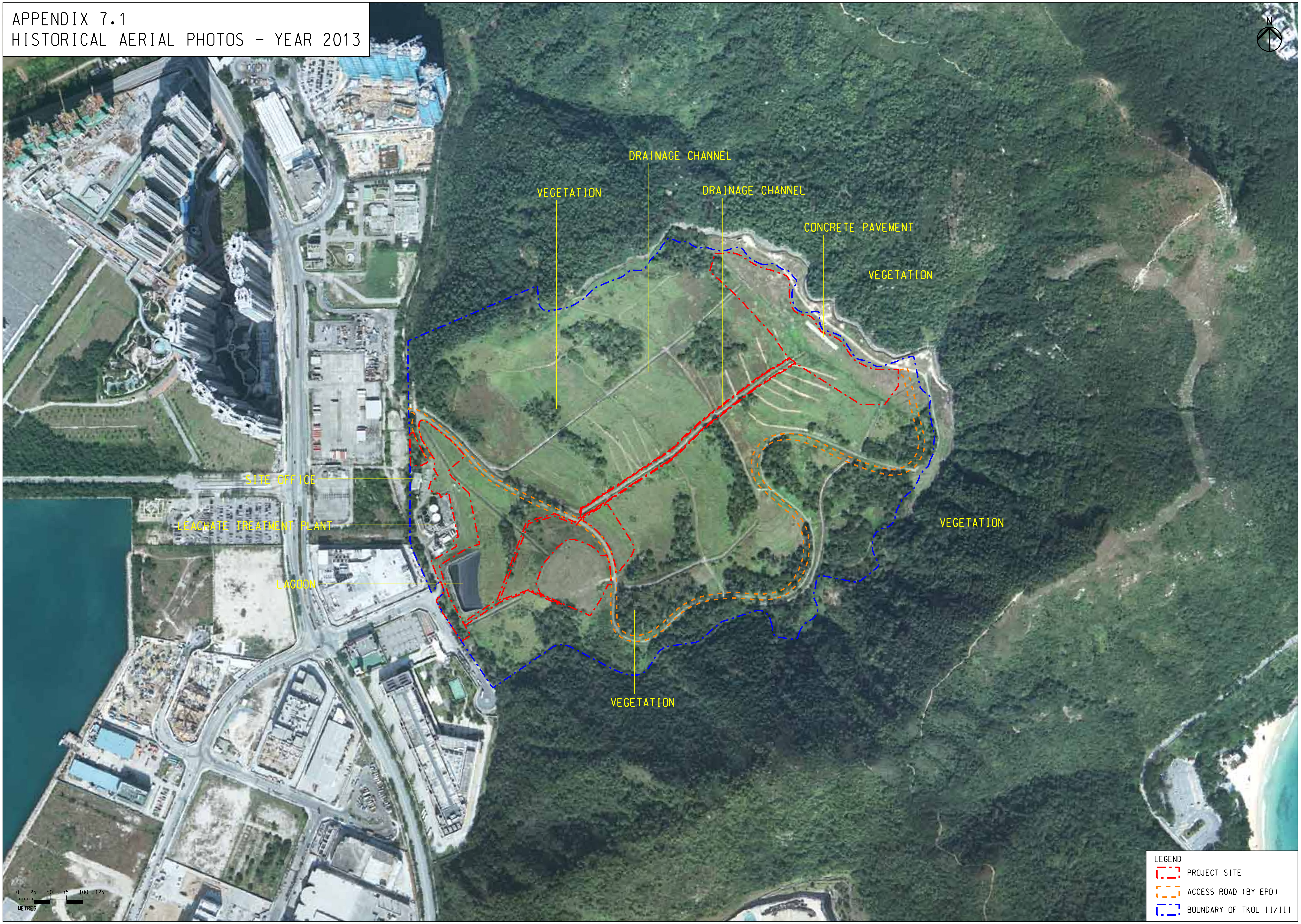
Printed by : $DATE$
Filename : $FILE$

APPENDIX 7.1
HISTORICAL AERIAL PHOTOS - YEAR 2003


N
DRAINAGE CHANNEL
DRAINAGE CHANNEL
VEGETATION
VEGETATION
SITE OFFICE
LEACHATE TREATMENT PLANT
0 25 50 75 100 125
METRES
LEGEND
PROJECT SITE
ACCESS ROAD (BY EPD)
BOUNDARY OF TKOL II/III

Printed by : $DATE$
Filename : $FILE$

APPENDIX 7.1
HISTORICAL AERIAL PHOTOS - YEAR 2013


N
DRAINAGE CHANNEL
VEGETATION
DRAINAGE CHANNEL
CONCRETE PAVEMENT
VEGETATION
SITE OFFICE
LEACHATE TREATMENT PLANT
VEGETATION
LAGOON
VEGETATION
0 25 50 75 100 125
METRES
LEGEND
PROJECT SITE
ACCESS ROAD (BY EPD)
BOUNDARY OF TKOL II/III

Printed by : $DATE$
Filename : $FILE$

Appendix 7.2

Site Walkover Checklist

Site Walkover Checklist

1) GENERAL SITE DETAILS	
Site Owner/ Client	Environmental Protection Department
Property Address	TKOL II/III
Person Conducting the Questionnaire (name & position)	Jansen Shu, Assistant Consultant
Authorised Owner/ Client Representative (if applicable) (name, position & telephone)	N/A

2) ACTIVITIES	
Briefly describe activities carried out on site, including types of products/chemicals/materials handled. **Obtain a flow schematic if possible.**	Landfill Restoration Works
Number of employees:	
- Full-time:	N/A
- Part-time:	N/A
- Temporary/Seasonal:	N/A
Maximum no. of people on site at any time:	N/A
Typical hours of operation:	N/A
Number of shifts:	N/A
Days per week:	N/A
Weeks per year:	N/A
Scheduled plant shut-down:	N/A
Detail the main sources of energy at the site:	
Gas (Yes/No)	No
Electricity (Yes/No)	Yes
Coal (Yes/No)	No
Oil (Yes/No)	No
Other (Yes/No)	No

Site Walkover Checklist

3) SITE DESCRIPTION	
This section is intended to gather information on site setting and environmental receptors on, adjacent or close to the site.	
What is the total site area (m^2):	#N/A
What area of the site is covered by buildings (%):	#N/A
Please list all current and previous owners/occupiers if possible.	N/A
Is a site plan available? (Yes/No) If yes, please attach.	N/A
Are there any other parties on site as tenants or sub-tenants? (Yes/No) If yes, identify those parties.	N/A
Describe surrounding land use (residential, industrial, rural, etc.) and identify neighbouring facilities and types of industry.	
North:	Road
South:	Vegetation
East:	Village house
West:	Vegetation
Describe the topography of the area (flat terrain, rolling hills, mountains, by a large body of water, vegetation, etc.).	Flat terrain
State the size and location of the nearest residential communities.	Village house to the east
Are there any sensitive habitats nearby, such as nature reserves, parks, wetlands, or sites of special scientific interest?	No

Site Walkover Checklist

4) QUESTIONNAIRE WITH EXISTING/ PREVIOUS SITE OWNER OR OCCUPIER		
	Yes/No	**Notes**
1. What are the main activities/operations at the above address?	Yes	Landfill Restoration Works (Leachate Treatment Plant outside Application Site)
2. How long have you been occupying the site?	Yes	Landfill restoration works completed in 1999.
3. Were you the first occupant on site? (If yes, what was the usage of the site prior to occupancy.)	Yes	-
4. Prior to your occupancy, who occupied the site?	No	-
5. What were the main activities/operations during their occupancy?	Yes	It was an active landfill prior to landfill restoration works.
6. Have there been any major changes in operations carried out at the site in the last 10 years?	No	-
7. Have any polluting activities been carried out in the vicinity of the site in the past?	No	-
8. To the best of your knowledge, has the site ever been used as a petrol filling station/car service garage?	No	-
9. Are there any boreholes/wells or natural springs either on the site or in the surrounding area?	No	-
10. Do you have any registered hazardous installations as defined under relevant ordinances? (If yes, please provide details.)	No	-
11. Are any chemicals used in your daily operations? (If yes, please provide details.)	No	-
- Where do you store these chemicals?	No	-
12. Material inventory lists, including quantities and locations available? (If yes, how often are these inventories updated?)	No	-
13. Has the facility produced a separate hazardous substance inventory?	No	-
14. Have there ever been any incidents or accidents (e.g. spills, fires, injuries, etc.) involving any of these materials? (If yes, please provide details.)	No	-
15. How are materials received (e.g. rail, truck, etc.) and stored on site (e.g. drums, tanks, carboys, bays, silos, cisterns, vaults and cylinders)?	No	-

Site Walkover Checklist

4) QUESTIONNAIRE WITH EXISTING/ PREVIOUS SITE OWNER OR OCCUPIER (CONTINUED)		
	Yes/No	**Notes**
16. Do you have any underground storage tanks? (If yes, please provide details.)	No	-
- How many underground storage tanks do you have on site?	-	-
- What are the tanks constructed of?	-	-
- What are the contents of these tanks?	-	-
- Are the pipelines above or below ground?	-	-
- If the pipelines are below ground, has any leak and integrity testing been performed?	-	-
- Have there been any spills associated with these tanks?	-	-
17. Are there any disused underground storage tanks?	No	-
18. Do you have regular check for any spillage and monitoring of chemicals handled? (If yes, please provide details.)	No	-
19. How are the wastes disposed of?	No	-
20. Have you ever received any notices of violation of environmental regulations or received public complains? (If yes, please provide details.)	No	-
21. Have any spills occurred on site? (If yes, please provide details)	No	-
- When did the spill occur?	-	-
- What were the substances spilled?	-	-
- What was the quantity of material spilled?	-	-
- Did you notify the relevant departments of the spill?	-	-
- What were the actions taken to clean up the spill?	-	-
- What were the areas affected?	-	-
22. Do you have any records of major renovation of your site or re-arrangement of underground utilities, pipe work/underground tanks? (If yes, please provide details.)	No	-
23. Have disused underground tanks been removed or otherwise secured (e.g. concrete, sand, etc.)?	No	-
24. Are there any known contaminations on site? (If yes, please provide details.)	No	-
25. Has the site ever been remediated? (If yes, please provide details.)	No	-

Site Walkover Checklist

5) SITE SURVEY INFORMATION	
1. Date of Survey:	10-Sep-24

6) OBSERVATIONS		
	Yes/No	**Notes**
1. Are chemical storage areas provided with secondary containment (i.e. bund walls and floors)?	N/A	No chemical storage areas observed during site appraisal
2. What are the conditions of the bund walls and floors?	N/A	-
3. Are any surface water drains located near to drum storage and unloading areas?	N/A	-
4. Are any solid or liquid waste (other than wastewater) generated at the site? (If yes, please provide details.)	N/A	-
5. Is there a storage site for the wastes?	No	-
6. Is there an on-site landfill?	No	-
7. Were any stressed vegetation noted on site during the site reconnaissance? (If yes, please indicate location and approximate size.)	No	-
8. Were any stained surfaces noted on-site during the site reconnaissance? (If yes, please provide details.)	No	-
9. Are there any potential off-site sources of contamination?	No	-
10. Does the site have any equipment which might contain polychlorinated biphenyls (PCBs)?	No	-
11. Are there any sumps, effluent pits, interceptors or lagoons on site?	No	-
12. Any noticeable odours during site walkover?	No	-
13. Are any of the following chemicals used on site: fuels, lubricating oils, hydraulic fluids, cleaning solvents, used chemical solutions, acids, anti-corrosive paints, thinners, coal, ash, oily tanks and bilge sludge, metal wastes, wood preservatives, and polyurethane foam?	No	-

Appendix 7.3

Correspondence with EPD

From:	YH LEUNG/EPD
To:	Toby Lung
Cc:	Alan WL YU/EPD; Iris YW CHEUNG/EPD; Lee, Simon K S; Chan, Eric L K; Hui, Terry T L; Lawrence Tam
Subject:	Re: Proposed Development of the Public Riding School at The Restored Landfill Site (TKOL II/III) in Tseung Kwan O - Revised Draft Preliminary Environmental Review Report (Rev. 2)
Date:	Wednesday, January 7, 2026 12:27:07 PM
Attachments:	image006.png image007.png Chemical Waste Producer Registration_TKO-I (2019).pdf Chemical Waste Producer Registration_TKO-II&III (2019).pdf

---

Dear Toby,

Please be advised that there is no spillage incident related to land contamination according to records available from our side. Please find the attached Chemical Waste Producer Registrations of TKOL-I, II&III for your information. The information should be restricted for the purpose of submission of PER report and should not be disclosed to other parties without prior approval by EPD. Thank you.
[See attachment "Chemical Waste Producer Registration_TKO-I (2019).pdf"]
[See attachment "Chemical Waste Producer Registration_TKO-II&III (2019).pdf"]

Best Regards,

Leo LEUNG
E(RL)22
EPD
Tel: 2872 1763

From: Toby Lung <toby.lung@arup.com>
Sent: Monday, January 5, 2026 12:16 PM
To: Iris YW CHEUNG/EPD <irischeung@epd.gov.hk>
Cc: Alan WL YU/EPD <alanyu@epd.gov.hk>; YH LEUNG/EPD <yhleung@epd.gov.hk>; 'Lee, Simon K S' <simon.ks.lee@hkjc.org.hk>; 'Chan, Eric L K' <eric.lk.chan@hkjc.org.hk>; Hui, Terry T L <terry.tl.hui@hkjc.org.hk>; Lawrence Tam <Lawrence.Tam@arup.com>
Subject: FW: Proposed Development of the Public Riding School at The Restored Landfill Site (TKOL II/III) in Tseung Kwan O - Revised Draft Preliminary Environmental Review Report (Rev. 2)

Dear Iris,

Could you please kindly share with us the Chemical Waste Producer Record (i.e. Name in the register, period of validity and nature of business, if any).

In addition, is there any incident record? If yes, what is the type of incident and its indicative location?

Feel free to call me you have any questions. Many thanks!

Best Regards,

Toby Lung
Senior Consultant | Environmental Consulting

Arup
Level 5, Festival Walk, 80 Tat Chee Avenue
Kowloon Tong, Kowloon, Hong Kong
d +852 3447 6161 f +852 2268 3380
t +852 2528 3031
arup.com

From: YH LEUNG/EPD <yhleung@epd.gov.hk>
Sent: Monday, January 5, 2026 10:59 AM
To: Chan, Eric L K <eric.lk.chan@hkjc.org.hk>; Toby Lung <toby.lung@arup.com>
Cc: Alan WL YU/EPD <alanyu@epd.gov.hk>; Lee, Simon K S <simon.ks.lee@hkjc.org.hk>; Hui, Terry T L <terry.tl.hui@hkjc.org.hk>
Subject: Re: Proposed Development of the Public Riding School at The Restored Landfill Site (TKOL II/III) in Tseung Kwan O - Revised Draft Preliminary Environmental Review Report (Rev. 2)

Dear Eric and Toby,

We have the following information which may be considered related to land contamination. Please review and liaise with Iris for extraction of information if required. Thank you.

- CWP records (permit issued and enforced by EPD local control office, chemical waste collection records were kept and available upon request)
- License for storage of diesel oils tank for 7,500 L Cat.5 D.G. (under FSD requirement, license submitted to RLG after annual renewal)
- No spillage happened on site therefore no spillage records kept.

Best Regards,

Leo LEUNG
E(RL)22
EPD
Tel: 2872 1763

Appendix 8.1

Ecological Baseline Survey Data

Figure 1 Locations of the Project Site, Study Area and Recognized Sites of Conservation Importance

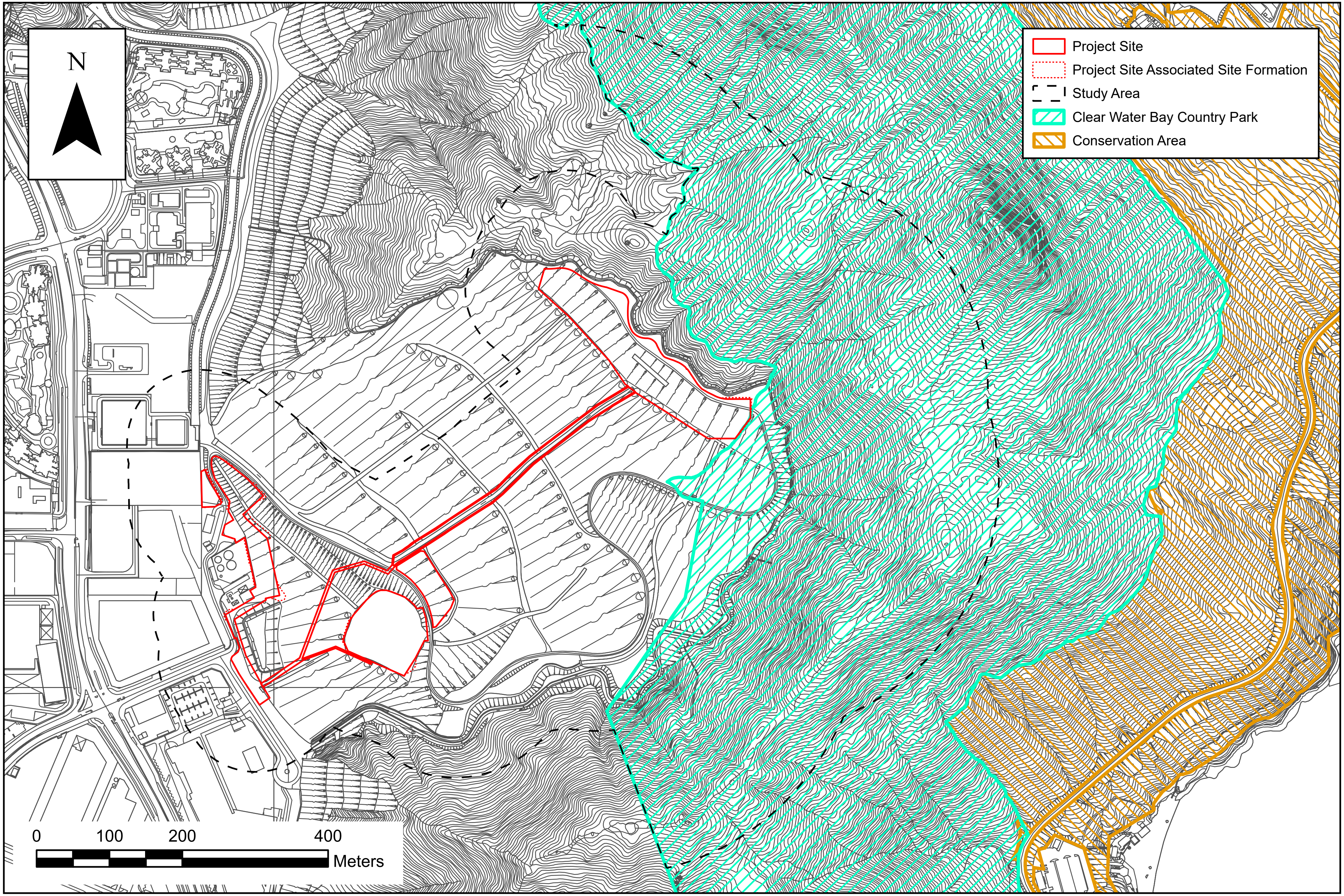

N
Project Site
Project Site Associated Site Formation
Study Area
Clear Water Bay Country Park
Conservation Area
0
100
200
400
Meters

Figure 2 Locations of Survey Transects and Aquatic Sampling Points

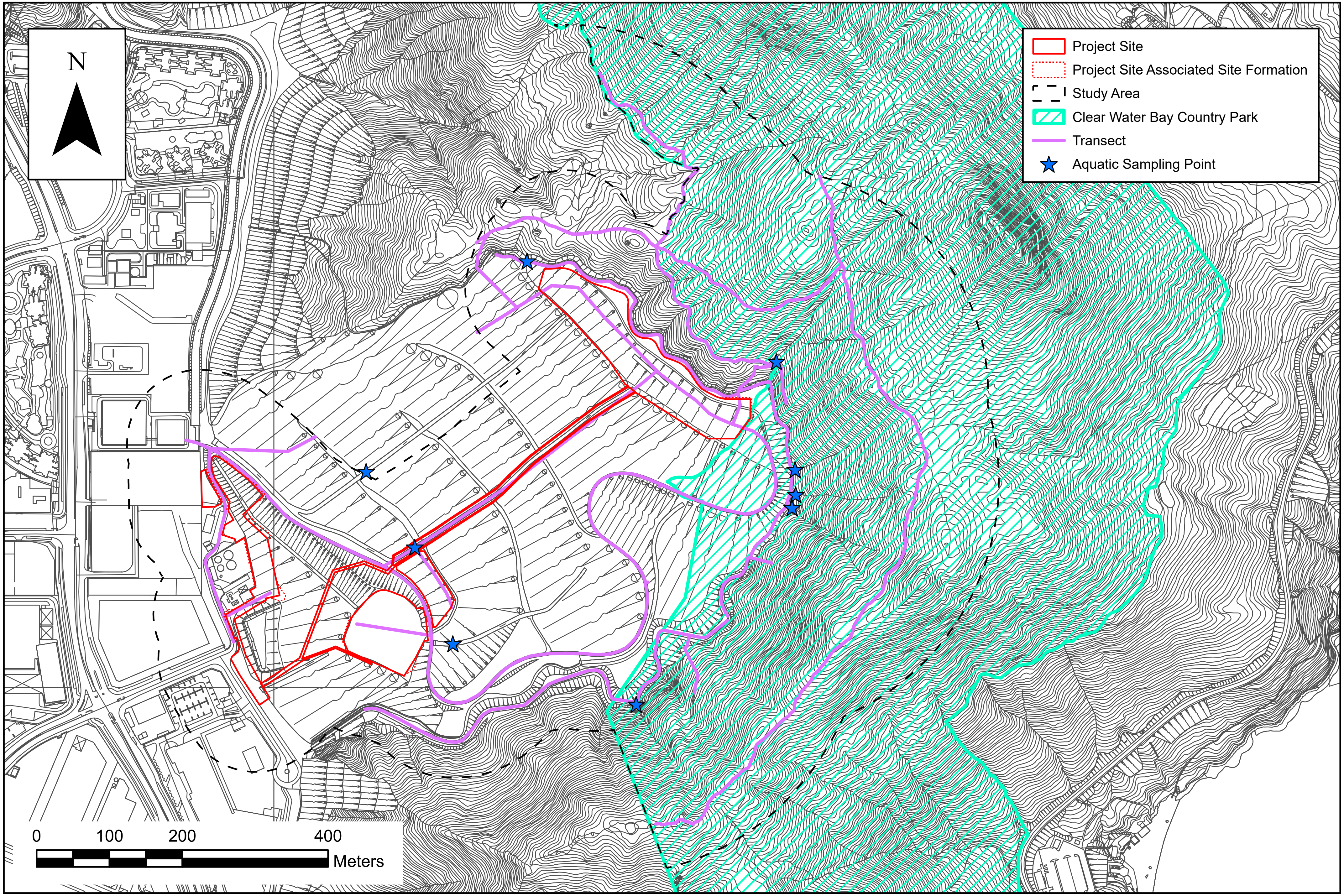

N
Project Site
Project Site Associated Site Formation
Study Area
Clear Water Bay Country Park
Transect
Aquatic Sampling Point
0
100
200
400
Meters

Figure 3a Habitat Map and Locations of the Recorded Species of Conservation Importance in Previous Literature

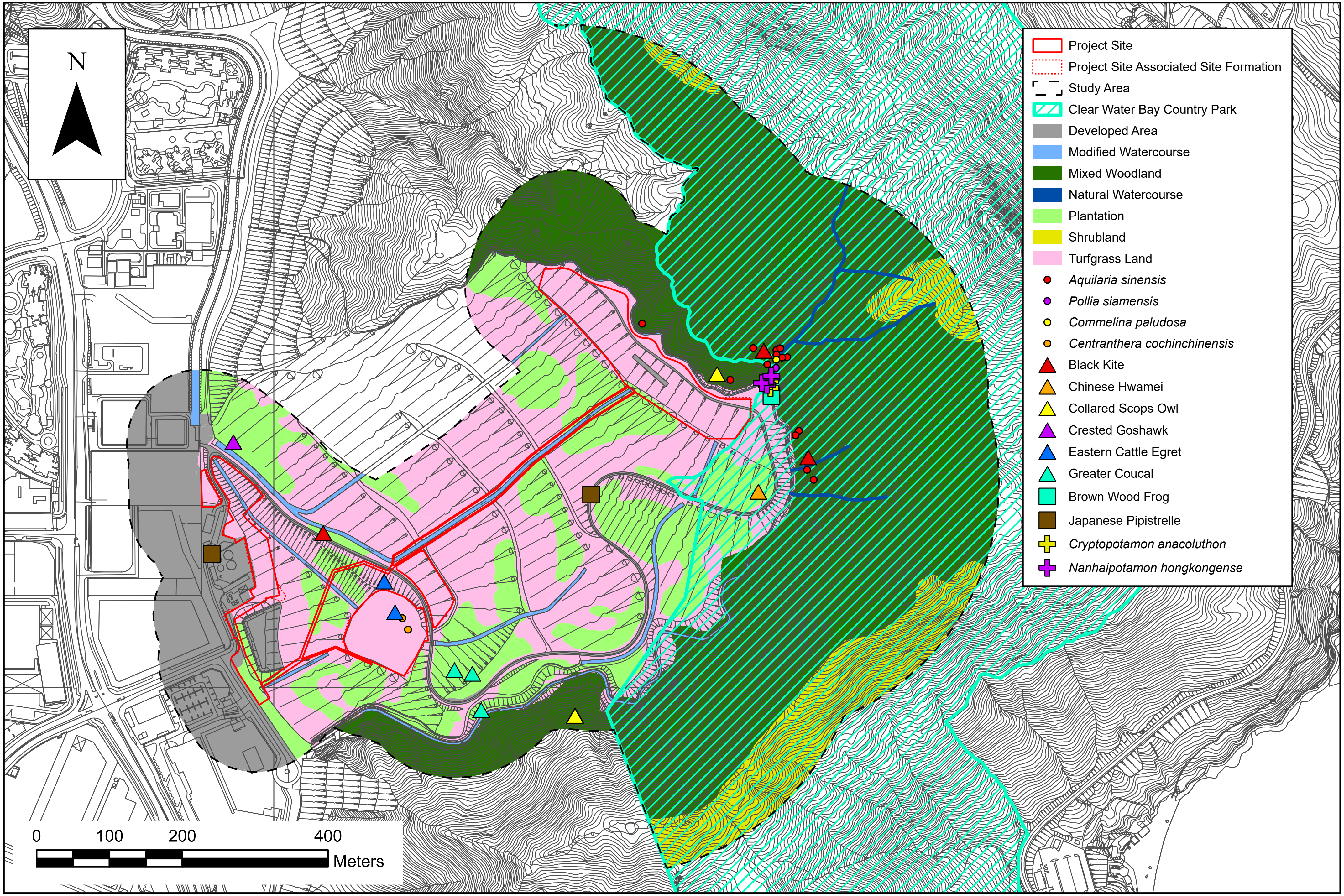

N
Project Site
Project Site Associated Site Formation
Study Area
Clear Water Bay Country Park
Developed Area
Modified Watercourse
Mixed Woodland
Natural Watercourse
Plantation
Shrubland
Turfgrass Land
Aquilaria sinensis
Pollia siamensis
Commelina paludosa
Centranthera cochinchinensis
Black Kite
Chinese Hwamei
Collared Scops Owl
Crested Goshawk
Eastern Cattle Egret
Greater Coucal
Brown Wood Frog
Japanese Pipistrelle
Cryptopotamon anacoluthon
Nanhaipotamon hongkongense
0
100
200
400
Meters

Figure 3b Habitat Map and Locations of the Recorded Species of Conservation Importance and Firefly Species inquirenda 1

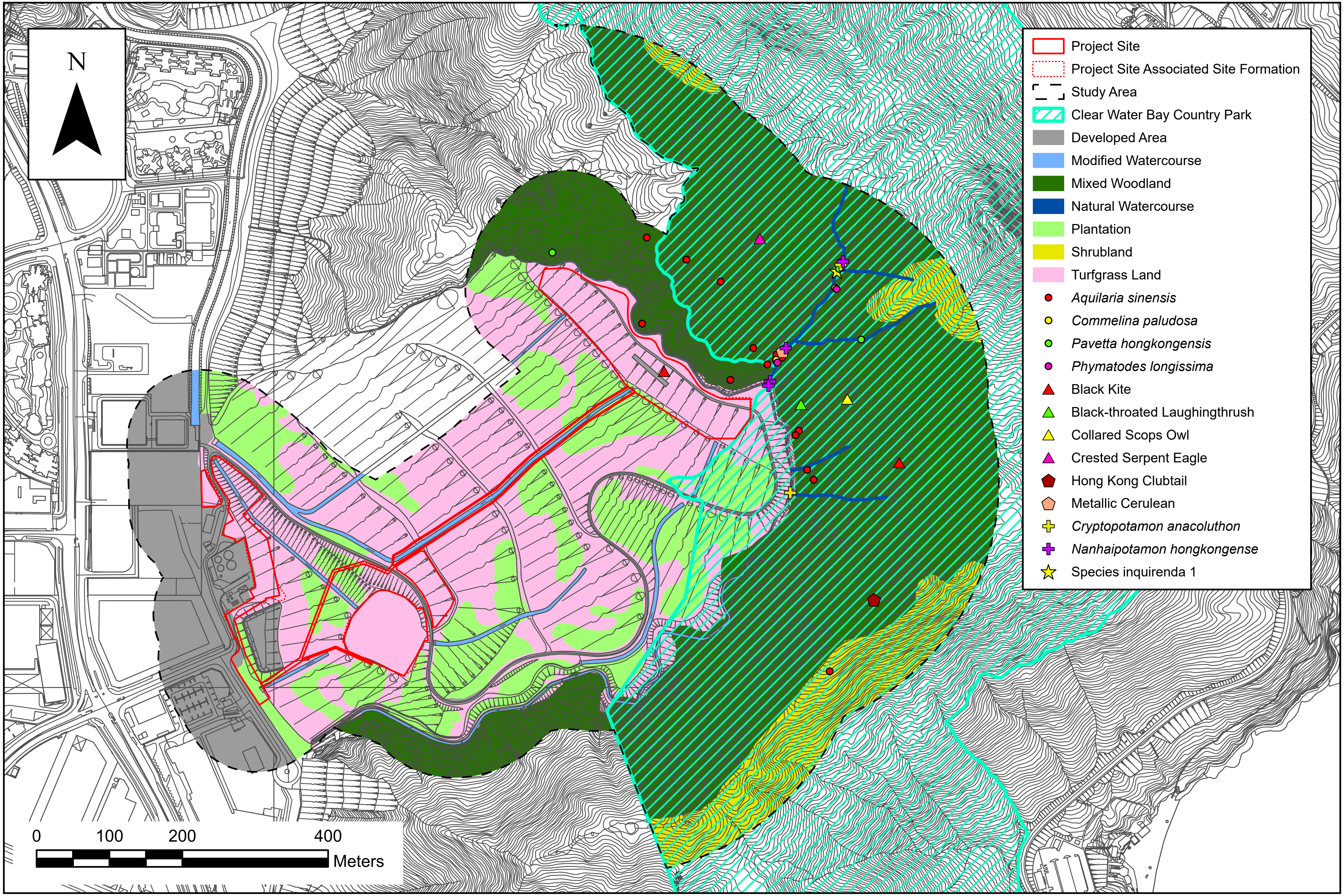
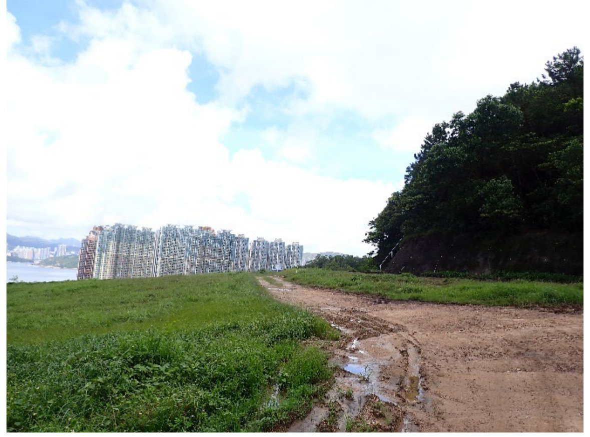
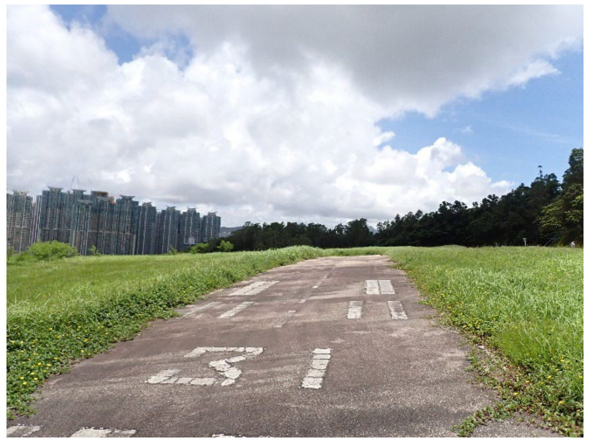

N
Project Site
Project Site Associated Site Formation
Study Area
Clear Water Bay Country Park
Developed Area
Modified Watercourse
Mixed Woodland
Natural Watercourse
Plantation
Shrubland
Turfgrass Land
Aquilaria sinensis
Commelina paludosa
Pavetta hongkongensis
Phymatodes longissima
Black Kite
Black-throated Laughingthrush
Collared Scops Owl
Crested Serpent Eagle
Hong Kong Clubtail
Metallic Cerulean
Cryptopotamon anacoluthon
Nanhaipotamon hongkongense
Species inquirenda 1
0
100
200
400
Meters

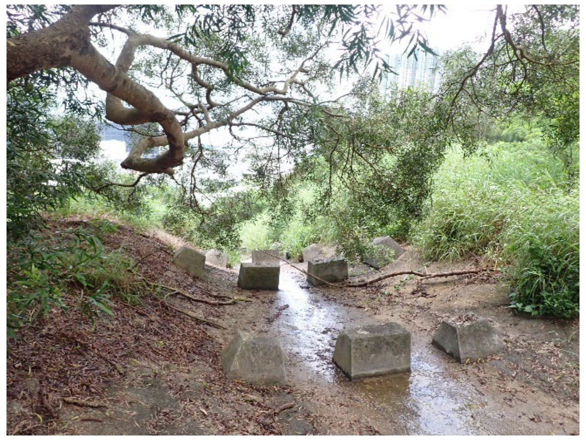
Figure 4 Photos of the Project Site and Habitats within the Study Area



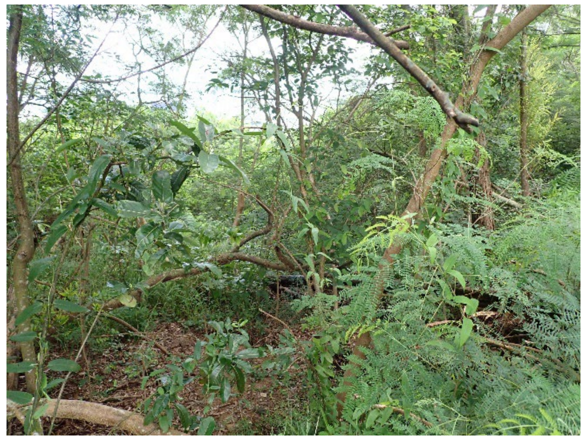
Project Site



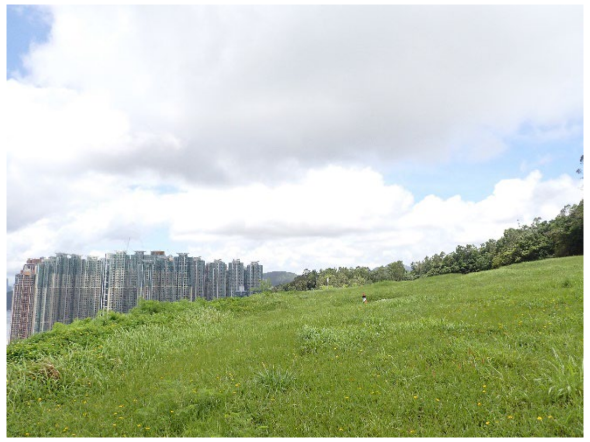
Developed Area within Project Site



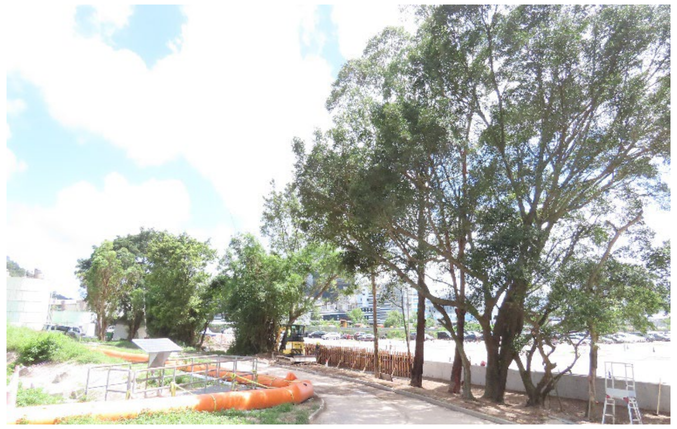
Modified Watercourse within Project Site



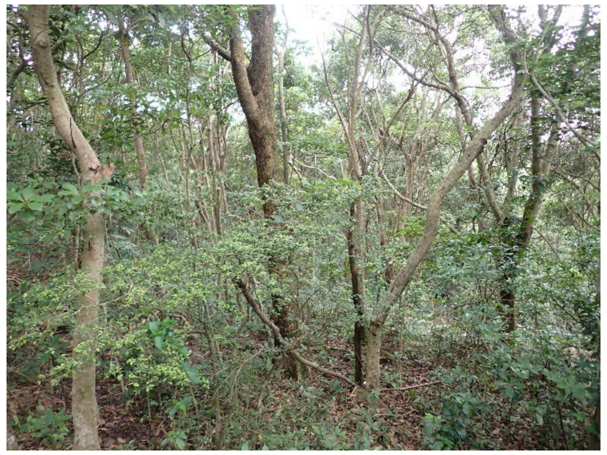
Plantation within Project Site



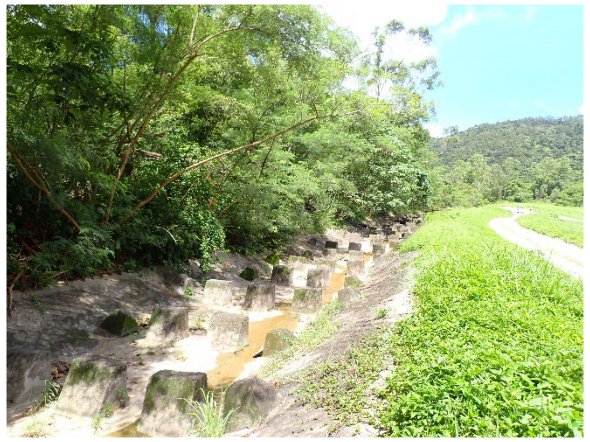
Turfgrass Land within Project Site



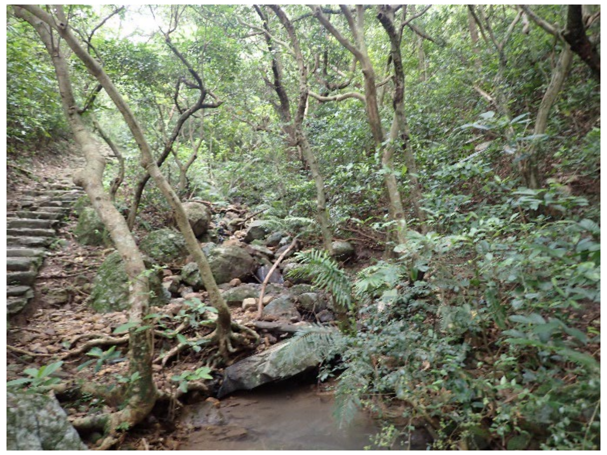
Developed Area



Mixed Woodland



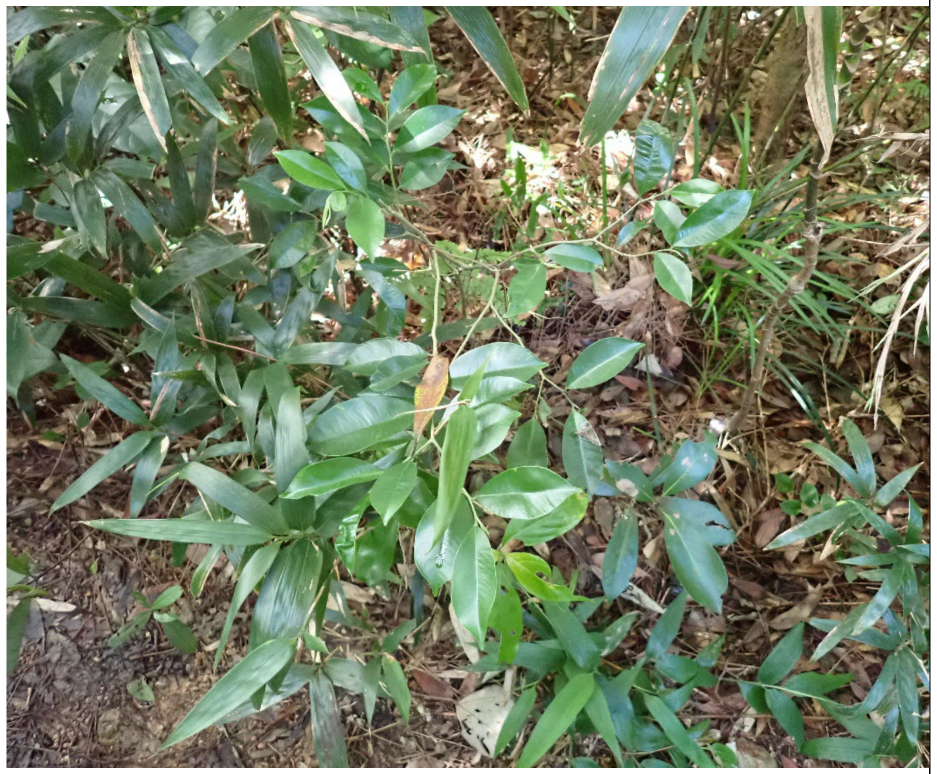
Modified Watercourse



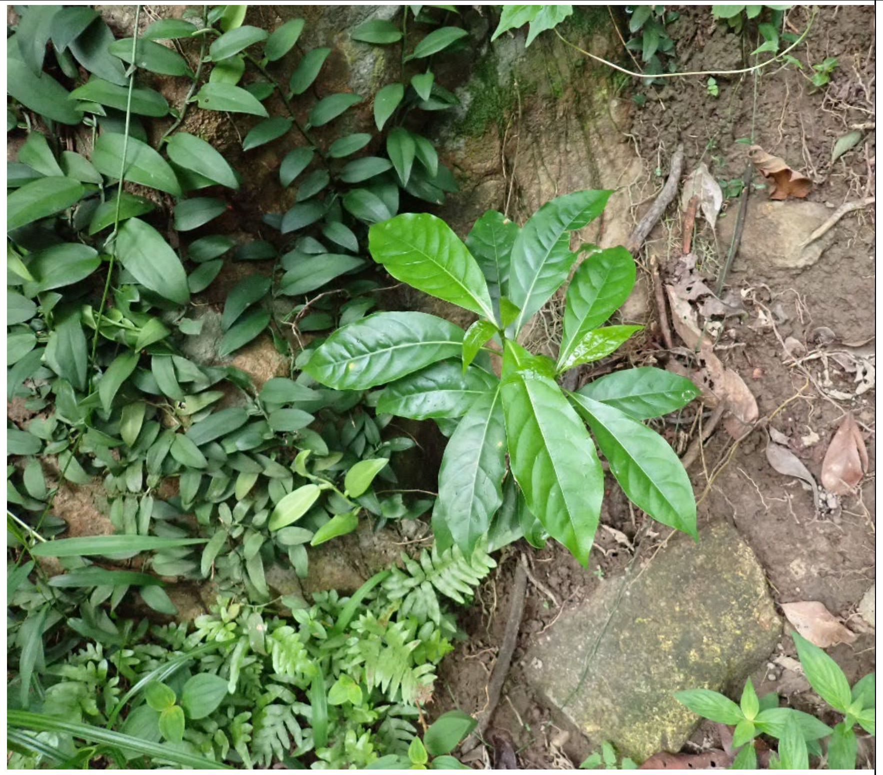
Natural Watercourse

Plantation	Shrubland	Turfgrass Land

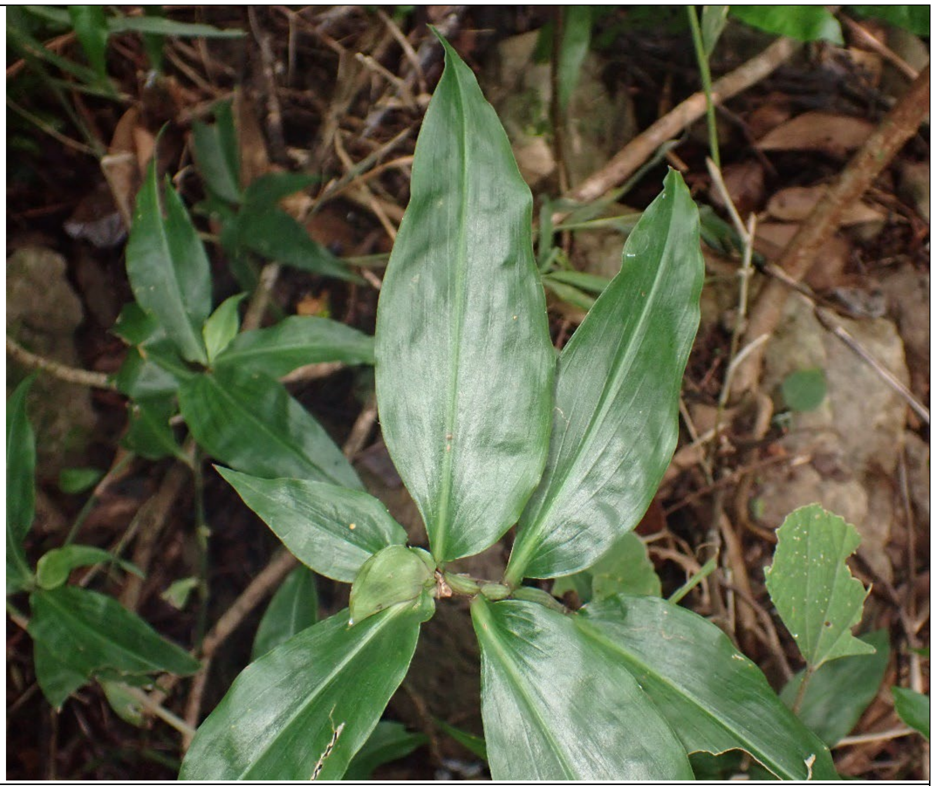
Figure 5 Photos of the Species of Conservation Importance



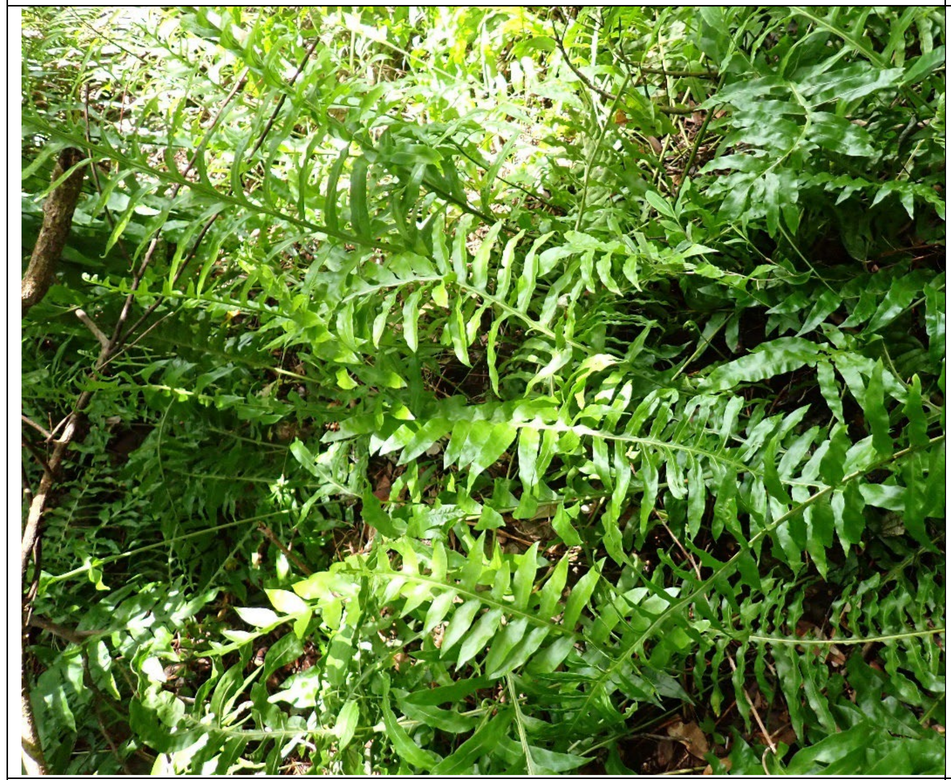
Aquilaria sinensis



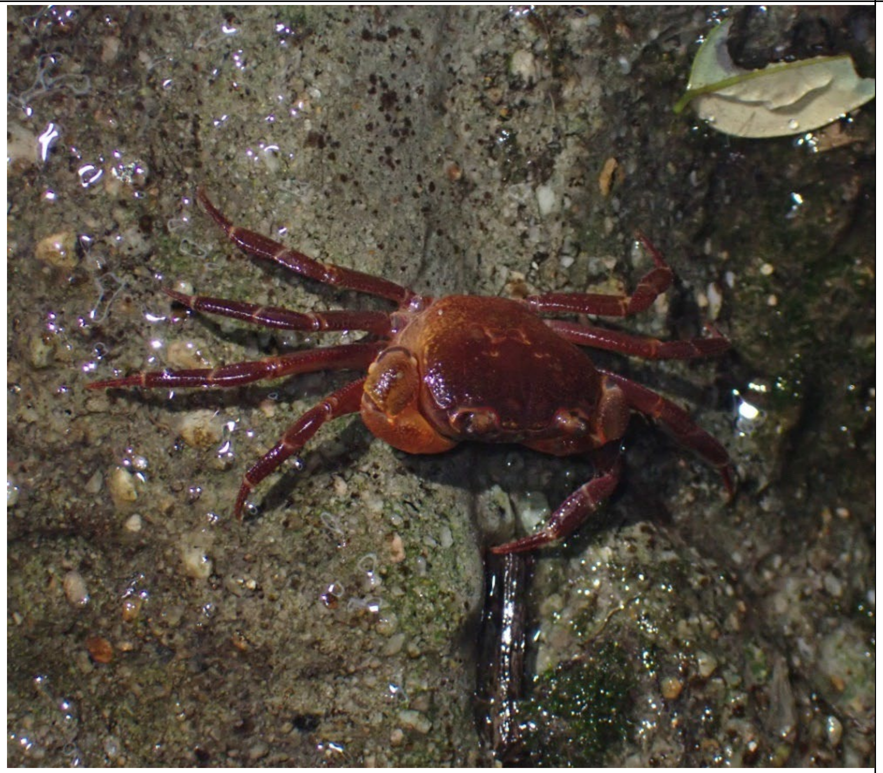
Pavetta hongkongensis



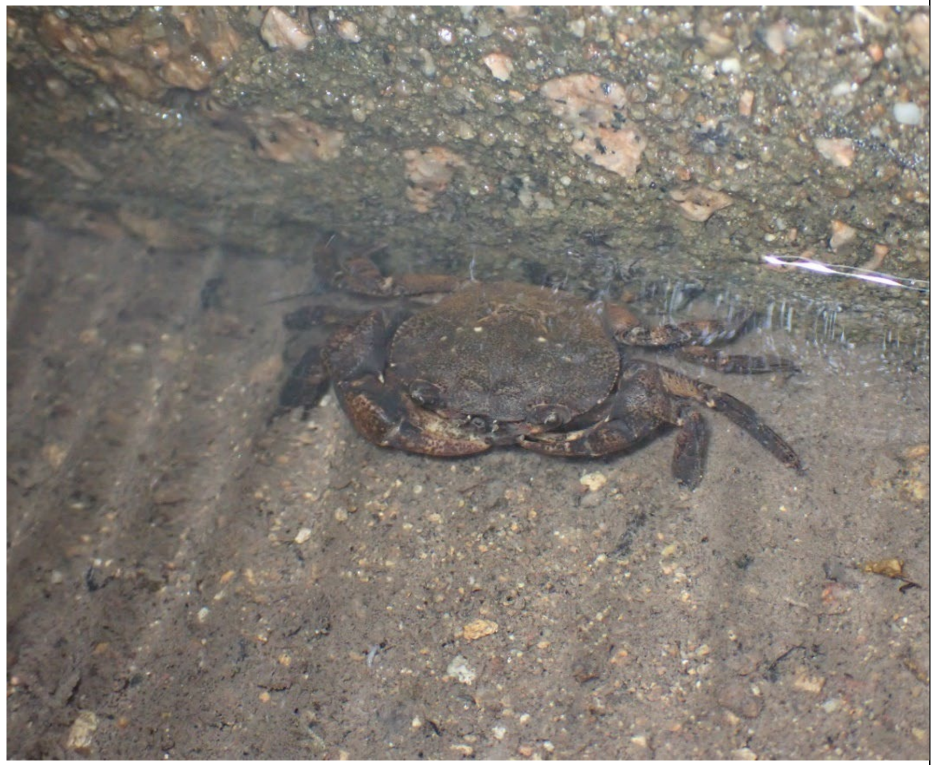
Commelina paludosa



Phymatodes longissima



Hong Kong Freshwater Crab
Nanhaipotamon hongkongense



Stream Crab *Cryptopotamon anacoluthon*

Appendix A Flora Species Recorded Within the Study Area

Scientific name	Growth form	Origin	Rarity in Hong Kong [1]	Protection/Conservation status [2,3,4,5,6,7,8,9,10]	Relative Abundance										
					Project Site				Study Area outside the Project Site						
					DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Acacia auriculiformis	Tree	Exotic	-	-						C			O		
Acacia confusa	Tree	Exotic	-	-	S		C	S		C			C		S
Acacia mangium	Tree	Exotic	-	-	S			S		O					
Acorus gramineus	Herb	Native	Very common	-							O	C			
Acronychia pedunculata	Tree	Native	Very common	-						S				S	
Adiantum capillus-veneris	Herb	Native	Common	-						S		S			
Adiantum flabellulatum	Herb	Native	Very common	-						C					
Adina pilulifera	Tree	Native	Very common	-								C			
Adinandra millettii	Shrub	Native	Common	-						S					
Agave americana	Herb	Exotic	-	-					S						
Ageratum conyzoides	Herb	Exotic	Common	-	S			S	S	S					
Aglaia odorata	Shrub	Exotic	-	-					S						
Alangium chinense	Tree	Native	Common	-						S					
Albizia lebbeck	Tree	Exotic	-	-			S			O			S		
Aleurites moluccana	Tree	Exotic	-	-						S					
Alocasia macrorrhizos	Herb	Native	Very common	-			S			S		S	S		
Alternanthera sessilis	Herb	Native	Common	-											S
Alysicarpus vaginalis	Herb	Native	Very common	-				S							O
Alyxia sinensis	Climber	Native	Common	-										S	
Amaranthus viridis	Herb	Native	Very common	-	S			O							S
Ampelopsis heterophylla var. kulingensis	Climber	Native	Common	-						S				S	
Antidesma ghaesembilla	Tree	Native	Common	-						S					
Aporusa dioica	Tree	Native	Very common	-			O			C			S		

Scientific name	**Growth form**	**Origin**	**Rarity in Hong Kong** [1]	**Protection/Conservation status** [2 3 4 5 6 7 8 9 10]	**Relative Abundance**										
					Project Site				**Study Area outside the Project Site**						
					DA	**MWAT**	**PL**	**TL**	**DA**	**MW**	**MWAT**	**NWAT**	**PL**	**SH**	**TL**
Aquilaria sinensis	**Tree**	**Native**	**Common**	**Cap. 586 Rare and Precious Plants of Hong Kong (Near threatened in China) China Plant Red Data Book (Vulnerable) Illustrations of Rare & endangered plant in Guangdong Province Wild plant under State protection (category II) Threatened Species List of China's Higher Plants (Vulnerable, endemic species) IUCN Red List (Vulnerable) CITES Appendix II**						**S**				**S**	
Araucaria heterophylla	Tree	Exotic	-	IUCN Red List (Vulnerable)						S					
Archidendron clypearia	Tree	Native	Common	-						S					
Archidendron lucidum	Tree	Native	Common	-						O					
Archontophoenix alexandrae	Tree	Exotic	-	-					S						
Ardisia lindleyana	Shrub	Native	Common	-						C					
Ardisia quinquegona	Shrub	Native	Very common	-						S					
Arundinella setosa	Herb	Native	Very common	-				S						S	S
Aster baccharoides	Herb	Native	Very common	-									S		
Asystasia micrantha	Herb	Exotic	-	-					C						
Baeckea frutescens	Tree	Native	Very common	-				S						S	S
Bambusa. sp.	Herb	-	-	-			O		S	S		S	S		
Bauhinia championii	Climber	Native	Common	-						S			S		
Bauhinia purpurea	Tree	Exotic	-	-					S						
Bauhinia variegata	Tree	Exotic	-	-					S						
Begonia cucullata var. *hookeri*	Herb	Exotic	-	-					S						

Scientific name	**Growth form**	**Origin**	**Rarity in Hong Kong** [1]	**Protection/Conservation status** [2,3,4,5,6,7,8,9,10]	**Relative Abundance**										
					Project Site				**Study Area outside the Project Site**						
					DA	**MWAT**	**PL**	**TL**	**DA**	**MW**	**MWAT**	**NWAT**	**PL**	**SH**	**TL**
Bidens alba	Herb	Exotic	Very common	-	C	S	C	O	C		O		C		C
Bischofia javanica	Tree	Native	Common	-						S					
Blechnum orientale	Herb	Native	Very common	-						C		O			
Boehmeria nivea	Shrub	Exotic	Restricted	-	S			O							S
Boehmeria nivea var. *tenacissima*	Shrub	Native	-	-						S					
Bombax ceiba	Tree	Exotic	-	-					S						
Bothriochloa bladhii	Herb	Native	Very common	-											O
Bougainvillea spectabilis	Climber	Exotic	-	-					S						
Breynia fruticosa	Shrub	Native	Very common	-						S					
Bridelia tomentosa	Shrub	Native	Very common	-						S					
Brucea javanica	Shrub	Native	Common	-						S					
Caesalpinia crista	Climber	Native	Very common	-						S					
Calliandra haematocephala	Shrub	Exotic	-	-	O				S						
Callicarpa kochiana	Shrub	Native	Common	-						S					
Canarium pimela	Tree	Exotic	Rare	-					S						
Carica papaya	Tree	Exotic	-	-					S						
Caryota mitis	Tree	Exotic	-	-					S						
Cassia fistula	Tree	Exotic	-	-					S						
Cassytha filiformis	Climber	Native	Very common	-						S			S		
Castanopsis fissa	Tree	Native	Common	-						O					
Casuarina equisetifolia	Tree	Exotic	Rare	-			S			S			O		
Cayratia corniculata	Climber	Native	Very common	-					S						
Celosia argentea	Herb	Native	Very common	-											S
Celtis sinensis	Tree	Native	Common	-			O	S		S			S		S
Cerbera manghas	Tree	Native	Common	-						S					

Scientific name	Growth form	Origin	Rarity in Hong Kong [1]	Protection/Conservation status [2,3,4,5,6,7,8,9,10]	Relative Abundance										
					Project Site				Study Area outside the Project Site						
					DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Chloris barbata	Herb	Native	Very common	-				S							S
Chloris virgata	Herb	Native	-	-	S				S						
Choerospondias axillaris	Tree	Native	Common	-						S					
Cinnamomum camphora	Tree	Native	Common	-						O					
Cinnamomum parthenoxylon	Tree	Native	Common	-						S					
Citrus maxima	Tree	Exotic	-	-						S					
Clausena lansium	Tree	Exotic	-	-						S					
Cleistocalyx nervosum	Tree	Native	Common	-						S		O			
Clerodendrum fortunatum	Shrub	Native	Common	-						S					
Clerodendrum japonicum	Shrub	Exotic	-	-						S					
Coccinia grandis	Climber	Native	Very rare	-					S						
Cocculus orbiculatus	Climber	Native	Common	-						S					
Colocasia esculenta	Herb	Exotic	-	-							S				
Commelina paludosa	**Herb**	**Native**	**Rare**	**-**								**S**			
Conyza canadensis	Herb	Exotic	Very common	-					S						S
Crateva trifoliata	Tree	Exotic	Rare	-					S						
Crateva unilocularis	Tree	Exotic	-	-					S						
Cratoxylum cochinchinense	Tree	Native	Very common	-						S					
Cyclosorus parasiticus	Herb	Native	Very common	-						C					
Cynodon dactylon	Herb	Native	Very common	-	S			S							S
Cyperus compressus	Herb	Native	Very common	-											S
Cyperus difformis	Herb	Native	Very common	-		S									S
Cyperus distans	Herb	Native	Common	-											S
Cyperus rotundus	Herb	Native	Very common	-				O							S
Cyrtococcum patens	Herb	Native	Very common	-						S					S
Dactyloctenium aegyptium	Herb	Native	Common	-					S						

Scientific name	Growth form	Origin	Rarity in Hong Kong [1]	Protection/Conservation status [2 3 4 5 6 7 8 9 10]	Relative Abundance										
					Project Site				Study Area outside the Project Site						
					DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Daemonorops jenkinsiana	Climber	Native	Very common	-						S					
Dalbergia benthamii	Climber	Native	Common	Cap. 586 CITES Appendix II				S		O					
Daphniphyllum calycinum	Tree	Native	Common	-						S					
Daphniphyllum pentandrum	Tree	Native	Common	-						S					
Desmodium heterocarpon	Shrub	Native	Very common	-				S							S
Desmodium tortuosum	Herb	Exotic	Common	-	S			O							S
Desmodium triflorum	Herb	Native	Very common	-				S							S
Desmos chinensis	Shrub	Native	Common	-						S					
Dianella ensifolia	Herb	Native	Very common	-										S	
Dicranopteris pedata	Herb	Native	Very common	-	S			O		S				C	S
Digitaria sanguinalis	Herb	Native	Very common	-				S	O						
Dimocarpus longan	Tree	Exotic	Restricted	China Plant Red Data Book (Vulnerable) Wild plant under State protection (category II) Threatened Species List of China's Higher Plants (Vulnerable)						O					
Dioscorea benthamii	Climber	Native	Common	-						S					
Dioscorea bulbifera	Climber	Native	Common	-						O					
Diospyros morrisiana	Tree	Native	Very common	-						S					
Diplospora dubia	Tree	Native	Common	-						S					
Dracaena fragrans	Shrub	Exotic	-	-									S		
Duhaldea cappa	Herb	Native	Common	-										S	
Duranta erecta	Climber	Exotic	-	-					S	S					
Dypsis lutescens	Shrub	Exotic	-	-					S						
Elaeocarpus chinensis	Tree	Native	Common	-						S					
Elaeocarpus sylvestris	Tree	Native	Very common	-						S					
Elephantopus scaber	Herb	Native	Common	-				S							S
Elephantopus tomentosus	Herb	Native	Common	-						S					

Scientific name	**Growth form**	**Origin**	**Rarity in Hong Kong** [1]	**Protection/Conservation status** [2][3][4][5][6][7][8][9][10]	**Relative Abundance**										
					Project Site				**Study Area outside the Project Site**						
					DA	**MWAT**	**PL**	**TL**	**DA**	**MW**	**MWAT**	**NWAT**	**PL**	**SH**	**TL**
Eleusine indica	Herb	Native	Very common	-	S			O	O						S
Embelia laeta	Climber	Native	Very common	-						S					
Embelia ribes	Climber	Native	Common	-						S					
Emilia sonchifolia	Herb	Native	Very common	-						S					
Epipremnum aureum	Climber	Exotic	-	-						S					
Eragrostis tenella	Herb	Native	Very common	-	S			C	S						S
Eucalyptus camaldulensis	Tree	Exotic	-	-						C			C		
Eucalyptus citriodora	Tree	Exotic	-	-						C			C		
Eucalyptus exserta	Tree	Exotic	-	-						C			O		
Eucalyptus robusta	Tree	Exotic	-	-						C			O		
Eucalyptus tereticornis	Tree	Exotic	-	-						C			O		
Eucalyptus urophylla	Tree	Exotic	-	-						C			C		
Euphorbia hirta	Herb	Exotic	Very common	-	S				O						
Ficus elastica	Tree	Exotic	-	-					S						
Ficus fistulosa	Tree	Native	Common	-								S			
Ficus hirta	Shrub	Native	Common	-						O					
Ficus hispida	Shrub	Native	Very common	-				S		O		S			S
Ficus microcarpa	Tree	Native	Common	-	S		S		O	S			C		
Ficus variegata var. *chlorocarpa*	Tree	Native	Common	-						S					
Ficus variolosa	Tree	Native	Very common	-						S					
Ficus virens var. *sublanceolata*	Tree	Native	Common	-					S	S					
Fimbristylis dichotoma	Herb	Native	Very common	-				S							S
Floscopa scandens	Herb	Native	Common	-							S				
Gahnia tristis	Herb	Native	Very common	-											S
Garcinia oblongifolia	Tree	Native	Very common	-						S					
Gardenia jasminoides	Shrub	Native	Common	-						S					

Scientific name	Growth form	Origin	Rarity in Hong Kong [1]	Protection/Conservation status [2 3 4 5 6 7 8 9 10]	Relative Abundance										
					Project Site				Study Area outside the Project Site						
					DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Glochidion lanceolarium	Tree	Native	Common	-						S					
Glochidion wrightii	Shrub	Native	Very common	-						S					
Glochidion zeylanicum	Shrub	Native	Common	-						S		O			
Gnetum luofuense	Climber	Native	Very common	-						S		S			
Hedyotis acutangula	Herb	Native	Very common	-						S					
Hedyotis corymbosa	Herb	Native	Very common	-					O						
Hedyotis hedyotidea	Shrub	Native	Very common	-						O					
Helicteres angustifolia	Shrub	Native	Very common	-				S						S	S
Heterosmilax japonica	Climber	Native	Common	-						O					
Hibiscus rosa-sinensis	Shrub	Exotic	-	-					S						
Ilex asprella	Shrub	Native	Very common	-						O					
Ilex pubescens	Shrub	Native	Very common	-						S					
Imperata cylindrica	Herb	Native	Very common	-				S							C
Ipomoea batatas	Herb	Exotic	-	-					S						O
Ipomoea cairica	Climber	Exotic	Very common	-	O			S	S	S					S
Ipomoea triloba	Herb	Native	-	-					S						S
Ischaemum aristatum var. *glaucum*	Herb	Native	Common	-				O							S
Ischaemum barbatum	Herb	Native	Very common	-				S							C
Itea chinensis	Shrub	Native	Very common	-						S					
Ixora chinensis	Shrub	Native	Restricted	-					S						
Juniperus chinensis	Tree	Exotic	-	-					S						
Kyllinga polyphylla	Herb	Exotic	Common	-	S			S	S						
Lagerstroemia speciosa	Tree	Exotic	-	Cap.96					S						
Lantana camara	Shrub	Exotic	Very common	-	S	O	C	S		S	S				S
Lepidosperma chinense	Herb	Native	Very common	-											S
Leucaena leucocephala	Tree	Exotic	Common	-	C		C	O	C	S			C	S	O
Ligustrum sinense	Tree	Native	Common	-						S			S		
Lindernia crustacea	Herb	Native	Restricted	-											S
Lindsaea ensifolia	Herb	Native	Very common	-						O					

Scientific name	**Growth form**	**Origin**	**Rarity in Hong Kong** [1]	**Protection/Conservation status** [2,3,4,5,6,7,8,9,10]	**Relative Abundance**										
					Project Site				**Study Area outside the Project Site**						
					DA	**MWAT**	**PL**	**TL**	**DA**	**MW**	**MWAT**	**NWAT**	**PL**	**SH**	**TL**
Liquidambar formosana	Tree	Native	Common	-						S					
Liriope spicata	Herb	Native	Very common	-						C	C				
Litsea cubeba	Shrub	Native	Common	-			S			S					
Litsea glutinosa	Tree	Native	Very common	-						S					
Litsea monopetala	Tree	Native	Restricted	-						S					
Litsea rotundifolia var. *oblongifolia*	Shrub	Native	Very common	-						O					
Livistona chinensis	Tree	Exotic	-	-					S						
Lophatherum gracile	Herb	Native	Very common	-						S					
Lophostemon confertus	Tree	Exotic	-	-					S	C					
Lygodium japonicum	Herb	Native	Very common	-						O		S			
Lygodium scandens	Herb	Native	Common	-								S			S
Macaranga tanarius var. *tomentosa*	Tree	Native	Common	-			S		O				C		
Machilus chekiangensis	Tree	Native	Very common	-						C			S		
Maesa perlarius	Shrub	Native	Common	-						C					
Mallotus apelta	Shrub	Native	Common	-						O					
Mallotus paniculatus	Tree	Native	Very common	-	S		O	S		C		S	O	O	S
Mangifera indica	Tree	Exotic	-	-					S						
Melastoma dodecandrum	Shrub	Native	Common	-						S				S	
Melastoma malabathricum	Shrub	Native	Common	-						S		S			
Melastoma sanguineum	Shrub	Native	Common	-										S	
Melia azedarach	Tree	Exotic	Common	-						S					
Melinis repens	Herb	Exotic	Very common	-											O
Melodinus suaveolens	Climber	Native	Common	-						S					
Michelia x alba	Tree	Exotic	-	Cap.96					S						
Microcos nervosa	Shrub	Native	Common	-			O			S			S		
Microstegium ciliatum	Herb	Native	Very common	-		O				O	C	O			O
Mikania micrantha	Herb	Exotic	Very common	-	O	O		O		S					O
Millettia dielsiana	Climber	Native	Very common	-						C		O			
Millettia speciosa	Climber	Native	Common	-										S	S

Scientific name	Growth form	Origin	Rarity in Hong Kong [1]	Protection/Conservation status [2,3,4,5,6,7,8,9,10]	Relative Abundance										
					Project Site				Study Area outside the Project Site						
					DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Mimosa pudica	Herb	Exotic	Very common	-				O							S
Miscanthus floridulus	Herb	Native	Common	-						S					
Miscanthus sinensis	Herb	Native	Very common	-						S					
Morinda parvifolia	Climber	Native	Very common	-									S		
Morus alba	Tree	Native	Common	-						S					
Murraya paniculata	Tree	Exotic	-	-					S				S		
Musa x paradisiaca	Herb	Exotic	-	-					S						
Mussaenda erosa	Climber	Native	Common	-						S			S		
Mussaenda pubescens	Climber	Native	Very common	-				S		C					
Nephrolepis auriculata	Herb	Native	Common	-						S		S			
Neyraudia reynaudiana	Herb	Native	Very common	-									S		
Osmunda vachellii	Herb	Native	Common	-						S		C			
Osterium citriodorum	Herb	Native	Common	-						S					
Oxalis corniculata	Herb	Native	Very common	-									S		
Paederia scandens	Climber	Native	Very common	-	S	S			O				O		
Pandanus tectorius	Shrub	Native	Very common	-						S					
Panicum maximum	Herb	Exotic	Common	-	O		O	O					C		C
Panicum repens	Herb	Native	Very common	-				S							S
Parthenocissus dalzielii	Climber	Exotic	-	-					S						
Paspalum conjugatum	Herb	Native	Common	-		S		S							C
Paspalum distichum	Herb	Native	Common	-				S	S						S
Paspalum urvillei	Herb	Exotic	Common	-											O
Passiflora foetida	Climber	Exotic	Very common	-					S						
Pavetta hongkongensis	**Tree**	**Native**	**Common**	**Cap.96**						**S**		**S**			
Pennisetum alopecuroides	Herb	Native	Common	-				O							
Pennisetum polystachion	Herb	Exotic	Very common	-				O			S		S		O
Persicaria barbata	Herb	Native	Common	-							S				
Persicaria chinensis	Herb	Native	Common	-						S					
Phoenix loureiroi	Tree	Native	Common	-					S					O	

Scientific name	**Growth form**	**Origin**	**Rarity in Hong Kong** [1]	**Protection/Conservation status** [2,3,4,5,6,7,8,9,10]	**Relative Abundance**										
					Project Site				**Study Area outside the Project Site**						
					DA	**MWAT**	**PL**	**TL**	**DA**	**MW**	**MWAT**	**NWAT**	**PL**	**SH**	**TL**
Photinia serratifolia	Tree	Exotic	-	-				O							S
Phyllanthus cochinchinensis	Shrub	Native	Very common	-						S					
Phyllanthus emblica	Tree	Native	Very common	-						S			S		
Phyllanthus urinaria	Herb	Native	Common	-							S				S
Phymatodes longissima	**Herb**	**Native**	**Rare**	**-**								**S**			
Pinus elliottii	Tree	Exotic	-	-						C					
Pinus massoniana	Tree	Native	Common	-						C					
Piper kadsura	Climber	-	-	-						C					
Plumeria rubra	Tree	Exotic	-	-					S						
Pogonatherum crinitum	Herb	Native	Common	-								C			
Polyspora axillaris	Shrub	Native	Very common	-						S					
Pothos chinensis	Herb	Native	Very common	-						S		O			
Psychotria asiatica	Tree	Native	Very common	-						C		S			
Psychotria serpens	Climber	Native	Very common	-						C					
Pteris ensiformis	Herb	Native	Common	-						S					
Pteris semipinnata	Herb	Native	Very common	-						C					
Pteris vittata	Herb	Native	Very common	-						S					
Pueraria lobata var. *montana*	Climber	Native	Common	-			O			S			S		O
Pueraria lobata var. *thomsonii*	Climber	Exotic	-	-								S			S
Pueraria phaseoloides	Climber	Native	Very common	-					S				S		S
Reevesia thyrsoidea	Tree	Native	Common	-						S					
Rhaphiolepis indica	Shrub	Native	Very common	-						S				S	
Rhapis excelsa	Shrub	Native	Common	-					S	S					
Rhodomyrtus tomentosa	Shrub	Native	Very common	-						S				C	
Rhus chinensis	Tree	Native	Common	-						S					
Rhus hypoleuca	Shrub	Native	Common	-			S						S		
Rhus succedanea	Shrub	Native	Common	-	S			S		S					S
Rhynchospora rubra	Herb	Native	Very common	-				O							S
Rourea microphylla	Climber	Native	Common	-						S				S	

Scientific name	**Growth form**	**Origin**	**Rarity in Hong Kong** [1]	**Protection/Conservation status** [2 3 4 5 6 7 8 9 10]	**Relative Abundance**										
					Project Site				**Study Area outside the Project Site**						
					DA	**MWAT**	**PL**	**TL**	**DA**	**MW**	**MWAT**	**NWAT**	**PL**	**SH**	**TL**
Rubus reflexus	Climber	Native	Very common	-						O					
Sansevieria trifasciata	Herb	Exotic	-	-					S						
Sapium discolor	Tree	Native	Very common	-						S	S				
Sapium sebiferum	Tree	Native	Common	-	S			S		S				S	
Sarcandra glabra	Shrub	Native	Very common	-						C					
Sarcosperma laurinum	Tree	Native	Very common	-						S		S			
Schefflera arboricola	Climber	Exotic	-	-					S				S		
Schefflera heptaphylla	Tree	Native	Very common	-			S			C			S		
Schima superba	Tree	Native	Common	-						S					
Scleria ciliaris	Herb	Native	Very common	-						C	S				O
Scleria levis	Herb	Native	Common	-				S							
Scleria terrestris	Herb	Native	Common	-						S					
Scoparia dulcis	Herb	Exotic	Common	-					S						
Senna alata	Shrub	Exotic	-	-				O							S
Sesbania cannabina	Herb	Exotic	Common	-				S							
Sida rhombifolia	Shrub	Native	Common	-				S							
Smilax china	Climber	Native	Very common	-						C					
Smilax glabra	Climber	Native	Very common	-										S	
Solanum torvum	Shrub	Exotic	Common	-					S						
Solena amplexicaulis	Climber	Native	Very common	-						S					
Spermacoce stricta	Herb	Native	Restricted	-					S						
Sporobolus fertilis	Herb	Native	Very common	-				O	O						
Stachytarpheta jamaicensis	Shrub	Exotic	Common	-					S						
Sterculia lanceolata	Tree	Native	Very common	-			S			C			S		
Strophanthus divaricatus	Climber	Native	Common	-										S	
Syzygium hancei	Tree	Native	Common	-						S			S		
Syzygium jambos	Tree	Exotic	Common	-			S			S			S		
Syzygium levinei	Tree	Native	Common	-						S					
Tadehagi triquetrum	Shrub	Native	Very common	-				O						S	

Scientific name	Growth form	Origin	Rarity in Hong Kong [1]	Protection/Conservation status [2 3 4 5 6 7 8 9 10]	Relative Abundance										
					Project Site				Study Area outside the Project Site						
					DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Terminalia catappa	Tree	Exotic	Very rare	-					S						
Tetracera asiatica	Climber	Native	Very common	-						S				S	
Tetradium glabrifolium	Tree	Native	Common	-						O					
Tradescantia spathacea	Herb	Exotic	-	-					S						
Trema tomentosa	Shrub	Native	Common	-			S			S			S		
Tridax procumbens	Herb	Exotic	Very common	-					O						
Uraria crinita	Shrub	Native	Common	-										S	
Uvaria macrophylla	Climber	Native	Common	-						S				S	
Vernicia montana	Tree	Exotic	-	-						C					
Vernonia cinerea	Herb	Native	Very common	-									O		
Viburnum odoratissimum	Shrub	Native	Very common	-						O		S			
Wedelia chinensis	Herb	Native	Common	-										S	
Wedelia trilobata	Herb	Exotic	Common	-	O		C	C	C				C		C
Wikstroemia indica	Shrub	Native	Common	-						S					
Youngia japonica	Herb	Native	Very common	-				S	S						S
Zanthoxylum avicennae	Tree	Native	Common	-						O			S		
Zanthoxylum nitidum	Climber	Native	Very common	-						S					

Notes:

1. Corlett *et al.* (2000). Hong Kong vascular plants: distribution and status.
2. International Union of Conservation for Nature (2024). The IUCN Red List of Threatened Species. Version 2024-1
3. Convention on International Trade in Endangered Species (CITES) of Wild Flora and Fauna (2020). Appendices I, II and III.
4. Qin *et al.* (2017). Threatened Species List of China's Higher Plants.
5. Fu & Chin (1992). China Plant Red Data Book – Rare and Endangered Plants.
6. Wu *et al.* (1988). Illustration of Rare & endangered plant in Guangdong Province.
7. Hu *et al.* (2003). Rare and Precious Plants of Hong Kong.
8. Cap. 586 Protection of Endangered Species of Animals and Plants Ordinance.
9. State Forestry Administration & Ministry of Agriculture (1999). List of Wild Plants under State Protection (Part 1).
10. Cap. 96 Forests and Countryside Ordinance.

- **Species in bold are considered of conservation importance. Only the protection and/or conservation status of species fulfilling the criteria of being considered of conservation importance according to Note 3 of Annex 16 of EIAO-TM will be supplemented.**

Abbreviations:

- Habitats: DA = Developed Area; MW = Mixed Woodland; MWAT = Modified Watercourse; NWAT = Natural Watercourse; PL = Plantation; SH = Shrubland; TL = Turfgrass Land
- Relative Abundance: C = Common; O = Occasional; S = Sparse

Appendix B Bird Species Recorded within the Study Area

Common Names [1]	Scientific Names [1]	Rarity and Distribution in Hong Kong [1]	Conservation status [1,2,3,4,5]	Abundance in each Habitat within the Project Site				Abundance in each Habitat within the Study area outside the Project Site						
				DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Crested Serpent Eagle	***Spilornis cheela***	**Common resident. Widely distributed in shrublands on hillsides throughout Hong Kong.**	**CITES: Appendix II; List of Wild Animals under State Priority Conservation: Class II; Fellowes *et al.* (2002): (LC); Cap. 586**						**2**					
Black Kite	***Milvus migrans***	**Common resident and winter visitor. Widely distributed in Hong Kong.**	**CITES: Appendix II; List of Wild Animals under State Priority Conservation: Class II; Fellowes *et al.* (2002): (RC); Cap. 586**				**2**		**3**					
Spotted Dove	*Spilopelia chinensis*	Abundant resident. Widely distributed in Hong Kong.	-					2	2					
Collared Scops Owl	***Otus lettia***	**Common resident. Widely distributed in shrubland throughout Hong Kong.**	**CITES: Appendix II; List of Wild Animals under State Priority Conservation: Class II; Cap. 586**						**2**					
House Swift	*Apus nipalensis*	Abundant spring migrant and common resident. Widely distributed in Hong Kong.	-						10					
Long-tailed Shrike	*Lanius schach*	Common resident. Widely distributed in open areas throughout Hong Kong.	-				1							1
Hair-crested Drongo	*Dicrurus hottentottus*	Common migrant and winter visitor, and locally common resident. Widely distributed in wooded area throughout Hong Kong.	-						1					
Red-billed Blue Magpie	*Urocissa erythroryncha*	Common resident. Widely distributed in woodland edges throught Hong Kong	-			1			2					

Common Names [1]	Scientific Names [1]	Rarity and Distribution in Hong Kong [1]	Conservation status [1,2,3,4,5]	Abundance in each Habitat within the Project Site				Abundance in each Habitat within the Study area outside the Project Site						
				DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Large-billed Crow	*Corvus macrorhynchos*	Common resident. Widely distributed in Hong Kong	-				3		5					
Cinereous Tit	*Parus cinereus*	Common resident. Widely distributed in Hong Kong.	-						3					
Red-whiskered Bulbul	*Pycnonotus jocosus*	Abundant resident. Widely distributed in Hong Kong.	-	2		5	6	8	10			3	4	
Chinese Bulbul	*Pycnonotus sinensis*	Abundant resident. Widely distributed in Hong Kong.	-				2					2		4
Barn Swallow	*Hirundo rustica*	Abundant passage migrant and summer visitor. Widely distributed in Hong Kong.	-	4										
Yellow-bellied Prinia	*Prinia flaviventris*	Common resident. Widely distributed in Hong Kong.	-				1						2	1
Common Tailorbird	*Orthotomus sutorius*	Common resident. Widely distributed in Hong Kong.	-						2			3		
Black-throated Laughingthrush	***Garrulax chinensis***	**Common resident. Widely distributed in woodland and shrubland throughout Hong Kong.**	**List of Wild Animals under State Priority Conservation: Class II**						**3**					
Swinhoe's White-eye	*Zosterops simplex*	Abundant resident. Widely distributed in Hong Kong.	-						5					
Crested Myna	*Acridotheres cristatellus*	Abundant resident. Widely distributed in Hong Kong.	-	5			3	23				5		4
Black-collared Starling	*Gracupica nigricollis*	Common resident. Widely distributed in Hong Kong.	-									4		
Oriental Magpie-Robin	*Copsychus saularis*	Abundant resident. Widely distributed in Hong Kong.	-									1		
Eurasian Tree Sparrow	*Passer montanus*	Abundant resident. Widely distributed in Hong Kong.	-	6				26						
Richard's Pipit	*Anthus richardi*	Common passage migrant, winter visitor and locally common	-				3							3

Common Names 1	Scientific Names 1	Rarity and Distribution in Hong Kong 1	Conservation status 1,2,3,4,5	Abundance in each Habitat within the Project Site				Abundance in each Habitat within the Study area outside the Project Site						
				DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
		resident. Widely distributed in Hong Kong.												

Notes:

1. Agriculture, Fisheries and Conservation Department (2024). Species Database of the Hong Kong Biodiversity Information Hub.
2. Convention on International Trade in Endangered Species (CITES) of Wild Flora and Fauna (2020). Appendices I, II and III.
3. Fellowes *et al*. (2002). Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong.
    - For conservation status listed by Fellowes *et al*. (2002), letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence
4. National Forestry and Grassland Administration and the Ministry of Agricultural and Rural Affairs (2023). List of Wild Animals under State Priority Conservation.
5. Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)

- **Species in bold are considered of conservation importance. Only the protection and/or conservation status of species fulfilling the criteria of being considered of conservation importance according to Note 3 of Annex 16 of EIAO-TM will be supplemented.**
- **All wild bird species are protected under Cap. 170 Wild Animals Protection Ordinance in Hong Kong.**

Abbreviations:

- Conservation Status in Fellowes *et al.* (2002): LC = Local Concern; RC = Regional Concern
- Habitats: DA = Developed Area; MW = Mixed Woodland; MWAT = Modified Watercourse; NWAT = Natural Watercourse; PL = Plantation; SH = Shrubland; TL = Turfgrass Land

Appendix C Butterfly Species Recorded within the Study Area

Common Names [1]	Scientific Names [1]	Rarity and Distribution in Hong Kong [1]	Conservation status [1]	Abundance in each Habitat within the Project Site				Abundance in each Habitat within the Study area outside the Project Site						
				DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Little Branded Swift	*Pelopidas agna*	Uncommon. Widely distributed throughout Hong Kong.	-				1							
Metallic Cerulean	***Jamides alecto***	**Very rare. Victoria Peak, Fung Yuen, Chuen Lung, Mui Wo**	**-**								**1**			
Dark Cerulean	*Jamides bochus*	Common. Widely distributed throughout Hong Kong.	-						1					
Pale Grass Blue	*Pseudozizeeria maha*	Very common. Widely distributed throughout Hong Kong	-				2							
Plain Tiger	*Danaus chrysippus*	Uncommon. Lung Kwu Tan, Tong Fuk, Tai Ho, Tung Chung, Pak Tam Chung	-				2							
Common Indian Crow	*Euploea core*	Common. Widely distributed throughout Hong Kong	-				3							
Blue-spotted Crow	*Euploea midamus*	Very common. Widely distributed throughout Hong Kong	-				4							4
Ceylon Blue Glassy Tiger	*Ideopsis similis*	Very common. Widely distributed throughout Hong Kong	-										3	
Glassy Tiger	*Parantica aglea*	Common. Widely distributed throughout Hong Kong	-				1							
Staff Sergeant	*Athyma selenophora*	Common. Widely distributed throughout Hong Kong	-						1					
Rustic	*Cupha erymanthis*	Very common. Widely distributed throughout Hong Kong	-										2	
Red Ring Skirt	*Hestina assimilis*	Common. Widely distributed throughout Hong Kong.	-						3					3
Great Eggfly	*Hypolimnas bolina*	Common. Widely distributed throughout Hong Kong	-				2							

Common Names [1]	Scientific Names [1]	Rarity and Distribution in Hong Kong [1]	Conservation status [1]	Abundance in each Habitat within the Project Site				Abundance in each Habitat within the Study area outside the Project Site						
				DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Blue Admiral	*Kaniska canace*	Common. Widely distributed throughout Hong Kong	-								1			
Common Sailer	*Neptis hylas*	Very common. Widely distributed throughout Hong Kong	-				1							
Large Faun	*Faunis eumeus*	Common. Widely distributed throughout Hong Kong.	-						2					
Angled Red Forester	*Lethe chandica*	Uncommon. New Territories.	-						1					
Common Five-ring	*Ypthima baldus*	Very common. Widely distributed throughout Hong Kong.	-						5					
Tailed Jay	*Graphium agamemnon*	Common. Widely distributed throughout Hong Kong	-						1					
Common Bluebottle	*Graphium sarpedon*	Very common. Widely distributed throughout Hong Kong	-				4							
Red Helen	*Papilio helenus*	Very common. Widely distributed throughout Hong Kong	-				1		1		1			
Great Mormon	*Papilio memnon*	Very common. Widely distributed throughout Hong Kong	-						1					
Paris Peacock	*Papilio paris*	Very common. Widely distributed throughout Hong Kong	-								1			2
Common Mormon	*Papilio polytes*	Very common. Widely distributed throughout Hong Kong	-	2			3				2			
Spangle	*Papilio protenor*	Very common. Widely distributed throughout Hong Kong	-	1		1	2		1					2
Lemon Emigrant	*Catopsilia pomona*	Common. Widely distributed throughout Hong Kong	-	2		1	5		3		4			6
Common Grass Yellow	*Eurema hecabe*	Very common. Widely distributed throughout Hong Kong	-				3	3	8		3			5
Indian Cabbage White	*Pieris canidia*	Very common. Widely distributed throughout Hong Kong	-				6							

Notes:

1. Agriculture, Fisheries and Conservation Department (2024). Species Database of the Hong Kong Biodiversity Information Hub.

- **Species in bold are considered of conservation importance. Only the protection and/or conservation status of species fulfilling the criteria of being considered of conservation importance according to Note 3 of Annex 16 of EIAO-TM will be supplemented.**

Abbreviations:

- Habitats: DA = Developed Area; MW = Mixed Woodland; MWAT = Modified Watercourse; NWAT = Natural Watercourse; PL = Plantation; SH = Shrubland; TL = Turfgrass Land

Appendix D Odonate Species Recorded within the Study Area

Common Names [1]	Scientific Names [1]	Rarity and Distribution in Hong Kong [1]	Conservation status [1,2,3]	Abundance in each Habitat within the Project Site				Abundance in each Habitat within the Study area outside the Project Site						
				DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Hong Kong Clubtail	***Leptogomphus hongkongensis***	**Common. Widely distributed in the woodlands adjacent to streams throughout Hong Kong.**	**Fellowes *et al*. (2002): LC; Reels (2019): Dragonfly species of conservation interest**						**1**					
Common Blue Skimmer	*Orthetrum glaucum*	Abundant. Widely distributed in streams, conduits, drainage channels, seepages and road gutters throughout Hong Kong.	-				3	2	3	5	3			3
Marsh Skimmer	*Orthetrum luzonicum*	Abundant. Widely distributed in abandoned paddies, marshy swampy and boggy locations.	-				1			2				
Common Red Skimmer	*Orthetrum pruinosum neglectum*	Abundant. Widely distributed in slow streams, ponds, rain puddles and irrigation conduits.	-				1			6	1			
Wandering Glider	*Pantala flavescens*	Abundant. Widely distributed all over Hong Kong.	-	2			6							3
Saddlebag Glider	*Tramea virginia*	Abundant. Widely distributed in trees adjacent to ponds and lakes throughout Hong Kong.	-				2							1
Indigo Dropwing	*Trithemis festiva*	Abundant. Favours sluggish sections of streams with a strong current or the small rock pools inof mountain streams. Widespread in Hong Kong.	-							4				

Notes:

1. Agriculture, Fisheries and Conservation Department (2024). Species Database of the Hong Kong Biodiversity Information Hub.

2. Fellowes *et al*. (2002). Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong.
    - For conservation status listed by Fellowes *et al*. (2002), letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
3. Reels (2019). An annotated check list of Hong Kong dragonflies and assessment of their local conservation significance.

- **Species in bold are considered of conservation importance. Only the protection and/or conservation status of species fulfilling the criteria of being considered of conservation importance according to Note 3 of Annex 16 of EIAO-TM will be supplemented.**

Abbreviations:

- Conservation Status in Fellowes *et al.* (2002): LC = Local Concern
- Habitats: DA = Developed Area; MW = Mixed Woodland; MWAT = Modified Watercourse; NWAT = Natural Watercourse; PL = Plantation; SH = Shrubland; TL = Turfgrass Land

Appendix E Firefly Species Recorded within the Study Area

Common Names [1]	Scientific Names [1]	Rarity and Distribution in Hong Kong [1]	Conservation status [1]	Present/Absent in each Habitat within the Project Site				Present/Absent in each Habitat within the Study area outside the Project Site						
				DA	MWAT	PL	TL	DA	MW	MWAT	NWAT	PL	SH	TL
Species inquirenda 1	-	Active in woodland margin close to wetland. Flying male display simple pulsation flash, frequency 11 Hz. According to the male genitalia morphology, there is not a genus into which it could reasonably fit at present. Distribution：Tai Po Kau, Shing Mun Reservoir, Tai Po Shan, Ng Tung Chai, Chek Kent, Ham Tin (Sai Kung), Yi Tung Shan, Tei Tong Chai, Nei Lak Shan.	Unknown						✓		✓			

Notes:

1. Yiu, V. (2024). Hong Kong Fireflies. Retrieved from: http://fireflies.hk

Abbreviations:

- Habitats: DA = Developed Area; MW = Mixed Woodland; MWAT = Modified Watercourse; NWAT = Natural Watercourse; PL = Plantation; SH = Shrubland; TL = Turfgrass Land

Appendix F Reptile Species Recorded within the Study Area

Common Names [1]	Scientific Names [1]	Rarity and Distribution in Hong Kong [1]	Conservation status [1]	Abundance in each Habitat within the Project Site				Abundance in each Habitat within the Study area outside the Project Site						
				DA	**MWAT**	**PL**	**TL**	**DA**	**MW**	**MWAT**	**NWAT**	**PL**	**SH**	**TL**
Changeable Lizard	*Calotes versicolor*	Widely distributed throughout Hong Kong.	-				1							2
Common Wolf Snake	*Lycodon capucinus*	Widely distributed at low elevations throughout Hong Kong Island, Lantau Island and Lamma Island. Several individuals recorded in New Territories.	-							1				
Chinese Gecko	*Gekko chinensis*	Widely distributed throughout Hong Kong.	-	2					3					
Garnot's Gecko	*Hemidactylus garnotii*	Distributed in Lantau Island, Hong Kong Island and Eastern New Territories.	-						2					
Long-tailed Skink	*Eutropis longicaudata*	Widely distributed throughout Hong Kong.	-											1
Bamboo Snake	*Trimeresurus albolabris*	Very common and widespread in Hong Kong.	-					1						2

Notes:

1. Agriculture, Fisheries and Conservation Department (2024). Species Database of the Hong Kong Biodiversity Information Hub.

Abbreviations:

- Habitats: DA = Developed Area; MW = Mixed Woodland; MWAT = Modified Watercourse; NWAT = Natural Watercourse; PL = Plantation; SH = Shrubland; TL = Turfgrass Land

Appendix G Amphibian Species Recorded within the Study Area

Common Names[1]	Scientific Names[1]	Rarity and Distribution in Hong Kong[1]	Conservation status[1]	Abundance in each Habitat within the Project Site				Abundance in each Habitat within the Study area outside the Project Site						
				DA	**MWAT**	**PL**	**TL**	**DA**	**MW**	**MWAT**	**NWAT**	**PL**	**SH**	**TL**
Asian Common Toad	*Duttaphrynus melanostictus*	Widely distributed in Hong Kong.	-	1				2	3	2	4			
Ornate Pigmy Frog	*Microhyla fissipes*	Widely distributed in Hong Kong.	-				5							8
Gunther's Frog	*Sylvirana guentheri*	Widely distributed throughout Hong Kong.	-							3	2			
Brown Tree Frog	*Polypedates megacephalus*	Widely distributed throughout Hong Kong.	-					4		5	3	2		

Notes:

1. Agriculture, Fisheries and Conservation Department (2024). Species Database of the Hong Kong Biodiversity Information Hub.

Abbreviations:

- Habitats: DA = Developed Area; MW = Mixed Woodland; MWAT = Modified Watercourse; NWAT = Natural Watercourse; PL = Plantation; SH = Shrubland; TL = Turfgrass Land

Appendix H Mammal Species Recorded within the Study Area by Direct Observation

Common Names [1]	Scientific Names [1]	Rarity and Distribution in Hong Kong [1]	Conservation status [1]	Abundance in each Habitat within the Project Site				Abundance in each Habitat within the Study area outside the Project Site						
				DA	**MWAT**	**PL**	**TL**	**DA**	**MW**	**MWAT**	**NWAT**	**PL**	**SH**	**TL**
Domestic Dog	*Canis lupus familiaris*	Common. Widely distributed in urban and countryside areas throughout Hong Kong.	-	4										
Eurasian Wild Pig	*Sus scrofa*	Very common. Very widely distributed in countryside areas throughout Hong Kong.	-				1							1

Notes:

1. Agriculture, Fisheries and Conservation Department (2024). Species Database of the Hong Kong Biodiversity Information Hub.

Abbreviations:

- Habitats: DA = Developed Area; MW = Mixed Woodland; MWAT = Modified Watercourse; NWAT = Natural Watercourse; PL = Plantation; SH = Shrubland; TL = Turfgrass Land

Appendix I Bat Species Recorded within the Study Area using Ultrasonic Bat Detector

Common Names [1]	Scientific Names [1]	Rarity and Distribution in Hong Kong [1,4]	Conservation status [1,2,3,4]	Present/Absent within the Study Area
Japanese Pipistrelle	***Pipistrellus abramus***	**Very common. Widely distributed throughout Hong Kong.**	**Cap. 170**	✓
Least Pipistrelle	***Pipistrellus tenuis***	**Uncommon. Ten-something records found in Nam Chung, Sheung Wo Hang, Lin Ma Hang, Plover Cove Country Park, Yuen Long, Shek Pik, Deep Water Bay, Ho Pui and Ho Chung.**	**Cap. 170**	✓
Lesser Yellow Bat	***Scotophilus kuhlii***	**Uncommon. Fairly widely distributed in countryside areas throughout Hong Kong.**	**Fellowes *et al*. (2002): (LC);** **Cap. 170**	✓
Lesser Bamboo Bat	***Tylonycteris pachypus***	**Very common. Fairly widely distributed in countryside areas throughout Hong Kong.**	**Fellowes *et al*. (2002): (LC);** **Cap. 170**	✓

Notes:

1. Agriculture, Fisheries and Conservation Department (2024). Species Database of the Hong Kong Biodiversity Information Hub.
2. Cap. 170 Wild Animals Protection Ordinance.
3. Fellowes *et al*. (2002). Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong.
    - For conservation status listed by Fellowes *et al*. (2002), letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
4. Shek (2006). A Field Guide to the Terrestrial Mammals of Hong Kong.

- **Species in bold are considered of conservation importance. Only the protection and/or conservation status of species fulfilling the criteria of being considered of conservation importance according to Note 3 of Annex 16 of EIAO-TM will be supplemented.**
- Due to the detection range of Echo Meter Touch 2 Pro and the relatively high habitat heterogeneity observed, it is not considered accurate to determine the exact habitat usage by the bat species recorded by ultrasonic bat detector.

Abbreviations:

- Protection or conservation status: LC = Local Concern

Appendix J Aquatic Fauna Species Recorded within the Study Area

Common Names [1]	**Scientific Names** [1]	**Rarity and Distribution in Hong Kong** [1,4,5,6]	**Conservation status** [1,2,3,4,5,6]	**Relative Abundance Within the Project Site**	**Relative Abundance Within the Study area outside the Project Site**	
				Modified Watercourse	**Modified Watercourse**	**Natural Watercourse**
Fish						
Flat-headed loach	*Oreonectes platycephalus*	Common. It can be found in upper streams throughout Hong Kong.	-		+	++
Mosquito fish	*Gambusia affinis*	Common. Introduced as a mosquito-control agent, widespread in local freshwater bodies	-		++	++
Whitecheek Goby	*Rhinogobius duospilus*	Probably the commonest goby in Hong Kong and is widely distributed in upper and middle course of streams, sometimes occurs in lowland streams.	-			+
Invertebrate						
Backswimmer	Notonectidae	-	-		++	+++
Canton Bee Shrimp	*Caridina cantonensis*	The species is known from Guangdong and Guangxi Provinces (China), Hong Kong and possibly northern Vietnam	-		+++	+++
Hong Kong Freshwater Crab	***Nanhaipotamon hongkongense***	**Widely distributed within Hong Kong; recorded throughout the New Territories, Hong Kong, Lamma and Lantau Islands**	**Fellowes *et al*. (2002): PGC**		**+**	**+**
Stream Crab	***Cryptopotamon anacoluthon***	**Widely distributed within Hong Kong; recorded throughout the New Territories, Hong Kong and Lantau Islands**	**Fellowes *et al*. (2002): PGC; IUCN Red List of Threatened Species (2024): Vulnerable**		**+**	**++**
Water Strider	Gerridae	-	-		+++	+++
-	*Macrobrachium sp.*	-	-		+	+

Notes:

1. Agriculture, Fisheries and Conservation Department (2024). Species Database of the Hong Kong Biodiversity Information Hub.
2. Fellowes *et al*. (2002). Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong.
    - For conservation status listed by Fellowes *et al*. (2002), letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
3. International Union of Conservation for Nature (2024). The IUCN Red List of Threatened Species
4. Stanton & Leven (2016). Distribution, habitat utilisation and conservation status of the freshwater crab, *Somanniathelphusa zanklon* Ng & Dudgeon, 1992 (Crustacea: Brachyura: Gecarcinucidae) endemic to Hong Kong.
5. Stanton *et al*. (2017). Distribution *of Cryptopotamon anacoluthon* (Kemp, 1918) (Crustacea: Brachyura: Potamidae), a freshwater crab endemic to Hong Kong.
6. Stanton *et al*. (2018). Distribution of *Nanhaipotamon hongkongense* (Shen, 1940) (Crustacea: Brachyura: Potamidae), a freshwater crab endemic to Hong Kong.

- **Species in bold are considered of conservation importance. Only the protection and/or conservation status of species fulfilling the criteria of being considered of conservation importance according to Note 3 of Annex 16 of EIAO-TM will be supplemented.**

Abbreviations:

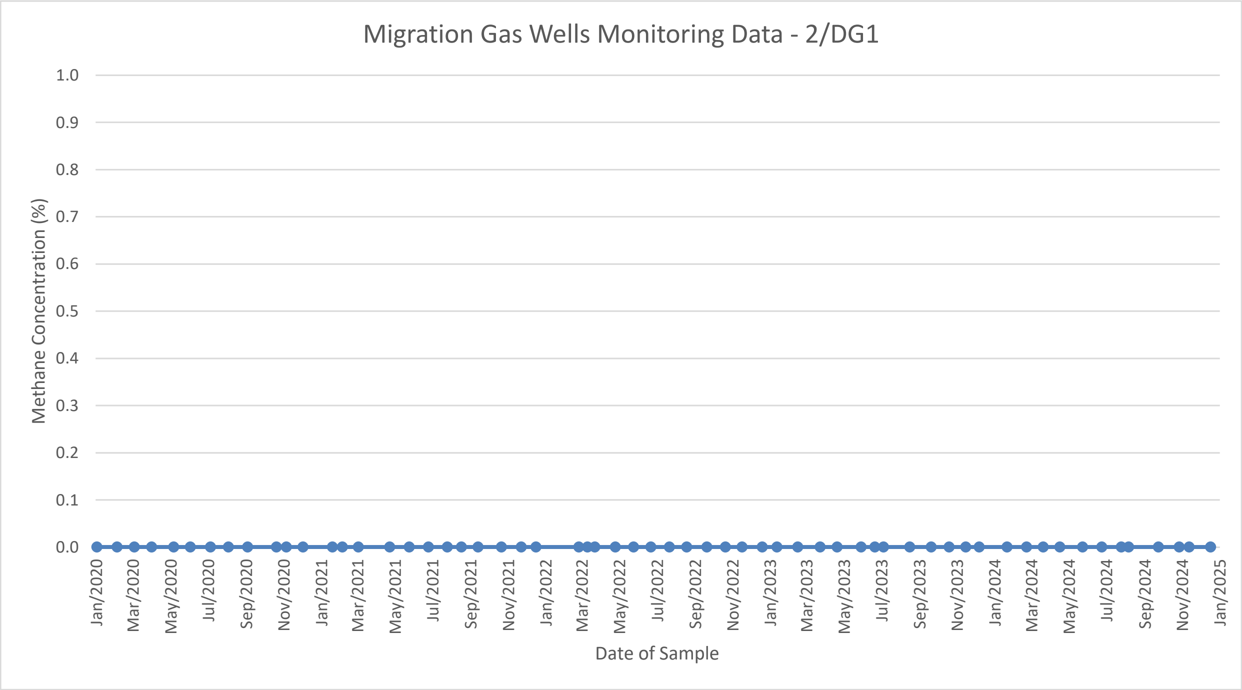
- Relative abundance: + = Sparse, ++ = Occasional, +++ = Common
- Protection or conservation status: PGC = Potential Global Concern

Appendix 10.1

Landfill Gas Monitoring Data at TKOL II/III

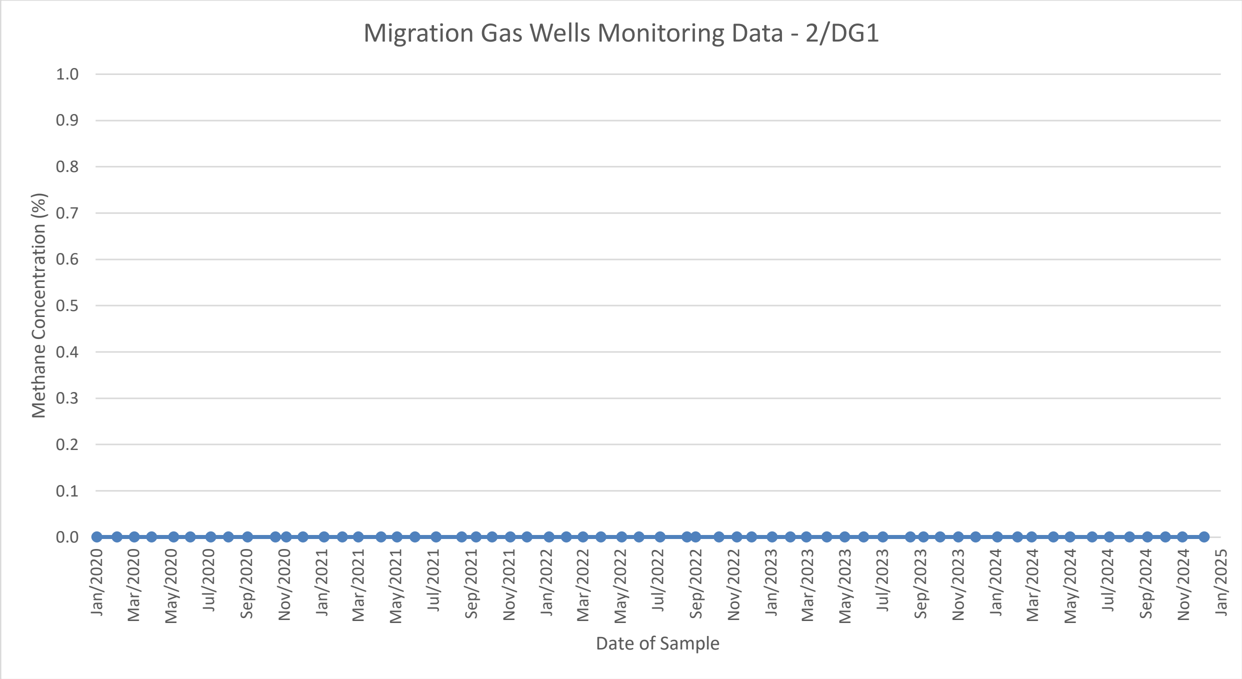
Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/DG1

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
3-Jan-20	1.4	0.0	18.9
5-Feb-20	0.0	0.0	20.8
4-Mar-20	0.0	0.0	20.6
1-Apr-20	0.1	0.0	20.5
7-May-20	0.4	0.0	19.0
3-Jun-20	0.6	0.0	19.2
6-Jul-20	1.9	0.0	17.1
4-Aug-20	2.2	0.0	17.4
4-Sep-20	2.7	0.0	16.5
21-Oct-20	0.0	0.0	20.1
6-Nov-20	0.2	0.0	18.9
3-Dec-20	0.6	0.0	19.6
20-Jan-21	2.0	0.0	18.7
5-Feb-21	2.4	0.0	17.9
3-Mar-21	2.0	0.0	17.9
23-Apr-21	1.7	0.0	17.1
25-May-21	1.5	0.0	19.9
25-Jun-21	2.4	0.0	17.7
26-Jul-21	3.3	0.0	14.8
18-Aug-21	3.6	0.0	16.5
14-Sep-21	3.6	0.0	18.6
22-Oct-21	5.5	0.0	8.9
23-Nov-21	2.7	0.0	17.2
17-Dec-21	3.8	0.0	15.2
--	--	--	--
25-Feb-22	0.0	0.0	20.6
11-Mar-22	0.1	0.0	16.5
23-Mar-22	0.0	0.0	17.6
25-Apr-22	0.0	0.0	16.5
25-May-22	0.1	0.0	16.7
22-Jun-22	0.0	0.0	13.2
22-Jul-22	0.0	0.0	21.1
19-Aug-22	0.0	0.0	20.0
21-Sep-22	0.0	0.0	20.5
21-Oct-22	0.0	0.0	17.9
17-Nov-22	0.0	0.0	21.9
20-Dec-22	0.0	0.0	21.5
13-Jan-23	0.0	0.0	19.5
16-Feb-23	0.0	0.0	21.1
24-Mar-23	0.0	0.0	18.2
21-Apr-23	0.1	0.0	18.8
30-May-23	0.0	0.0	17.7
21-Jun-23	0.3	0.0	16.8
5-Jul-23	0.0	0.0	17.1
17-Aug-23	0.0	0.0	17.3
21-Sep-23	0.1	0.0	20.4
20-Oct-23	0.2	0.0	20.9
16-Nov-23	0.0	0.0	23.6
8-Dec-23	0.0	0.0	22.6
22-Jan-24	0.0	0.0	23.1
23-Feb-24	0.1	0.0	21.7
21-Mar-24	0.1	0.0	21.1
17-Apr-24	0.0	0.0	19.4
24-May-24	0.0	0.0	20.1
24-Jun-24	3.7	0.0	12.8
26-Jul-24	0.0	0.0	19.7
7-Aug-24	0.0	0.0	21.2
24-Sep-24	0.0	0.0	20.4
28-Oct-24	0.1	0.0	20.7
13-Nov-24	0.0	0.0	22.6
18-Dec-24	0.1	0.0	21.0



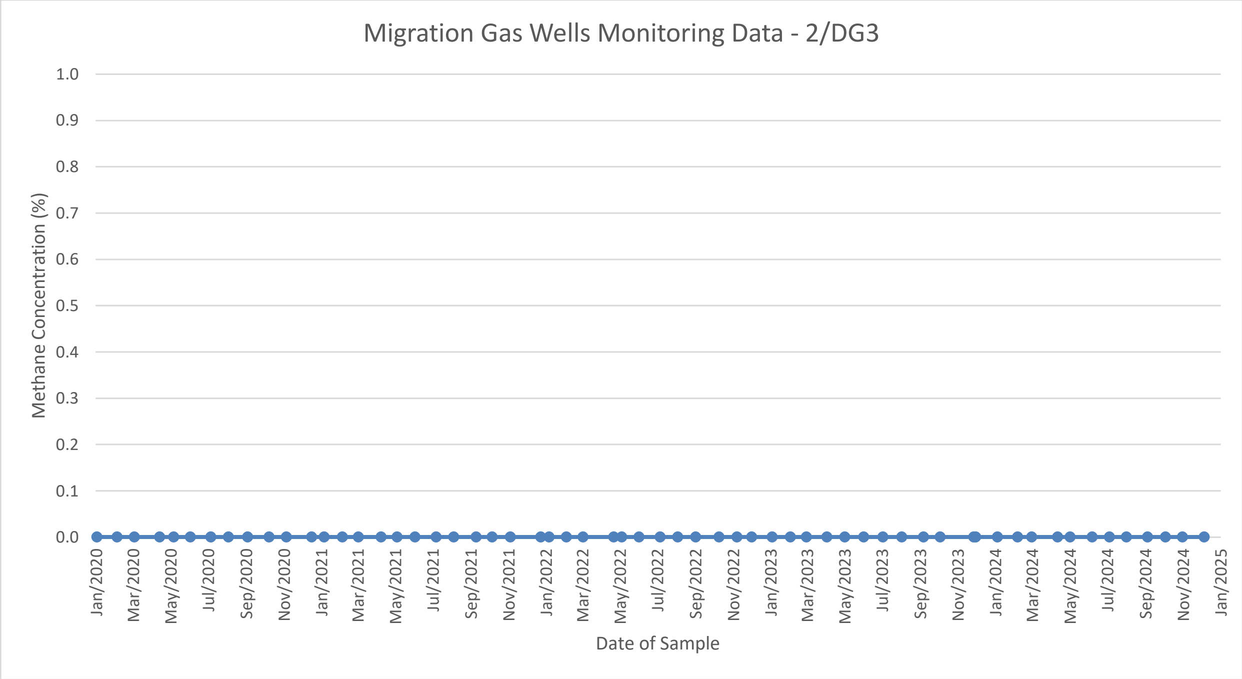
Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/DG2

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
3-Jan-20	2.7	0.0	18.2
5-Feb-20	0.0	0.0	20.7
4-Mar-20	2.6	0.0	17.7
1-Apr-20	2.8	0.0	16.3
7-May-20	0.0	0.0	19.0
3-Jun-20	0.0	0.0	20.3
6-Jul-20	0.0	0.0	19.7
4-Aug-20	2.6	0.0	16.7
4-Sep-20	1.9	0.0	16.5
19-Oct-20	2.4	0.0	16.1
6-Nov-20	2.4	0.0	16.8
3-Dec-20	1.9	0.0	19.3
6-Jan-21	1.3	0.0	19.6
5-Feb-21	1.5	0.0	18.5
3-Mar-21	1.6	0.0	16.8
9-Apr-21	0.0	0.0	20.6
5-May-21	1.7	0.0	18.1
3-Jun-21	0.0	0.0	20.3
7-Jul-21	0.0	0.0	20.8
18-Aug-21	0.0	0.0	20.5
10-Sep-21	2.7	0.0	17.3
6-Oct-21	2.5	0.0	16.8
5-Nov-21	1.7	0.0	18.6
2-Dec-21	1.7	0.0	20.0
7-Jan-22	0.0	0.0	20.9
4-Feb-22	1.1	0.0	20.7
3-Mar-22	0.2	0.0	20.6
1-Apr-22	0.3	0.0	20.5
5-May-22	0.0	0.0	21.2
2-Jun-22	0.0	0.0	20.7
6-Jul-22	1.0	0.0	18.4
19-Aug-22	1.4	0.0	16.4
2-Sep-22	1.4	0.0	17.2
10-Oct-22	2.4	0.0	19.2
8-Nov-22	0.0	0.0	20.8
2-Dec-22	0.9	0.0	19.8
4-Jan-23	0.2	0.0	21.7
3-Feb-23	0.2	0.0	20.8
1-Mar-23	0.1	0.0	20.4
3-Apr-23	1.3	0.0	19.5
2-May-23	0.1	0.0	20.5
2-Jun-23	0.0	0.0	20.9
3-Jul-23	0.2	0.0	21.9
17-Aug-23	0.1	0.0	21.3
7-Sep-23	0.7	0.0	20.8
4-Oct-23	0.2	0.0	19.2
3-Nov-23	0.0	0.0	23.5
1-Dec-23	2.3	0.0	20.0
5-Jan-24	1.7	0.0	18.6
7-Feb-24	0.0	0.0	22.7
1-Mar-24	0.0	0.0	22.8
5-Apr-24	0.0	0.0	21.9
2-May-24	0.3	0.0	20.0
7-Jun-24	0.0	0.0	20.9
5-Jul-24	1.0	0.0	19.0
7-Aug-24	0.0	0.0	22.2
5-Sep-24	0.0	0.0	20.8
4-Oct-24	0.2	0.0	20.1
1-Nov-24	0.1	0.0	19.2
6-Dec-24	1.5	0.0	19.7



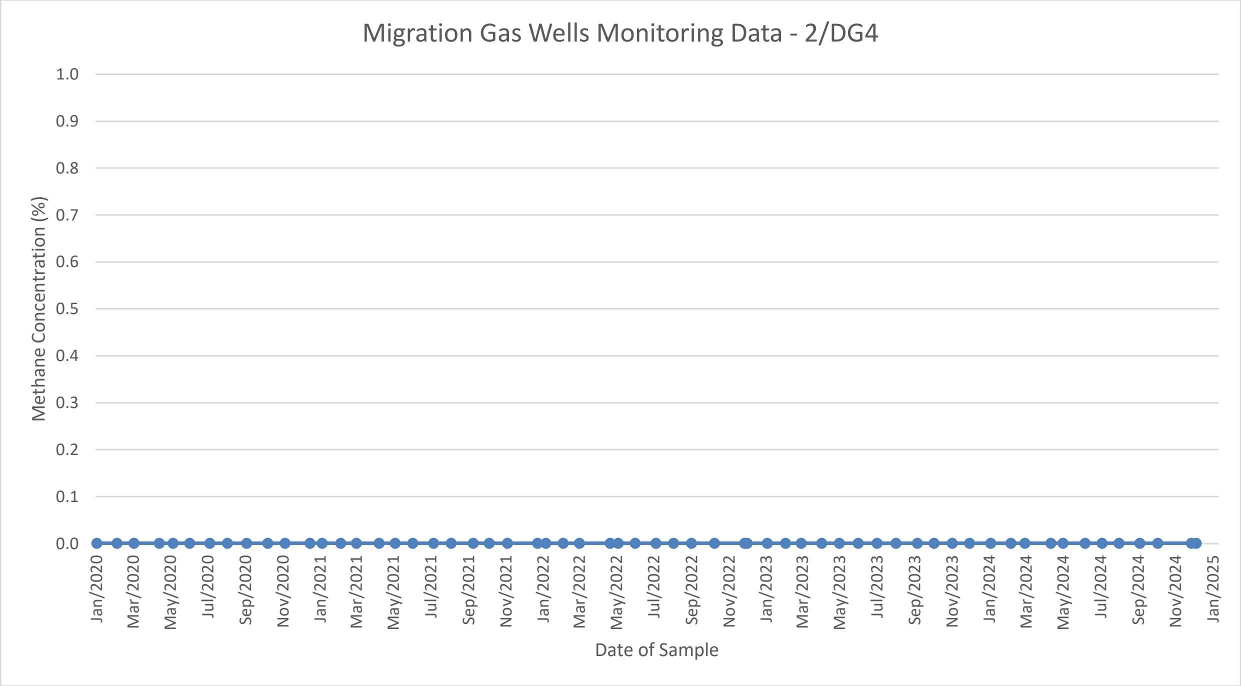
Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/DG3

Date of Sample	CO$_2$ (%)	Methane (%)	O$_2$ (%)
3-Jan-20	8.5	0.0	12.2
5-Feb-20	6.7	0.0	13.6
4-Mar-20	6.4	0.0	13.0
14-Apr-20	9.2	0.0	8.0
7-May-20	6.9	0.0	12.7
3-Jun-20	5.8	0.0	1.4
6-Jul-20	8.8	0.0	9.2
4-Aug-20	2.4	0.0	10.0
4-Sep-20	7.4	0.0	4.1
9-Oct-20	10.7	0.0	3.6
6-Nov-20	8.4	0.0	6.7
17-Dec-20	11.2	0.0	9.0
6-Jan-21	10.8	0.0	10.7
5-Feb-21	6.6	0.0	13.2
3-Mar-21	4.1	0.0	15.8
9-Apr-21	4.8	0.0	16.1
5-May-21	7.5	0.0	12.0
3-Jun-21	7.2	0.0	10.0
7-Jul-21	6.1	0.0	0.0
5-Aug-21	4.2	0.0	7.8
10-Sep-21	11.8	0.0	0.3
6-Oct-21	2.6	0.0	0.4
5-Nov-21	12.2	0.0	2.3
24-Dec-21	12.0	0.0	9.3
7-Jan-22	13.3	0.0	8.3
4-Feb-22	12.2	0.0	10.5
3-Mar-22	6.3	0.0	6.9
22-Apr-22	11.0	0.0	7.3
5-May-22	5.5	0.0	2.9
2-Jun-22	5.7	0.0	0.5
6-Jul-22	5.2	0.0	1.7
4-Aug-22	5.5	0.0	0.2
2-Sep-22	10.4	0.0	0.9
10-Oct-22	0.4	0.0	20.7
8-Nov-22	0.0	0.0	20.5
2-Dec-22	6.9	0.0	21.4
4-Jan-23	8.0	0.0	9.7
3-Feb-23	2.7	0.0	17.4
1-Mar-23	0.1	0.0	20.4
3-Apr-23	4.1	0.0	15.8
2-May-23	0.1	0.0	20.1
2-Jun-23	1.5	0.0	18.3
3-Jul-23	7.9	0.0	1.4
3-Aug-23	9.4	0.0	1.4
7-Sep-23	0.5	0.0	20.8
4-Oct-23	0.6	0.0	20.8
28-Nov-23	12.9	0.0	3.1
1-Dec-23	0.2	0.0	21.2
5-Jan-24	0.1	0.0	21.3
7-Feb-24	0.0	0.0	22.6
1-Mar-24	0.0	0.0	22.7
12-Apr-24	7.8	0.0	10.5
2-May-24	0.0	0.0	20.5
7-Jun-24	0.0	0.0	20.8
5-Jul-24	0.0	0.0	25.0
2-Aug-24	0.0	0.0	20.7
5-Sep-24	1.7	0.0	17.2
4-Oct-24	5.1	0.0	4.5
1-Nov-24	1.1	0.0	16.6
6-Dec-24	6.7	0.0	1.7



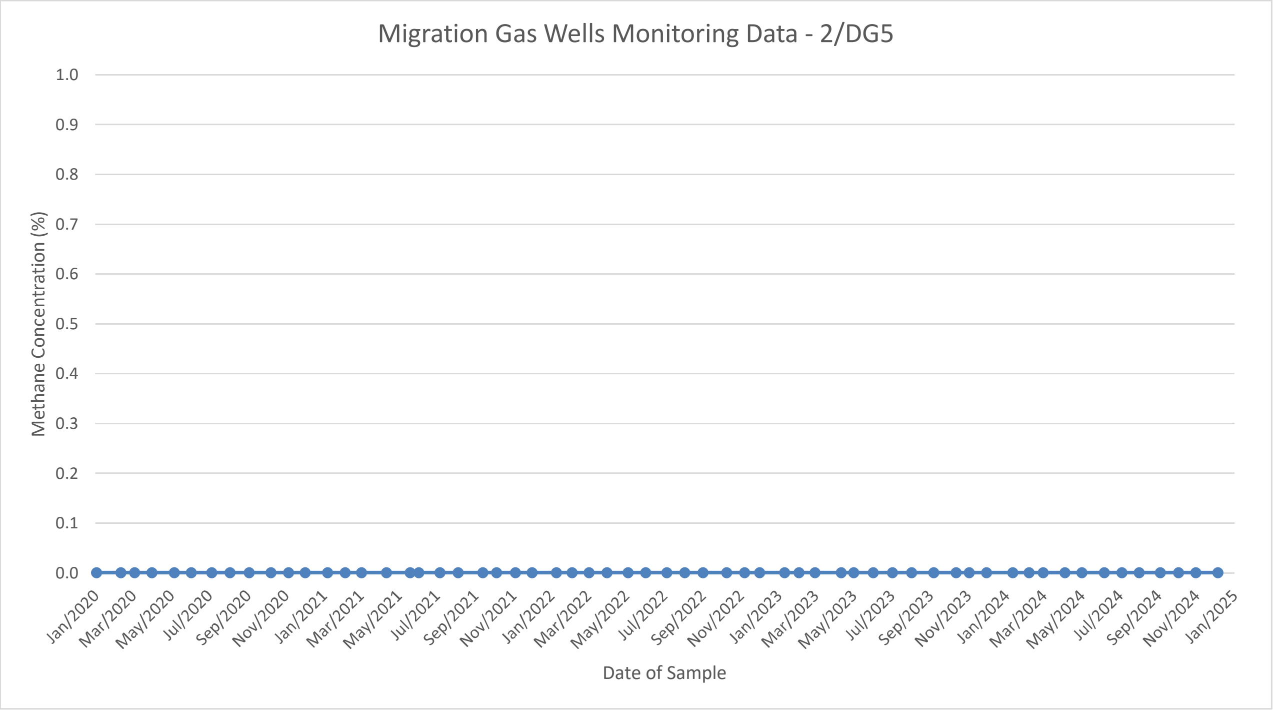
Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/DG4

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
3-Jan-20	2.4	0.0	18.0
5-Feb-20	0.0	0.0	20.7
4-Mar-20	0.8	0.0	19.9
14-Apr-20	1.3	0.0	18.0
7-May-20	0.0	0.0	19.7
3-Jun-20	0.0	0.0	19.3
6-Jul-20	0.0	0.0	19.7
4-Aug-20	2.3	0.0	16.0
4-Sep-20	6.0	0.0	11.8
9-Oct-20	4.9	0.0	14.5
6-Nov-20	2.9	0.0	16.3
17-Dec-20	4.0	0.0	16.6
6-Jan-21	3.2	0.0	16.8
5-Feb-21	0.6	0.0	19.4
3-Mar-21	1.4	0.0	18.0
9-Apr-21	0.1	0.0	20.3
5-May-21	0.9	0.0	19.0
3-Jun-21	0.0	0.0	19.6
7-Jul-21	2.0	0.0	15.3
5-Aug-21	4.9	0.0	13.8
10-Sep-21	4.8	0.0	13.7
6-Oct-21	0.4	0.0	19.5
5-Nov-21	4.3	0.0	15.3
24-Dec-21	6.1	0.0	13.6
7-Jan-22	1.9	0.0	18.6
4-Feb-22	4.9	0.0	15.9
3-Mar-22	1.6	0.0	18.6
22-Apr-22	0.7	0.0	19.7
5-May-22	1.2	0.0	18.0
2-Jun-22	0.0	0.0	21.1
6-Jul-22	0.0	0.0	20.5
4-Aug-22	1.9	0.0	5.1
2-Sep-22	7.4	0.0	7.3
10-Oct-22	4.0	0.0	15.8
28-Nov-22	2.8	0.0	17.9
2-Dec-22	3.5	0.0	15.5
4-Jan-23	3.6	0.0	15.3
3-Feb-23	1.0	0.0	19.0
1-Mar-23	1.1	0.0	19.7
3-Apr-23	2.3	0.0	17.5
2-May-23	0.2	0.0	20.1
2-Jun-23	1.7	0.0	17.9
3-Jul-23	0.6	0.0	19.9
3-Aug-23	4.2	0.0	14.6
7-Sep-23	0.1	0.0	21.8
4-Oct-23	2.2	0.0	18.2
3-Nov-23	0.1	0.0	22.9
1-Dec-23	3.3	0.0	17.7
5-Jan-24	1.1	0.0	19.9
7-Feb-24	3.1	0.0	18.5
1-Mar-24	3.4	0.0	17.8
12-Apr-24	0.5	0.0	19.4
2-May-24	0.1	0.0	20.3
7-Jun-24	0.0	0.0	20.6
5-Jul-24	2.1	0.0	15.8
2-Aug-24	1.8	0.0	15.7
5-Sep-24	3.1	0.0	16.2
4-Oct-24	6.3	0.0	13.5
28-Nov-24	4.8	0.0	15.2
6-Dec-24	3.8	0.0	15.5



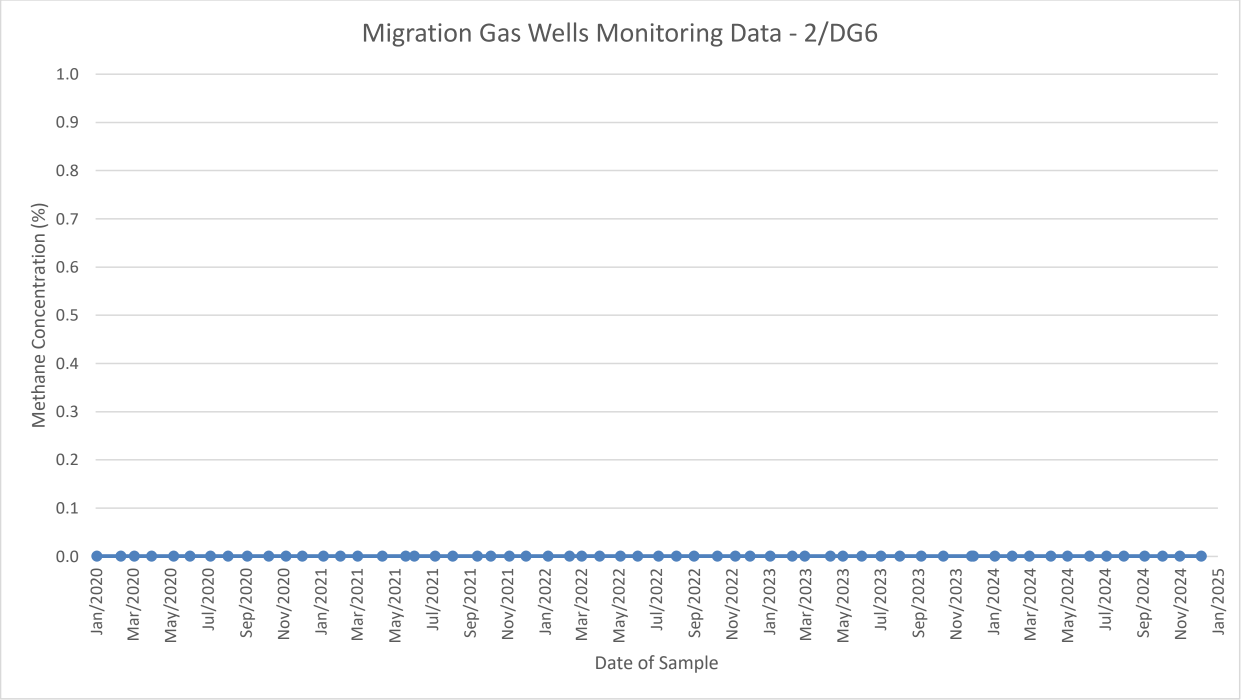
Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/DG5

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
3-Jan-20	0.0	0.0	20.4
11-Feb-20	0.1	0.0	20.7
4-Mar-20	0.0	0.0	21.1
1-Apr-20	0.0	0.0	20.7
7-May-20	0.0	0.0	19.5
3-Jun-20	0.0	0.0	19.1
6-Jul-20	0.2	0.0	18.0
4-Aug-20	0.0	0.0	20.6
4-Sep-20	0.0	0.0	19.9
9-Oct-20	0.0	0.0	19.8
6-Nov-20	0.0	0.0	19.5
3-Dec-20	0.0	0.0	20.3
8-Jan-21	0.0	0.0	20.8
5-Feb-21	0.0	0.0	20.0
3-Mar-21	0.0	0.0	19.9
12-Apr-21	0.0	0.0	19.1
20-May-21	0.0	0.0	21.6
3-Jun-21	0.0	0.0	19.4
7-Jul-21	0.0	0.0	18.2
5-Aug-21	0.1	0.0	20.4
14-Sep-21	0.0	0.0	21.0
6-Oct-21	0.0	0.0	20.4
5-Nov-21	0.0	0.0	20.4
2-Dec-21	0.0	0.0	20.3
10-Jan-22	0.0	0.0	20.6
4-Feb-22	0.0	0.0	21.0
3-Mar-22	0.0	0.0	20.7
1-Apr-22	0.0	0.0	20.7
5-May-22	0.0	0.0	20.1
2-Jun-22	0.1	0.0	20.3
6-Jul-22	0.0	0.0	20.3
4-Aug-22	0.0	0.0	21.4
2-Sep-22	0.0	0.0	21.0
10-Oct-22	0.1	0.0	20.8
8-Nov-22	0.0	0.0	20.7
2-Dec-22	0.0	0.0	21.3
11-Jan-23	0.0	0.0	21.0
3-Feb-23	0.0	0.0	21.0
1-Mar-23	0.1	0.0	20.7
12-Apr-23	0.1	0.0	20.4
2-May-23	0.0	0.0	20.1
2-Jun-23	0.0	0.0	20.3
3-Jul-23	0.0	0.0	21.1
3-Aug-23	0.2	0.0	19.3
7-Sep-23	0.0	0.0	21.7
13-Oct-23	0.1	0.0	21.4
3-Nov-23	0.4	0.0	22.1
1-Dec-23	0.3	0.0	21.5
12-Jan-24	0.1	0.0	21.5
7-Feb-24	2.7	0.0	18.9
1-Mar-24	1.2	0.0	18.4
5-Apr-24	0.0	0.0	22.3
2-May-24	0.0	0.0	20.8
7-Jun-24	0.0	0.0	20.7
5-Jul-24	0.0	0.0	26.2
2-Aug-24	0.2	0.0	19.7
5-Sep-24	0.8	0.0	18.3
4-Oct-24	0.0	0.0	20.2
1-Nov-24	0.1	0.0	20.0
6-Dec-24	0.1	0.0	20.4



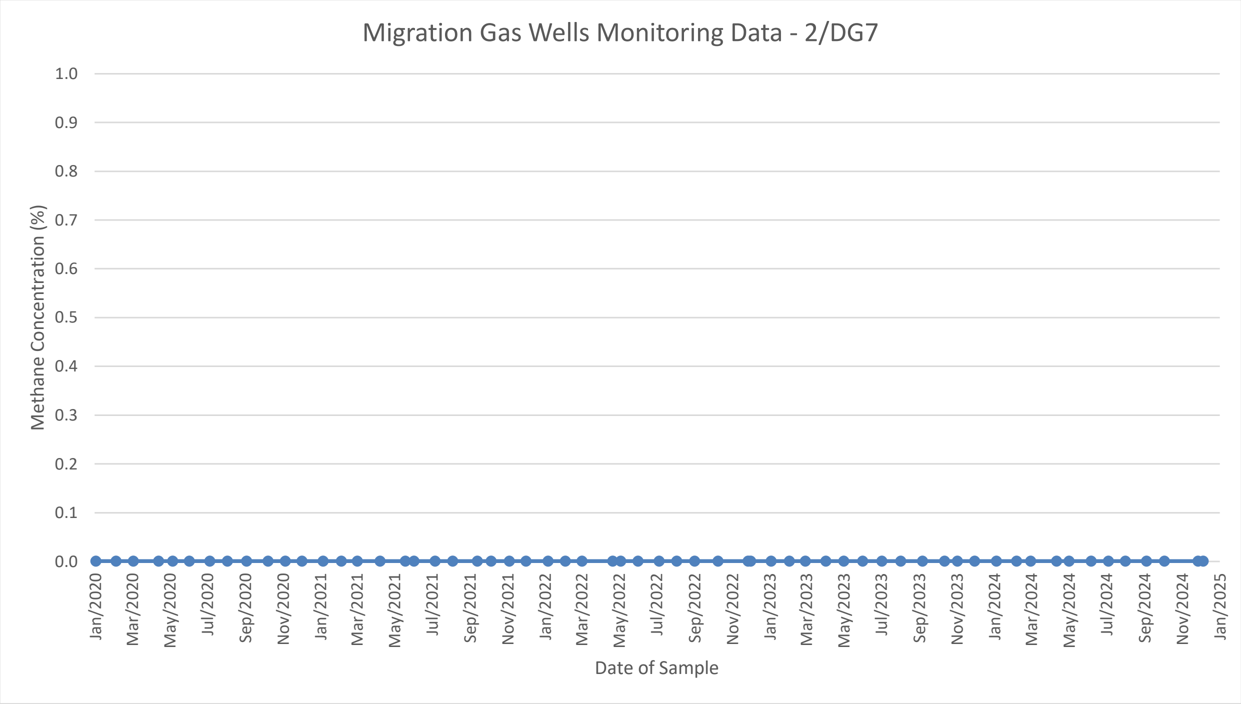
Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/DG6

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
3-Jan-20	0.8	0.0	19.7
11-Feb-20	0.6	0.0	20.1
4-Mar-20	0.6	0.0	20.3
1-Apr-20	0.6	0.0	19.9
7-May-20	0.5	0.0	19.1
3-Jun-20	0.0	0.0	19.2
6-Jul-20	0.0	0.0	19.5
4-Aug-20	0.8	0.0	18.9
4-Sep-20	1.2	0.0	17.5
9-Oct-20	1.0	0.0	18.9
6-Nov-20	0.8	0.0	17.7
3-Dec-20	0.8	0.0	19.5
6-Jan-21	0.6	0.0	20.2
3-Feb-21	0.7	0.0	20.1
3-Mar-21	6.5	0.0	19.2
12-Apr-21	0.8	0.0	18.7
20-May-21	0.0	0.0	21.1
3-Jun-21	0.5	0.0	18.8
7-Jul-21	0.7	0.0	16.9
5-Aug-21	1.1	0.0	19.1
14-Sep-21	2.0	0.0	19.5
6-Oct-21	0.7	0.0	19.3
5-Nov-21	0.9	0.0	19.2
2-Dec-21	0.7	0.0	19.7
7-Jan-22	0.8	0.0	19.3
11-Feb-22	0.8	0.0	19.6
3-Mar-22	0.5	0.0	19.9
1-Apr-22	0.5	0.0	19.9
5-May-22	0.6	0.0	19.0
2-Jun-22	0.0	0.0	20.8
6-Jul-22	0.1	0.0	20.2
4-Aug-22	0.4	0.0	20.4
2-Sep-22	0.0	0.0	21.0
10-Oct-22	1.1	0.0	19.6
8-Nov-22	0.8	0.0	20.8
2-Dec-22	0.0	0.0	21.2
4-Jan-23	0.2	0.0	21.8
9-Feb-23	0.3	0.0	20.2
1-Mar-23	0.1	0.0	20.8
12-Apr-23	0.8	0.0	20.0
2-May-23	0.1	0.0	20.1
2-Jun-23	1.0	0.0	19.1
3-Jul-23	1.6	0.0	18.7
3-Aug-23	1.6	0.0	17.8
7-Sep-23	0.3	0.0	21.7
13-Oct-23	1.1	0.0	20.2
28-Nov-23	0.6	0.0	20.0
1-Dec-23	0.6	0.0	21.3
5-Jan-24	0.8	0.0	19.9
2-Feb-24	0.0	0.0	22.2
1-Mar-24	0.7	0.0	19.7
5-Apr-24	0.3	0.0	21.9
2-May-24	0.5	0.0	19.4
7-Jun-24	0.1	0.0	20.3
5-Jul-24	0.4	0.0	19.5
2-Aug-24	0.6	0.0	18.1
5-Sep-24	1.2	0.0	17.9
4-Oct-24	2.2	0.0	18.1
1-Nov-24	1.2	0.0	19.3
6-Dec-24	1.2	0.0	18.7



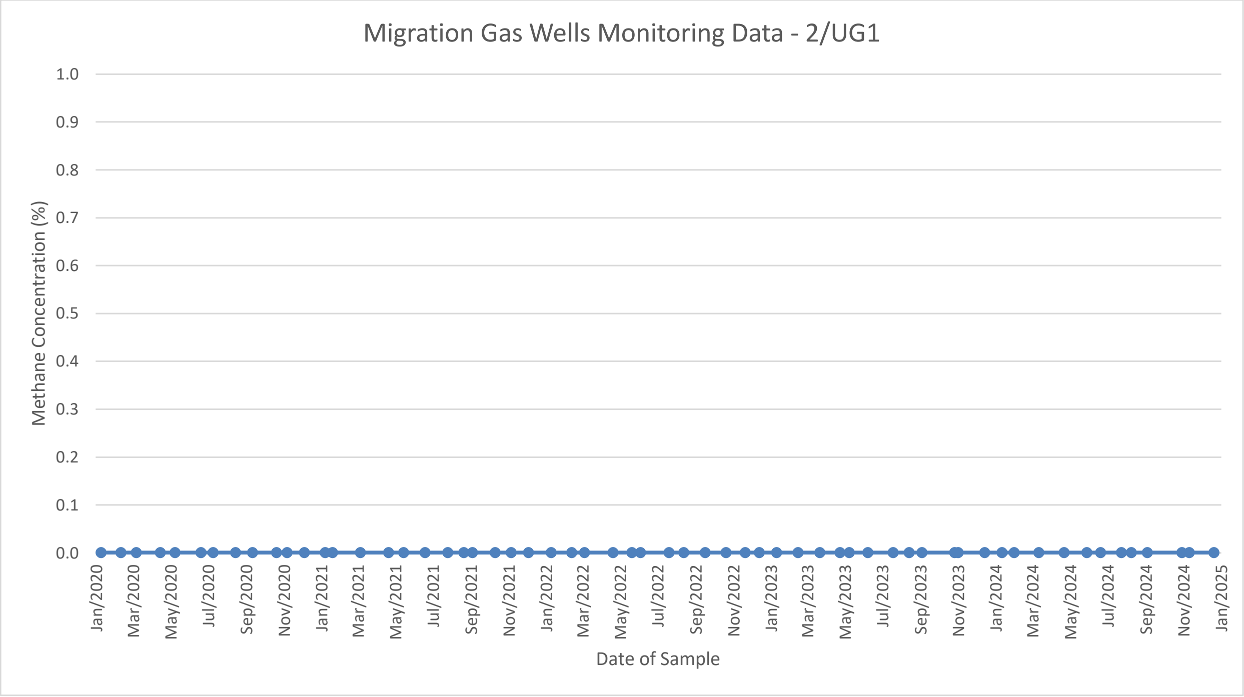
Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/DG7

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
3-Jan-20	1.7	0.0	19.2
5-Feb-20	0.2	0.0	20.8
4-Mar-20	1.1	0.0	20.1
14-Apr-20	1.1	0.0	19.3
7-May-20	2.8	0.0	11.3
3-Jun-20	0.7	0.0	18.4
6-Jul-20	0.8	0.0	18.2
4-Aug-20	1.0	0.0	19.3
4-Sep-20	2.4	0.0	15.6
9-Oct-20	3.0	0.0	17.3
6-Nov-20	2.1	0.0	16.5
3-Dec-20	0.3	0.0	19.8
6-Jan-21	0.2	0.0	20.7
5-Feb-21	1.6	0.0	16.5
3-Mar-21	1.5	0.0	16.2
9-Apr-21	0.9	0.0	18.8
20-May-21	0.6	0.0	20.4
3-Jun-21	3.1	0.0	10.8
7-Jul-21	0.2	0.0	18.1
5-Aug-21	5.5	0.0	5.0
14-Sep-21	2.2	0.0	18.5
6-Oct-21	0.2	0.0	20.4
5-Nov-21	0.0	0.0	20.0
2-Dec-21	1.6	0.0	19.0
7-Jan-22	1.4	0.0	17.5
4-Feb-22	1.0	0.0	19.2
3-Mar-22	0.1	0.0	20.6
22-Apr-22	0.0	0.0	20.4
5-May-22	0.2	0.0	19.6
2-Jun-22	0.4	0.0	19.7
6-Jul-22	0.2	0.0	20.0
4-Aug-22	2.2	0.0	16.4
2-Sep-22	4.8	0.0	5.0
10-Oct-22	2.0	0.0	19.7
28-Nov-22	2.2	0.0	18.6
2-Dec-22	0.3	0.0	20.0
4-Jan-23	0.4	0.0	20.9
3-Feb-23	0.1	0.0	20.1
1-Mar-23	0.2	0.0	20.5
3-Apr-23	0.1	0.0	21.0
2-May-23	0.0	0.0	20.1
2-Jun-23	1.1	0.0	18.0
3-Jul-23	1.3	0.0	18.0
3-Aug-23	1.5	0.0	17.8
7-Sep-23	0.4	0.0	21.3
13-Oct-23	0.2	0.0	20.9
3-Nov-23	0.3	0.0	22.6
1-Dec-23	0.1	0.0	21.7
5-Jan-24	0.2	0.0	20.4
7-Feb-24	0.4	0.0	19.7
1-Mar-24	0.0	0.0	22.6
12-Apr-24	0.6	0.0	19.5
2-May-24	0.0	0.0	20.4
7-Jun-24	0.0	0.0	20.5
5-Jul-24	0.8	0.0	17.4
2-Aug-24	1.0	0.0	16.9
5-Sep-24	2.5	0.0	17.1
4-Oct-24	4.4	0.0	15.1
28-Nov-24	2.2	0.0	15.0
6-Dec-24	3.6	0.0	12.6



Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/UG1

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
10-Jan-20	2.1	0.0	18.7
11-Feb-20	0.2	0.0	20.7
7-Mar-20	0.5	0.0	19.9
15-Apr-20	1.2	0.0	19.4
9-May-20	1.9	0.0	18.4
20-Jun-20	2.2	0.0	18.0
10-Jul-20	0.4	0.0	19.8
15-Aug-20	0.6	0.0	19.5
12-Sep-20	1.6	0.0	17.8
21-Oct-20	0.2	0.0	19.8
7-Nov-20	0.3	0.0	19.5
5-Dec-20	0.3	0.0	20.0
8-Jan-21	0.2	0.0	20.5
20-Jan-21	0.2	0.0	20.2
6-Mar-21	0.4	0.0	19.9
21-Apr-21	0.6	0.0	19.6
15-May-21	1.0	0.0	20.2
19-Jun-21	0.4	0.0	19.9
26-Jul-21	0.3	0.0	19.7
21-Aug-21	0.4	0.0	18.8
4-Sep-21	1.1	0.0	18.6
11-Oct-21	0.1	0.0	20.2
6-Nov-21	0.3	0.0	20.4
4-Dec-21	0.1	0.0	20.7
10-Jan-22	0.9	0.0	20.0
12-Feb-22	1.2	0.0	19.1
5-Mar-22	1.9	0.0	18.3
20-Apr-22	0.3	0.0	20.7
21-May-22	0.4	0.0	20.0
4-Jun-22	0.2	0.0	20.1
20-Jul-22	0.5	0.0	20.5
13-Aug-22	0.4	0.0	20.5
17-Sep-22	0.3	0.0	20.0
21-Oct-22	0.0	0.0	19.8
21-Nov-22	0.2	0.0	20.3
14-Dec-22	0.1	0.0	22.3
11-Jan-23	0.2	0.0	21.7
15-Feb-23	0.4	0.0	19.7
22-Mar-23	0.6	0.0	19.7
24-Apr-23	1.3	0.0	19.3
9-May-23	0.9	0.0	19.0
8-Jun-23	1.4	0.0	18.2
19-Jul-23	1.2	0.0	18.9
14-Aug-23	0.7	0.0	19.1
4-Sep-23	0.5	0.0	20.3
27-Oct-23	0.4	0.0	21.9
2-Nov-23	0.2	0.0	22.9
15-Dec-23	0.0	0.0	21.7
12-Jan-24	0.1	0.0	21.3
1-Feb-24	0.3	0.0	19.9
12-Mar-24	0.4	0.0	19.6
22-Apr-24	0.2	0.0	20.4
29-May-24	0.5	0.0	18.4
20-Jun-24	0.8	0.0	17.2
24-Jul-24	1.1	0.0	16.9
9-Aug-24	0.9	0.0	17.1
4-Sep-24	1.1	0.0	17.7
30-Oct-24	0.1	0.0	20.3
11-Nov-24	0.1	0.0	20.2
21-Dec-24	0.2	0.0	19.7



Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/UG2

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
10-Jan-20	0.4	0.0	20.1
11-Feb-20	0.1	0.0	20.1
7-Mar-20	0.2	0.0	20.5
15-Apr-20	1.4	0.0	19.0
9-May-20	0.8	0.0	19.2
20-Jun-20	1.5	0.0	18.3
10-Jul-20	0.5	0.0	19.4
15-Aug-20	0.2	0.0	20.2
12-Sep-20	0.4	0.0	20.0
21-Oct-20	0.7	0.0	19.3
7-Nov-20	1.4	0.0	19.1
5-Dec-20	0.8	0.0	19.8
25-Jan-21	0.5	0.0	19.8
3-Feb-21	0.8	0.0	20.1
6-Mar-21	0.8	0.0	19.5
21-Apr-21	0.0	0.0	19.8
15-May-21	0.0	0.0	21.1
19-Jun-21	0.1	0.0	20.6
26-Jul-21	0.5	0.0	18.9
21-Aug-21	0.5	0.0	19.1
4-Sep-21	1.2	0.0	19.0
11-Oct-21	0.2	0.0	20.6
6-Nov-21	0.7	0.0	20.1
4-Dec-21	0.0	0.0	21.0
19-Jan-22	0.9	0.0	20.3
11-Feb-22	0.6	0.0	20.0
5-Mar-22	0.4	0.0	20.1
20-Apr-22	0.8	0.0	19.9
21-May-22	1.9	0.0	17.7
4-Jun-22	2.2	0.0	17.3
20-Jul-22	1.2	0.0	19.1
13-Aug-22	1.7	0.0	18.4
17-Sep-22	0.9	0.0	19.8
21-Oct-22	0.6	0.0	19.0
21-Nov-22	0.5	0.0	19.7
14-Dec-22	0.3	0.0	22.1
27-Jan-23	0.1	0.0	20.9
9-Feb-23	0.1	0.0	20.5
22-Mar-23	0.2	0.0	20.0
24-Apr-23	0.9	0.0	19.9
9-May-23	0.7	0.0	19.3
8-Jun-23	0.8	0.0	19.6
19-Jul-23	0.0	0.0	21.4
14-Aug-23	1.1	0.0	17.7
4-Sep-23	1.3	0.0	18.4
27-Oct-23	0.4	0.0	22.2
2-Nov-23	0.3	0.0	22.7
15-Dec-23	0.1	0.0	21.4
10-Jan-24	0.1	0.0	21.9
2-Feb-24	0.0	0.0	22.2
12-Mar-24	0.3	0.0	20.1
22-Apr-24	0.4	0.0	20.0
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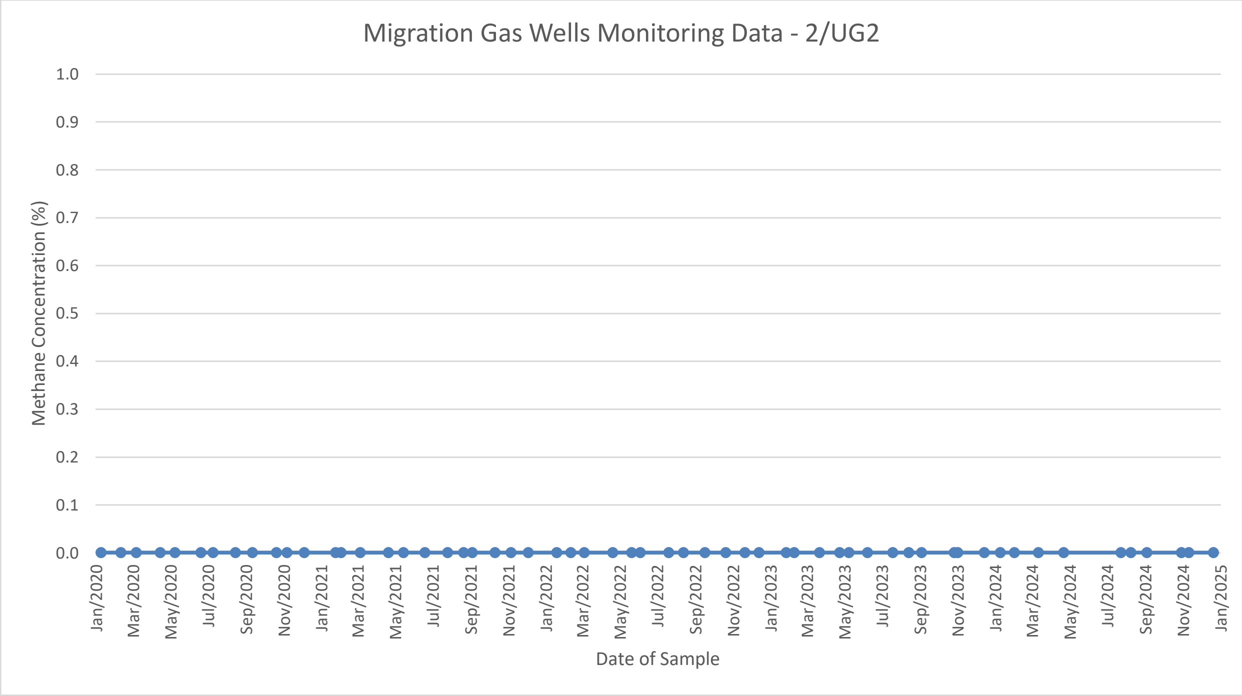
24-Jul-24	0.0	0.0	23.7
9-Aug-24	1.2	0.0	16.2
4-Sep-24	1.3	0.0	17.4
30-Oct-24	0.1	0.0	20.4
11-Nov-24	0.0	0.0	20.6
21-Dec-24	0.1	0.0	21.0



The steel stairs under maintenance.
The steel stairs under maintenance.

Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/UG3

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
6-Jan-20	0.3	0.0	20.0
1-Feb-20	0.4	0.0	20.2
14-Mar-20	0.2	0.0	20.4
3-Apr-20	0.4	0.0	20.2
16-May-20	0.5	0.0	20.0
13-Jun-20	0.3	0.0	20.2
17-Jul-20	0.5	0.0	19.2
22-Aug-20	0.8	0.0	19.5
19-Sep-20	0.2	0.0	20.1
12-Oct-20	0.2	0.0	20.1
14-Nov-20	0.1	0.0	20.0
15-Dec-20	0.3	0.0	21.1
15-Jan-21	0.2	0.0	20.2
27-Jan-21	0.4	0.0	20.0
13-Mar-21	0.2	0.0	20.0
7-Apr-21	0.2	0.0	20.0
22-May-21	0.5	0.0	20.8
17-Jun-21	0.8	0.0	19.9
7-Jul-21	0.3	0.0	18.5
14-Aug-21	0.8	0.0	18.3
11-Sep-21	0.8	0.0	19.1
27-Oct-21	0.4	0.0	20.3
20-Nov-21	0.2	0.0	20.8
24-Dec-21	0.2	0.0	20.9
12-Jan-22	0.4	0.0	20.9
16-Feb-22	0.2	0.0	20.0
12-Mar-22	0.2	0.0	20.6
13-Apr-22	0.3	0.0	20.2
28-May-22	0.2	0.0	20.3
18-Jun-22	0.3	0.0	20.4
20-Jul-22	0.4	0.0	20.1
26-Aug-22	0.2	0.0	20.7
10-Sep-22	0.2	0.0	20.7
19-Oct-22	0.3	0.0	20.1
21-Nov-22	0.1	0.0	21.3
15-Dec-22	0.7	0.0	21.5
11-Jan-23	0.0	0.0	20.8
15-Feb-23	0.1	0.0	20.3
21-Mar-23	0.1	0.0	20.1
17-Apr-23	0.7	0.0	20.1
10-May-23	0.8	0.0	19.3
7-Jun-23	1.1	0.0	18.4
24-Jul-23	0.8	0.0	18.8
3-Aug-23	0.4	0.0	20.6
5-Sep-23	0.3	0.0	20.5
25-Oct-23	1.1	0.0	20.9
3-Nov-23	0.3	0.0	22.9
6-Dec-23	0.2	0.0	21.6
10-Jan-24	0.0	0.0	22.6
1-Feb-24	0.0	0.0	20.5
12-Mar-24	0.0	0.0	21.2
10-Apr-24	0.3	0.0	21.7
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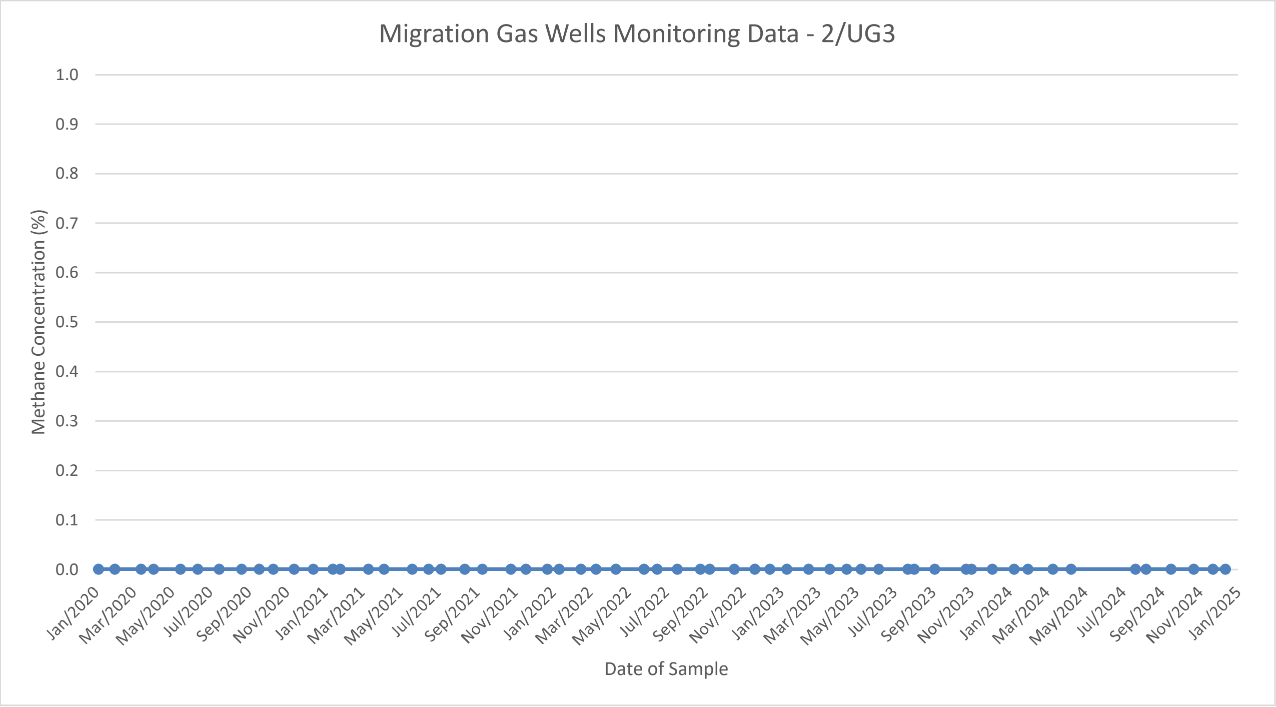
22-Jul-24	0.7	0.0	18.9
8-Aug-24	0.2	0.0	19.7
17-Sep-24	0.5	0.0	18.7
23-Oct-24	1.1	0.0	14.2
23-Nov-24	0.9	0.0	19.3
13-Dec-24	0.3	0.0	22.2

The steel stairs under maintenance.

The steel stairs under maintenance.



Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/UG4

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
6-Jan-20	0.0	0.0	20.3
1-Feb-20	0.5	0.0	20.0
14-Mar-20	0.0	0.0	20.3
3-Apr-20	0.3	0.0	20.2
16-May-20	0.4	0.0	19.9
13-Jun-20	0.8	0.0	19.4
17-Jul-20	0.2	0.0	19.5
22-Aug-20	0.3	0.0	20.0
19-Sep-20	1.3	0.0	18.7
12-Oct-20	0.2	0.0	19.7
14-Nov-20	0.4	0.0	19.7
15-Dec-20	0.3	0.0	21.0
15-Jan-21	0.0	0.0	20.4
27-Jan-21	0.0	0.0	20.5
13-Mar-21	0.3	0.0	19.7
7-Apr-21	0.2	0.0	19.6
22-May-21	0.4	0.0	20.7
17-Jun-21	0.4	0.0	20.0
7-Jul-21	0.0	0.0	19.4
14-Aug-21	0.2	0.0	20.0
11-Sep-21	0.5	0.0	18.9
27-Oct-21	0.0	0.0	20.4
20-Nov-21	0.0	0.0	20.7
24-Dec-21	0.6	0.0	20.3
12-Jan-22	0.6	0.0	20.8
16-Feb-22	0.8	0.0	20.3
12-Mar-22	1.1	0.0	19.0
13-Apr-22	0.2	0.0	19.8
28-May-22	0.2	0.0	20.0
18-Jun-22	0.4	0.0	19.6
20-Jul-22	0.0	0.0	20.8
26-Aug-22	0.2	0.0	20.5
10-Sep-22	0.0	0.0	20.7
19-Oct-22	0.0	0.0	20.7
21-Nov-22	0.2	0.0	21.5
15-Dec-22	0.2	0.0	22.2
11-Jan-23	0.1	0.0	20.5
15-Feb-23	0.2	0.0	20.0
21-Mar-23	0.3	0.0	19.8
17-Apr-23	0.6	0.0	19.9
10-May-23	0.5	0.0	19.5
7-Jun-23	0.7	0.0	19.6
24-Jul-23	0.1	0.0	20.5
3-Aug-23	0.5	0.0	20.4
5-Sep-23	0.0	0.0	21.6
25-Oct-23	0.0	0.0	22.2
3-Nov-23	0.0	0.0	23.4
6-Dec-23	0.0	0.0	21.8
10-Jan-24	0.0	0.0	22.9
1-Feb-24	0.1	0.0	20.1
12-Mar-24	0.2	0.0	20.0
10-Apr-24	0.1	0.0	21.8
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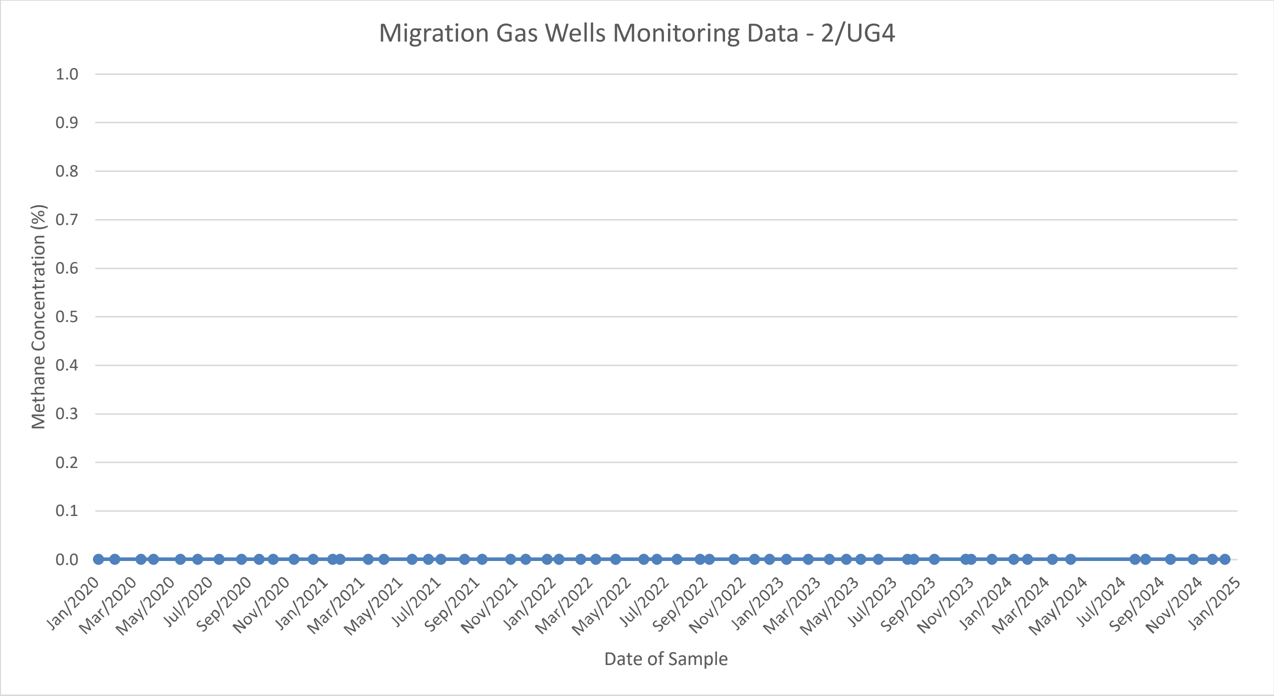
22-Jul-24	0.3	0.0	20.7
8-Aug-24	0.4	0.0	19.2
17-Sep-24	0.3	0.0	19.1
23-Oct-24	0.7	0.0	13.8
23-Nov-24	0.6	0.0	14.8
13-Dec-24	0.1	0.0	22.8



The steel stairs under maintenance.
The steel stairs under maintenance.

Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/UG5

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
17-Jan-20	0.3	0.0	20.3
15-Feb-20	0.3	0.0	20.2
24-Mar-20	0.7	0.0	20.0
20-Apr-20	0.2	0.0	19.6
23-May-20	0.3	0.0	20.0
11-Jun-20	0.1	0.0	19.4
8-Jul-20	0.2	0.0	20.0
22-Aug-20	0.3	0.0	20.2
19-Sep-20	0.6	0.0	20.2
19-Oct-20	0.1	0.0	19.9
21-Nov-20	0.0	0.0	19.8
16-Dec-20	0.0	0.0	20.5
18-Jan-21	1.0	0.0	19.7
20-Jan-21	1.3	0.0	19.0
27-Mar-21	1.8	0.0	18.0
16-Apr-21	0.0	0.0	19.9
22-May-21	0.0	0.0	21.5
18-Jun-21	0.1	0.0	20.3
23-Jul-21	0.1	0.0	19.5
14-Aug-21	0.4	0.0	20.0
4-Sep-21	0.2	0.0	20.4
20-Oct-21	0.2	0.0	20.2
13-Nov-21	0.1	0.0	20.7
11-Dec-21	0.1	0.0	20.8
14-Jan-22	0.6	0.0	20.9
26-Feb-22	0.4	0.0	20.3
12-Mar-22	0.3	0.0	20.2
8-Apr-22	0.2	0.0	19.7
28-May-22	0.5	0.0	20.2
23-Jun-22	0.0	0.0	19.7
11-Jul-22	0.0	0.0	20.8
27-Aug-22	0.0	0.0	20.8
10-Sep-22	0.1	0.0	20.9
3-Oct-22	0.2	0.0	20.7
14-Nov-22	0.3	0.0	20.5
22-Dec-22	0.1	0.0	21.7
27-Jan-23	0.1	0.0	20.9
15-Feb-23	0.2	0.0	20.1
20-Mar-23	0.2	0.0	20.0
12-Apr-23	0.5	0.0	20.1
3-May-23	0.4	0.0	19.9
9-Jun-23	0.8	0.0	19.8
21-Jul-23	0.7	0.0	19.9
3-Aug-23	0.2	0.0	20.8
5-Sep-23	0.4	0.0	20.2
18-Oct-23	0.3	0.0	22.2
2-Nov-23	0.0	0.0	23.1
18-Dec-23	0.2	0.0	22.0
8-Jan-24	0.2	0.0	21.3
1-Feb-24	0.1	0.0	20.2
14-Mar-24	0.1	0.0	20.0
19-Apr-24	0.0	0.0	20.5
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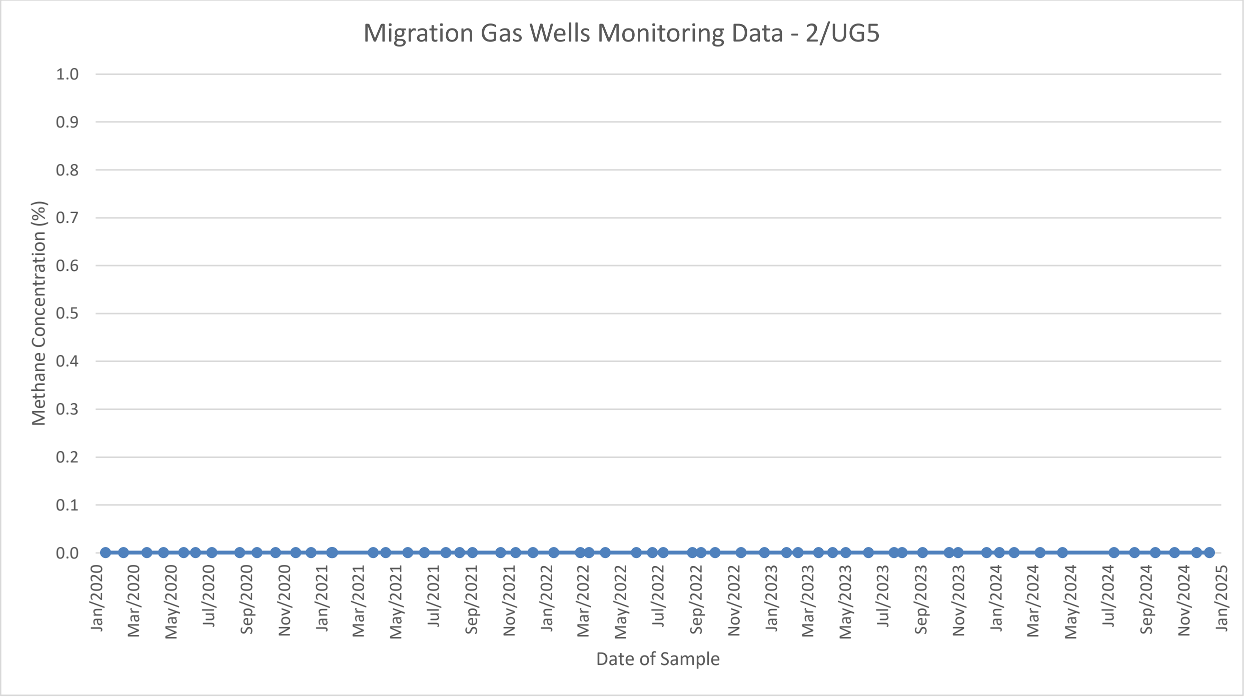
12-Jul-24	0.1	0.0	20.7
14-Aug-24	0.0	0.0	20.1
17-Sep-24	0.2	0.0	19.6
18-Oct-24	0.4	0.0	20.2
23-Nov-24	0.2	0.0	20.1
14-Dec-24	0.1	0.0	20.8

The steel stairs under maintenance.
The steel stairs under maintenance.



Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/UG6

Date of Sample	CO$_2$ (%)	Methane (%)	O$_2$ (%)
17-Jan-20	0.3	0.0	20.3
15-Feb-20	0.2	0.0	20.4
24-Mar-20	0.4	0.0	20.4
20-Apr-20	0.1	0.0	20.6
23-May-20	1.7	0.0	19.2
11-Jun-20	0.4	0.0	19.5
8-Jul-20	0.1	0.0	20.7
15-Aug-20	0.1	0.0	20.6
12-Sep-20	0.4	0.0	20.2
19-Oct-20	0.2	0.0	20.0
14-Nov-20	0.2	0.0	20.3
16-Dec-20	0.4	0.0	20.3
18-Jan-21	0.1	0.0	20.5
20-Jan-21	0.0	0.0	20.6
27-Mar-21	0.0	0.0	20.6
16-Apr-21	0.1	0.0	20.3
15-May-21	0.2	0.0	21.2
18-Jun-21	0.2	0.0	20.4
23-Jul-21	0.2	0.0	19.7
21-Aug-21	0.0	0.0	20.8
11-Sep-21	0.0	0.0	21.0
20-Oct-21	0.4	0.0	20.3
20-Nov-21	0.2	0.0	21.0
11-Dec-21	0.6	0.0	20.3
14-Jan-22	0.6	0.0	20.8
26-Feb-22	0.2	0.0	20.8
26-Mar-22	0.0	0.0	20.4
8-Apr-22	0.3	0.0	20.6
21-May-22	0.2	0.0	20.4
23-Jun-22	0.1	0.0	19.8
11-Jul-22	0.2	0.0	20.7
27-Aug-22	0.5	0.0	20.5
17-Sep-22	0.4	0.0	20.8
3-Oct-22	0.2	0.0	20.8
14-Nov-22	0.3	0.0	20.7
22-Dec-22	0.0	0.0	21.9
9-Jan-23	0.0	0.0	22.5
15-Feb-23	0.1	0.0	20.4
20-Mar-23	0.3	0.0	19.8
12-Apr-23	0.2	0.0	20.4
3-May-23	0.3	0.0	19.9
9-Jun-23	0.2	0.0	20.8
21-Jul-23	0.3	0.0	20.6
4-Aug-23	0.4	0.0	20.5
5-Sep-23	0.6	0.0	19.9
18-Oct-23	0.3	0.0	22.6
2-Nov-23	0.1	0.0	22.7
18-Dec-23	0.0	0.0	22.3
8-Jan-24	0.2	0.0	21.3
1-Feb-24	0.1	0.0	20.2
14-Mar-24	0.2	0.0	19.8
19-Apr-24	0.0	0.0	21.1
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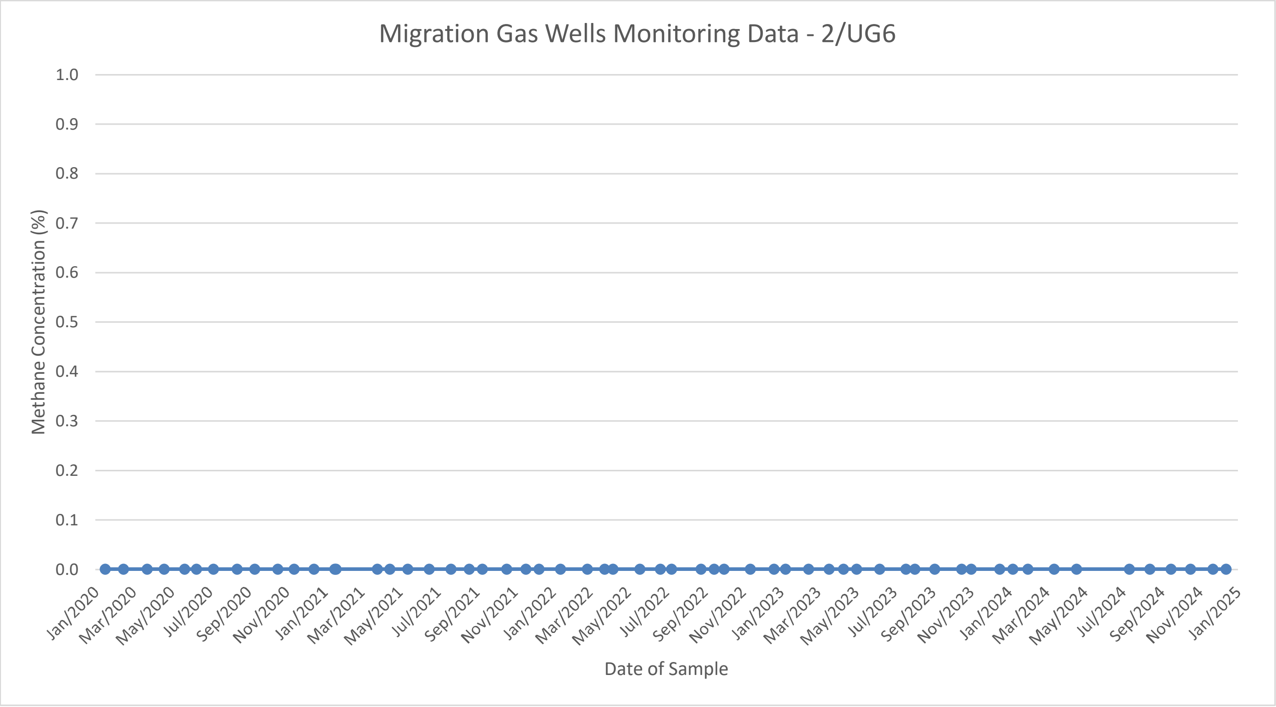
12-Jul-24	0.3	0.0	19.5
14-Aug-24	0.0	0.0	20.6
17-Sep-24	0.1	0.0	19.8
18-Oct-24	0.6	0.0	20.0
23-Nov-24	0.3	0.0	20.1
14-Dec-24	0.3	0.0	19.7



The steel stairs under maintenance.

The steel stairs under maintenance.

Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/UG7

Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
20-Jan-20	0.2	0.0	21.1
8-Feb-20	0.2	0.0	20.3
20-Mar-20	0.6	0.0	19.7
3-Apr-20	0.1	0.0	20.4
2-May-20	0.4	0.0	19.8
11-Jun-20	0.6	0.0	19.8
8-Jul-20	0.2	0.0	19.7
8-Aug-20	0.2	0.0	19.8
26-Sep-20	0.1	0.0	19.9
12-Oct-20	0.2	0.0	19.6
21-Nov-20	0.2	0.0	19.9
12-Dec-20	0.2	0.0	20.0
4-Jan-21	0.0	0.0	21.2
6-Feb-21	0.0	0.0	20.3
20-Mar-21	0.0	0.0	20.4
7-Apr-21	0.1	0.0	20.6
8-May-21	0.1	0.0	20.7
18-Jun-21	0.1	0.0	20.8
23-Jul-21	0.2	0.0	20.1
7-Aug-21	0.0	0.0	20.0
18-Sep-21	0.0	0.0	19.8
6-Oct-21	0.0	0.0	20.8
13-Nov-21	2.7	0.0	17.9
18-Dec-21	0.0	0.0	20.5
5-Jan-22	0.3	0.0	20.1
5-Feb-22	0.4	0.0	19.7
26-Mar-22	0.6	0.0	19.6
6-Apr-22	0.0	0.0	20.6
7-May-22	0.0	0.0	20.1
23-Jun-22	0.0	0.0	20.8
11-Jul-22	0.1	0.0	20.5
20-Aug-22	0.0	0.0	20.8
3-Sep-22	0.1	0.0	20.5
12-Oct-22	0.0	0.0	21.9
15-Nov-22	0.1	0.0	21.7
12-Dec-22	1.1	0.0	20.6
9-Jan-23	0.0	0.0	22.7
14-Feb-23	0.0	0.0	21.1
14-Mar-23	0.0	0.0	20.3
17-Apr-23	0.2	0.0	20.5
19-May-23	0.1	0.0	20.2
9-Jun-23	0.2	0.0	21.2
21-Jul-23	0.2	0.0	20.7
4-Aug-23	0.1	0.0	20.9
4-Sep-23	0.2	0.0	20.7
13-Oct-23	0.3	0.0	21.9
1-Nov-23	0.1	0.0	22.9
18-Dec-23	0.3	0.0	21.1
8-Jan-24	0.3	0.0	21.5
14-Feb-24	0.5	0.0	19.4
14-Mar-24	0.3	0.0	19.6
8-Apr-24	0.0	0.0	21.7
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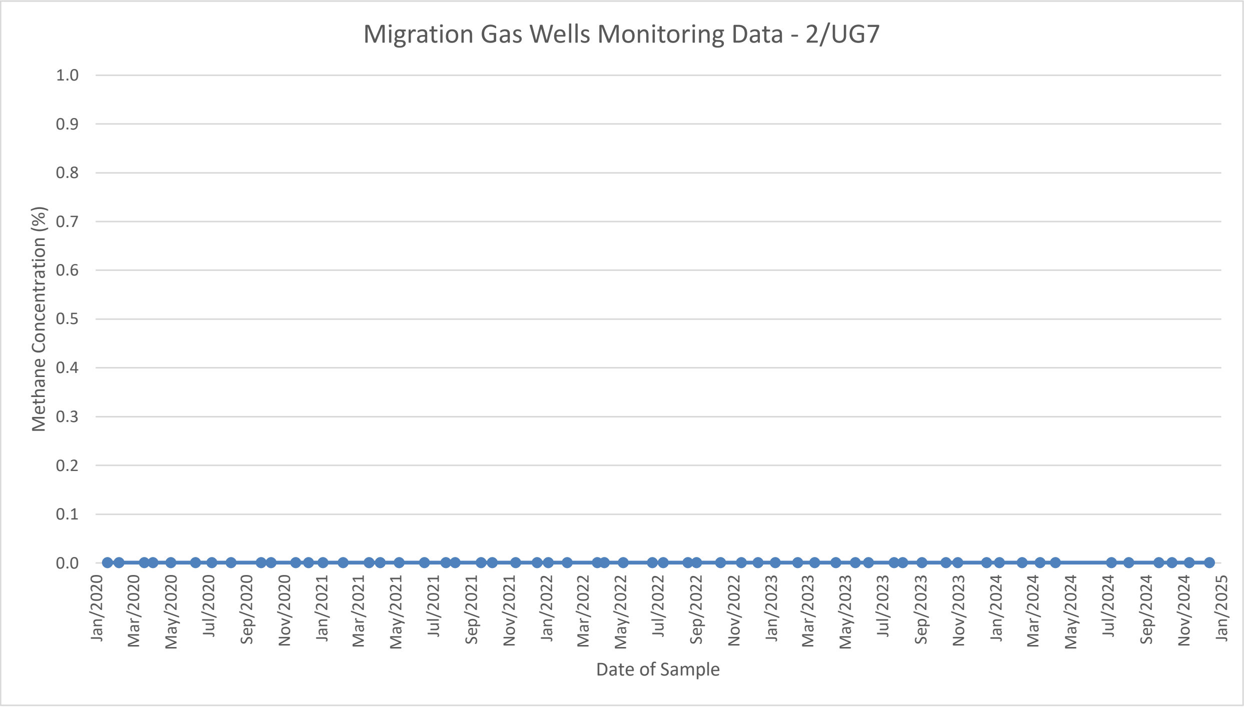
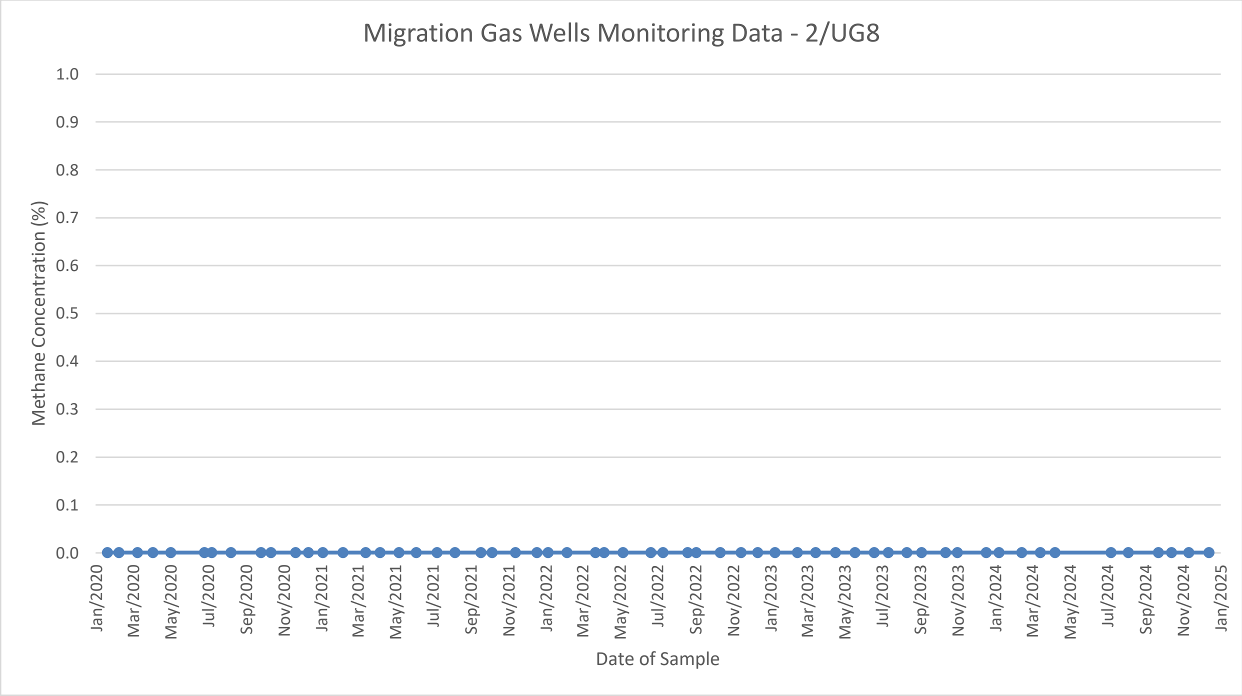
8-Jul-24	0.1	0.0	20.7
5-Aug-24	0.4	0.0	19.7
23-Sep-24	0.7	0.0	18.3
14-Oct-24	0.5	0.0	20.4
11-Nov-24	0.4	0.0	19.3
14-Dec-24	0.5	0.0	19.7



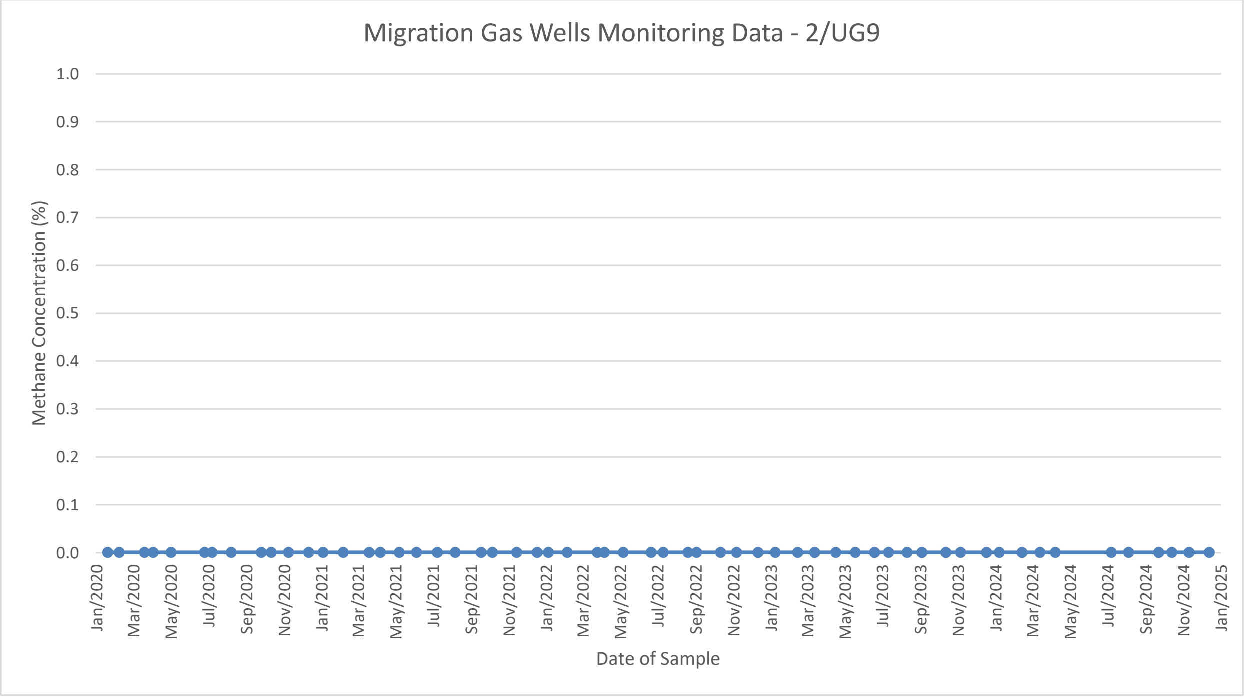
Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/UG8

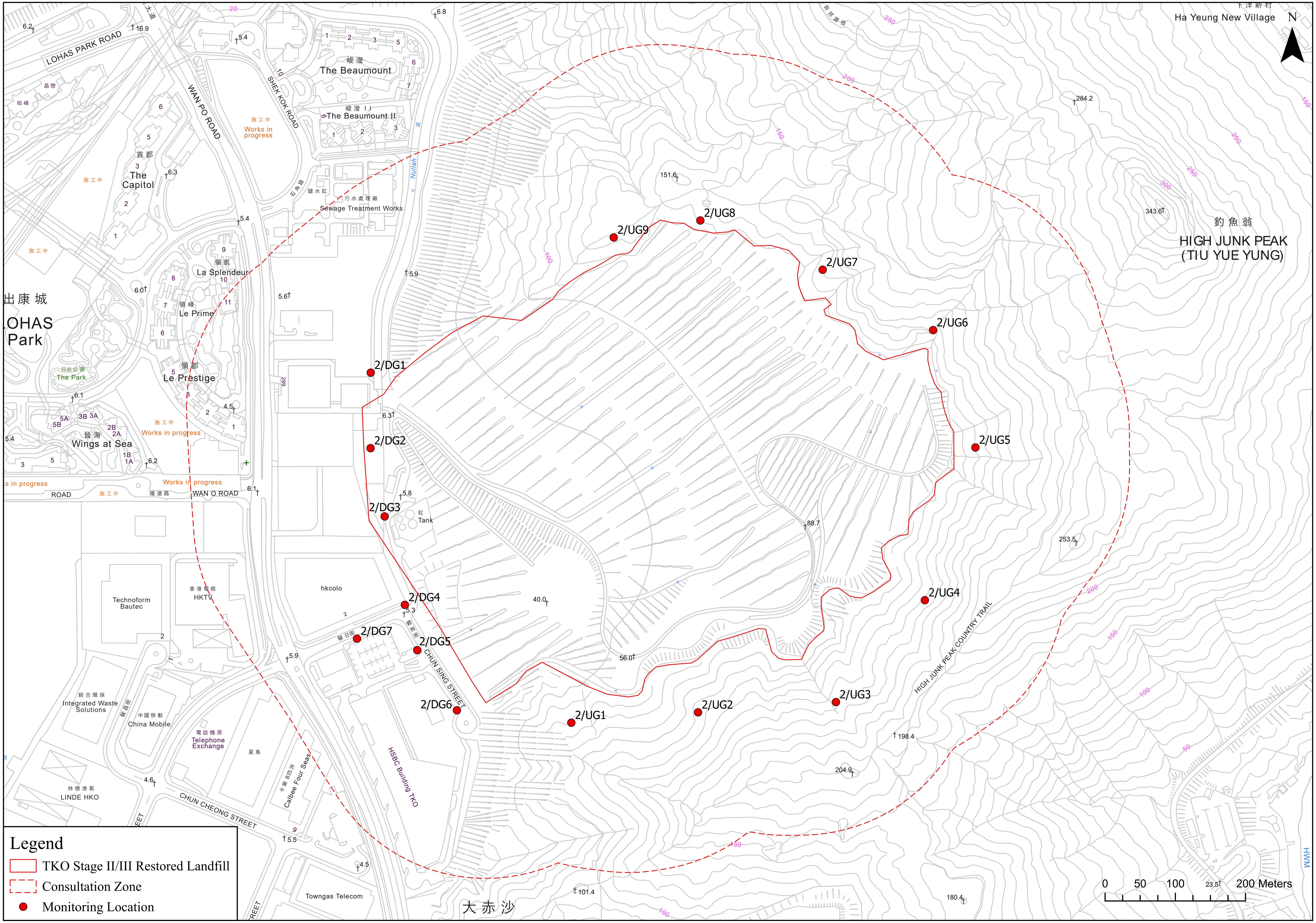
Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
20-Jan-20	0.7	0.0	20.5
8-Feb-20	0.5	0.0	20.1
9-Mar-20	0.4	0.0	20.2
3-Apr-20	0.6	0.0	19.9
2-May-20	0.4	0.0	20.0
26-Jun-20	0.5	0.0	19.7
8-Jul-20	0.4	0.0	19.4
8-Aug-20	0.5	0.0	20.0
26-Sep-20	1.2	0.0	18.0
12-Oct-20	0.6	0.0	19.3
21-Nov-20	0.4	0.0	20.0
12-Dec-20	0.2	0.0	20.2
4-Jan-21	0.2	0.0	21.0
6-Feb-21	0.4	0.0	19.4
15-Mar-21	0.3	0.0	20.1
7-Apr-21	0.2	0.0	20.4
8-May-21	0.4	0.0	20.6
5-Jun-21	0.6	0.0	19.8
9-Jul-21	0.5	0.0	19.4
7-Aug-21	0.6	0.0	19.4
18-Sep-21	1.4	0.0	18.6
6-Oct-21	0.1	0.0	20.7
13-Nov-21	0.4	0.0	20.8
18-Dec-21	0.3	0.0	20.4
5-Jan-22	0.5	0.0	19.8
5-Feb-22	0.4	0.0	19.8
23-Mar-22	0.3	0.0	20.6
6-Apr-22	0.3	0.0	20.0
7-May-22	0.8	0.0	19.7
21-Jun-22	0.5	0.0	20.0
11-Jul-22	0.0	0.0	20.4
20-Aug-22	0.1	0.0	20.8
3-Sep-22	0.4	0.0	20.4
12-Oct-22	0.2	0.0	21.3
15-Nov-22	0.4	0.0	20.4
12-Dec-22	1.4	0.0	20.3
9-Jan-23	0.0	0.0	22.4
14-Feb-23	0.0	0.0	20.9
16-Mar-23	0.4	0.0	20.4
17-Apr-23	0.9	0.0	19.8
19-May-23	0.6	0.0	19.2
19-Jun-23	0.9	0.0	19.7
12-Jul-23	0.7	0.0	20.0
11-Aug-23	0.4	0.0	20.4
4-Sep-23	0.5	0.0	20.4
13-Oct-23	0.6	0.0	21.7
1-Nov-23	0.2	0.0	22.7
18-Dec-23	0.7	0.0	20.8
8-Jan-24	0.3	0.0	20.8
14-Feb-24	0.7	0.0	19.1
15-Mar-24	0.2	0.0	22.2
8-Apr-24	0.2	0.0	21.2
--	--	--	--
--	--	--	--
8-Jul-24	2.0	0.0	17.6
5-Aug-24	0.7	0.0	19.4
23-Sep-24	1.1	0.0	17.6
14-Oct-24	0.3	0.0	20.6
11-Nov-24	0.1	0.0	22.4
14-Dec-24	0.0	0.0	21.1



Restoration of TKO Stage II/III Landfill
Migration Gas Wells Monitoring Data - 2/UG9

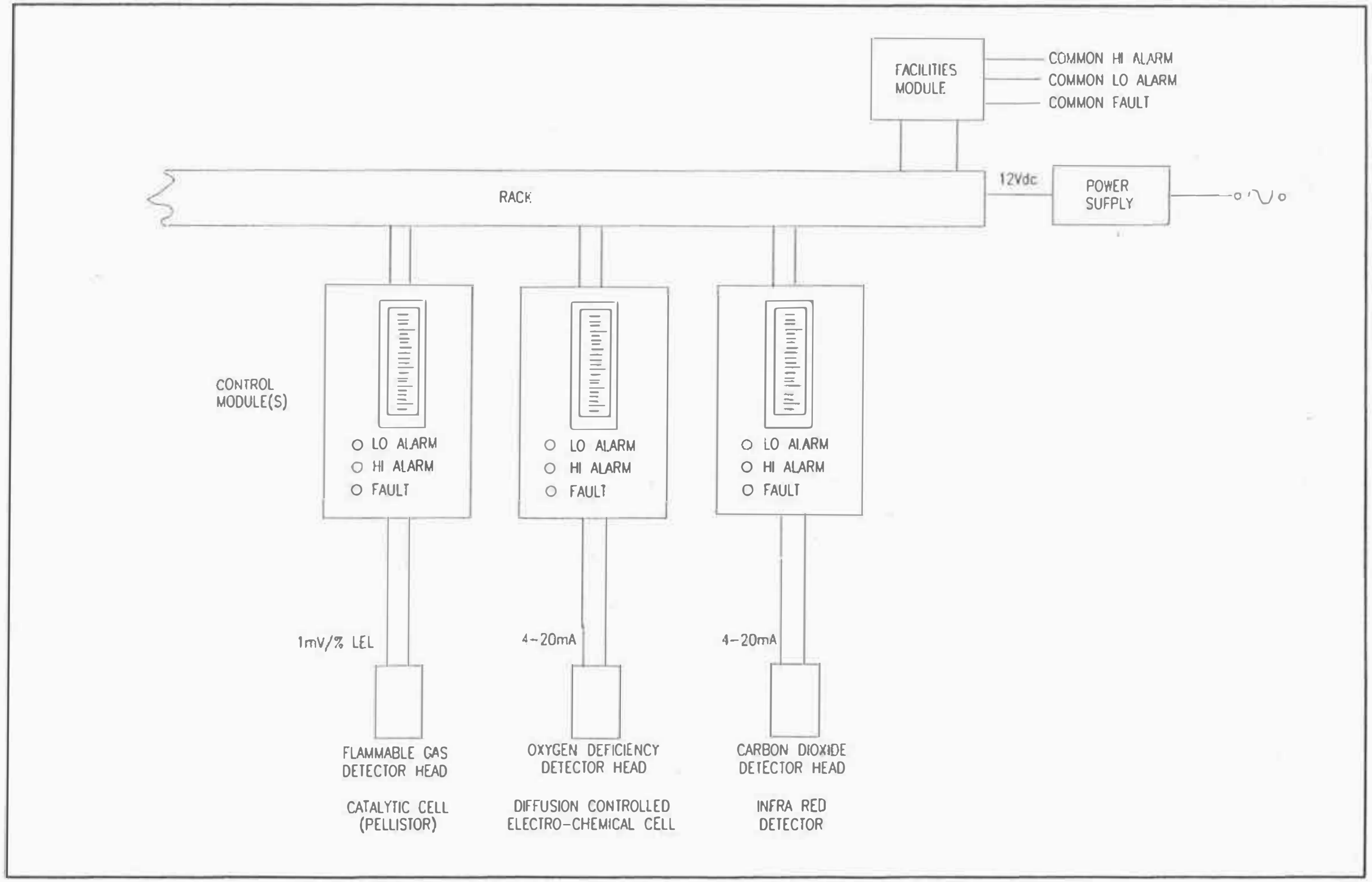
Date of Sample	CO_2 (%)	Methane (%)	O_2 (%)
20-Jan-20	0.7	0.0	20.8
8-Feb-20	1.2	0.0	19.0
20-Mar-20	1.2	0.0	19.3
3-Apr-20	1.6	0.0	18.9
2-May-20	2.1	0.0	17.6
26-Jun-20	1.6	0.0	18.4
8-Jul-20	0.1	0.0	20.7
8-Aug-20	0.4	0.0	20.2
26-Sep-20	0.3	0.0	20.3
12-Oct-20	0.4	0.0	19.8
9-Nov-20	6.9	0.0	13.7
12-Dec-20	2.7	0.0	15.2
4-Jan-21	5.7	0.0	15.8
6-Feb-21	4.8	0.0	15.7
20-Mar-21	4.2	0.0	15.7
7-Apr-21	0.1	0.0	20.4
8-May-21	1.2	0.0	20.0
5-Jun-21	0.8	0.0	19.6
9-Jul-21	0.0	0.0	20.4
7-Aug-21	1.0	0.0	18.7
18-Sep-21	0.9	0.0	19.2
6-Oct-21	5.6	0.0	11.4
15-Nov-21	0.0	0.0	20.7
18-Dec-21	4.2	0.0	13.6
5-Jan-22	6.1	0.0	11.4
5-Feb-22	5.3	0.0	12.6
26-Mar-22	0.4	0.0	20.1
6-Apr-22	0.0	0.0	20.6
7-May-22	1.1	0.0	18.5
21-Jun-22	2.7	0.0	16.7
11-Jul-22	1.0	0.0	19.2
20-Aug-22	2.1	0.0	17.3
3-Sep-22	3.3	0.0	16.9
12-Oct-22	0.0	0.0	22.3
7-Nov-22	0.7	0.0	19.4
12-Dec-22	1.9	0.0	19.7
9-Jan-23	6.8	0.0	8.3
14-Feb-23	4.5	0.0	16.7
14-Mar-23	3.9	0.0	17.1
17-Apr-23	0.1	0.0	20.7
19-May-23	0.9	0.0	19.9
19-Jun-23	1.3	0.0	18.1
12-Jul-23	0.1	0.0	21.1
11-Aug-23	1.1	0.0	18.9
4-Sep-23	2.7	0.0	18.1
13-Oct-23	0.1	0.0	22.5
6-Nov-23	0.0	0.0	23.6
18-Dec-23	1.1	0.0	20.2
8-Jan-24	0.3	0.0	21.3
14-Feb-24	1.3	0.0	18.2
14-Mar-24	0.9	0.0	18.4
8-Apr-24	6.6	0.0	13.1
--	--	--	--
--	--	--	--
8-Jul-24	0.2	0.0	19.3
5-Aug-24	1.3	0.0	18.5
23-Sep-24	1.9	0.0	16.9
14-Oct-24	0.8	0.0	17.4
11-Nov-24	0.0	0.0	23.5
14-Dec-24	1.4	0.0	19.3




Legend
TKO Stage II/III Restored Landfill
Consultation Zone
Monitoring Location
N
0 50 100 200 Meters
2/DG1
2/DG2
2/DG3
2/DG4
2/DG5
2/DG6
2/DG7
2/UG1
2/UG2
2/UG3
2/UG4
2/UG5
2/UG6
2/UG7
2/UG8
2/UG9
HIGH JUNK PEAK (TIU YUE YUNG)
釣 魚 翁
Ha Yeung New Village
HIGH JUNK PEAK COUNTRY TRAIL
LOHAS PARK ROAD
WAN PO ROAD
SHEK KOK ROAD
WAN O ROAD
CHUN SING STREET
CHUN CHEONG STREET
LOHAS Park
The Beaumount
The Beaumount II
The Capitol
La Splendeur
Le Prime
Le Prestige
Wings at Sea
The Park
Sewage Treatment Works
Nullah
Tank
hkcolo
HKTV
Technoform Bautec
Integrated Waste Solutions
China Mobile
Telephone Exchange
LINDE HKO
Calbee Four Seas
HSBC Building TKO
Towngas Telecom
Works in progress
大 赤 沙

Appendix 10.2

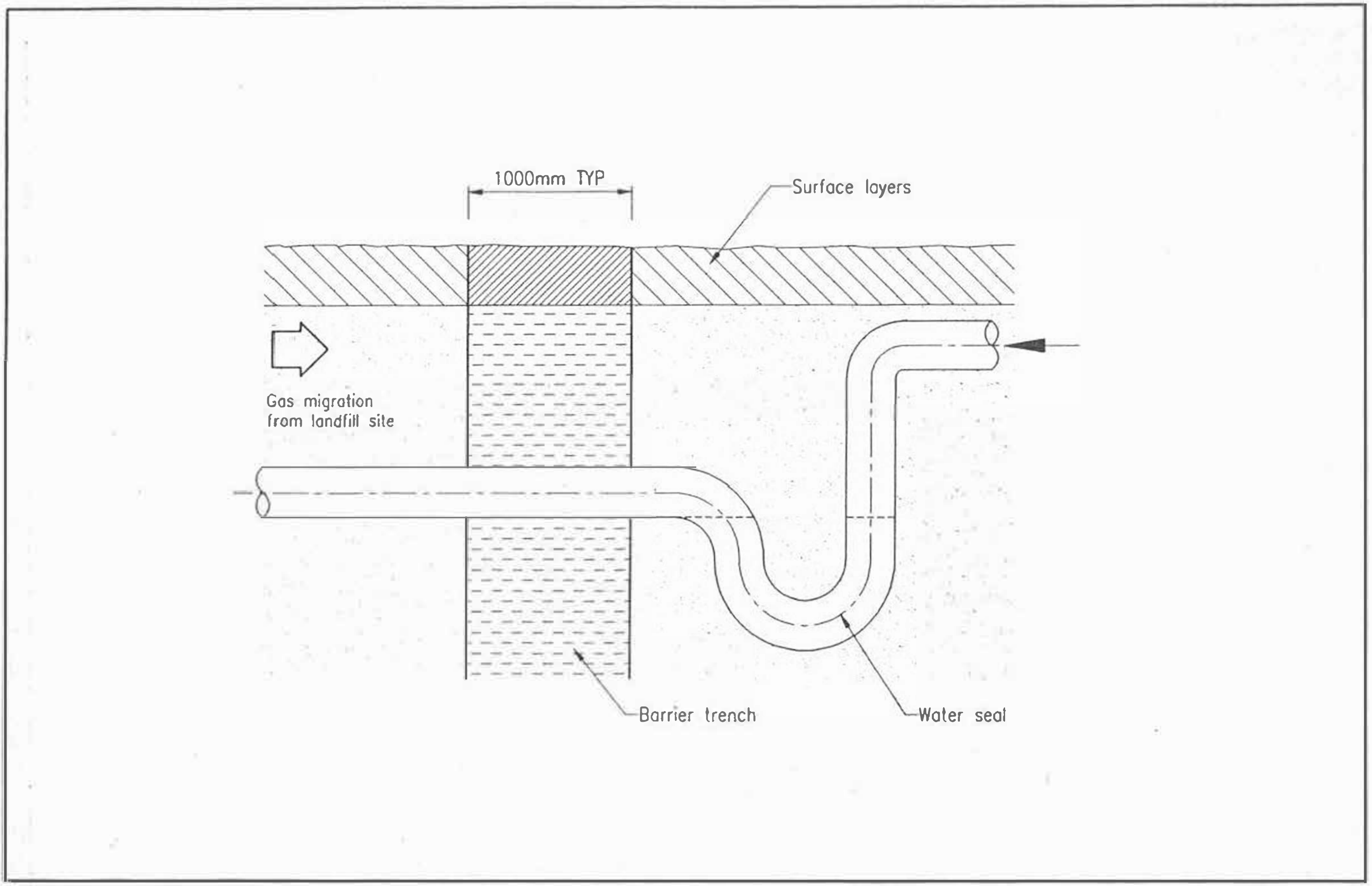
Automatic Gas Detection System


FACILITIES MODULE
COMMON HI ALARM
COMMON LO ALARM
COMMON FAULT
RACK
12Vdc
POWER SUPPLY
CONTROL MODULE(S)
LO ALARM
HI ALARM
FAULT
LO ALARM
HI ALARM
FAULT
LO ALARM
HI ALARM
FAULT
1mV/% LEL
4-20mA
4-20mA
FLAMMABLE GAS DETECTOR HEAD
CATALYTIC CELL (PELLISTOR)
OXYGEN DEFICIENCY DETECTOR HEAD
DIFFUSION CONTROLLED ELECTRO-CHEMICAL CELL
CARBON DIOXIDE DETECTOR HEAD
INFRA RED DETECTOR

APPENDIX : SCHEMATIC OF AUTOMATIC GAS DETECTION SYSTEM

Appendix 10.3

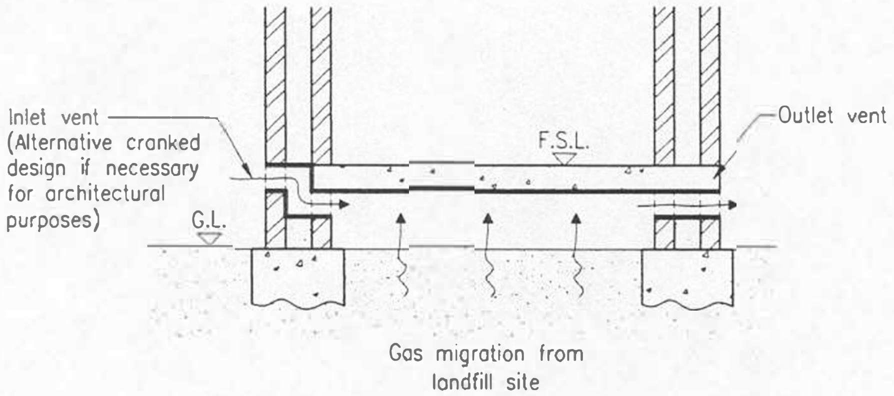
Open Conduit Protection by Water Seal


1000mm TYP
Surface layers
Gas migration from landfill site
Barrier trench
Water seal

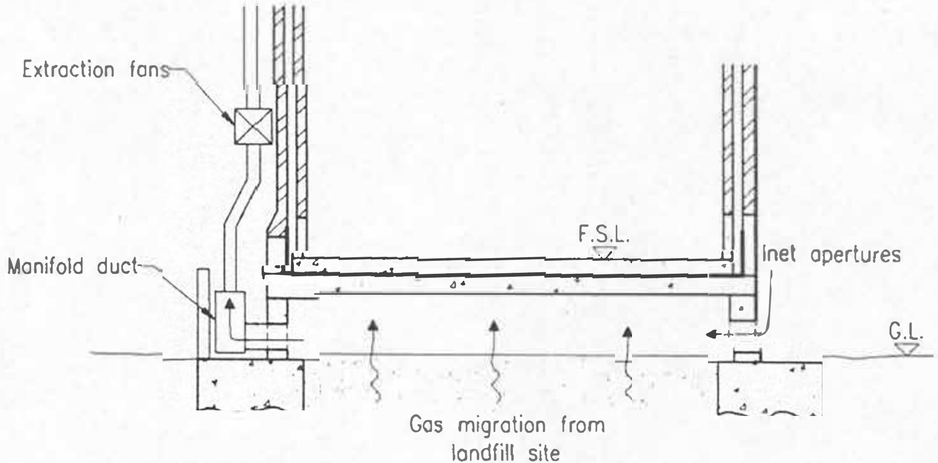
APPENDIX : OPEN CONDUIT PROTECTION BY WATER SEAL (LONGITUDINAL SECTION)

Appendix 10.4

Subfloor Venting


Inlet vent
(Alternative cranked design if necessary for architectural purposes)
Outlet vent
F.S.L.
G.L.
Gas migration from landfill site

(a) PASSIVE

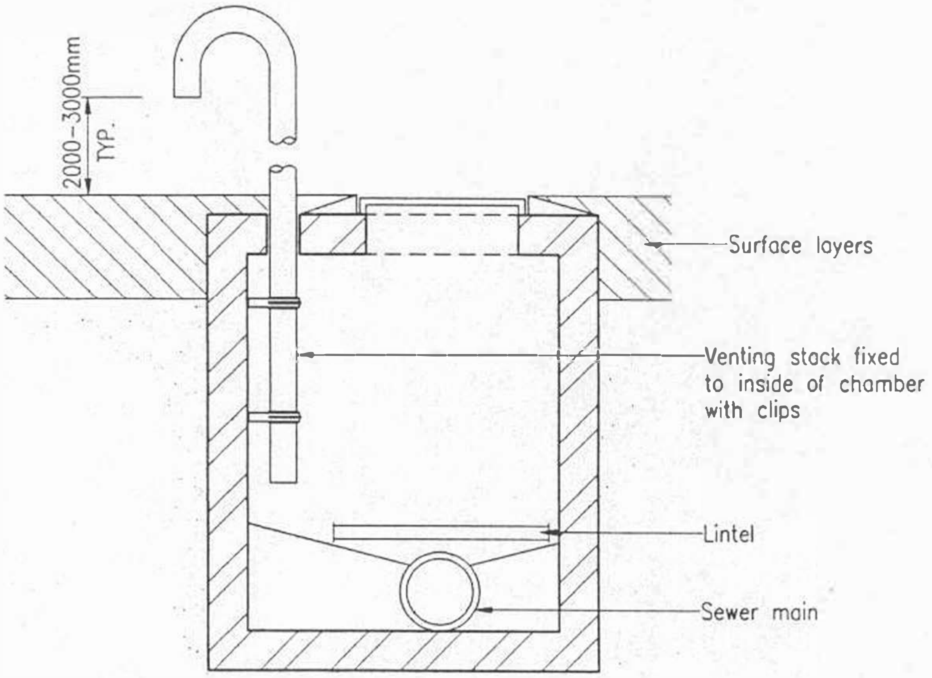

Extraction fans
Manifold duct
F.S.L.
Inet apertures
G.L.
Gas migration from landfill site

(b) ACTIVE

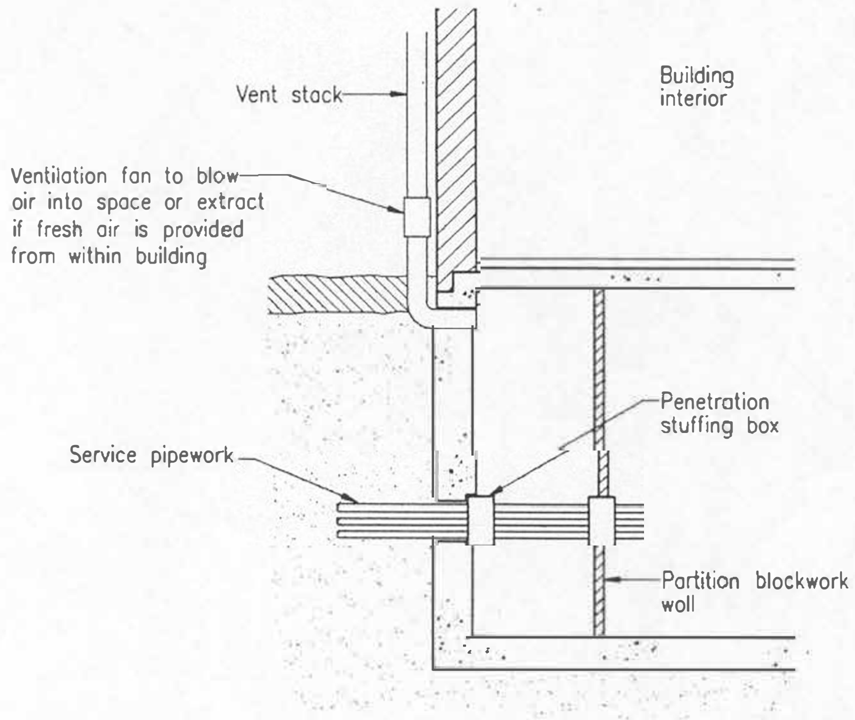
APPENDIX : SUBFLOOR VENTING

Appendix 10.5

Vented Manhole or Gas Interceptor Cavity


2000-3000mm
TYP.
Surface layers
Venting stack fixed to inside of chamber with clips
Lintel
Sewer main

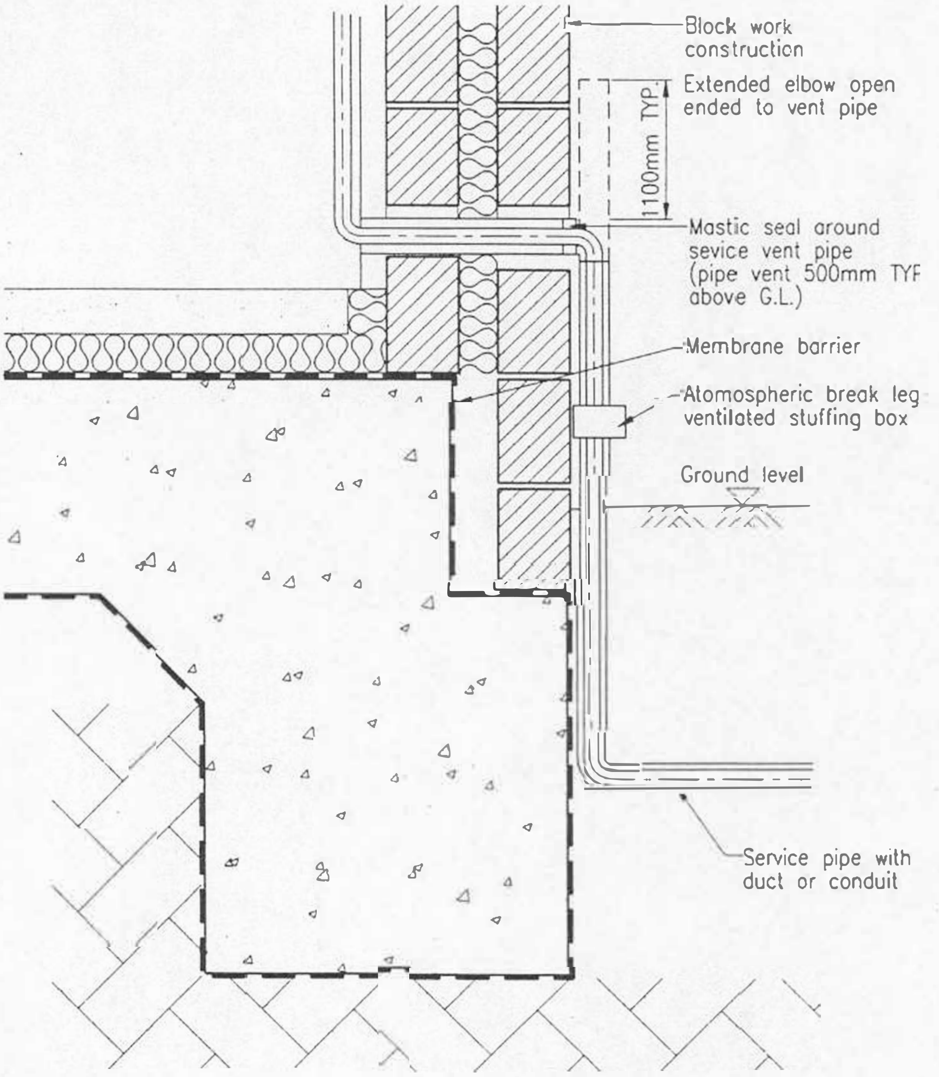
APPENDIX : VENTED MANHOLE (CROSS-SECTION)


Vent stack
Building interior
Ventilation fan to blow air into space or extract if fresh air is provided from within building
Penetration stuffing box
Service pipework
Partition blockwork woll

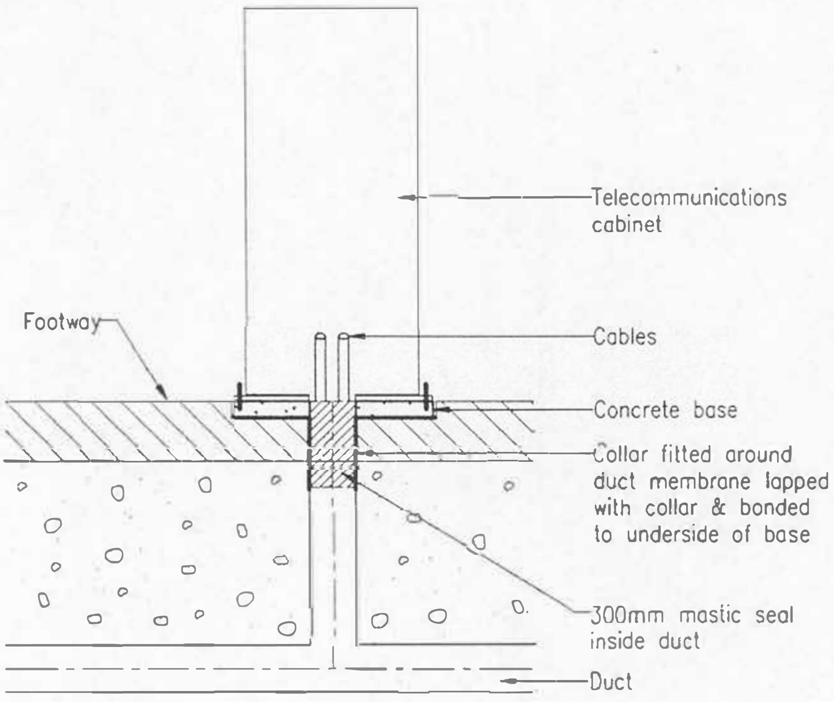
APPENDIX : VENTED GAS INTERCEPTOR CAVITY (CROSS-SECTION)

Appendix 10.6

Above Ground Service Entry and Above Ground Termination of Services


Block work construction
Extended elbow open ended to vent pipe
1100mm TYP.
Mastic seal around sevice vent pipe (pipe vent 500mm TYF above G.L.)
Membrane barrier
Atomospheric break leg ventilated stuffing box
Ground level
Service pipe with duct or conduit

APPENDIX : ABOVE GROUND SERVICE ENTRY


Telecommunications cabinet
Footway
Cables
Concrete base
Collar fitted around duct membrane lapped with collar & bonded to underside of base
300mm mastic seal inside duct
Duct

APPENDIX : TYPICAL SURFACE DETAIL FOR ABOVE GROUND TERMINATION OF SERVICES WITHIN THE CONSULTATION ZONE (CROSS-SECTION)

Appendix 6

SEWERAGE IMPACT ASSESSMENT

ARUP

The Hong Kong Jockey Club

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500(Part))

Sewerage Impact Assessment

Reference: SIA_REP_002

Rev. 2 | 30 January 2026

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 304521

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Kowloon
Hong Kong
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1.1 Project Description 1

1.2 Purpose of the Report 1

1.3 Structure of the Report 1

2. Sewerage Impact Assessment 2

2.1 Assessment Approach 2

2.2 Sewerage Flow Estimation 2

2.3 System Capacity 4

2.4 Sewerage Impact Assessment 4

3. Conclusion 6

3.1 Conclusion 6

Appendices

Appendix A A-1

Records and As-built Drawings of Existing Sewerage System A-1

Appendix B B-1

Sewerage Catchment Plan B-1

Appendix C C-1

Proposed Sewerage Layout Plan C-1

Appendix D D-2

Hydraulic Calculations D-2

1. Introduction

1.1 Project Description

This **Sewerage Impact Assessment (SIA)** is prepared in support of the Section 16 (“**S16**”) Planning Application to allow for the development of a Public Riding School with ancillary facilities (e.g. utility trench) (collectively as the “**PRS**”) at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories ("**TKOL II/III**") for the HKJC Public Riding Schools Limited (the “**Applicant**”). The Application Site comprises of three (3) existing platforms and land required for the provision of ancillary utility trench connecting to the three (3) platforms (collectively as the “**Application Site**”) within TKOL II/III. The PRS aligns with the Government’s policy objectives in fostering more public participation in the community through wider visibility and popularity of horse riding, supporting equestrian as an elite sport, and maintaining Hong Kong as a centre for major international sports events.

The Application Site is predominately zoned “Open Space” (“**O**”) on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 ("**Approved OZP**”), whilst a strip of area at the north is zoned “Green Belt” (“**GB**”) and a minor portion abutting Chun Sing Street is zoned “Other Specified Uses” annotated “Industrial Estate” (“**OU(Industrial Estate)**”) on the Approved OZP. The PRS with ancillary facilities (‘Horse Riding School’ subsumed under ‘Place of Recreation, Sports or Culture’ use) is a Column 2 use under the “O”, “GB” and “OU(Industrial Estate)” zones that may be permitted with or without conditions on Application under S16 of the Town Planning Ordinance (“**TPO**”). There are no plot ratio (“**PR**”), building height (“**BH**”), and site coverage (“**SC**”) restrictions imposed on the “O”, “GB” and “OU(Industrial Estate)” zones of the Approved OZP. While a portion of TKOL II/III falls within the Clear Water Bay Country Park (“**CWBCP**”), the Application Site does not involve any areas falling within the Country Park Boundary.

The PRS is located on three (3) platforms, namely the Lower Platform (i.e. Reception and Hospitality Lounges) (approx.+6.0mPD), Middle Platform (i.e. Pony Paddock & Pavilion I)(approx. +40.0mPD) and Upper Platform (i.e. Horse Paddock & Pavilion II) (approx.140.0mPD), with a proposed total GFA of approx. 9,000m² and a proposed building height of 4.8m to 7.7m. An ancillary utility trench connecting to the three (3) platforms is also proposed to accommodate various essential utilities services in support of the PRS operations.

1.2 Purpose of the Report

The objective of this SIA report is to identify, assess and mitigate potential sewerage impacts from the proposed development of new PRS at the three platforms within TKOL II/III; and formulate an acceptable discharge scheme to support the proposed development.

1.3 Structure of the Report

This report is structured as follow:

Section 1	**Introduction** Introduction and a brief description of the project
Section 2	**Sewerage Impact Assessment** Assessment of the sewerage impact due to the proposed development
Section 3	**Conclusion** Conclusion of the assessment results

2. Sewerage Impact Assessment

2.1 Assessment Approach

This SIA has been carried out in accordance with the guidelines set out in Environmental Protection Department (EPD)'s Report No. EPD/TP 1/05 Guidelines for Estimating Sewage Flows (GESF) for Sewerage Infrastructure Planning Version 1.0 and DSD's Sewerage Manual.

2.2 Sewerage Flow Estimation

Referring to DSD's sewerage record, as-built drawings of the Tseung Kwan O Landfills Restoration under Contract No. EP/SP/29/95 and Contract No. CV/89/05, major sewerage facilities in the vicinity of the Site are listed as the following,

1) 375 mm diameter to 450 mm diameter public sewer along Chun Shing Street and Chun Yat Street
2) 600 mm diameter to 1650 mm diameter public sewer along Wan Po Road
3) 300 mm diameter sewer along the boundary of the Site used by TKOL II/III

Relevant records and drawings are provided in **Appendix A** and the sewerage catchment plan of the abovementioned sewerage facilities are appended to **Appendix B**. The sewerage catchments consist of TKOL II/III, TKO InnoPark zoned "Other Specified Uses (Industrial Estate)" in the Approved OZP, the existing HSBC Building Tseung Kwan O, the existing Tai Chik Sha Fire Station cum Ambulance Depot, the South East New Territories Landfill and its extension (SENT/ SENTX), TKOL II/III and its restoration contractor's site office.

2.2.1 Development Parameters

As advised by the HKJC, the number of staffs and visitors per day for the proposed PRS shall range from 45 to 50 and 200 to 350 respectively. For conservativeness, 50 nos. staffs and 350 nos. visitors per day are assumed in this assessment. Based on the latest planning, 74 nos. horses would be kept at the proposed PRS.

2.2.2 Population Estimation

TKO InnoPark zoned "Other Specified Uses (Industrial Estate)" in the Approved OZP

776,397.32 m^2 of Other Specified Uses (Industrial Estate) land use falls into the sewerage catchment of the 600mm diameter to 1650 mm diameter sewer along Wan Po Road. The plot ratio is assumed as 2.5, which is the maximum average plot ration for Special Industrial Use – Industrial Estate stipulated in Table 1 of the Hong Kong Planning Standards and Guidelines Chapter 5 Industry. The employment density is assumed as 3.4 nos. workers per GFA (in 100 m^2) and referred to the Commercial and Industrial Floor Space Utilisation Survey published by the Planning Department, which is applicable for all economic activities.

Tai Chik Sha Fire Station cum Ambulance Depot

The plan area of Tai Chik Sha Fire Station cum Ambulance Depot is 3,225.4 m^2. There is no requirement on the plot ratio of Government, Institution and Community Facilities, and is assumed as 2.5. The employment density is assumed as 3.3 nos. workers per GFA (in 100 m^2) and referred to the Commercial and Industrial Floor Space Utilisation Survey published by the Planning Department, which is applicable for Community, Social and Personal Services.

HSBC Building Tseung Kwan O

The GFA of the HSBC Building Tseung Kwan O is 56,000 m^2 (https://www.leighorange.com/project/hsbc-building-tko-sus/). The employment density is assumed as 5.5 nos. workers per GFA (in 100 m^2) and referred to the Commercial and Industrial Floor Space Utilisation Survey published by the Planning Department, which is applicable for Financial, Insurance, Real Estate & Business Services.

SENT/ SENTX

The sewage generated from SENT/ SENTX is not estimated by the number of employees. The figure adopted is the design flow rate of 1,500 m^3/day of its leachate treatment plant extracted from Agreement No. CE 10/2005 (EP) South East New Territories (SENT) Landfill Extension – Feasibility Study: Environmental Impact Assessment Report – Volume 1 (Reference #0036286).

TKOL II/III and its Restoration Contractor's Site Office

The sewage generated from TKOL II/III is not estimated by the number of employees. The figure adopted is advised by EPD's restoration contractor, which the sewage flow from landfill facilities vary from 750 m^3/day to 1,450 m^3/day, subject to seasons. The latter is used in this assessment for conservativeness. For the sewage flow generated from EPD's restoration contractor's site office, it is advised by EPD that that number of staff and TKOL II/III and its restoration contractor's site office is approximately 23 nos.

2.2.3 Unit Flor Factors and Peaking Factors

Unit flow factors (UFF) under EPD's Report No. EPD/TP 1/05 GESF for Sewerage Infrastructure Planning Version 1.0 are generally adopted for sewage flow estimation.

Table 2.1 – Unit Flow Factors

Land Use	Category	Unit Flow Factor (m^3/day)
Proposed PRS – Staff	J11 – Community, Social & Personal Services	0.28
Proposed PRS – Visitors	School Student	0.04
TKOL II/III Restoration Contractor's Site Office	Territorial Average	0.28
Tai Chik Sha Fire Station cum Ambulance Depot	J11 – Community, Social & Personal Services	0.28
HSBC Building TKO	J6 – Finance, Insurance, Real Estate & Business Services	0.08
Other Specified Use (Industrial Estate)	J1 – Manufacturing (Tseung Kwan O)	1.08

Sewage flows from horse cleaning is also considered in this assessment. It is assumed that each horse would be cleaned on a daily basis for a duration of 20 minutes under the flow rate of 15 L/minute.

Peaking factors cater for seasonal/diurnal fluctuation and normal amount of infiltration and inflow. The peaking factors adopted in this study are shown in the table below.

Table 2.2 – Peaking Factors

Population Range	Peaking Factor (including stormwater allowance) for Facility with Existing Upstream Sewerage	Peaking Factor (excluding stormwater allowance) for Facility with New Upstream Sewerage
For Sewers		
< 1,000	8	6
1,000 – 5,000	6	5
5,000 – 10,000	5	4
10,000 – 50,000	4	3

> 50,000	Max ($7.3/N^{0.15}$, 2.4)	Max ($6/N^{0.175}$, 1.6)
Notes: N = Contributing population in thousands. $\text{Contributing population} = \frac{\text{Calculated total average flow (m}^3\text{/day)}}{0.27\ \text{(m}^3\text{/person/day)}}$		

2.3 System Capacity

The capacity of the proposed and existing sewerage system is checked by using the continuity equation, assuming full-bore flow condition:

$$Q = VA$$

where, Q = peak runoff in m^3/s

V = cross-sectional mean velocity in m/s

A = cross-sectional area of the pipe/channel in m^2

The cross-section mean velocity, V, of drainage pipes is estimated using the Colebrook-white equation:

$$V = -\sqrt{32gRS_f}\log\left[\frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{32gRS_f}}\right]$$

where, V = cross-sectional mean velocity in m/s

R = hydraulic radius in m

S_f = friction gradient

ks = roughness

v = kinematic viscosity

The roughness, ks for the proposed and existing sewers is assumed to be 3 mm in accordance with DSD's Sewerage Manual Table 5, i.e., Sewers/ drains slimed to about half depth; velocity, when flowing half full, approximately 0.75 m/s, clayware, poor and sewers/ drains slimed to about half depth; velocity, when flowing half full, approximately 1.2 m/s, concrete, spun or vertically cast, poor.

2.4 Sewerage Impact Assessment

Two sewerage connection points are identified for the proposed PRS. One at manhole FMH4035436 at Chung Shing Street/ Chung Yat Street with a 450 mm diameter downstream public sewer, and the another at manhole S11A with a 300mm diameter downstream sewer, which is currently used by TKOL II/III, connected to the Tseung Kwan O Preliminary Treatment Works. The proposed sewerage connections with 225mm diameter pipes are indicated in **Appendix C**. 100% of the estimated sewage peak flow from the proposed PRS is adopted to assess the sewerage impact downstream to each proposed connection point for conservativeness.

Table 2.5 – Summary of Catchments within near the Site/ in the Vicinity

Sewerage Catchment	Average Dry Weather Flow (m^3/day)	Peak Flow (L/s)	Sewerage Connection Point
Proposed PRS	60.24	5.58	FMH4035436
			S11A

TKOL II/III	7.73	20.86	S11A
HSBC Building TKO	295.68	20.53	FMH4035432
Tai Chik Sha Fire Station cum Ambulance Depot	89.41	6.21	FMH4035439
Other Specified Use (Industrial Estate)	85527.93	3046.53	FMH4035440
SENT/ SENTX	-	20.83	FMH4035440

Table 2.6 – Hydraulic Performance of Sewerage Connection Points

Upstream Manhole	Downstream Manhole	Pipe Size (mm)	Peak Flow (L/s)	Pipe Capacity (L/s)	Percentage Full (%)
FTMH-L1.4	FMH-1	225	5.58	40.70	13.71%
FMH-1	FMH4035436	225	5.58	40.70	13.71%
FMH4035436	FMH4035437	450	24.72	124.21	19.90%
FMH4035437	FMH4035438	450	24.72	163.19	15.15%
FMH4035438	FMH4035439	450	24.72	142.83	17.30%
FMH4035439	FMH4035440	450	30.93	157.24	19.67%
FMH4035440	FMH4035441	1650	3080.84	3697.92	83.31%
FTMH-L3.3	S11A	225	5.58	33.21	16.80%
S11A	S12	300	26.43	54.65	48.36%
S12	S13	300	26.43	42.93	61.58%

The capacity of existing sewers which would be utilised by the proposed PRS is checked. The detailed calculations are appended to **Appendix D**. For the 450 mm to 1650 mm diameter sewers from FMH4035436 to FMH4035441, the capacities are 19.90% to 83.31% utilised and checked to be sufficient. For the 300mm diameter sewers from S11A to S13, the capacities are 48.36% to 61.58% and also checked to be sufficient.

3. Conclusion

3.1 Conclusion

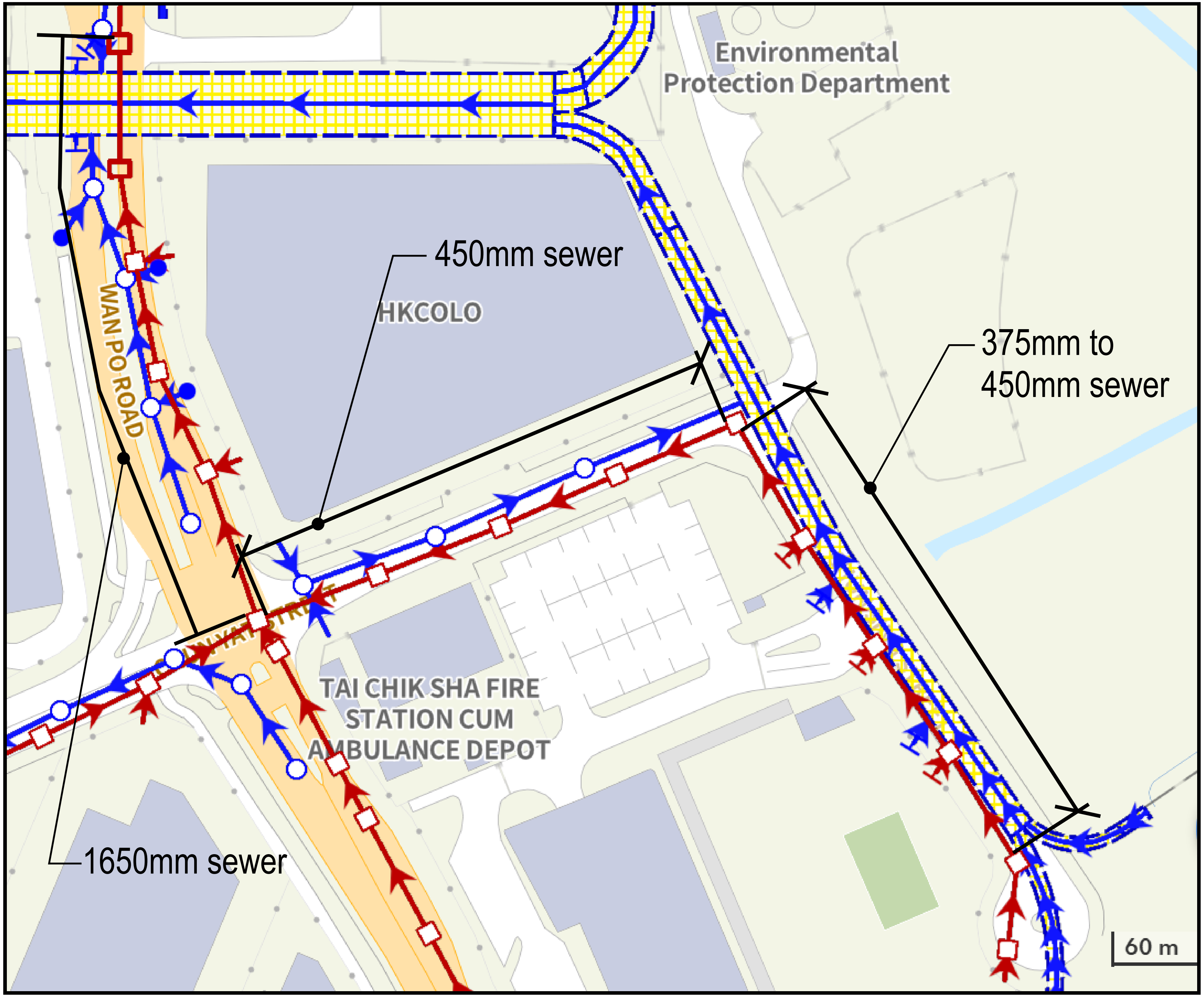
This report assessed the sewerage impact of the proposed PRS at the restored landfill site (TKOL II/III) in Tseung Kwan O. The existing sewerage system downstream to the proposed connection point had been checked to have sufficient capacity.

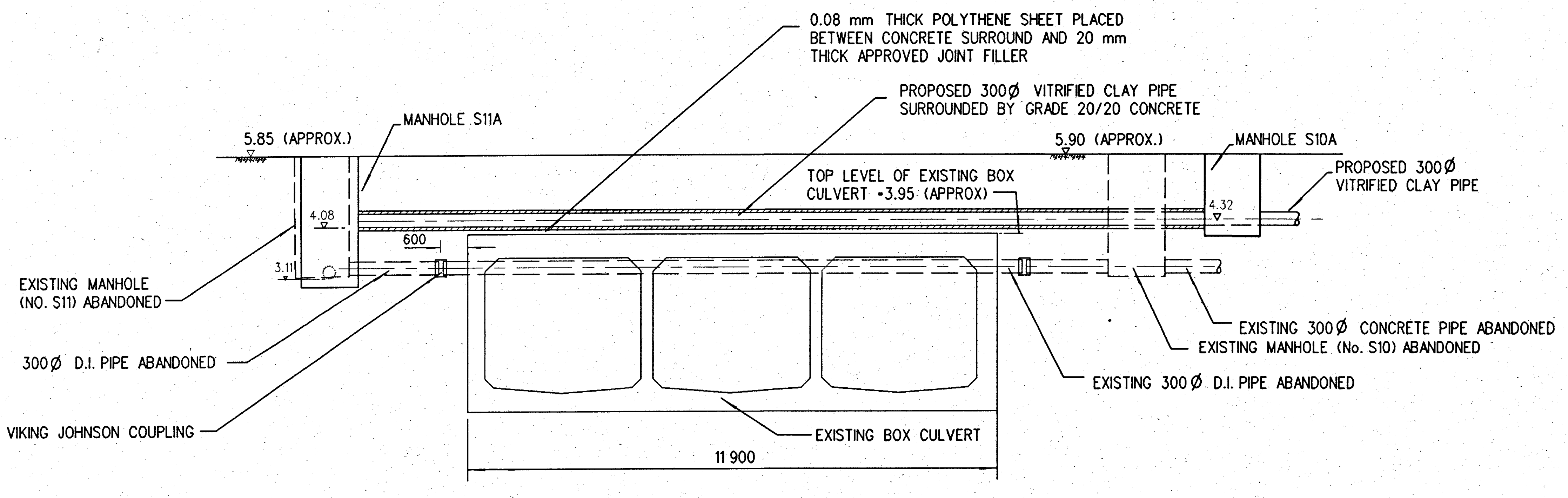
No adverse sewerage impact is anticipated due to the proposed development.

Appendix A

Records and As-built Drawings of Existing Sewerage System

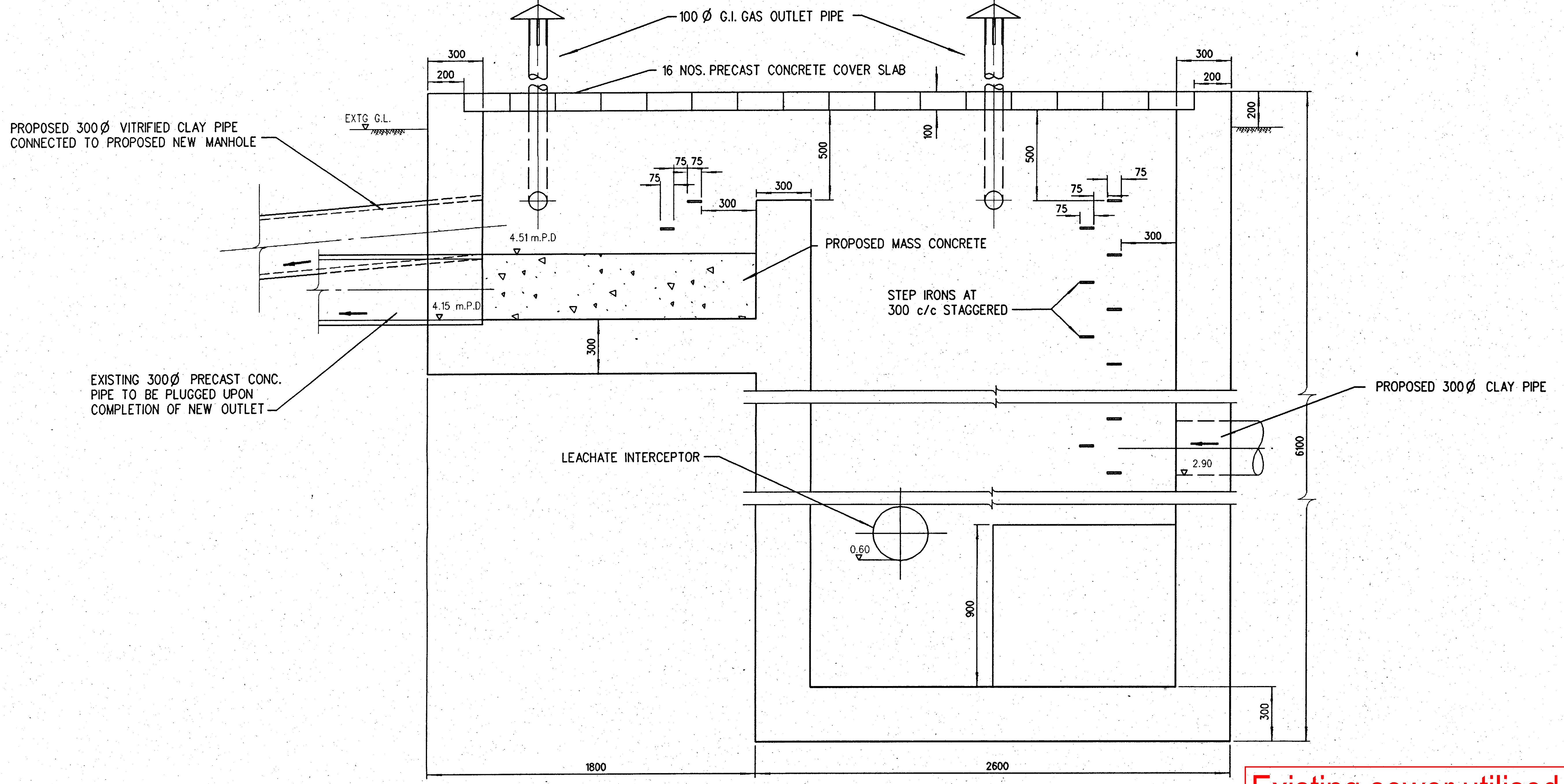
Existing Sewerage Records


Environmental
Protection Department
450mm sewer
HKCOLO
375mm to
450mm sewer
WAN PO ROAD
CHUN YAT STREET
TAI CHIK SHA FIRE
STATION CUM
AMBULANCE DEPOT
1650mm sewer
60 m


0.08 mm THICK POLYTHENE SHEET PLACED BETWEEN CONCRETE SURROUND AND 20 mm THICK APPROVED JOINT FILLER
PROPOSED 300Ø VITRIFIED CLAY PIPE SURROUNDED BY GRADE 20/20 CONCRETE
MANHOLE S11A
5.85 (APPROX.)
5.90 (APPROX.)
MANHOLE S10A
TOP LEVEL OF EXISTING BOX CULVERT -3.95 (APPROX)
PROPOSED 300Ø VITRIFIED CLAY PIPE
4.08
4.32
3.11
600
EXISTING MANHOLE (NO. S11) ABANDONED
300Ø D.I. PIPE ABANDONED
VIKING JOHNSON COUPLING
EXISTING 300Ø CONCRETE PIPE ABANDONED
EXISTING MANHOLE (No. S10) ABANDONED
EXISTING 300Ø D.I. PIPE ABANDONED
EXISTING BOX CULVERT
11 900

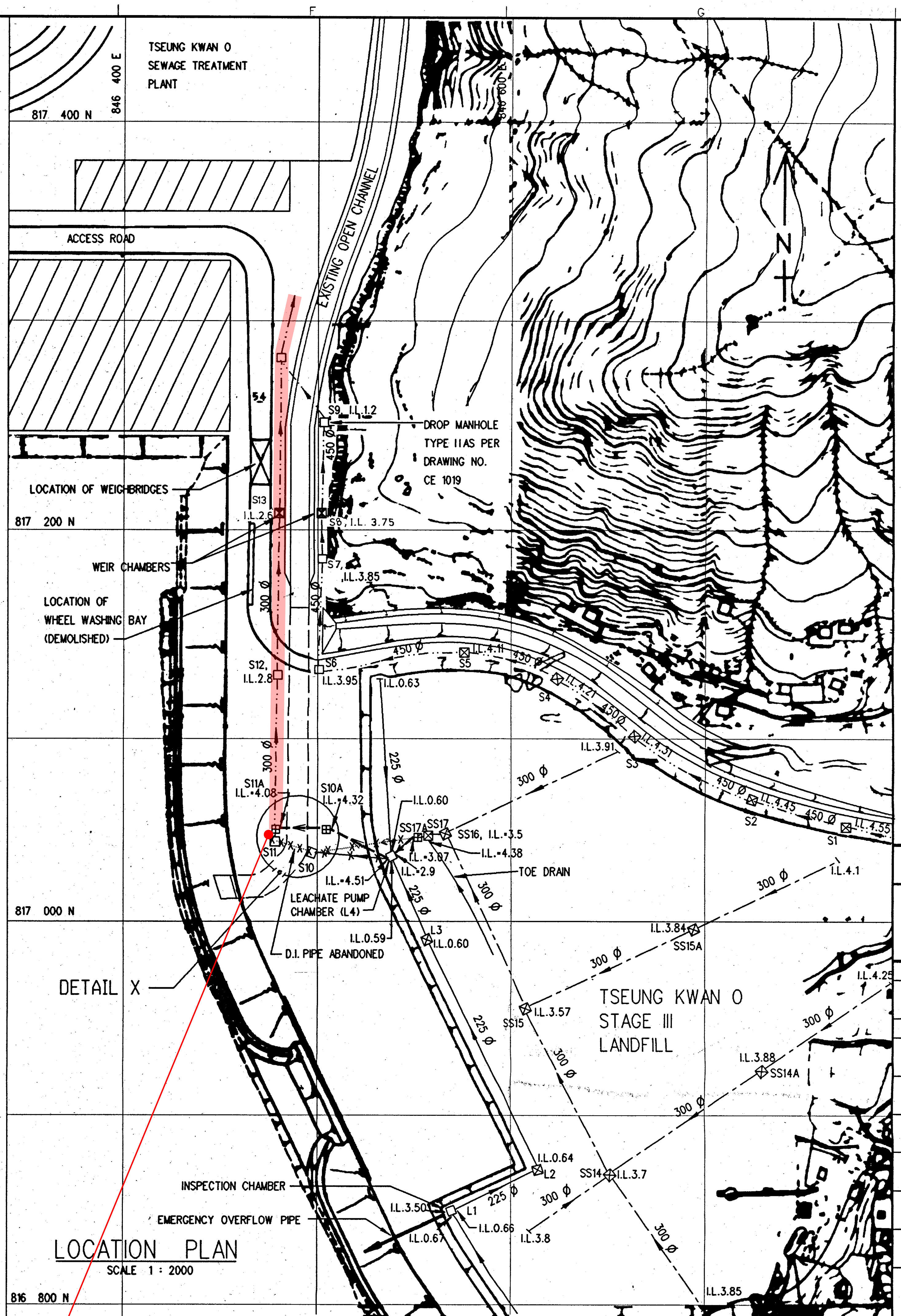
SECTION Y-Y

SCALE 1 : 100


100 Ø G.I. GAS OUTLET PIPE
16 NOS. PRECAST CONCRETE COVER SLAB
300
200
EXTG G.L.
PROPOSED 300Ø VITRIFIED CLAY PIPE CONNECTED TO PROPOSED NEW MANHOLE
4.51 m.P.D
4.15 m.P.D
PROPOSED MASS CONCRETE
STEP IRONS AT 300 c/c STAGGERED
EXISTING 300Ø PRECAST CONC. PIPE TO BE PLUGGED UPON COMPLETION OF NEW OUTLET
PROPOSED 300Ø CLAY PIPE
LEACHATE INTERCEPTOR
0.60
2.90
6100
900
500
100
75
1800
2600

SECTION X-X

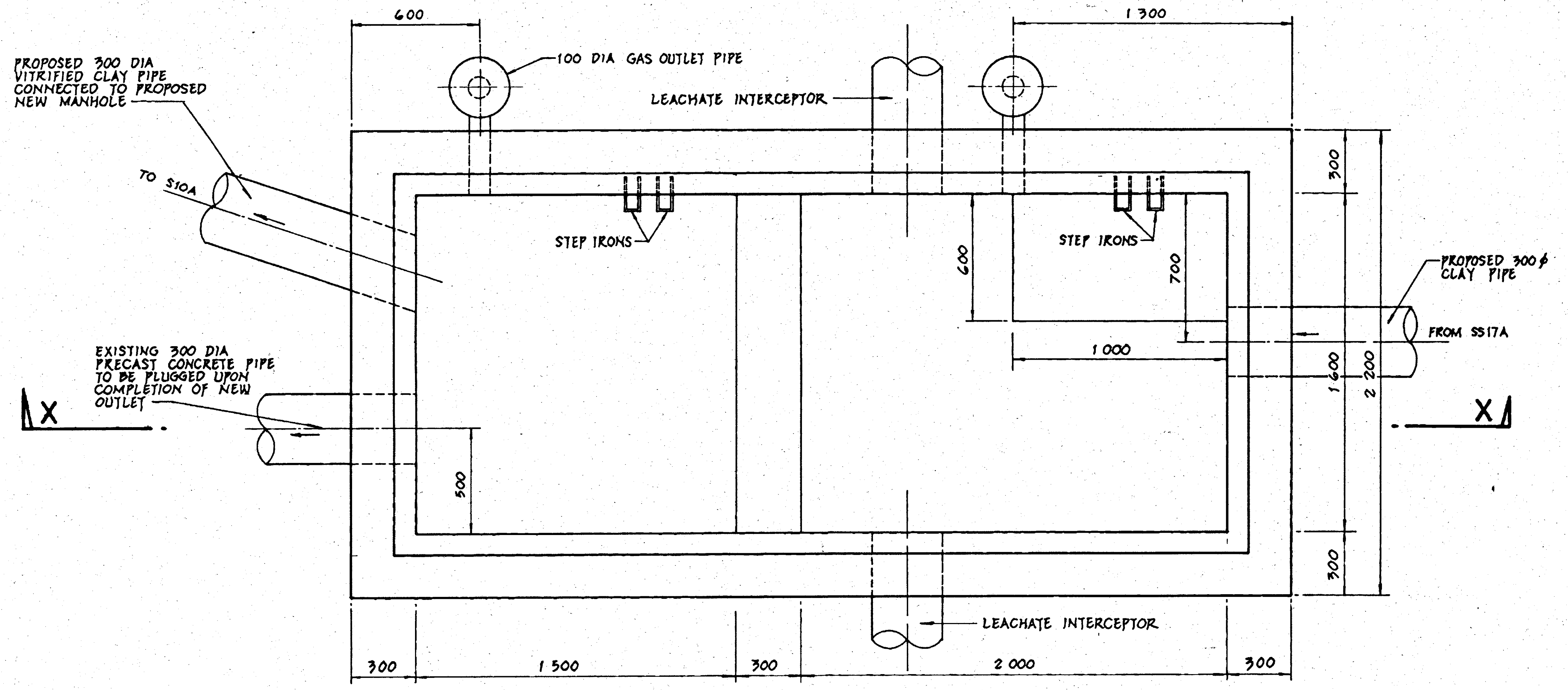
SCALE 1 : 20


TSEUNG KWAN O SEWAGE TREATMENT PLANT
817 400 N
846 400 E
ACCESS ROAD
EXISTING OPEN CHANNEL
LOCATION OF WEIGHBRIDGES
817 200 N
WEIR CHAMBERS
LOCATION OF WHEEL WASHING BAY (DEMOLISHED)
DROP MANHOLE TYPE IIAS PER DRAWING NO. CE 1019
S13
S12 I.L.2.8
S11A I.L.4.08
S10A I.L.4.32
LEACHATE PUMP CHAMBER (L4)
D.I. PIPE ABANDONED
TOE DRAIN
817 000 N
DETAIL X
TSEUNG KWAN O STAGE III LANDFILL
INSPECTION CHAMBER
EMERGENCY OVERFLOW PIPE
816 800 N
SS15A
SS14A
SS14
SS15
SS16
SS17
L1
L2
L3
S1
S2
S3
S4
S5
S6
S7
S8
S9

LOCATION PLAN

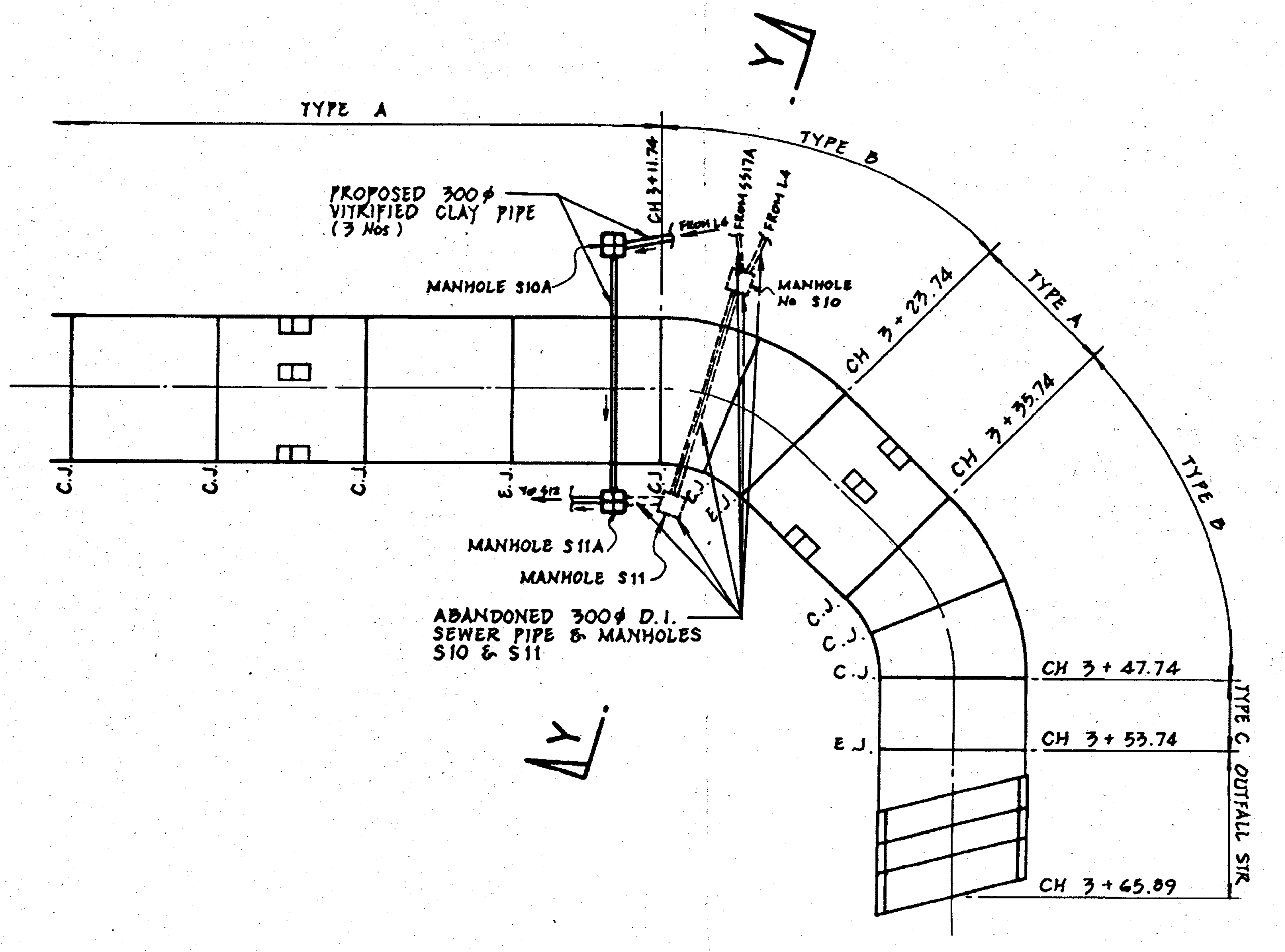
SCALE 1 : 2000

Existing sewer utilised by TKOL II/III


600
1 300
PROPOSED 300 DIA VITRIFIED CLAY PIPE CONNECTED TO PROPOSED NEW MANHOLE
100 DIA GAS OUTLET PIPE
LEACHATE INTERCEPTOR
TO S10A
STEP IRONS
PROPOSED 300 Ø CLAY PIPE
FROM SS17A
1 000
EXISTING 300 DIA PRECAST CONCRETE PIPE TO BE PLUGGED UPON COMPLETION OF NEW OUTLET
X
1 600
2 200
700
300
500
LEACHATE INTERCEPTOR
1 300
2 000

PLAN OF LEACHATE PUMP CHAMBER (L4)

SCALE 1 : 20


Y
TYPE A
TYPE B
PROPOSED 300Ø VITRIFIED CLAY PIPE (3 Nos)
MANHOLE S10A
MANHOLE No S10
MANHOLE S11A
MANHOLE S11
ABANDONED 300Ø D.I. SEWER PIPE & MANHOLES S10 & S11
CH 3 + 23.74
CH 3 + 35.74
CH 3 + 47.74
CH 3 + 53.74
CH 3 + 65.89
TYPE C OUTFALL STR.
C.J.
E.J.

DETAIL X

SCALE 1 : 500

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. ALL LEVELS ARE IN METRES ABOVE P.D.H.K.
3. THE CONTRACTOR IS REQUIRED TO CHECK/CONFIRM ALL LEVELS MARKED WITH AN ASTERISK (*) PRIOR TO ANY EXCAVATION WORK COMMENCED ON SITE.

LEGENDS :

—⊠—	EXISTING SUBSOIL DRAIN AND CATCHPIT
———	EXISTING LEACHATE INTERCEPTOR
—·—·—	EXISTING SEWER
☐	EXISTING MANHOLE
⊞	PROPOSED MANHOLE
— — —	PROPOSED SEWER
—x—x—	EXISTING LEACHATE INTERCEPTOR ABANDONED
·x·x·	EXISTING SEWER ABANDONED

AS CONSTRUCTED

C	PREPARED: (I.O.W.) 23/10/95 P. K. MANG CERTIFIED: (ENGINEER) 27.10.95 C. WONG

no.	date	description	initial
REVISION			

	name		date
surveyed			
designed	SIGNED	K. K. HO	01.05.94
drawn	SIGNED	K. H. TONG	05.05.94
traced	SIGNED	K. H. TONG	06.05.94
checked	SIGNED	K. K. HO	09.05.94
approved	SIGNED	C. Y. CHAN	27.10.94

Chief Engineer

contract no. CV/91/06

file no. DVK 3610 AND DVK 3639

project no. 21 DR

contract

TSEUNG KWAN O LANDFILL
STAGE III PHASE I —
SANITARY LANDFILL AND
ASSOCIATED WORKS

drawing title

SEWER RECONSTRUCTION

drawing no. SWS 1107C

scale AS SHOWN

office

SOLID WASTE DIVISION
CIVIL ENGINEERING OFFICE

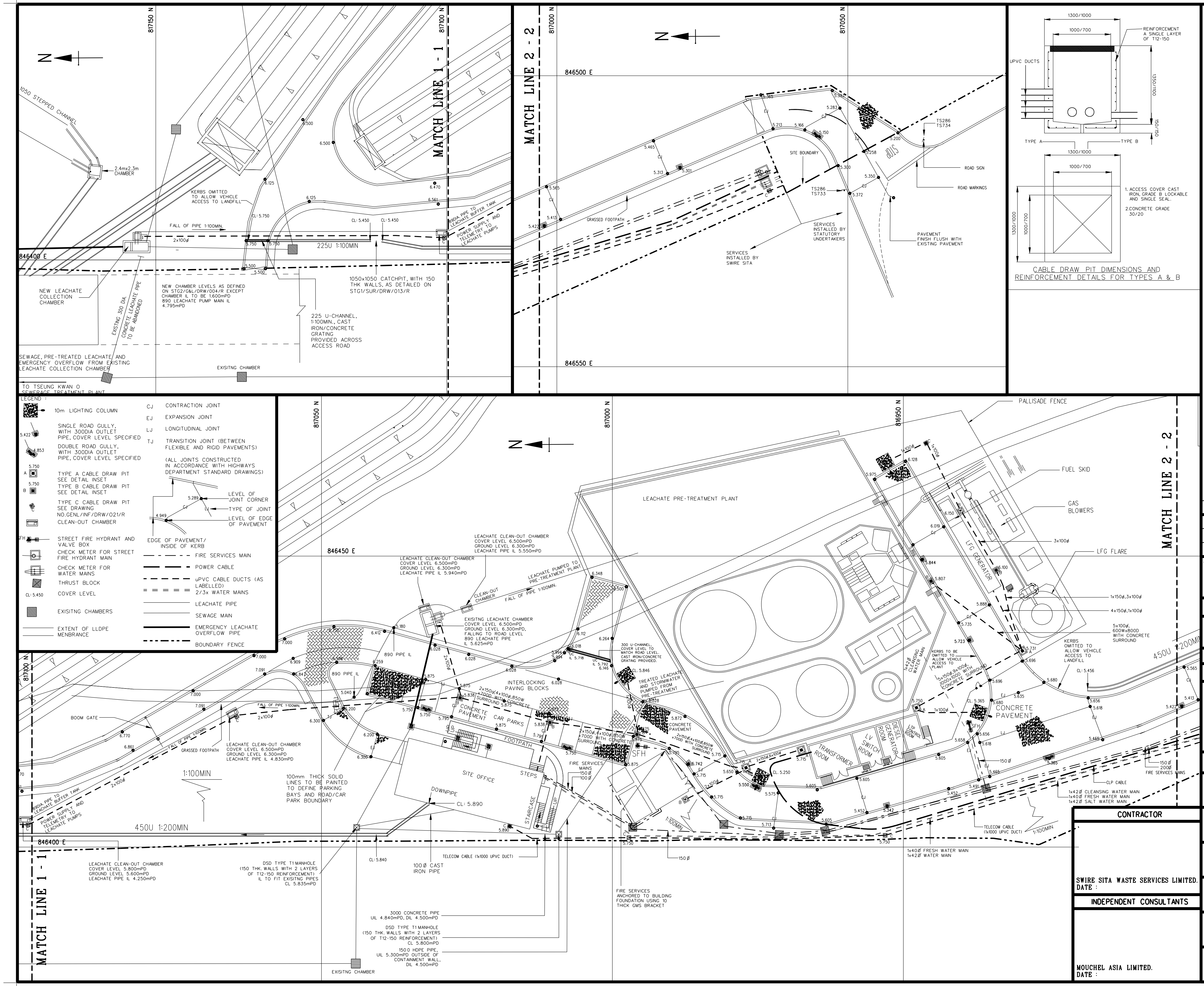
CIVIL ENGINEERING
DEPARTMENT
HONG KONG

COPYRIGHT RESERVED

A1 841 x 594

NOTES :

1. ALL LEVELS IN METERS ABOVE PRINCIPAL DATUM.
2. ALL GRIDS ARE HONG KONG GRID 1980.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NO. STG2/INF/DRW/201/R.


MATCH LINE 1 - 1
MATCH LINE 2 - 2
817150 N
817100 N
817050 N
817000 N
816950 N
846400 E
846450 E
846500 E
846550 E
1050 STEPPED CHANNEL
2.4mx2.3m CHAMBER
KERBS OMITTED TO ALLOW VEHICLE ACCESS TO LANDFILL
FALL OF PIPE 1:100MIN.
225U 1:100MIN
NEW LEACHATE COLLECTION CHAMBER
NEW CHAMBER LEVELS AS DEFINED ON STG2/C&L/DRW/004/R EXCEPT CHAMBER IL TO BE 1.600mPD 890 LEACHATE PUMP MAIN IL 4.795mPD
1050x1050 CATCHPIT, WITH 150 THK WALLS, AS DETAILED ON STG1/SUR/DRW/013/R
225 U-CHANNEL, 1:100MIN., CAST IRON/CONCRETE GRATING PROVIDED ACROSS ACCESS ROAD
EXISTING 300 DIA. CONCRETE LEACHATE PIPE TO BE ABANDONED
SEWAGE, PRE-TREATED LEACHATE AND EMERGENCY OVERFLOW FROM EXISTING LEACHATE COLLECTION CHAMBER
TO TSEUNG KWAN O SEWERAGE TREATMENT PLANT
EXISITNG CHAMBER
POWER SUPPLY AND TELEMETRY TO LEACHATE PUMPS
890IA PIPE TO LEACHATE BUFFER TANK
SITE BOUNDARY
GRASSED FOOTPATH
SERVICES INSTALLED BY STATUTORY UNDERTAKERS
SERVICES INSTALLED BY SWIRE SITA
TS286 TS734
TS286 TS733
ROAD SIGN
ROAD MARKINGS
PAVEMENT FINISH FLUSH WITH EXISTING PAVEMENT
STOP
UPVC DUCTS
REINFORCEMENT A SINGLE LAYER OF T12-150
TYPE A
TYPE B
1300/1000
1000/700
1350/1100
150/150
1. ACCESS COVER CAST IRON, GRADE B LOCKABLE AND SINGLE SEAL.
2. CONCRETE GRADE 30/20
CABLE DRAW PIT DIMENSIONS AND REINFORCEMENT DETAILS FOR TYPES A & B
PALLISADE FENCE
FUEL SKID
GAS BLOWERS
LFG FLARE
LFG GENERATOR
LEACHATE PRE-TREATMENT PLANT
TRANSFORMER ROOM
LV SWITCH ROOM
DIESEL GENERATOR ROOM
LTD ROOM
KERBS OMITTED TO ALLOW VEHICLE ACCESS TO LANDFILL
450U 1:200MIN
CONCRETE PAVEMENT
INTERLOCKING PAVING BLOCKS
CAR PARKS
FOOTPATH
SITE OFFICE
STEPS
STAIRCASE
UP
DOWNPIPE
CL: 5.890
BOOM GATE
890 PIPE IL
LEACHATE CLEAN-OUT CHAMBER COVER LEVEL 6.500mPD GROUND LEVEL 6.300mPD LEACHATE PIPE IL 5.940mPD
LEACHATE CLEAN-OUT CHAMBER COVER LEVEL 6.500mPD GROUND LEVEL 6.300mPD LEACHATE PIPE IL 5.550mPD
LEACHATE PUMPED TO PRE-TREATMENT PLANT
EXISTING LEACHATE CHAMBER COVER LEVEL 6.500mPD GROUND LEVEL 6.300mPD, FALLING TO ROAD LEVEL 890 LEACHATE PIPE IL 5.625mPD
300 U-CHANNEL, COVER LEVEL TO MATCH ROAD LEVEL, CAST IRON/CONCRETE GRATING PROVIDED.
TREATED LEACHATE AND STORMWATER PUMPED FROM PRE-TREATMENT
LEACHATE CLEAN-OUT CHAMBER COVER LEVEL 6.500mPD GROUND LEVEL 6.300mPD LEACHATE PIPE IL 4.830mPD
100mm THICK SOLID LINES TO BE PAINTED TO DEFINE PARKING BAYS AND ROAD/CAR PARK BOUNDARY
FIRE SERVICES MAINS
FIRE SERVICES ANCHORED TO BUILDING FOUNDATION USING 10 THICK GMS BRACKET
LEACHATE CLEAN-OUT CHAMBER COVER LEVEL 5.800mPD GROUND LEVEL 5.600mPD LEACHATE PIPE IL 4.250mPD
DSD TYPE T1 MANHOLE (150 THK. WALLS WITH 2 LAYERS OF T12-150 REINFORCEMENT) IL TO FIT EXISITNG PIPES CL 5.835mPD
100Ø CAST IRON PIPE
TELECOM CABLE (1x100 UPVC DUCT)
3000 CONCRETE PIPE UIL 4.840mPD, DIL 4.500mPD
DSD TYPE T1 MANHOLE (150 THK. WALLS WITH 2 LAYERS OF T12-150 REINFORCEMENT) CL 5.800mPD
1500 HDPE PIPE, UIL 5.300mPD OUTSIDE OF CONTAINMENT WALL, DIL 4.500mPD
EXISITNG CHAMBER
1x42Ø CLEANSING WATER MAIN
1x40Ø FRESH WATER MAIN
1x42Ø SALT WATER MAIN
CLP CABLE
150Ø
200Ø
FIRE SERVICES MAINS
TELECOM CABLE (1x1000 UPVC DUCT)
1x40Ø FRESH WATER MAIN
1x42Ø WATER MAIN
1x150Ø,3x100Ø
4x150Ø,1x100Ø
5x100Ø, 600Wx800D WITH CONCRETE SURROUND
SFH
1:100MIN

LEGEND :

▨	10m LIGHTING COLUMN
5.422	SINGLE ROAD GULLY, WITH 300DIA OUTLET PIPE, COVER LEVEL SPECIFIED
4.853	DOUBLE ROAD GULLY, WITH 300DIA OUTLET PIPE, COVER LEVEL SPECIFIED
5.750 A	TYPE A CABLE DRAW PIT SEE DETAIL INSET
5.750 B	TYPE B CABLE DRAW PIT SEE DETAIL INSET
C	TYPE C CABLE DRAW PIT SEE DRAWING NO.GENL/INF/DRW/021/R
	CLEAN-OUT CHAMBER
SFH	STREET FIRE HYDRANT AND VALVE BOX
	CHECK METER FOR STREET FIRE HYDRANT MAIN
	CHECK METER FOR WATER MAINS
	THRUST BLOCK
CL: 5.450	COVER LEVEL
▨	EXISITNG CHAMBERS
	EXTENT OF LLDPE MENBRANCE

CJ	CONTRACTION JOINT
EJ	EXPANSION JOINT
LJ	LONGITUDINAL JOINT
TJ	TRANSITION JOINT (BETWEEN FLEXIBLE AND RIGID PAVEMENTS)

(ALL JOINTS CONSTRUCTED IN ACCORDANCE WITH HIGHWAYS DEPARTMENT STANDARD DRAWINGS)

5.289 — LEVEL OF JOINT CORNER
LJ — TYPE OF JOINT
4.949 — LEVEL OF EDGE OF PAVEMENT
EDGE OF PAVEMENT/ INSIDE OF KERB

— - — -	FIRE SERVICES MAIN
— — -	POWER CABLE
- - - -	uPVC CABLE DUCTS (AS LABELLED)
= = =	2/3x WATER MAINS
——	LEACHATE PIPE
——	SEWAGE MAIN
——	EMERGENCY LEACHATE OVERFLOW PIPE
- · - ·	BOUNDARY FENCE

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN : A2INF202.DGN
REF : STAGE23, RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

STAGE II/III
MANAGEMENT COMPOUND
SERVICES LAYOUT PLAN

AS CONSTRUCTED RECORD DRAWING

Drawing no. STG2/INF/DRW/202/R

Scale 1 : 300

Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE SITA WASTE
SERVICES LTD.

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

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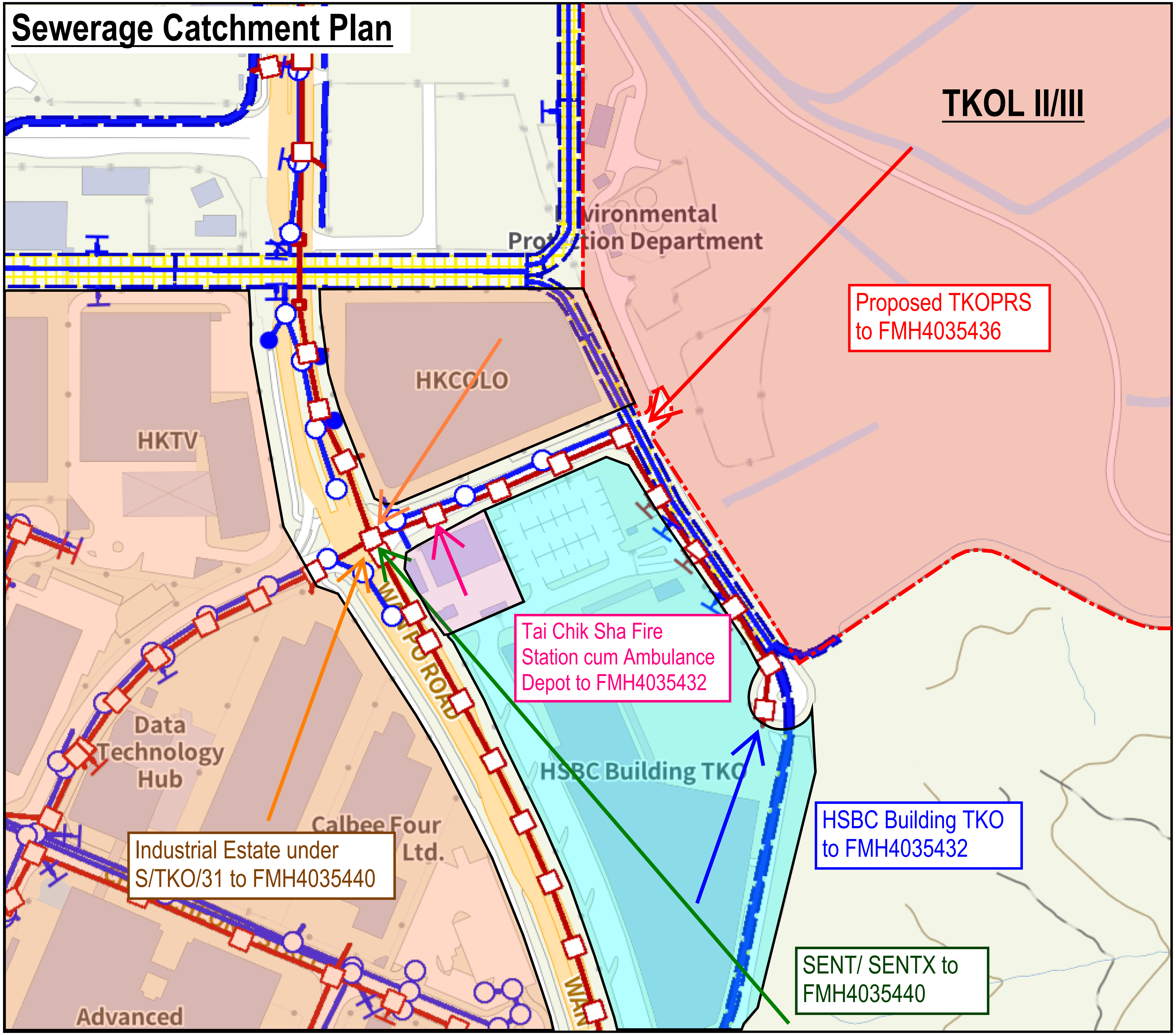
Appendix B

Sewerage Catchment Plan

Sewerage Catchment Plan



TKOL II/III
Environmental Protection Department
HKCOLO
HKTV
Data Technology Hub
HSBC Building TKO
Calbee Four Ltd.
WAN PO ROAD
Advanced

Proposed TKOPRS to FMH4035436

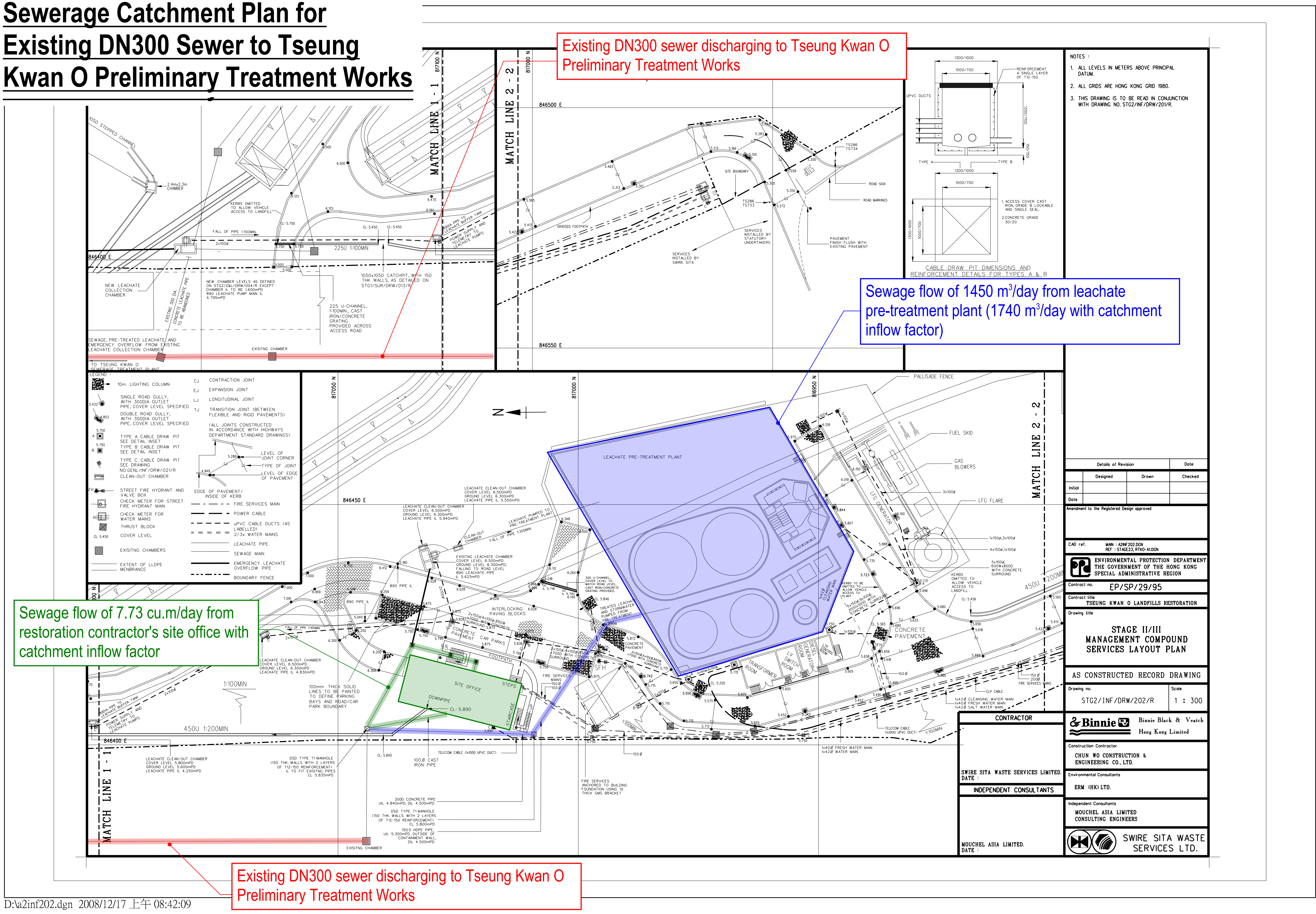
Tai Chik Sha Fire Station cum Ambulance Depot to FMH4035432

HSBC Building TKO to FMH4035432

Industrial Estate under S/TKO/31 to FMH4035440

SENT/ SENTX to FMH4035440

Sewerage Catchment Plan for Existing DN300 Sewer to Tseung Kwan O Preliminary Treatment Works


NOTES :
1. ALL LEVELS IN METERS ABOVE PRINCIPAL DATUM.
2. ALL GRIDS ARE HONG KONG GRID 1980.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NO. STG2/INF/DRW/201/R.
CABLE DRAW PIT DIMENSIONS AND REINFORCEMENT DETAILS FOR TYPES A & B
TYPE A
TYPE B
1. ACCESS COVER CAST IRON, GRADE B LOCKABLE AND SINGLE SEAL.
2. CONCRETE GRADE 30/20
MATCH LINE 1 - 1
MATCH LINE 2 - 2
LEACHATE PRE-TREATMENT PLANT
SITE OFFICE
LEGEND
10m LIGHTING COLUMN
SINGLE ROAD GULLY, WITH 300DIA OUTLET PIPE, COVER LEVEL SPECIFIED
DOUBLE ROAD GULLY, WITH 300DIA OUTLET PIPE, COVER LEVEL SPECIFIED
TYPE A CABLE DRAW PIT SEE DETAIL INSET
TYPE B CABLE DRAW PIT SEE DETAIL INSET
TYPE C CABLE DRAW PIT SEE DRAWING NO.GENL/INF/DRW/021/R
CLEAN-OUT CHAMBER
STREET FIRE HYDRANT AND VALVE BOX
CHECK METER FOR STREET FIRE HYDRANT MAIN
CHECK METER FOR WATER MAINS
THRUST BLOCK
COVER LEVEL
EXISTING CHAMBERS
EXTENT OF LLDPE MEMBRANCE
CJ CONTRACTION JOINT
EJ EXPANSION JOINT
LJ LONGITUDINAL JOINT
TJ TRANSITION JOINT (BETWEEN FLEXIBLE AND RIGID PAVEMENTS)
(ALL JOINTS CONSTRUCTED IN ACCORDANCE WITH HIGHWAYS DEPARTMENT STANDARD DRAWINGS)
FIRE SERVICES MAIN
POWER CABLE
uPVC CABLE DUCTS (AS LABELLED)
2/3x WATER MAINS
LEACHATE PIPE
SEWAGE MAIN
EMERGENCY LEACHATE OVERFLOW PIPE
BOUNDARY FENCE
SEWAGE, PRE-TREATED LEACHATE AND EMERGENCY OVERFLOW FROM EXISTING LEACHATE COLLECTION CHAMBER
TO TSEUNG KWAN O SEWERAGE TREATMENT PLANT
EXISITNG CHAMBER
Details of Revision
Date
Designed
Drawn
Checked
Amendment to the Registered Design approved
CAD ref. MAIN : A2INF202.DGN REF : STAGE23, RTKO-A1.DGN
ENVIRONMENTAL PROTECTION DEPARTMENT THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION
Contract no. EP/SP/29/95
Contract title TSEUNG KWAN O LANDFILLS RESTORATION
Drawing title STAGE II/III MANAGEMENT COMPOUND SERVICES LAYOUT PLAN
AS CONSTRUCTED RECORD DRAWING
Drawing no. STG2/INF/DRW/202/R
Scale 1 : 300
CONTRACTOR
SWIRE SITA WASTE SERVICES LIMITED. DATE :
INDEPENDENT CONSULTANTS
MOUCHEL ASIA LIMITED. DATE :
Binnie Black & Veatch Hong Kong Limited
Construction Contractor CHUN WO CONSTRUCTION & ENGINEERING CO., LTD.
Environmental Consultants ERM (HK) LTD.
Independent Consultants MOUCHEL ASIA LIMITED CONSULTING ENGINEERS
SWIRE SITA WASTE SERVICES LTD.

Existing DN300 sewer discharging to Tseung Kwan O Preliminary Treatment Works

Sewage flow of 1450 m^3/day from leachate pre-treatment plant (1740 m^3/day with catchment inflow factor)

Sewage flow of 7.73 cu.m/day from restoration contractor's site office with catchment inflow factor

Existing DN300 sewer discharging to Tseung Kwan O Preliminary Treatment Works

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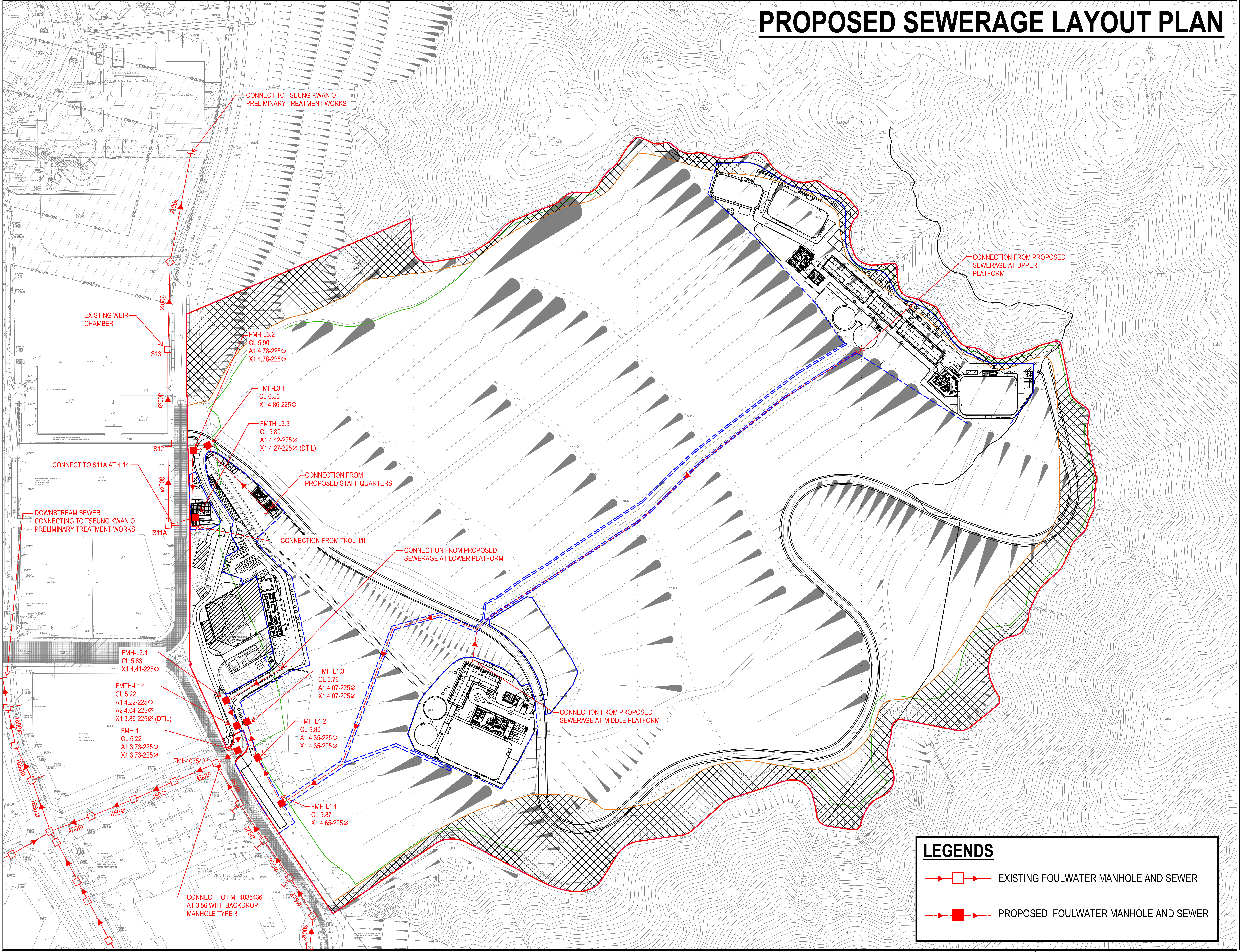
Appendix C

Proposed Sewerage Layout Plan

PROPOSED SEWERAGE LAYOUT PLAN


CONNECT TO TSEUNG KWAN O PRELIMINARY TREATMENT WORKS
300Ø
EXISTING WEIR CHAMBER
S13
300Ø
S12
CONNECT TO S11A AT 4.14
300Ø
DOWNSTREAM SEWER CONNECTING TO TSEUNG KWAN O PRELIMINARY TREATMENT WORKS
S11A
FMH-L3.2
CL 5.90
A1 4.78-225Ø
X1 4.78-225Ø
FMH-L3.1
CL 6.50
X1 4.86-225Ø
FMTH-L3.3
CL 5.80
A1 4.42-225Ø
X1 4.27-225Ø (DTIL)
CONNECTION FROM PROPOSED STAFF QUARTERS
CONNECTION FROM TKOL II/III
CONNECTION FROM PROPOSED SEWERAGE AT LOWER PLATFORM
CONNECTION FROM PROPOSED SEWERAGE AT UPPER PLATFORM
CONNECTION FROM PROPOSED SEWERAGE AT MIDDLE PLATFORM
FMH-L2.1
CL 5.63
X1 4.41-225Ø
FMTH-L1.4
CL 5.22
A1 4.22-225Ø
A2 4.04-225Ø
X1 3.89-225Ø (DTIL)
FMH-1
CL 5.22
A1 3.73-225Ø
X1 3.73-225Ø
FMH4035436
FMH-L1.3
CL 5.76
A1 4.07-225Ø
X1 4.07-225Ø
FMH-L1.2
CL 5.80
A1 4.35-225Ø
X1 4.35-225Ø
FMH-L1.1
CL 5.87
X1 4.65-225Ø
1650Ø
1650Ø
1650Ø
450Ø
450Ø
450Ø
450Ø
450Ø
375Ø
375Ø
375Ø
300Ø
CONNECT TO FMH4035436 AT 3.56 WITH BACKDROP MANHOLE TYPE 3
DRAINAGE RESERVE (59)L/M MS10/JBTL/39
TAI CHIK SHA FIRE STATION CUM AMBULANCE DEPOT
CHUN YAT STREET
Environmental Protection Department

LEGENDS

- EXISTING FOULWATER MANHOLE AND SEWER
- PROPOSED FOULWATER MANHOLE AND SEWER

Appendix D

Hydraulic Calculations

ARUP	Ove Arup & Partners Calculation Sheet	Job No.	304521	Sheet No.		Rev.	1
Job Title	**Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))**	Made by	DL	Date	30/1/2026	Checked	CC

TABLE D1
Estimation of Sewage Flows Estimation for Existing Developments

Design Code

1. Based on EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning.
2. Plumbing Engineering Services Design Guide by The Institute of Plumbing.

Design Assumption:

Global Peaking Factor, P (Including Stormwater Allowance) as per Table T-5
Global Unit Flow Factors as per Tables T-2 and T-3
Catchment Inflow Factor for Central (PCIF = 1.20) as per Table T-4

Development Schedule

Sewage Flow Estimates	**Estimation**	**Remark**
HSBC Building TKO		
Non-domestic		**Connect to FMH4035432**
GFA (m^2)	56000.00	Zoning "OU"
Worker Density (No. of Worker per $100m^2$)	5.50	Community, Social & Personal Services
No. of Employee	3080	
Unit flow factor (m^3/person/day)	0.08	J6 - Finance, Insurance, Real Estate & Business Services
ADWF, (m^3/day)	295.68	**P_{CIF} = 1.20 included**
Tai Chik Sha Fire Station cum Ambulance Depot		
Non-domestic		**Connect to FMH4035439**
Plan Area (m^2)	3225.40	
Plot Ratio	2.50	Special Industrial Use - Industrial Estate
GFA (m^2)	8063.50	G/IC
Worker Density (No. of Worker per $100m^2$)	3.30	Community, Social & Personal Services
No. of Employee	266	
Unit flow factor (m^3/person/day)	0.28	J11 - Community, Socal & Personal Services
ADWF, (m^3/day)	89.41	**P_{CIF} = 1.20 included**
Other Specied Use (Industrial Estate)		
Non-domestic		**Connect to FMH4035440**
Plan Area (m^2)	776397.32	
Plot Ratio	2.50	Special Industrial Use - Industrial Estate
GFA (m^2)	1940993.30	Zoning "OU"
Worker Density (No. of Worker per $100m^2$)	3.40	All economic activities
No. of Employee	65994	
Unit flow factor (m^3/person/day)	1.08	J1 - Manufacturing (Tseung Kwan O)
ADWF, (m^3/day)	85527.93	**P_{CIF} = 1.20 included**
SENT/ SENTX		
Non-domestic		**Connect to FMH4035440**
GFA (m^2)	-	
Worker Density (No. of Worker per $100m^2$)	-	
No. of Employee	-	
Unit flow factor (m^3/person/day)	-	
Peak Flow, (m^3/day)	1800.00	**P_{CIF} = 1.20 included**
		Sewage flow from SENTX extracted from SENTX EIA Report Volume 1 (Reference #0036286) 1500 is the design flow rate of the leachate treatment plant
TKOL II/III		
Non-domestic		**Connect to S11A**
GFA (m^2)	-	
Worker Density (No. of Worker per $100m^2$)	-	
No. of Employee	-	
Unit flow factor (m^3/person/day)	-	
Peak Flow, (m^3/day)	1740.00	**P_{CIF} = 1.20 included**
		Sewage flow from TKOL II/III Landfill Facilities advised by EPD's restoration contractor. Sewage flow varies from 750 m^3/day to 1450 m^3/day, subject to seasons
TKOL II/III Restoration Contractor's Site Office		
No. of Employee (Restoration Contractor and EPD)	23.00	**Connect to S11A**
Unit flow factor (m^3/person/day)	0.28	General - territorial average
ADWF, (m^3/day)	7.73	**P_{CIF} = 1.20 included**

Notes:
Employment density shall refer to Commercial and Industrial Floor Space Utilization Survey published by PlanD.
Office = 5.5 employee per $100m^2$ of GFA
Retail = 3.5 employee per $100m^2$ of GFA
Restaurant = 5.1 employee per $100m^2$ of GFA
Community, Social & Personal Services = 3.3 employee per $100m^2$ of GFA

ARUP	Ove Arup & Partners Calculation Sheet	Job No.	304521	Sheet No.		Rev.	1
Job Title	**Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))**	Made by	DL	Date	30/1/2026	Checked	CC

TABLE D2
Estimation of Sewage Flows Estimation for Existing Developments

Design Code

1. Based on EPD Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning.
2. Plumbing Engineering Services Design Guide by The Institute of Plumbing.

Design Assumption:

Global Peaking Factor, P (Including Stormwater Allowance) as per Table T-5
Global Unit Flow Factors as per Tables T-2 and T-3
Catchment Inflow Factor for Central (PCIF = 1.20) as per Table T-4

Development Schedule

Sewage Flow Estimates	**Estimation**	**Remark**
TKOPRS		
No. of Staff	50	
Unit flow factor (m^3/person/day)	0.28	J11 Community, Social & Personal Services
ADWF, (m^3/day)	16.80	**P_{CIF} = 1.20 included**
No. of Visitors	350	
Unit flow factor (m^3/person/day)	0.04	School Student
ADWF, (m^3/day)	16.80	**P_{CIF} = 1.20 included**
Sewage flow from horse cleanin		
No. of Horses	74.00	
Flow Rate of Horse Cleaning (L/min	15.00	
Duration of Horse Cleaning (min.	20.00	
Frequency of Horse Cleaning (Number of time per da	1.00	
ADWF, (m^3/day)	26.64	**P_{CIF} = 1.20 included**
Sub total ADWF, (m^3/day)	**60.24**	

ARUP

30-Jan-26

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Table D3 - Hydraulic Calculation - Sewerage design

Parameters:
ks = 3.0 mm (for slimed clayware sewer pipe with 0.75m/s under poor condition)
ks = 0.6 mm (for slimed clayware sewer pipe with 1.2m/s under poor condition)
ks = 3.0 mm (for slimed concrete sewer pipe with 1.2m/s under poor condition)
u 0.000001

Capacity Check

From	To	ADWF (m^3/d)	Contributing Population	Peaking Factor	Peak (L/s)	Diameter (mm)	Upstream G.L. (mPD)	Downstream G.L. (mPD)	Upstream I.L. (mPD)	Downstream I.L. (mPD)	Upstream Cover	Downstream Cover	Length (m)	Gradient	Area (m^2)	Perimeter (m)	R=A/P	Pipe Roughness, ks (mm)	Full Bore Velocity (m/s)	Full Bore Capacity (L/s)	% of Capacity	Remark
FMH-L1.1	FMH-L1.2	60	223	8	5.58	225	5.87	5.80	4.65	4.35	1.00	1.23	30.00	0.01	0.04	0.71	0.06	3.00	1.02	40.70	13.71%	
FMH-L1.2	FMH-L1.3	60	223	8	5.58	225	5.80	5.76	4.35	4.07	1.23	1.46	27.42	0.01	0.04	0.71	0.06	3.00	1.02	40.70	13.71%	
FMH-L1.3	FTMH-L1.4	60	223	8	5.58	225	5.76	5.22	4.07	4.04	1.46	0.96	3.47	0.01	0.04	0.71	0.06	3.00	1.02	40.70	13.71%	
FMH-L2.1	FTMH-L1.4	60	223	8	5.58	225	5.63	5.22	4.41	4.22	1.00	0.77	18.50	0.01	0.04	0.71	0.06	3.00	1.02	40.70	13.71%	
FTMH-L1.4	FMH-1	60	223	8	5.58	225	5.22	5.22	3.89	3.73	1.11	1.26	15.55	0.01	0.04	0.71	0.06	3.00	1.02	40.70	13.71%	
FMH-1	FMH4035436	60	223	8	5.58	225	5.22	5.48	3.73	3.56	1.26	1.69	16.80	0.01	0.04	0.71	0.06	3.00	1.02	40.70	13.71%	
FMH4035436	FMH4035437	356	1318	6	24.72	450	5.48	5.57	0.72	0.63	4.31	4.49	38.94	0.00	0.16	1.41	0.11	3.00	0.78	124.21	19.90%	
FMH4035437	FMH4035438	356	1318	6	24.72	450	5.57	5.14	0.63	0.48	4.49	4.21	37.66	0.00	0.16	1.41	0.11	3.00	1.03	163.19	15.15%	
FMH4035438	FMH4035439	356	1318	6	24.72	450	5.14	4.77	0.43	0.31	4.26	4.01	39.30	0.00	0.16	1.41	0.11	3.00	0.90	142.83	17.30%	
FMH4035439	FMH4035440	445	1649	6	30.93	450	4.77	5.50	0.28	0.14	4.04	4.91	37.85	0.00	0.16	1.41	0.11	3.00	0.99	157.24	19.67%	
FMH4035440	FMH4035441	85973	318419	3	3080.84	1650	5.50	5.20	-1.66	-1.76	5.51	5.31	47.20	0.00	2.14	5.18	0.41	3.00	1.73	3697.92	83.31%	
FMH-L3.1	FMH-L3.2	60	223	8	5.58	225	6.50	5.90	4.86	4.78	1.42	0.90	7.81	0.01	0.04	0.71	0.06	3.00	1.02	40.70	13.71%	
FMH-L3.2	FTMH-L3.3	60	223	8	5.58	225	5.90	5.80	4.78	4.42	0.90	1.16	54.00	0.01	0.04	0.71	0.06	3.00	0.84	33.21	16.80%	
FTMH-L3.3	S11A	60	223	8	5.58	225	5.80	-	4.27	4.14	1.16	-	19.13	0.01	0.04	0.71	0.06	3.00	0.84	33.21	16.80%	
S11A	S12	68	252	8	26.43	300	-	-	3.11	2.80	-	-	79.89	0.00	0.07	0.94	0.08	3.00	0.77	54.65	48.36%	
S12	S13	68	252	8	26.43	300	-	-	2.80	2.60	-	-	83.40	0.00	0.07	0.94	0.08	3.00	0.61	42.93	61.58%	

Appendix 7

DRAINAGE IMPACT ASSESSMENT

ARUP

The Hong Kong Jockey Club

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drainage Impact Assessment

Reference: DIA_REP_003

Rev. 2 | 30 January 2026

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 304521

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1. Introduction

1.1 Project Description

This **Drainage Impact Assessment (DIA)** is prepared in support of the Section 16 (“**S16**”) Planning Application to allow for the development of a Public Riding School with ancillary facilities (e.g. utility trench) (collectively as the “**PRS**”) at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories ("**TKOL II/III**") for the HKJC Public Riding Schools Limited (the “**Applicant**”). The Application Site comprises of three (3) existing platforms and land required for the provision of ancillary utility trench connecting to the three (3) platforms (collectively as the “**Application Site**”) within TKOL II/III. The PRS aligns with the Government’s policy objectives in fostering more public participation in the community through wider visibility and popularity of horse riding, supporting equestrian as an elite sport, and maintaining Hong Kong as a centre for major international sports events.

The Application Site is predominately zoned “Open Space” (“**O**”) on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 ("**Approved OZP**”), whilst a strip of area at the north is zoned “Green Belt” (“**GB**”) and a minor portion abutting Chun Sing Street is zoned “Other Specified Uses” annotated “Industrial Estate” (“**OU(Industrial Estate)**”) on the Approved OZP. The PRS with ancillary facilities (‘Horse Riding School’ subsumed under ‘Place of Recreation, Sports or Culture’ use) is a Column 2 use under the “O”, “GB” and “OU(Industrial Estate)” zones that may be permitted with or without conditions on Application under S16 of the Town Planning Ordinance (“**TPO**”). There are no plot ratio (“**PR**”), building height (“**BH**”), and site coverage (“**SC**”) restrictions imposed on the “O”, “GB” and “OU(Industrial Estate)” zones of the Approved OZP. While a portion of TKOL II/III falls within the Clear Water Bay Country Park (“**CWBCP**”), the Application Site does not involve any areas falling within the Country Park Boundary.

The PRS is located on three (3) platforms, namely the Lower Platform (i.e. Reception and Hospitality Lounges) (approx.+6.0mPD), Middle Platform (i.e. Pony Paddock & Pavilion I)(approx. +40.0mPD) and Upper Platform (i.e. Horse Paddock & Pavilion II) (approx.140.0mPD), with a proposed total GFA of approx. 9,000m² and a proposed building height of 4.8m to 7.7m. An ancillary utility trench connecting to the three (3) platforms is also proposed to accommodate various essential utilities services in support of the PRS operations.

1.2 Purpose of the Report

The objective of this DIA is to identify, assess and mitigate potential drainage impacts from the proposed development of public riding school at the three platforms with ancillary facilities and land required for the provision of ancillary utility trench connecting to the three (3) platforms within at TKOL II/III. The existing access road will undergo upgrading and widening works by EPD to facilitate operation and aftercare of TKOL II/III by EPD which will enable two-way traffic operations, while meeting a minimum width of 6m necessary for Emergency Vehicular Access (“EVA”). The drainage impact of the road improvement works had been separately assessed, and the cumulative drainage impact had been considered in this report.

1.3 Structure of the Report

This report is structured as follow:

Section 1	**Introduction** Introduction and a brief description of the project
Section 2	**Drainage Impact Assessment** Assessment of the drainage impact due to the proposed development of public riding school
Section 3	**Conclusion** Conclusion of the assessment results

2. Drainage Impact Assessment

2.1 Assessment Approach

This drainage impact assessment (DIA) is following the standards set out in the Stormwater Drainage Manual (Fifth Edition) issued by the Drainage Services Department in January 2018 (SDM), the Corrigendum No. 1/2022 and No. 1/2024. The objective of this assessment is to review the performance of the existing stormwater drainage system and propose mitigation measures, if any.

2.2 Runoff Estimation

Flood Protection Level

The design standard for a drainage system shall be able to accommodate a flood event with a predefined return period, which depends on the area and type of drainage system.

The design flood protection level is determined in accordance with Table 10 of the SDM, which is reproduced in the below table.

Table 2.1 – Design Flood Protection Levels

Category	**Return Period**
Intensively Used Agricultural Land	2-5 years
Village Drainage including Internal Drainage System under a Polder Scheme	10 years [1, 3]
Main Rural Catchment Drainage Channels	50 years [2, 3]
Urban Drainage Trunk Systems	200 years [4]
Urban Drainage Branch Systems	50 years [4]

Notes:

1. The impact of a 50-year event should be assessed in each village to check whether a higher standard than 10 years can be justified.
2. Embanked channels must be capable of passing a 200-year flood within banks.
3. For definitions of Village Drainage and Main Rural Catchment Drainage Channels, refer to Section 6.6.1 of the SDM
4. For definitions of Urban Drainage Branch and Urban Drainage Trunk Systems, refer to Section 6.6.2 of the SDM

Peak Runoff

The peak runoff is estimated using the Rational Method in accordance with Section 7.5.2 of the SDM with the following equation:

$$Q = 0.278CiA$$

where, Q = peak runoff in m^3/s
C = runoff coefficient
i = rainfall intensity in mm/hr
A = catchment area in km^2

Runoff Coefficient

The runoff coefficients, C, for different surface characteristic to be adopted in this DIA for the peak runoff estimation are made reference to Section 7.5.2 (b) of the SDM and listed in the below table.

Table 2.2 – Runoff Coefficient

Surface Characteristics	**Runoff Coefficient, C[1]**
Asphalt	0.70 – 0.95
Concrete	0.80 – 0.95
Brick	0.70 – 0.85
Grassland (heavy soil[2]) Flat Steep	 0.13 – 0.25 0.25 – 0.35
Grassland (sandy soil) - Flat - Steep	 0.05 – 0.15 0.15 – 0 20
Notes: 1. For steep natural slopes or areas where a shallow soil surface is underlain by an impervious rock layer, a higher C value of 0.4 – 0.9 may be applicable. 2. Heavy soil refers to fine grain soil composed largely of silt and clay	

Runoff coefficients of 0.9 and 0.35 are adopted for paved and unpaved catchments respectively. The drainage layout plan showing the footprint of the proposed development, including the Upper Platform (Horse Paddock & Pavilion II), Middle Platform (Pony Paddock & Pavilion I), Lower Platform (Reception and Hospitality Lounges), Spelling Yard, Central Fodder Store and E&M Block, is appended to **Appendix A**. For the development at the Upper Platform, Middle Platform, Lower Platform, Central Fodder Store and E&M Block, they are assumed to be paved in this assessment. For the Spelling Yard, no change to the catchment characteristic is anticipated and remains unpaved.

Rainfall Intensity

The rainfall intensity is determined by the following equation with reference to Section 4.3.3 of the SDM:

$$i = \frac{a}{(t_d + b)^c}$$

where, i = rainfall intensity in mm/hr
t_d = duration in minutes
a, b, c = storm constants

The storm constants, i.e., a, b, and c, under Table 3a “Storm Constants for Different Return Period of HKO Headquarters” of the SDM, which are recommended for general application, are adopted in this DIA. The Application Site is a restored landfill, where strict measures are required to protect the integrity of the capping system. The capping comprises a geotextile polyethylene liner, overlain by a synthetic geo-composite drainage layer and fill above the waste. To avoid damaging these layers, an excavation depth limit of approximately 500 mm has been imposed across most of the site. This constraint presents significant technical challenges for any pipeline upgrading works. In addition, the site is located within a well-developed urban area, where the nearest public drainage facilities consist of 3-cell and 2-cell box culverts with limited space for further expansion, climate change effects up to mid-21st century (2014-2060) with 11.1% increase in rainfall intensity are therefore considered. The equation is given as,

$$i = \frac{a}{(t_d + b)^c} \times (1 + 11.1\%)$$

where, i = rainfall intensity in mm/hr
t_d = duration in minutes
a, b, c = storm constants

2.3 System Capacity

The capacity of the proposed and existing stormwater drainage system is checked by using the continuity equation, assuming full-bore flow condition:

$$Q = VA$$

where, Q = peak runoff in m^3/s

V = cross-sectional mean velocity in m/s

A = cross-sectional area of the pipe/channel in m^2

The cross-section mean velocity, V, of drainage pipes is estimated using the Colebrook-white equation:

$$V = -\sqrt{32gRS_f}\log\left[\frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{32gRS_f}}\right]$$

where, V = cross-sectional mean velocity in m/s

R = hydraulic radius in m

S_f = friction gradient

ks = roughness

v = kinematic viscosity

The cross-section mean velocity, V, of box culverts is estimated using the Manning equation:

$$V = \frac{R^{\frac{1}{6}}}{n}\sqrt{RS_f}$$

where, V = cross-sectional mean velocity in m/s

R = hydraulic radius in m

S_f = friction gradient

n = Manning roughness coefficient

The roughness, ks for the proposed and existing drainage pipe is assumed to be 0.15 mm in accordance with the SDM Table 14, Precast concrete pipes with 'O' ring joints, normal.

The Manning roughness coefficient, n for the existing box culvert is assumed to be 0.014 in accordance with the SDM Table 13, Concrete-lined channels, good.

Other than typical surface channels and pipes, the Site is served by a number of baffled channels, which are 1000mm to 3300mm trapezoidal channels with baffle blocks. Relevant as-built drawings are provided in **Appendix B** for reference. The basic parameters of baffled channels within the Site are summarised in the table below,

Table 2.3 – Summary of Existing Baffled Channels Parameters

Channel Width	Baffled Block Height	Channel Depth

(Based Width in mm)	(mm)	(mm)
1000	400	1000
1500	400	1000
2200	500	1000
3300	600	1200

To account for the baffled blocks, the roughness coefficient is assumed to be 0.06, Natural-stream channels, Winding some pools and shoals, clean, lower stages, more ineffective slope and sections, stony sections, bad.

For all underground pipeworks and box culverts, 10% reduction in flow area is considered to take into account the effects to flow capacity due to materials deposited on the bed. No reduction in flow area is assumed for open channels as any sediments could be removed on a regular basis under a normal maintenance regime.

2.4 Drainage Impact Assessment

Referring to the as-built drainage drawings of the Site and DSD drainage record, drainage provisions at each platform are subsoil drains only with a perimeter perforated pipe along the platform edge. Surface runoff is anticipated to be soaked away and drained to the baffled channels down the slope. Ultimately, they are to be discharged to the 3-cell 3500mm (W) x 2600mm (H) and 2-cell 3500mm (W) x 3200mm (H) box culverts along the Site's boundary, which both merge into a 5-cell to 7-cell 3500mm (W) x 3200mm (H) box culvert to the sea. New drainage system would be designed to serve each platform and the associated facilities and it is subject to further development. Existing drainage infrastructure within TKOL II/III would be utilised for stormwater discharge to the public drainage system. As the TKOL II/III site is subject to long-term settlement, the invert levels shown in the as-built drawings shall be for reference only. The levels and their condition are subject to verification on site.

The catchments within the Site could be divided into 13 sub-catchments, which surface runoff would either be discharged to the 3-cell 3500mm (W) x 2600mm (H) or the 2-cell 3500mm (W) x 3200mm (H) box culverts. They are summarised as the following,

Table 2.4 – Summary of Catchments within the Site

Catchment Name	Paved Catchment Area (m^2)	Unpaved Catchment Area (m^2)	Downstream Trunk Drainage
A	0	27,350	3-cell 3500mm(W) x 2600mm(H) Box Culverts
B	0	77,600	3-cell 3500mm(W) x 2600mm(H) Box Culverts
C	0	73,650	3-cell 3500mm(W) x 2600mm(H) Box Culverts
D1	0	70,540	2-cell 3500mm(W) x 3200mm(H) Box Culverts
D2	0	42,050	2-cell 3500mm(W) x 3200mm(H) Box Culverts
D3	0	14,990	2-cell 3500mm(W) x 3200mm(H) Box Culverts
E	0	32,670	3-cell 3500mm(W) x 2600mm(H) Box Culverts

F	0	15,340	2-cell 3500(mm) x 3200mm(H) Box Culverts
G	0	880	2-cell 3500mm(W) x 3200mm(H) Box Culverts
H	1,640	1,770	3-cell 3500mm(W) x 2600mm(H) Box Culverts
I	4,620	8,550	2-cell 3500mm(W) x 3200mm(H) Box Culverts
J	0	15,420	3-cell 3500mm(W) x 2600mm(H) Box Culverts
Existing Access Road	5,130	0	1520 m^2 to 3-cell 3500mm(W) x 2600mm(H) Box Culverts 3610 m^2 to 2-cell 3500 mm(W) x 3200mm(H) Box Culverts

For the existing access road, it can be further delineated into 7 sub-catchments. Surface runoff from sub-catchment R1 to R5 would be ultimately discharged to the 2-cell 3500mm(W) x 3200mm (H) box culverts, and that from sub-catchment R6 and R7 would be discharged to the 3-cell 3500mm(W) x 3200mm (H) box culverts. The road widening roads would result in an increase in paved catchment area by 8,120 m^2.

Table 2.5 – Summary of Access Road Sub-catchments Before and After Road Widening

Access Road Sub-catchment Name	Catchment Area before Widening (m^2)	Catchment Area after Widening (m^2)
R1	800	2,300
R2	810	1,990
R3	1,040	2,430
R4	510	1,200
R5	450	1,090
R6	1,520	3,620
R7 (from Catchment H)	470	1,090
Total	5,600	13,720

Regarding the catchments of the proposed development, each sub-catchment and their corresponding discharge point is presented below,

Table 2.6 – Summary of PRS Sub-catchments

PRS Sub-catchment Name	Catchment Area (m^2)	Proposed Discharge Point
Upper Platform 1	9,080	C18
Upper Platform 2	5,820	C17
Upper Platform 3	5,590	C16

Middle Platform (Spelling Yard)	-	-
Middle Platform	8,960	C20
Lower Platform 1	3,700	C3
Lower Platform 2	510	MH1
Lower Platform 3	3,040	MH5
Lower Platform (Central Fodder Store)	840	C4
Lower Platform (E&M Block)	440	C7

Subject to design development of the PRS and agreement with EPD, the existing catchpits within TKOL II/III may not be utilised and new drainage pipes may be constructed for connection to the existing drainage network. Such change would not alter the hydraulic checking in this report.

For the catchments of the abovementioned 2 box culverts (including the Site), they are summarised in the following table,

Table 2.6 – Summary of Catchments of the 3-cell 3500mm (W) x 2600mm (H) and 2-cell 3500mm (W) x 3200mm (H) Box Culvert Before and After Road Widening, and After PRS Development

	Before Road Widening		**After Road Widening**		**After PRS Development**	
	Paved Catchment Area (m^2)	**Unpaved Catchment Area (m^2)**	**Paved Catchment Area (m^2)**	**Unpaved Catchment Area (m^2)**	**Paved Catchment Area (m^2)**	**Unpaved Catchment Area (m^2)**
3-cell 3500mm(W) x 2600mm(H) Box Culverts	276,590	1,475,040	276,590	1,475,040	276,590	1,475,040
Catchment from the Site	3,160	228,460	5,880	225,740	39,870	189,280
Total	**279,750**	**1,703,500**	**282,470**	**1,700,780**	**316,460**	**1,664,320**
2-cell 3500mm(W) x 3200mm(H) Box Culverts	119,100	619,080	119,100	619,080	119,100	619,080
Catchment from the Site	8,230	137,010	13,630	131,610	17,620	130,090
Total	**127,330**	**756,090**	**132,730**	**750,690**	**136,720**	**749,170**

The corresponding catchment plans are appended to **Appendix C**. For the baffled channels within the Site and the box culverts along the Site's boundary, they are considered to be Urban Drainage Trunk System (equivalent diameter larger than 1800mm) and checked against 200-year rainfall events. Whereas for the others, they are checked against 50-year rainfall events. As the road widening works would convert various unpaved catchments at respective sub-catchments to paved by margin, no reduction in unpaved catchments within the Site is assumed in the assessment of drainage system within TKOL II/III for conservativeness.

Based on the current available information, the existing drainage system within TKOL II/III had been checked to have sufficient capacity to cater for the increased surface runoff due to the proposed development, ranging from 1.83% to 86.44% full. Regarding the 3-cell 3500mm (W) x 2600mm (W) and 2-cell 3500mm (W) x 3200mm (H) box culverts, the peak flow only increased from 66.95m^3/s to 68.47m^3/s by 2.27% (83.06% full) and 29.69 m^3/s to 30.16 m^3/s by 1.58% (69.76% full) respectively, no adverse drainage impact to the public drainage system is anticipated.

The detailed calculation for hydraulic assessment is provided in **Appendix D**.

3. Conclusion

3.1 Conclusion

This report assessed the drainage impact of the proposed road widening works at the restored landfill site (TKOL II/III) in Tseung Kwan O. The drainage provisions within the Site and the public drainage system in the vicinity had been reviewed, no adverse drainage impact to the existing public drainage system is anticipated.

Appendix A

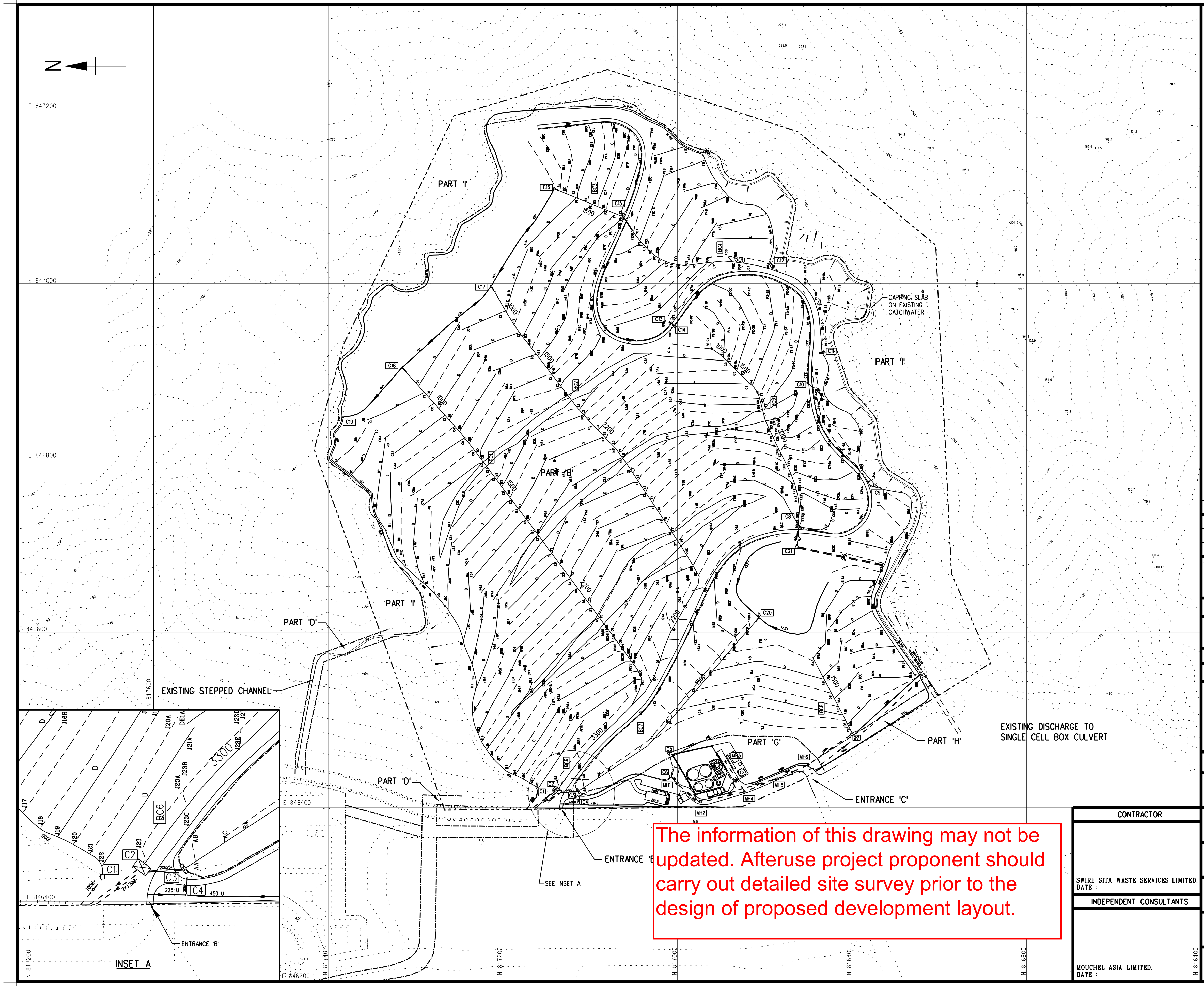
Drainage Layout Plan

Drainage Layout Plan

3-CELL 3500(W) x 2700(H) BOX CULVERT
Central Fodder Store
5-CELL 3500(W) x 3200(H) BOX CULVERT
E&M Block
2-CELL 3500(W) x 3200(H) BOX CULVERT
4000(W) x 3200(H) BOX CULVERT
3000(W) x 3000(H) BOX CULVERT
Upper Platform
Utility Trench
Spelling Yard
Lower Platform
Middle Platform
450SC
600SC
750SC
1050SC
1000BC
1500BC
2200BC
3300BC
1050
1200
C2
C3
C7
C8
C12
C15
C20
C21
MH1
MH2
MH3
MH4
MH5
MH6
375CC(M)
PC1
PC2 (C14)
PC3 (C10)
PC4 (C9)
1200SC
1500SC
1350
762
457
900
750
Legends
1200S — EXISTING OPENING CHANNEL, SC DENOTES STEPPED CHANNEL, BC DENOTES BAFFLED CHANNEL
762 — EXISTING DRAINAGE PIPE
☒ EXISTING CATCHPIT
375CC(M) — PROPOSED SURFACE CHANNEL WITH COVER, M DENOTES MEDIUM DUTY (FOR ACCESS ROAD)
467 — PROPOSED DRAINAGE PIPE (FOR ACCESS ROAD)
☒ PROPOSED CATCHPIT (FOR ACCESS ROAD)

Appendix B

As-built Drawings of Existing Drainage System


N
E 847200
E 847000
E 846800
E 846600
E 846400
E 846200
N 817600
N 817400
N 817200
N 817000
N 816800
N 816600
N 816400
PART 'I'
PART 'B'
PART 'D'
PART 'G'
PART 'H'
EXISTING STEPPED CHANNEL
CAPPING SLAB ON EXISTING CATCHWATER
EXISTING DISCHARGE TO SINGLE CELL BOX CULVERT
ENTRANCE 'B'
ENTRANCE 'C'
SEE INSET A
INSET A
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
MH1
MH2
MH4
MH5
MH6
1500
1000
2200
3300
450 U
225 U
J16B
J17
J18
J19
J20
J21
J22
J23
BC6
AB
AC
BA

The information of this drawing may not be updated. Afteruse project proponent should carry out detailed site survey prior to the design of proposed development layout.

NOTES:

1. ALL GRIDS ARE HONG KONG GRID 1980.
2. ALL LEVEL ARE METRES ABOVE PRINCIPAL DATUM.
3. FOR SURFACE WATER DETAILS REFER TO DRAWING NOS. GENL/SUR/DRW/001/R TO 008/R AND STG2/SUR/DRW/011/R TO 020/R.
4. PLATFORM PERIMETER DRAINS LAID AT 1 : 125.
5. FOR PRECAST CONCRETE PIPE, ALL PIPES BEDDINGS CLASS B AS PER DSD DRAWING NO. 1048.
6. ALL PRECAST CONCRETE PIPES CLASS H TO BS 5911: PART 100 : 1988 UNLESS OTHERWISE STATED.
7. FOR AS-CONSTRUCTED DETAILS OF CATCHPITS AND MANHOLES, REFER TO STG2/SUR/DRW/002/R.

LEGEND :

— - - — - -	SITE BOUNDARY
═	EXISTING STEPPED CHANNEL
1000 BC1	BAFFLED CHANNEL OF BC1 WITH BASE WIDTH 1000mm
— — — —	250mm DIAMETER NETLON PIPE
o	NETLON WITH DAYLIGHT
457	PERIMETER DRAIN PERFORATED HDPE PIPE OF DIA. 457mm
1050 SC	STEPPED CHANNEL OF SIZE 1050mm
300	ROADWAY DRAIN 300mm DIA. PERFORATED PIPE
600 U	U-CHANNEL WITH SIZE 600mm
300	HDPE PIPE OF DIAMETER 300mm
300	PRECAST CONCRETE PIPE OF DIAMETER 300mm
——	RECTANGULAR CHANNEL WITH WIDTH 1200mm
—	PIPEWORK CONNECTION TO DOWNSLOPE SURFACE CHANNEL
⊠	CATCHPIT
C1	CATCHPIT NUMBER
○	CONNECTION BETWEEN DIFFERENT SIZES OF BAFFLED CHANNELS / U-CHANNELS
●	TAPER SECTION / APRON STRUCTURE

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN: A2SUR001.DGN
REF: TKOSF-AB, S2-PTRD, S2TOPDRN & RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

STAGE II/III
SURFACE WATER DRAINAGE
LAYOUT PLAN

AS CONSTRUCTED RECORD DRAWING

Drawing no. STG2/SUR/DRW/001/R

Scale 1:2000

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

Binnie Black & Veatch
Hong Kong Limited

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CHUN WO CONSTRUCTION &
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MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

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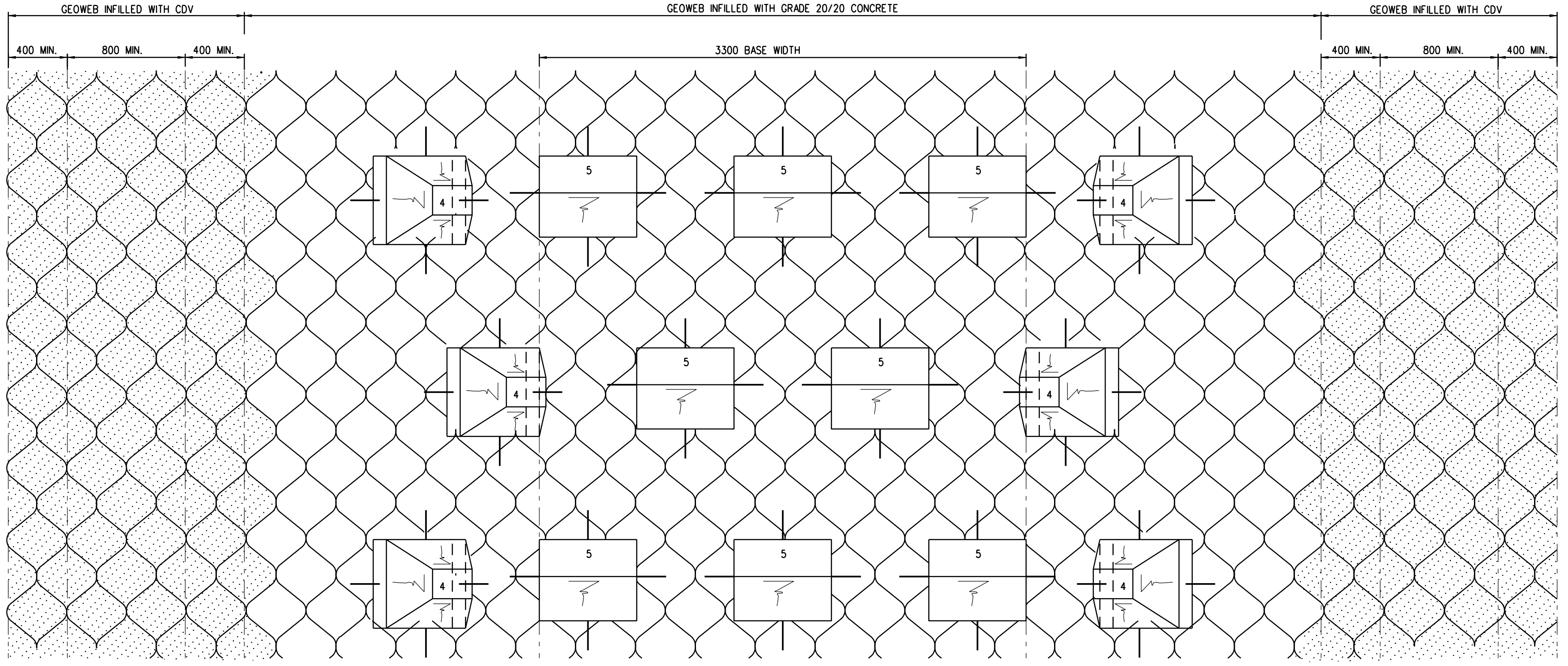
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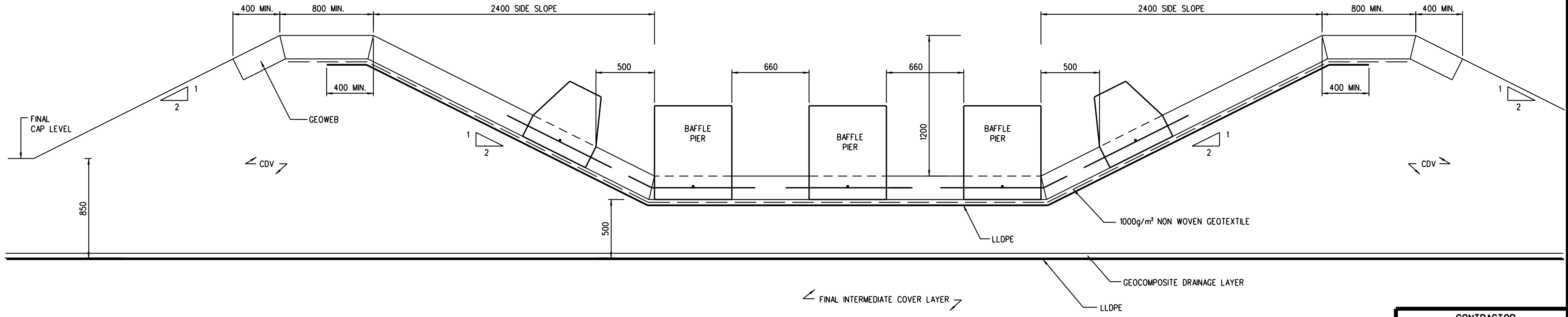
GEOWEB INFILLED WITH GRADE 20/20 CONCRETE
GEOWEB INFILLED WITH CDV
400 MIN.
800 MIN.
400 MIN.
3300 BASE WIDTH
400 MIN.
800 MIN.
400 MIN.
4
5
5
5
4
4
5
5
4
4
5
5
5
4

BAFFLED CHANNEL
(BASE WIDTH = 3300mm)


400 MIN.
800 MIN.
2400 SIDE SLOPE
2400 SIDE SLOPE
800 MIN.
400 MIN.
400 MIN.
400 MIN.
500
660
660
500
1200
FINAL CAP LEVEL
GEOWEB
1
2
1
2
1
2
1
2
CDV
CDV
BAFFLE PIER
BAFFLE PIER
BAFFLE PIER
850
500
1000g/m² NON WOVEN GEOTEXTILE
LLDPE
GEOCOMPOSITE DRAINAGE LAYER
LLDPE
FINAL INTERMEDIATE COVER LAYER

TRANSVERSE SECTION OF BAFFLED CHANNEL

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. STG2/SUR/DRW/012/R TO 017/R, 019/R & 020/R.
3. BAFFLED CHANNEL IS FORMED BY GEOWEB INFILLED WITH GRADE 20/20 CONCRETE.
4. GEOWEB IS LARGE CELL A-SECTION 203 THICK.
5. BAFFLE PIERS ARE PRECAST UNITS OF CONCRETE GRADE 30/20.
6. FOR LAYOUT OF SURFACE WATER DRAINAGE REFER TO DRAWING NO. STG2/SUR/DRW/001/R.
7. FOR BAFFLE PIERS ROW SPACING, AND DETAILS OF PIERS REFER TO DRAWING NO. STG2/SUR/DRW/012/R.
8. FOR DOWEL BAR DETAILS REFER TO DRAWING NO. GENL/SUR/DRW/003/R.

LEGEND :

▨	INFILLED WITH CDV
▨	INFILLED WITH CONCRETE

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

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MAIN : A2SUR011.DGN
REF : RTKO-A1.DGN

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SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

STAGE II/III
SURFACE WATER
DRAINAGE DETAILS
SHEET 1 OF 10

AS CONSTRUCTED RECORD DRAWING

Drawing no. STG2/SUR/DRW/011/R

Scale 1 : 20

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
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INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
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Hong Kong Limited

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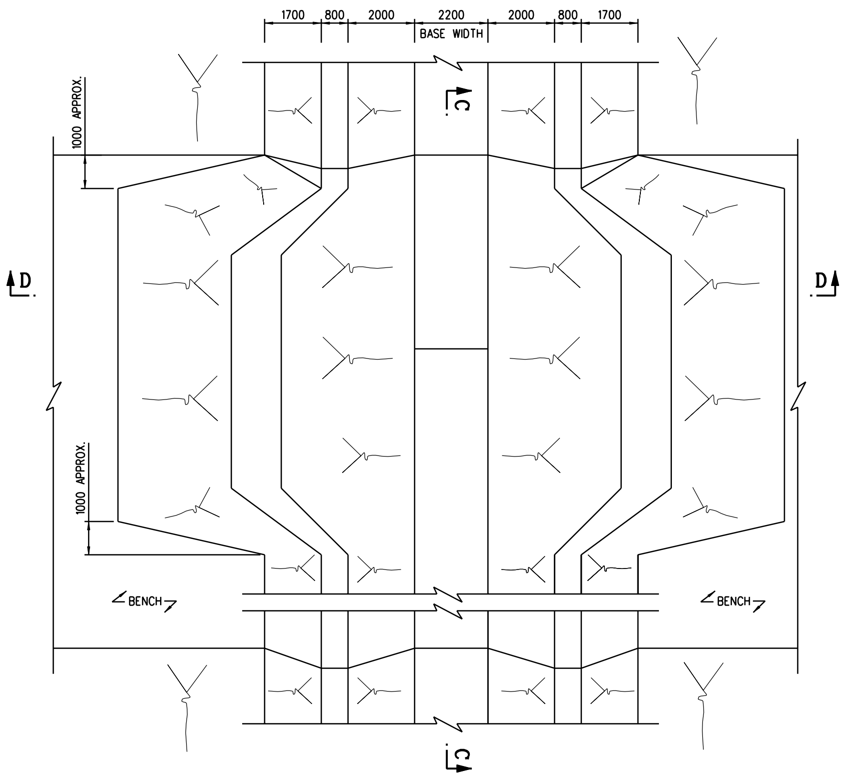
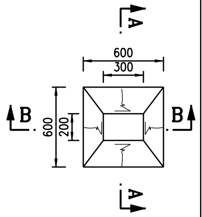
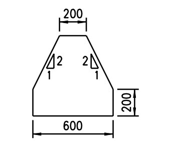
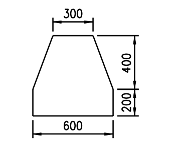
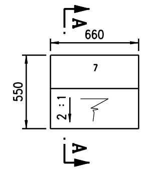
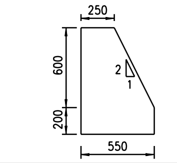

1700
800
2000
2200
BASE WIDTH
2000
800
1700
1000 APPROX.
1000 APPROX.
C
C
D
D
BENCH
BENCH

DETAILS OF BAFFLED CHANNEL CROSSING BENCH

1 : 100

DETAILS OF BAFFLE PIERS AND SPACING FOR 3300 mm BAFFLE CHANNEL
REFER TO DRAWING NO. STG2/SUR/DRW/011/R.

BAFFLE PIER TYPE	PLAN	SECTION A - A	SECTION B - B
4	 A 600 300 B B 600 200 A	 200 2 1 2 1 200 600	 300 400 200 600
5	 A 660 7 550 2 : 1 A	 250 600 2 1 200 550	

NOTE : DOWEL BAR NOT SHOWN

CHANNEL GRADIENT	L (mm) (REFER TO DRAWING NO. GENL/SUR/DRW/002 FOR L)
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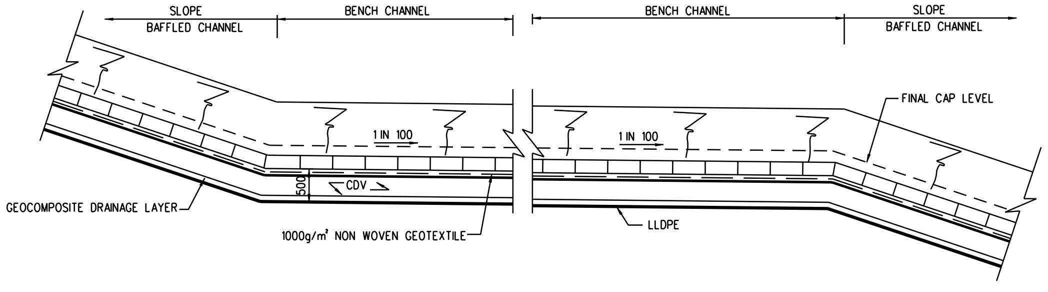
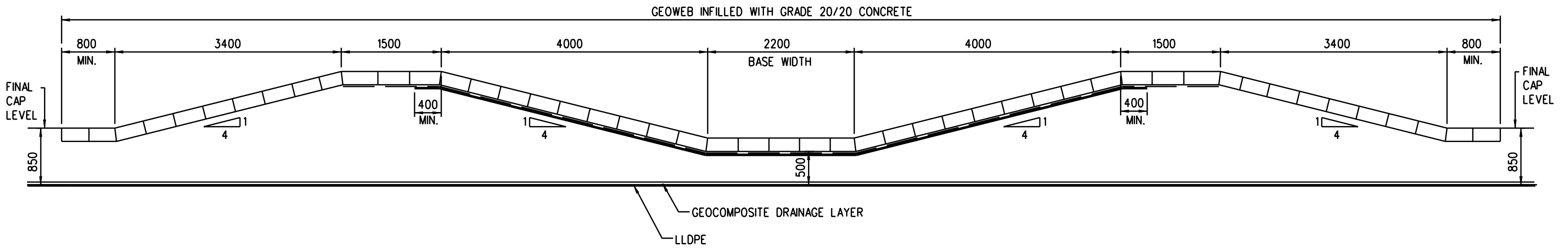
1:4	2220
1:5	2740
> 1:6	3270


SLOPE
BAFFLED CHANNEL
BENCH CHANNEL
BENCH CHANNEL
SLOPE
BAFFLED CHANNEL
FINAL CAP LEVEL
1 IN 100
1 IN 100
500
CDV
GEOCOMPOSITE DRAINAGE LAYER
1000g/m² NON WOVEN GEOTEXTILE
LLDPE

SECTION C - C

1 : 50


GEOWEB INFILLED WITH GRADE 20/20 CONCRETE
800
MIN.
3400
1500
4000
2200
BASE WIDTH
4000
1500
3400
800
MIN.
FINAL
CAP
LEVEL
FINAL
CAP
LEVEL
400
MIN.
400
MIN.
1
4
1
4
1
4
1
4
850
500
850
GEOCOMPOSITE DRAINAGE LAYER
LLDPE

SECTION D - D

1 : 50

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. STG2/SUR/DRW/011/R, 013/R TO 017/R, 019/R & 020/R.
3. FOR LOCATIONS OF BENCH REFER TO DRAWING NO. STG2/SUR/DRW/001/R.

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

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REF. RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
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Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

STAGE II/III
SURFACE WATER
DRAINAGE DETAILS
SHEET 2 OF 10

AS CONSTRUCTED RECORD DRAWING

Drawing no. STG2/SUR/DRW/012/R

Scale AS SHOWN

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
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INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

Binnie

Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
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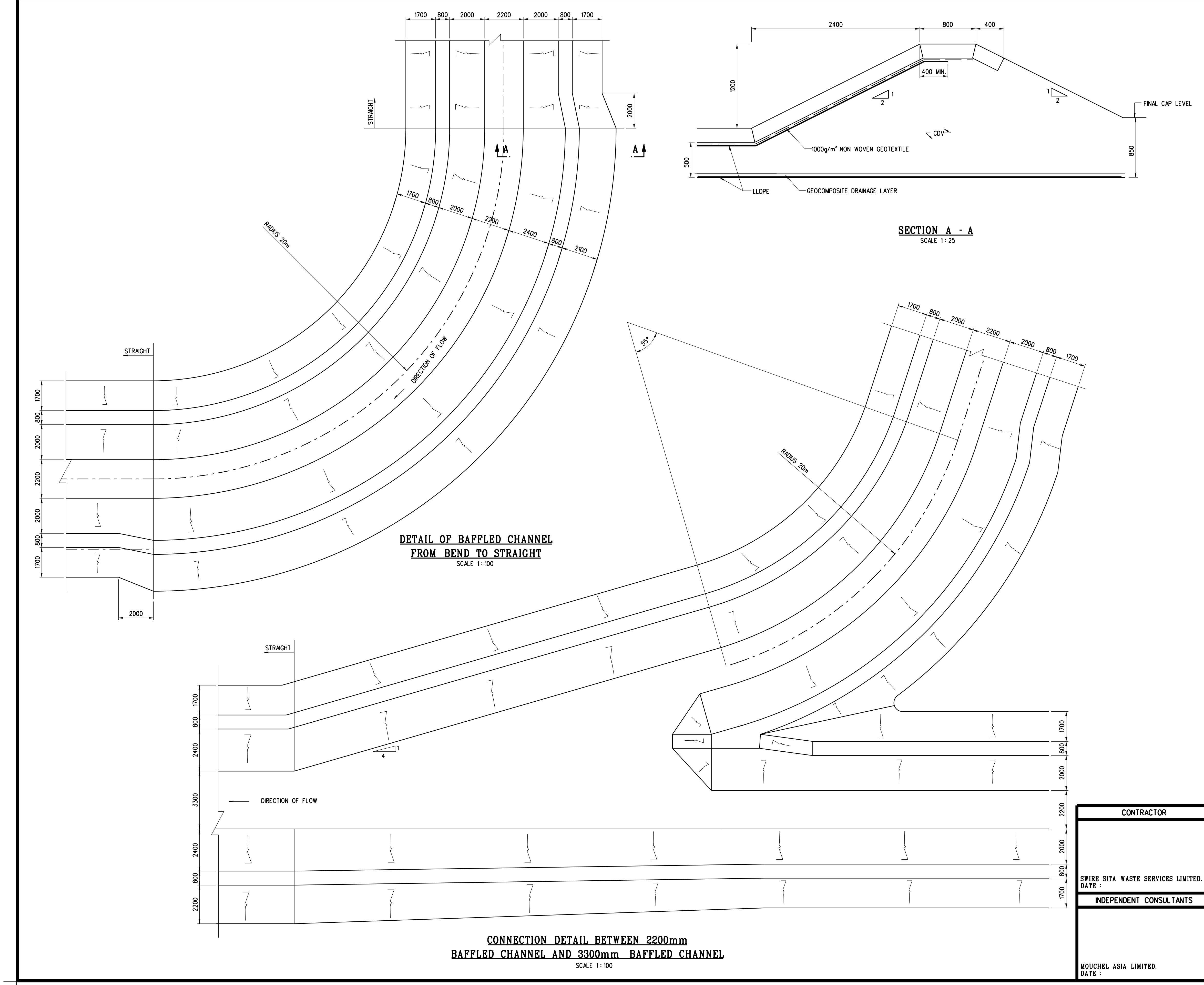
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE SITA WASTE
SERVICES LTD.



1700
800
2000
2200
2000
800
1700
2000
STRAIGHT
A
A
1700
800
2000
2200
2400
800
2100
RADIUS 20m
DIRECTION OF FLOW
STRAIGHT
1700
800
2000
2200
2000
800
1700
2000
2400
800
400
1200
400 MIN.
1
2
1
2
FINAL CAP LEVEL
CDV
1000g/m² NON WOVEN GEOTEXTILE
500
850
LLDPE
GEOCOMPOSITE DRAINAGE LAYER
1700
800
2000
2200
2000
800
1700
55°
RADIUS 20m
STRAIGHT
1700
800
2400
1
4
3300
DIRECTION OF FLOW
2400
800
2200
1700
800
2000
2200
2000
800
1700

DETAIL OF BAFFLED CHANNEL FROM BEND TO STRAIGHT

SCALE 1 : 100

SECTION A - A

SCALE 1 : 25

CONNECTION DETAIL BETWEEN 2200mm BAFFLED CHANNEL AND 3300mm BAFFLED CHANNEL

SCALE 1 : 100

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. STG2/SUR/DRW/011/R TO 012/R, 014/R TO 017/R, 19/R & 20/R.
3. DETAILS OF BAFFLED CHANNEL REFER TO DRAWING NO. GENL/SUR/DRW/001/R.
4. NOT USED.

Details of Revision	Date

	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref.
MAIN : 2SUR013.DGN
REF : TKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

STAGE II/III
SURFACE WATER
DRAINAGE DETAILS
SHEET 3 OF 10

AS CONSTRUCTED RECORD DRAWING

Drawing no.	Scale
STG2/SUR/DRW/013/R	AS SHOWN

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
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Construction Contractor
CHUN WO CONSTRUCTION &
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Environmental Consultants
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Independent Consultants
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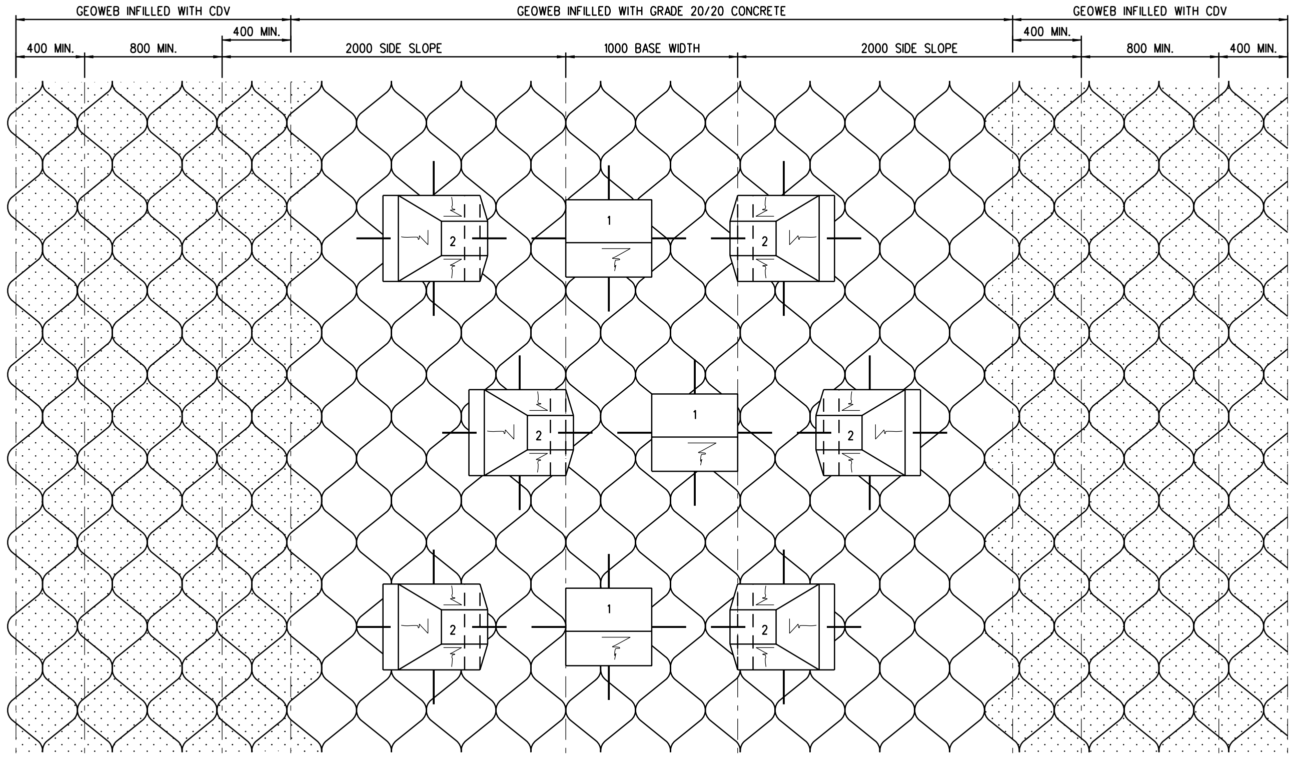
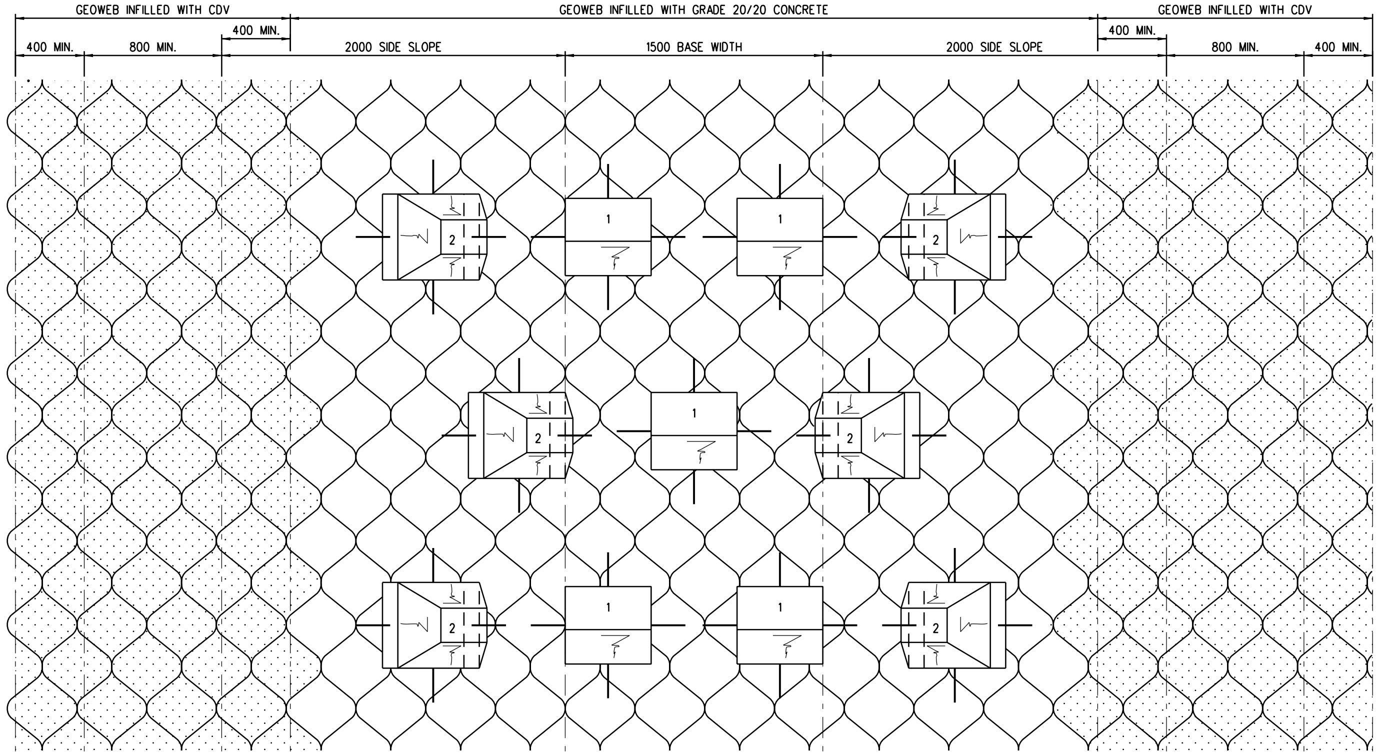

GEOWEB INFILLED WITH CDV
GEOWEB INFILLED WITH GRADE 20/20 CONCRETE
GEOWEB INFILLED WITH CDV
400 MIN.
800 MIN.
400 MIN.
2000 SIDE SLOPE
1000 BASE WIDTH
2000 SIDE SLOPE
400 MIN.
800 MIN.
400 MIN.
1
2

TYPE 1 BAFFLED CHANNEL
(BASE WIDTH = 1000mm)


GEOWEB INFILLED WITH CDV
GEOWEB INFILLED WITH GRADE 20/20 CONCRETE
GEOWEB INFILLED WITH CDV
400 MIN.
800 MIN.
400 MIN.
2000 SIDE SLOPE
1500 BASE WIDTH
2000 SIDE SLOPE
400 MIN.
800 MIN.
400 MIN.
1
2

TYPE 2 BAFFLED CHANNEL
(BASE WIDTH = 1500mm)

NOTE :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. GENL/SUR/DRW/002/R TO 009/R.
3. BAFFLED CHANNEL IS FORMED BY GEOWEB INFILL WITH GRADE 20/20 CONCRETE.
4. GEOWEB IS LARGE CELL A-SECTION 203 THICK.
5. BAFFLE PIERS ARE PRECAST UNIT OF CONCRETE GRADE 30/20.
6. FOR LAYOUT OF SURFACE WATER DRAINAGE REFER TO DRAWING NO. STG1/SUR/DRW/001 & STG2/SUR/DRW/001.
7. TYPICAL SECTION OF CHANNEL REFER TO DRAWING NO. GENL/SUR/DRW/003/R.

LEGEND :

▨ INFILLED WITH CDV

▨ INFILLED WITH CONCRETE

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN : AGSUR001.DGN
REF : RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

SURFACE WATER
DRAINAGE GENERAL DETAILS
SHEET 1 OF 9

AS CONSTRUCTED RECORD DRAWING

Drawing no. GENL/SUR/DRW/001/R

Scale 1 : 20

Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
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Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

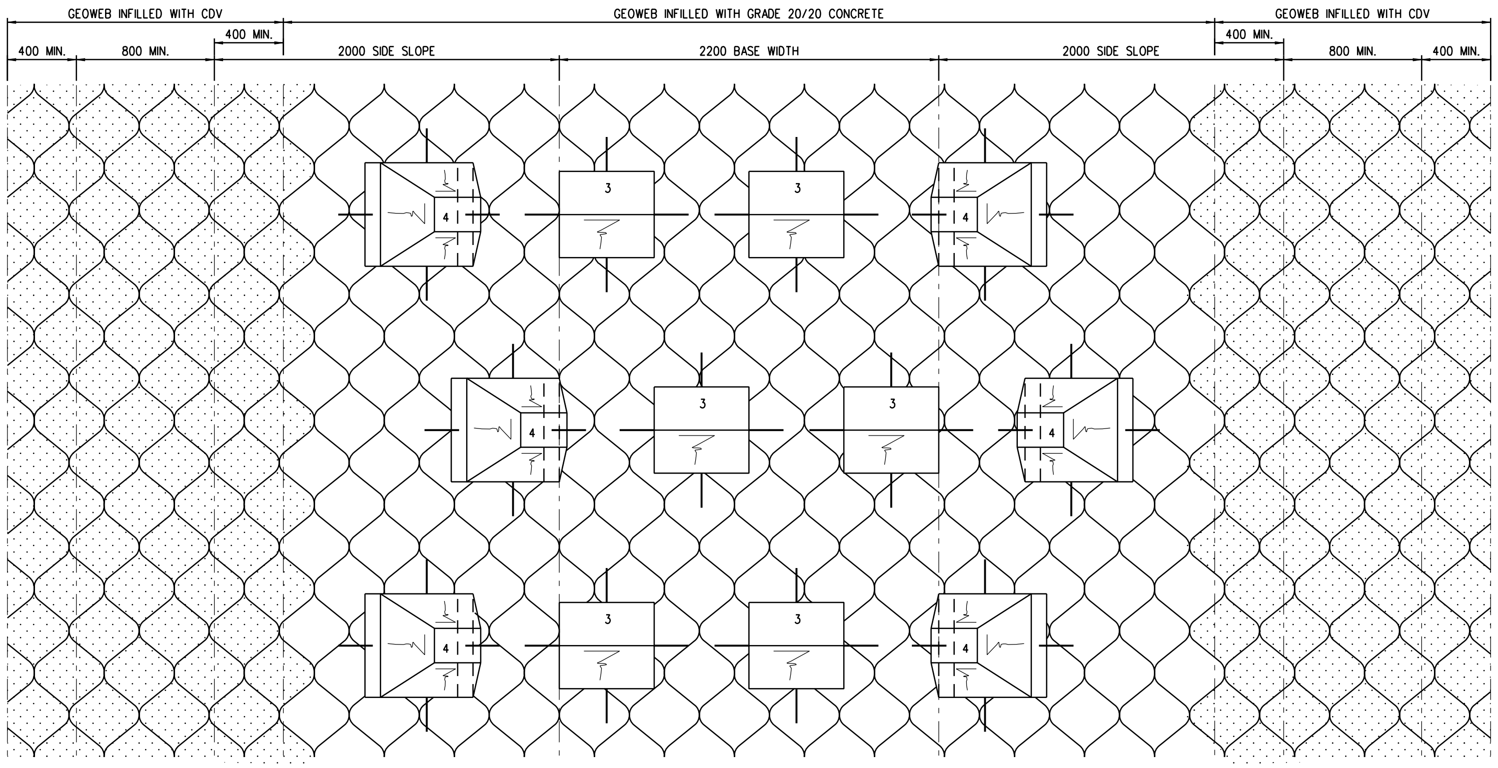
SWIRE SITA WASTE
SERVICES LTD.

CONTRACTOR

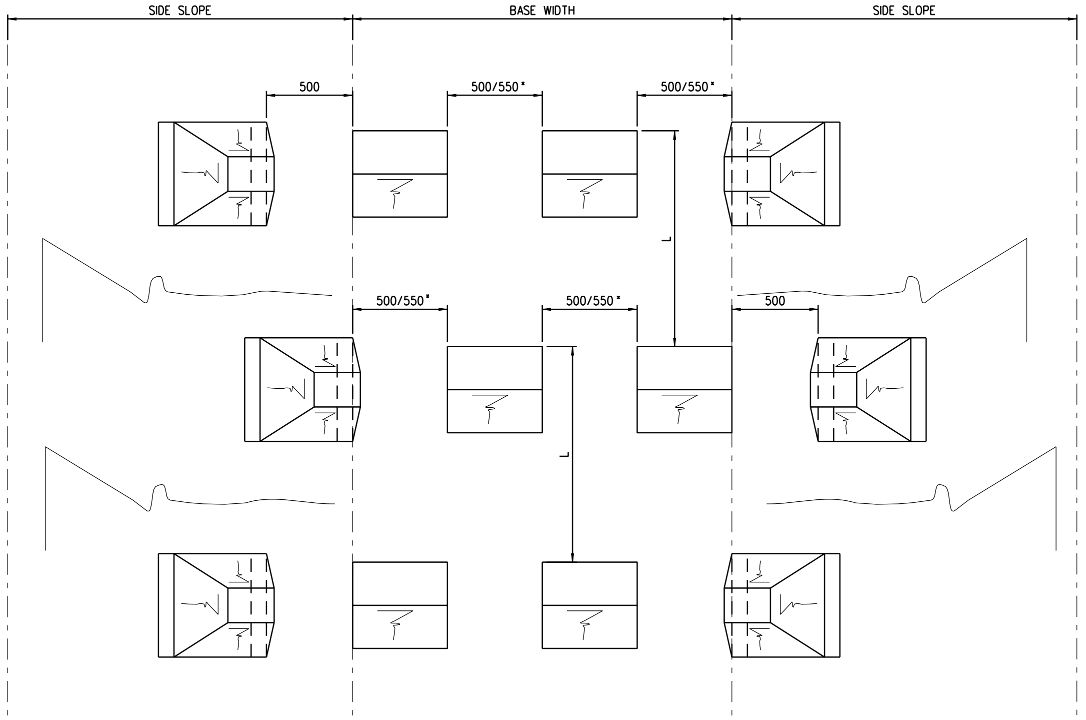
SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :


GEOWEB INFILLED WITH CDV
GEOWEB INFILLED WITH GRADE 20/20 CONCRETE
GEOWEB INFILLED WITH CDV
400 MIN.
800 MIN.
400 MIN.
2000 SIDE SLOPE
2200 BASE WIDTH
2000 SIDE SLOPE
400 MIN.
800 MIN.
400 MIN.
3
4

TYPE 3 BAFFLED CHANNEL
(BASE WIDTH = 2200mm)


SIDE SLOPE
BASE WIDTH
SIDE SLOPE
500
500/550*
500/550*
500/550*
500/550*
500
L
L

* FOR TYPE 3 BAFFLE CHANNEL

ARRANGEMENT OF BAFFLE PIERS

CHANNEL GRADIENT	L (mm)	
	PIER HEIGHT 500mm	PIER HEIGHT 400mm
1 : 3	1580	1260
1 : 4	2060	1650
1 : 5	2550	2040
> 1 : 6	3040 MIN.	2430

NOTE : PIER HEIGHT REFER TO DRAWING GENL/SUR/DRW/003/R.

NOTE :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. GENL/SUR/DRW/001/R, 003/R TO 009/R.
3. BAFFLED CHANNEL IS FORMED BY GEOWEB INFILL WITH GRADE 20/20 CONCRETE.
4. GEOWEB IS LARGE CELL A-SECTION 203 THICK.
5. BAFFLE PIERS ARE PRECAST UNIT OF CONCRETE GRADE 30/20.
6. DETAILS OF TRAPEZODIAL CHANNELS ARE SAME AS BAFFLED CHANNELS BUT WITHOUT BAFFLE PIERS.
7. FOR LAYOUT OF SURFACE WATER DRAINAGE REFER TO DRAWING NOS. STG1/SUR/DRW/001/R & STG2/SUR/DRW/001/R.
8. TYPICAL SECTION OF CHANNEL REFER TO DRAWING NO. GENL/SUR/DRW/003/R.
9. FOR DETAILS OF 3300mm INVERT BAFFLE CHANNEL (STAGE II/III ONLY) REFER TO DRAWING STG2/SUR/DRW/011/R.

LEGEND :

▨	INFILLED WITH CDV
◇	INFILLED WITH CONCRETE

Details of Revision	Date

	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN : AGSUR002.DGN
REF : RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

SURFACE WATER
DRAINAGE GENERAL DETAILS
SHEET 2 OF 9

AS CONSTRUCTED RECORD DRAWING

Drawing no. GENL/SUR/DRW/002/R

Scale 1 : 20

Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

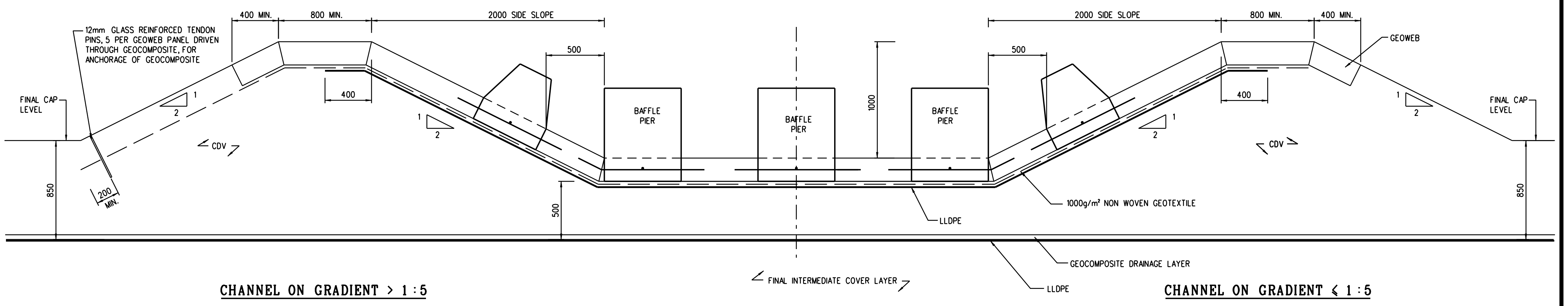
SWIRE SITA WASTE
SERVICES LTD.

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

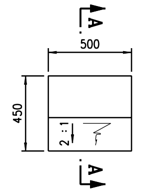
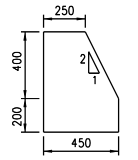
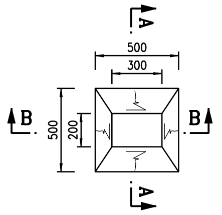
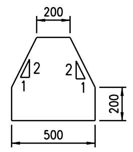
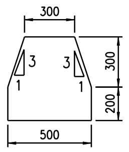
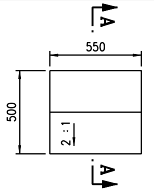
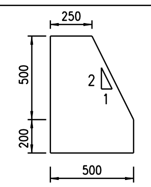
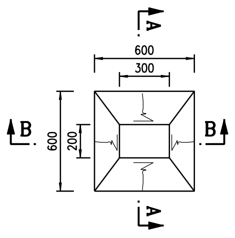
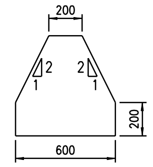
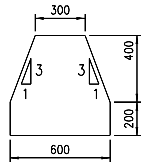
MOUCHEL ASIA LIMITED.
DATE :


400 MIN.
800 MIN.
2000 SIDE SLOPE
12mm GLASS REINFORCED TENDON PINS, 5 PER GEOWEB PANEL DRIVEN THROUGH GEOCOMPOSITE, FOR ANCHORAGE OF GEOCOMPOSITE
500
400
1
2
FINAL CAP LEVEL
CDV
850
200 MIN.
BAFFLE PIER
1000
500
LLDPE
1000g/m² NON WOVEN GEOTEXTILE
GEOCOMPOSITE DRAINAGE LAYER
FINAL INTERMEDIATE COVER LAYER
LLDPE
GEOWEB

CHANNEL ON GRADIENT > 1 : 5

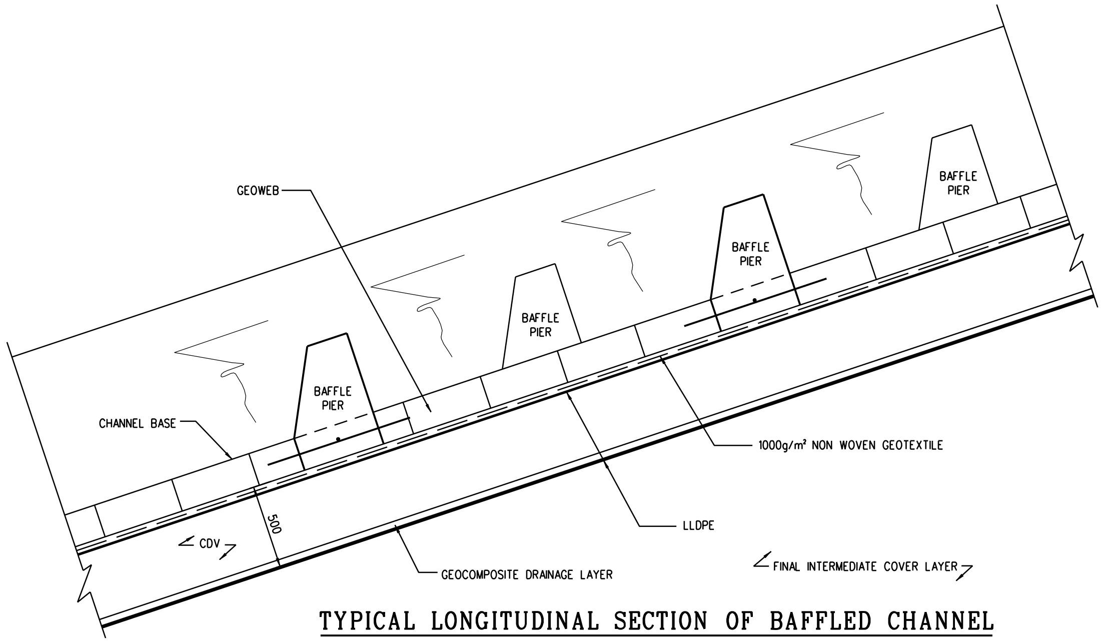
CHANNEL ON GRADIENT ≤ 1 : 5

TYPICAL TRANSVERSE SECTION OF BAFFLED CHANNEL

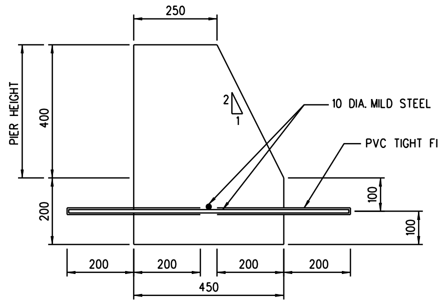
BAFFLE PIER TYPE	PLAN	SECTION A - A	SECTION B - B
1			
2			
3			
4			

A
500
450
2 : 1
250
400
200
2
1
300
B
3
600
550

NOTE : DOWEL BAR NOT SHOWN.
PARTICULAR DETAILS OF BAFFLES REFER TO DRAWING STG/SUR/DRW/012/R.


GEOWEB
BAFFLE PIER
CHANNEL BASE
1000g/m² NON WOVEN GEOTEXTILE
LLDPE
CDV
500
GEOCOMPOSITE DRAINAGE LAYER
FINAL INTERMEDIATE COVER LAYER

TYPICAL LONGITUDINAL SECTION OF BAFFLED CHANNEL


250
PIER HEIGHT
400
200
2
1
10 DIA. MILD STEEL DOWEL BAR
PVC TIGHT FITTING DOWEL SLEEVE
100
100
200
200
200
200
450

DOWEL BARS DETAILS

1 : 10

NOTE :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. GENL/SUR/DRW/001/R, 002/R, 004/R TO 009/R.
3. BAFFLED CHANNEL IS FORMED BY GEOWEB INFILLED WITH GRADE 20/20 CONCRETE.
4. GEOWEB IS LARGE CELL A-SECTION 203 THICK.
5. BAFFLE PIERS ARE PRECAST UNITS OF CONCRETE GRADE 30/20.
6. NOT USED.
7. FOR LAYOUT OF SURFACE WATER DRAINAGE REFER TO DRAWING NOS. STG1/SUR/DRW/001/R AND STG2/SUR/DRW/001/R.
8. FOR DIMENSIONS OF CHANNEL BASE WIDTH REFER TO DRAWING NOS. GENL/SUR/DRW/001/R AND GENL/SUR/DRW/002/R.

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN : AGSUR003.DGN
REF : RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

SURFACE WATER
DRAINAGE GENERAL DETAILS
SHEET 3 OF 9

AS CONSTRUCTED RECORD DRAWING

Drawing no. GENL/SUR/DRW/003/R

Scale 1 : 20

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

Binnie
Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE SITA WASTE
SERVICES LTD.

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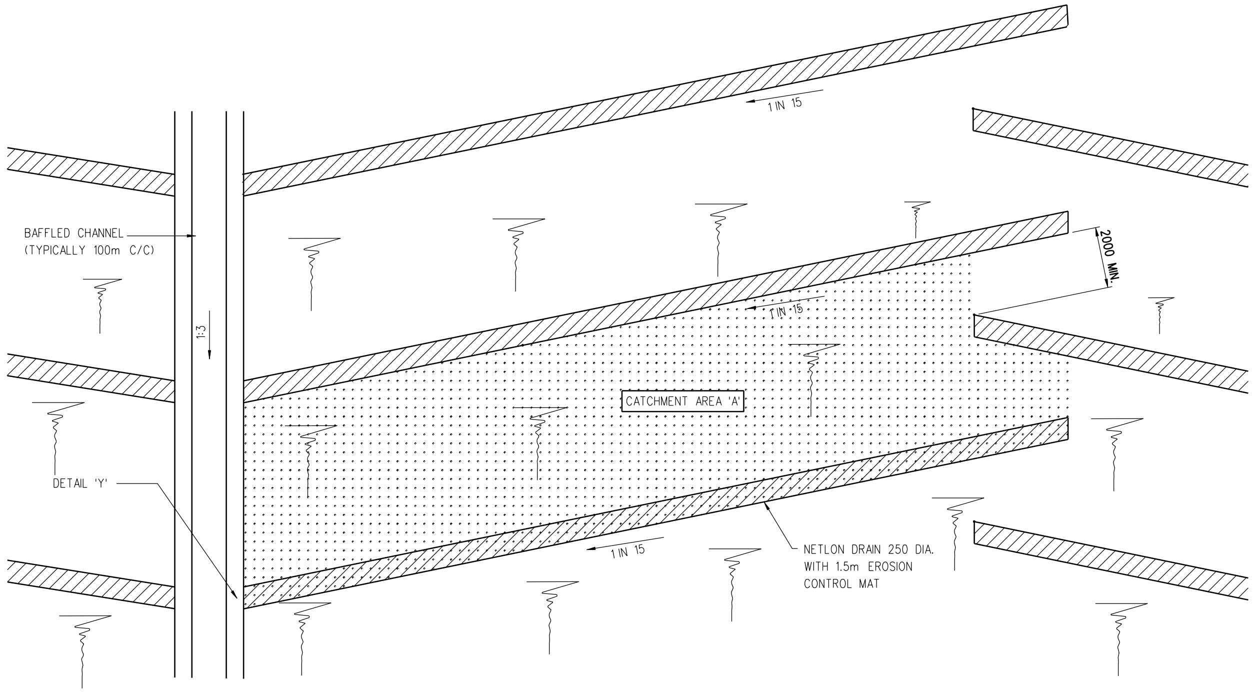
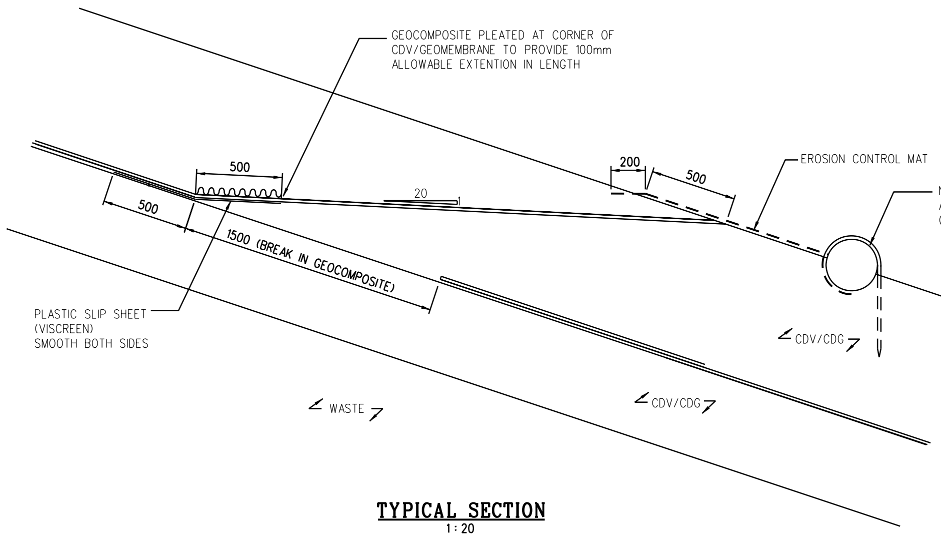

1 IN 15
2000 MIN.
BAFFLED CHANNEL
(TYPICALLY 100m C/C)
1:3
1 IN 15
CATCHMENT AREA 'A'
DETAIL 'Y'
1 IN 15
NETLON DRAIN 250 DIA.
WITH 1.5m EROSION
CONTROL MAT

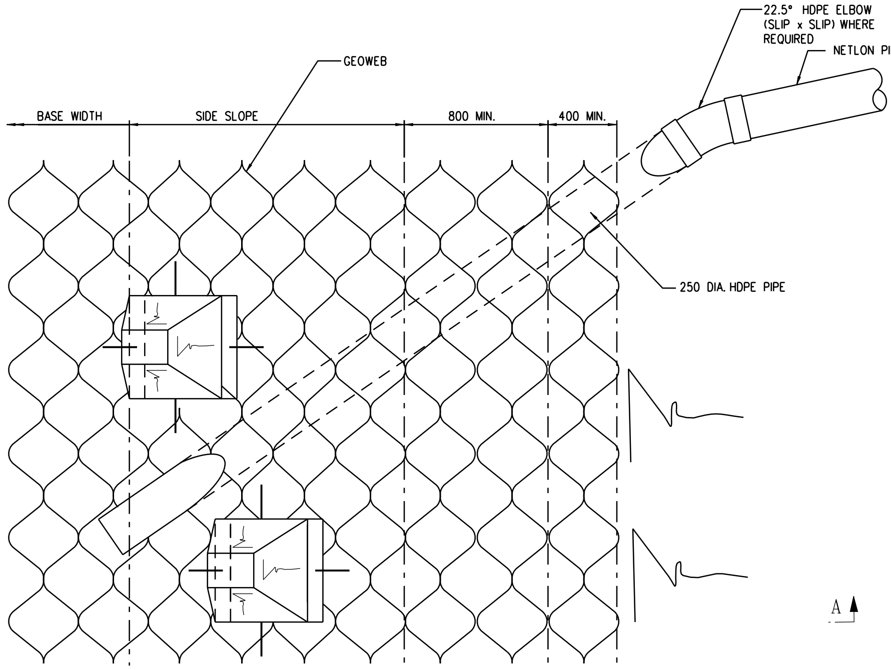
TYPICAL ARRANGEMENT OF NETLON DRAINS

1:200


GEOCOMPOSITE PLEATED AT CORNER OF
CDV/GEOMEMBRANE TO PROVIDE 100mm
ALLOWABLE EXTENTION IN LENGTH
500
500
1500 (BREAK IN GEOCOMPOSITE)
20
1
200
500
EROSION CONTROL MAT
NETLON PIPE
AND J-PIN
(SEE DETAIL 'X')
PLASTIC SLIP SHEET
(VISCREEN)
SMOOTH BOTH SIDES
CDV/CDG
WASTE
CDV/CDG

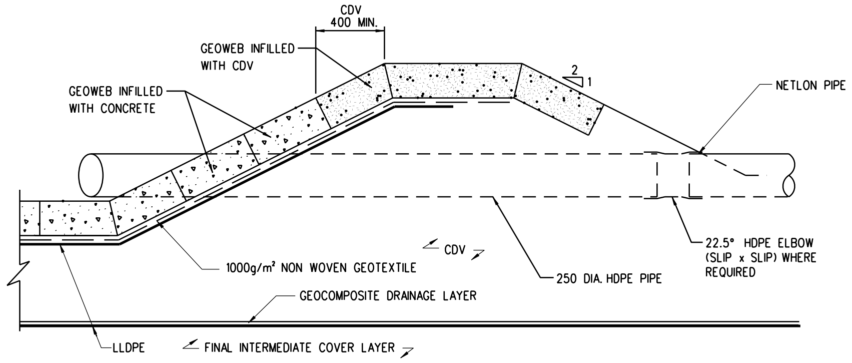
TYPICAL SECTION

1 : 20


22.5° HDPE ELBOW
(SLIP x SLIP) WHERE
REQUIRED
NETLON PIPE
GEOWEB
BASE WIDTH
SIDE SLOPE
800 MIN.
400 MIN.
250 DIA. HDPE PIPE
A
A

PLAN

1 : 200


CDV
400 MIN.
GEOWEB INFILLED
WITH CDV
GEOWEB INFILLED
WITH CONCRETE
2
1
NETLON PIPE
CDV
1000g/m² NON WOVEN GEOTEXTILE
250 DIA. HDPE PIPE
22.5° HDPE ELBOW
(SLIP x SLIP) WHERE
REQUIRED
GEOCOMPOSITE DRAINAGE LAYER
LLDPE
FINAL INTERMEDIATE COVER LAYER

SECTION A - A
DETAIL 'Y'

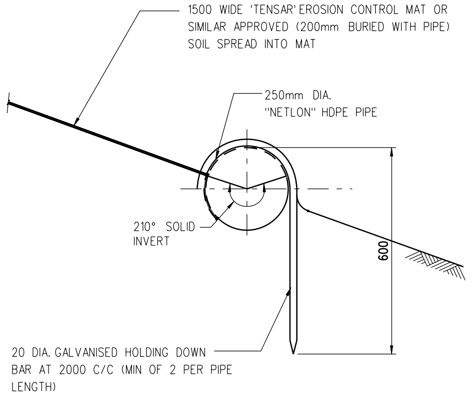
DISCHARGE OF NETLON DRAIN INTO BAFFLED CHANNEL

1 : 20

NOTE : DETAIL OF BAFFLED CHANNEL ON GRADIENT ≮ 1 : 5 SHOWN

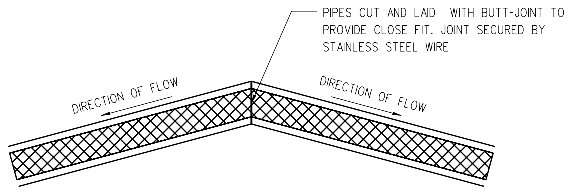
TABLE OF NETLON CATCHMENT AREAS

NETLON DIAMETER (mm)	TYPICAL FALL	MAXIMUM CATCHMENT AREA 'A' (m^2) 210° SOLID INVERT
250	1:15	1280
250	1:20	1110
250	1:40	780


1500 WIDE 'TENSAR' EROSION CONTROL MAT OR
SIMILAR APPROVED (200mm BURIED WITH PIPE)
SOIL SPREAD INTO MAT
250mm DIA.
"NETLON" HDPE PIPE
210° SOLID
INVERT
600
20 DIA. GALVANISED HOLDING DOWN
BAR AT 2000 C/C (MIN OF 2 PER PIPE
LENGTH)

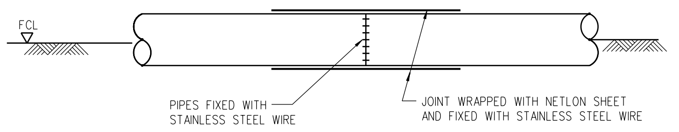
DETAIL 'X'

1:10


PIPES CUT AND LAID WITH BUTT-JOINT TO
PROVIDE CLOSE FIT. JOINT SECURED BY
STAINLESS STEEL WIRE
DIRECTION OF FLOW
DIRECTION OF FLOW

DETAIL OF APEX JOINT

1:20


FCL
PIPES FIXED WITH
STAINLESS STEEL WIRE
JOINT WRAPPED WITH NETLON SHEET
AND FIXED WITH STAINLESS STEEL WIRE

DETAIL OF SPLICE JOINT

1:20

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. GENL/SUR/DRW/001/R TO 004/R, 006/R TO 009/R.
3. FOR DETAILS OF BAFFLED CHANNEL, REFER TO DRAWING NOS. GENL/SUR/DRW/001/R & 002/R.
4. 'NETLON' IS EXTRUDED HDPE PIPE BY MITSUI PETROCHEMICAL IND..

LEGEND :

▨	INFILLED WITH CONCRETE
▨	INFILLED WITH CDV

Details of Revision	Date
DETAIL OF SPLICE JOINT REVISED	12/99

	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN: AGSUR005.DGN
REF. RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

SURFACE WATER
DRAINAGE GENERAL DETAILS
SHEET 5 OF 9

AS CONSTRUCTED RECORD DRAWING

Drawing no. GENL/SUR/DRW/005/R

Scale AS SHOWN

Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE SITA WASTE
SERVICES LTD.

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

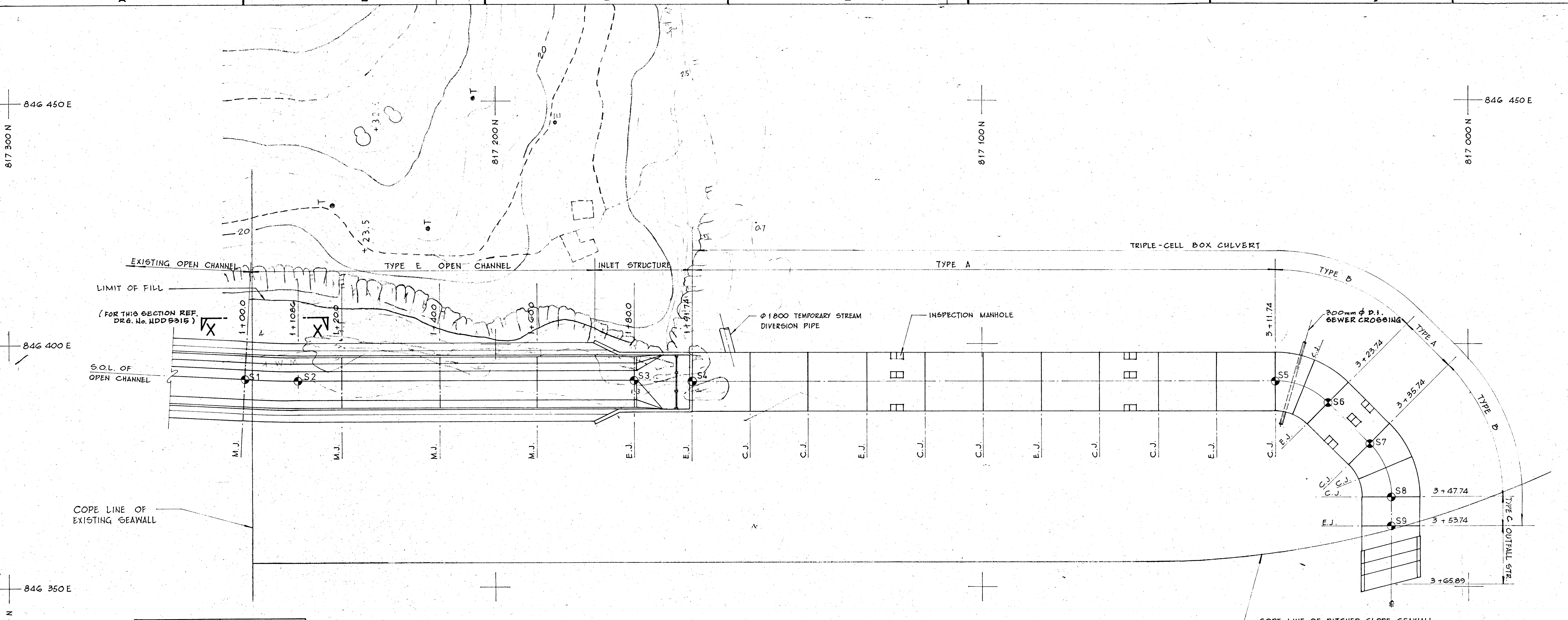
INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

D:\agsur005.dgn 2008/12/17 上午 09:12:26

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SPECIFIED OTHERWISE.
2. ALL LEVELS ARE IN METRES ABOVE P.D.
3. ABBREVIATIONS :-
   M.J. DENOTES MOVEMENT JOINT
   E.J. DENOTES EXPANSION JOINT
   C.J. DENOTES CONTRACTION JOINT
4. CONCRETE SHELL BE :-
   GRADE 30/20 FOR TYPE E OPEN CHANNEL, INLET STRUCTURE, TRIPLE-CELL BOX CULVERT AND OUTFALL STRUCTURE.
   GRADE 10/20 FOR BLINDING LAYER
5. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRAWING Nos. NDD 5310, NDD 5311, NDD 5312 NDD 5313, NDD 5314 AND NDD 5315.

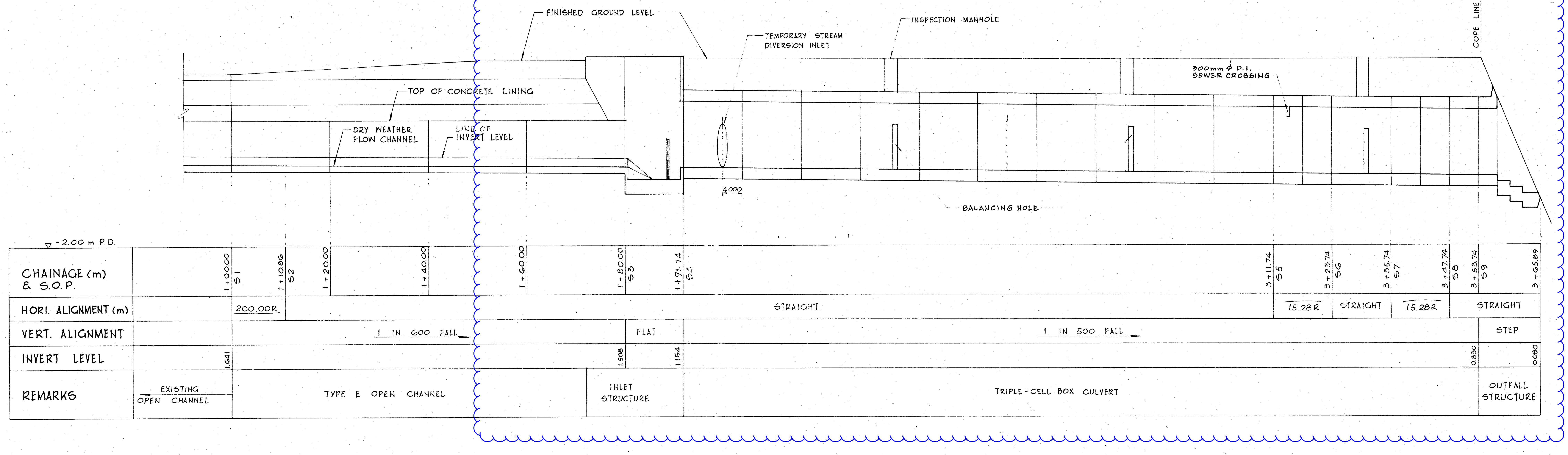

846 450 E
846 400 E
846 350 E
817 300 N
817 200 N
817 100 N
817 000 N
EXISTING OPEN CHANNEL
TYPE E OPEN CHANNEL
INLET STRUCTURE
TRIPLE-CELL BOX CULVERT
TYPE A
TYPE B
TYPE A
TYPE B
LIMIT OF FILL
(FOR THIS SECTION REF. DRG. No. NDD 5315)
X
X
S.O.L. OF OPEN CHANNEL
Φ 1800 TEMPORARY STREAM DIVERSION PIPE
INSPECTION MANHOLE
300mm Φ D.I. SEWER CROSSING
1+00.0
1+1086
1+20.0
1+400
1+600
1+80.0
1+91.74
3+11.74
3+23.74
3+35.74
3+47.74
3+53.74
3+65.89
S1
S2
S3
S4
S5
S6
S7
S8
S9
M.J.
M.J.
M.J.
M.J.
E.J.
E.J.
C.J.
C.J.
E.J.
C.J.
C.J.
E.J.
C.J.
C.J.
E.J.
C.J.
E.J.
C.J.
C.J.
C.J.
E.J.
TYPE C
OUTFALL STR.
COPE LINE OF EXISTING SEAWALL
COPE LINE OF PITCHED SLOPE SEAWALL
20
23.5
0.7

	NORTHING (m)	EASTING (m)
S 1	817 251.500	846 392.798
S 2	817 240.644	846 392.504
S 3	817 171.503	846 392.504
S 4	817 159.764	846 392.254
S 5	817 039.764	846 392.254
S 6	817 028.960	846 387.779
S 7	817 020.475	846 379.294
S 8	817 016.000	846 368.490
S 9	817 016.000	846 362.490

PLAN

SCALE :- 1 : 500

3-cell 3500mm (W) x 2600mm (H) box culvert
downstream from GLA-TSK 500 drainage connection


FINISHED GROUND LEVEL
TEMPORARY STREAM DIVERSION INLET
INSPECTION MANHOLE
300mm Φ D.I. SEWER CROSSING
COPE LINE
TOP OF CONCRETE LINING
DRY WEATHER FLOW CHANNEL
LINE OF INVERT LEVEL
4000
BALANCING HOLE
-2.00 m P.D.
CHAINAGE (m) & S.O.P.
1+00.00 S1
1+10.86 S2
1+20.00
1+40.00
1+60.00
1+80.00 S3
1+91.74 S4
3+11.74 S5
3+23.74 S6
3+35.74 S7
3+47.74 S8
3+53.74 S9
3+65.89
HORI. ALIGNMENT (m)
200.00R
STRAIGHT
15.28R
STRAIGHT
15.28R
STRAIGHT
VERT. ALIGNMENT
1 IN 600 FALL
FLAT
1 IN 500 FALL
STEP
INVERT LEVEL
1.641
1.508
1.154
0.830
0.080
REMARKS
EXISTING OPEN CHANNEL
TYPE E OPEN CHANNEL
INLET STRUCTURE
TRIPLE-CELL BOX CULVERT
OUTFALL STRUCTURE

LONGITUDINAL SECTION

SCALE : HORI. 1 : 500
VERT. 1 : 100

no.	date	description	initial
A	24.4.91	AS CONSTRUCTED	J. Ccky

REVISION

	name	date
surveyed		
designed	M. T. Cheuk M.T. CHEUK	5/12/86
drawn	Y. C. Wong Y.C. WONG	6/12/86
traced	Y. C. Wong Y.C. WONG	6/12/86
checked	W.T. YEUNG	6/1/87
approved	Thomas Thumb T. THUMB	18.2.87

26.2.87
Chief Engineer

contract no. CV/86/15
file no. SP 9/1/44
project no. 29 DR

contract
CONTROLLED TIPPING OF REFUSE
AT JUNK BAY
STAGE II, PHASE I, CONTRACT A
-SITE WORKS AND SANITARY LANDFILL

drawing title
CHANNEL EXTENSION DETAILS—
GENERAL ARRANGEMENT OF
TYPE E OPEN CHANNEL AND
TRIPLE-CELL BOX CULVERT

drawing no. NDD 5309A
scale AS SHOWN

office
DRAINAGE (DESIGN) DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING
SERVICES
DEPARTMENT
HONG KONG

AS CONSTRUCTED

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pwd 123

A1 841 x 594

846100 E
846200 E
846300 E
846400 E
846500 E
COPE LINE OF SEAWALL
COPE LINE OF SEAWALL
816700 N
816600 N
816600 N
N
HWM
LIMIT OF ROADWORKS
LIMIT OF ROADWORKS
LIMIT OF ROADWORKS
LIMIT OF ROADWORKS
LIMIT OF ROADWORKS
ROAD D6
ROAD L871
ROAD L870
ROAD L872
BOX CULVERT No. 2
BOX CULVERT No. 1(N)
BOX CULVERT No. 1(S)
(FUTURE ROAD D6)
CUT LINE A - A
CUT LINE B - B
FOR CONTINUATION SEE DRG. No. 92790/10/1002
4.500 FOOTPATH
3.500 CYCLE TRACK
+5.4
+5.3
+5.2
+5.1
+5.0
+4.9
+4.8
+4.7
+4.6

Drainage connection from GLA-TSK 500

LEGEND:

- DIAMETER / PIPE CLASS / BEDDING / GRADIENT 1 IN 300 — 900 Ø (M.1) 300 — STORMWATER DRAIN
- DIAMETER / PIPE CLASS / BEDDING / GRADIENT 1 IN 100 — 300 Ø (H.1) 100 — FOUL SEWER
- MANHOLE No. / COVER LEVEL / DROP MANHOLE / MANHOLE TYPE / CHAMBER SIZE — C.L. 6.190 A3.6(3.A) 2250 ø — STORMWATER MANHOLE
- MANHOLE No. / COVER LEVEL / DROP MANHOLE / MANHOLE TYPE / CHAMBER SIZE — C.L. 2.175 C2.9(3.A) 1200 ø — FOUL SEWER MANHOLE
- ⓘ SINGLE BAY GULLY (PATTERN OF GULLY GRATE-LEFT HAND)
- ● SINGLE BUY GULLY (PATTERN OF GULLY GRATE-RIGHT HAND)
- ●T GULLY WITH TRAP
- ○ 2.1 CATCHPIT
- D 2.1 DRAINPIT
- 225U U-CHANNEL
- 450U U-CHANNEL WITH CAST IRON COVER
- 300 S.C. STEPPED CHANNEL
- 500(W)× 200(H) T.C. TRAPEZOIDAL CHANNEL
- SUBSOIL DRAIN
- SURFACE FALL
- TEMPORARY PLUG AT END OF PIPE FOR FUTURE PIPE CONNECTION
- TWO SINGLE BAY GULLIES AT LOW POINT (PATTERN OF GULLY GRATE-ONE LEFT HAND & ONE RIGHT HAND)

NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRG. Nº 92790 / 10 / 1002 & 1062.
2. ALL LEVELS SHOWN ARE IN METRES AND REFER TO THE PRINCIPAL DATUM.

4. ALL LOW POINTS IN CARRIAGEWAY ARE PROVIDED WITH TWO SINGLE GULLIES WITH SIDE OVERFLOW WEIRS.
5. THE LOCATIONS OF LOW POINTS ARE IN ACCORDANCE WITH THE SETTING OUT PLAN.

7. ALL GULLY CONNECTIONS ARE 150Ø PIPES WITH 150 THICK GRADE 20/20 CONCRETE SURROUND UNLESS OTHERWISE SPECIFIED.
8. FOR MANHOLE AND DRAINAGE DETAILS REFER TO TYPICAL DETAIL DRAWINGS.
9. ALL PIPES ARE DESIGNED TO WIDE TRENCH (W.T.) CONDITION UNLESS STATED OTHERWISE.
10. ALL U-CHANNELS HAVE A MINIMUM GRADIENT OF 1:100 UNLESS STATED OTHERWISE.
11. FOR TYPICAL DETAILS OF GULLY REFER TO H.O. DRG. Nº H3005 & H3006.

13. MANHOLE COVERS ARE LOCATED AT THE CENTRE OF TRAFFIC LANES UNLESS SHOWN OTHERWISE.
14. TRAPPED GULLIES ARE PROVIDED FOR THOSE GULLIES CONNECTED TO BOX CULVERT.
15. REFER TO DRG. Nº 92790/10/1002-1004 & 1081-1083 FOR LAYOUT OF CHANNELS.
16. GRIT REMOVAL CHANNELS ARE PROVIDED TO THE TRAPEZOIDAL CHANNELS BEFORE CONNECTING TO THE STORMWATER DRAINS/CULVERTS. SEE DRG. Nº 92790/10/R3054 FOR THE DETAILS OF THE GRIT REMOVAL CHANNELS. THE DIMENSIONS OF THE GRIT REMOVAL CHANNELS ARE SHOWN IN THE TABLE ON THIS DRAWING.

TABLE FOR THE DIMENSIONS OF THE GRIT REMOVAL CHANNELS

TRAPEZOIDAL CHANNEL SIZE	W (m.)	D (m.)	S (m.)
400 W x 150 H TO 400 W x 1100 H	0.75	1.25	0.77
400 W x 250 H TO 400 W x 650 H	0.75	1.25	0.77
400 W x 300 H TO 400 W x 650 H	1.25	1.25	0.96
500 W x 100 H TO 500 W x 550 H	0.75	1.00	0.85
500 W x 125 H TO 500 W x 650 H	0.75	1.25	0.77
500 W x 360 H TO 500 W x 650 H	0.75	1.50	0.73
500 W x 445 H TO 500 W x 600 H	1.25	1.25	0.96
500 W x 525 H TO 500 W x 725 H	1.00	1.50	0.81
600 W x 330 H TO 600 W x 900 H	0.75	1.50	0.73
600 W x 350 H TO 600 W x 700 H	1.00	1.50	0.81
600 W x 350 H TO 600 W x 950 H	0.75	1.50	0.75
800 W x 1210 H TO 800 W x 1500 H	2.75	2.50	1.17
600 W x 615 H TO 600 W x 900 H	1.00	1.75	0.79
600 W x 680 H TO 600 W x 1000 H	1.25	2.00	0.85
700 W x 540 H TO 700 W x 1000 H	1.25	2.00	0.85
800 W x 320 H TO 800 W x 900 H	1.00	2.00	0.78
800 W x 345 H TO 800 W x 900 H	1.50	1.75	0.93
800 W x 1010 H TO 800 W x 1600 H	1.50	2.25	0.90
400 W x 150 H TO 400 W x 525 H	0.75	1.00	0.85
1300 W x 1100 H TO 1300 W x 1600 H	2.50	2.50	1.12

M.H. No.	Coordinate Northing	Coordinate Easting	M.H. No.	Coordinate Northing	Coordinate Easting	M.H. No.	Coordinate Northing	Coordinate Easting
A3.1 (2)	816641.020	846095.681	A12.3(2)	816565.953	846155.976	C1.23(3)	816590.710	846077.613
A3.2 (1)	816678.805	846117.776	A13.1(2)	816823.335	846377.258	C1.24(3)	816566.293	846139.946
A3.3 (1)	816708.010	846144.864	A13.2(1)	816804.459	846329.646	C2.1 (3)	816792.125	846312.840
A3.4 (1)	816731.176	846177.277	A13.3(1)	816787.711	846290.476	C2.2 (3)	816807.836	846349.625
A3.5 (1)	816748.415	846213.530	C1.12(3A)	816890.061	846240.970	C2.3 (3)	816823.940	846387.330
A3.6 (2)	816765.210	846250.937	C1.13(3)	816855.808	846247.380	C2.4 (3)	816838.503	846424.682
A4.1 (3)	816560.468	846060.529	C1.14(3A)	816824.389	846261.967	C2.5 (3)	816802.881	846444.903
A6.2 (2)	816885.896	846236.926	C1.15(3)	816777.930	846277.110	C2.6 (3)	816769.820	846466.844
A6.3 (1)	816845.967	846244.836	C1.16(3)	816755.546	846243.135	C2.7 (3)	816734.760	846490.600
A7.1 (2)	816758.485	846271.893	C1.17(3)	816740.823	846207.611	C2.8 (3)	816703.540	846511.477
A7.2 (1)	816731.468	846288.839	C1.18(3)	816725.558	846176.602	C2.9 (3)	816674.844	846509.648
A10.1(2)	816562.780	846055.158	C1.19(3)	816704.645	846147.819	C3.1 (3)	816612.939	846052.191
A11.2(3)	816599.459	846077.432	C1.20(3)	816679.929	846124.271	D7.1	816849.921	846254.291
A11.3(2)	816568.504	846156.743	C1.21(3A)	816651.425	846105.476	D8.1	816886.273	846245.438
A12.2(3)	816597.562	846071.751	C1.22(3)	816609.998	846084.687	A3.1.1(1)	816645.088	846091.003

7 MAR 2025

AS-BUILT DRAWING
DRAWING OFFICE COPY
MAINLAND SOUTH DIVISION, D.S.D.

REV. 修訂	DESCRIPTION 內容摘要	DATE 日期	CHECKED 覆核
D	AS BUILT DRAWING	31. 5. 95	
C	TRAPEZOIDAL CHANNEL RELOCATED REFER TO HKIEC FAX (PS/TIE/14) DATED 2 JULY 1993	22/11/93	
B	FOUL SEWER ADDED AT ROAD D6	5/9/91	
A	WORKING DRAWING	15/8/91	

香港工業邨公司
THE HONG KONG INDUSTRIAL ESTATES CORPORATION

TSEUNG KWAN O INDUSTRIAL ESTATE

LAND FORMATION AND INFRASTRUCTURE

DRAINAGE AND SEWERAGE LAYOUT

SHEET 1 OF 2

MAUNSELL
CONSULTANTS ASIA LTD.
茂盛工程顧問有限公司

DESIGNED 設計 Cheung Wai Man
CHECKED 覆核
DRAWN 繪圖
CHECKED 覆核 Cheung Wai Man
APPROVED FOR ISSUE 批准人
DATE 日期 DEC. 90
SCALE 比例 1:500
DIMENSIONS ARE IN 尺寸單位 METRES

DRG. NO. 圖紙編號 92790 / 10 / 1061D
CONTRACT NO 合約編號 TIE/1/91
DATE OF ISSUE 簽發日期

AS BUILT DRAWING

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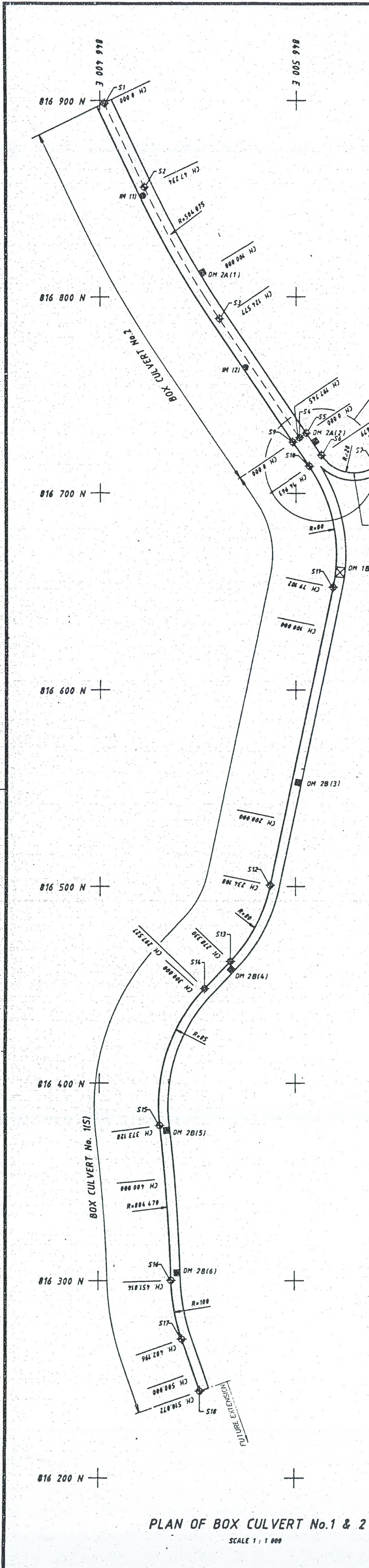
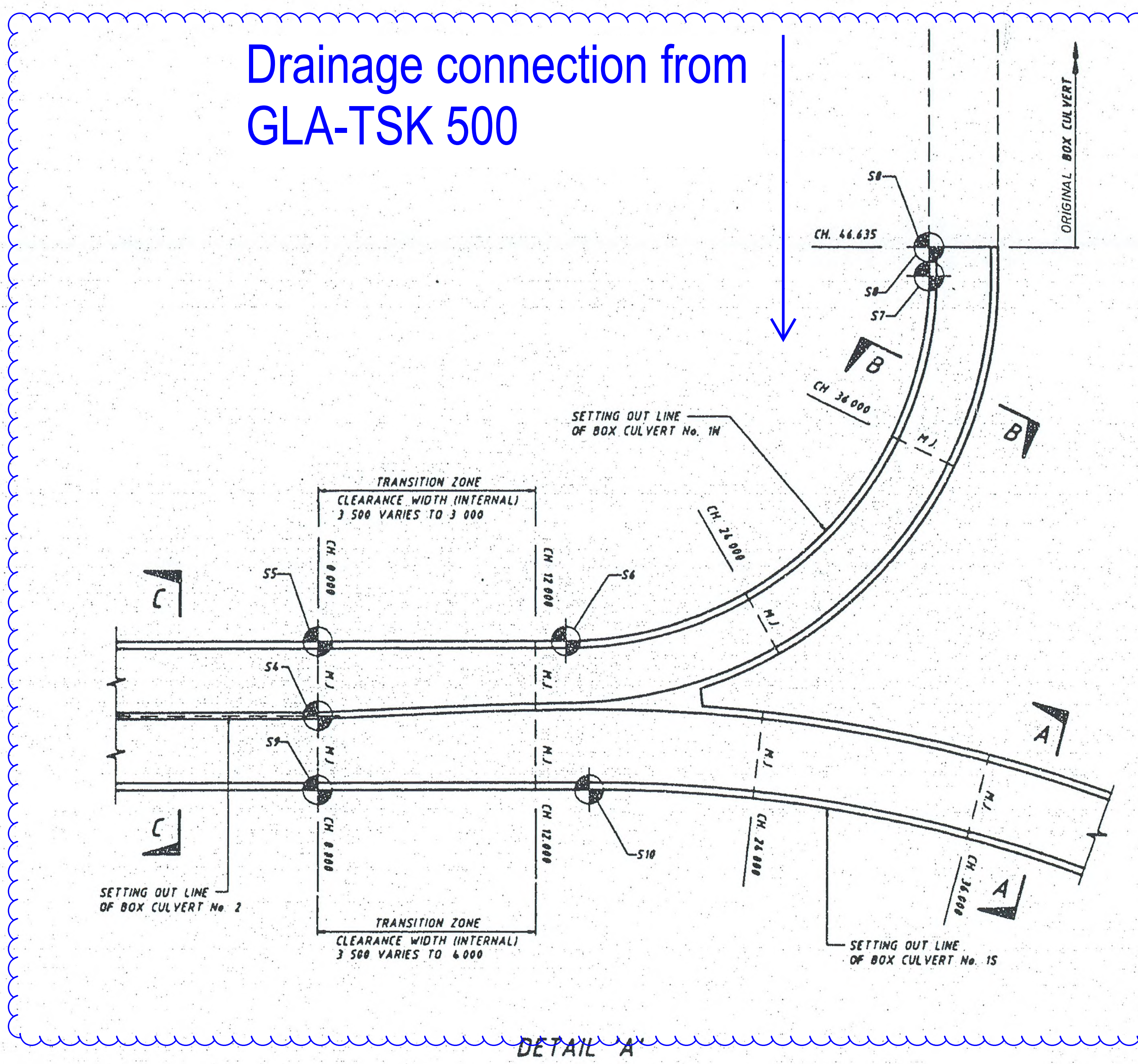
ACTUAL SCALE 0 0.5 1 2 3 4 5cm

JB 9101
CONT No.: TIE/1/91
DRG No.: 92790/10/1061D


816 900 N
816 800 N
816 700 N
816 600 N
816 500 N
816 400 N
816 300 N
816 200 N
846 400 E
846 500 E
846 600 E
S1
CH 0.000
S2
CH 47.234
IM (1)
R=506.075
CH 100.000
DM 2A(1)
S3
CH 124.577
IM (2)
BOX CULVERT No. 2
CH 197.745
S4
S5
CH 0.000
DM 2A(2)
S6
S9
S10
CH 13.676
S7
S8
R=20
CH 46.635
CH 45.049
CH 0.000
CH 14.963
R=80
FOR CONNECTION SETTING OUT DETAIL SEE DETAIL 'A'
BOX CULVERT No. 1(N)
S11
DM 1B(1)
CH 79.182
CH 150.000
DM 2B(3)
CH 200.000
S12
CH 234.100
R=80
S13
S14
DM 2B(4)
CH 300.000
R=85
S15
CH 373.128
DM 2B(5)
BOX CULVERT No. 1(S)
CH 400.000
R=884.470
S16
DM 2B(6)
CH 451.814
R=100
S17
CH 500.000
CH 510.072
S18
FUTURE EXTENSION

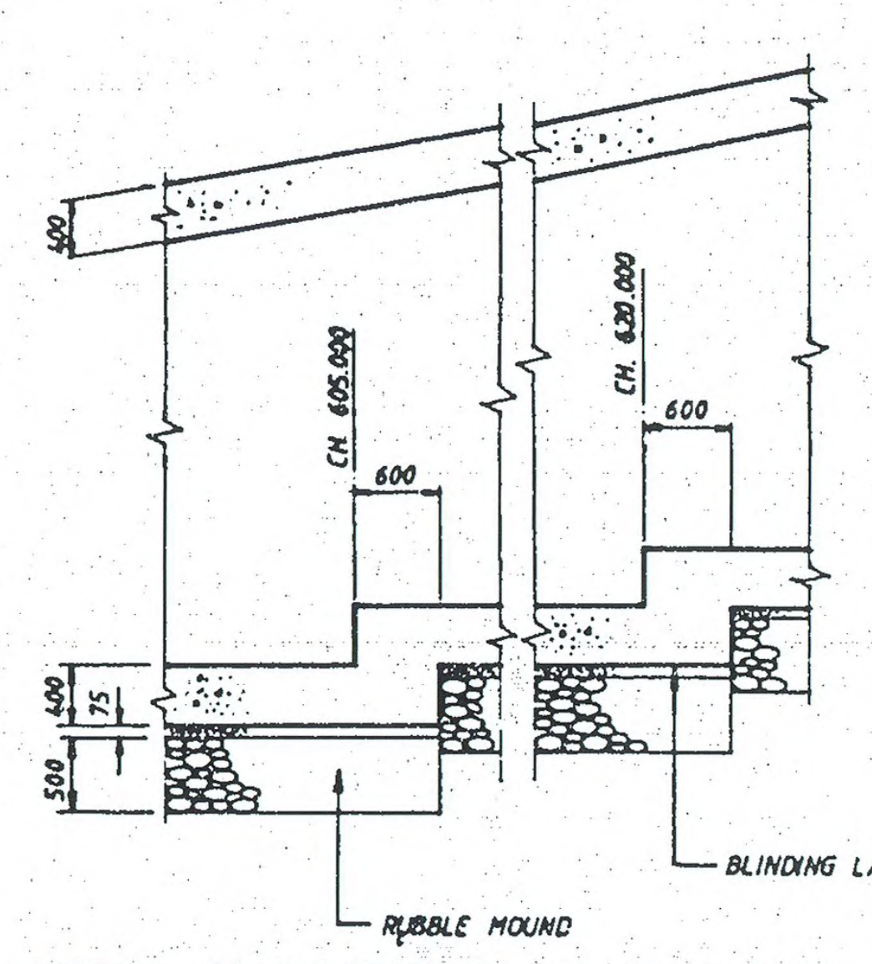
PLAN OF BOX CULVERT No.1 & 2

SCALE 1 : 1 000


Drainage connection from GLA-TSK 500
ORIGINAL BOX CULVERT
S8
CH. 46.635
S8
S7
B
CH 36.000
B
SETTING OUT LINE OF BOX CULVERT No. 1N
M.J.
TRANSITION ZONE
CLEARANCE WIDTH (INTERNAL) 3 500 VARIES TO 3 000
CH. 24.000
C
S5
CH 0.000
CH 12.000
S6
S4
M.J.
S9
M.J.
A
C
CH 0.000
CH 12.000
S10
CH 24.000
CH 36.000
A
SETTING OUT LINE OF BOX CULVERT No. 2
TRANSITION ZONE
CLEARANCE WIDTH (INTERNAL) 3 500 VARIES TO 4 000
SETTING OUT LINE OF BOX CULVERT No. 1S
846 100 E
816 000 N

DETAIL 'A'

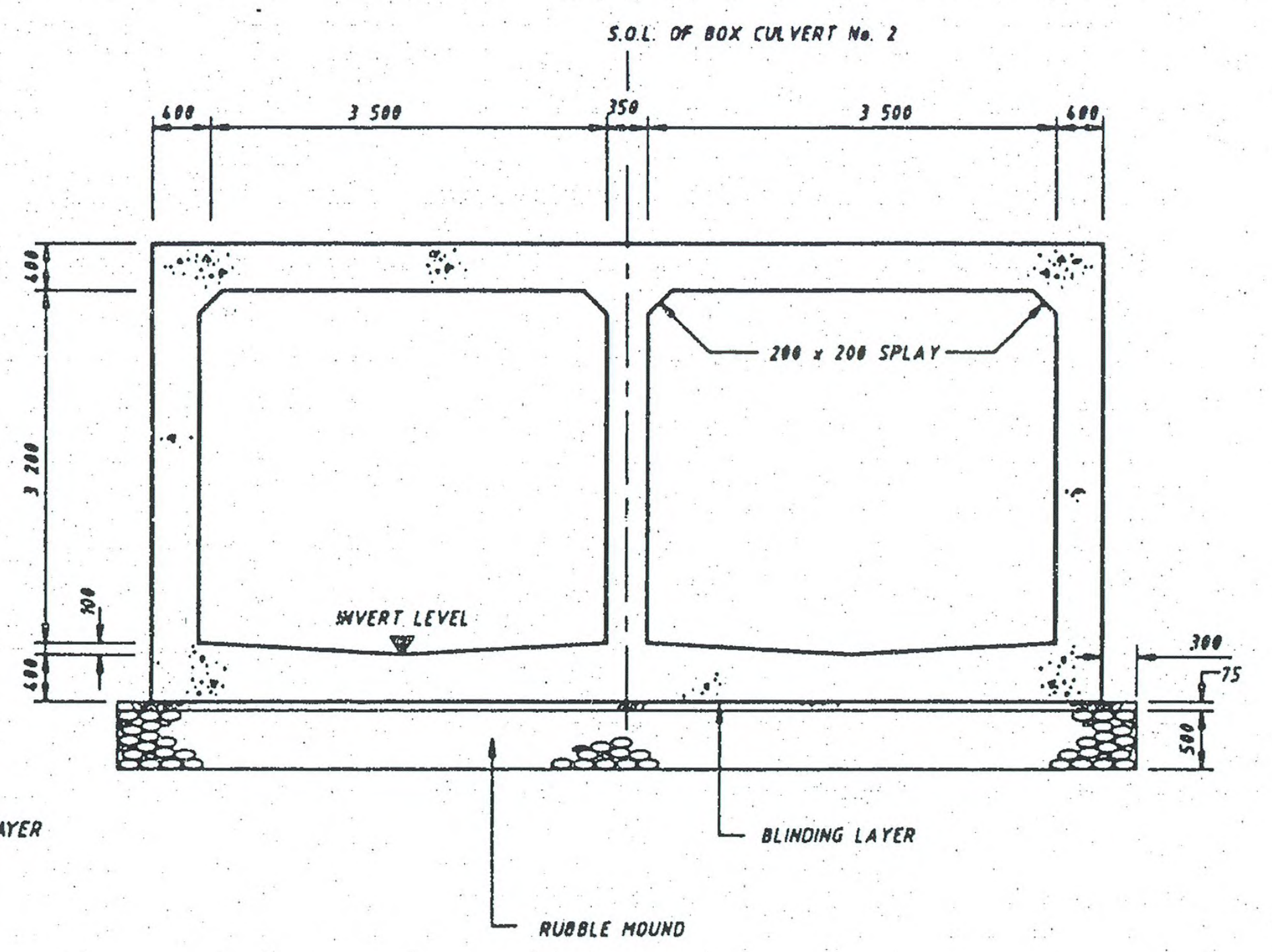
SCALE 1 : 200


CH. 605.000
CH. 620.000
600
600
400
500
75
RUBBLE MOUND
BLINDING LAYER

DETAIL OF BOTTOM SLAB AT STEPS

(FOR BOX CULVERT No. 3 ONLY)

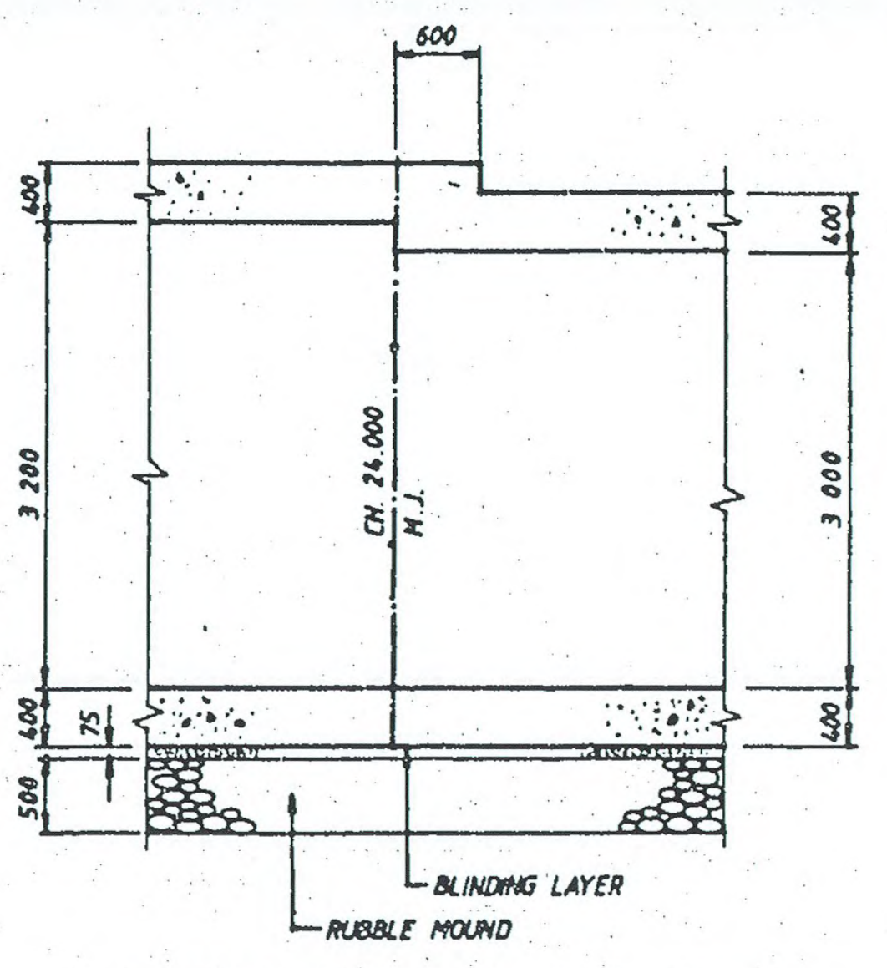
SCALE 1 : 50


S.O.L. OF BOX CULVERT No. 2
400
3 500
350
3 500
400
200 x 200 SPLAY
INVERT LEVEL
3 200
400
400
300
75
500
BLINDING LAYER
RUBBLE MOUND

SECTION C - C

TYPICAL SECTION OF TWIN-CELLS BOX CULVERT

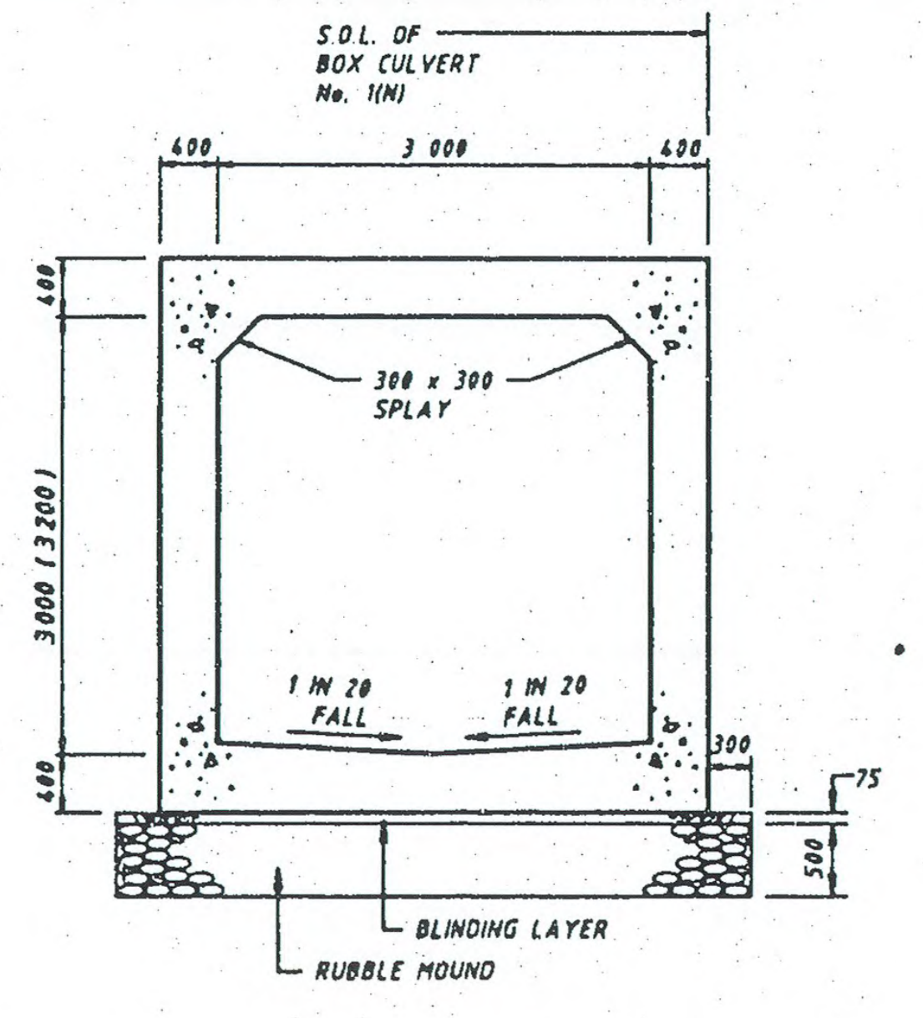
SCALE 1 : 50


600
400
3 200
3 000
CH 24.000 M.J.
400
400
75
500
BLINDING LAYER
RUBBLE MOUND

DETAIL OF TOP SLAB AT STEP

FOR BOX CULVERT No.1 (N)

SCALE 1:50

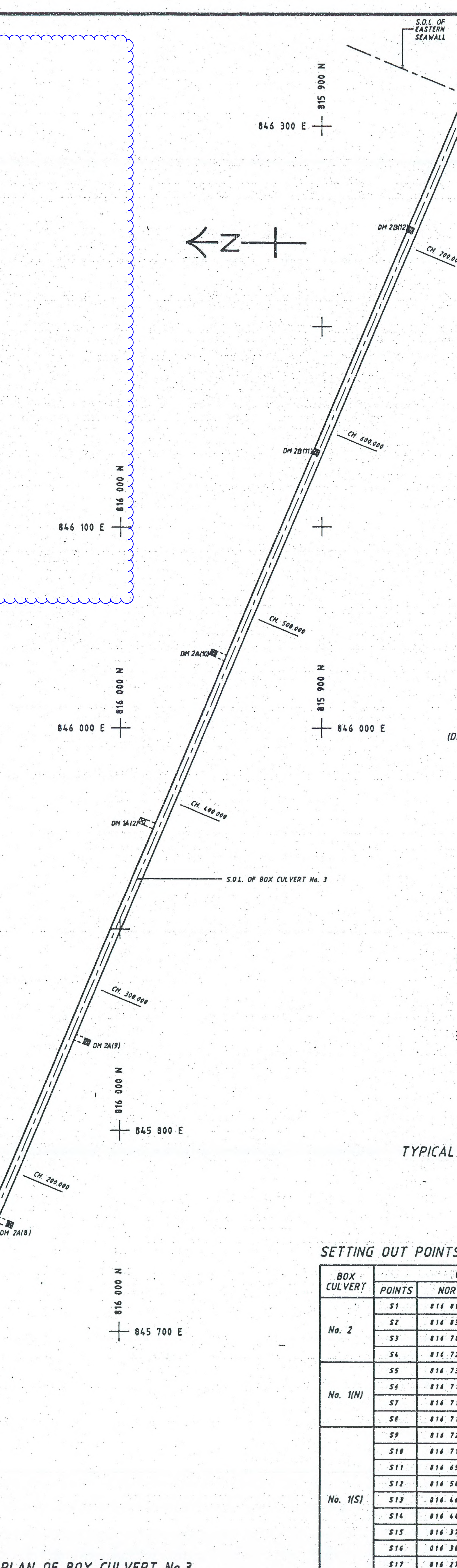

S.O.L. OF BOX CULVERT No. 1(N)
400
3 000
400
300 x 300 SPLAY
3000 (3200)
1 IN 20 FALL
1 IN 20 FALL
300
75
500
BLINDING LAYER
RUBBLE MOUND

SECTION B-B

TYPICAL SECTION OF BOX CULVERT No. 1(N)

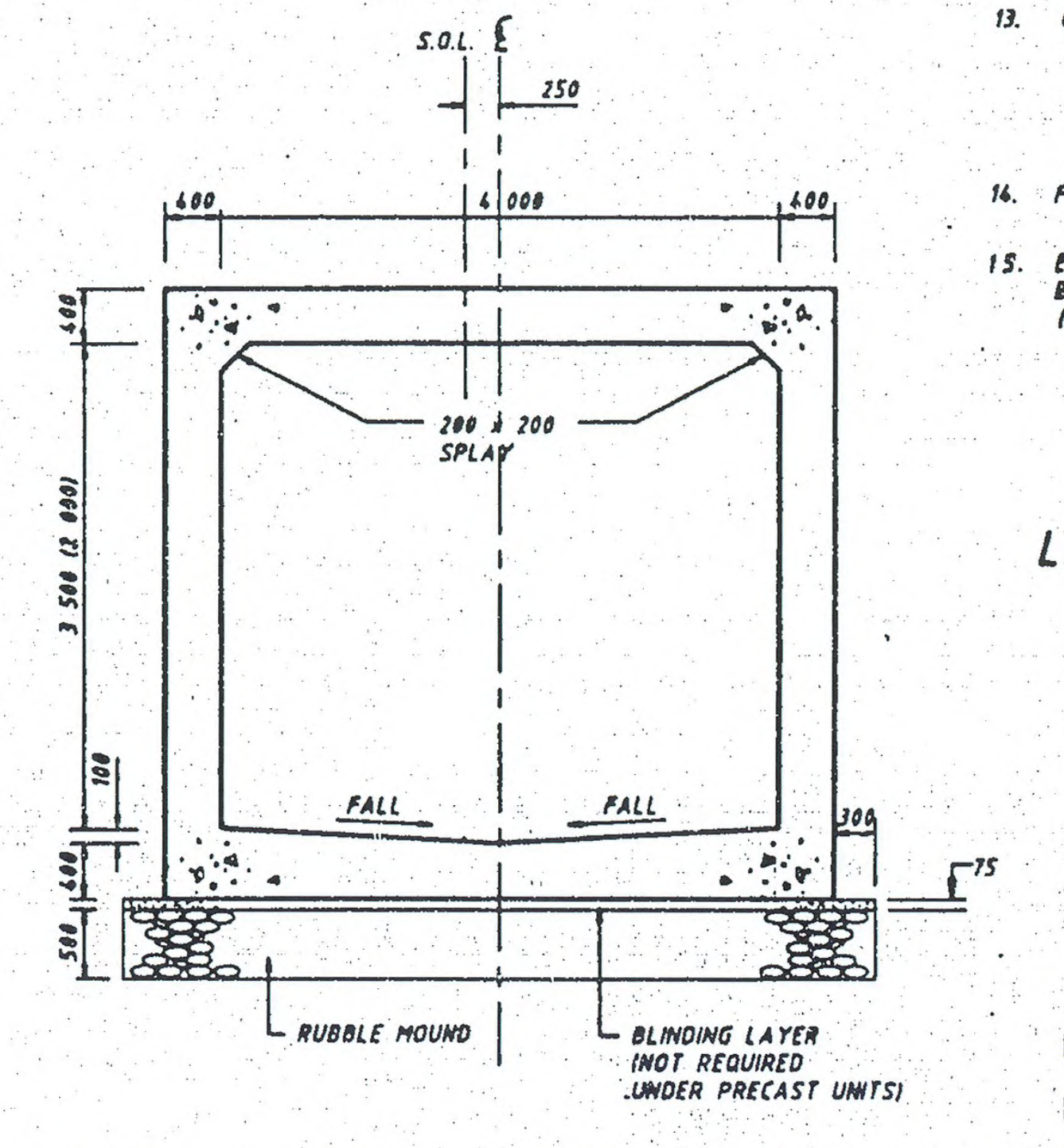
(DIMENSIONS IN BRACKET FOR CH. 0.000 TO CH. 24.000)

SCALE 1:50


S.O.L. OF EASTERN SEAWALL
FUTURE EXTENSION
3.2
CH. 788.745
815 900 N
815 800 N
846 300 E
846 200 E
846 100 E
846 000 E
845 800 E
845 700 E
845 600 E
816 000 N
816 100 N
DM 2B(12)
CH. 700.000
CH. 600.000
DM 2B(11)
CH. 500.000
DM 2A(10)
CH. 400.000
DM 1A(2)
S.O.L. OF BOX CULVERT No. 3
CH. 300.000
DM 2A(9)
CH. 200.000
DM 2A(8)
CH. 100.000
DM 2A(7)
S.O.L. OF WESTERN SEAWALL
OUTLET No.3
CH. 0.000
3.1

PLAN OF BOX CULVERT No.3

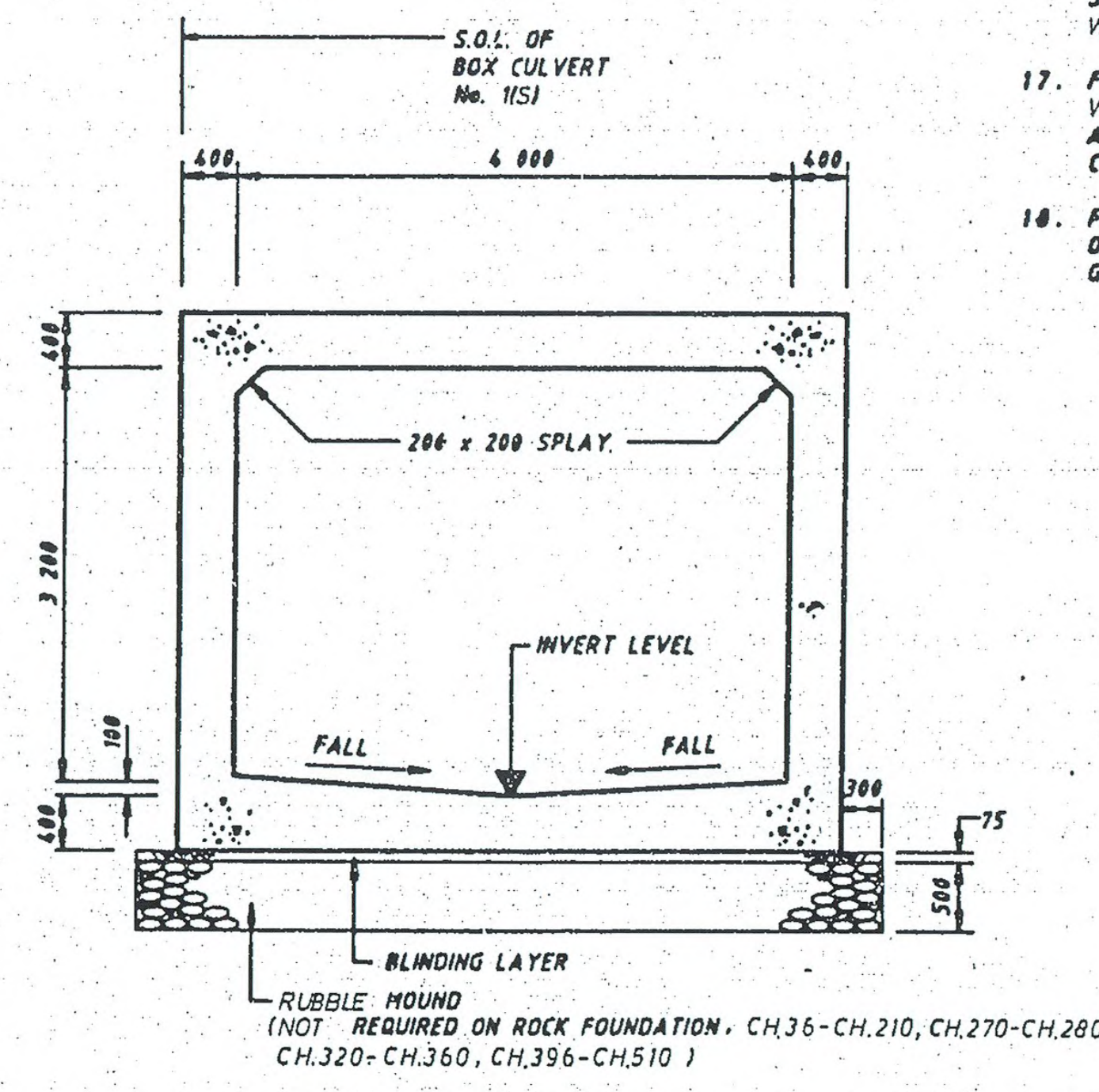
SCALE 1 : 1 000


S.O.L.
250
400
4 000
400
200 x 200 SPLAY
3 500 (3 000)
FALL
FALL
300
75
RUBBLE MOUND
BLINDING LAYER (NOT REQUIRED UNDER PRECAST UNITS)

TYPICAL SECTION OF BOX CULVERT No. 3

(DIMENSIONS IN BRACKET FOR CH. 620.000 TO FUTURE EXTENSION)

SCALE 1:50


S.O.L. OF BOX CULVERT No. 1(S)
400
4 000
400
200 x 200 SPLAY
INVERT LEVEL
3 200
FALL
FALL
300
75
500
BLINDING LAYER
RUBBLE MOUND (NOT REQUIRED ON ROCK FOUNDATION: CH.36-CH.210, CH.270-CH.280, CH.320-CH.360, CH.396-CH.510)

SECTION A - A

TYPICAL SECTION OF SINGLE CELL BOX CULVERT No. 1(S)

SCALE 1 : 50

NOTES :-

1. THIS DRAWING TO BE READ IN CONJECTION WITH DRG. No.92790/10/ 1072 TO 1075.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. CONCRETE GRADE IS :
   STRUCTURE - 40/20
   BLINDING - 10/20
4. UNLESS OTHERWISE STATED ALL EXPOSED CONCRETE CORNERS ARE 25 x 25 CHAMFERS.
7. THE RUBBLE MOUND FOR USE UNDER BOX CULVERTS IS 150mm NOMINAL SIZE RUBBLE.
8. THE TEMPERATURE OF FRESH CONCRETE OF CHARACTERISTIC STRENGTH ABOVE 20 MPa WAS NOT EXCEED 32°C BEFORE IT WAS COMPACTED IN POSITION.
9. FOR REINFORCEMENT DETAILS SEE DRG. No.92790/10/ 1076 TO 1079 & 1401,1402.
10. ALL MOVEMENT JOINTS ARE SET OUT NORMAL TO S.O.L.
11. DOWEL BARS AT MOVEMENT JOINTS WERE SAW CUT PERPENDICULAR TO BAR AXIS AND INSTALLED NORMAL TO THE MOVEMENT JOINT.
12. ALL METAL WORKS WERE HOT DIP GALVANISED IN ACCORDANCE WITH THE SPECIFICATION.
13. CONCRETE SURFACES FINISH CLASSES :
   FORMED SURFACE : F3 FOR EXPOSED SURFACE.
   F2 FOR UNEXPOSED SURFACE.
   UNFORMED SURFACE : U3 FOR EXPOSED SURFACE.
   U2 FOR UNEXPOSED SURFACE.
14. FOR GENERAL NOTES SEE DRG. NO. 92790/10/ 1002.
15. EXPOSED SURFACES ARE THOSE STILL VISIBLE AFTER BACKFILLING AND THE APPLICATION OF FINISHES (e.g. INTERNAL SURFACES OF THE BOX CULVERT CELLS, ACCESS CHAMBERS, MANHOLES AND EXTERNAL SURFACES WHERE VISIBLE ABOVE GROUND).

LEGEND :-

S.O.L.	SETTING OUT LINE
℄	CENTRE LINE
CH.	CHAINAGE
M.J.	MOVEMENT JOINT
2.2 ⊕	SETTING OUT POINT 2.2
● IM (3)	INSPECTION MANHOLE No.3
☒ DM 1B (1)	DESILTING MANHOLE TYPE 1B No.1
▣ DM 2A (1)	DESILTING MANHOLE TYPE 2A No.1

16. FOR BOX CULVERT Nos. 1S, 1N & 2 WHERE THE BOX CULVERT IS SITUATED IN NEW RECLAMATION AREA. THE FILL WAS FIRST PLACED AND COMPACTED TO THE FORMATION LEVEL FOR A DISTANCE OF NOT LESS THAN 20m ON EITHER SIDE OF THE CENTRE-LINE OF THE BOX CULVERT. THE CULVERT WAS THEN CONSTRUCTED IN AN EXCAVATED TRENCH.
17. FOR BOX CULVERT No.3 THE CONSTRUCTION OF THE CULVERT WAS COMMENCED AFTER THE REMOVAL OF THE SURCHARGE ABOVE THE CULVERT AND THE CULVERT WAS THEN CONSTRUCTED IN AN EXCAVATED TRENCH.
18. FOR ~~DETAILS OF~~ PIPES CONNECTING TO OR IN THE VICINITY OF THE BOX CULVERTS REFER TO DRAINAGE LAYOUT AND GENERAL LAYOUT DRAWINGS.

7 MAR 2005

AS-BUILT DRAWING
DRAWING OFFICE COPY
MAINLAND SOUTH DIVISION, D.S.D.

SETTING OUT POINTS FOR BOX CULVERTS

BOX CULVERT	CO-ORDINATES			CHAINAGE
	POINTS	NORTHING	EASTING	
No. 2	S1	816 898.565	846 402.253	0.000
	S2	816 855.059	846 422.475	47.234
	S3	816 788.806	846 460.785	124.577
	S4	816 728.208	846 501.866	197.745
No. 1(N)	S5	816 730.494	846 505.239	0.000
	S6	816 719.172	846 512.914	13.676
	S7	816 713.838	846 540.689	45.049
	S8	816 714.728	846 542.001	46.635
No. 1(S)	S9	816 725.921	846 498.493	0.000
	S10	816 713.536	846 506.889	14.963
	S11	816 652.204	846 518.963	79.182
	S12	816 580.586	845 487.123	234.108
	S13	816 461.927	845 466.331	278.330
	S14	816 440.809	846 453.609	297.527
	S15	816 378.476	846 438.947	373.128
	S16	816 300.076	845 437.289	451.814
	S17	816 278.321	845 442.618	482.196
	S18	815 244.000	846 452.000	518.072
No. 3	3.1	816 138.945	845 595.538	0.000
	3.2	815 826.739	846 314.580	788.745

REV. 修訂	DESCRIPTION 內容摘要	DATE 日期	CHECKED 複核
B	AS BUILT DRAWING	31.5.95	
A	WORKING DRAWING	15/8/91	

香港工業邨公司
THE HONG KONG INDUSTRIAL ESTATES CORPORATION

TSEUNG KWAN O INDUSTRIAL ESTATE

LAND FORMATION AND INFRASTRUCTURE

BOX CULVERT DETAILS
(G.A.)

SHEET 1 OF 5

DESIGNED 設計 Cheung Wai Man
CHECKED 複核
DRAWN 繪圖 C.F. Lau
CHECKED 複核 Cheung Wai Man
APPROVED FOR ISSUE 批准人
DATE 日期 JAN., 1991
SCALE 比例 AS SHOWN
DIMENSIONS ARE IN 尺寸單位 MILLIMETRES

MAUNSELL
CONSULTANTS ASIA LTD.
茂盛工程顧問有限公司

DRG. NO. 圖紙編號 92790/10/1071 B

CONTRACT NO. 合約編號 TIE/1/91

DATE OF ISSUE 簽發日期

AS BUILT DRAWING

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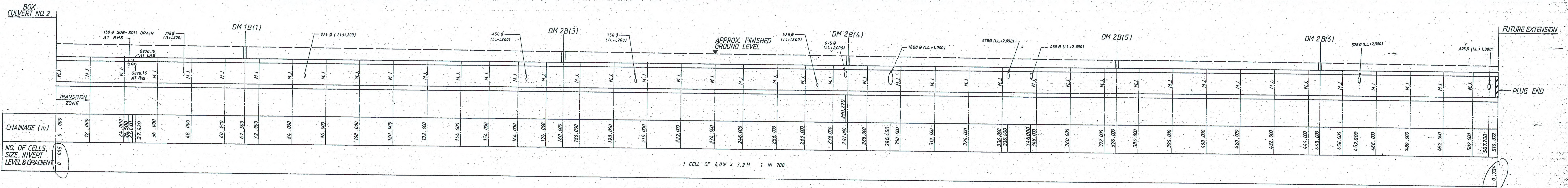
ACTUAL SCALE 0 0.5 1 2 3 4 5cm

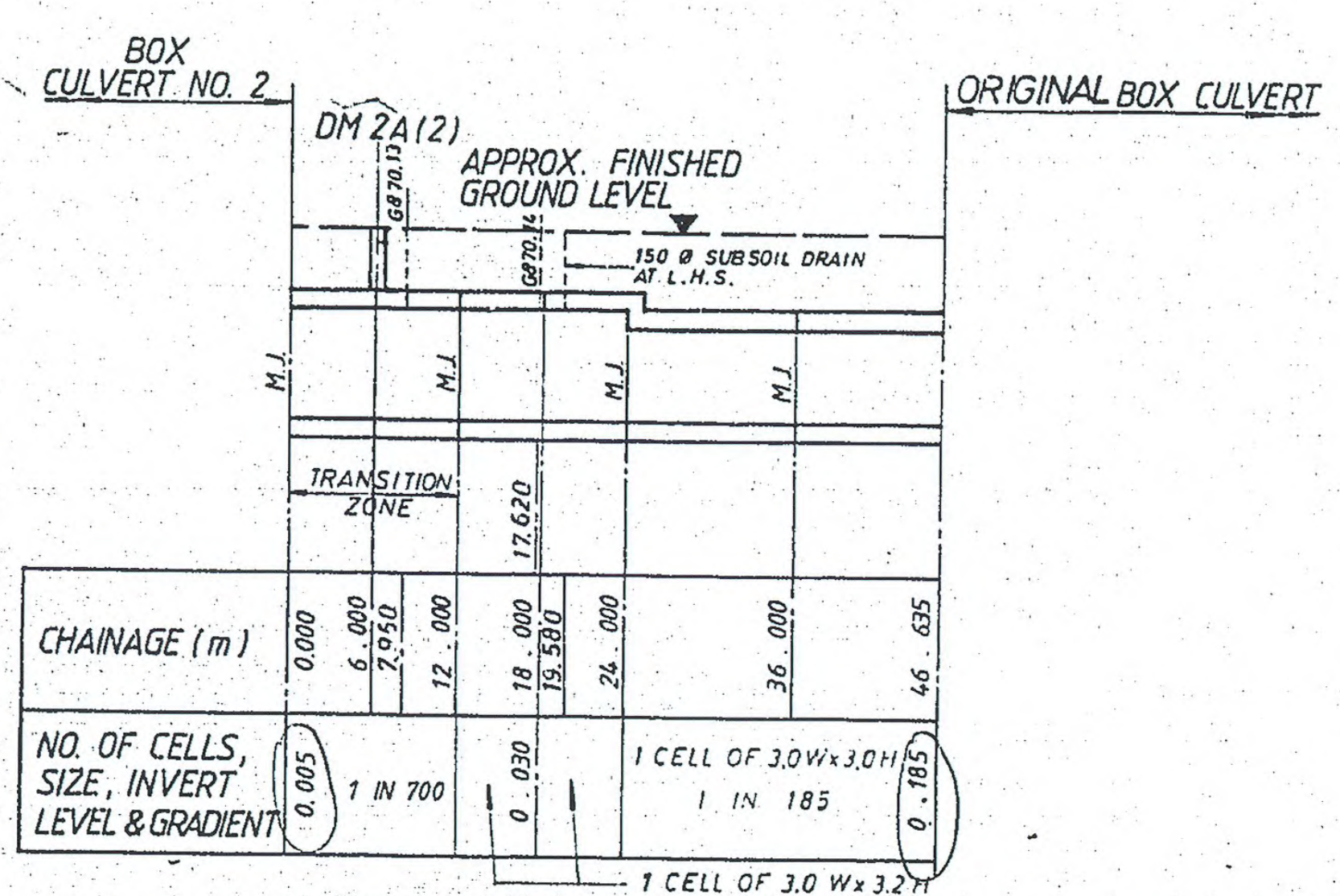
JB 9101
CONT No. : TIE/1/91
DRG No. : 92790/10/1071B


BOX CULVERT NO. 2
DM 1B(1)
DM 2B(3)
DM 2B(4)
DM 2B(5)
DM 2B(6)
APPROX. FINISHED GROUND LEVEL
FUTURE EXTENSION
PLUG END
TRANSITION ZONE
M.J.
CHAINAGE (m)
NO. OF CELLS, SIZE, INVERT LEVEL & GRADIENT
1 CELL OF 4.0W x 3.2H 1 IN 700
0.005
0.734

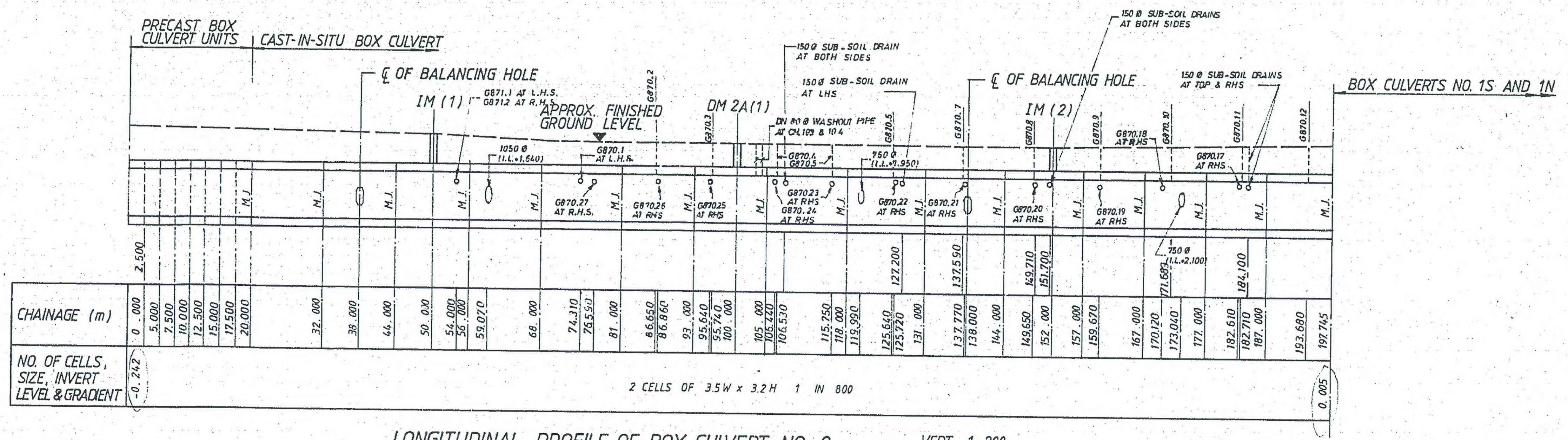
LONGITUDINAL PROFILE OF BOX CULVERT NO. 1 (S) SCALE: VERT. 1: 200 HORI. 1: 500

NOTES :

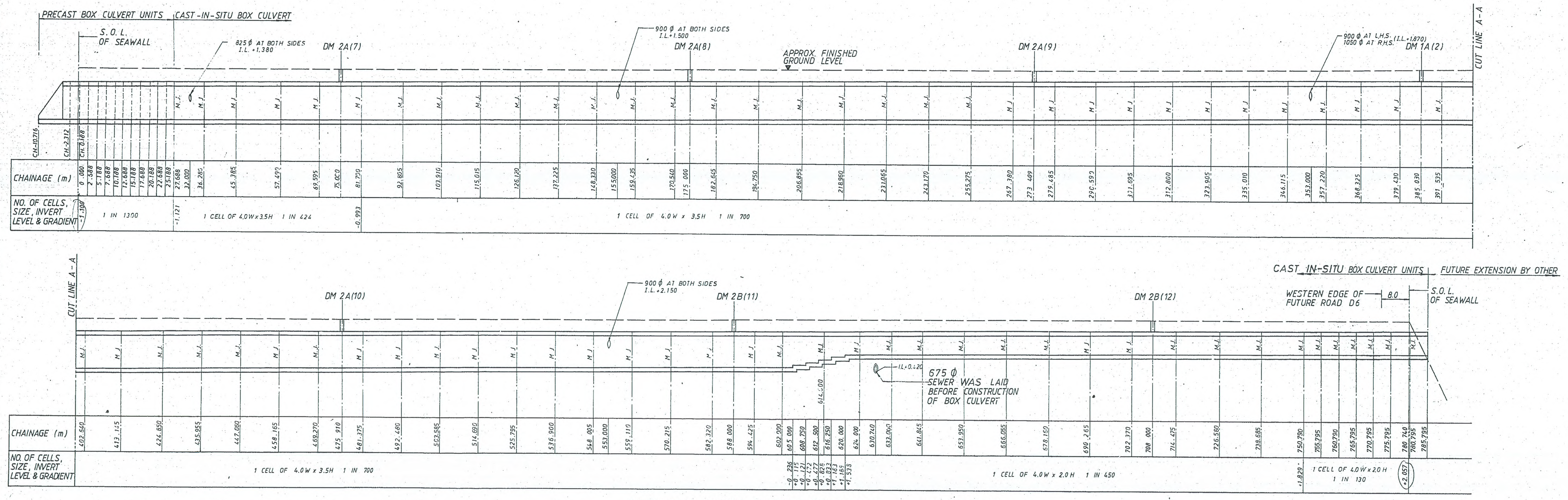
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRG. NOS. 92790/10/ 1071, 1073 TO 1075.
2. FOR GENERAL NOTES, SEE DRG. NO. 92790/10/ 1002.
3. FOR R.C. DETAILS SEE DRG. NO. 92790/10/ 1076 & 1079, & 1401 TO 1402.


BOX CULVERT NO. 2
DM 2A(2)
APPROX. FINISHED GROUND LEVEL
ORIGINAL BOX CULVERT
150 Ø SUBSOIL DRAIN AT L.H.S.
TRANSITION ZONE
CHAINAGE (m)
NO. OF CELLS, SIZE, INVERT LEVEL & GRADIENT
1 CELL OF 3.0W x 3.0H
1 IN 185
1 IN 700
1 CELL OF 3.0 W x 3.2H

LONGITUDINAL PROFILE OF BOX CULVERT NO. 1 (N)
SCALE: VERT. 1: 200 HORI. 1: 500


PRECAST BOX CULVERT UNITS
CAST-IN-SITU BOX CULVERT
℄ OF BALANCING HOLE
IM (1)
IM (2)
APPROX. FINISHED GROUND LEVEL
DM 2A(1)
150 Ø SUB-SOIL DRAIN AT BOTH SIDES
150 Ø SUB-SOIL DRAIN AT LHS
BOX CULVERTS NO. 1S AND 1N
CHAINAGE (m)
NO. OF CELLS, SIZE, INVERT LEVEL & GRADIENT
2 CELLS OF 3.5W x 3.2H 1 IN 800

LONGITUDINAL PROFILE OF BOX CULVERT NO. 2 SCALE: VERT. 1: 200 HORI. 1: 500


PRECAST BOX CULVERT UNITS
CAST-IN-SITU BOX CULVERT
S.O.L. OF SEAWALL
825 Ø AT BOTH SIDES I.L. +1.380
DM 2A(7)
900 Ø AT BOTH SIDES I.L. +1.500
DM 2A(8)
APPROX. FINISHED GROUND LEVEL
DM 2A(9)
900 Ø AT L.H.S. 1050 Ø AT R.H.S. (I.L. +1.870)
DM 1A(2)
CUT LINE A-A
CHAINAGE (m)
NO. OF CELLS, SIZE, INVERT LEVEL & GRADIENT
1 IN 1300
1 CELL OF 4.0W x 3.5H 1 IN 424
1 CELL OF 4.0W x 3.5H 1 IN 700
DM 2A(10)
900 Ø AT BOTH SIDES I.L. +2.150
DM 2B(11)
DM 2B(12)
CAST IN-SITU BOX CULVERT UNITS
FUTURE EXTENSION BY OTHER
WESTERN EDGE OF FUTURE ROAD D6
8.0
S.O.L. OF SEAWALL
675 Ø SEWER WAS LAID BEFORE CONSTRUCTION OF BOX CULVERT
1 CELL OF 4.0W x 2.0H 1 IN 450
1 CELL OF 4.0W x 2.0H 1 IN 130

LONGITUDINAL PROFILE OF BOX CULVERT NO. 3 SCALE VERT. 1: 200 HORI. 1: 500

AS-BUILT DRAWING
DRAWING OFFICE COPY
MAINLAND SOUTH DIVISION, D.S.D.

REV. 修訂	DESCRIPTION 內容摘要	DATE 日期	CHECKED 複核
C	AS BUILT DRAWING	31.5.95	
B	BOX-OUT LOCATIONS ADDED	21/9/93	
A	WORKING DRAWING	15/8/91	

香港工業邨公司
THE HONG KONG INDUSTRIAL ESTATES CORPORATION

TSEUNG KWAN O INDUSTRIAL ESTATE

LAND FORMATION AND INFRASTRUCTURE

BOX CULVERT DETAILS (G.A.)

SHEET 2 OF 5

DESIGNED 設計 Cheung Wai Man
CHECKED 複核
DRAWN 繪圖 B. Chang
CHECKED 複核 Cheung Wai Man
APPROVED FOR ISSUE 批准人
DATE 日期 DEC. 90
SCALE 比例 AS SHOWN
DIMENSIONS ARE IN 尺寸單位 METRES

MAUNSELL CONSULTANTS ASIA LTD.
茂盛工程顧問有限公司

DRG. NO. 圖紙編號 92790 / 10 / 1072 C

CONTRACT NO. 合約編號 TIE/1/91
DATE OF ISSUE 簽發日期

AS BUILT DRAWING

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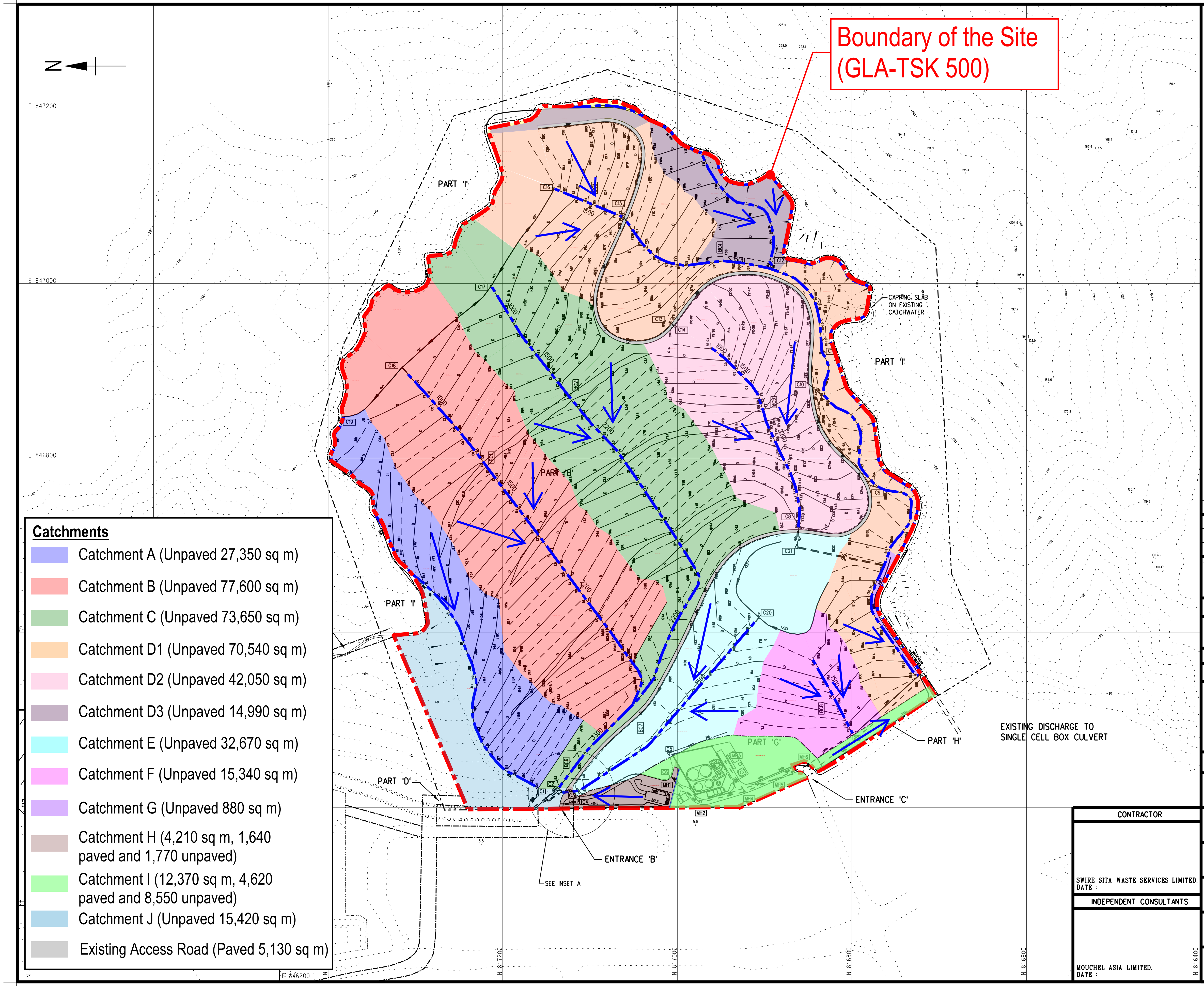
ACTUAL SCALE 0 0.5 1 2 3 4 5cm

JB 9101
CONT No.: TIE/1/91
DRG No.: 92790/10/1072C

AME 1126 x 800mm | AO SHEET 1189 x 841mm

Appendix C

Catchment Plans



Catchments

- Catchment A (Unpaved 27,350 sq m)
- Catchment B (Unpaved 77,600 sq m)
- Catchment C (Unpaved 73,650 sq m)
- Catchment D1 (Unpaved 70,540 sq m)
- Catchment D2 (Unpaved 42,050 sq m)
- Catchment D3 (Unpaved 14,990 sq m)
- Catchment E (Unpaved 32,670 sq m)
- Catchment F (Unpaved 15,340 sq m)
- Catchment G (Unpaved 880 sq m)
- Catchment H (4,210 sq m, 1,640 paved and 1,770 unpaved)
- Catchment I (12,370 sq m, 4,620 paved and 8,550 unpaved)
- Catchment J (Unpaved 15,420 sq m)
- Existing Access Road (Paved 5,130 sq m)

NOTES:

1. ALL GRIDS ARE HONG KONG GRID 1980.
2. ALL LEVEL ARE METRES ABOVE PRINCIPAL DATUM.
3. FOR SURFACE WATER DETAILS REFER TO DRAWING NOS. GENL/SUR/DRW/001/R TO 008/R AND STG2/SUR/DRW/011/R TO 020/R.
4. PLATFORM PERIMETER DRAINS LAID AT 1 : 125.
5. FOR PRECAST CONCRETE PIPE, ALL PIPES BEDDINGS CLASS B AS PER DSD DRAWING NO. 1048.
6. ALL PRECAST CONCRETE PIPES CLASS H TO BS 5911: PART 100 : 1988 UNLESS OTHERWISE STATED.
7. FOR AS-CONSTRUCTED DETAILS OF CATCHPITS AND MANHOLES, REFER TO STG2/SUR/DRW/002/R.

LEGEND :

- SITE BOUNDARY
- EXISTING STEPPED CHANNEL
- 1000 BC1 — BAFFLED CHANNEL OF BC1 WITH BASE WIDTH 1000mm
- 250mm DIAMETER NETLON PIPE
- D — NETLON WITH DAYLIGHT
- 457• — PERIMETER DRAIN PERFORATED HDPE PIPE OF DIA. 457mm
- 1050 SC — STEPPED CHANNEL OF SIZE 1050mm
- 300• — ROADWAY DRAIN 300mm DIA. PERFORATED PIPE
- 600 U — U-CHANNEL WITH SIZE 600mm
- 300• — HDPE PIPE OF DIAMETER 300mm
- 300• — PRECAST CONCRETE PIPE OF DIAMETER 300mm
- RECTANGULAR CHANNEL WITH WIDTH 1200mm
- PIPEWORK CONNECTION TO DOWNSLOPE SURFACE CHANNEL
- ⊠ CATCHPIT
- C1 — CATCHPIT NUMBER
- ○ CONNECTION BETWEEN DIFFERENT SIZES OF BAFFLED CHANNELS / U-CHANNELS
- ● TAPER SECTION / APRON STRUCTURE

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN: A2SUR001.DGN
REF: TKOSF-AB, S2-PTRD, S2TOPDRN & RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

STAGE II/III
SURFACE WATER DRAINAGE
LAYOUT PLAN

AS CONSTRUCTED RECORD DRAWING

Drawing no. STG2/SUR/DRW/001/R

Scale 1:2000

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

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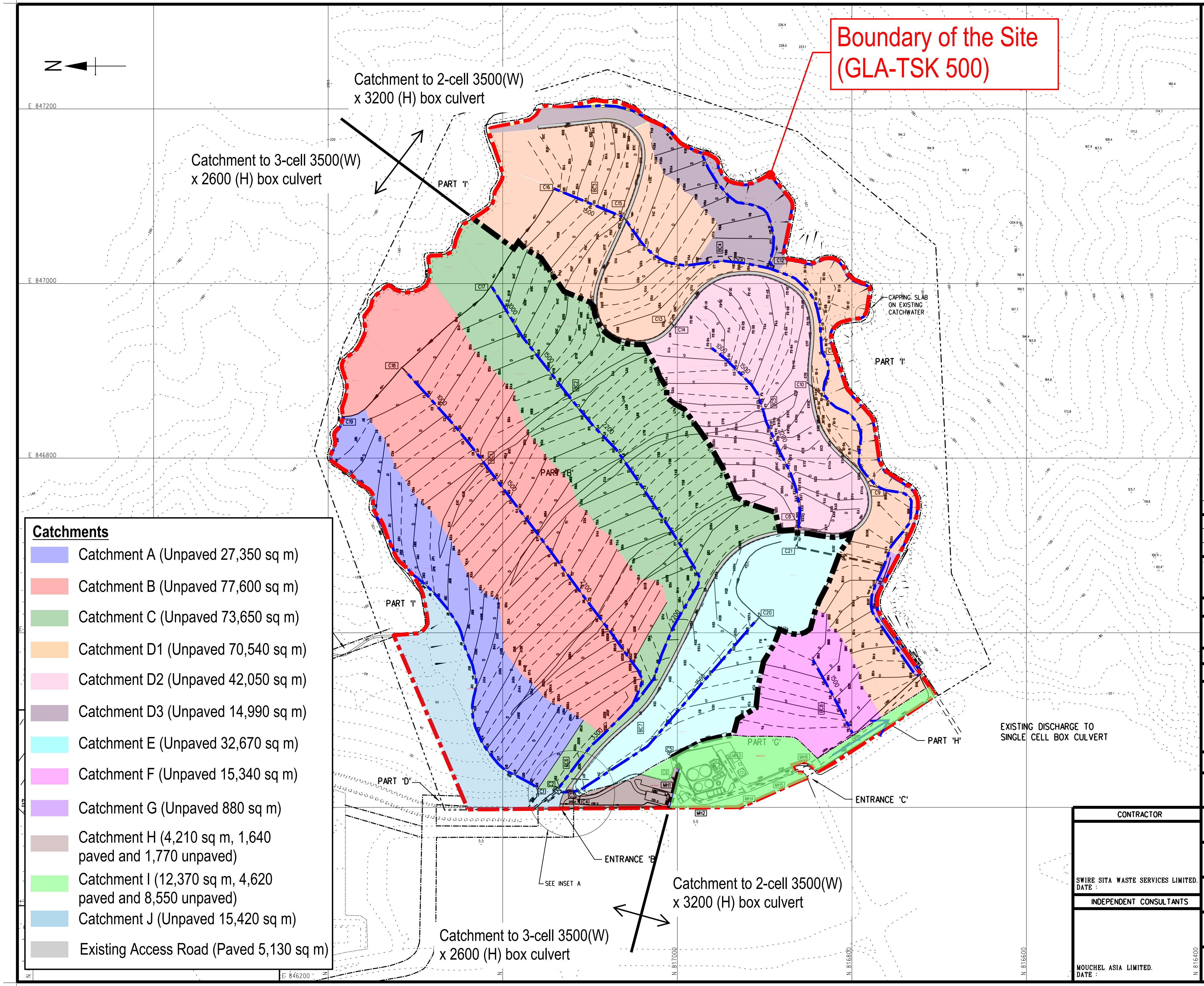
Boundary of the Site
(GLA-TSK 500)
Catchment to 2-cell 3500(W)
x 3200 (H) box culvert
Catchment to 3-cell 3500(W)
x 2600 (H) box culvert
PART 'I'
CAPPING SLAB
ON EXISTING
CATCHWATER
PART 'I'
PART 'B'
PART 'I'
PART 'D'
PART 'G'
PART 'H'
EXISTING DISCHARGE TO
SINGLE CELL BOX CULVERT
ENTRANCE 'C'
ENTRANCE 'B'
SEE INSET A
Catchment to 2-cell 3500(W)
x 3200 (H) box culvert
Catchment to 3-cell 3500(W)
x 2600 (H) box culvert
E 847200
E 847000
E 846800
E 846200
N 817000
N 816800
N 816600

Catchments

🟦	Catchment A (Unpaved 27,350 sq m)
🟥	Catchment B (Unpaved 77,600 sq m)
🟩	Catchment C (Unpaved 73,650 sq m)
🟧	Catchment D1 (Unpaved 70,540 sq m)
🟥	Catchment D2 (Unpaved 42,050 sq m)
🟪	Catchment D3 (Unpaved 14,990 sq m)
🟦	Catchment E (Unpaved 32,670 sq m)
🟪	Catchment F (Unpaved 15,340 sq m)
🟪	Catchment G (Unpaved 880 sq m)
🟫	Catchment H (4,210 sq m, 1,640 paved and 1,770 unpaved)
🟩	Catchment I (12,370 sq m, 4,620 paved and 8,550 unpaved)
🟦	Catchment J (Unpaved 15,420 sq m)
⬜	Existing Access Road (Paved 5,130 sq m)

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MOUCHEL ASIA LIMITED.
DATE :

N 816400

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LEGEND :

— - - — - -	SITE BOUNDARY
═	EXISTING STEPPED CHANNEL
1000 BC1	BAFFLED CHANNEL OF BC1 WITH BASE WIDTH 1000mm
— — — —	250mm DIAMETER NETLON PIPE
D	NETLON WITH DAYLIGHT
457•	PERIMETER DRAIN PERFORATED HDPE PIPE OF DIA. 457mm
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300•	ROADWAY DRAIN 300mm DIA. PERFORATED PIPE
600 U	U-CHANNEL WITH SIZE 600mm
300•	HDPE PIPE OF DIAMETER 300mm
300•	PRECAST CONCRETE PIPE OF DIAMETER 300mm
——	RECTANGULAR CHANNEL WITH WIDTH 1200mm
▬	PIPEWORK CONNECTION TO DOWNSLOPE SURFACE CHANNEL
☒	CATCHPIT
C1	CATCHPIT NUMBER
○	CONNECTION BETWEEN DIFFERENT SIZES OF BAFFLED CHANNELS / U-CHANNELS
●	TAPER SECTION / APRON STRUCTURE

Details of Revision	Date

	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN: A2SUR001.DGN
REF: TKOSF-AB, S2-PTRD, S2TOPDRN & RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

STAGE II/III
SURFACE WATER DRAINAGE LAYOUT PLAN

AS CONSTRUCTED RECORD DRAWING

Drawing no.	Scale
STG2/SUR/DRW/001/R	1:2000

Binnie Black & Veatch
Hong Kong Limited

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Environmental Consultants
ERM (HK) LTD.

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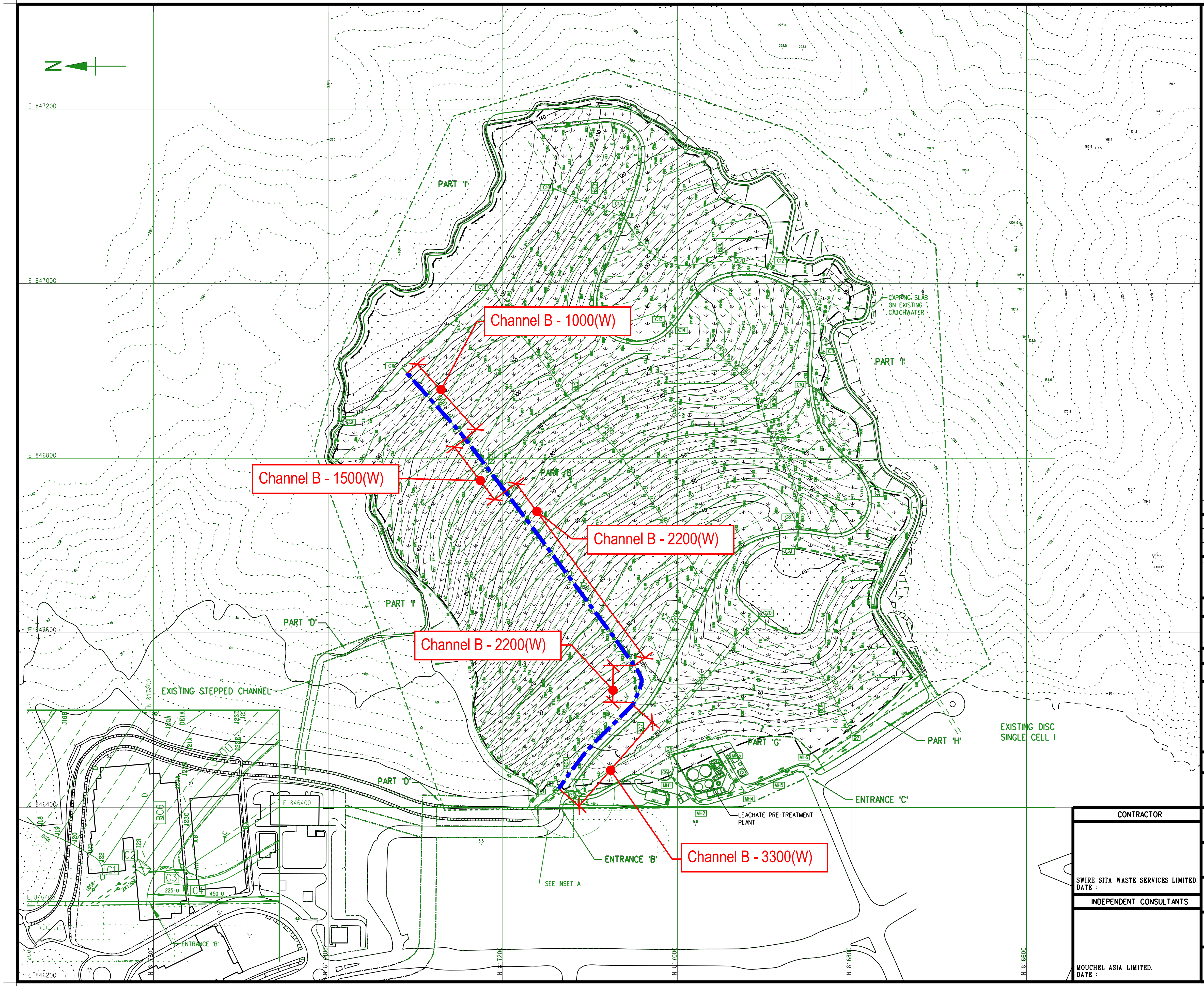
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E 847200
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E 846800
E 846600
E 846400
E 846200
N 817200
N 817000
N 816800
N 816600
PART 'I'
PART 'B'
PART 'D'
PART 'G'
PART 'H'
Channel B - 1000(W)
Channel B - 1500(W)
Channel B - 2200(W)
Channel B - 2200(W)
Channel B - 3300(W)
CAPPING SLAB ON EXISTING CATCHWATER
EXISTING STEPPED CHANNEL
EXISTING DISC SINGLE CELL I
LEACHATE PRE-TREATMENT PLANT
ENTRANCE 'B'
ENTRANCE 'C'
SEE INSET A

NOTES:

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2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. FOR DETAILS OF CAP TYPES REFER TO DRAWING NO. GENL/STE/DRW/001/R & 002/R.

LEGEND:

⁘	CAP TYPE 1
↓	CAP TYPE 2
— — —	LIMIT OF LLDPE
— - - — - -	SITE BOUNDARY
—·—·—·	BOUNDARY BETWEEN SITE PARTS
- - - - - -	CONTOURS
———	CAP CONTOURS

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN: A2STE003.DGN
REF: TKOSF-AB, S2-PTRD & RTKO-A1.DGN

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SPECIAL ADMINISTRATIVE REGION

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Drawing title

STAGE II/III
CAP LAYOUT PLAN

AS CONSTRUCTED RECORD DRAWING

Drawing no.	Scale
STG2/STE/DRW/003/R	1:2000

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
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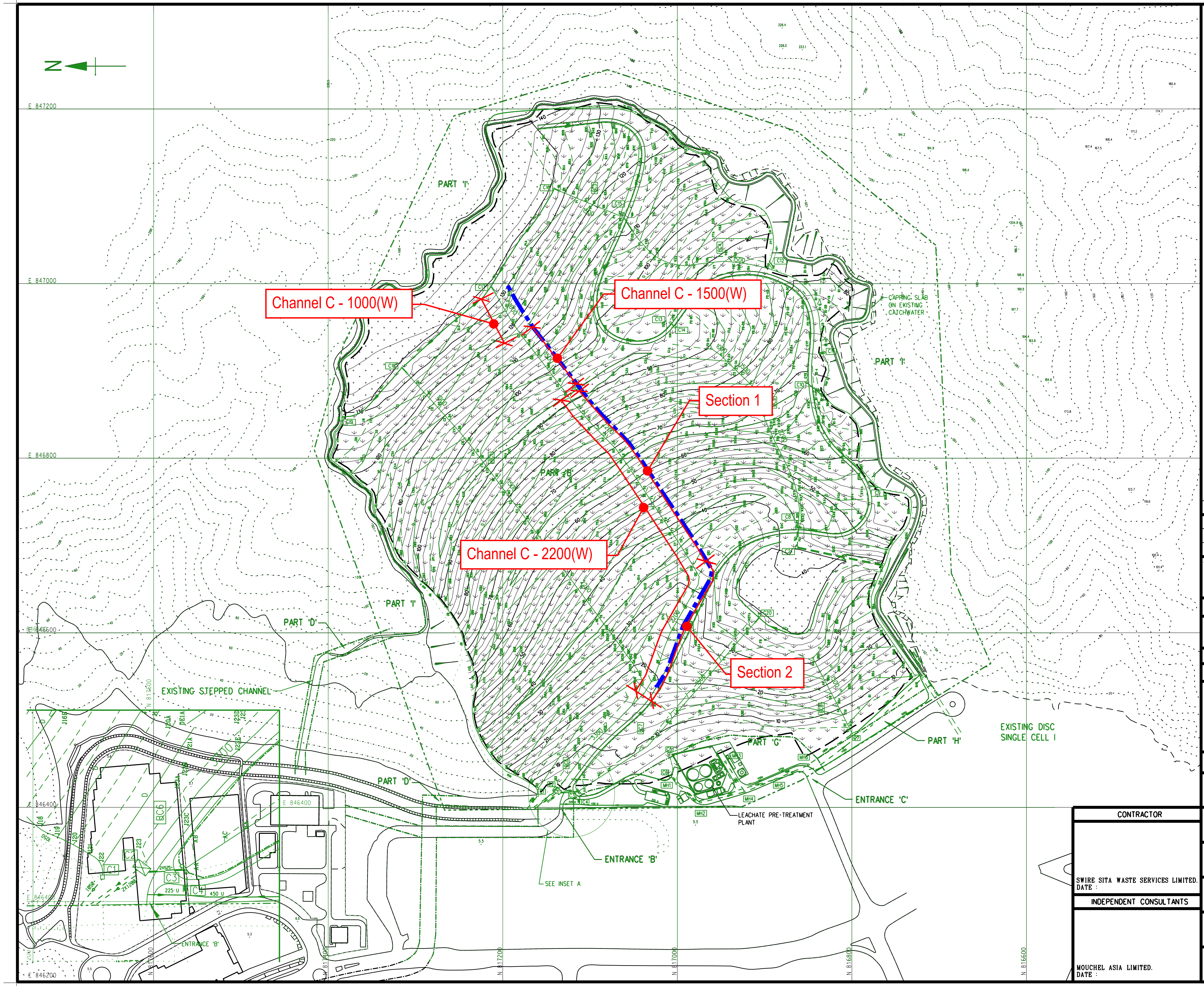
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PART 'I'
PART 'I'
PART 'I'
PART 'E'
PART 'D'
PART 'D'
PART 'G'
PART 'H'
CAPPING SLAB ON EXISTING CATCHWATER
Channel C - 1000(W)
Channel C - 1500(W)
Section 1
Channel C - 2200(W)
Section 2
EXISTING STEPPED CHANNEL
EXISTING DISC SINGLE CELL I
LEACHATE PRE-TREATMENT PLANT
ENTRANCE 'B'
ENTRANCE 'C'
ENTRANCE 'B'
SEE INSET A

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—·—·—·	BOUNDARY BETWEEN SITE PARTS
- - - - - -	CONTOURS
———	CAP CONTOURS

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Drawing title

STAGE II/III
CAP LAYOUT PLAN

AS CONSTRUCTED RECORD DRAWING

Drawing no. STG2/STE/DRW/003/R
Scale 1:2000

CONTRACTOR

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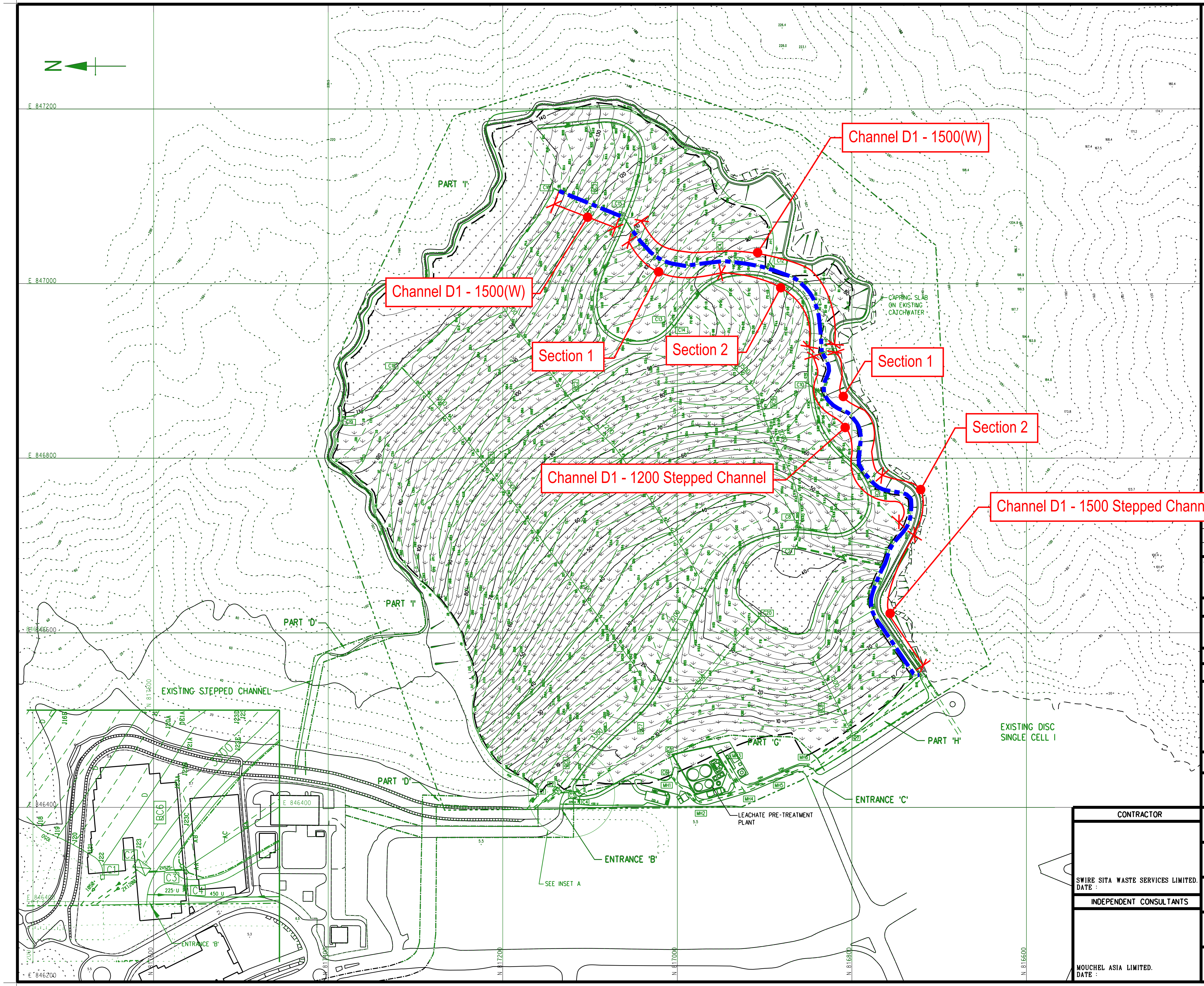
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E 846400
E 846200
N 817400
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N 816800
N 816600
Channel D1 - 1500(W)
Channel D1 - 1500(W)
Section 1
Section 2
Section 1
Section 2
Channel D1 - 1200 Stepped Channel
Channel D1 - 1500 Stepped Channel
CAPPING SLAB ON EXISTING CATCHWATER
PART 'I'
PART 'I'
PART 'D'
PART 'D'
PART 'G'
PART 'H'
EXISTING STEPPED CHANNEL
EXISTING DISC SINGLE CELL I
ENTRANCE 'B'
ENTRANCE 'B'
ENTRANCE 'C'
LEACHATE PRE-TREATMENT PLANT
SEE INSET A

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⩒	CAP TYPE 2
— — —	LIMIT OF LLDPE
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—·—·—·—	BOUNDARY BETWEEN SITE PARTS
- - - - - -	CONTOURS
———	CAP CONTOURS

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STAGE II/III
CAP LAYOUT PLAN

AS CONSTRUCTED RECORD DRAWING

Drawing no. STG2/STE/DRW/003/R

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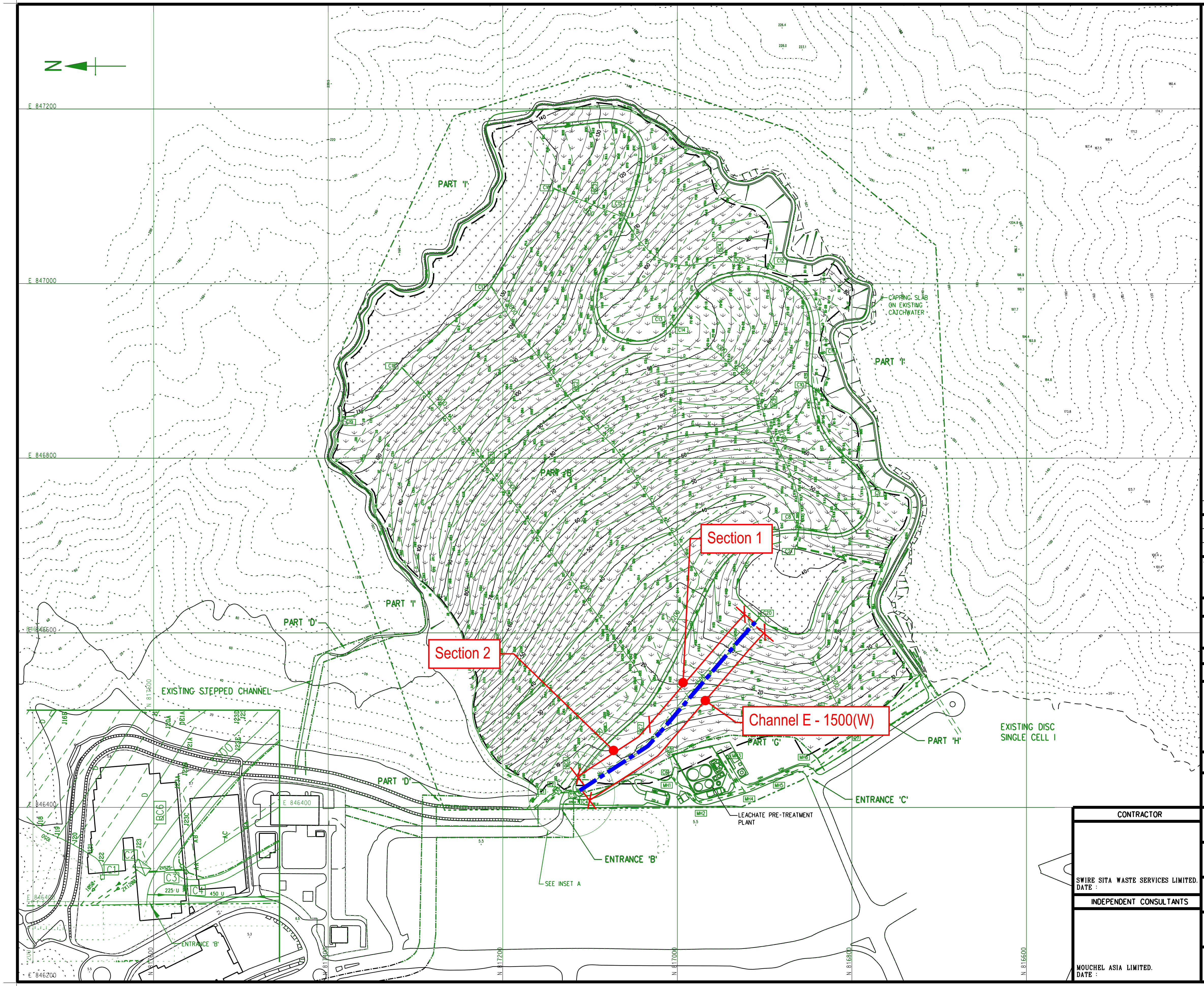
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N 816600
PART 'I'
PART 'E'
PART 'D'
PART 'G'
PART 'H'
CAPPING SLAB ON EXISTING CATCHWATER
EXISTING STEPPED CHANNEL
EXISTING DISC SINGLE CELL I
ENTRANCE 'B'
ENTRANCE 'C'
LEACHATE PRE-TREATMENT PLANT
SEE INSET A
Section 1
Section 2
Channel E - 1500(W)

NOTES:

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⁘	CAP TYPE 1
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— — —	LIMIT OF LLDPE
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—·—·—·—	BOUNDARY BETWEEN SITE PARTS
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———	CAP CONTOURS

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SERVICES LTD.

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Catchment Plan for Access Road Before and After Widening

Catchment area of access road before widening: 5600 sqm (Paved)

Catchment area of access road after widening: 13720 sqm (Paved)

1050
1200
1200
C2
C3
C8
C21
C12
C15
900
762
762
457
PC1
PC2 (C14)
PC3 (C10)
PC4 (C9)
375CC(M)
WAN PO ROAD
CHUN YAT STREET
CHUN SING STREET
Environmental Protection Department

Catchment R1
Before widening: 800 sq m
After widening: 2300 sq m

Catchment R2
Before widening: 810 sq m
After widening:1990 sq m

Catchment R3
Before widening: 1040 sq m
After widening:2430 sq m

Catchment R4
Before widening: 510 sq m
After widening:1200 sq m

Catchment R5
Before widening: 450 sq m
After widening:1090 sq m

Catchment R6
Before widening: 1520 sq m
After widening:3620 sq m

Catchment R7
Before widening: 470 sq m
After widening:1090 sq m

Legends

🟪 / 🟦 Catchment Area of Access Road before Widening

🟪 / 🟦 Catchment Area of Access Road after Widening

Catchment Area to 3-cell 3500(W) X 2600(H) Box Culvert that changed from Unpaved to Paved after widening: **2720 sq m**

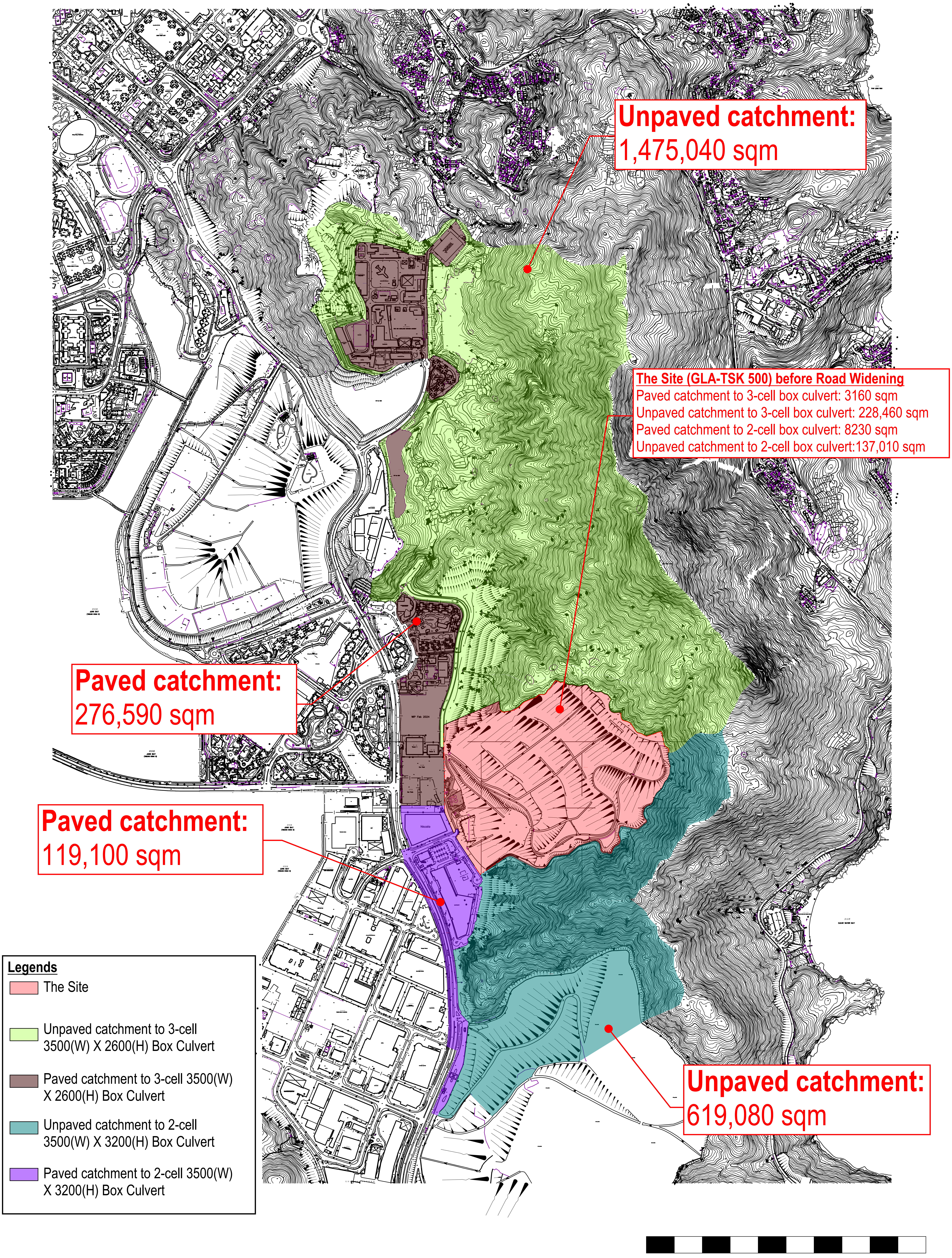
Catchment Area to 2-cell 3500(W) X 3200(H) Box Culvert that changed from Unpaved to Paved after widening: **5400 sq m**

Tseung Kwan O Public Riding School Project
1:1500

Catchment Plan

Catchment Area to 3-cell 3500(W) X 2600(H) that changed from
Unpaved to Paved after PRS Development: **33,990 sq m**
Catchment Area to 2-cell 3500(W) X 3200(H) that changed from
Unpaved to Paved after PRS Development: **39,90 sq m**

9080 sq m paved catchment to C18
5820 sq m paved catchment to C17
5590 sq m paved catchment to C16
3-CELL 3500(W) x 2700(H) BOX CULVERT
3700 sq m paved catchment to C3
Utility trench unchanged
840 sq m paved catchment to C4
510 sq m paved catchment to MH1
5-CELL 3500(W) x 3200(H) BOX CULVERT
Middle Platform (Spelling Yard) unchanged
3040 sq m paved catchment to MH5
Lower Platform unchanged
440 sq m paved catchment to C7
2-CELL 3500(W) x 3200(H) BOX CULVERT
8960 sq m paved catchment to C20
4000(W) x 3200(H) BOX CULVERT
3000(W) x 3000(H) BOX CULVERT
C2
C3
C4
C7
C8
C12
C15
C16
C17
C18
C20
C21
MH1
MH2
MH3
MH4
MH5
MH6
PC1
PC2 (C14)
PC3 (C10)
PC4 (C9)
450SC
600SC
750SC
1050SC
1000BC
1500BC
2200BC
3300BC
1200SC
375CC(M)
762
457
467
Legends
1200SC
EXISTING OPENING CHANNEL, SC DENOTES STEPPED CHANNEL, BC DENOTES BAFFLED CHANNEL
762
EXISTING DRAINAGE PIPE
EXISTING CATCHPIT
375CC(M)
PROPOSED SURFACE CHANNEL WITH COVER, M DENOTES MEDIUM DUTY (FOR ACCESS ROAD)
467
PROPOSED DRAINAGE PIPE (FOR ACCESS ROAD)
PROPOSED CATCHPIT (FOR ACCESS ROAD)



Unpaved catchment:
1,475,040 sqm

The Site (GLA-TSK 500) before Road Widening
Paved catchment to 3-cell box culvert: 3160 sqm
Unpaved catchment to 3-cell box culvert: 228,460 sqm
Paved catchment to 2-cell box culvert: 8230 sqm
Unpaved catchment to 2-cell box culvert:137,010 sqm

Paved catchment:
276,590 sqm

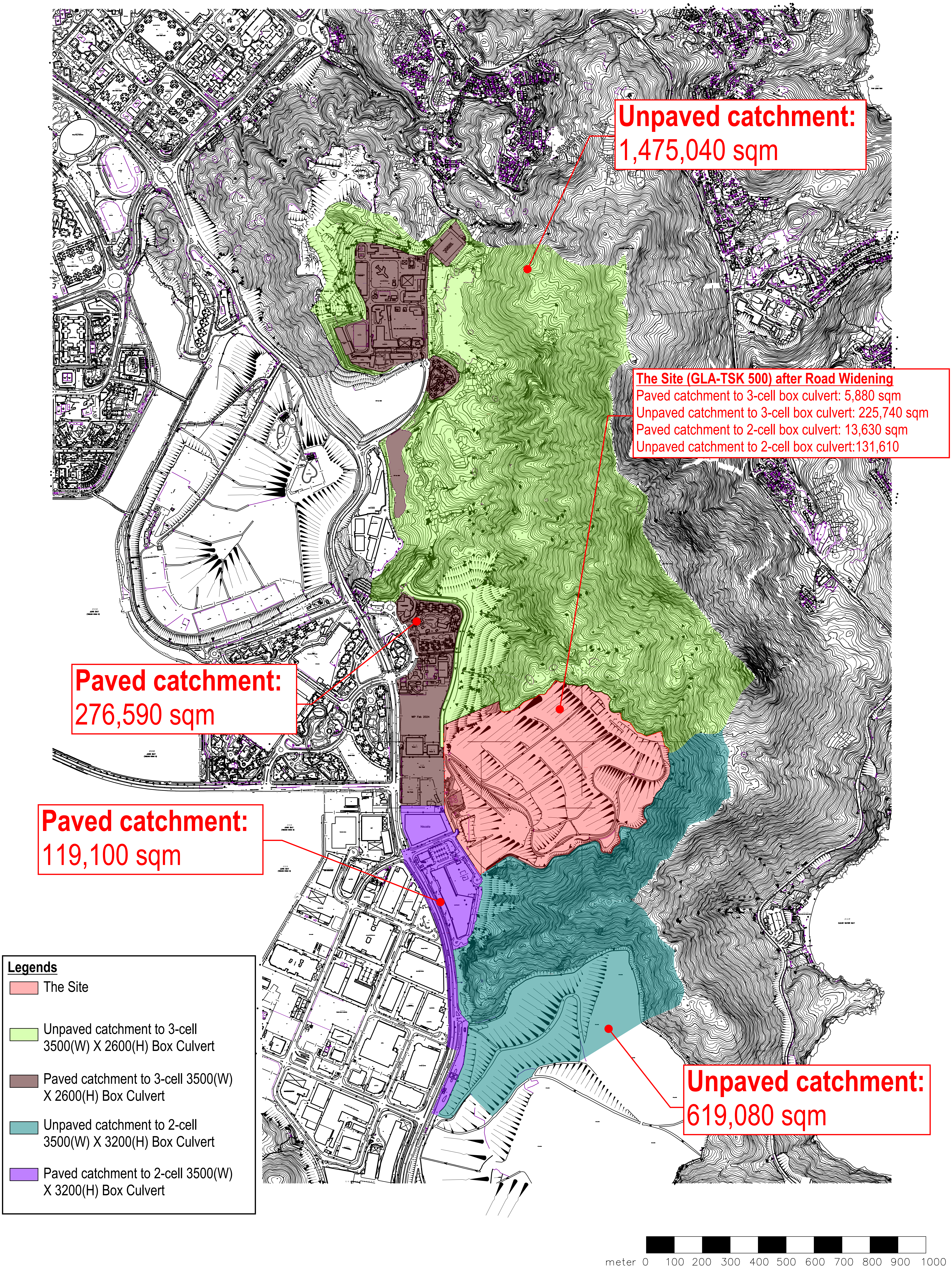
Paved catchment:
119,100 sqm

Unpaved catchment:
619,080 sqm

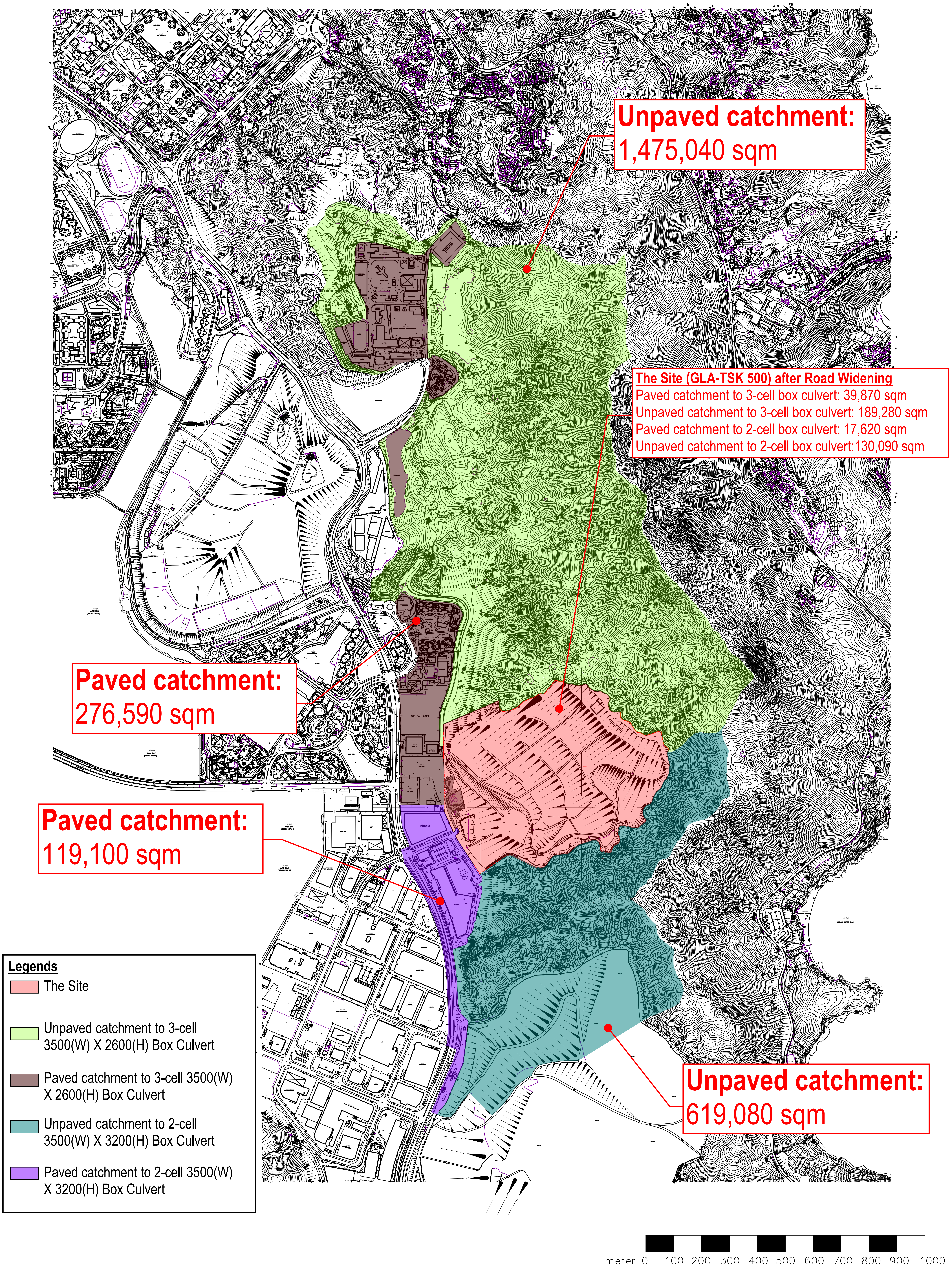
Legends

- 🟥 The Site
- 🟩 Unpaved catchment to 3-cell 3500(W) X 2600(H) Box Culvert
- 🟫 Paved catchment to 3-cell 3500(W) X 2600(H) Box Culvert
- 🟦 Unpaved catchment to 2-cell 3500(W) X 3200(H) Box Culvert
- 🟪 Paved catchment to 2-cell 3500(W) X 3200(H) Box Culvert

Tseung Kwan O Sitewide Catchment Plan before Road Widening and PRS Development


Unpaved catchment:
1,475,040 sqm
The Site (GLA-TSK 500) after Road Widening
Paved catchment to 3-cell box culvert: 5,880 sqm
Unpaved catchment to 3-cell box culvert: 225,740 sqm
Paved catchment to 2-cell box culvert: 13,630 sqm
Unpaved catchment to 2-cell box culvert:131,610
Paved catchment:
276,590 sqm
Paved catchment:
119,100 sqm
Unpaved catchment:
619,080 sqm
Legends
🟥 The Site
🟩 Unpaved catchment to 3-cell 3500(W) X 2600(H) Box Culvert
■ Paved catchment to 3-cell 3500(W) X 2600(H) Box Culvert
■ Unpaved catchment to 2-cell 3500(W) X 3200(H) Box Culvert
■ Paved catchment to 2-cell 3500(W) X 3200(H) Box Culvert
meter 0 100 200 300 400 500 600 700 800 900 1000

Tseung Kwan O Sitewide Catchment Plan after Road Widening



Unpaved catchment:
1,475,040 sqm

The Site (GLA-TSK 500) after Road Widening
Paved catchment to 3-cell box culvert: 39,870 sqm
Unpaved catchment to 3-cell box culvert: 189,280 sqm
Paved catchment to 2-cell box culvert: 17,620 sqm
Unpaved catchment to 2-cell box culvert:130,090 sqm

Paved catchment:
276,590 sqm

Paved catchment:
119,100 sqm

Unpaved catchment:
619,080 sqm

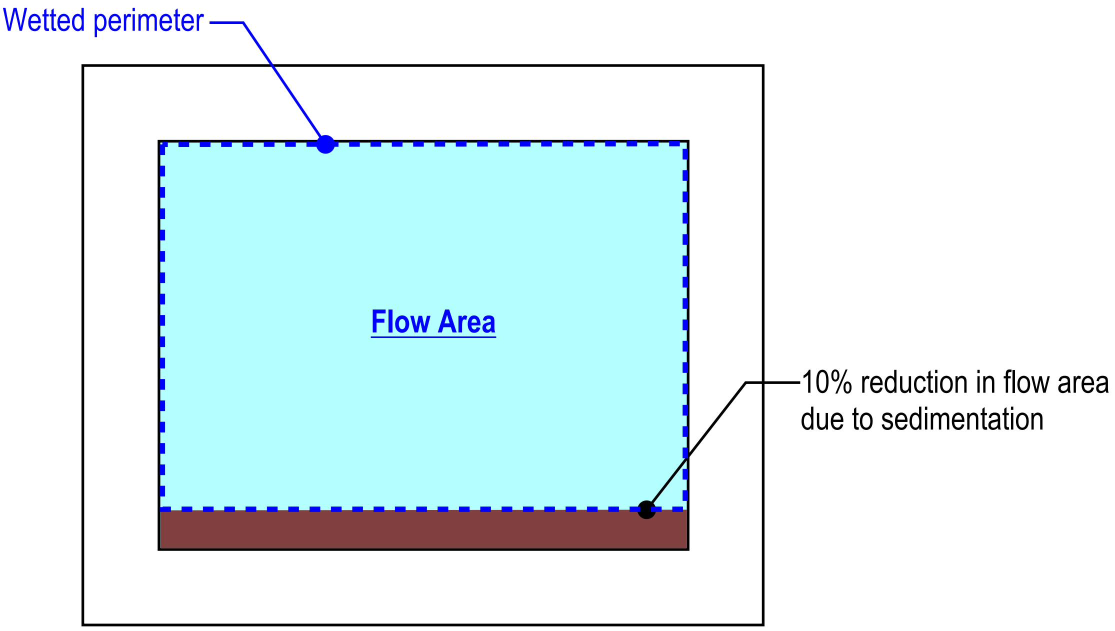
Legends
- 🟥 The Site
- 🟩 Unpaved catchment to 3-cell 3500(W) X 2600(H) Box Culvert
- 🟫 Paved catchment to 3-cell 3500(W) X 2600(H) Box Culvert
- 🟦 Unpaved catchment to 2-cell 3500(W) X 3200(H) Box Culvert
- 🟪 Paved catchment to 2-cell 3500(W) X 3200(H) Box Culvert

Tseung Kwan O Sitewide Catchment Plan after PRS Development

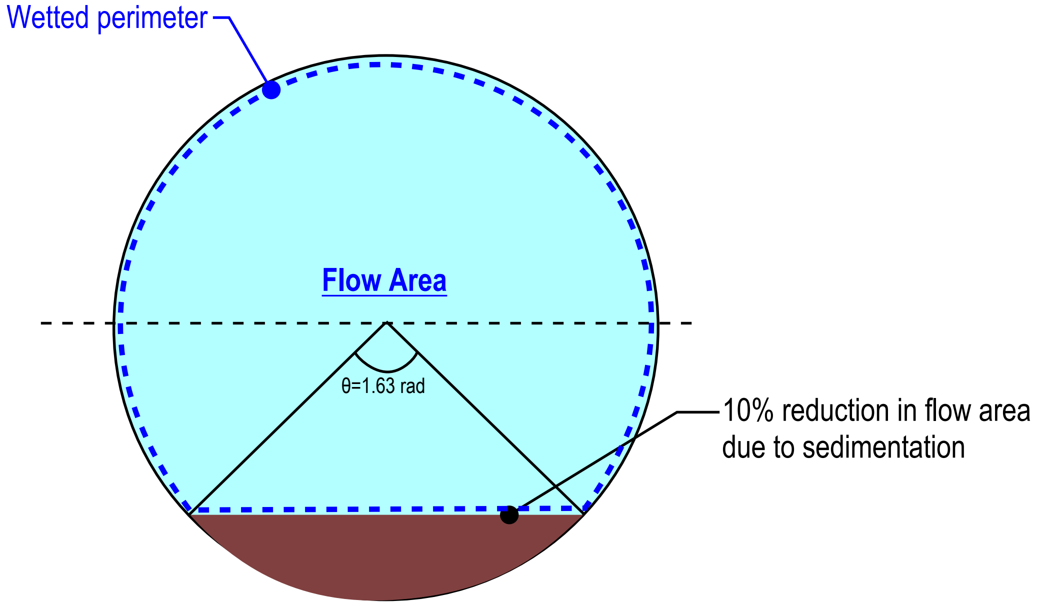
Appendix D

Hydraulic Calculations

DEPOSITION OF SEDIMENTS IN BOX CULVERT AND UNDERGROUND PIPE


Wetted perimeter
Flow Area
10% reduction in flow area
due to sedimentation

TYPICAL SECTION OF BOX CULVERTS FOR HYDRAULIC CALCULATION


Wetted perimeter
Flow Area
θ=1.63 rad
10% reduction in flow area
due to sedimentation

TYPICAL SECTION OF UNDERGROUND PIPE FOR HYDRAULIC CALCULATION

ARUP

Job No.	Sheet No.	Rev.
		02

Member/Location

Drg. Ref.

Job Title **Proposed Public Riding School Development at the Restored Tseung Kwan O Landfill Stage II/III (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500)**

Calculation **Hydraulic Checking of Existing Drainage System**

Made by DL Date 16 January 2026 Chd. CC

Table A1 Capacity Checking of Existing Drainage System before PRS Development and Road Widening

Column 1	Upstream Manhole/ Box Culvert Reference
Column 2	Downstream Manhole/ Box Culvert Reference
Column 3	Pipe/Box Culvert Length
Column 4	Pipe Size in mm
Column 5	Box Culvert Width and Height in mm
Column 6	Channel or Pipe
Column 7	Upstream Manhole/ Catchpit Ground Level in mPD
Column 8	Downstream Manhole/ Catchpit Ground Level in mPD
Column 9	Upstream Manhole/ Catchpit Invert Level in mPD
Column 10	Downstream Manhole/ Catchpit Invert Level in mPD
Column 11	Upstream Soil Cover to Pipe
Column 12	Downstream Soil Cover to Pipe
Column 13	Pipe/ Channel Gradient
Column 14	Pipe/ Channel Gradient (1 in X) = 1 / Gradient from Column 12
Column 15	Drain Flow Area in m^2
Column 16	Wetted Perimeter in m
Column 17	Hydraulic Radius in m (R=A/P)
Column 18	Velocity at Full Bore from Manning Equation for Box Culvert/ Channels

$$V = \frac{R^{\frac{1}{6}}}{n}\sqrt{RS_f}$$

where n= 0.014 Box Culvert/ Surface Channels (Extracted DSD Stormwater Drainage Manual Table 13)
0.060 Baffled Channel

Velocity at Full bore from Colebrook-White Equation for Pipe

$$V = -\sqrt{32gRS_f}\,\log\left[\frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{32gRS_f}}\right]$$

where v= 0.000001

Column 19	Time of Flow T_f (Length from Column 3/ Velocity at Full Bore from Column 18)
Column 20	Time of Concentration T_c (Time of Inlet = 5min + Time of Flow from Column 19)
Column 21	Rainfall Intensity in mm/hr

$$I = \frac{a}{(b + t_c)^c}$$

where,

	50-Year	200-Year	
a=	505.5	508.8	(Extracted from DSD Stormwater Drainage Manual Table 3a)
b=	3.29	3.46	
c=	0.355	0.322	

Column 22	Paved Catchment Area in m^2
Column 23	Runoff Coefficient of Paved Runoff Coefficient; K=0.90 for Paved Area
Column 24	Unpaved Area Catchment Area in m^2
Column 25	Runoff Coefficient of Unpaved Area Catchment Area in m^2, K=0.35 for Unpaved Area
Column 26	Cumulative Effective Catchment Area (Effective Catchment Area = Catchment Area x Runoff Coefficient)
Column 27	Peak Runoff in m^3/sec and l/sec
Column 28	Pipe/ Channel Capacity
Column 29	Percentage of Flow to Pipe/ Channel Capacity
Column 30	Remark

#REF!

to = 5 minutes k_s = 0.15 (Precast Concrete Pipe - Normal 0.06 (Precast Concrete Pipe - Good)

(1)	(2)	(3)	(4)	(5)			(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)		(28)		(29)	(30)
US MH	DS MH	Length	Pipe Size (d)	Bottom Width	Channel Height	Side Slope (H:V)	Pipe/ Trapezoidal/ Box Culvert	US GL	DS GL	US IL	DS IL	US Soil Cover	DS Soil Cover	Gradient	Gradient	Pipe/ Channel Area	Perimeter	R =A/P	Velocity at Full Bore	T_f	T_c	Intensity	Paved Area	Runoff Coefficient	Unpaved Area	Runoff Coefficient	Cumulative Effective Catchment Area	Q	Q	Capacity	Capacity	Percent of Flow to Capacity	Remark
		(m)	(mm)	(mm)	(mm)	(X:1)		(mPD)	(mPD)	(mPD)	(mPD)	(m)	(m)		(1 in x)	(m^2)	(m)	(m)	(m/sec)	(mins)	(mins)	(mm/hr)	(m^2)		(m^2)		(m^2)	(m^3/sec)	(l/sec)	(m^3/sec)	(l/sec)	(%)	
Existing Channels within GLA-TSK 500 - 50-Year																																	
C18	Channel B - 1000W	7.00	457	-	-	-	Pipe	132.39	131.00	130.73	130.00	1.20	0.54	0.104	9.59	0.15	1.40	0.11	7.42	0.02	5.00	264.82	0	0.90	10140	0.35	3549.00	0.26	261.07	1.10	1096.07	23.82	Catchment B
Channel B - 1000W	Channel B - 1500W	99.32	-	1000	1000	2	Trapezoidal	131.00	101.00	130.00	100.00	-	-	0.302	3.31	2.56	7.14	0.36	4.62	0.36	5.02	264.65	0	0.90	14890	0.35	8760.50	0.64	644.01	11.84	11838.01	5.44	Catchment B
Channel B - 1500W	Channel B - 2200 W (Section 1)	76.36	-	1500	1000	2	Trapezoidal	101.00	82.00	100.00	81.00	-	-	0.249	4.02	2.86	8.44	0.34	4.04	0.31	5.37	260.71	0	0.90	12040	0.35	12974.50	0.94	939.61	11.56	11559.59	8.13	Catchment B
Channel B - 2200 W (Section 1)	Channel B - 2200 W (Section 2)	247.85	-	2200	1000	2	Trapezoidal	82.00	20.00	81.00	19.00	-	-	0.250	4.00	3.29	9.78	0.34	4.03	1.02	5.69	257.43	0	0.90	40620	0.35	27191.50	1.94	1944.40	13.26	13264.46	14.66	Catchment B
Channel B - 2200 W (Section 2)	Channel B - 3300 W	48.80	-	2200	1000	2	Trapezoidal	20.00	16.00	19.00	15.00	-	-	0.082	12.20	3.29	9.78	0.34	2.31	0.35	6.71	247.74	0	0.90	0	0.35	27191.50	1.87	1871.23	7.59	7592.91	24.64	Catchment B
C17	Channel C - 1000W	4.65	457	-	-	-	Twin Pipe	133.78	131.00	130.74	130.00	2.58	0.54	0.159	6.28	0.15	1.40	0.11	9.18	0.01	5.00	264.82	0	0.90	5970	0.35	2089.50	0.15	153.71	2.71	2711.51	5.67	Catchment C
Channel C - 1000W	Channel C - 1500W	55.60	-	1000	1000	2	Trapezoidal	131.00	115.00	130.00	114.00	-	-	0.288	3.48	2.56	7.14	0.36	4.51	0.21	5.01	264.73	0	0.90	7160	0.35	4595.50	0.34	337.93	11.55	11554.71	2.92	Catchment C
Channel C - 1500W	Channel C - 2200 W (Section 1)	82.00	-	1500	1000	2	Trapezoidal	115.00	92.00	114.00	91.00	-	-	0.280	3.57	2.86	8.44	0.34	4.29	0.32	5.21	262.44	0	0.90	11160	0.35	8501.50	0.62	619.76	12.27	12273.13	5.05	Catchment C
Channel C - 2200 W (Section 1)	Channel B - 2200 W (Section 2)	250.00	-	2200	1000	2	Trapezoidal	82.00	32.00	81.00	31.00	-	-	0.200	5.00	3.29	9.78	0.34	3.61	1.16	5.53	259.04	0	0.90	47450	0.35	25109.00	1.81	1806.72	11.86	11860.51	15.23	Catchment C
Channel B - 2200 W (Section 2)	Channel B - 3300 W	163.00	-	2200	1000	2	Trapezoidal	32.00	16.00	31.00	15.00	-	-	0.098	10.19	3.29	9.78	0.34	2.53	1.08	6.69	247.96	0	0.90	1910	0.35	25777.50	1.78	1775.50	8.31	8309.11	21.37	Catchment C
Channel B - 3300 W	C2	129.67	-	3300	1200	2	Trapezoidal	16.00	7.20	14.80	6.00	-	-	0.068	14.74	5.29	13.38	0.40	2.34	0.92	7.07	244.71	0	0.90	0	0.35	52969.00	3.60	3600.62	12.38	12383.20	29.08	Catchment B & C
C20	Channel E - 1500W (Section 1)	6.08	457	-	-	-	Twin Pipe	38.05	37.00	36.77	36.00	0.82	0.54	0.127	7.90	0.15	1.40	0.11	8.19	0.01	5.00	264.82	0	0.90	9620	0.35	3367.00	0.25	247.68	2.42	2417.27	10.25	Catchment E
Channel E - 1500W (Section 1)	Channel E - 1500W (Section 2)	99.32	-	1000	1000	2	Trapezoidal	37.00	10.00	36.00	9.00	-	-	0.272	3.68	2.56	7.14	0.36	18.80	0.09	5.01	264.68	0	0.90	23050	0.35	11434.50	0.84	840.70	48.13	48130.80	1.75	Catchment E
Channel E - 1500W (Section 2)	C3	76.36	-	1500	1000	2	Trapezoidal	10.00	6.83	9.00	5.55	-	-	0.045	22.13	2.86	8.44	0.34	7.38	0.17	5.10	263.69	0	0.90	0	0.35	11434.50	0.84	837.56	21.11	21110.49	3.97	Catchment E
C3	C2	19.88	525	-	-	-	Twin Pipe	6.83	5.70	3.95	3.15	2.36	2.03	0.040	24.84	0.19	1.60	0.12	5.00	0.07	5.27	261.80	1990	0.90	0	0.35	14160.00	1.03	1029.74	1.95	1949.06	52.83	Access Road R6 & R7+Catchment E
C2	3-Cell 3500(W) X 2700(H) BC	32.60	1200	-	-	-	Twin Pipe	7.20	5.70	2.82	2.23	3.18	2.27	0.018	55.25	1.02	3.67	0.28	5.52	0.10	7.99	237.40	1290	0.90	0	0.35	68290.00	4.50	4503.40	11.24	11242.37	40.06	Catchment B, C, E & H
C4	C3	11.00	300	-	-	-	Pipe	5.42	6.83	3.93	3.69	1.19	2.84	0.022	45.83	0.06	0.92	0.07	2.60	0.07	5.00	264.82	350	0.90	1770	0.35	934.50	0.07	68.74	0.17	165.11	41.64	Part of Catchment H
C16	Channel D1 - 1500W	4.30	457	-	-	-	Twin Pipe	133.45	132.00	131.85	131.00	1.14	0.54	0.198	5.06	0.15	1.40	0.11	10.24	0.01	5.00	264.82	0	0.90	7270	0.35	2544.50	0.19	187.18	3.02	3023.75	6.19	Catchment D1
Channel D1 - 1500W	C15	76.80	-	1500	1000	2	Trapezoidal	132.00	111.68	131.00	110.68	-	-	0.265	3.78	2.86	8.44	0.34	17.86	0.07	5.01	264.74	0	0.90	17850	0.35	8792.00	0.65	646.57	51.09	51086.12	1.27	Catchment D1
C15	Channel D1 - 1500W (Section 1)	17.60	762	-	-	-	Twin Pipe	111.68	109.00	108.41	108.00	2.51	0.24	0.023	42.93	0.41	2.33	0.18	4.76	0.06	5.08	263.94	0	0.90	0	0.35	8792.00	0.64	644.59	3.91	3910.69	16.48	Catchment D1
Channel D1 - 1500W (Section 1)	Channel D1 - 1500W (Section 2)	119.61	-	1500	1000	2	Trapezoidal	110.00	88.00	109.00	87.00	-	-	0.184	5.44	2.86	8.44	0.34	14.89	0.13	5.14	263.25	800	0.90	18850	0.35	16109.50	1.18	1178.01	42.59	42594.09	2.77	Catchment D1 and Access Road R1
Channel D1 - 1500W (Section 2)	C11	178.09	-	1500	1000	2	Trapezoidal	88.00	72.00	87.00	71.00	-	-	0.090	11.13	2.86	8.44	0.34	10.41	0.29	5.27	261.78	0	0.90	23630	0.35	24380.00	1.77	1772.86	29.77	29768.84	5.96	Catchment D3
C11	Channel D1 - 1200 Stepped Channel (Section 1)	182.79	-	1200	-	-	U-Shaped Stepped	72.00	56.00	70.80	54.80	-	-	0.088	11.42	1.29	3.08	0.42	11.79	0.26	5.56	258.76	1850	0.90	17930	0.35	32320.50	2.32	2323.10	15.16	15155.46	15.33	Access Road R2 and R3
Channel D1 - 1200 Stepped Channel (Section 1)	Channel D1 - 1200 Stepped Channel (Section 2)	78.49	-	1200	-	-	U-Shaped Stepped	56.00	54.00	54.80	52.80	-	-	0.025	39.25	1.29	3.08	0.42	6.36	0.21	5.82	256.13	510	0.90	0	0.35	32779.50	2.33	2332.14	8.18	8176.98	28.52	Access Road R4
Channel D1 - 1200 Stepped Channel (Section 2)	Channel D1 - 1500 Stepped Channel	195.24	-	1500	-	-	U-Shaped Stepped	54.00	6.00	52.50	4.50	-	-	0.246	4.07	2.01	3.86	0.52	22.93	0.14	6.02	254.10	450	0.90	42050	0.35	47902.00	3.38	3381.14	46.05	46051.97	7.34	Catchment D2 and Access Road R5
MH1	MH2	32.89	750	-	-	-	Pipe	6.02	5.59	3.78	3.37	1.49	1.47	0.012	80.22	0.40	2.29	0.17	3.44	0.16	5.00	264.82	4620	0.90	8550	0.35	7150.50	0.53	526.01	1.37	1367.27	38.47	Catchment I
MH2	MH4	49.84	750	-	-	-	Pipe	5.59	5.43	3.36	3.11	1.48	1.57	0.005	199.36	0.40	2.29	0.17	2.16	0.38	5.00	264.82	0	0.90	0	0.35	7150.50	0.53	526.01	0.86	860.76	61.11	Catchment I
MH4	MH5	36.76	750	-	-	-	Pipe	5.43	5.37	3.09	2.69	1.59	1.93	0.011	91.90	0.40	2.29	0.17	3.21	0.19	5.00	264.82	0	0.90	0	0.35	7150.50	0.53	526.01	1.28	1276.21	41.22	Catchment I
MH5	MH6	39.07	900	-	-	-	Pipe	5.37	5.36	2.66	2.32	1.81	2.14	0.009	114.91	0.57	2.75	0.21	3.20	0.20	5.00	264.82	0	0.90	0	0.35	7150.50	0.53	526.01	1.83	1833.98	28.68	Catchment I
MH6	C7	57.69	1050	-	-	-	Pipe	5.36	6.66	2.28	1.83	2.03	3.78	0.008	128.20	0.78	3.21	0.24	3.33	0.29	5.00	264.82	0	0.90	0	0.35	7150.50	0.53	526.01	2.59	2593.76	20.28	Catchment I
C7	1-Cell 3000(W) X 3000(H) BC	99.00	1350	-	-	-	Pipe	6.66	-	1.76	1.38	3.55	-	0.004	260.53	1.29	4.12	0.31	2.70	0.61	5.00	264.82	0	0.90	15340	0.35	12519.50	0.92	920.96	3.48	3484.69	26.43	Catchment F
Existing Public Drainage Syetm (Box Culverts) - 50-Year																																	
3-Cell 3500(W) X 2700(H) BC	5-Cell 3500(W) X 3200(H) BC	-	-	3500	2700	1	Box Culvert	-	-	-	-			0.002	500.00	8.51	8.36	1.02	3.23	-	5.00	264.82	279750	0.90	1703500	0.35	848000.00	62.38	62380.76	82.44	82444.41	75.66	
1-Cell 3000(W) X 3000(H) BC	1-Cell 3000(W) X 3200(H) BC	22.635	-	3000	3000	1	Box Culvert	-	-	-	-			0.005	185.00	8.10	8.40	0.96	5.13	0.07	5.00	264.82	8230	0.90	321890	0.35	120068.50	8.83	8832.50	41.52	41518.50	21.27	
1-Cell 3000(W) X 3200(H) BC	2-Cell 3000(W) X 3200(H) BC	24	-	3000	3200	1	Box Culvert	-	-	-	-			0.001	700.00	8.64	8.76	0.99	2.68	0.15	5.07	263.99	0	0.90	0	0.35	120068.50	8.80	8804.83	23.11	23112.30	38.10	
2-Cell 3000(W) X 3200(H) BC	5-Cell 3500(W) X 3200(H) BC	197.745	-	3000	3200	1	Box Culvert	-	-	-	-			0.001	800.00	8.64	8.76	0.99	2.50	1.32	5.22	262.34	119100	0.90	434200	0.35	379228.50	27.64	27635.09	43.24	43239.15	63.91	

ARUP

Job No.
Sheet No.
Rev. 02
Member/Location
Drg. Ref.

Job Title **Proposed Public Riding School Development at the Restored Tseung Kwan O Landfill Stage II/III (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500)**
Calculation **Hydraulic Checking of Existing Drainage System**
Made by DL Date 16 January 2026 Chd. CC

Table A1 Capacity Checking of Existing Drainage System before PRS Development and Road Widening

Column 1 Upstream Manhole/ Box Culvert Reference
Column 2 Downstream Manhole/ Box Culvert Reference
Column 3 Pipe/Box Culvert Length
Column 4 Pipe Size in mm
Column 5 Box Culvert Width and Height in mm
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Column 7 Upstream Manhole/ Catchpit Ground Level in mPD
Column 8 Downstream Manhole/ Catchpit Ground Level in mPD
Column 9 Upstream Manhole/ Catchpit Invert Level in mPD
Column 10 Downstream Manhole/ Catchpit Invert Level in mPD
Column 11 Upstream Soil Cover to Pipe
Column 12 Downstream Soil Cover to Pipe
Column 13 Pipe/ Channel Gradient
Column 14 Pipe/ Channel Gradient (1 in X) = 1 / Gradient from Column 12
Column 15 Drain Flow Area in m^2
Column 16 Wetted Perimeter in m
Column 17 Hydraulic Radius in m (R=A/P)
Column 18 Velocity at Full Bore from Manning Equation for Box Culvert/ Channels

$V = \frac{R^{\frac{1}{6}}}{n}\sqrt{RS_f}$ where n= 0.014 Box Culvert/ Surface Channels (Extracted DSD Stormwater Drainage Manual Table 13)
0.060 Baffled Channel

Velocity at Full bore from Colebrook-White Equation for Pipe

$V = -\sqrt{32gRS_f}\log\left[\frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{32gRS_f}}\right]$ where v= 0.000001

Column 19 Time of Flow T_f (Length from Column 3/ Velocity at Full Bore from Column 18)
Column 20 Time of Concentration T_c (Time of Inlet = 5min + Time of Flow from Column 19)
Column 21 Rainfall Intensity in mm/hr

$I = \frac{a}{(b + t_c)^c}$

where,

	50-Year	200-Year	
a=	505.5	508.8	(Extracted from DSD Stormwater Drainage Manual Table 3a)
b=	3.29	3.46	
c=	0.355	0.322	

Column 22 Paved Catchment Area in m^2
Column 23 Runoff Coefficient of Paved Runoff Coefficient; K=0.90 for Paved Area
Column 24 Unpaved Area Catchment Area in m^2
Column 25 Runoff Coefficient of Unpaved Area Catchment Area in m^2, K=0.35 for Unpaved Area
Column 26 Cumulative Effective Catchment Area (Effective Catchment Area = Catchment Area x Runoff Coefficient)
Column 27 Peak Runoff in m^3/sec and l/sec
Column 28 Pipe/ Channel Capacity
Column 29 Percentage of Flow to Pipe/ Channel Capacity
Column 30 Remark

#REF!

to = 5 minutes k_s = 0.15 (Precast Concrete Pipe - Normal 0.06 (Precast Concrete Pipe - Good)

(1)	(2)	(3)	(4)	(5)			(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)		(28)		(29)	(30)
US MH	DS MH	Length	Pipe Size (d)	Bottom Width	Channel Height	Side Slope (H:V)	Pipe/ Trapezoidal/ Box Culvert	US GL	DS GL	US IL	DS IL	US Soil Cover	DS Soil Cover	Gradient	Gradient	Pipe/ Channel Area	Perimeter	R =A/P	Velocity at Full Bore	T_f	T_c	Intensity	Paved Area	Runoff Coefficient	Unpaved Area	Runoff Coefficient	Cumulative Effective Catchment Area	Q	Q	Capacity	Capacity	Percent of Flow to Capacity	Remark
		(m)	(mm)	(mm)	(mm)	(X:1)		(mPD)	(mPD)	(mPD)	(mPD)	(m)	(m)		(1 in x)	(m^2)	(m)	(m)	(m/sec)	(mins)	(mins)	(mm/hr)	(m^2)		(m^2)		(m^2)	(m^3/sec)	(l/sec)	(m^3/sec)	(l/sec)	(%)	
Existing Channels within GLA-TSK 500 - 200-Year																																	
C18	Channel B - 1000W	7.00	457	-	-	-	Pipe	132.39	131.00	130.73	130.00	1.20	0.54	0.104	9.59	0.15	1.40	0.11	7.42	0.02	5.00	283.96	0	0.90	10140	0.35	3549.00	0.28	279.94	1.10	1096.07	25.54	Catchment B
Channel B - 1000W	Channel B - 1500W	99.32	-	1000	1000	2	Trapezoidal	131.00	101.00	130.00	100.00	-	-	0.302	3.31	2.56	7.14	0.36	4.62	0.36	5.02	283.79	0	0.90	14890	0.35	8760.50	0.69	690.60	11.84	11838.01	5.83	Catchment B
Channel B - 1500W	Channel B - 2200 W (Section 1)	76.36	-	1500	1000	2	Trapezoidal	101.00	82.00	100.00	81.00	-	-	0.249	4.02	2.86	8.44	0.34	4.04	0.31	5.37	280.04	0	0.90	12040	0.35	12974.50	1.01	1009.25	11.56	11559.59	8.73	Catchment B
Channel B - 2200 W (Section 1)	Channel B - 2200 W (Section 2)	247.85	-	2200	1000	2	Trapezoidal	82.00	20.00	81.00	19.00	-	-	0.250	4.00	3.29	9.78	0.34	4.03	1.02	5.69	276.89	0	0.90	40620	0.35	27191.50	2.09	2091.44	13.26	13264.46	15.77	Catchment B
Channel B - 2200 W (Section 2)	Channel B - 3300 W	48.80	-	2200	1000	2	Trapezoidal	20.00	16.00	19.00	15.00	-	-	0.082	12.20	3.29	9.78	0.34	2.31	0.35	6.71	267.59	0	0.90	0	0.35	27191.50	2.02	2021.16	7.59	7592.91	26.62	Catchment B
C17	Channel C - 1000W	4.65	457	-	-	-	Twin Pipe	133.78	131.00	130.74	130.00	2.58	0.54	0.159	6.28	0.15	1.40	0.11	9.18	0.01	5.00	283.96	0	0.90	5970	0.35	2089.50	0.16	164.81	2.71	2711.51	6.08	Catchment C
Channel C - 1000W	Channel C - 1500W	55.60	-	1000	1000	2	Trapezoidal	131.00	115.00	130.00	114.00	-	-	0.288	3.48	2.56	7.14	0.36	4.51	0.21	5.01	283.87	0	0.90	7160	0.35	4595.50	0.36	362.37	11.55	11554.71	3.14	Catchment C
Channel C - 1500W	Channel C - 2200 W (Section 1)	82.00	-	1500	1000	2	Trapezoidal	115.00	92.00	114.00	91.00	-	-	0.280	3.57	2.86	8.44	0.34	4.29	0.32	5.21	281.69	0	0.90	11160	0.35	8501.50	0.67	665.21	12.27	12273.13	5.42	Catchment C
Channel C - 2200 W (Section 1)	Channel B - 2200 W (Section 2)	250.00	-	2200	1000	2	Trapezoidal	82.00	32.00	81.00	31.00	-	-	0.200	5.00	3.29	9.78	0.34	3.61	1.16	5.53	278.44	0	0.90	47450	0.35	25109.00	1.94	1942.01	11.86	11860.51	16.37	Catchment C
Channel B - 2200 W (Section 2)	Channel B - 3300 W	163.00	-	2200	1000	2	Trapezoidal	32.00	16.00	31.00	15.00	-	-	0.098	10.19	3.29	9.78	0.34	2.53	1.08	6.69	267.80	0	0.90	1910	0.35	25777.50	1.92	1917.58	8.31	8309.11	23.08	Catchment C
Channel B - 3300 W	C2	129.67	-	3300	1200	2	Trapezoidal	16.00	7.20	14.80	6.00	-	-	0.068	14.74	5.29	13.38	0.40	2.34	0.92	7.07	264.67	0	0.90	0	0.35	52969.00	3.89	3894.27	12.38	12383.20	31.45	Catchment B & C
C20	Channel E - 1500W (Section 1)	6.08	457	-	-	-	Twin Pipe	38.05	37.00	36.77	36.00	0.82	0.54	0.127	7.90	0.15	1.40	0.11	8.19	0.01	5.00	283.96	0	0.90	9620	0.35	3367.00	0.27	265.58	2.42	2417.27	10.99	Catchment E
Channel E - 1500W (Section 1)	Channel E - 1500W (Section 2)	99.32	-	1000	1000	2	Trapezoidal	37.00	10.00	36.00	9.00	-	-	0.272	3.68	2.56	7.14	0.36	18.80	0.09	5.01	283.83	0	0.90	23050	0.35	11434.50	0.90	901.50	48.13	48130.80	1.87	Catchment E
Channel E - 1500W (Section 2)	C3	76.36	-	1500	1000	2	Trapezoidal	10.00	6.83	9.00	5.55	-	-	0.045	22.13	2.86	8.44	0.34	7.38	0.17	5.10	282.88	0	0.90	0	0.35	11434.50	0.90	898.51	21.11	21110.49	4.26	Catchment E
C3	C2	19.88	525	-	-	-	Twin Pipe	6.83	5.70	3.95	3.15	2.36	2.03	0.040	24.84	0.19	1.60	0.12	5.00	0.07	5.27	281.07	1990	0.90	0	0.35	14160.00	1.11	1105.55	1.95	1949.06	56.72	Access Road R6 & R7+Catchment E
C2	3-Cell 3500(W) X 2700(H) BC	32.60	1200	-	-	-	Twin Pipe	7.20	5.70	2.82	2.23	3.18	2.27	0.018	55.25	1.02	3.67	0.28	5.52	0.10	7.99	257.60	1290	0.90	0	0.35	68290.00	4.89	4886.52	11.24	11242.37	43.47	Catchment B, C, E & H
C4	C3	11.00	300	-	-	-	Pipe	5.42	6.83	3.93	3.69	1.19	2.84	0.022	45.83	0.06	0.92	0.07	2.60	0.07	5.00	283.96	350	0.90	1770	0.35	934.50	0.07	73.71	0.17	165.11	44.64	Part of Catchment H
C16	Channel D1 - 1500W	4.30	457	-	-	-	Twin Pipe	133.45	132.00	131.85	131.00	1.14	0.54	0.198	5.06	0.15	1.40	0.11	10.24	0.01	5.00	283.96	0	0.90	7270	0.35	2544.50	0.20	200.70	3.02	3023.75	6.64	Catchment D1
Channel D1 - 1500W	C15	76.80	-	1500	1000	2	Trapezoidal	132.00	111.68	131.00	110.68	-	-	0.265	3.78	2.86	8.44	0.34	17.86	0.07	5.01	284.14		0.90	17850	0.35	8792.00	0.69	693.93	51.09	51086.12	1.36	Catchment D1
C15	Channel D1 - 1500W (Section 1)	17.60	762	-	-	-	Twin Pipe	111.68	109.00	108.41	108.00	2.51	0.24	0.023	42.93	0.41	2.33	0.18	4.76	0.06	5.08	283.11	0	0.90	0	0.35	8792.00	0.69	691.43	3.91	3910.69	17.68	Catchment D1
Channel D1 - 1500W (Section 1)	Channel D1 - 1500W (Section 2)	119.61	-	1500	1000	2	Trapezoidal	110.00	88.00	109.00	87.00	-	-	0.184	5.44	2.86	8.44	0.34	14.89	0.13	5.14	282.72	800	0.90	18850	0.35	16109.50	1.27	1265.11	42.59	42594.09	2.97	Catchment D1 and Access Road R1
Channel D1 - 1500W (Section 2)	C11	178.09	-	1500	1000	2	Trapezoidal	88.00	72.00	87.00	71.00	-	-	0.090	11.13	2.86	8.44	0.34	10.41	0.29	5.27	281.31	0	0.90	23630	0.35	24380.00	1.91	1905.11	29.77	29768.84	6.40	Catchment D3
C11	Channel D1 - 1200 Stepped Channel (Section 1)	182.79	-	1200	-	-	U-Shaped Stepped	72.00	56.00	70.80	54.80	-	-	0.088	11.42	1.29	3.08	0.42	11.79	0.26	5.56	278.42	1850	0.90	17930	0.35	32320.50	2.50	2499.61	15.16	15155.46	16.49	Access Road R2 and R3
Channel D1 - 1200 Stepped Channel (Section 1)	Channel D1 - 1200 Stepped Channel (Section 2)	78.49	-	1200	-	-	U-Shaped Stepped	56.00	54.00	54.80	52.80	-	-	0.025	39.25	1.29	3.08	0.42	6.36	0.21	5.82	275.90	510	0.90	0	0.35	32779.50	2.51	2512.15	8.18	8176.98	30.72	Access Road R4
Channel D1 - 1200 Stepped Channel (Section 2)	Channel D1 - 1500 Stepped Channel	195.24	-	1500	-	-	U-Shaped Stepped	54.00	6.00	52.50	4.50	-	-	0.246	4.07	2.01	3.86	0.52	22.93	0.14	6.02	273.96	450	0.90	42050	0.35	47902.00	3.65	3645.28	46.05	46051.97	7.92	Catchment D2 and Access Road R5
MH1	MH2	32.89	750	-	-	-	Pipe	6.02	5.59	3.78	3.37	1.49	1.47	0.012	80.22	0.40	2.29	0.17	3.44	0.16	5.00	283.96	4620	0.90	8550	0.35	7150.50	0.56	564.02	1.37	1367.27	41.25	Catchment I
MH2	MH4	49.84	750	-	-	-	Pipe	5.59	5.43	3.36	3.11	1.48	1.57	0.005	199.36	0.40	2.29	0.17	2.16	0.38	5.00	283.96	0	0.90	0	0.35	7150.50	0.56	564.02	0.86	860.76	65.53	Catchment I
MH4	MH5	36.76	750	-	-	-	Pipe	5.43	5.37	3.09	2.69	1.59	1.93	0.011	91.90	0.40	2.29	0.17	3.21	0.19	5.00	283.96	0	0.90	0	0.35	7150.50	0.56	564.02	1.28	1276.21	44.19	Catchment I
MH5	MH6	39.07	900	-	-	-	Pipe	5.37	5.36	2.66	2.32	1.81	2.14	0.009	114.91	0.57	2.75	0.21	3.20	0.20	5.00	283.96	0	0.90	0	0.35	7150.50	0.56	564.02	1.83	1833.98	30.75	Catchment I
MH6	C7	57.69	1050	-	-	-	Pipe	5.36	6.66	2.28	1.83	2.03	3.78	0.008	128.20	0.78	3.21	0.24	3.33	0.29	5.00	283.96	0	0.90	0	0.35	7150.50	0.56	564.02	2.59	2593.76	21.75	Catchment I
C7	1-Cell 3000(W) X 3000(H) BC	99.00	1350	-	-	-	Pipe	6.66	-	1.76	1.38	3.55	-	0.004	260.53	1.29	4.12	0.31	2.70	0.61	5.00	283.96	0	0.90	15340	0.35	12519.50	0.99	987.51	3.48	3484.69	28.34	Catchment F
Existing Public Drainage Syetm (Box Culverts) - 200-Year																																	
3-Cell 3500(W) X 2700(H) BC	5-Cell 3500(W) X 3200(H) BC	-	-	3500	2700	1	Box Culvert	-	-	-	-			0.002	500.00	8.51	8.36	1.02	3.23	-	5.00	284.22	279750	0.90	1703500	0.35	848000.00	66.95	66948.56	82.44	82444.41	81.20	
1-Cell 3000(W) X 3000(H) BC	1-Cell 3000(W) X 3200(H) BC	22.635	-	3000	3000	1	Box Culvert	-	-	-	-			0.005	185.00	8.10	8.40	0.96	5.13	0.07	5.00	284.22	8230	0.90	321890	0.35	120068.50	9.48	9479.26	41.52	41518.50	22.83	
1-Cell 3000(W) X 3200(H) BC	2-Cell 3000(W) X 3200(H) BC	24	-	3000	3200	1	Box Culvert	-	-	-	-			0.001	700.00	8.64	8.76	0.99	2.68	0.15	5.07	283.42	0	0.90	0	0.35	120068.50	9.45	9452.86	23.11	23112.30	40.90	
2-Cell 3000(W) X 3200(H) BC	5-Cell 3500(W) X 3200(H) BC	197.745	-	3000	3200	1	Box Culvert	-	-	-	-			0.001	800.00	8.64	8.76	0.99	2.50	1.32	5.22	281.84	119100	0.90	434200	0.35	379228.50	29.69	29689.70	43.24	43239.15	68.66	

ARUP

Job Title	Proposed Public Riding School Development at the Restored Tseung Kwan O Landfill II/III (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500)	Job No.	
		Sheet No.	
		Rev.	01
		Member/Location	
Calculation	Hydraulic Checking of Existing Drainage System	Drg. Ref.	
		Made by	DL
		Date	16 January 2026
		Chd.	CC

Table A2 Capacity Checking of Existing Drainage System after PRS Development and Road Widening

Column 1 Upstream Manhole/ Box Culvert Reference
Column 2 Downstream Manhole/ Box Culvert Reference
Column 3 Pipe/Box Culvert Length
Column 4 Pipe Size in mm
Column 5 Box Culvert Width and Height in mm
Column 6 Channel or Pipe
Column 7 Upstream Manhole/ Catchpit Ground Level in mPD
Column 8 Downstream Manhole/ Catchpit Ground Level in mPD
Column 9 Upstream Manhole/ Catchpit Invert Level in mPD
Column 10 Downstream Manhole/ Catchpit Invert Level in mPD
Column 11 Upstream Soil Cover to Pipe
Column 12 Downstream Soil Cover to Pipe
Column 13 Pipe/ Channel Gradient
Column 14 Pipe/ Channel Gradient (1 in X) = 1 / Gradient from Column 12
Column 15 Drain Flow Area in m^2
Column 16 Wetted Perimeter in m
Column 17 Hydraulic Radius in m (R=A/P)
Column 18 Velocity at Full Bore from Manning Equation for Box Culvert/ Channels

$V = \frac{R^{\frac{1}{6}}}{n}\sqrt{RS_f}$ where n= 0.014 Box Culvert/ Surface Channels (Extracted DSD Stormwater Drainage Manual Table 13)
0.060 Baffled Channel

Velocity at Full bore from Colebrook-White Equation for Pipe

$V = -\sqrt{32gRS_f}\log\left[\frac{k_s}{14.8R}+\frac{1.255v}{R\sqrt{32gRS_f}}\right]$ where v= 0.000001

Column 19 Time of Flow T_f (Length from Column 3/ Velocity at Full Bore from Column 18)
Column 20 Time of Concentration T_c (Time of Inlet = 5min + Time of Flow from Column 19)
Column 21 Rainfall Intensity in mm/hr

$I = \frac{a}{(b+t_c)^c}$

where,

	50-Year	200-Year	
a=	505.5	508.8	(Extracted from DSD Stormwater Drainage Manual Table 3a)
b=	3.29	3.46	
c=	0.355	0.322	

Column 22 Paved Catchment Area in m^2
Column 23 Runoff Coefficient of Paved Runoff Coefficient; K=0.90 for Paved Area
Column 24 Unpaved Area Catchment Area in m^2
Column 25 Runoff Coefficient of Unpaved Area Catchment Area in m^2, K=0.35 for Unpaved Area
Column 26 Cumulative Effective Catchment Area (Effective Catchment Area = Catchment Area x Runoff Coefficient)
Column 27 Peak Runoff in m^3/sec and l/sec
Column 28 Pipe/ Channel Capacity
Column 29 Percentage of Flow to Pipe/ Channel Capacity
Column 30 Remark

to = 5 minutes k_s = 0.15 (Precast Concrete Pipe - Normal) 0.06 (Precast Concrete Pipe - Good)

(1)	(2)	(3)	(4)	(5)			(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)		(28)		(29)	(30)
US MH	DS MH	Length	Pipe Size (d)	Bottom Width	Channel Height	Side Slope (H:V)	Pipe/ Trapezoidal/ Box Culvert	US GL	DS GL	US IL	DS IL	US Soil Cover	DS Soil Cover	Gradient	Gradient	Pipe/ Channel Area	Perimeter	R =A/P	Velocity at Full Bore	T_f	T_c	Intensity	Paved Area	Runoff Coefficient	Unpaved Area	Runoff Coefficient	Cumulative Effective Catchment Area	Q	Q	Capacity	Capacity	Percent of Flow to Capacity	Remark
		(m)	(mm)	(mm)	(mm)	(X:1)		(mPD)	(mPD)	(mPD)	(mPD)	(m)	(m)		(1 in x)	(m^2)	(m)	(m)	(m/sec)	(mins)	(mins)	(mm/hr)	(m^2)		(m^2)		(m^2)	(m^3/sec)	(l/sec)	(m^3/sec)	(l/sec)	(%)	
Existing Channels within GLA-TSK 500 - 50-Year																																	
C18	Channel B - 1000W	7.00	457	-	-	-	Pipe	132.39	131.00	130.73	130.00	1.20	0.54	0.104	9.59	0.15	1.40	0.11	7.42	0.02	5.00	264.82	9080	0.90	1060	0.35	8543.00	0.63	628.44	1.10	1096.07	57.34	Catchment B (9080 sqm from Upper Platform)
Channel B - 1000W	Channel B - 1500W	99.32	-	1000	1000	2	Trapezoidal	131.00	101.00	130.00	100.00	-	-	0.302	3.31	2.56	7.14	0.36	4.62	0.36	5.02	264.65	0	0.90	14890	0.35	13754.50	1.01	1011.13	11.84	11838.01	8.54	Catchment B
Channel B - 1500W	Channel B - 2200 W (Section 1)	76.36	-	1500	1000	2	Trapezoidal	101.00	82.00	100.00	81.00	-	-	0.249	4.02	2.86	8.44	0.34	4.04	0.31	5.37	260.71	0	0.90	12040	0.35	17968.50	1.30	1301.27	11.56	11559.59	11.26	Catchment B
Channel B - 2200 W (Section 1)	Channel B - 2200 W (Section 2)	247.85	-	2200	1000	2	Trapezoidal	82.00	20.00	81.00	19.00	-	-	0.250	4.00	3.29	9.78	0.34	4.03	1.02	5.69	257.43	0	0.90	40620	0.35	32185.50	2.30	2301.51	13.26	13264.46	17.35	Catchment B
Channel B - 2200 W (Section 2)	Channel B - 3300 W	48.80	-	2200	1000	2	Trapezoidal	20.00	16.00	19.00	15.00	-	-	0.082	12.20	3.29	9.78	0.34	2.31	0.35	6.71	247.74	0	0.90	0	0.35	32185.50	2.21	2214.90	7.59	7592.91	29.17	Catchment B
C17	Channel C - 1000W	4.65	457	-	-	-	Twin Pipe	133.78	131.00	130.74	130.00	2.58	0.54	0.159	6.28	0.15	1.40	0.11	9.18	0.01	5.00	264.82	5820	0.90	150	0.35	5290.50	0.39	389.18	2.71	2711.51	14.35	Catchment C (5820 sqm from Upper Platform)
Channel C - 1000W	Channel C - 1500W	55.60	-	1000	1000	2	Trapezoidal	131.00	115.00	130.00	114.00	-	-	0.288	3.48	2.56	7.14	0.36	4.51	0.21	5.01	264.73	0	0.90	7160	0.35	7796.50	0.57	573.32	11.55	11554.71	4.96	Catchment C
Channel C - 1500W	Channel C - 2200 W (Section 1)	82.00	-	1500	1000	2	Trapezoidal	115.00	92.00	114.00	91.00	-	-	0.280	3.57	2.86	8.44	0.34	4.29	0.32	5.21	262.44	0	0.90	11160	0.35	11702.50	0.85	853.12	12.27	12273.13	6.95	Catchment C
Channel C - 2200 W (Section 1)	Channel B - 2200 W (Section 2)	250.00	-	2200	1000	2	Trapezoidal	82.00	32.00	81.00	31.00	-	-	0.200	5.00	3.29	9.78	0.34	3.61	1.16	5.53	259.04	0	0.90	47450	0.35	28310.00	2.04	2037.05	11.86	11860.51	17.18	Catchment C
Channel B - 2200 W (Section 2)	Channel B - 3300 W	163.00	-	2200	1000	2	Trapezoidal	32.00	16.00	31.00	15.00	-	-	0.098	10.19	3.29	9.78	0.34	2.53	1.08	6.69	247.96	0	0.90	1910	0.35	28978.50	2.00	1995.98	8.31	8309.11	24.02	Catchment C
Channel B - 3300 W	C2	129.67	-	3300	1200	2	Trapezoidal	16.00	7.20	14.80	6.00	-	-	0.068	14.74	5.29	13.38	0.40	2.34	0.92	7.07	244.71	0	0.90	0	0.35	61164.00	4.16	4157.68	12.38	12383.20	33.58	Catchment B & C
C20	Channel E - 1500W (Section 1)	6.08	457	-	-	-	Twin Pipe	38.05	37.00	36.77	36.00	0.82	0.54	0.127	7.90	0.15	1.40	0.11	8.19	0.01	5.00	264.82	8960	0.90	660	0.35	8295.00	0.61	610.20	2.42	2417.27	25.24	Catchment E (8960 from Middle Platform)
Channel E - 1500W (Section 1)	Channel E - 1500W (Section 2)	99.32	-	1000	1000	2	Trapezoidal	37.00	10.00	36.00	9.00	-	-	0.272	3.68	2.56	7.14	0.36	18.80	0.09	5.01	264.68	3700	0.90	16880	0.35	17533.00	1.29	1289.08	48.13	48130.80	2.68	Catchment E (3700 from Lower Platform)
Channel E - 1500W (Section 2)	C3	76.36	-	1500	1000	2	Trapezoidal	10.00	6.83	9.00	5.55	-	-	0.045	22.13	2.86	8.44	0.34	7.38	0.17	5.10	263.69	0	0.90	0	0.35	17533.00	1.28	1284.26	21.11	21110.49	6.08	Catchment E
C3	C2	19.88	525	-	-	-	Twin Pipe	6.83	5.70	3.95	3.15	2.36	2.03	0.040	24.84	0.19	1.60	0.12	5.00	0.07	5.27	261.80	4710	0.90	0	0.35	23168.50	1.68	1684.85	1.95	1949.06	86.44	Access Road R6 & R7+Catchment E
C2	3-Cell 3500(W) X 2700(H) BC	32.60	1200	-	-	-	Twin Pipe	7.20	5.70	2.82	2.23	3.18	2.27	0.018	55.25	1.02	3.67	0.28	5.52	0.10	7.99	237.40	1290	0.90	0	0.35	85493.50	5.64	5637.89	11.24	11242.37	50.15	Catchment B, C, E & H
C4	C3	11.00	300	-	-	-	Pipe	5.42	6.83	3.93	3.69	1.19	2.84	0.022	45.83	0.06	0.92	0.07	2.60	0.07	5.00	264.82	1190	0.90	930	0.35	1396.50	0.10	102.73	0.17	165.11	62.22	Part of Catchment H (840 sqm from Central Fodder Store)
C16	Channel D1 - 1500W	4.30	457	-	-	-	Twin Pipe	133.45	132.00	131.85	131.00	1.14	0.54	0.198	5.06	0.15	1.40	0.11	10.24	0.01	5.00	264.82	5590	0.90	1680	0.35	5619.00	0.41	413.35	3.02	3023.75	13.67	Catchment D1 (5590 from Upper Platform)
Channel D1 - 1500W	C15	76.80	-	1500	1000	2	Trapezoidal	132.00	111.68	131.00	110.68	-	-	0.265	3.78	2.86	8.44	0.34	17.86	0.07	5.01	264.74	0	0.90	17850	0.35	11866.50	0.87	872.66	51.09	51086.12	1.71	Catchment D1
C15	Channel D1 - 1500W (Section 1)	17.60	762	-	-	-	Twin Pipe	111.68	109.00	108.41	108.00	2.51	0.24	0.023	42.93	0.41	2.33	0.18	4.76	0.06	5.08	263.94	0	0.90	0	0.35	11866.50	0.87	870.00	3.91	3910.69	22.25	Catchment D1
Channel D1 - 1500W (Section 1)	Channel D1 - 1500W (Section 2)	119.61	-	1500	1000	2	Trapezoidal	110.00	88.00	109.00	87.00	-	-	0.184	5.44	2.86	8.44	0.34	14.89	0.13	5.14	263.25	2300	0.90	18850	0.35	20534.00	1.50	1501.56	42.59	42594.09	3.53	Catchment D1 and Access Road R1
Channel D1 - 1500W (Section 2)	C11	178.09	-	1500	1000	2	Trapezoidal	88.00	72.00	87.00	71.00	-	-	0.090	11.13	2.86	8.44	0.34	10.41	0.29	5.27	261.78	0	0.90	23630	0.35	28804.50	2.09	2094.60	29.77	29768.84	7.04	Catchment D3
C11	Channel D1 - 1200 Stepped Channel (Section 1)	182.79	-	1200	-	-	U-Shaped Stepped	72.00	56.00	70.80	54.80	-	-	0.088	11.42	1.29	3.08	0.42	11.79	0.26	5.56	258.76	4420	0.90	17930	0.35	39058.00	2.81	2807.37	15.16	15155.46	18.52	Access Road R2 and R3
Channel D1 - 1200 Stepped Channel (Section 1)	Channel D1 - 1200 Stepped Channel (Section 2)	78.49	-	1200	-	-	U-Shaped Stepped	56.00	54.00	54.80	52.80	-	-	0.025	39.25	1.29	3.08	0.42	6.36	0.21	5.82	256.13	1200	0.90	0	0.35	40138.00	2.86	2855.67	8.18	8176.98	34.92	Access Road R4
Channel D1 - 1200 Stepped Channel (Section 2)	Channel D1 - 1500 Stepped Channel	195.24	-	1500	-	-	U-Shaped Stepped	54.00	6.00	52.50	4.50	-	-	0.246	4.07	2.01	3.86	0.52	22.93	0.14	6.02	254.10	1090	0.90	42050	0.35	55836.50	3.94	3941.20	46.05	46051.97	8.56	Catchment D2 and Access Road R5
MH1	MH2	32.89	750	-	-	-	Pipe	6.02	5.59	3.78	3.37	1.49	1.47	0.012	80.22	0.40	2.29	0.17	3.44	0.16	5.00	264.82	5130	0.90	7030	0.35	7077.50	0.52	520.64	1.37	1367.27	38.08	Catchment I (510 from Lower Platform)
MH2	MH4	49.84	750	-	-	-	Pipe	5.59	5.43	3.36	3.11	1.48	1.57	0.005	199.36	0.40	2.29	0.17	2.16	0.38	5.00	264.82	0	0.90	0	0.35	7077.50	0.52	520.64	0.86	860.76	60.49	Catchment I
MH4	MH5	36.76	750	-	-	-	Pipe	5.43	5.37	3.09	2.69	1.59	1.93	0.011	91.90	0.40	2.29	0.17	3.21	0.19	5.00	264.82	0	0.90	0	0.35	7077.50	0.52	520.64	1.28	1276.21	40.80	Catchment I
MH5	MH6	39.07	900	-	-	-	Pipe	5.37	5.36	2.66	2.32	1.81	2.14	0.009	114.91	0.57	2.75	0.21	3.20	0.20	5.00	264.82	3040	0.90	0	0.35	9813.50	0.72	721.90	1.83	1833.98	39.36	Catchment I (3040 from Lower Platform)
MH6	C7	57.69	1050	-	-	-	Pipe	5.36	6.66	2.28	1.83	2.03	3.78	0.008	128.20	0.78	3.21	0.24	3.33	0.29	5.00	264.82	0	0.90	0	0.35	9813.50	0.72	721.90	2.59	2593.76	27.83	Catchment I
C7	1-Cell 3000(W) X 3000(H) BC	99.00	1350	-	-	-	Pipe	6.66	-	1.76	1.38	3.55	-	0.004	260.53	1.29	4.12	0.31	2.70	0.61	5.00	264.82	440	0.90	15340	0.35	15578.50	1.15	1145.99	3.48	3484.69	32.89	Catchment F (440 from E&M Block from Catchment I)
Existing Public Drainage Syetm (Box Culverts) - 50-Year																																	
3-Cell 3500(W) X 2700(H) BC	5-Cell 3500(W) X 3200(H) BC	-	-	3500	2700	1	Box Culvert	-	-	-	-			0.002	500.00	8.51	8.36	1.02	3.23	-	5.00	264.82	316460	0.90	1664320	0.35	867326.00	63.80	63802.42	82.44	82444.41	77.39	
1-Cell 3000(W) X 3000(H) BC	1-Cell 3000(W) X 3200(H) BC	22.635	-	3000	3000	1	Box Culvert	-	-	-	-			0.005	185.00	8.10	8.40	0.96	5.13	0.07	5.00	264.82	17620	0.90	314970	0.35	126097.50	9.28	9276.01	41.52	41518.50	22.34	
1-Cell 3000(W) X 3200(H) BC	2-Cell 3000(W) X 3200(H) BC	24	-	3000	3200	1	Box Culvert	-	-	-	-			0.001	700.00	8.64	8.76	0.99	2.68	0.15	5.07	263.99	0	0.90	0	0.35	126097.50	9.25	9246.95	23.11	23112.30	40.01	
2-Cell 3000(W) X 3200(H) BC	5-Cell 3500(W) X 3200(H) BC	197.745	-	3000	3200	1	Box Culvert	-	-	-	-			0.001	800.00	8.64	8.76	0.99	2.50	1.32	5.22	262.34	119100	0.90	434200	0.35	385257.50	28.07	28074.44	43.24	43239.15	64.93	

ARUP

Job Title **Proposed Public Riding School Development at the Restored Tseung Kwan O Landfill II/III (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500)**
Calculation **Hydraulic Checking of Existing Drainage System**

Job No.
Sheet No.
Rev. 01
Member/Location
Drg. Ref.
Made by DL
Date 16 January 2026
Chd. CC

Table A2 Capacity Checking of Existing Drainage System after PRS Development and Road Widening

Column 1 Upstream Manhole/ Box Culvert Reference
Column 2 Downstream Manhole/ Box Culvert Reference
Column 3 Pipe/Box Culvert Length
Column 4 Pipe Size in mm
Column 5 Box Culvert Width and Height in mm
Column 6 Channel or Pipe
Column 7 Upstream Manhole/ Catchpit Ground Level in mPD
Column 8 Downstream Manhole/ Catchpit Ground Level in mPD
Column 9 Upstream Manhole/ Catchpit Invert Level in mPD
Column 10 Downstream Manhole/ Catchpit Invert Level in mPD
Column 11 Upstream Soil Cover to Pipe
Column 12 Downstream Soil Cover to Pipe
Column 13 Pipe/ Channel Gradient
Column 14 Pipe/ Channel Gradient (1 in X) = 1 / Gradient from Column 12
Column 15 Drain Flow Area in m^2
Column 16 Wetted Perimeter in m
Column 17 Hydraulic Radius in m (R=A/P)
Column 18 Velocity at Full Bore from Manning Equation for Box Culvert/ Channels

$V = \frac{R^{\frac{1}{6}}}{n}\sqrt{RS_f}$ where n= 0.014 Box Culvert/ Surface Channels (Extracted DSD Stormwater Drainage Manual Table 13)
0.060 Baffled Channel

Velocity at Full bore from Colebrook-White Equation for Pipe

$V = -\sqrt{32gRS_f}\log\left[\frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{32gRS_f}}\right]$ where v= 0.000001

Column 19 Time of Flow T_f (Length from Column 3/ Velocity at Full Bore from Column 18)
Column 20 Time of Concentration T_c (Time of Inlet = 5min + Time of Flow from Column 19)
Column 21 Rainfall Intensity in mm/hr

$I = \frac{a}{(b+t_c)^c}$

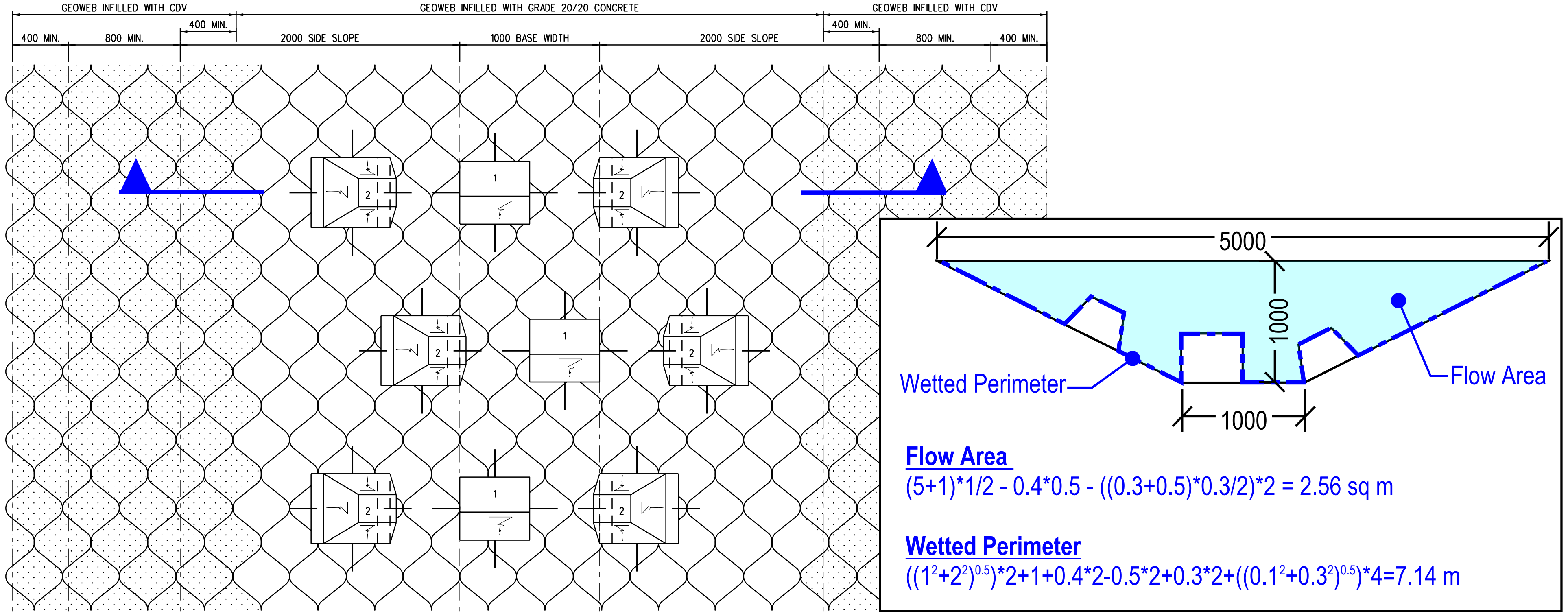
where,

	50-Year	200-Year	
a=	505.5	508.8	(Extracted from DSD Stormwater Drainage Manual Table 3a)
b=	3.29	3.46	
c=	0.355	0.322	

Column 22 Paved Catchment Area in m^2
Column 23 Runoff Coefficient of Paved Runoff Coefficient; K=0.90 for Paved Area
Column 24 Unpaved Area Catchment Area in m^2
Column 25 Runoff Coefficient of Unpaved Area Catchment Area in m^2, K=0.35 for Unpaved Area
Column 26 Cumulative Effective Catchment Area (Effective Catchment Area = Catchment Area x Runoff Coefficient)
Column 27 Peak Runoff in m^3/sec and l/sec
Column 28 Pipe/ Channel Capacity
Column 29 Percentage of Flow to Pipe/ Channel Capacity
Column 30 Remark

to = 5 minutes k_s = 0.15 (Precast Concrete Pipe - Normal) 0.06 (Precast Concrete Pipe - Good)

(1)	(2)	(3)	(4)	(5)			(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)		(28)		(29)	(30)
US MH	DS MH	Length	Pipe Size (d)	Bottom Width	Channel Height	Side Slope (H:V)	Pipe/ Trapezoidal/ Box Culvert	US GL	DS GL	US IL	DS IL	US Soil Cover	DS Soil Cover	Gradient	Gradient	Pipe/ Channel Area	Perimeter	R =A/P	Velocity at Full Bore	T_f	T_c	Intensity	Paved Area	Runoff Coefficient	Unpaved Area	Runoff Coefficient	Cumulative Effective Catchment Area	Q	Q	Capacity	Capacity	Percent of Flow to Capacity	Remark
		(m)	(mm)	(mm)	(mm)	(X:1)		(mPD)	(mPD)	(mPD)	(mPD)	(m)	(m)		(1 in x)	(m^2)	(m)	(m)	(m/sec)	(mins)	(mins)	(mm/hr)	(m^2)		(m^2)		(m^2)	(m^3/sec)	(l/sec)	(m^3/sec)	(l/sec)	(%)	
Existing Channels within GLA-TSK 500 - 200-Year																																	
C18	Channel B - 1000W	7.00	457	-	-	-	Pipe	132.39	131.00	130.73	130.00	1.20	0.54	0.104	9.59	0.15	1.40	0.11	7.42	0.02	5.00	283.96	9080	0.90	1060	0.35	8543.00	0.67	673.85	1.10	1096.07	61.48	Catchment B (9080 sqm from Upper Platform)
Channel B - 1000W	Channel B - 1500W	99.32	-	1000	1000	2	Trapezoidal	131.00	101.00	130.00	100.00	-	-	0.302	3.31	2.56	7.14	0.36	4.62	0.36	5.02	283.79	0	0.90	14890	0.35	13754.50	1.08	1084.28	11.84	11838.01	9.16	Catchment B
Channel B - 1500W	Channel B - 2200 W (Section 1)	76.36	-	1500	1000	2	Trapezoidal	101.00	82.00	100.00	81.00	-	-	0.249	4.02	2.86	8.44	0.34	4.04	0.31	5.37	280.04	0	0.90	12040	0.35	17968.50	1.40	1397.72	11.56	11559.59	12.09	Catchment B
Channel B - 2200 W (Section 1)	Channel B - 2200 W (Section 2)	247.85	-	2200	1000	2	Trapezoidal	82.00	20.00	81.00	19.00	-	-	0.250	4.00	3.29	9.78	0.34	4.03	1.02	5.69	276.89	0	0.90	40620	0.35	32185.50	2.48	2475.55	13.26	13264.46	18.66	Catchment B
Channel B - 2200 W (Section 2)	Channel B - 3300 W	48.80	-	2200	1000	2	Trapezoidal	20.00	16.00	19.00	15.00	-	-	0.082	12.20	3.29	9.78	0.34	2.31	0.35	6.71	267.59	0	0.90	0	0.35	32185.50	2.39	2392.36	7.59	7592.91	31.51	Catchment B
C17	Channel C - 1000W	4.65	457	-	-	-	Twin Pipe	133.78	131.00	130.74	130.00	2.58	0.54	0.159	6.28	0.15	1.40	0.11	9.18	0.01	5.00	283.96	5820	0.90	150	0.35	5290.50	0.42	417.30	2.71	2711.51	15.39	Catchment C (5820 sqm from Upper Platform)
Channel C - 1000W	Channel C - 1500W	55.60	-	1000	1000	2	Trapezoidal	131.00	115.00	130.00	114.00	-	-	0.288	3.48	2.56	7.14	0.36	4.51	0.21	5.01	283.87	0	0.90	7160	0.35	7796.50	0.61	614.77	11.55	11554.71	5.32	Catchment C
Channel C - 1500W	Channel C - 2200 W (Section 1)	82.00	-	1500	1000	2	Trapezoidal	115.00	92.00	114.00	91.00	-	-	0.280	3.57	2.86	8.44	0.34	4.29	0.32	5.21	281.69	0	0.90	11160	0.35	11702.50	0.92	915.68	12.27	12273.13	7.46	Catchment C
Channel C - 2200 W (Section 1)	Channel B - 2200 W (Section 2)	250.00	-	2200	1000	2	Trapezoidal	82.00	32.00	81.00	31.00	-	-	0.200	5.00	3.29	9.78	0.34	3.61	1.16	5.53	278.44	0	0.90	47450	0.35	28310.00	2.19	2189.59	11.86	11860.51	18.46	Catchment C
Channel B - 2200 W (Section 2)	Channel B - 3300 W	163.00	-	2200	1000	2	Trapezoidal	32.00	16.00	31.00	15.00	-	-	0.098	10.19	3.29	9.78	0.34	2.53	1.08	6.69	267.80	0	0.90	1910	0.35	28978.50	2.16	2155.70	8.31	8309.11	25.94	Catchment C
Channel B - 3300 W	C2	129.67	-	3300	1200	2	Trapezoidal	16.00	7.20	14.80	6.00	-	-	0.068	14.74	5.29	13.38	0.40	2.34	0.92	7.07	264.67	0	0.90	0	0.35	61164.00	4.50	4496.77	12.38	12383.20	36.31	Catchment B & C
C20	Channel E - 1500W (Section 1)	6.08	457	-	-	-	Twin Pipe	38.05	37.00	36.77	36.00	0.82	0.54	0.127	7.90	0.15	1.40	0.11	8.19	0.01	5.00	283.96	8960	0.90	660	0.35	8295.00	0.65	654.29	2.42	2417.27	27.07	Catchment E (8960 from Middle Platform)
Channel E - 1500W (Section 1)	Channel E - 1500W (Section 2)	99.32	-	1000	1000	2	Trapezoidal	37.00	10.00	36.00	9.00	-	-	0.272	3.68	2.56	7.14	0.36	18.80	0.09	5.01	283.83	3700	0.90	16880	0.35	17533.00	1.38	1382.31	48.13	48130.80	2.87	Catchment E (3700 from Lower Platform)
Channel E - 1500W (Section 2)	C3	76.36	-	1500	1000	2	Trapezoidal	10.00	6.83	9.00	5.55	-	-	0.045	22.13	2.86	8.44	0.34	7.38	0.17	5.10	282.88	0	0.90	0	0.35	17533.00	1.38	1377.72	21.11	21110.49	6.53	Catchment E
C3	C2	19.88	525	-	-	-	Twin Pipe	6.83	5.70	3.95	3.15	2.36	2.03	0.040	24.84	0.19	1.60	0.12	5.00	0.07	5.27	281.07	4710	0.90	0	0.35	23168.50	1.81	1808.90	1.95	1949.06	92.81	Access Road R6 & R7+Catchment E
C2	3-Cell 3500(W) X 2700(H) BC	32.60	1200	-	-	-	Twin Pipe	7.20	5.70	2.82	2.23	3.18	2.27	0.018	55.25	1.02	3.67	0.28	5.52	0.10	7.99	257.60	1290	0.90	0	0.35	85493.50	6.12	6117.53	11.24	11242.37	54.41	Catchment B, C, E & H
C4	C3	11.00	300	-	-	-	Pipe	5.42	6.83	3.93	3.69	1.19	2.84	0.022	45.83	0.06	0.92	0.07	2.60	0.07	5.00	283.96	1190	0.90	930	0.35	1396.50	0.11	110.15	0.17	165.11	66.72	Part of Catchment H (840 sqm from Central Fodder Store)
C16	Channel D1 - 1500W	4.30	457	-	-	-	Twin Pipe	133.45	132.00	131.85	131.00	1.14	0.54	0.198	5.06	0.15	1.40	0.11	10.24	0.01	5.00	283.96	5590	0.90	1680	0.35	5619.00	0.44	443.21	3.02	3023.75	14.66	Catchment D1 (5590 from Upper Platform)
Channel D1 - 1500W	C15	76.80	-	1500	1000	2	Trapezoidal	132.00	111.68	131.00	110.68	-	-	0.265	3.78	2.86	8.44	0.34	17.86	0.07	5.01	284.14	0	0.90	17850	0.35	11866.50	0.94	936.60	51.09	51086.12	1.83	Catchment D1
C15	Channel D1 - 1500W (Section 1)	17.60	762	-	-	-	Twin Pipe	111.68	109.00	108.41	108.00	2.51	0.24	0.023	42.93	0.41	2.33	0.18	4.76	0.06	5.08	283.11	0	0.90	0	0.35	11866.50	0.93	933.22	3.91	3910.69	23.86	Catchment D1
Channel D1 - 1500W (Section 1)	Channel D1 - 1500W (Section 2)	119.61	-	1500	1000	2	Trapezoidal	110.00	88.00	109.00	87.00	-	-	0.184	5.44	2.86	8.44	0.34	14.89	0.13	5.14	282.72	2300	0.90	18850	0.35	20534.00	1.61	1612.58	42.59	42594.09	3.79	Catchment D1 and Access Road R1
Channel D1 - 1500W (Section 2)	C11	178.09	-	1500	1000	2	Trapezoidal	88.00	72.00	87.00	71.00	-	-	0.090	11.13	2.86	8.44	0.34	10.41	0.29	5.27	281.31	0	0.90	23630	0.35	28804.50	2.25	2250.85	29.77	29768.84	7.56	Catchment D3
C11	Channel D1 - 1200 Stepped Channel (Section 1)	182.79	-	1200	-	-	U-Shaped Stepped	72.00	56.00	70.80	54.80	-	-	0.088	11.42	1.29	3.08	0.42	11.79	0.26	5.56	278.42	4420	0.90	17930	0.35	39058.00	3.02	3020.67	15.16	15155.46	19.93	Access Road R2 and R3
Channel D1 - 1200 Stepped Channel (Section 1)	Channel D1 - 1200 Stepped Channel (Section 2)	78.49	-	1200	-	-	U-Shaped Stepped	56.00	54.00	54.80	52.80	-	-	0.025	39.25	1.29	3.08	0.42	6.36	0.21	5.82	275.90	1200	0.90	0	0.35	40138.00	3.08	3076.09	8.18	8176.98	37.62	Access Road R4
Channel D1 - 1200 Stepped Channel (Section 2)	Channel D1 - 1500 Stepped Channel	195.24	-	1500	-	-	U-Shaped Stepped	54.00	6.00	52.50	4.50	-	-	0.246	4.07	2.01	3.86	0.52	22.93	0.14	6.02	273.96	1090	0.90	42050	0.35	55836.50	4.25	4249.09	46.05	46051.97	9.23	Catchment D2 and Access Road R5
MH1	MH2	32.89	750	-	-	-	Pipe	6.02	5.59	3.78	3.37	1.49	1.47	0.012	80.22	0.40	2.29	0.17	3.44	0.16	5.00	283.96	5130	0.90	7030	0.35	7077.50	0.56	558.26	1.37	1367.27	40.83	Catchment I
MH2	MH4	49.84	750	-	-	-	Pipe	5.59	5.43	3.36	3.11	1.48	1.57	0.005	199.36	0.40	2.29	0.17	2.16	0.38	5.00	283.96	0	0.90	0	0.35	7077.50	0.56	558.26	0.86	860.76	64.86	Catchment I
MH4	MH5	36.76	750	-	-	-	Pipe	5.43	5.37	3.09	2.69	1.59	1.93	0.011	91.90	0.40	2.29	0.17	3.21	0.19	5.00	283.96	0	0.90	0	0.35	7077.50	0.56	558.26	1.28	1276.21	43.74	Catchment I
MH5	MH6	39.07	900	-	-	-	Pipe	5.37	5.36	2.66	2.32	1.81	2.14	0.009	114.91	0.57	2.75	0.21	3.20	0.20	5.00	283.96	3040	0.90	0	0.35	9813.50	0.77	774.07	1.83	1833.98	42.21	Catchment I (3040 from Lower Platform)
MH6	C7	57.69	1050	-	-	-	Pipe	5.36	6.66	2.28	1.83	2.03	3.78	0.008	128.20	0.78	3.21	0.24	3.33	0.29	5.00	283.96	0	0.90	0	0.35	9813.50	0.77	774.07	2.59	2593.76	29.84	Catchment I
C7	1-Cell 3000(W) X 3000(H) BC	99.00	1350	-	-	-	Pipe	6.66	-	1.76	1.38	3.55	-	0.004	260.53	1.29	4.12	0.31	2.70	0.61	5.00	283.96	440	0.90	15340	0.35	15578.50	1.23	1228.80	3.48	3484.69	35.26	Catchment F (440 from E&M Block)
Existing Public Drainage Syetm (Box Culverts) - 200-Year																																	
3-Cell 3500(W) X 2700(H) BC	5-Cell 3500(W) X 3200(H) BC	-	-	3500	2700	1	Box Culvert	-	-	-	-			0.002	500.00	8.51	8.36	1.02	3.23	-	5.00	284.22	316460	0.90	1664320	0.35	867326.00	68.47	68474.33	82.44	82444.41	83.06	
1-Cell 3000(W) X 3000(H) BC	1-Cell 3000(W) X 3200(H) BC	22.635	-	3000	3000	1	Box Culvert	-	-	-	-			0.005	185.00	8.10	8.40	0.96	5.13	0.07	5.00	284.22	17620	0.90	314970	0.35	126097.50	9.96	9955.24	41.52	41518.50	23.98	
1-Cell 3000(W) X 3200(H) BC	2-Cell 3000(W) X 3200(H) BC	24	-	3000	3200	1	Box Culvert	-	-	-	-			0.001	700.00	8.64	8.76	0.99	2.68	0.15	5.07	283.42	0	0.90	0	0.35	126097.50	9.93	9927.52	23.11	23112.30	42.95	
2-Cell 3000(W) X 3200(H) BC	5-Cell 3500(W) X 3200(H) BC	197.745	-	3000	3200	1	Box Culvert	-	-	-	-			0.001	800.00	8.64	8.76	0.99	2.50	1.32	5.22	281.84	119100	0.90	434200	0.35	385257.50	30.16	30161.71	43.24	43239.15	69.76	


GEOWEB INFILLED WITH CDV
GEOWEB INFILLED WITH GRADE 20/20 CONCRETE
GEOWEB INFILLED WITH CDV
400 MIN.
400 MIN.
400 MIN.
800 MIN.
2000 SIDE SLOPE
1000 BASE WIDTH
2000 SIDE SLOPE
800 MIN.
400 MIN.
1
2
5000
1000
1000
Wetted Perimeter
Flow Area

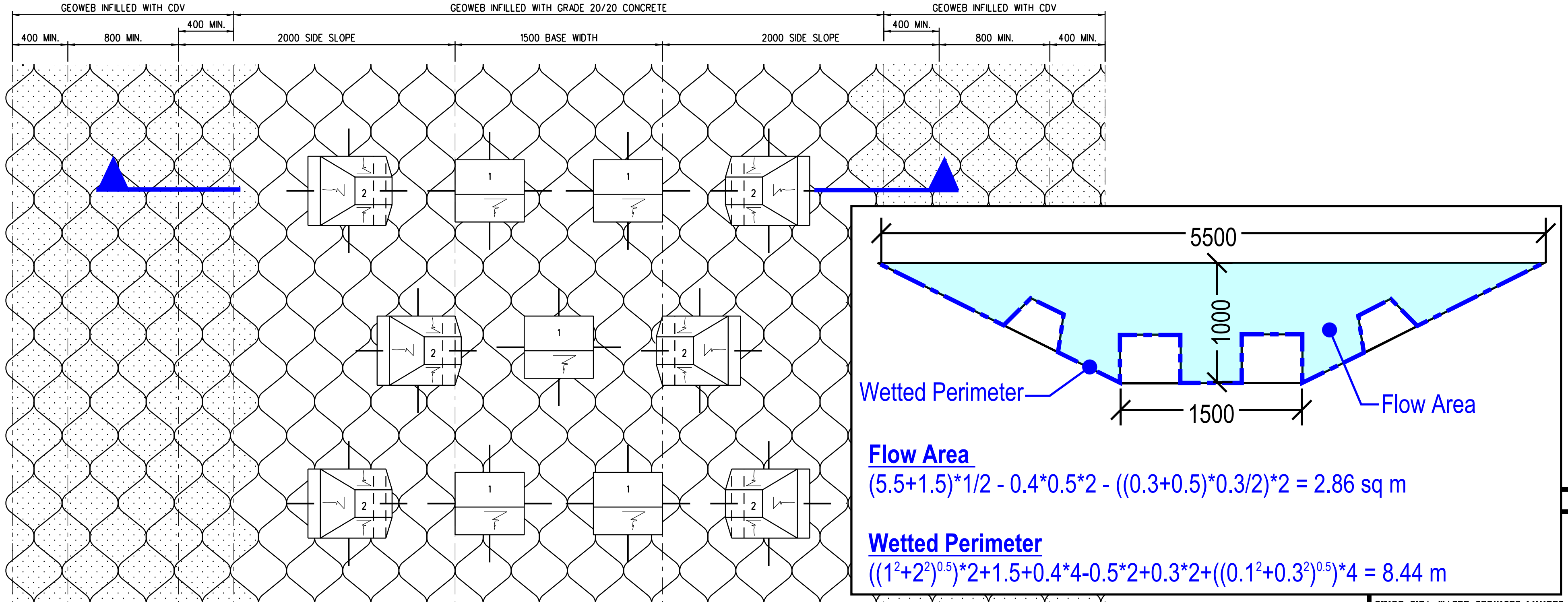
Flow Area

$(5+1)*1/2 - 0.4*0.5 - ((0.3+0.5)*0.3/2)*2 = 2.56$ sq m

Wetted Perimeter

$((1^2+2^2)^{0.5})*2+1+0.4*2-0.5*2+0.3*2+((0.1^2+0.3^2)^{0.5})*4=7.14$ m

TYPE 1 BAFFLED CHANNEL
(BASE WIDTH = 1000mm)


GEOWEB INFILLED WITH CDV
GEOWEB INFILLED WITH GRADE 20/20 CONCRETE
GEOWEB INFILLED WITH CDV
400 MIN.
400 MIN.
400 MIN.
800 MIN.
2000 SIDE SLOPE
1500 BASE WIDTH
2000 SIDE SLOPE
800 MIN.
400 MIN.
1
2
5500
1000
1500
Wetted Perimeter
Flow Area

Flow Area

$(5.5+1.5)*1/2 - 0.4*0.5*2 - ((0.3+0.5)*0.3/2)*2 = 2.86$ sq m

Wetted Perimeter

$((1^2+2^2)^{0.5})*2+1.5+0.4*4-0.5*2+0.3*2+((0.1^2+0.3^2)^{0.5})*4 = 8.44$ m

TYPE 2 BAFFLED CHANNEL
(BASE WIDTH = 1500mm)

NOTE :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. GENL/SUR/DRW/002/R TO 009/R.
3. BAFFLED CHANNEL IS FORMED BY GEOWEB INFILL WITH GRADE 20/20 CONCRETE.
4. GEOWEB IS LARGE CELL A-SECTION 203 THICK.
5. BAFFLE PIERS ARE PRECAST UNIT OF CONCRETE GRADE 30/20.
6. FOR LAYOUT OF SURFACE WATER DRAINAGE REFER TO DRAWING NO. STG1/SUR/DRW/001 & STG2/SUR/DRW/001.
7. TYPICAL SECTION OF CHANNEL REFER TO DRAWING NO. GENL/SUR/DRW/003/R.

LEGEND :

▨ INFILLED WITH CDV
▨ INFILLED WITH CONCRETE

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref.
MAIN : AGSUR001.DGN
REF : RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

SURFACE WATER
DRAINAGE GENERAL DETAILS
SHEET 1 OF 9

AS CONSTRUCTED RECORD DRAWING

Drawing no. GENL/SUR/DRW/001/R
Scale 1 : 20

Binnie
Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

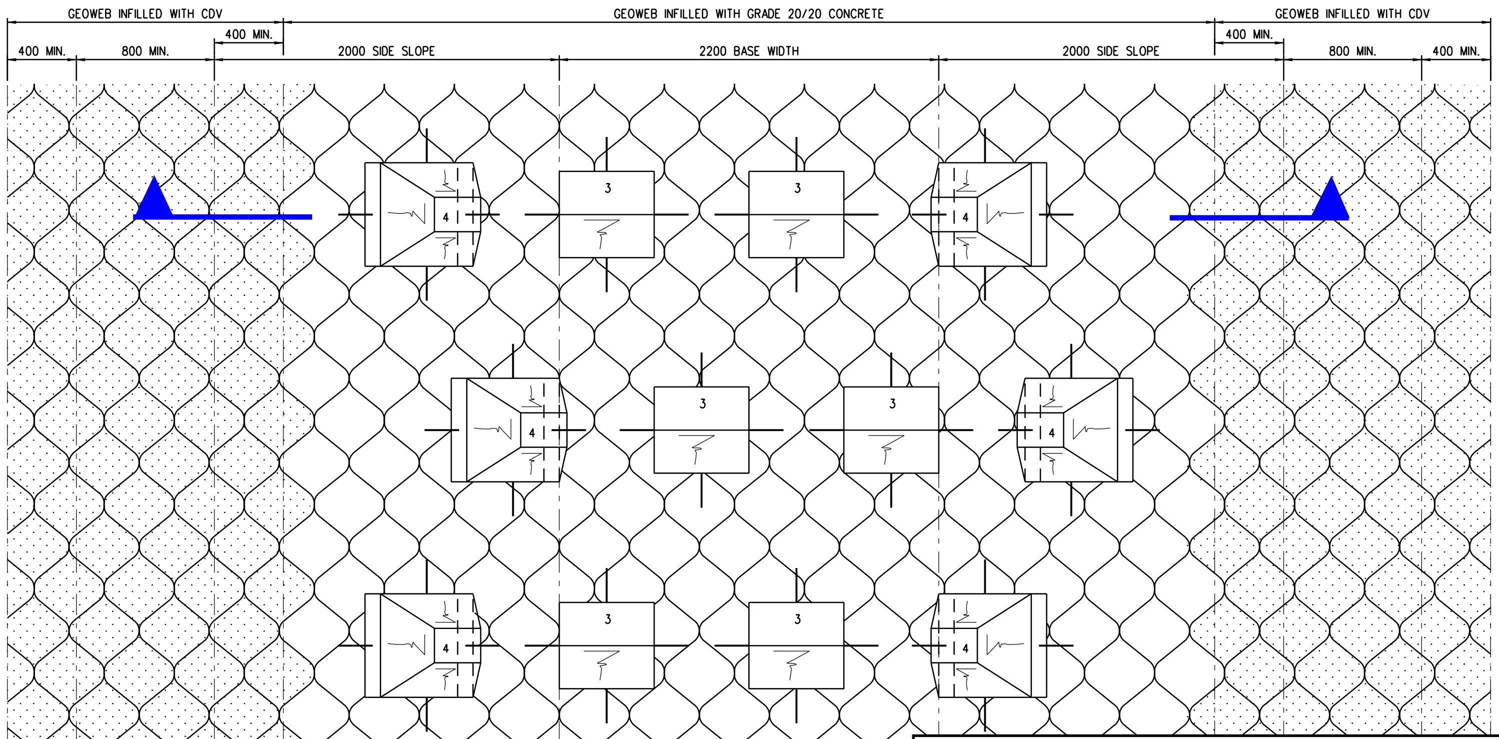
Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE SITA WASTE
SERVICES LTD.

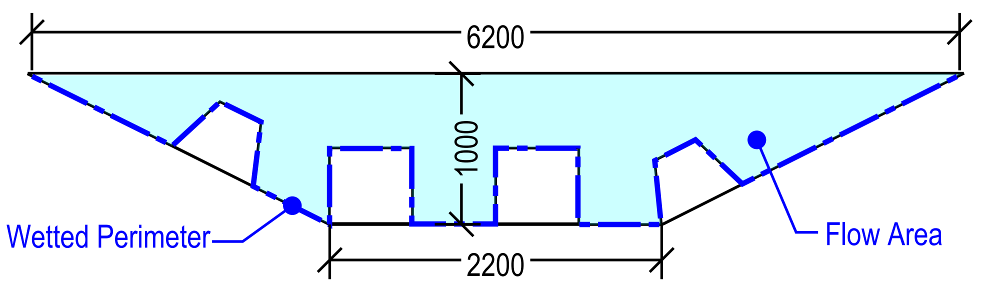
SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :


GEOWEB INFILLED WITH CDV
GEOWEB INFILLED WITH GRADE 20/20 CONCRETE
GEOWEB INFILLED WITH CDV
400 MIN.
800 MIN.
400 MIN.
2000 SIDE SLOPE
2200 BASE WIDTH
2000 SIDE SLOPE
400 MIN.
800 MIN.
400 MIN.
3
4

TYPE 3 BAFFLED CHANNEL
(BASE WIDTH = 2200mm)

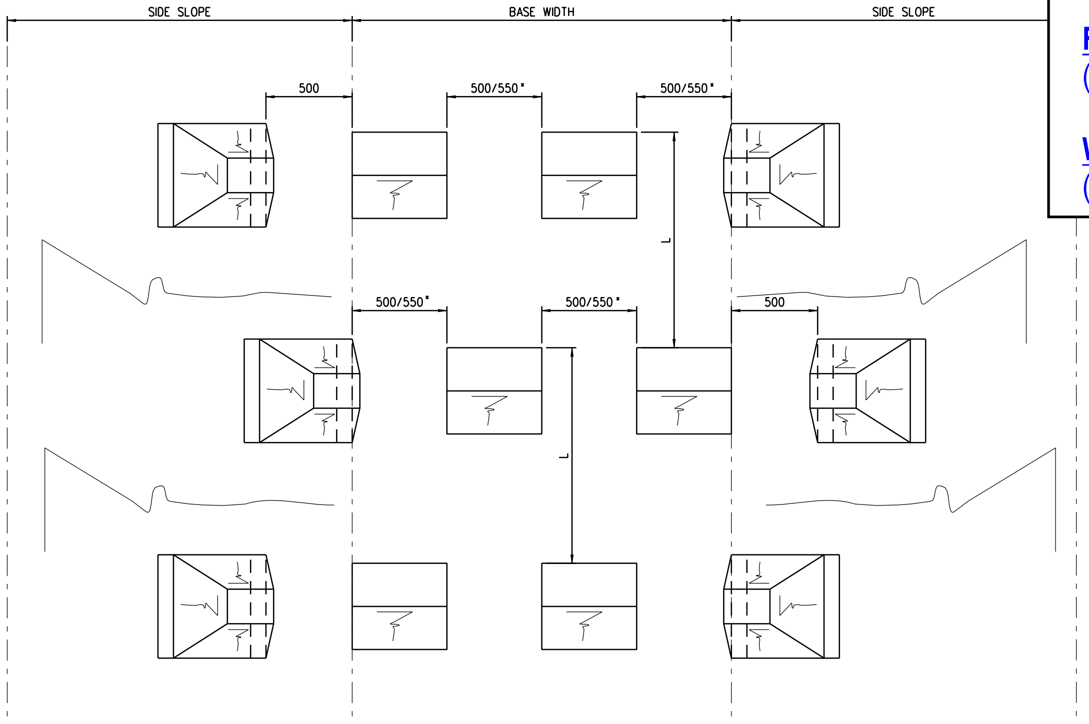

6200
1000
2200
Wetted Perimeter
Flow Area

Flow Area

(6.2+2.2)*1/2 - 0.55*0.5*2 - ((0.3+0.6)*0.4/2)*2 = 3.29 sq m

Wetted Perimeter

$((1^2+2^2)^{0.5})*2+2.2+0.5*4-0.6*2+0.3*2+((0.15^2+0.4^2)^{0.5})*4 = 9.78$ m


SIDE SLOPE
BASE WIDTH
SIDE SLOPE
500
500/550*
500/550*
500/550*
500/550*
500
L
L

* FOR TYPE 3 BAFFLE CHANNEL

ARRANGEMENT OF BAFFLE PIERS

CHANNEL GRADIENT	L (mm)	
	PIER HEIGHT 500mm	PIER HEIGHT 400mm
1 : 3	1580	1260
1 : 4	2060	1650
1 : 5	2550	2040
> 1 : 6	3040 MIN.	2430

NOTE : PIER HEIGHT REFER TO DRAWING GENL/SUR/DRW/003/R.

NOTE :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. GENL/SUR/DRW/001/R, 003/R TO 009/R.
3. BAFFLED CHANNEL IS FORMED BY GEOWEB INFILL WITH GRADE 20/20 CONCRETE.
4. GEOWEB IS LARGE CELL A-SECTION 203 THICK.
5. BAFFLE PIERS ARE PRECAST UNIT OF CONCRETE GRADE 30/20.
6. DETAILS OF TRAPEZODIAL CHANNELS ARE SAME AS BAFFLED CHANNELS BUT WITHOUT BAFFLE PIERS.
7. FOR LAYOUT OF SURFACE WATER DRAINAGE REFER TO DRAWING NOS. STG1/SUR/DRW/001/R & STG2/SUR/DRW/001/R.
8. TYPICAL SECTION OF CHANNEL REFER TO DRAWING NO. GENL/SUR/DRW/003/R.
9. FOR DETAILS OF 3300mm INVERT BAFFLE CHANNEL (STAGE II/III ONLY) REFER TO DRAWING STG2/SUR/DRW/011/R.

LEGEND :

▨	INFILLED WITH CDV
▨	INFILLED WITH CONCRETE

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN : AGSUR002.DGN
REF : RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

SURFACE WATER
DRAINAGE GENERAL DETAILS
SHEET 2 OF 9

AS CONSTRUCTED RECORD DRAWING

Drawing no. GENL/SUR/DRW/002/R
Scale 1 : 20

Binnie
Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE SITA WASTE
SERVICES LTD.

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

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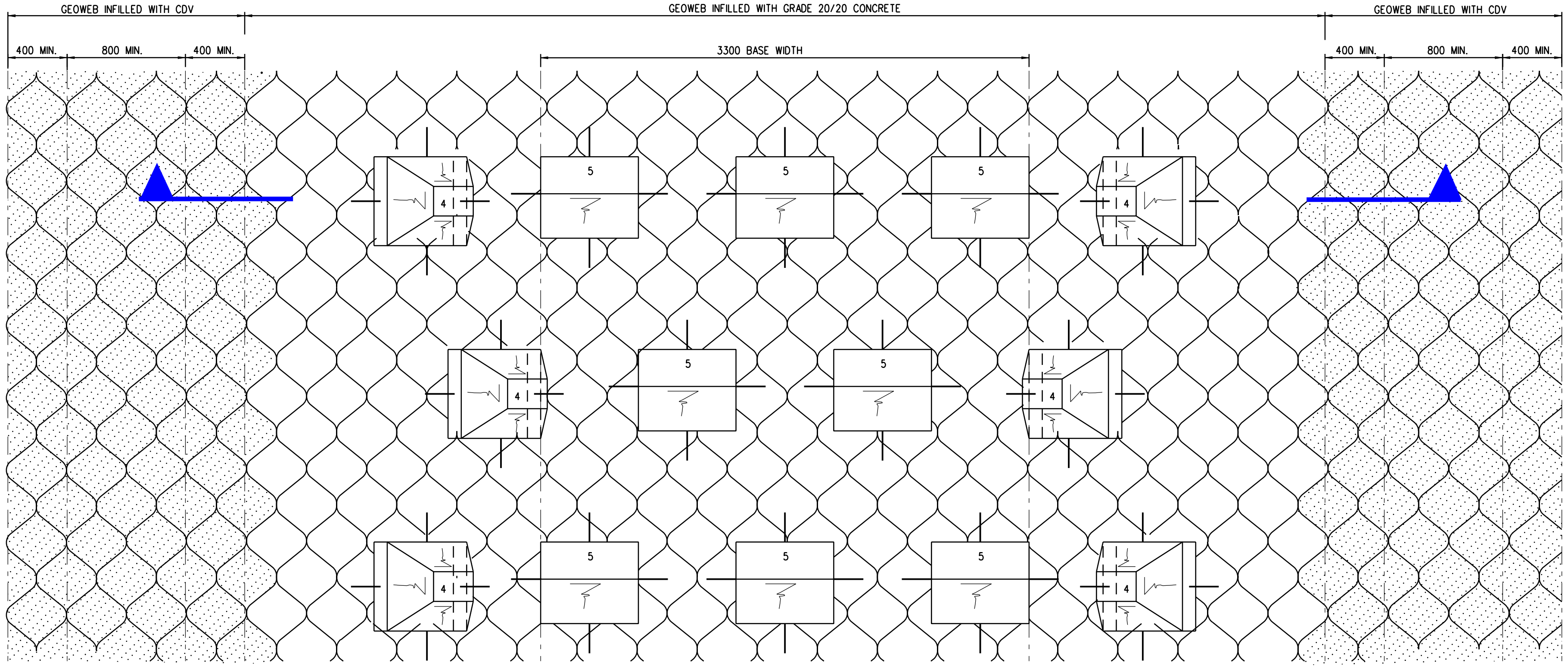
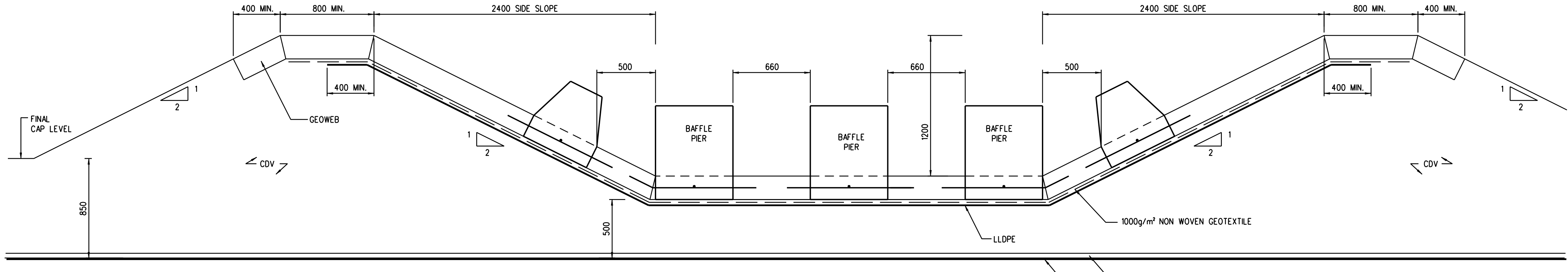

GEOWEB INFILLED WITH CDV
GEOWEB INFILLED WITH GRADE 20/20 CONCRETE
GEOWEB INFILLED WITH CDV
400 MIN.
800 MIN.
400 MIN.
3300 BASE WIDTH
400 MIN.
800 MIN.
400 MIN.
5
4

BAFFLED CHANNEL
(BASE WIDTH = 3300mm)


400 MIN.
800 MIN.
2400 SIDE SLOPE
2400 SIDE SLOPE
800 MIN.
400 MIN.
500
660
660
500
400 MIN.
400 MIN.
1
2
FINAL
CAP LEVEL
GEOWEB
BAFFLE
PIER
BAFFLE
PIER
BAFFLE
PIER
1200
CDV
CDV
850
500
1000g/m² NON WOVEN GEOTEXTILE
LLDPE
GEOCOMPOSITE DRAINAGE LAYER
FINAL INTERMEDIATE COVER LAYER
LLDPE

SVERSE SECTION OF BAFFLED CHANNEL

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. STG2/SUR/DRW/012/R TO 017/R, 019/R & 020/R.
3. BAFFLED CHANNEL IS FORMED BY GEOWEB INFILLED WITH GRADE 20/20 CONCRETE.
4. GEOWEB IS LARGE CELL A-SECTION 203 THICK.
5. BAFFLE PIERS ARE PRECAST UNITS OF CONCRETE GRADE 30/20.
6. FOR LAYOUT OF SURFACE WATER DRAINAGE REFER TO DRAWING NO. STG2/SUR/DRW/001/R.
7. FOR BAFFLE PIERS ROW SPACING, AND DETAILS OF PIERS REFER TO DRAWING NO. STG2/SUR/DRW/012/R.
8. FOR DOWEL BAR DETAILS REFER TO DRAWING NO. GENL/SUR/DRW/003/R.

LEGEND :

▨	INFILLED WITH CDV
▨	INFILLED WITH CONCRETE

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN : A2SUR011.DGN
REF : RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title
STAGE II/III
SURFACE WATER
DRAINAGE DETAILS
SHEET 1 OF 10

AS CONSTRUCTED RECORD DRAWING

Drawing no. STG2/SUR/DRW/011/R
Scale 1 : 20

Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
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Independent Consultants
MOUCHEL ASIA LIMITED
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SWIRE SITA WASTE
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CONTRACTOR

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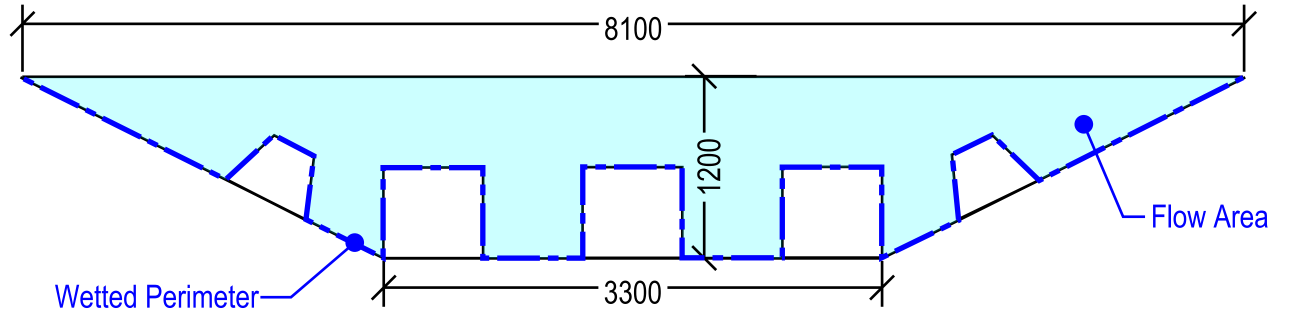
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

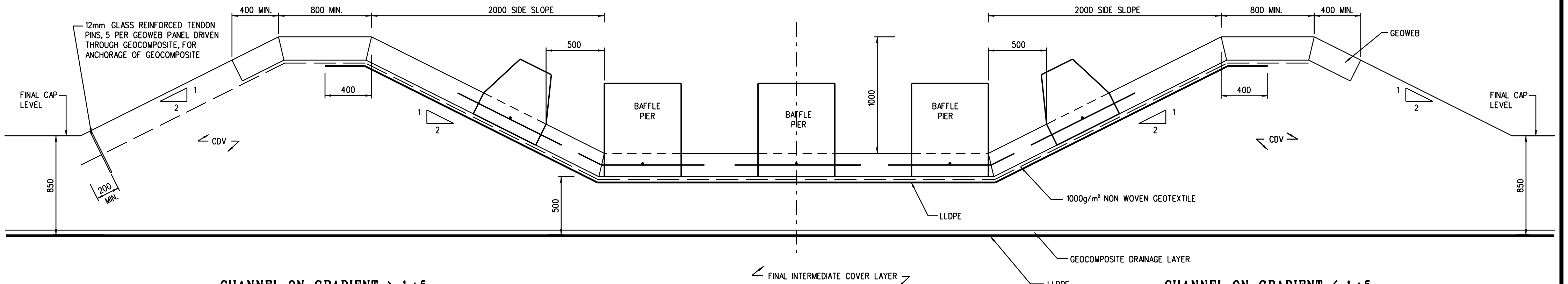

8100
1200
3300
Flow Area
Wetted Perimeter

Flow Area

$(8.1+3.3)*1.2/2 - 0.66*0.6*3 - ((0.3+0.6)*0.4/2)*2 = 5.292$ sq m

Wetted Perimeter

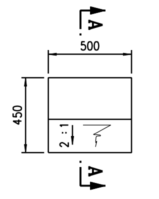
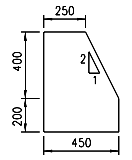
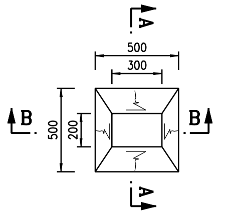
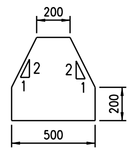
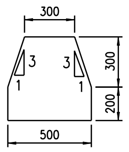
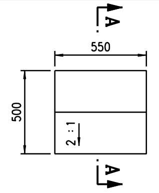
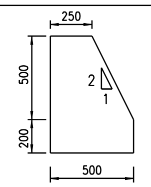
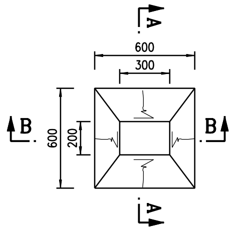
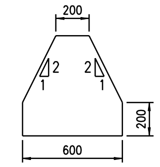
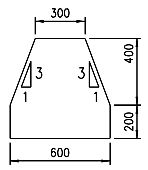
$((1.2^2+2.4^2)^{0.5})*2+3.3+0.6*6-0.6*2+0.3*2+((0.15^2+0.4^2)^{0.5})*4 = 13.38$ m


400 MIN.
800 MIN.
2000 SIDE SLOPE
12mm GLASS REINFORCED TENDON PINS, 5 PER GEOWEB PANEL DRIVEN THROUGH GEOCOMPOSITE, FOR ANCHORAGE OF GEOCOMPOSITE
FINAL CAP LEVEL
500
400
1
2
CDV
850
200 MIN.
BAFFLE PIER
BAFFLE PIER
BAFFLE PIER
1000
500
GEOWEB
FINAL CAP LEVEL
LLDPE
1000g/m² NON WOVEN GEOTEXTILE
GEOCOMPOSITE DRAINAGE LAYER
FINAL INTERMEDIATE COVER LAYER
LLDPE

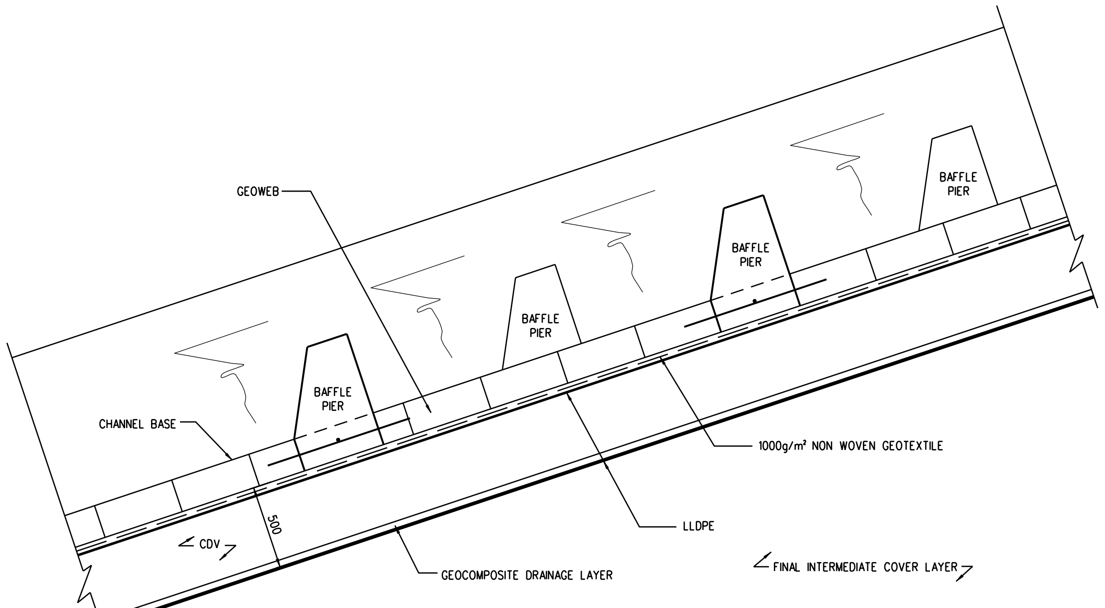
CHANNEL ON GRADIENT > 1 : 5

CHANNEL ON GRADIENT ⩽ 1 : 5

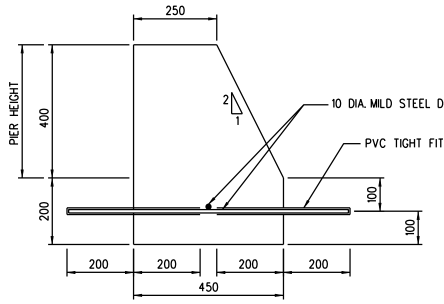
TYPICAL TRANSVERSE SECTION OF BAFFLED CHANNEL

BAFFLE PIER TYPE	PLAN	SECTION A - A	SECTION B - B
1			
2			
3			
4			

NOTE : DOWEL BAR NOT SHOWN.
PARTICULAR DETAILS OF BAFFLES REFER TO DRAWING STG/SUR/DRW/012/R.


GEOWEB
BAFFLE PIER
BAFFLE PIER
BAFFLE PIER
BAFFLE PIER
CHANNEL BASE
1000g/m² NON WOVEN GEOTEXTILE
LLDPE
CDV
500
GEOCOMPOSITE DRAINAGE LAYER
FINAL INTERMEDIATE COVER LAYER

TYPICAL LONGITUDINAL SECTION OF BAFFLED CHANNEL


250
PIER HEIGHT
400
200
2
1
10 DIA. MILD STEEL DOWEL BAR
PVC TIGHT FITTING DOWEL SLEEVE
100
100
200
200
200
200
450

DOWEL BARS DETAILS

1 : 10

NOTE :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. GENL/SUR/DRW/001/R, 002/R, 004/R TO 009/R.
3. BAFFLED CHANNEL IS FORMED BY GEOWEB INFILLED WITH GRADE 20/20 CONCRETE.
4. GEOWEB IS LARGE CELL A-SECTION 203 THICK.
5. BAFFLE PIERS ARE PRECAST UNITS OF CONCRETE GRADE 30/20.
6. NOT USED.
7. FOR LAYOUT OF SURFACE WATER DRAINAGE REFER TO DRAWING NOS. STG1/SUR/DRW/001/R AND STG2/SUR/DRW/001/R.
8. FOR DIMENSIONS OF CHANNEL BASE WIDTH REFER TO DRAWING NOS. GENL/SUR/DRW/001/R AND GENL/SUR/DRW/002/R.

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN : AGSUR003.DGN
REF : RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

SURFACE WATER
DRAINAGE GENERAL DETAILS
SHEET 3 OF 9

AS CONSTRUCTED RECORD DRAWING

Drawing no. GENL/SUR/DRW/003/R
Scale 1 : 20

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

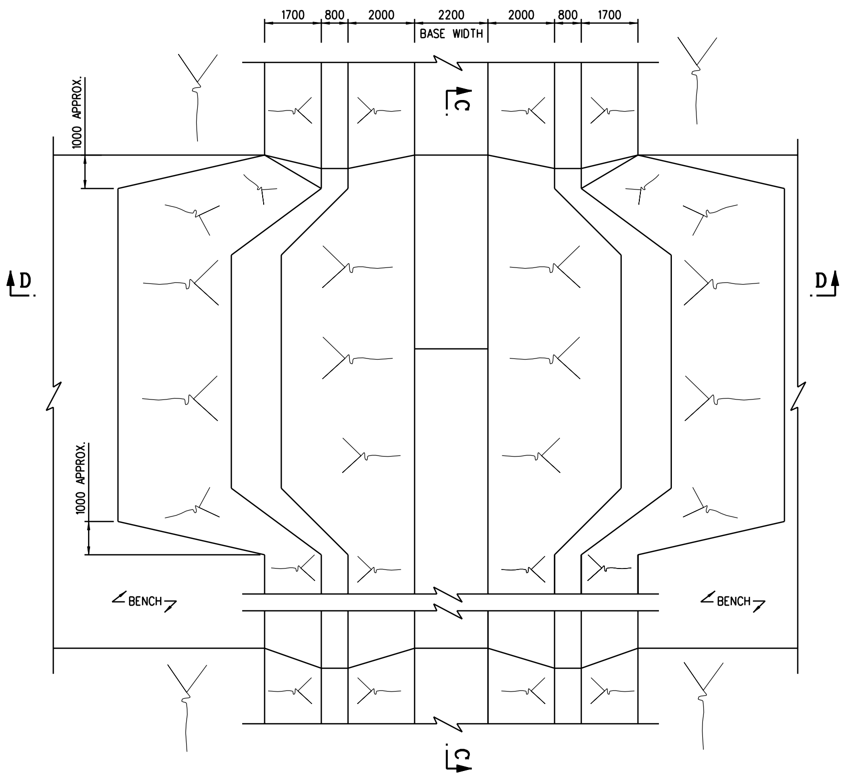
Binnie
Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

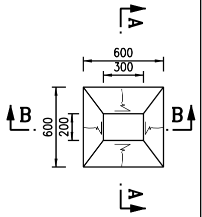
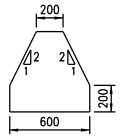
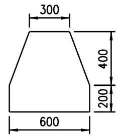
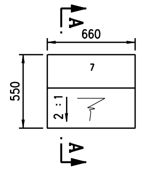
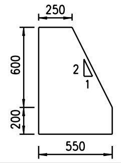
SWIRE SITA WASTE
SERVICES LTD.


1700
800
2000
2200
BASE WIDTH
2000
800
1700
1000 APPROX.
1000 APPROX.
C
C
D
D
BENCH
BENCH

DETAILS OF BAFFLED CHANNEL CROSSING BENCH

1 : 100

DETAILS OF BAFFLE PIERS AND SPACING FOR 3300 mm BAFFLE CHANNEL
REFER TO DRAWING NO. STG2/SUR/DRW/011/R.

BAFFLE PIER TYPE	PLAN	SECTION A - A	SECTION B - B
4			
5			

A
B
600
300
600
200
200
2
1
200
600
300
400
200
600
660
7
550
2 : 1
250
600
200
550

NOTE : DOWEL BAR NOT SHOWN

CHANNEL GRADIENT	L (mm) (REFER TO DRAWING NO. GENL/SUR/DRW/002 FOR L)
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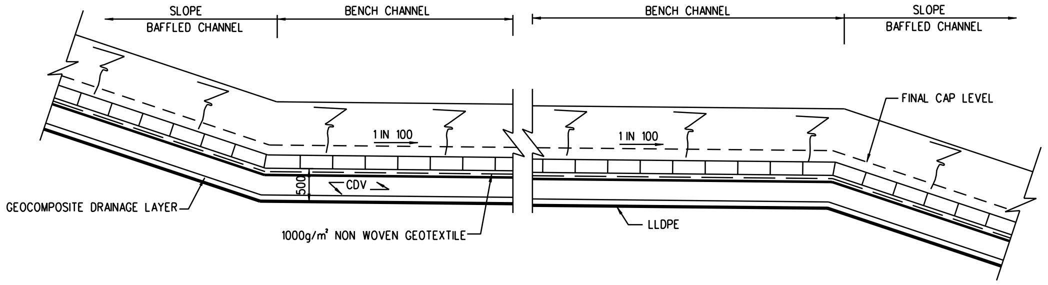
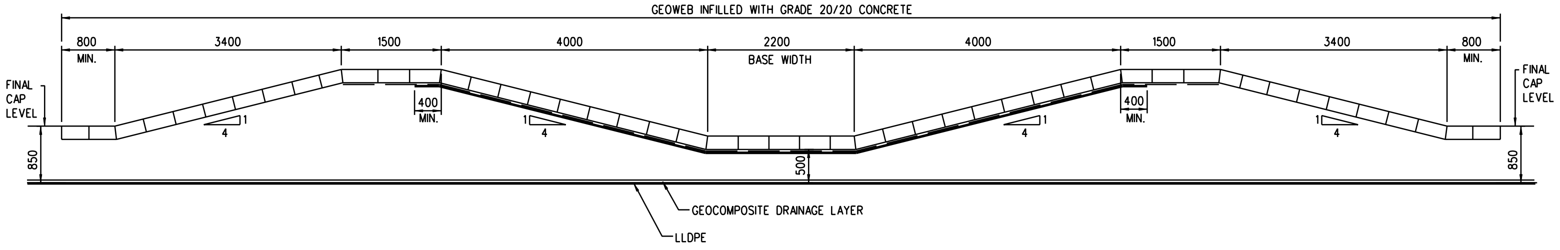
1:4	2220
1:5	2740
> 1:6	3270


SLOPE
BAFFLED CHANNEL
BENCH CHANNEL
BENCH CHANNEL
SLOPE
BAFFLED CHANNEL
FINAL CAP LEVEL
1 IN 100
1 IN 100
500
CDV
GEOCOMPOSITE DRAINAGE LAYER
1000g/m² NON WOVEN GEOTEXTILE
LLDPE

SECTION C - C

1 : 50


GEOWEB INFILLED WITH GRADE 20/20 CONCRETE
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MIN.
3400
1500
4000
2200
BASE WIDTH
4000
1500
3400
800
MIN.
FINAL CAP LEVEL
FINAL CAP LEVEL
400
MIN.
400
MIN.
1
4
850
500
850
GEOCOMPOSITE DRAINAGE LAYER
LLDPE

SECTION D - D

1 : 50

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING NOS. STG2/SUR/DRW/011/R, 013/R TO 017/R, 019/R & 020/R.
3. FOR LOCATIONS OF BENCH REFER TO DRAWING NO. STG2/SUR/DRW/001/R.

Details of Revision	Date

	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN: A2SUR012.DGN
REF. RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title
STAGE II/III
SURFACE WATER
DRAINAGE DETAILS
SHEET 2 OF 10

AS CONSTRUCTED RECORD DRAWING

Drawing no. STG2/SUR/DRW/012/R

Scale AS SHOWN

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

Binnie
Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE SITA WASTE
SERVICES LTD.

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SECTION 16 PLANNING APPLICATION TOWN PLANNING ORDINANCE (CAP. 131)

PROPOSED PLACE OF RECREATION, SPORTS OR CULTURE (PUBLIC RIDING SCHOOL) WITH ANCILLARY FACILITIES AT GOVERNMENT LAND IN D.D. 233, THE RESTORED LANDFILL SITE (TKOL II/III) IN TKO AREA 105, TSEUNG KWAN O (GLA TSK-500 (PART))

- Supplementary Planning Statement -

Volume 3 of 3

TOWNLAND CONSULTANTS LIMITED

Appendix 8

WATER SUPPLY STUDY

WATER SUPPLY STUDY

FOR

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Prepared by : P&T (M&E) Limited

Date : January 2026

7041/KPY/SCW/AC/DW

CONTENT

1.0 INTRODUCTION....................1

2.0 WATER SUPPLY STUDY....................3

2.1 Purpose and Methodology....................3

2.2 Existing Water Supply System....................3

2.3 Water Demands....................4

2.4 Proposed Waterworks....................6

2.5 Conclusion....................6

Appendix

Appendix 1 Location Plan

Appendix 2 Layout of Existing Water Supply System

Appendix 3 Pipe Sizing Chart for Potable and Flushing Water Pipe

1.0 INTRODUCTION

This water supply study is prepared in support of the Section 16 (“**S16**”) Planning Application to allow for the development of a Public Riding School with ancillary facilities (e.g. utility trench) (collectively as the “**PRS**”) at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories ("**TKOL II/III**") for the HKJC Public Riding Schools Limited (the “**Applicant**”). The Application Site comprises of three (3) existing platforms and land required for the provision of ancillary utility trench connecting to the three (3) platforms (collectively as the “**Application Site**”) within TKOL II/III. The PRS aligns with the Government’s policy objectives in fostering more public participation in the community through wider visibility and popularity of horse riding, supporting equestrian as an elite sport, and maintaining Hong Kong as a centre for major international sports events.

The Application Site is predominately zoned “Open Space” (“**O**”) on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 ("**Approved OZP**”), whilst a strip of area at the north is zoned “Green Belt” (“**GB**”) and a minor portion abutting Chun Sing Street is zoned “Other Specified Uses” annotated “Industrial Estate” (“**OU(Industrial Estate)**”) on the Approved OZP. The PRS with ancillary facilities (‘Horse Riding School’ subsumed under ‘Place of Recreation, Sports or Culture’ use) is a Column 2 use under the “O”, “GB” and “OU(Industrial Estate)” zones that may be permitted with or without conditions on Application under S16 of the Town Planning Ordinance (“**TPO**”). There are no plot ratio (“**PR**”), building height (“**BH**”), and site coverage (“**SC**”) restrictions imposed on the “O”, “GB” and “OU(Industrial Estate)” zones of the Approved OZP. While a portion of TKOL II/III falls within the Clear Water Bay Country Park (“**CWBCP**”), the Application Site does not involve any areas falling within the Country Park Boundary.

The PRS is located on three (3) platforms, namely the Lower Platform (i.e. Reception and Hospitality Lounges) (approx.+6.0mPD), Middle Platform (i.e. Pony Paddock & Pavilion I)(approx. +40.0mPD) and Upper Platform (i.e. Horse Paddock & Pavilion II) (approx.140.0mPD), with a proposed total GFA of approx. 9,000m^2 and a proposed building height of 4.84m to 7.7m. An ancillary utility trench connecting to the three (3) platforms is also proposed to accommodate various essential utilities services in support of the PRS operations.

1.1 Key information for the Proposed PRS at the Proposed Site is summarized in Table T1 below.

Table T1 - Key Information of the proposed site in Restored Landfill Site (TKO II/III) in Tseung Kwan O

Proposed Site Area (m^2)	Approx. 46,500 m^2
Proposed Non-Domestic GFA (m^2)	≤ 9,000m^2
Proposed Domestic GFA (m^2)	≤ 200 m^2
Proposed Plot Ratio (Non-Domestic)	N/A
Overall Site Coverage	Approx. 20.9%
No. of Building Blocks	≤ 17

1.2 This report presents the findings of studies on the following study to support the Planning Application :

- Water Supply Study

2.0 WATER SUPPLY STUDY

2.1 Purpose and Methodology

2.1.1 The purpose of this study is to assess the feasibility of the Proposed Development in terms of fresh and flushing water supply.

The study presents the existing and proposed water supply system to cater for the water demand required to serve the proposed development.

2.1.2 The methodology adopted in the study is as follows :

- To estimate the size of the water supply pipe to the development.

2.2 Existing Water Supply System

For Fresh Water, a connection will be given from the proposed 200mm diameter water main at CHUN SING STREET as shown on the attached plan.

For Flushing Water, a connection will be given from the proposed 150mm diameter water main at CHUN SING STREET as shown on the attached plan.

A record of the existing fresh and salt water supply services in the vicinity of the proposed development is enclosed in Appendix 2.

2.3 Water Demands

2.3.1 The fresh and flushing water demands generated from the Proposed Development is listed below.

According to EPD guideline, the daily water consumption of potable water for Community, Social & Personal Services Group is $0.2m^3$/person/day.

Daily Water Consumption of Potable Water

Assume : $0.2m^3$/person/day* (A1)
$0.055m^3$/horse/day (A2)

*(70% of human daily water consumption is for potable purpose)

Platform	Nos. of People	Nos. of Horse Stall
Lower Platform	-	0
Middle Platform	-	24
Upper Platform	-	51
Total Nos. of People	163	75

Daily water consumption
= 163 x (A1) x 0.7+ 75 x (A2)
= 163 x 0.2 x 0.7+ 75 x 0.055
= 26.945 m^3/day (A3)

Daily Water Consumption of Cleansing Water

Assumptions:

	Flow Rate(L/s)	Daily Operation Duration (min)	Quantity
Rain gun	4.54	30	24
Tap	0.15	30	20

Daily water consumption
= 4.54 x 60 x 30 x 24 + 0.15 x 60 x 30 x 20
= 201500 L/day
= 201.5 m^3/ day (A4)

2.3 Water Demands (Cont'd)

2.3.1 (Cont'd)

Daily Water Consumption of Irrigation Water

Total 6 nos. of tap
Assume 30 mins./tap/day operation
Total daily water consumption
= 0.15 x 60 x 30 x 6
= 1620 L/day
= 1.6 m^3/ day (A5)

Total Daily Water Consumption of Fresh Water

Daily water consumption of potable water + daily water consumption of cleansing water + daily water consumption of irrigation water
= (A3)+(A4)+(A5)
= 26.945 + 201.5 + 1.6
= 230 m^3/day

Daily Water Consumption of Flushing Water

Assume : 0.2m^3/person/day (A6)
(30% of daily water consumption is for flushing purpose)

Daily water consumption
= 163 x (A6) x 0.3
= 163 x 0.2 x 0.3
= 7.2 m^3/day

Table 2: Water Demand

	Fresh Water Demand (m^3/day)	Flushing Water Demand (m^3/day)
Potable water	26.945	-
Cleansing water	201.5	-
Irrigation water	1.6	-
Flushing water	-	9.78
Total	230	9.78
Flow rate (L/s) (Assume 10 hours operation time)	6.4	0.27

2.4 Proposed Waterworks

2.4.1 The proposed connections of water supply to the Proposed Development is attached in Appendix 2.

2.4.2 A proposed new 80mm diameter fresh water and 50mm diameter salt water are tee-off from the distribution mains.

Pipe sizing methodology for potable and flushing pipe is attached in Appendix 3.

2.5 Conclusion

Based on Fresh and Flushing Water Demand Table T2 above, the proposed new 80mm diameter fresh water and 50mm diameter salt water are adequate to meet water supplies required for the Application Site.

Appendix 1

Location Plan

N
5.9
100
1
2
hkcolo
2
5.3
5.9
198.4
LEGEND:
TKOL STAGE II/ III SITE BOUNDARY (GLA-TSK 500)
PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY/ APPLICATION SITE
CAP ZONE
CLEARWATER BAY COUNTRY PARK ZONE
NO-BUILD ZONE LINE / AREA
EXISTING EPD FACILITIES

WONG TUNG 王董

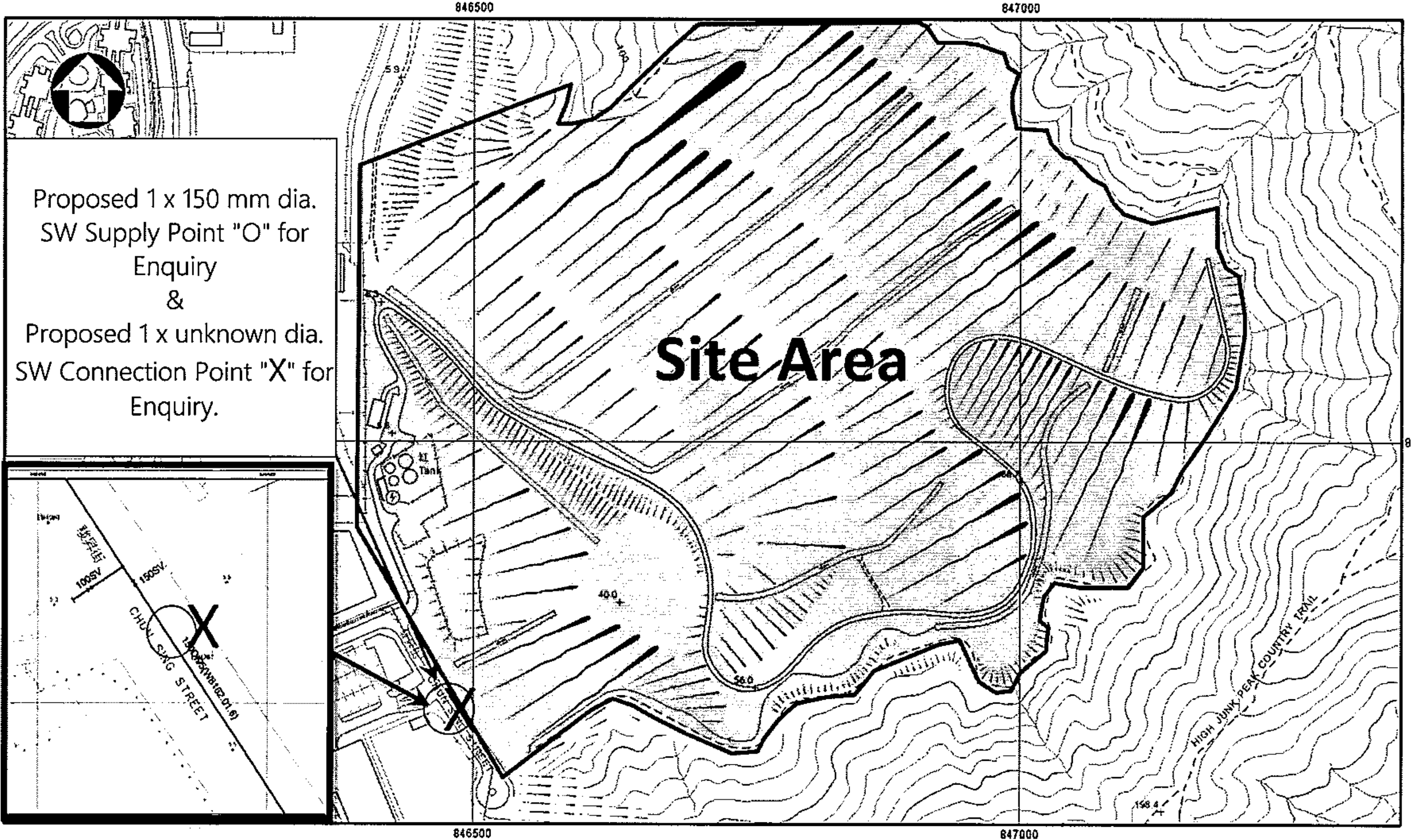
Title

Indicative Master Layout Plan

Checked	SKW	Drawn	RYT
Rev	0	Date	JAN 2026
Scale 1 : 3000		Figure 1.1	

Appendix 2

Layout of Existing Water Supply System


846500
847000
817000
Site Area
Tank
40.0
56.0
CHUN SING STREET
HIGH JUNK PEAK COUNTRY TRAIL
150SV
100SV
X

Proposed 1 x 150 mm dia.
SW Supply Point "O" for
Enquiry
&
Proposed 1 x unknown dia.
SW Connection Point "X" for
Enquiry.

NOTES:

PROPOSED REDEVELOPMENT OF PUBLIC RIDING SCHOOL AT THE RESTORED LANDFILL SITE (TKO II/III), TSEUNG KWAN O, NT

140 70 0 140 Meters

▨ Site Area

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PART COPY OF SALT WATER MAINS RECORD PLAN(S)

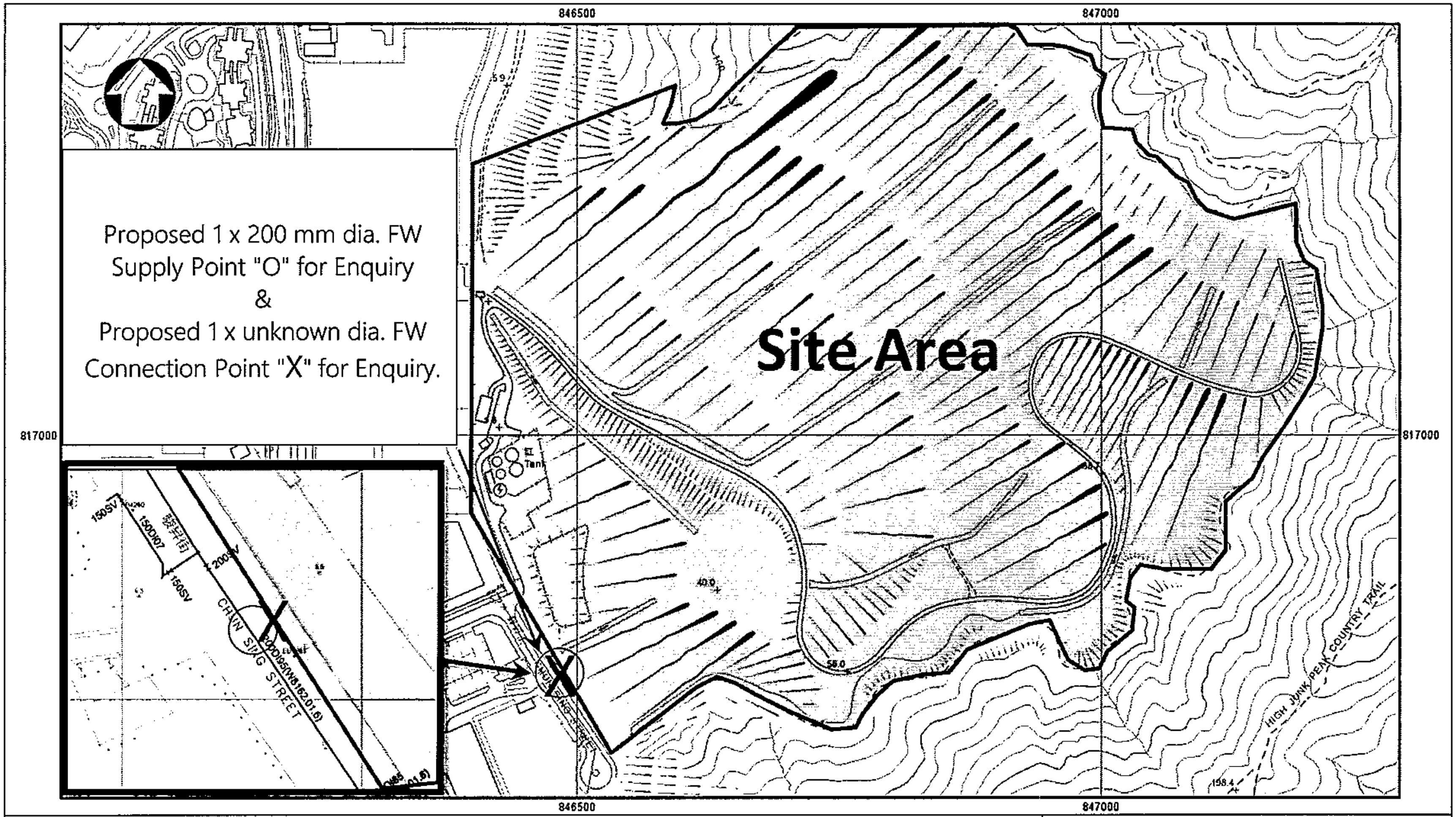
Water Main Record

CCID: 0946683256 (SW)

	Sheet 1 of 1	1:5000

水 務 署
Water Supplies Department

Salt Water Government Main


846500
847000
817000
817000
846500
847000
Site Area
40.0
55.0
Tank
HIGH JUNK PEAK COUNTRY TRAIL
158.4
150SV
200SV
150SV
CHUN SING STREET
X

Proposed 1 x 200 mm dia. FW Supply Point "O" for Enquiry
&
Proposed 1 x unknown dia. FW Connection Point "X" for Enquiry.

NOTES:

PROPOSED REDEVELOPMENT OF PUBLIC RIDING SCHOOL AT THE RESTORED LANDFILL SITE (TKO II/III), TSEUNG KWAN O, NT

140 70 0 140 Meters

■ Site Area

©The Government of the Hong Kong SAR, Map reproduced with permission of the Director of Lands

PART COPY OF FRESH WATER MAINS RECORD PLAN(S)

Water Main Record

CCID: 0946683256 (FW)

Sheet 1 of 1 1:5000

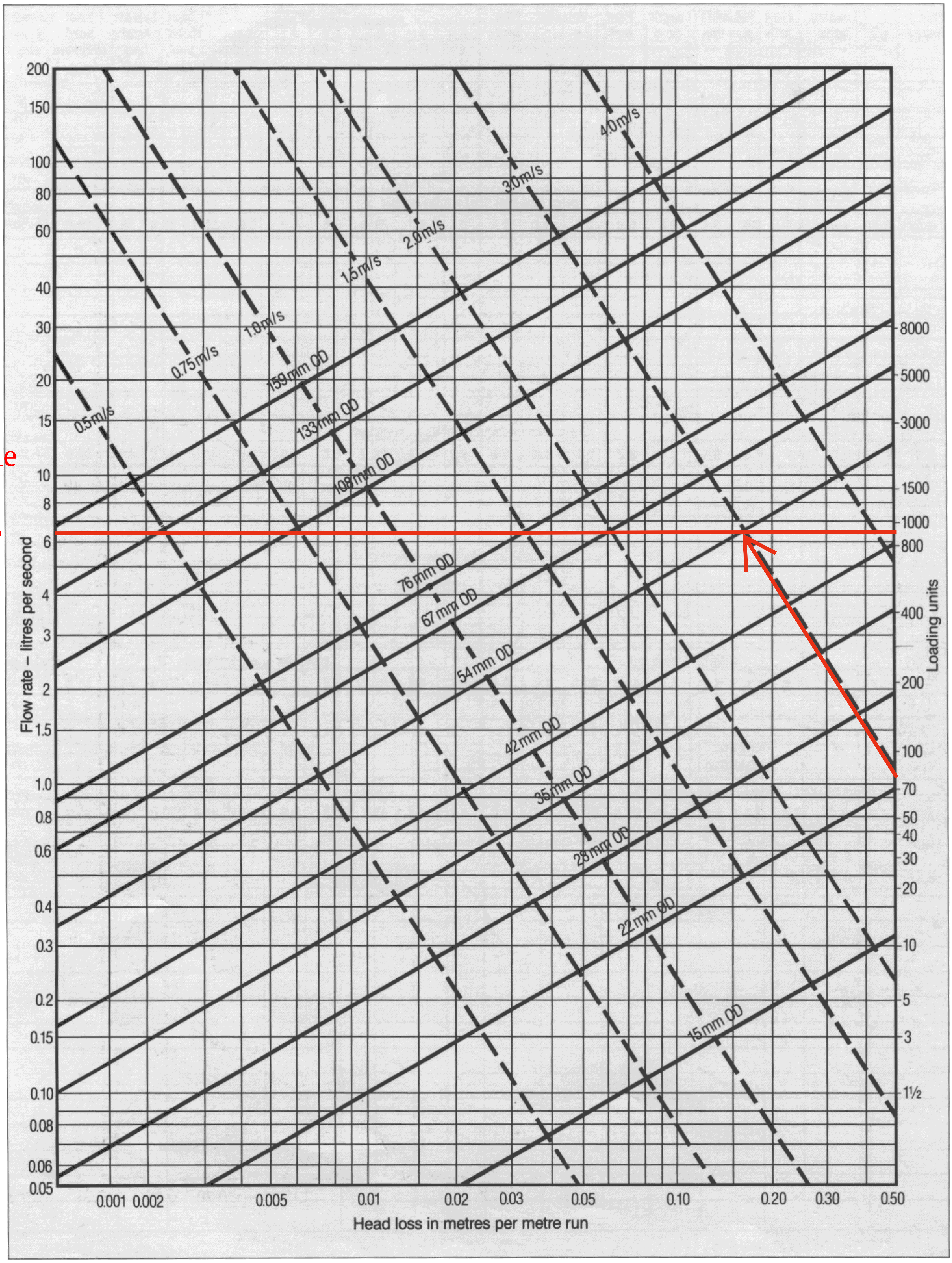
水 務 署
Water Supplies Department

Fresh Water Government Main

Appendix 3

Pipe Sizing Chart for Potable and Flushing Water Pipe

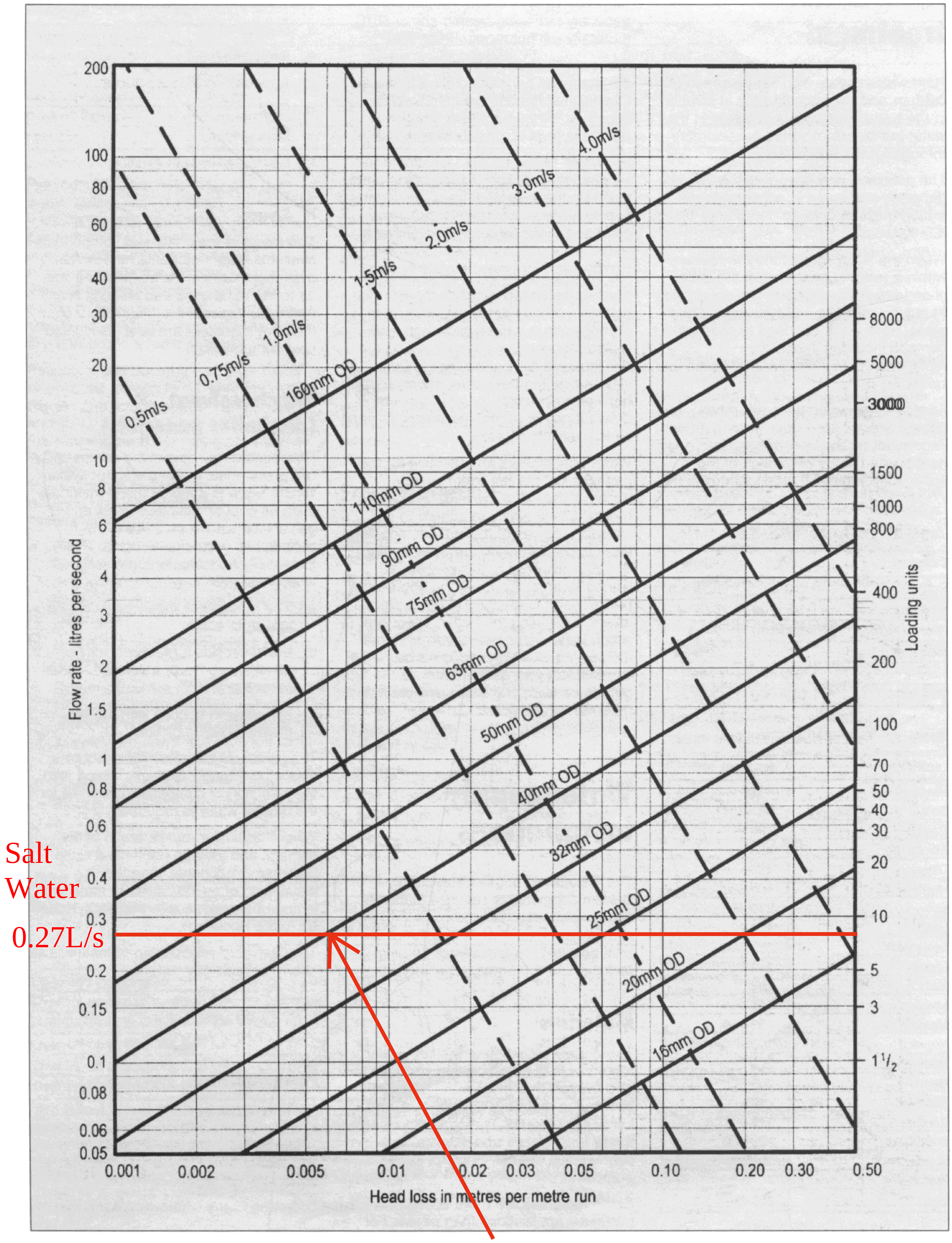
Graph 3 *Pipe sizing chart – copper and stainless steel.*



Potable Water 6.4L/s

DN 54 pipe is used, which is suitable

Graph 4 *Pipe sizing chart – plastic*



Salt Water

0.27L/s

DN 40 pipe is used, which is suitable

UPVC pipe for Flushing Water

Appendix 9

GEOTECHNICAL PLANNING REVIEW REPORT

ARUP

The Hong Kong Jockey Club

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Geotechnical Planning Review Report

Reference: REP-004-02

Rev 2| 30 January 2026

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 304521

Ove Arup & Partners Hong Kong Limited
Level 5 Festival Walk
80 Tat Chee Avenue
Kowloon Tong
Kowloon, Hong Kong
arup.com

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1.1 Project Description 1
1.2 Purpose of this Report 1
2. Site Description 2
2.1 TKOL II/III 2
2.2 The Application Site 2
3. Geotechnical Review 3
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3.2 Desk Study 3
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3.4 Solid and Structural Geology 4
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Appendices

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Previous NTHS Report 2003 A-1

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Appendix C C-1
Previous NTHS Report 2023 C-1

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Detailed Aerial Photograph Interpretation Extracted from Previous NTHS Report 2023 D-1

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Relevant As-built Drawings of Stage II/III Landfill E-1

Appendix F F-1
GEO Memo for Previous NTHS Report 2023 F-1

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Technical Information Kit for TKOL II/III by EPD G-1

Figures

Figure 1.1 Location Plan with S/TKO/31
Figure 1.2 Indicative Scheme of the Proposed Amendment (Master Layout Plan)
Figure 2.1 Site Location Plan
Figure 3.1 Part Plan of Geological Map Sheet 12
Figure 3.2 Existing GI Location
Figure 3.3 Adjacent Registered Man-made Features
Figure 5.1 Typical Section of Proposed Utility Trench

1. Introduction

1.1 Project Description

1.1.1 This Geotechnical Planning Review Report is prepared in support of the Section 16 (“**S16**”) Planning Application to allow for the development of a Public Riding School with ancillary facilities (e.g. utility trench) (collectively as the “**PRS**”) at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, New Territories ("**TKOL II/III**") for the HKJC Public Riding Schools Limited (the “**Applicant**”). The Application Site comprises of three (3) existing platforms and land required for the provision of ancillary utility trench connecting to the three (3) platforms (collectively as the “**Application Site**”) within TKOL II/III. The PRS aligns with the Government’s policy objectives in fostering more public participation in the community through wider visibility and popularity of horse riding, supporting equestrian as an elite sport, and maintaining Hong Kong as a centre for major international sports events.

1.1.2 The Application Site is predominately zoned “Open Space” (“**O**”) on the Approved Tseung Kwan O Outline Zoning Plan No. S/TKO/32 ("**Approved OZP**"), whilst a strip of area at the north is zoned “Green Belt” (“**GB**”) and a minor portion abutting Chun Sing Street is zoned “Other Specified Uses” annotated “Industrial Estate” (“**OU(Industrial Estate)**”) on the Approved OZP. The PRS with ancillary facilities (‘Horse Riding School’ subsumed under ‘Place of Recreation, Sports or Culture’ use) is a Column 2 use under the “O”, “GB” and “OU(Industrial Estate)” zones that may be permitted with or without conditions on Application under S16 of the Town Planning Ordinance (“**TPO**”). There are no plot ratio (“**PR**”), building height (“**BH**”), and site coverage (“**SC**”) restrictions imposed on the “O”, “GB” and “OU(Industrial Estate)” zones of the Approved OZP. While a portion of TKOL II/III falls within the Clear Water Bay Country Park (“**CWBCP**”), the Application Site does not involve any areas falling within the Country Park Boundary.

1.1.3 The PRS is located on three (3) platforms, namely the Lower Platform (i.e. Reception and Hospitality Lounges) (approx.+6.0mPD), Middle Platform (i.e. Pony Paddock & Pavilion I)(approx. +40.0mPD) and Upper Platform (i.e. Horse Paddock & Pavilion II) (approx.140.0mPD), with a proposed total GFA of approx. 9,000m^2 and a proposed building height of 4.8m to 7.7m. An ancillary utility trench connecting to the three (3) platforms is also proposed to accommodate various essential utilities services in support of the PRS operations.

1.2 Purpose of this Report

1.2.1 The location of the Application Site and the indicative scheme for the proposed development is shown in **Figure 1.1** and **Figure 1.2** respectively.

1.2.2 This Geotechnical Planning Review Report provides the following assessment to support the planning application for the PRS:

- Summary of the available geotechnical information for the Application Site;
- Initial review of the geotechnical issues relating to the proposed development; and
- Proposed works and the corresponding impact on the existing slope features.

2. Site Description

2.1 TKOL II/III

2.1.1 TKOL II/III has a total area of about 40 hectares with the large level difference from approx. +5mPD up to approx. +140mPD. There are three relatively flat platforms (namely Upper Platform, Middle Platform and Lower Platform) at the elevation of approx. +140mPD, +40mPD and +6mPD respectively with about 43,700 m^2 which can be utilized for the PRS. The location of TKOL II/III is shown in **Figure 2.1**.

2.2 The Application Site

2.2.1 For the S16 application purpose, the Application Site in this report comprises of three (3) existing platforms and land required for the provision of ancillary utility trench connecting to the three (3) platforms within TKOL II/III. The extent of the Application Site is also shown in **Figure 2.1**.

2.2.2 The Application Site is surrounded by a number of existing registered man-made features, namely Feature Nos. 12SW-A/F67, 12SW-A/F68, 12SW-A/F69, 12SW-A/F70, 12SW-A/F72, 12SW-A/F73, 12SW-A/F74, 12SW-A/F96, 12SW-A/C203, 12SW-A/C227, and 12SW-A/C228.

3. Geotechnical Review

3.1 Previous Natural Terrain Hazard Studies and Geotechnical Assessment

3.1.1 Two different studies were carried by EPD and HKJC separately in 2003/2004 and 2023 respectively for geotechnical review / natural terrain hazard study for any potential afteruse development. The aforementioned studies have been summarized in **Table 3-1** below and enclosed in **Appendix A**, **Appendix B** and **Appendix C** for reference.

Table 3-1 Summary of Previous Studies

Report Date	Report Title	Prepared By	Appendix No.
February 2003	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development – Natural Terrain Hazard Assessment Report [Report No. 382311/NTHA/Revised Issue 2]	Binnie Black & Veatch Hong Kong Limited (under EPD)	Appendix A
January 2004	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development – Final Geotechnical Assessment Report [Report No. 382311/FGAP/ Issue 1]	Binnie Black & Veatch Hong Kong Limited (under EPD)	Appendix B
January 2023	Natural Terrain Hazard Study Report for the Proposed Development of New Public riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL II/III)	Modern Consulting Engineers Limited (under HKJC)	Appendix C

3.2 Desk Study

3.2.1 A desk study has been carried out to support the geotechnical appraisal. The desk study included a review of the general site history through aerial photograph interpretation (API); the checking of the condition and engineering status of the existing registered man-made features within and adjacent to the Application Site; gathering and review of existing ground investigation (GI) records; and a review of topographic conditions to determine the need (or otherwise) for further assessment of natural terrain hazards. The API refer to the previous study carried out by Modern Consulting Engineers Limited in January 2023 (Modern, 2023) is extracted and enclosed in **Appendix D** for natural terrain hazard assessment. All salient geological features, hydrology, change of land use, past instability, ground condition and any potential geological or landslide problems have been identified and documented within this.

3.3 Published Geology

3.3.1 The Application Site is covered by the following geological publication and references:-

- Hong Kong Geological Survey Sheet 12 (1:20,000) “Solid and Superficial Geology for Hong Kong and Kowloon (1989);
- Hong Kong Geological Survey Memoir No. 4 (1990);
- Geological Area Studies Programme VII – Clear Water Bay (1988);

- The Pre-Quaternary Geology of Hong Kong, with the 1:100 000 Geological Map of Hong Kong (2000); and
- The Quaternary Geology of Hong Kong (2000).

3.4 Solid and Structural Geology

3.4.1 The published 1:20,000 scale solid and superficial map sheet no. 12 (GEO, 1989), and the published 1:100,000 scale geological map indicate that the solid geology of the Upper Platform is dominated by the Trachydacite lava of the Ta Miu Wan Member of the Clear Water Bay Formation (Jmw), with the minor northeastern-most portion falls within the fine ash Tuff of the Clear Water Bay Formation (fa). Whilst for the Middle and Lower Platform, only limited extent of solid geology of tuffaceous mudstone, siltstone and breccia of Jurassic Mang Kung Uk Formation (JMK) are recorded near the boundary.

3.4.2 The major structural features recorded in the published geological maps consist of three (3) nos. of NW-SE trending faults situated to the southeast of TKOL II/III. A NE-SW trending fault is also recorded around 25m to the southwest of the Middle Platform. Fractured fault materials and deepening of rockhead could be encountered near the recorded faults.

3.5 Superficial Geology

3.5.1 According to the published 1:20,000 scale geological map, extensive quaternary marine mud (QHH) with fill is recorded at the Lower Platform, with minor extent of marine sand (ms) is recorded at the northern tip of the Lower Platform. The Middle Platform is situated within a variety of quaternary superficial deposits, consisting of alluvium (Qa), beach deposits (Qb), marine sand (ms) and debris flow deposits (Qd). Whilst only a minor portion of the Upper Platform consists of superficial deposits of debris flow deposits (Qd).

3.5.2 In addition to the published geology, as the Application Site was used for landfill purpose from 1988 to 1994; majority of the Application Site was underlain by the waste fill materials, comprising mixed domestic, commercial, construction and special wastes. A capping layer had been constructed on top of the landfills after the completion of the operation of the landfill in 1994.

3.6 Existing Ground Investigation Data

3.6.1 Existing Ground Investigation (GI) information for the proposed works' boundary has been retrieved from the Geotechnical Information Unit (GIU), Geotechnical Engineering Office (GEO) of CEDD. The previous investigations conducted in the vicinity of TKOL II/III are summarized in **Table 3-1** below and shown in **Figure 3.2**.

GIU Ref.	Year	Contractor	Report Title
05396	1984	Gammon (Hong Kong) Limited	Junk Bay Controlled Tip, Stages II & III, Phase I & II Site Investigation Report
05553	1984	Gammon (Hong Kong) Limited	Junk Bay Controlled Tip Stage II Site Investigation Report
05554	1984	Gammon (Hong Kong) Limited	Junk Bay Controlled Tip Stage I Site Investigation Report
06641	1985	Gammon (Hong Kong) Limited	Junk Bay Controlled Additional Marine Site Investigation Report
12800	1990	Lam Geotechnics Limited	Junk Bay Landfill Stage II & III Site Investigation Report
18164	1993	Enpack (Hong Kong) Limited	Tseung Kwan O Landfill Stage II/III Slope Monitoring Works Final Report

GIU Ref.	Year	Contractor	Report Title
21370	1996	Geotechnics & Concrete Engineering (Hong Kong) LTD.	Restoration of Tseung Kwan O Landfills Provision of Monitoring Holes in Tseung Kwan O Stage II/III Landfill Ground Investigation Report
24046	1991	Gammon (Hong Kong) Limited	Project No. 5021 Dr Tseung Kwan O Landfill Stage III Phase I Geotechnical Submission - Borrow Area

3.6.2 Most of the GIs were completed prior to the construction of the TKOL II/III. As the TKOL II/III was carried out later than most of the exiting ground investigation, only limited GIs provides information on waste fill and capping fill thicknesses.

3.6.3 TKOL II/III was modelled by GI information extracted from GIU and supplemented by the as-built drawing nos. STG2/STE/DRW/001, 011 and 012/R and NDD/6235 to 6242 of the landfill site enclosed in **Appendix E**. From the information available, the landfill comprises approximately 1.35m thick fill capping layer overlaying the waste body. For the northeast part of TKOL II/III, the waste fill is mainly underlain by Completely/Highly Decomposed Volcanic rocks (C/HDV); while the southwest part of TKOL II/III, due to the historical reclamation works, marine mud and alluvium with limited thickness may be found below the waste fill.

3.7 Existing Man-made Features

3.7.1.1 A total of 5 nos registered man-made features that overlap or are in close proximity with the Application Site are recorded in the GEO Slope Information System (SIS). A summary of the feature registration numbers, responsible maintenance parties and current study status retrieved from the Landslip Prevention Measures Information System (LPMIS) for these features are provided in **Table 3-2**. The feature extent and locations are presented in **Figure 3.3.**

Table 3-3 Summary of Existing Features

Existing Feature	Maintenance	Maximum Height (m)	Length (m)	Average Angle (degree)
12SW-A/F67	EPD	32	440	20
12SW-A/F68	EPD	28	396	25
12SW-A/F70	EPD	20	210	20
12SW-A/F73	EPD	30	145	25
12SW-A/F96	EPD	8	200	35

The detail descriptions of the registered features are presented as follows:

3.7.2 Feature No. 12SW-A/F67
The feature is a southwestern-facing soil fill slope, located in the western portion of TKOL II/III. The slope portion is about 32m high with a slope angle of 20°.

The northern portion of the feature is overlapping with the Application Site at the lower platform. The southern portion of the feature is overlapping with the Application Site at the middle platform.

3.7.3 Feature No. 12SW-A/F68
The feature is a southwestern-facing soil fill slope, located in the western portion of TKOL II/III. The slope portion is about 28m high with a slope angle of 25°.

The southern portion of the feature is overlapping with the Application Site at the middle platform.

3.7.4 Feature No. 12SW-A/F70

The feature is a southwestern-facing soil fill slope, located in the western portion of TKOL II/III. The slope portion is about 20m high with a slope angle of 20°.

The southern portion of the feature is overlapping with the Application Site at the middle platform.

3.7.5 Feature No. 12SW-A/F73

The feature is a southwestern-facing soil cut slope, located in the eastern portion of TKOL II/III. The slope portion is about 30m high with a slope angle of 20°.

The northern portion of the feature is overlapping with the Application Site at the upper platform.

3.7.6 Feature No. 12SW-A/F96

The feature is a northeastern-facing soil fill slope, located in the eastern portion of TKOL II/III. The slope portion is about 8m high with a slope angle of 35°.

The feature is located along the edge of the Application Site at the middle platform.

3.8 Stage 2 Study Report

3.8.1 The GIU did not contain the record of any Stage 2 Study Report covering the features around TKOL II/III area likely due to Stage 2 Studies have not been carried out for those features as they were previously under the maintenance responsibility of the EPD.

4. Natural Terrain Hazard Study

4.1 Overview

4.1.1 The Natural Terrain Hazard Study (NTHS) has been looked at extensively in the previous studies that were done by Binnie Black & Veatch Hong Kong Limited (B&V) under EPD in 2003/2004 and Modern Consulting Engineers Limited (Modern) under HKJC in 2023. The NTHS was initially investigated by B&V in 2003 with a production of NTHS report (**Appendix A**); then in 2004, the NTHS was reviewed again by B&V in a Geotechnical Assessment Report (**Appendix B**), where a passive mitigation measure so called 'no-build zone' was introduced.

4.1.2 Subsequently in 2023, the NTHS done by B&V, as well as the proposed 'no-build zone', for the Upper Platform area was further reviewed and validated by Modern. The corresponding reports can be found in **Appendix C**. The report was approved by GEO and the approval memo dated 18 May 2023 is enclosed in **Appendix F**.

4.1.3 The three reports mentioned above covered the engineering geological assessment, natural terrain hazard review, natural terrain hazard assessment and hazard mitigation strategy in accordance with GEO SPR 1/2002 and GEO Report No. 138 (2nd Edition) respectively.

4.1.4 It should be noted that as discussed in Section 2.2 of the previous NTHS report by Modern in 2023, a natural terrain hazard screening had been carried out following the "In-principle Objection Criteria" and the "Alert Criteria" according to the GEO Report No. 138 2nd Edition, for the three (3) platforms (Lower Platform, Middle Platform and Upper Platform) at the PRS.

4.1.5 The screening result indicated that the measured angular elevations from the natural terrain catchments to the Lower and Middle Platforms range between 16° and 18°, which did not satisfy the alert criteria. As a result, the natural terrain hazard study is considered not required for these two (2) platforms. This screen result is considered to be still valid taking into account the current proposed development layout and location at Lower and Middle Platform.

4.2 Natural Terrain Hazard Assessment

4.2.1 The Design Event Approach (DEA) has been promulgated in both of the above-mentioned NTHS reports. This comprises the standard method for the assessment of natural terrain hazards and involves the classification of catchments as either Level 1 catchments suitable for the application of prescriptive mitigation measures or Level 2 catchments requiring measures to be designed through the determination of a Design Event volume, and the debris mobility modelling has been carried out to simulate the design event and the potential natural terrain hazard.

4.3 Natural Terrain Hazard Mitigation Strategy

4.3.1 Following the Geotechnical Assessment Report that were done by B&V in 2004, a 'no-build zone' was established for the Site as passive natural terrain hazard mitigation measure and was defined as one meter further away from the calculated debris run-distances, outside which no development will be affected by any potential natural terrain hazard. The proposed extent of the 'no-build zone' by B&V in 2004 can be found in **Figure 1.2**.

4.3.2 The NTHS report by Morden in 2023 had reviewed and validated this "No-build Zone" for the Upper Platform only, which was considered to be reasonable since the Middle and lower Platforms will not be affected by natural terrain hazard based on the initial screening.

4.3.3 Additionally, at the time of writing this report, a preliminary review on the previous studies has been carried out. The initial findings suggest that the 'no-build zone' was established in a reasonably conservative manner and is considered still valid for the purpose of current assessment.

4.3.4 As indicated in **Figure 1.2,** the entire Middle and Lower Platforms are located outside the 'no-build zone' and will not be affected by natural terrain hazard. However, it should be noted the 'no-build zone' encroaches slightly into the Upper Platform in the north and part of the proposed EVA/Driveway, ancillary E&M facillities, and wash box facilities located within the 'no-build zone'. The need to relocate or mitigate the EVA (e.g. concrete retaining wall), ancillary E&M facillities and wash box facilities shall be further reviewed at the later stage of the project, taking into account the GEO Report No. 138 (2nd Edition) requirement and the operational need of the project.

4.3.5 Additional, two (2) boulders within natural terrain area have also been recommended to be removed or in-situ stabilized as a precautionary measure based on the previous studies. This requirement should also be reviewed at the later stage.

5. Proposed Geotechnical Works

5.1 General

5.1.1 The Application Site area comprises three relatively flat platforms (namely Upper Platform, Middle Platform and Lower Platform) and are surrounded by mainly natural terrain and several registered features, where the slope angles range between 20 and 35 degrees. Minimal site formation works are expected within the three platforms as they have already been formed with fairly flat areas as part of the landfill site construction works.

5.1.2 The proposed excavation works will be limited to a depth of 500mm as requested by EPD to protect the LLDPE layer which forms part of the landfill site capping layer.

5.1.3 As extracted from the Technical Information Kit for TKOL II/III by EPD **(Appendix G)**, the planned development loads at the three platforms have been limited to 50kPa for Upper and Lower Platforms and 40kPa for Middle Platform for the purpose of protecting the underground restoration facilities. In order to maximise the development potential of the three platforms, the current proposed master layout plan will lead to maximum design load up to the load limit as set up by EPD.

5.1.4 In view of the excavation depth constraints and the gentle sloping ground at the platforms, stepped raft foundations may be considered as the foundation type to suit the existing topography and limit the excavation depth. Nevertheless, to further control the magnitude of the total development load to be below 50/40kPa, stepped raft foundations are likely to be upgraded into stepped cellular raft foundations, which comprises flat upper (suspended) slab and stepped bottom (ground bearing) slab with two-way interlocking vertical structural elements (concrete walls). This could effectively limit the thickness of the raft, keep the weight of the foundation to a minimum and helps to form flat areas for the superstructures.

5.1.5 Furthermore, utilities trenches have been proposed at the landfill slope surface to accommodate proposed essential utilities in supporting the operation of PRS. A typical section of the utility trench can be found in Figure 5.1. The total weight of the utility trench is considered to be less than 5kPa, which is quite manageable from the slope stability point of view. The details of the utility trench shall be further studies at the later stage of the project.

5.2 Impact on Existing Features

5.2.1 The load limits as mentioned in **Section 5.1.3** have been used to check the impact on stability of the existing man-made features affecting or being affected by the Application Site, including Feature nos.: 12SW-A/F 67, 12SW-A/F 68, 12SW-A/F 70, 12SW-A/F 73 and 12SW-A/F96.

5.2.2 The required factor of safety (FoS) of those concerned features affecting or being affecting by the Application Site is determined based on the "Consequence-to-life" and "Economic Consequence" categories in accordance with the guidelines provided in GEO TGN No. 15 and WBTC No. 13/1999. A FoS of up to 1.4 was found to be required for all the above-mentioned features affecting or being affecting by the Application Site.

5.2.3 The preliminary stability assessment suggested the FoS of the existing features nos. 12SW-A/F 67, 12SW-A/F 68, 12SW-A/F 70, 12SW-A/F 73 and 12SW-A/F96 affecting or being affecting by the Application Site are up to the required value of 1.4 and is considered to be satisfactory to the current standard. A sensitivity of the slope stability check for increased development load from 40kPa to 50kPa for Middle Platform also suggested the FoS of all features affecting or being affecting Middle Platform is still up the required standard of 1.4. The potential of adopting a higher load of 50kPa for the development in Middle Platform will be investigated in detail at a later stage of the project.

6. Conclusion and Recommendation

6.1 Conclusion and Recommendation

6.1.1 A geotechnical planning review has been conducted for the HKJC Public Riding School (PRS) at the three platforms and the land required for the provision of ancillary utility trench connecting to the platforms to accommodate proposed essential utilities in supporting the operation of PRS within the restored landfill site (TKOL II/III) in Tseung Kwan O that may affect, or be affected by, natural terrain of man-made slopes or retaining wall features in accordance to GEO Advice Note for Planning Application under Towen Planning Ordinance (Cap. 131). The Indicative Scheme of the Development Site comprises various structures and stables spread across three platforms.

6.1.2 The review has been carried out based on the findings of desk studies, aerial photo interpretation (API) and site inspection of TKOL II/III and the adjacent natural terrain catchments. TKOL II/III is located at the toe of the few catchments.

6.1.3 The Natural Terrain Hazard Study covered the engineering geological assessment, natural terrain hazard review, natural terrain hazard assessment and hazard mitigation strategy has been carried out for TKOL II/III, which indicates there is potential natural terrain hazard at the natural terrain catchments overlooking TKOL II/III. The 'no-build zone' has thus been delineated for TKOL II/III, with localised in-situ stabilization of boulders.

6.1.4 Schematic plans of PRS development have been proposed. The structures are proposed on the platforms and will adopt a stepped-raft foundation to follow the elevation of the terrain and limit excavation depth to within 500mm.

6.1.5 The planned development load at the three platforms has been limited to 50kPa for Upper and Lower Platforms and 40kPa for Middle Platform. However, the preliminary slope stability assessment suggested the FoS of the existing landfill slopes are still satisfactory even with 50kPa load at all the platforms. The potential of adopting a higher load (50kPa) at Middle Platform will be explored in detail at the later stage of the project.

6.1.6 In conclusion, the proposed redevelopment is considered to be feasible from the geotechnical perspective.

7. References

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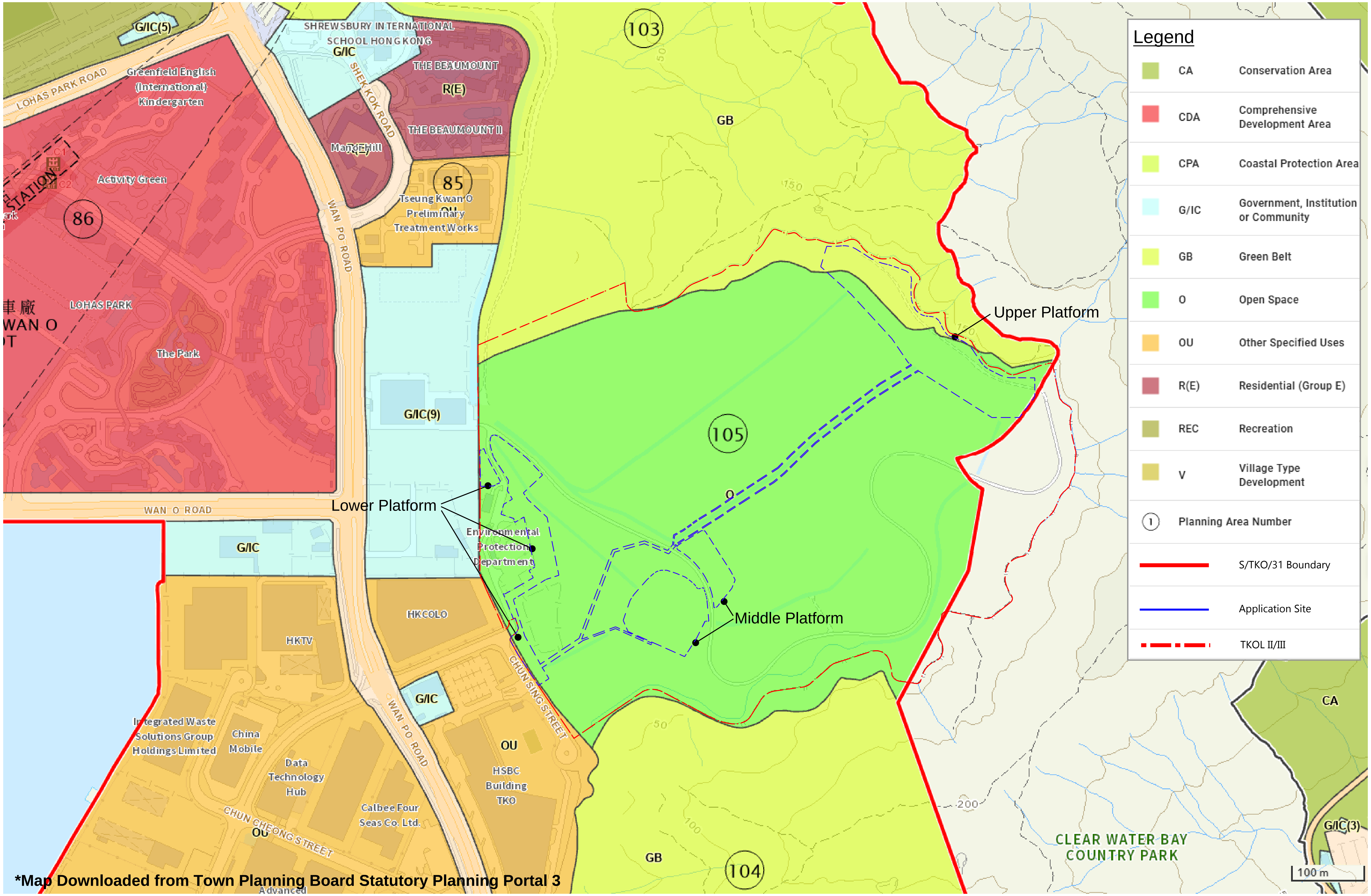
Figures


Legend
CA Conservation Area
CDA Comprehensive Development Area
CPA Coastal Protection Area
G/IC Government, Institution or Community
GB Green Belt
O Open Space
OU Other Specified Uses
R(E) Residential (Group E)
REC Recreation
V Village Type Development
1 Planning Area Number
S/TKO/31 Boundary
Application Site
TKOL II/III
Upper Platform
Lower Platform
Middle Platform
103
104
105
85
86
GB
O
OU
CA
G/IC
G/IC(5)
G/IC(9)
G/IC(3)
R(E)
SHREWSBURY INTERNATIONAL SCHOOL HONG KONG
THE BEAUMOUNT
THE BEAUMOUNT II
Man Chi Hill
Greenfield English (International) Kindergarten
LOHAS PARK ROAD
Activity Green
LOHAS PARK
The Park
WAN PO ROAD
SHEK KOK ROAD
WAN O ROAD
Tseung Kwan O Preliminary Treatment Works
Environmental Protection Department
HKCOLO
HKTV
Integrated Waste Solutions Group Holdings Limited
China Mobile
Data Technology Hub
Calbee Four Seas Co. Ltd.
HSBC Building TKO
CHUN SING STREET
CHUN CHEONG STREET
CLEAR WATER BAY COUNTRY PARK
50
100
150
200
100 m

*Map Downloaded from Town Planning Board Statutory Planning Portal 3

Job Title

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing Title

Location Plan with S/TKO/31

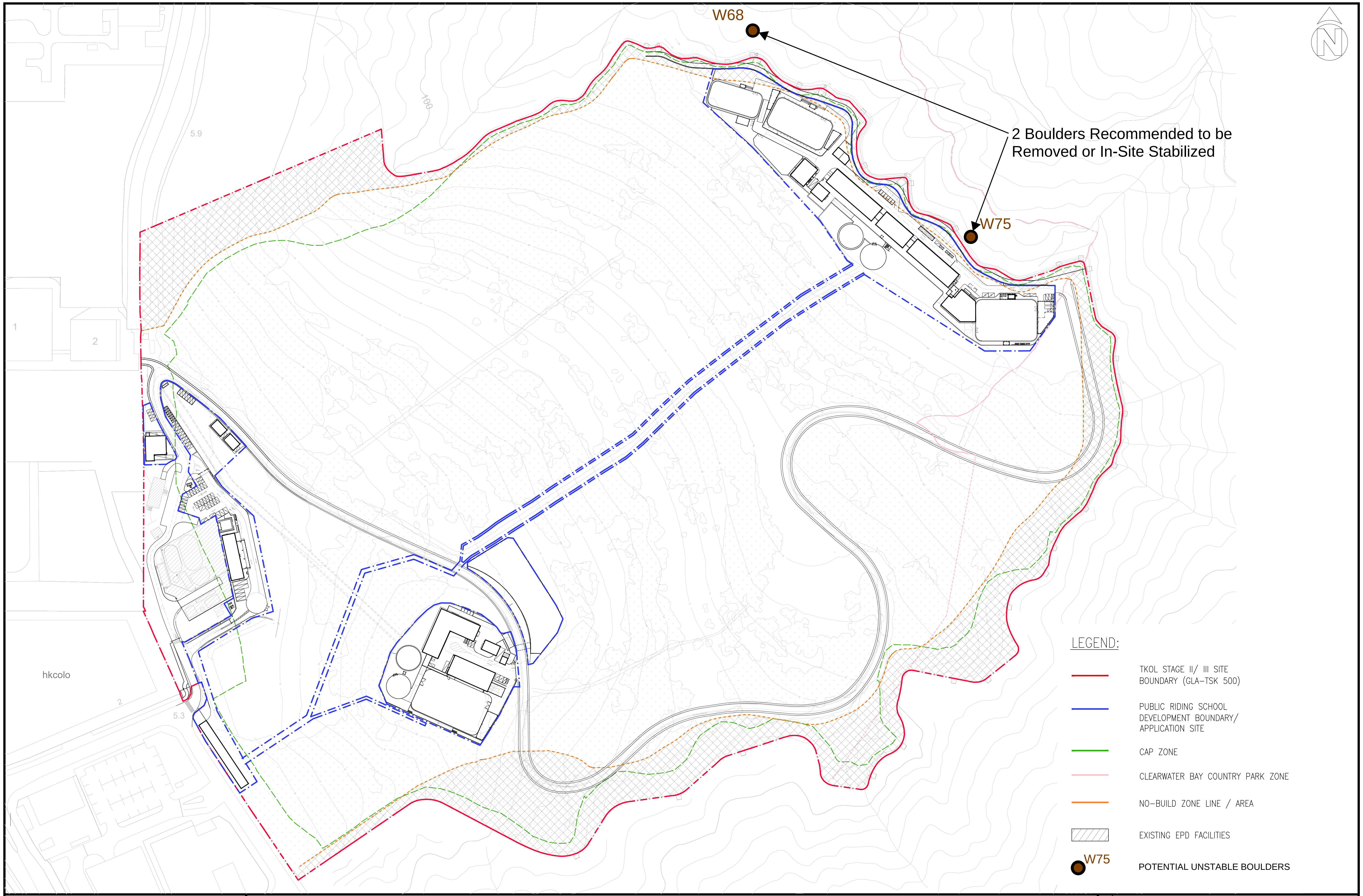
ARUP

Scale As Shown

Drawn by: WT Date July 25 Checked: MX Approved: JL

Job No. **304521**

Figure No. **FIGURE 1.1**


W68
2 Boulders Recommended to be Removed or In-Site Stabilized
W75
N
100
5.9
1
2
hkcolo
2
5.3
LEGEND:
TKOL STAGE II/ III SITE BOUNDARY (GLA–TSK 500)
PUBLIC RIDING SCHOOL DEVELOPMENT BOUNDARY/ APPLICATION SITE
CAP ZONE
CLEARWATER BAY COUNTRY PARK ZONE
NO–BUILD ZONE LINE / AREA
EXISTING EPD FACILITIES
W75
POTENTIAL UNSTABLE BOULDERS

Job Title

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing Title

Indicative Scheme of the Proposed Amendment (Master Layout Plan)

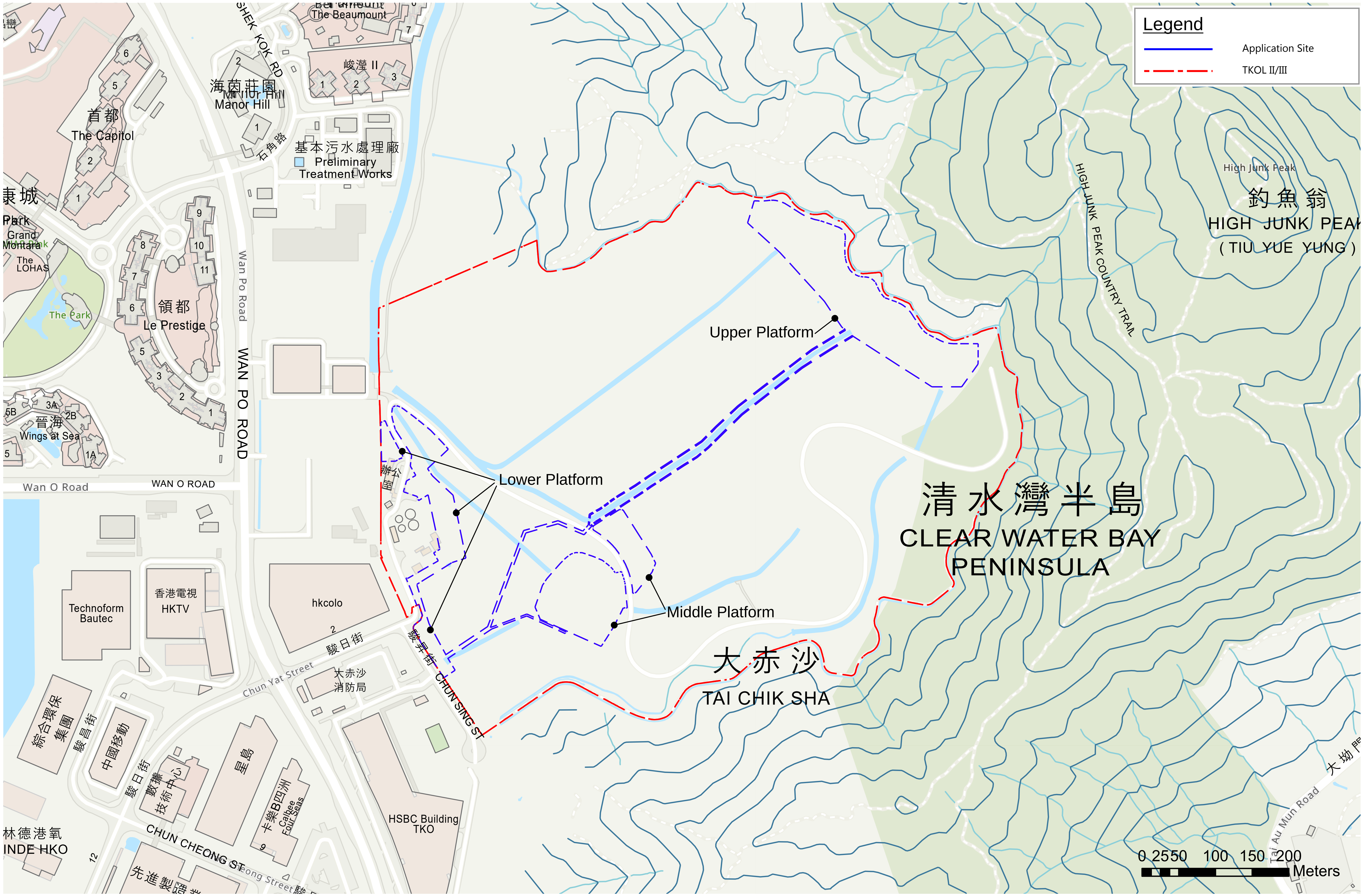
ARUP

Scale 1:3000 (A3)

Drawn by: WT Date July 25 Checked: MX Approved: JL

Job No. **304521**

Figure No. **FIGURE 1.2**


Legend
Application Site
TKOL II/III
Upper Platform
Lower Platform
Middle Platform
清 水 灣 半 島
CLEAR WATER BAY
PENINSULA
大 赤 沙
TAI CHIK SHA
High Junk Peak
釣 魚 翁
HIGH JUNK PEAK
(TIU YUE YUNG)
HIGH JUNK PEAK COUNTRY TRAIL
Tai Au Mun Road
大 坳 門
0 25 50 100 150 200
Meters
The Beaumount
峻瀅 II
SHEK KOK RD
石角路
海茵莊園
Manor Hill
首都
The Capitol
基本污水處理廠
Preliminary Treatment Works
康城
Park
Grand Montara
The LOHAS
The Park
領都
Le Prestige
晉海
Wings at Sea
Wan Po Road
WAN PO ROAD
Wan O Road
WAN O ROAD
Technoform Bautec
香港電視
HKTV
hkcolo
駿日街
駿昇街
CHUN SING ST
Chun Yat Street
大赤沙
消防局
綜合環保集團
駿昌街
中國移動
駿日街
數據技術中心
星島
卡樂B四洲
Calbee Four Seas
HSBC Building TKO
林德港氧
INDE HKO
CHUN CHEONG ST
Chun Cheong Street
先進製造業

Job Title

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing Title

Site Location Plan

ARUP

Scale 1:3000 (A3)

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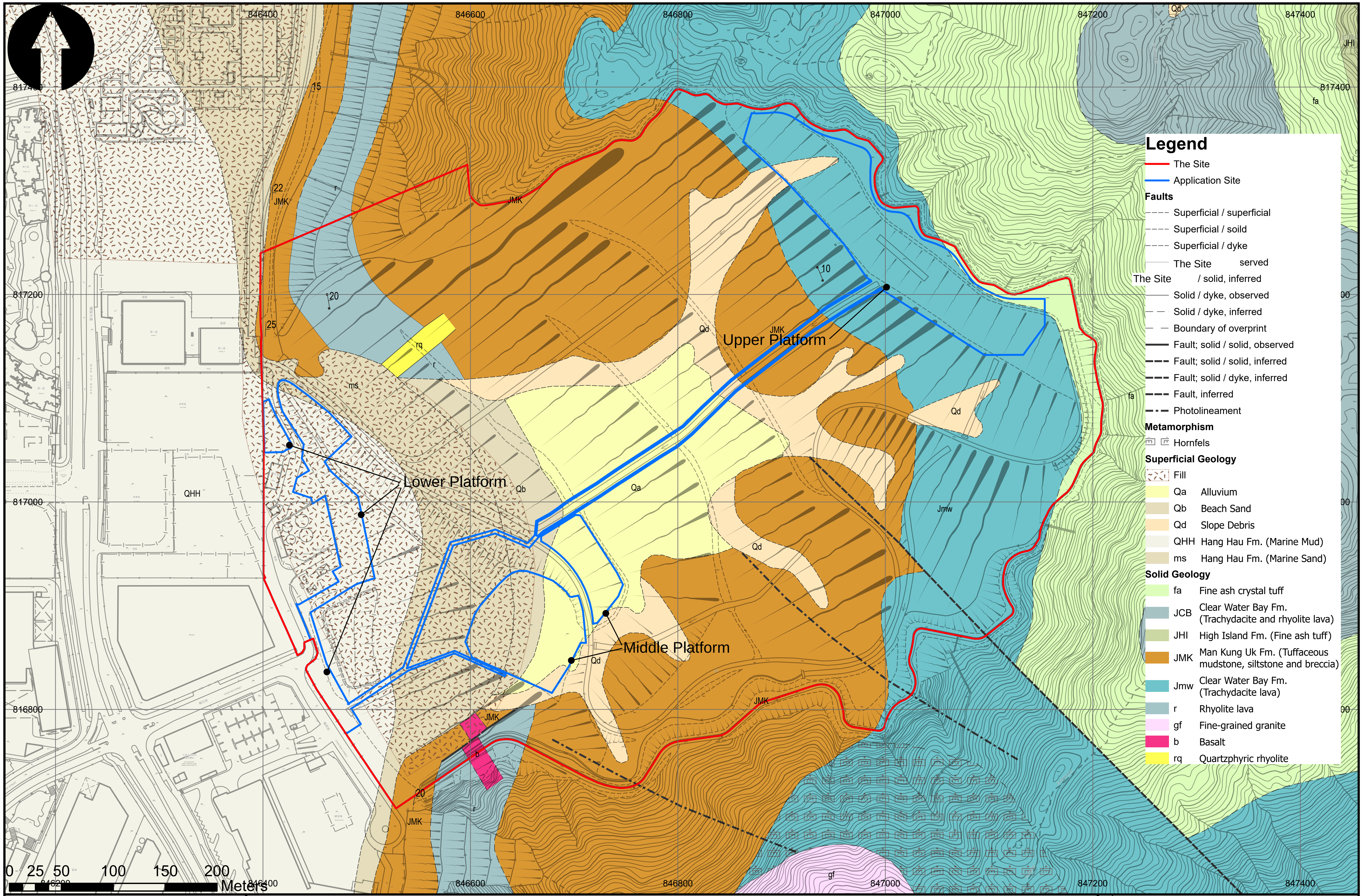
Checked: MX
Approved: JL

Job No. **304521**

Figure No. **FIGURE 2.1**


846400
846600
846800
847000
847200
847400
817400
817200
817000
816800
Legend
The Site
Application Site
Faults
Superficial / superficial
Superficial / soild
Superficial / dyke
The Site served
The Site / solid, inferred
Solid / dyke, observed
Solid / dyke, inferred
Boundary of overprint
Fault; solid / solid, observed
Fault; solid / solid, inferred
Fault; solid / dyke, inferred
Fault, inferred
Photolineament
Metamorphism
Hornfels
Superficial Geology
Fill
Qa Alluvium
Qb Beach Sand
Qd Slope Debris
QHH Hang Hau Fm. (Marine Mud)
ms Hang Hau Fm. (Marine Sand)
Solid Geology
fa Fine ash crystal tuff
JCB Clear Water Bay Fm. (Trachydacite and rhyolite lava)
JHI High Island Fm. (Fine ash tuff)
JMK Man Kung Uk Fm. (Tuffaceous mudstone, siltstone and breccia)
Jmw Clear Water Bay Fm. (Trachydacite lava)
r Rhyolite lava
gf Fine-grained granite
b Basalt
rq Quartzphyric rhyolite
Upper Platform
Lower Platform
Middle Platform
JMK
Qd
Qa
Qb
QHH
ms
rq
r
Jmw
fa
JHI
gf
b
15
22
20
25
10
0 25 50 100 150 200
Meters

Job Title

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing Title

Part Plan of Geological Map Sheet 12

ARUP

Scale As Shown

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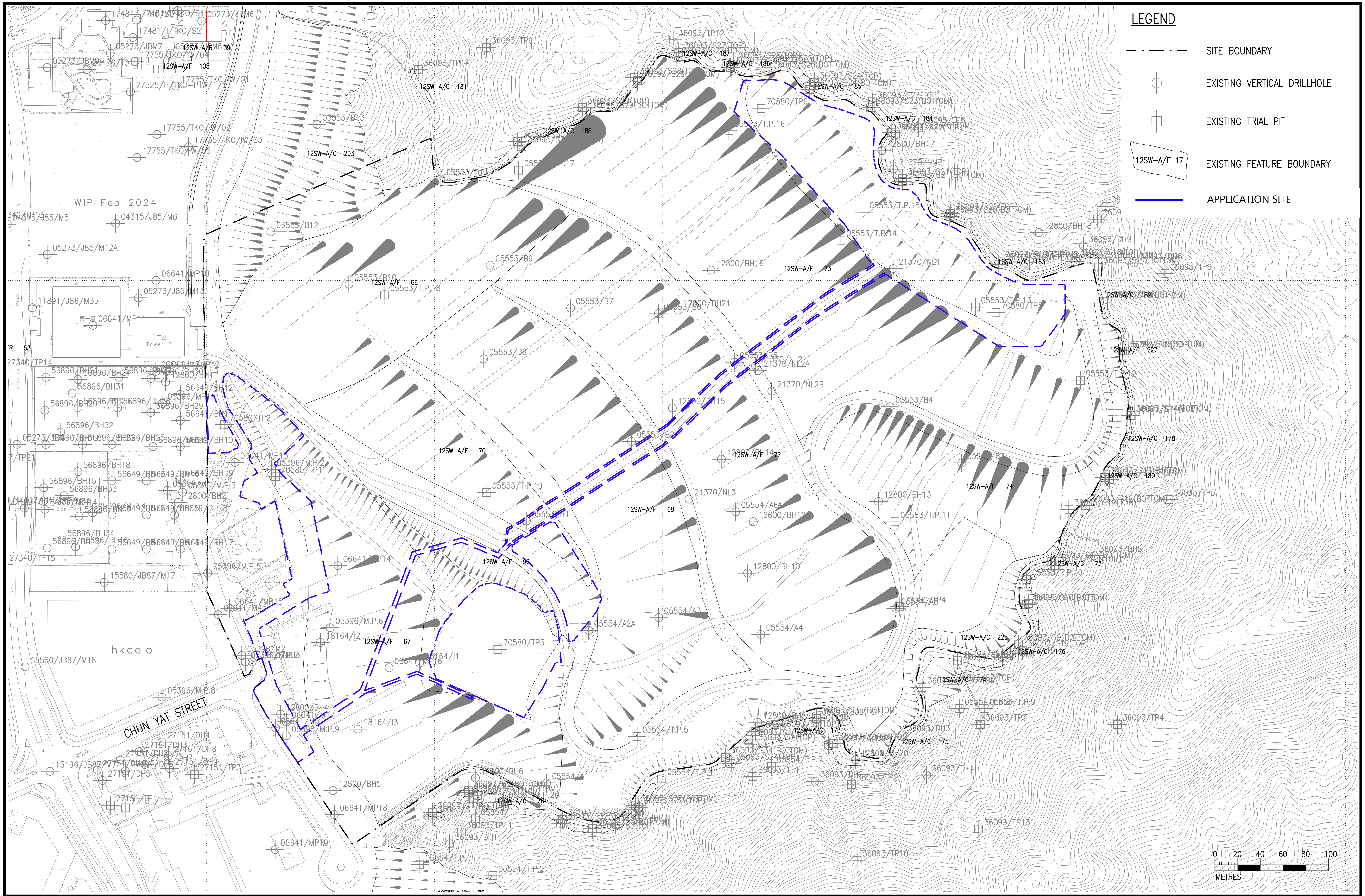
Date May 25
Checked: MX
Approved: JL

Job No. **304521**

Figure No. **FIGURE 3.1**


LEGEND
SITE BOUNDARY
EXISTING VERTICAL DRILLHOLE
EXISTING TRIAL PIT
12SW-A/F 17
EXISTING FEATURE BOUNDARY
APPLICATION SITE
0 20 40 60 80 100
METRES
WIP Feb 2024
CHUN YAT STREET
hkcolo

Job Title

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing Title

Existing GI Location

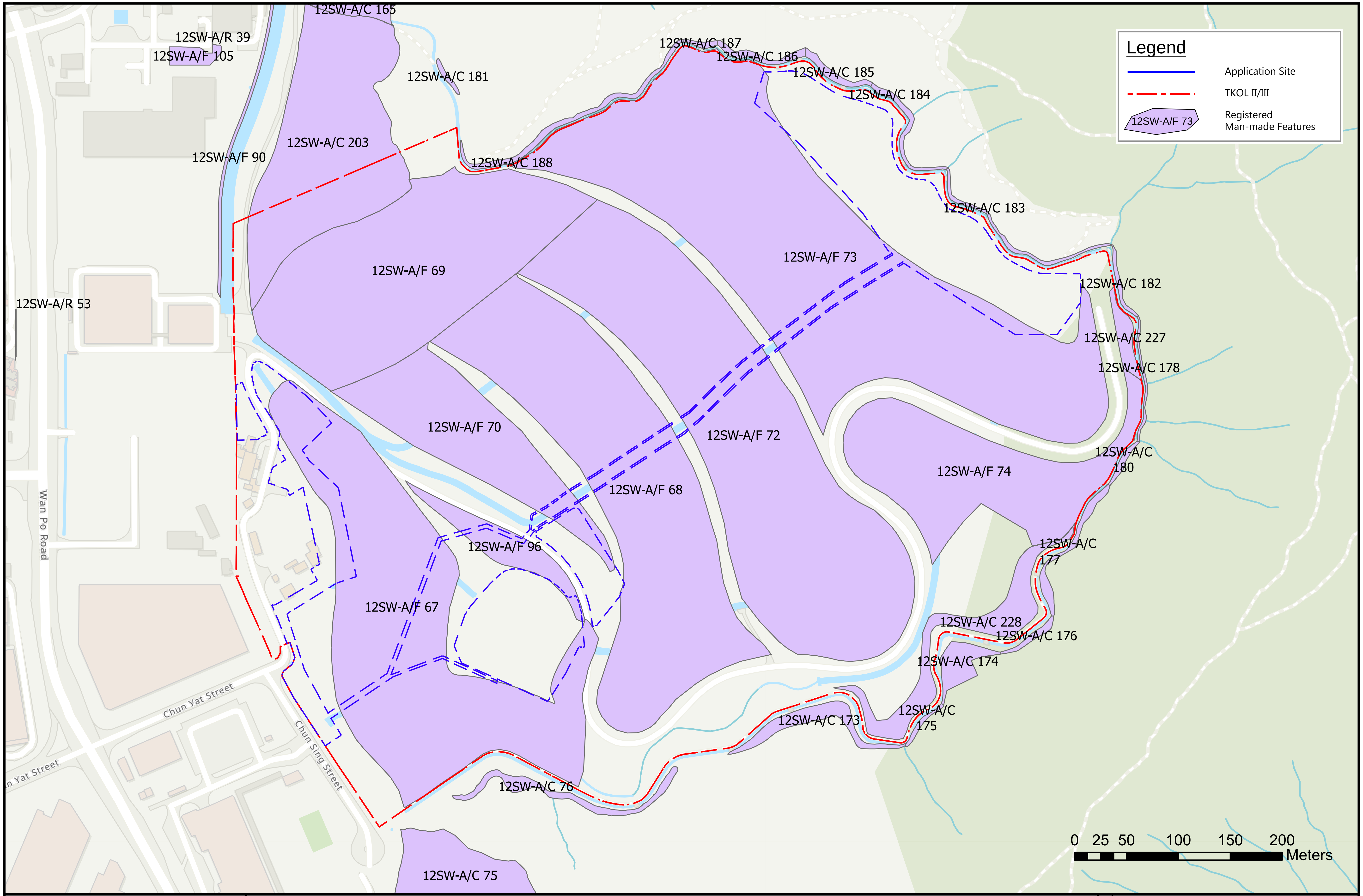
ARUP

Scale As Shown

Drawn by: WT Date July 25 Checked: MX Approved: JL

Job No. **304521**

Figure No. **FIGURE 3.2**


Legend
Application Site
TKOL II/III
12SW-A/F 73
Registered Man-made Features
12SW-A/C 165
12SW-A/R 39
12SW-A/F 105
12SW-A/C 181
12SW-A/C 187
12SW-A/C 186
12SW-A/C 185
12SW-A/C 184
12SW-A/C 203
12SW-A/F 90
12SW-A/C 188
12SW-A/C 183
12SW-A/F 73
12SW-A/F 69
12SW-A/R 53
12SW-A/C 182
12SW-A/C 227
12SW-A/C 178
12SW-A/F 70
12SW-A/F 72
12SW-A/C 180
12SW-A/F 74
12SW-A/F 68
Wan Po Road
12SW-A/F 96
12SW-A/C 177
12SW-A/F 67
12SW-A/C 228
12SW-A/C 176
12SW-A/C 174
Chun Yat Street
12SW-A/C 175
12SW-A/C 173
Chun Sing Street
n Yat Street
12SW-A/C 76
12SW-A/C 75
0 25 50 100 150 200
Meters

Job Title

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing Title

Adjacent Registered Man-made Features

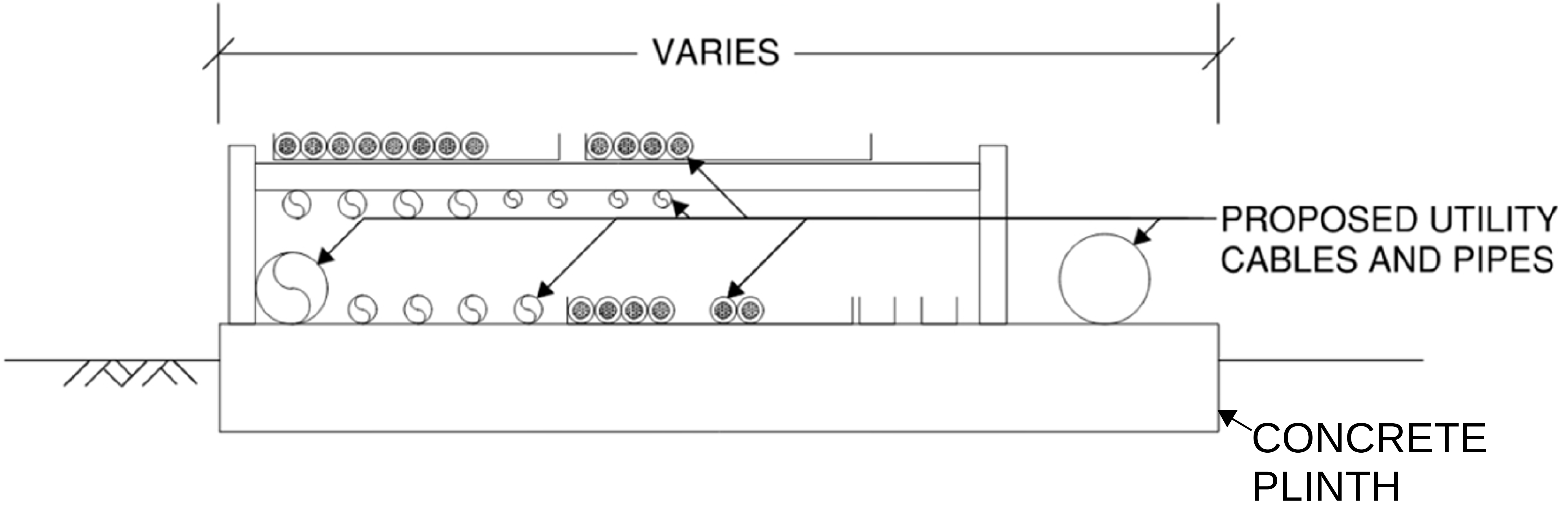
ARUP

Scale As Shown

Drawn by: WT Date July 25 Checked: MX Approved: JL

Job No. **304521**

Figure No. **FIGURE 3.3**


VARIES
PROPOSED UTILITY CABLES AND PIPES
CONCRETE PLINTH

Job Title

Proposed Place of Recreation, Sports or Culture (Public Riding School) with Ancillary Facilities at Government Land in D.D. 233, The Restored Landfill Site (TKOL II/III) in TKO Area 105, Tseung Kwan O (GLA TSK-500 (Part))

Drawing Title

Typical Section of Proposed Utility Trench

ARUP

Scale As Shown

Drawn by: WT Date July 25 Checked: MX Approved: JL

Job No. **304521**

Figure No. **FIGURE 5.1**

Appendix A

Previous NTHS Report 2003

Agreement No. FD 01-052
Geotechnical Review and Site Investigation Works For Tseung Kwan O Landfill Stage II/III Afteruse Development

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Natural Terrain Hazard Assessment Report

[Report No. 382311/NTHA/Revised Issue 2]

Report Authorized For Issue By: ……………………………………………………

For and on Behalf of
Black & Veatch Hong Kong Ltd.

Black & Veatch Hong Kong Ltd.
11 Floor New Town Tower
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Shatin NT
Hong Kong

February 2003

SUMMARY

The Hong Kong Environmental Protection Department (EPD) launched in 1996 a Landfill Restoration Programme (LRP) for 13 closed landfills. Tseung Kwan O Landfill Stage II/III is one of the 13 closed landfills. In October 2001, the EPD appointed Binnie Black & Veatch Hong Kong Ltd (BBVHKL) to study the geotechnical feasibility of the park.

This report provides a study of the natural terrain that could impact on the landfill site. The objective of the natural terrain hazard assessment is to identify, determine and quantify any natural hazards that could affect the proposed works and also, where necessary, to propose conceptual designs for appropriate mitigation measures.

The API in association with the NTLI Database and site walkover confirmed that there is evidence of relict and recent landsliding within several of the catchments within the study area.

Based on assessment results, it is considered that channelised debris flows, boulder falls and open hillslope landslides all form potential hazards. Mitigation measures for both types of landslides and boulder falls have been determined on a catchment by catchment basis and includes a ramp-up barrier such as an earth bund proposed along the toe of the slope and stabilisation/preventive measures of several boulders. In addition, where barriers are not required, a restricted zone, isolated by fencing be incorporated along the toe of the natural terrain.

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	Name	Signature	Date
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Checked	John Hall	pp Tony Chen	Feb 2003
Reviewed	Tony Chen	Tony Chen	Feb 2003

1. INTRODUCTION

1.1 Background

The Hong Kong Environmental Protection Department (EPD) launched in 1996 a Landfill Restoration Programme (LRP) for 13 closed landfills. Tseung Kwan O Landfill II/III is one of the 13 closed landfills.

The restoration works for TKO II/III were completed in 1999 and the landfill is considered safe and environmentally acceptable for afteruse. At present, there are several afteruse proposals for the landfill being explored, including an option to develop the landfill into a recreational facility with a material recycling facility for educational purposes (the Park).

In October 2001, the Environmental Protection Department appointed Binnie Black & Veatch Hong Kong Ltd. (BBVHKL) to study the geotechnical feasibility of the park.

1.2 Purpose of Report

The purpose of this report is to provide a study of the natural terrain that could impact on the landfill site. The report includes a summary of background information reviewed in the Preliminary Geotechnical Assessment report (December 2001) and a more detailed review of the Aerial Photograph Interpretation (API). The objective of the natural terrain hazard assessment is to identify, determine and quantify any natural hazards that could affect the proposed works and also, where necessary, to propose conceptual designs for appropriate mitigation measures.

2. THE SITE

2.1 Site Description

Tseung Kwan O Landfill Stage II/III (TKO II/III) is located near Tseung Kwan O Bay, as shown in Figure 1, and was formed by infilling of the Tai Chik Sha Valley. The area was formerly a west facing, bowl shaped valley overlooking Tai Chik Sha Wan and a small embayment to Tseung Kwan O Bay. Only a small part of the landfill extends over the original seabed.

The landfill operations in Stage II/III filled the northern side of the valley at Tai Chik Sha, to the top platform level of 140mPD. The landfill profile now dips at a gradient of approximately 1 in 3 to the west from the top of the platform at the valley head to 5mPD at the toe, over a horizontal distance of about 750m. The site comprises several waste slopes and is bounded by a series of cut slopes, and beyond these cuttings, natural terrain as shown in Figure 2.

3. BACKGROUND INFORMATION

3.1 General

This section summarises the findings of the preliminary geotechnical assessment report for the proposed site.

3.2 Site Geology

The Geological Map Sheet No. 12, Solid and Superficial Geology (Scale 1:20 000, GCO, 1989) indicates that the site comprises tuffs, ash and lavas of Upper Jurassic age (Figure 3). The original landform, prior to the construction and operation of the landfill, was a basin enclosed by hills on three sides with a bay on the shore to the west of the site boundary. To the sides of the valley are volcanic rocks of the Repulse Bay Formation, weathered in places to form decomposed volcanic material and covered in part by superficial deposits. The valley floor consists of alluvium, comprising clays, silts and sands. Existing boreholes located around the site show that the volcanic tuff is fractured and jointed. A summary of the existing borehole records is presented in Appendix A.

GASP Report VII for the Clear Water Bay area (GCO, 1988) discusses the site during its pre-operation condition and relevant maps are shown in Appendix A. It reveals that the site is classified as having predominantly extreme geotechnical limitations, requiring a very high engineering cost and very intensive site investigation. Localised areas of moderate to high geotechnical limitations requiring a normal to high engineering cost and normal to intensive site investigation situated in the western portion of the site. The central region of the site is identified as zones of colluvium surrounded by zones of general instability associated with predominantly insitu terrain. Slopes on insitu terrain generally steeper than 30° occur in the westernmost region of the site. The two rock types (Repulse Bay Formation) of banded acid lavas, some welded tuffs in the east and pyroclastic rocks in the west usually produces a thin soil horizon followed downwards by sandy completely weathered material overlying less weathered, locally strongly jointed rock below an average depth of 11m. Several geological photolineaments cut the site, trending approximately East-West, North-South, and NW-SE.

3.3 Site Hydrogeology

The steep hillsides and relatively high permeability of the superficial deposits indicates that the groundwater regime must be highly transient, responding not only to seasonal variation in infiltration but also to rainfall events. Limited groundwater monitoring data indicates that, prior to the restoration of the landfill, the ground water level was below 122mPD.

The basal leachate collection systems (Ref. 16 & 17) on the back face of the formation slopes are on natural ground. Hence the exterior sub-surface water regime is intimately connected with that of the leachate regime.

A sub-soil water abstraction system (Ref. 18) has been installed as part of the restoration works. This system is designed to limit the amount of groundwater infiltration from the surrounding hillsides into the waste mass, to control leachate generation. The annual design review undertaken in May 2001 indicates that the measured leachate levels were within the design expectations (Ref 19).

3.4 Previous and Recent Ground Investigation

3.4.1 Previous Ground Investigation (Pre-2002)

Previous ground investigation (predominantly carried out in 1988-89) within the landfill site (Figure 4 and Appendix A) reveals that the ground conditions; at the base of the terrain (in the west) consists of several layers of fill (sand, gravel & rock fill) overlying superficial deposits, marine and alluvial deposits, which in turn overlie insitu soil. Midslope, rockhead was generally encountered between +17.32 and +39.43mPD overlain by insitu soil and in one drillhole (12800/BH13) 0.60m of alluvial sand. At the crest of the terrain (in the east), rockhead was encountered between +107.38 and +162.36 below 2.0-5.0m thickness of soil.

3.4.2 Recent Ground Investigation (2002)

Ground investigation has been carried out on the natural terrain (see Figure 4 and Appendix A), and the findings are discussed below.

In the north-west, trial pits reveal that 0.5 to 1.30m of colluvium (generally of silty fine to coarse sand with fine to coarse gravel and cobble sized rock fragments) overlies completely to highly decomposed rhyolite with bedrock encountered in TP14 at 1.65m below ground level.

In the northern region, drillholes reveal that the ground conditions comprise of superficial deposits of fill, completely to highly/moderately decomposed rock (12m in thickness), and rockhead at between 152 and 157mPD (at 1.22m and 13.65m below ground level). Trial pits reveal 0.1 to 1.5m of colluvium (silty fine sand to sandy silt) overlying insitu soil and bedrock. Rock types encountered are of fine ash tuff and trachydacite lava.

In the easternmost region, drillhole DH5 reveals fill and topsoil overlying completely to highly/moderately decomposed tuff and rockhead encountered at 135.64mPD (5.13m depth). Trial pits further upslope reveal topsoil and colluvium (silty fine to coarse sand with gravel and boulder sized rock fragments) up to 1.2m thick overlying bedrock.

In the southernmost area, drillhole DH3 at the toe of the natural terrain comprises of 2.6m fill (for the construction of the catchwater channel), completely to highly decomposed trachydacite lava and rockhead at 79.91mPD (7.55m depth). Drillholes further upslope reveal 1.5m of colluvium, insitu soil up to 14m in thickness and rockhead at 118.11mPD (8.40m depth). Trial pits reveal topsoil and colluvium up to 1.65m thickness over highly to moderately decomposed trachydacite lava and tuffaceous breccia. Further upslope, colluvium (0.1 to 0.90m thickness) overlies moderately decomposed rock.

In the south-westernmost, drillhole DH1 and trial pit TP11 reveals up to 1.0m colluvium overlying insitu soil (rhyolite).

Concealed open joints were observed in trial pit TP4 situated near the crest of Catchment No. 6A and indicates the presence of potential instability.

A summary of the groundwater monitoring records from the ground investigation works reveal groundwater levels of 147mPD (6m bgl) and 155.33mPD (15.40m bgl) in the north, 132.16mPD

(8.61m bgl) in the east, 118.51 (8.0m bgl), 98.26 (15.10m bgl) and 79.51mPD (7.95m bgl) in the southern region, and 27.09mPD (14.60m bgl) in the southwest.

3.5 Natural Terrain Landslide Inventory and Large Landslide Database

The Catalogue of Natural Slope Landslides (NTLI) and Large Landslide Database of the area (see Figure 6 and Appendix C) have been examined.

No landslides are recorded in the Large Landslide Database for this area.

The NTLI records 13 landslides on the natural terrain above the landfill area. Eight of these have been verified by API. Ten of these are on the southern slopes. And three on the eastern slopes. Ground slope angles across the landslide heads of between 18° to 45° were measured and the landslide scars are all less than 20m in width.

4. AERIAL PHOTOGRAPH INTERPRETATION (API)

4.1 Introduction

Table 4.1 lists the aerial photographs obtained from the Geotechnical Engineering Office, which comprise high and low flight and partially enlarged photography and cover the entire project area. A summary of the features observed is contained in Appendix B, and a recent aerial photograph is illustrated in Figure 5 (Part Print – AP No. CN17111, Year 1997). The serial numbers of the photographs inspected are listed in Table 4.1.

4.2 Geomorphology

The ridgelines that form the watershed to this catchment can be generally likened to the rim of a bowl tilted in a north westerly direction. The ridgeline rises from the capped landfill level in the south west, to a high of around 230mPD in the east, before descending back to landfill level in the north west (see Figure 5).

The exception to this simplistic analogy is a sub-catchment in the north east which extends back beyond the general peripheral rim, to a peak at around 330mPD.

The capped surface of the landfill that fills the bowl slopes down in a south westerly direction, intercepting the mainly first order drainage lines at what would have been their mid-sections.

The natural terrain that the streams drain is generally steep (around 30° or steeper) with just isolated patches and ridge sections that fall to shallower angles of between 20° to 30°. Natural slopes in the north and south were found to be predominantly similar with slope angles between 17° and 43° (see Appendix D for the Natural Terrain Hazard Map and Sections 1-3 in Appendix E). However, localised areas of slope angles up to 48° can be identified in the natural slopes in the south.

The choice of slope angle classes used in the Natural Terrain Hazard Map (see Appendix D) is based on the work of Hungr et al (1984, 1987) and Franks (1998). These are 0 - 7°, 8°-17°, 18°-

29° and 30°+ respectively. These ranges have been chosen on the basis of GEO Report No. 57 which states that the formation of debris deposition fan starts on < 8° slopes for channelised failure, < 18° slopes for non-channelised failure, < 30° slopes for openhill landslide; and >30° slopes for landslide initiation to occur. The slope angles were measured automatically from the 2m contour interval on the 1:1,000 scale maps using ArcGIS.

4.3 Structural Geology

The geological map shows a NW-SE trending fault cutting the south-western area of the site with several geological photolineaments trending approximately East-West, North-South and NW-SE which are also identified from the API (see Figure 5).

Fracture Trace Analysis of the landfill site carried out in 2001 to identify potential extraction well locations, also identified a number of distinct structural features trending in orientations identical to those seen in the API. These are likely to exert primary control over the hydrological and hydrogeological regimes within the landfill catchment.

4.4 Hydrology/Hydrogeology

Streams are relatively steep and stream sections (Sections 4-4 to 13-13 included in Appendix E) reveal that streams in the northern and southern regions of the site were generally found to be predominantly between 14° and 42°.

The 9 catchments that make up the study area are discussed below;

Catchment Nos. 1 to 3 in the North

The stream lines within these catchments can be classified as ephemeral and are poorly developed and dry. There is no API evidence for extensive sub-surface piping nor any springs or seepage lines.

Catchment No. 4

The south-west flowing stream lines which run centrally along the catchment are well developed and can be classified as perennial. Stream sections reveal stream angles of between 14° and 42°. The mid-point and the lower reaches of the streams were observed to be densely vegetated and site inspection also observed boulders of approximately 0.5m diameter in size along the stream course. Water flow and seepage are observed at the toe of the natural terrain.

Catchment Nos. 5, 6A and 6B

The stream lines within these catchments are poorly developed and dry and can be classified as ephemeral. Stream sections (6-6 and 13-13) reveal stream angles of between 22° and 41°. There is no API evidence for extensive sub-surface piping nor any springs or seepage lines.

Catchment No. 7

The ephemeral drain paths are observed to be densely vegetated within the study catchment. Stream sections (7-7 to 9-9) reveal stream angles of between 20° and 35°. Site inspection also observed boulders of approximately 0.5m diameter in size along the stream course. There is no API evidence for extensive sub-surface piping nor any springs or seepage lines.

Catchment Nos. 8 and 9

The ephemeral drain paths are observed to be densely vegetated within the study catchment. Stream sections (10-10 to 12-12) reveal stream angles of between 29° and 32°. Site inspection also observed boulders of approximately 0.5m diameter in size along the drainage line in the west (adjacent to drillhole DH1). There is no API evidence for extensive sub-surface piping nor any springs or seepage lines.

4.4.1 Discussion

The majority of the drainage lines were found to be dry with no API evidence for extensive sub-surface piping nor any springs or seepage lines. The exception is within Catchment No. 4 along Stream sections 4-4 and 5-5 where constant water flow was observed during the site inspections and seepage on adjacent cut slopes.

4.5 Natural Terrain Hazards

Based on API, the Catalogue of Natural Slope Landslides and Landslide Database of the area, a total of twenty-two landslides have been identified of which 20 occurred prior to 1975. The landslides have been numbered for easy reference on the API and Engineering Geology Maps (contained in Appendix B and I) and an inventory is included as Table 6.2. One landslide in the south occurred in 1997 and had an estimated volume of around 100m^3. The debris trail extended for approximately 40m into an adjacent drainage line.

Rock failure occurred in 2000 on the formed slope, 12SW-A/C175, in the southern region of the site which was later cleared and the surface covered with shotcrete.

Some boulders and boulder fields are observed mainly within Catchment Nos. 2 and 4 which may pose boulder fall hazards to the proposed development. Detailed assessment is discussed in Section 7.

4.6 Conclusions

The API indicates that there is evidence of relict and recent landslides, and boulders within the natural terrain of the study area. Landslides and rockfalls pose a potential threat to the landfill afteruse development. The results identified by the API is presented in the API Map in Appendix B.

5 SITE RECONNAISSANCE

5.1 Natural Terrain

Field inspections were carried out by BBV's geotechnical engineer and geologist in November 2001 and July 2002. The general views of the natural terrain are shown in Plates 1 to 6 in Appendix F. The locations of the photographs taken during the inspections are shown in Figure 7.

During the inspection (field traverses are shown in Figure 7), most of the natural slopes were covered by vegetation. No fresh or recent landslide scars were identified except the one identified in the 1997 aerial photographs. However, based upon API and NTLI information, and this site inspection, the southern slopes in Catchment Nos. 6A, 6B, 7 to 9 appear historically unstable as indicated by relict landslide scars in this area.

Boulder fields were observed mainly at the eastern and northern slopes, some of which pose long term potential risk to the landfill afteruse development. Boulder stabilisation measures, as recommended in a boulder survey in 1998, had been carried out in most of the boulder-field areas within Catchment Nos 3, 4, 8 and 9 (see Plates 9 and 11 in Appendix F). However, a detailed boulder survey carried out for this assessment revealed that several boulders in Catchments 2 and 4 require stabilisation measures.

Boulders, on average 0.5m in diameter, were observed along drainage channels in Catchment No. 4 and 9 (see Plates 13 and 14) and 7 and because of their relatively small size, these boulders are not considered to be a major concern.

The inspection observed colluvial deposits in Catchment 4 which consists of silty fine to coarse sand to silty clay with fine to coarse gravel and occasional boulder sized rock fragments.

Constant water flow was observed at the toe of the natural slope (along streams of Sections 4-4 and 5-5) in the north-westernmost area of the site indicating a high ground water level as recorded in the ground investigation works.

No distressed ground or tension cracks have been observed on most of the natural slopes during site inspection. However, open joints up to 20mm wide were found in trial pit TP4 located in Catchment No. 6A. At this location, the slope angle is >30°.

6 NATURAL TERRAIN HAZARD STUDIES

6.1 General

The Design Event Approach, as promulgated by GEO SPR 1/2002 has been used to assess the natural terrain hazards and mitigation. The procedure is outlined below and relevant tables are included in Appendix E.

The facility type and group has been assessed. Group 1 facilities exist along the north-eastern edge of the landfill platform (beneath catchments 3 and 4) and beneath part of catchment 9.

Elsewhere Group 3 facilities have been assumed, which includes open space and lightly trafficked roads.

The 20°, 25° and 30° angular elevation trace was superimposed onto the landfill platform beneath the surrounding natural terrain to determine the proximity of the facilities to possible natural terrain hazards, as shown in Appendix E.

The susceptibility of the hillside to failure (susceptibility classes A-D, Table 4 in Appendix E) was determined on a catchment by catchment basis (see Landslide Susceptibility Map in Appendix E) to determine the relative likelihood of a natural terrain hazard being produced by each catchment (see Natural Terrain Hazard Map in Appendix D).

The Consequence Class has been assessed in accordance with Table 3 (Appendix E) depending on the facility group and proximity as described above.

The design event, Conservative Event (CE), for the majority of the catchments have been determined in accordance with Table 2 in Appendix E.

6.2. Design Landslides

As mentioned above and in accordance with SPR 1/2002, "Conservative Event" (CE) landslides have needed to be modelled.

Referring to Hong Kong GEO Reports (Nos. 35, 43, 54, 59, 70, 97 and 105) containing rainfall and landslides occurrence between 1992-1998, a total of 355 natural slope landslides were reported (Table 6.1). The size distribution chart accompanying the table shows that the majority of landslides are less than 300m^3 (95%).

All recorded landslides on the site from the Catalogue of Natural Slope Landslides and Landslide Database and from API are presented in Table 6.2. The landslides have been numbered for easy reference on the API Map (contained in Appendix B). Based on site inspection and from ground investigation information, the average thickness of the original landslide debris would be between 1.0 and 1.5m. The estimation of landslide source volumes is presented in Table 6.2. The size distribution histogram and accumulative frequency chart accompanying the table shows that the largest historical landslide volume in the area is not greater then 200m^3 and that up to 95% have volumes of <185m^3. Thus, it is considered that the source volume of 240m^3 (the mean between site specific and GEO reported landslides) assumed for CE events is appropriate.

6.2.1 Channelised Debris Flow Landslides Study

In order to ascertain appropriate run-out volumes for each individual potential landslide, long sections along each relevant drainage line have been prepared and are included in Appendix E. From this information, and assuming the source landslide all occur near to the ridgeline of each catchment, entrainment values have been added to the original source volume pro-rata with the length of colluvium identified along the stream channel. The rate of erosion has been considered as 2.3 m^3/m for CE landslides.

The estimation of the failure debris discharge, velocity and run-out has been carried out in accordance with GEO Report No. 104. The calculation of the debris discharge, debris velocity and run-out distances, for all catchments considered as possible sources for CE landslides are included in Table G1 in Appendix G.

Each catchment considered is discussed in turn below, starting from the most westerly catchment and working around the landfill in an anti-clockwise direction. Reference should also be made to Tables 6.3 and 6.4 and also the Landslide Susceptibility Map (contained in Appendix E) which shows the individual catchments.

Catchment 1

There are records of two relict landslides recorded from NTLI and API information within Catchment 1 in the north-west. However, these are found to affect the area to the north of the study area only, and not the landfill platform.

Catchment 2

There are no records of relict landslides within Catchment 2 which would affect the landfill site and therefore it is considered that this catchment is of low susceptibility (Class D). Furthermore, the small size of this catchment limits the size of debris flow that could be developed. Consequently no further study of channelised debris flows are considered necessary in this area.

Catchment 3

Catchment 3 does not have any evidence of recent or relict landsliding. There is however the potential for landsliding given the presence of locally steep (greater than 30°) soil slopes. Hence the catchment has been designated Susceptibility Class C. The facility at the toe has been designated Group 1, and is deemed to be moderately close (20 to 25° angular elevation). This gives a Consequence Class of III, which according to Table 2 of SPR 1/2002, requires a CE landslide to be allowed for.

Calculations show that 697m^3 of debris could discharge onto the platform, with a theoretical run-out distance of 36m.

not per m.

Catchment 4

There are records of relict landslides both within and in the relevant vicinity of the catchment and is thus classified as Susceptibility Class C (i.e. the natural terrain is moderately susceptible to the type of failure under consideration, with a notional annual probability of occurrence within the order of 1/100 to 1/1000). The Facility Grouping of 1, together with the proximity of "Moderately Close" based on Table 3, with an angular elevation from the natural terrain of 25°-30°, gives a Consequence Class of II. Thus a "Conservative Event" as the design event has been adopted.

The calculated volume of debris of 3756m^3 could be deposited along the stream section considered and thus mitigation measures will not be required. However, the lowermost reaches of the stream is found to have slope angles of 21°, and therefore mitigation measures are recommended for potential mid-slope failures. The calculations show that for a run-out volume of 552m^3, an expected run-out distance of 31m is possible.

Catchments 5

There are no records of relict landslides within this catchment from NTLI and API information. However, catchments on either side are deemed Class C, and it is therefore considered that this catchment is of moderate susceptibility (Class C) also. On this basis, a CE channelised debris flow has been modelled and gives a total run-out volume of $697m^3$, and a run-out distance of 35.48m.

303 × 2.3 m^3/m
from drawing, distance

Catchment 6A

There are records of relict landslides within the catchment and is thus classified as Susceptibility Class C (i.e. the natural terrain is moderately susceptible to the type of failure under consideration, with a notional annual probability of occurrence within the order of 1/100 to 1/1000). The Facility Grouping of 3, together with the proximity of "Moderately Close" based on Table 3, with an angular elevation from the natural terrain of 25°-30°, gives a Consequence Class of III. Thus a "Conservative Event" as the design event will be adopted.

Calculations taking into account an entry channel slope angle of 41° shows that for a final run-out volume of $550m^3$, an expected run-out distance of 45m is estimated from the slope toe.

Catchment 6B

There are records of relict landslides within the catchment and thus the existing access road is classified as Susceptibility Class C (i.e. the natural terrain is moderately susceptible to the type of failure under consideration, with a notional annual probability of occurrence within the order of 1/100 to 1/1000). The Facility Grouping of 3, together with the proximity of "Moderately Close" based on Table 3, with an angular elevation from the natural terrain of 25°-30°, gives a Consequence Class of III. Thus a "Conservative Event" as the design event will be adopted.

Calculations taking into account an entry channel slope angle of 32° estimates that for a final run-out volume of $550m^3$, an expected run-out distance of 53.48m is estimated.

Catchment 7

There are records of relict and recent landslides within the catchment and thus the existing access road is classified as Susceptibility Class B (i.e. the natural terrain is highly susceptible to the type of failure under consideration, with a notional annual probability of occurrence in the order of 1/10 or higher). The Facility Grouping of 3, together with the proximity of "Moderately Close" based on Table 3, with an angular elevation from the natural terrain of 25°-30°, gives a Consequence Class of III. Thus a "Conservative Event" as the design event will be adopted.

Calculations taking into account an entry channel slope angle of 32° estimates that for a final run-out volume of $628m^3$, an expected run-out distance of 53.48m from the slope toe is estimated.

Catchment 8

Records indicate the presence of a relict landslide within the catchment and is thus classified as Susceptibility Class C (i.e. the natural terrain is moderately susceptible to the type of failure under consideration, with a notional annual probability of occurrence within the order of 1/100 to

1/1000). The Facility Grouping of 3, together with the proximity of "Moderately Close" based on Table 3, with an angular elevation from the natural terrain of <25°, gives a Consequence Class of III. Thus a "Conservative Event" as the design event will be adopted.

Calculations taking into account an entry channel slope angle of 32° estimates that for a final run-out volume of 655m^3, an expected run-out distance of 53.48m is estimated from the slope toe.

Catchment 9

There are records of recent landslides within and in the vicinity of the catchment and is thus classified as Susceptibility Class B (i.e. the natural terrain is highly susceptible to the type of failure under consideration, with a notional annual probability of occurrence within the order of 1/10 to 1/100). The Facility Grouping of 3 for the access road, together with the proximity of "Moderately Close" based on Table 3, with an angular elevation from the natural terrain of 25°-30°, gives a Consequence Class of III. Thus a "Conservative Event" as the design event will be adopted. In addition, the Facility Grouping of 1 for the proposed recycling facility, together with the proximity of "Far", with an angular elevation from the natural terrain of <25°, gives a Consequence Class of III, and thus a "Conservative Event" is also adopted.

The calculations have taken into account an entry channel slope angle of 31° and shows that for a final run-out volume of 701m^3, an expected run-out distance of 109.37m is estimated from the toe of the slope. This could theoretically impact on the proposed recycling facility proposed in the Conceptual Design layout (Figure 9).

6.2.2 Open Hillslope Landslides

Areas of the proposed development that are considered vulnerable to zones of potential open hillslope failure, are those that lie directly downslope from a natural slope steeper than 30°, with no intervening depositional area (a slope of 17° or less). Based on the Natural Terrain hazard Map (Appendix D) this affects much of the proposed platform particularly where such steep ground occurs directly above cut slopes.

The landslide source volume of 240 m^3 for conservative events used in the case of channelised debris flow landslides is assumed. The estimation of the failure debris run-out has been carried out in accordance with SPR1/2002 and calculations are summarised in Table G2 in Appendix G.

Where open hillslope failures are considered possible, and have been required to be modelled, it has been assumed that the entire volume of debris from the design landslide is deposited on the platform below with an angle of reach of 20°. This is deemed a conservative angle of reach based on the works of Franks (1996), which suggests that the relationship between angle of reach and landslide volume is given by:

$\theta = 38.256 - 6.0244 \times \log V$

Where: θ = angle of reach, and
V = landslide volume (m^3)

This gives a theoretical angle of reach of 24.0° for CE landslides.

Run-out distances for individual open hillslope landslides are given in Appendix G. The calculations assume that CE size landslides have a width of 10m, based on the average width of natural terrain landslides quoted in the Mid-Levels Study, which give debris volumes per metre width of landslide of $24m^3$.

Each catchment considered is discussed in turn below, working around the landfill in an anti-clockwise direction from the west.

Catchment 1

As previously discussed, this catchment, cannot affect the landfill platform due to its orientation, and has therefore not been considered further as part of this study.

Catchment 2

There are no records of relict or recent landslides in Catchment 2 indicating a low susceptibility to landsliding. This fact together with the catchment's small area and low elevation indicates that no further open hillslope consideration need be given to this catchment.

Catchment 3

Calculations show that $240m^3$ of debris from a CE sized landslide could discharge onto the platform, with a theoretical run-out distance of 11.84m.

Catchment 4

Calculations show that for a CE run-out volume of $24m^3/m$, an expected run-out distance of 12.06m is estimated from the slope toe.

per m^2

Catchment 5

Calculations show that $240m^3$ of debris from a CE sized landslide could discharge onto the platform, with a theoretical run-out distance of 12.01m.

Catchment 6A

Calculations show that for a CE run-out volume of $24m^3/m$, an expected run-out distance of 15.08m is estimated from the slope toe.

Catchment 6B

Calculations show that for a CE run-out volume of $24m^3/m$, an expected run-out distance of 15.64m is estimated from the slope toe.

Catchment 7

Calculations show that for a CE run-out volume of $24m^3/m$, an expected run-out distance of 14.66m is estimated from the slope toe.

Catchment 8

Calculations show that for a run-out volume of $24m^3/m$, an expected run-out distance of 14.97m is estimated from the slope toe.

Catchment 9

Calculations show that for a run-out volume of $24m^3/m$, an expected run-out distance of 22.38m is estimated from the slope toe.

The findings of the open hillslope hazard assessment are summarised in Table 6.6.

7 ASSESSMENT OF ROCK/BOULDER FALLS

7.1 General

The objectives of the boulder study has been to identify all boulders which pose a threat to the development area and to propose appropriate remedial measures to reduce the risk to an acceptable level.

7.2 Boulder Study

The site survey of the hillsides involved the inspection of all boulders within the catchment area above the development. Where active erosion, typified by an absence of vegetation, is evident and therefore providing a potential failure trigger mechanism, the boulder has been classed as having low stability. Where active erosion is not ongoing, typified by stable vegetation, boulders are classed as having a high stability. The boulder study has been carried out on site and the results are included below.

Each of the low stability boulders has then been classified in terms of shape, potential failure mechanism and risk to the development. In particular, it is judged whether the likely trajectory of the boulder would result in its reaching or stopping before the development. The former case would be deemed high risk, the latter low risk. All high-risk boulders have been recommended for preventive works.

Based on the past design submission for Contract No. EP/SP/29/95, Tseung Kwan O Landfills Restoration Contract, Stage II/III Boulder Stabilisation (prepared by Swire BFI & BCL in 1998), boulders with size $>2m^3$ were considered to be of low or intermediate stability and at risk of falling/sliding to the landfill. The summary made in this report presented that there are more than 500 boulders exposed in the hillside above the Stage II/III landfill site. Approximately 400 were of sufficient size to warrant close inspection and classification.

Of these, 75 boulders have been rated as having low or intermediate stability and therefore classified as high risk. Of these, 38 boulders were rated as low stability and therefore recommended for stabilisation works. During site inspection carried out in November 2001, it was seen that the boulder stabilisation works proposed in 1998 had been carried out (see Plates 10 and 12) and no stability problems were observed.

However, site inspection carried out in July 2002 revealed the presence of two potentially high-risk boulders in Catchment Nos. 2 and 4 (see Plates. 9 and 11). The boulders of medium stability category have been classified on the basis of shape, potential failure mode, and recommended preventive works. The results of the study are summarised in Table 7.1 and the mitigation measures described in the following section.

7.3 Rock Fall Study

The only location where rockfalls are considered a possibility is in Catchment 4 where numerous rock outcrops occur within the 80m high natural terrain, which slopes at an angle of between 23° to 32° (predominantly <30°).

Empirical studies of rockfall have been carried out by several authors. The most commonly quoted reference is the work done by Ritchie (1963) for the Washington State Highway Commission in the United States. Ritchie's work involved the use of slow-motion cameras to record hundreds of full-scale rockfall tests. Most of the study involved hard basaltic rocks and natural or excavated slopes of varying ages. Ritchie observed that the prevalent modes of rockfall motion were as follows:

- rolling on slopes at less than 45°,
- bouncing on slopes in the range of 45°-75°;
- falling on slopes steeper than 75°.

The natural slopes above the proposed site is generally at angles between 23° to 32° (predominantly <30°) and covered by vegetation. Given that the friction angle between boulder and slope surface would have greater than 30° (i.e. slope angle predominantly < friction angle) boulder movement triggered by erosion or thermal effects are unlikely to occur.

Site inspection reveals that previous stabilization measures have been carried out within this catchment. Consequently, no further boulder study is considered necessary.

8 MITIGATION MEASURES

8.1 Introduction

Mitigation measures generally fall into one of the three categories: the slowing down by means of absorbing energy; to divert by redirection; and to stop by means of a barrier. The effects of the first are hard to determine and these measures are normally utilised as a factor of safety rather than a designed feature. The effects of the second and third are easier to determine once the size, velocity and direction of the debris flow have been determined as recommended by GEO Report No. 104.

8.2 Proposed Mitigation Measures

The proposed conceptual mitigation measures are designed to isolate the natural slopes from the proposed development and to adequately protect the development from landslide debris. The measures proposed have taken into account isolated boulders in catchments 2 and 4, and channelised debris flows and open hillslope landslide failures elsewhere.

The options of either a retaining structure or a ramp-up barrier or bund have been considered as mitigation measures for this site. However, it is considered that the construction of a retaining structure would result in disturbance of the landfill capping system. In addition, the ramp-up barrier (earth bund) is considered to be the most cost-effective, and environmentally acceptable.

Calculations show that all channelised debris flows could be contained within a 2.5m high earth bund located approximately 14m distance from the drainage line entry point onto the landfill waste slopes. Similarly, all open hillslope failures could be contained within a 2.5m high earth bund located approximately 3m from the edge of the platform. Calculations showing the heights and distances for the bund is given in Appendix G, and are summarised in Table G2.

Consequently it is proposed to construct a 2.5m high earth bund at a minimum distance of 3m from the platform edge, or 14m from a drainage line entry point (or projected entry point) onto the platform, whichever is the greater, around the site. Given the low susceptibility of Catchment 2, it is considered that the bund could be omitted around this part of the platform, although a 4m sterile zone isolated by fencing could be considered as a precaution.

The general arrangement is shown in the Mitigation Strategy Map in Appendix H.

If this option is to be adopted, several factors need to be considered, including:

- Access to the catchwater within the isolated sterile zone for maintenance
- Realigning the existing assess road where it encroaches within the bund/ sterile zone

With regard to access to the catchwater, this could be achieved by breaks in the bund at strategic locations, or else ramps over the top at intervals.

Previous boulder stabilisation works had been carried out. However, site inspection revealed that two potentially high-risk boulders in Catchment Nos. 2 and 4 require stabilising/preventive measures. It is recommended that Boulder D1 be removed and dentition be carried out on Boulder D2. Removal and breaking up of boulder D1 should be by splitting using pneumatic percussive drilling using either dynamic or chemical means. Care should be taken to avoid dislodging the boulder during splitting. The removal of Boulder D2 would affect the stability of the surrounding boulders and thus dentition has been considered the best stabilising measure.

In all cases, environmental acceptability with respect to visual impact of the proposed measures needs to be considered, and specialist landscaping advice sought.

9 CONCLUSIONS

The API in association with the NTLI Database and site walkover confirmed that there is evidence of relict and recent landsliding within several of the catchments within the study area. No distressed ground and tension cracks are observed during the site inspection. However, concealed open joints were observed in trial pit TP4 situated near the crest of Catchment No. 6A and indicates the presence of potential instability.

Based on assessment results, it is considered that channelised debris flows, boulder falls and open hillslope landslides all form potential hazards.

Landslide source volumes have been estimated from a statistical appraisal of site specific relict and recent landslide scars, and a comparison with regional landslide data. A landslide source volume of 240m^3 has been determined as a conservative size.

Mitigation measures for both types of landslides and boulder falls have been determined on a catchment by catchment basis. A ramp-up barrier such as an earth bund, is proposed along the toe of the slope where potential hazards have been identified and boulders require stabilisation/preventive measures. In addition, it is recommended that where barriers are not required, a restricted zone, isolated by fencing be incorporated along the toe of the natural terrain.

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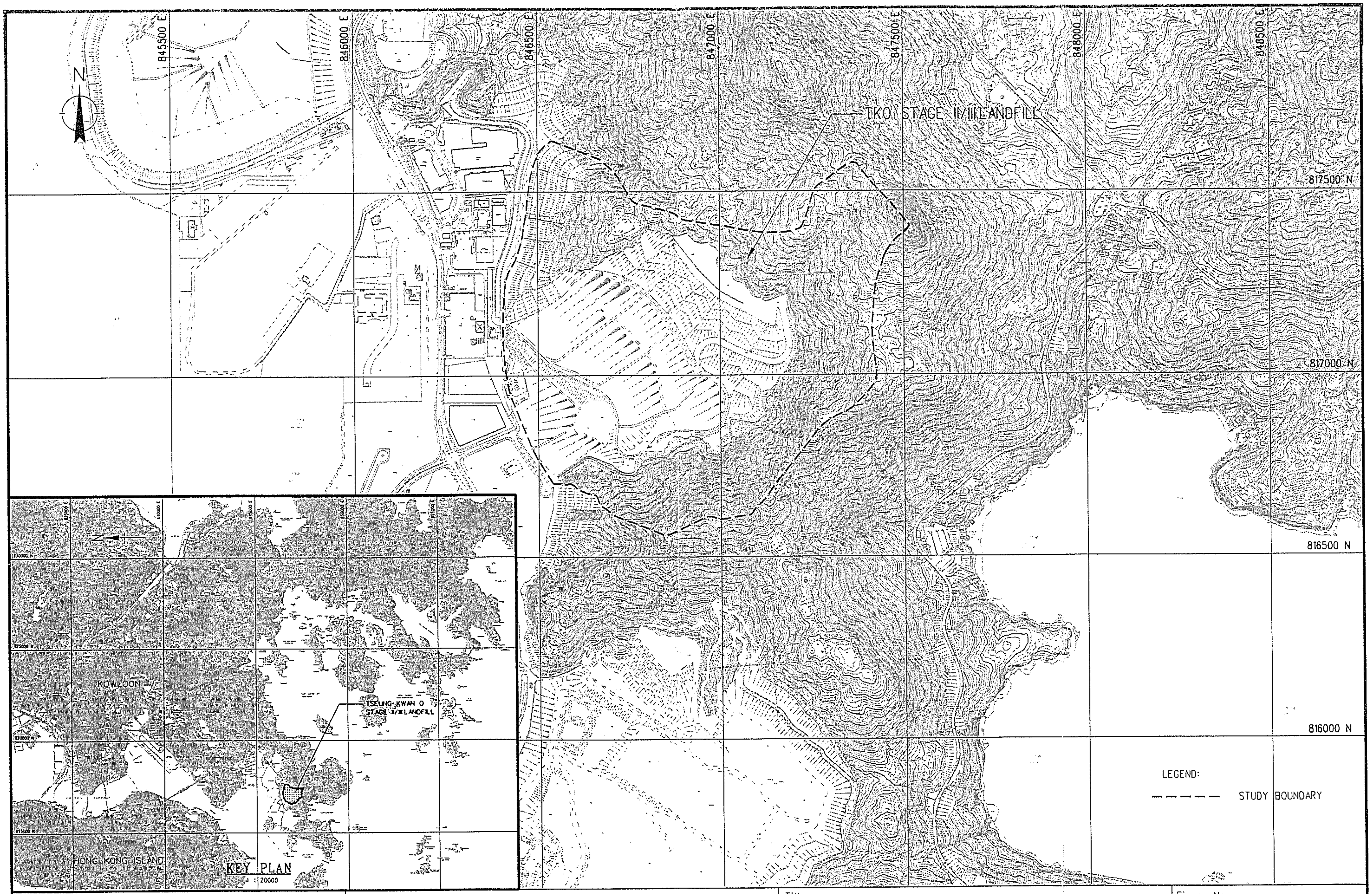
End of Text

FIGURES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Project
Tseung Kwan O Stage II/III Landfill Afteruse Development

Prepared By: SMO
Checked By: KWK

Title
SITE LOCATION PLAN

Figure No. 1

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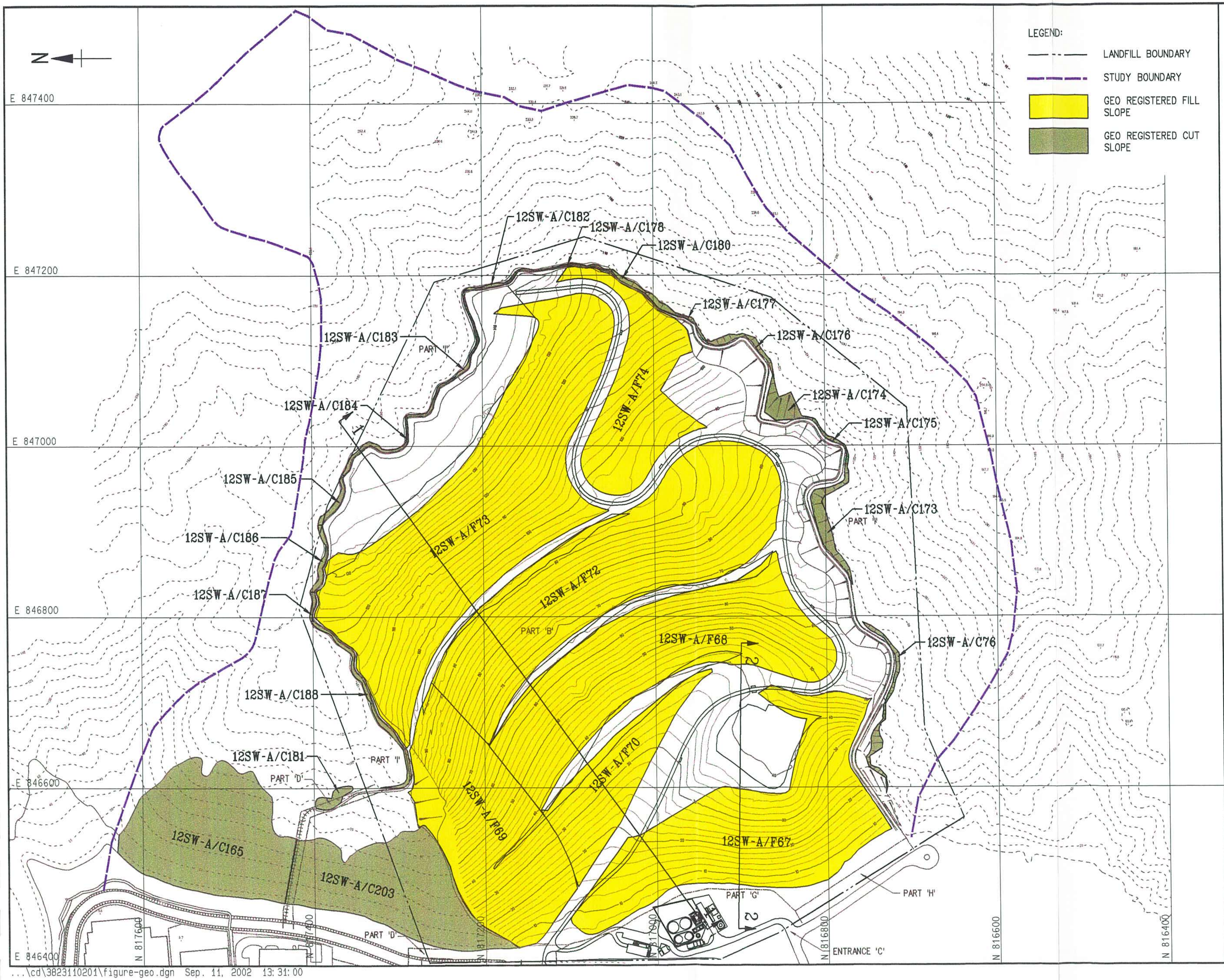
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PART 'I'
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12SW-A/C165
12SW-A/F67
12SW-A/C203
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PART 'H'
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—·—·—	STUDY BOUNDARY
🟨	GEO REGISTERED FILL SLOPE
🟩	GEO REGISTERED CUT SLOPE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. ALL DIMENSIONS ARE TYPICAL AND TO BE CONFIRMED AT DETAILED DESIGN.

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Contract no.

Contract
GEOTECHNICAL REVIEW AND
SITE INVESTIGATION WORKS
FOR TSEUNG KWAN O STAGE II/III
AFTERUSE DEVELOPMENT

Figure Title

TSEUNG KWAN O
STAGE II/III LANDFILL
GEO REGISTERED SLOPES

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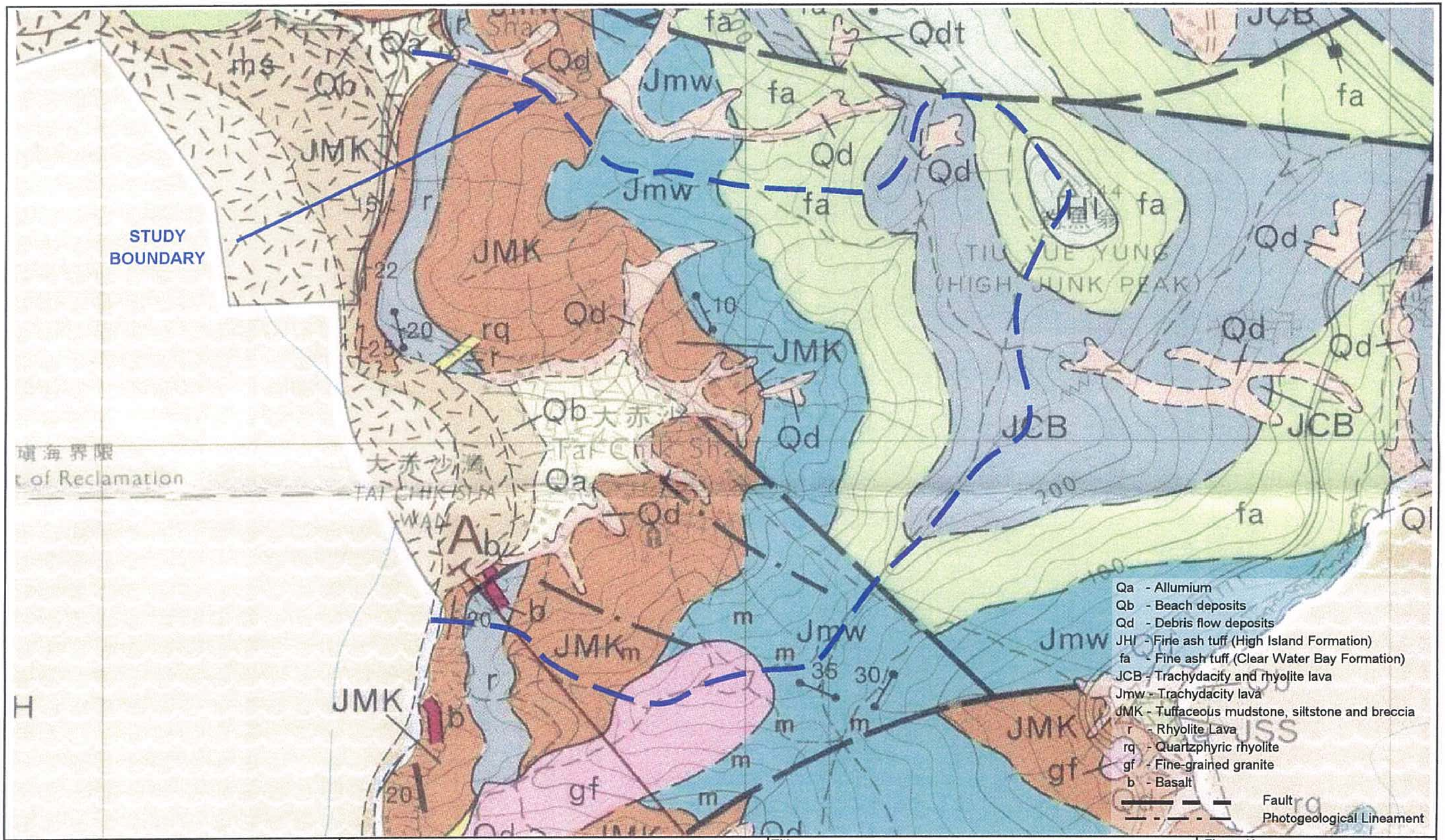
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Qd - Debris flow deposits
JHI - Fine ash tuff (High Island Formation)
fa - Fine ash tuff (Clear Water Bay Formation)
JCB - Trachydacity and rhyolite lava
Jmw - Trachydacity lava
JMK - Tuffaceous mudstone, siltstone and breccia
r - Rhyolite Lava
rq - Quartzphyric rhyolite
gf - Fine-grained granite
b - Basalt
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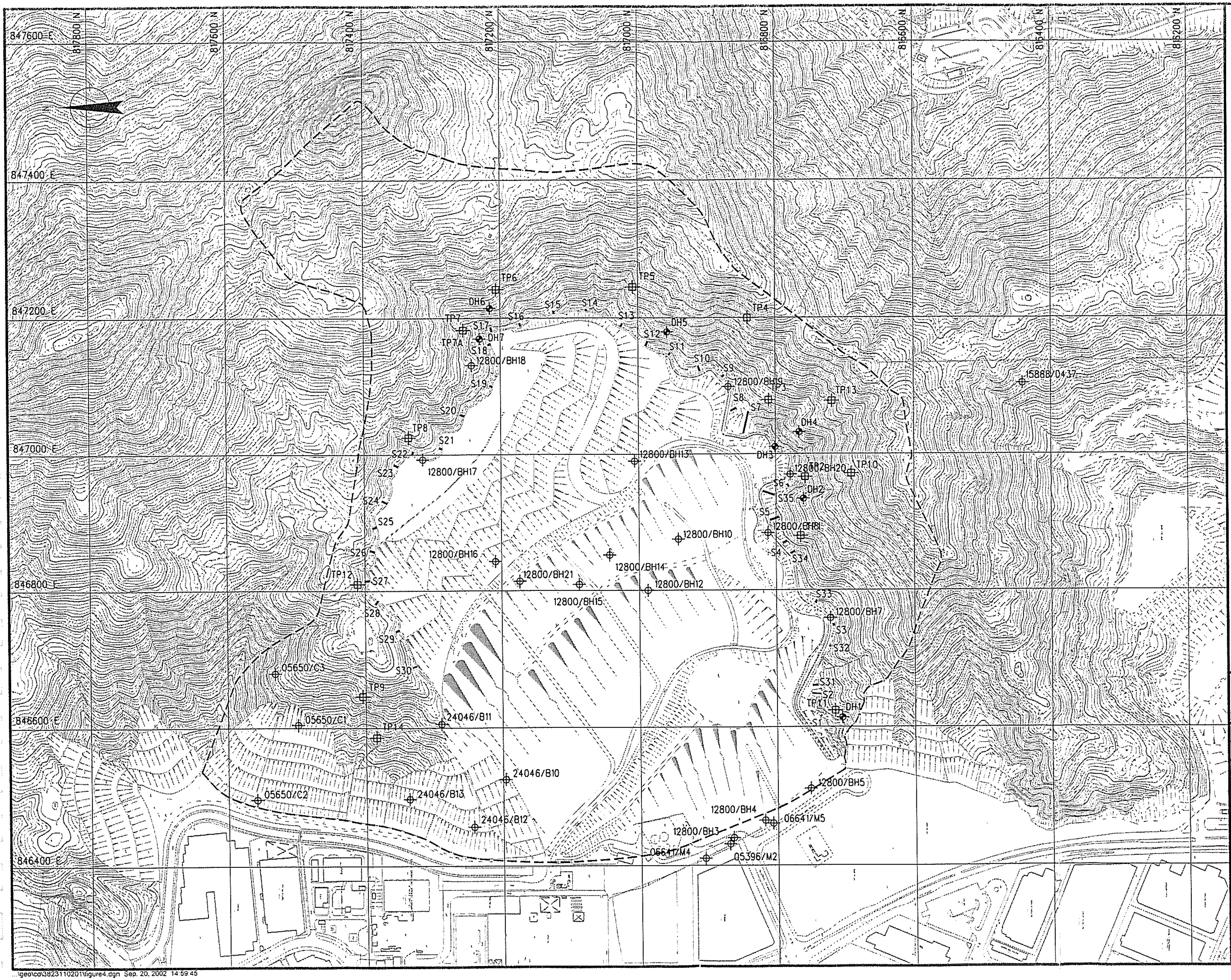
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NOTES:

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2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. ALL DIMENSIONS ARE TYPICAL AND TO BE CONFIRMED AT DETAILED DESIGN.

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⌖	EXISTING DRILLHOLES
⊞	RECENT TRIALPITS
◐ DH1	RECENT DRILLHOLES
— S1	RECENT SLOPE STRIPPING
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GEOTECHNICAL REVIEW AND
SITE INVESTIGATION WORKS
FOR TSEUNG KWAN O STAGE II/III
AFTERUSE DEVELOPMENT

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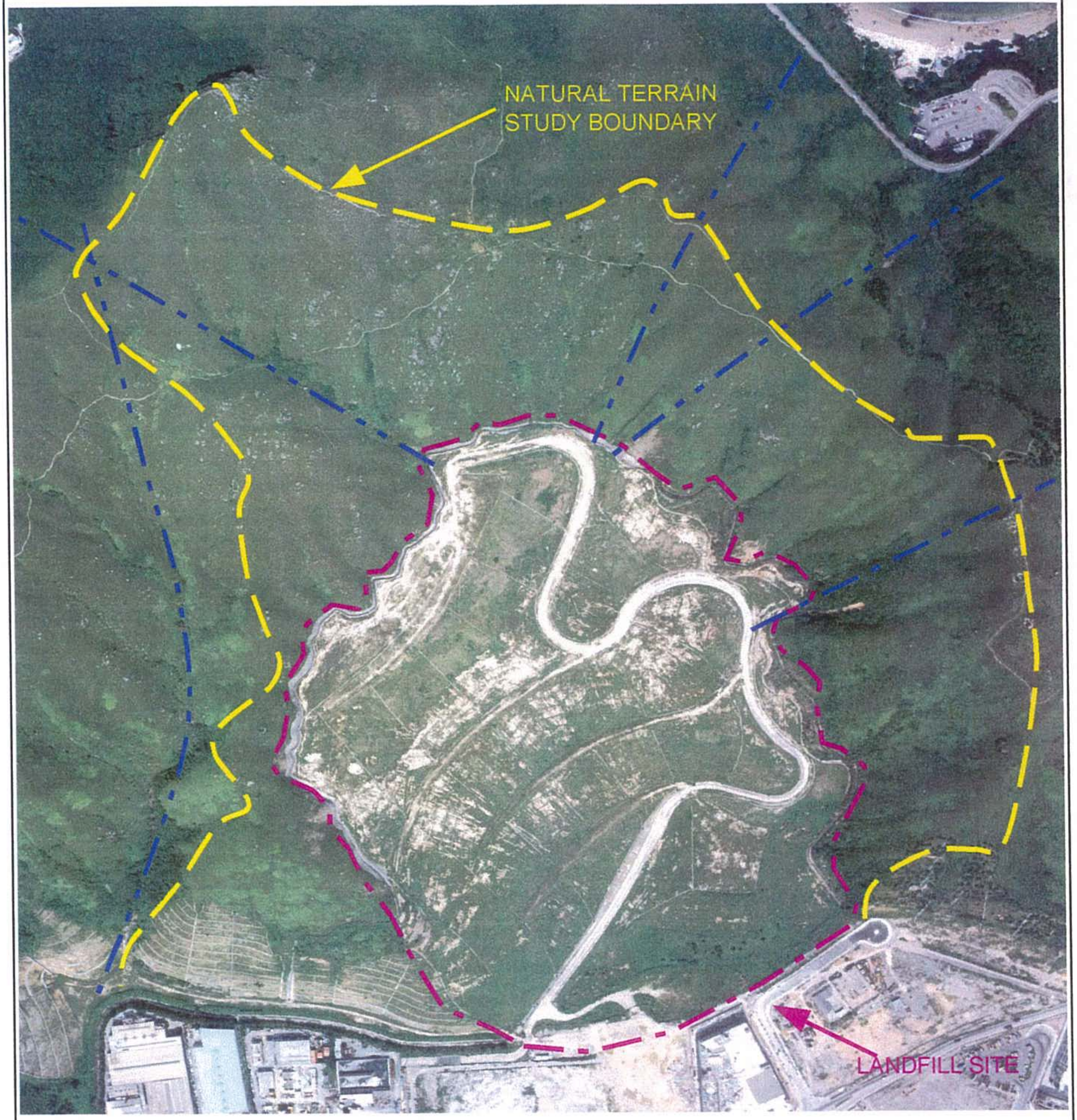
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LANDFILL SITE

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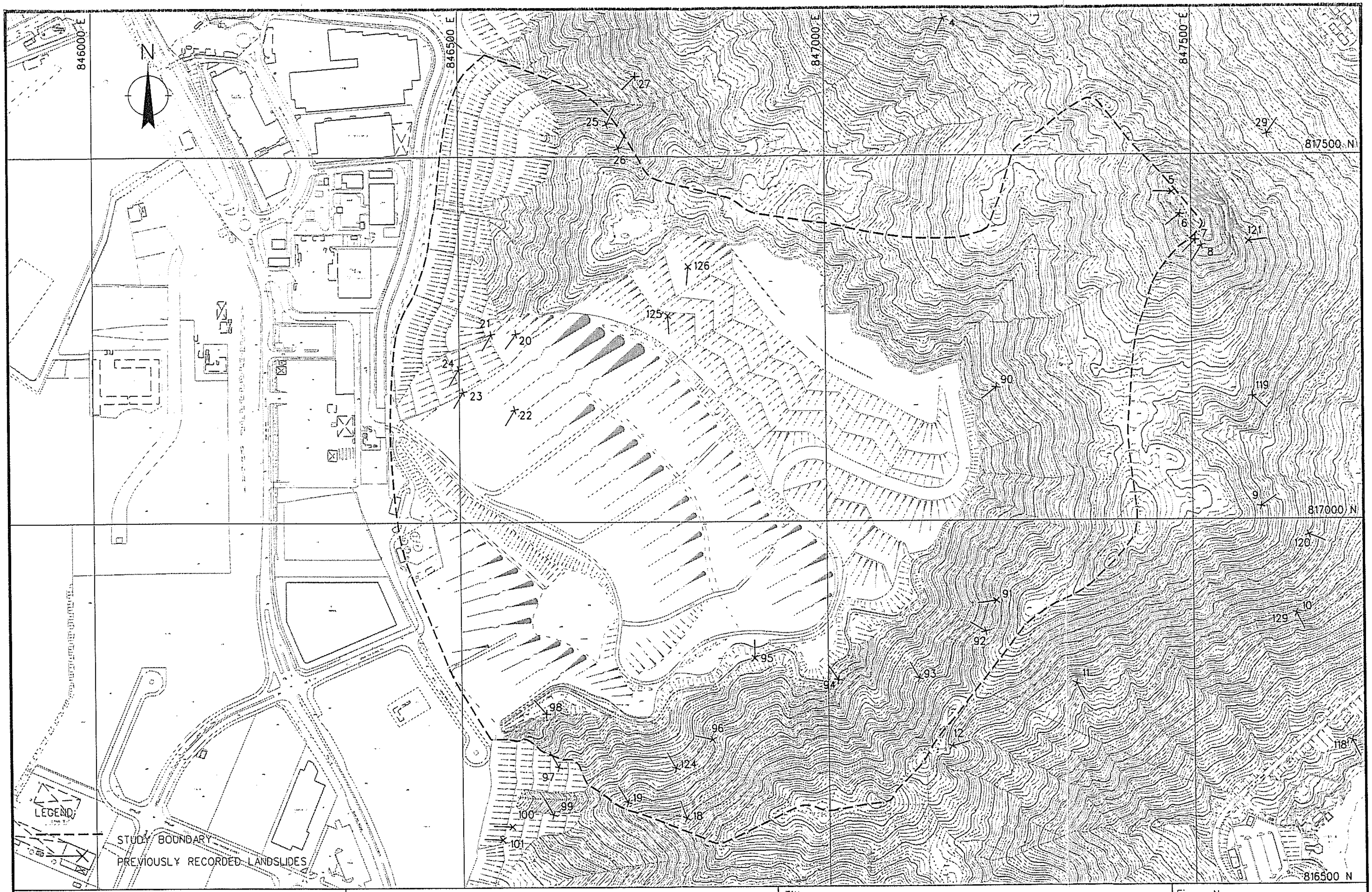
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PREVIOUSLY RECORDED LANDSLIDES

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Project
Tseung Kwan O Stage II/III Landfill Afteruse Development

Prepared By: SMO
Checked By: KWK

Title
NATURAL TERRAIN LANDSLIDE INVENTORY MAP

Figure No.
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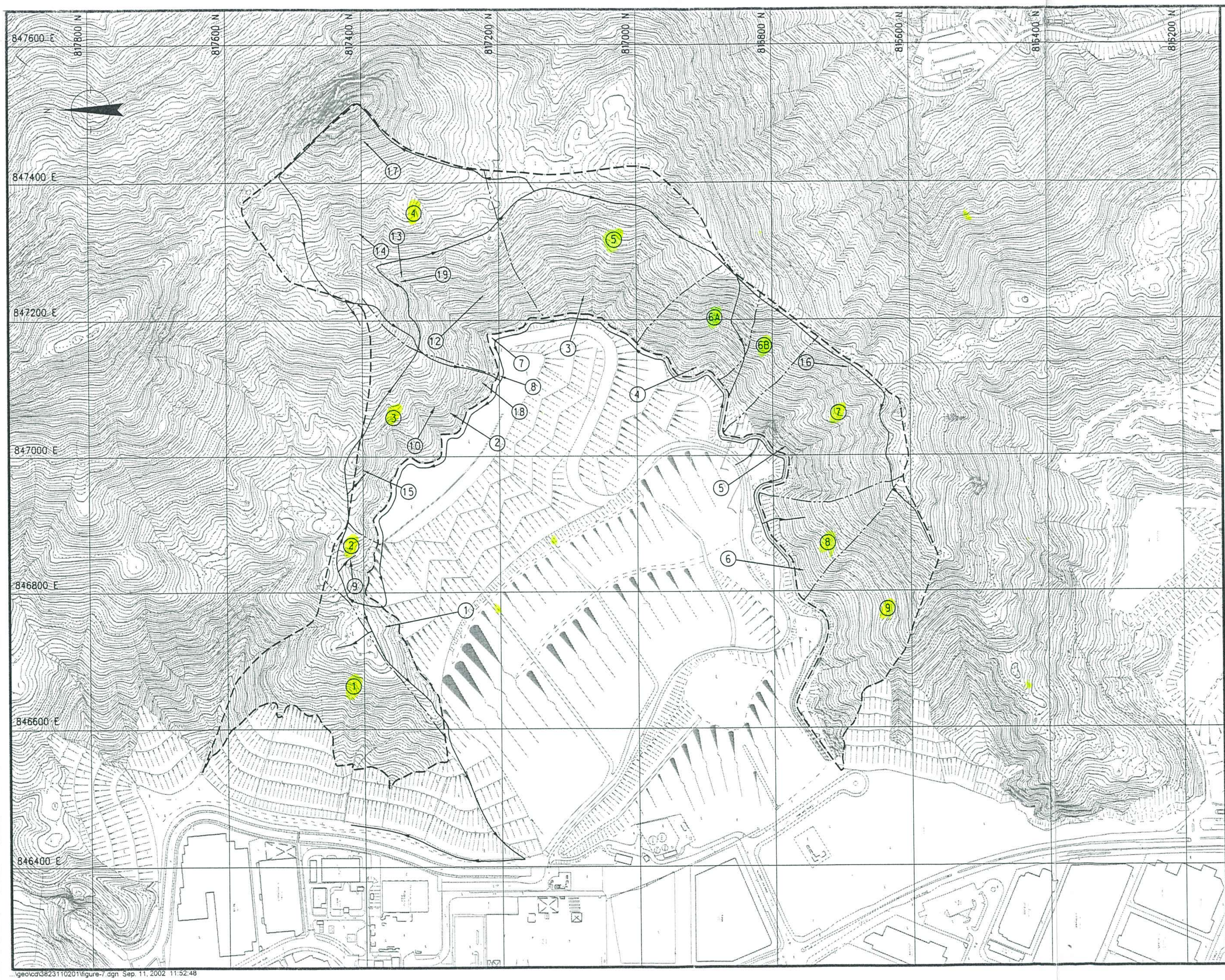
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NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. ALL DIMENSIONS ARE TYPICAL AND TO BE CONFIRMED AT DETAILED DESIGN.

LEGENDS:

①	CATCHMENT NOS.
— - - —	CATCHMENT BOUNDARY
←①	PHOTO NO.
——◄——	FIELD TRAVERSES
— — —	NATURAL TERRAIN BOUNDARY

Approved

ORIGINAL SIGNED BY C. DUTTON

CAD ref. MAIN : FIGURE-7.DGN
XREF : B12SW06B,D, B12SW01B,D,
B12SW02A,B,C,D & B12SW07A,B,C,D.DGN

Contract no. FD01-052

Contract
GEOTECHNICAL REVIEW AND
SITE INVESTIGATION WORKS
FOR TSEUNG KWAN O STAGE II/III
AFTERUSE DEVELOPMENT

Figure Title

FIELD INSPECTION TRAVERSE
AND LOCATIONS OF PHOTOGRAPHS
FOR NATURAL SLOPES

Figure no. 7

Scale 1 : 5000

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博威工程顧問有限公司
Engineers and Scientists

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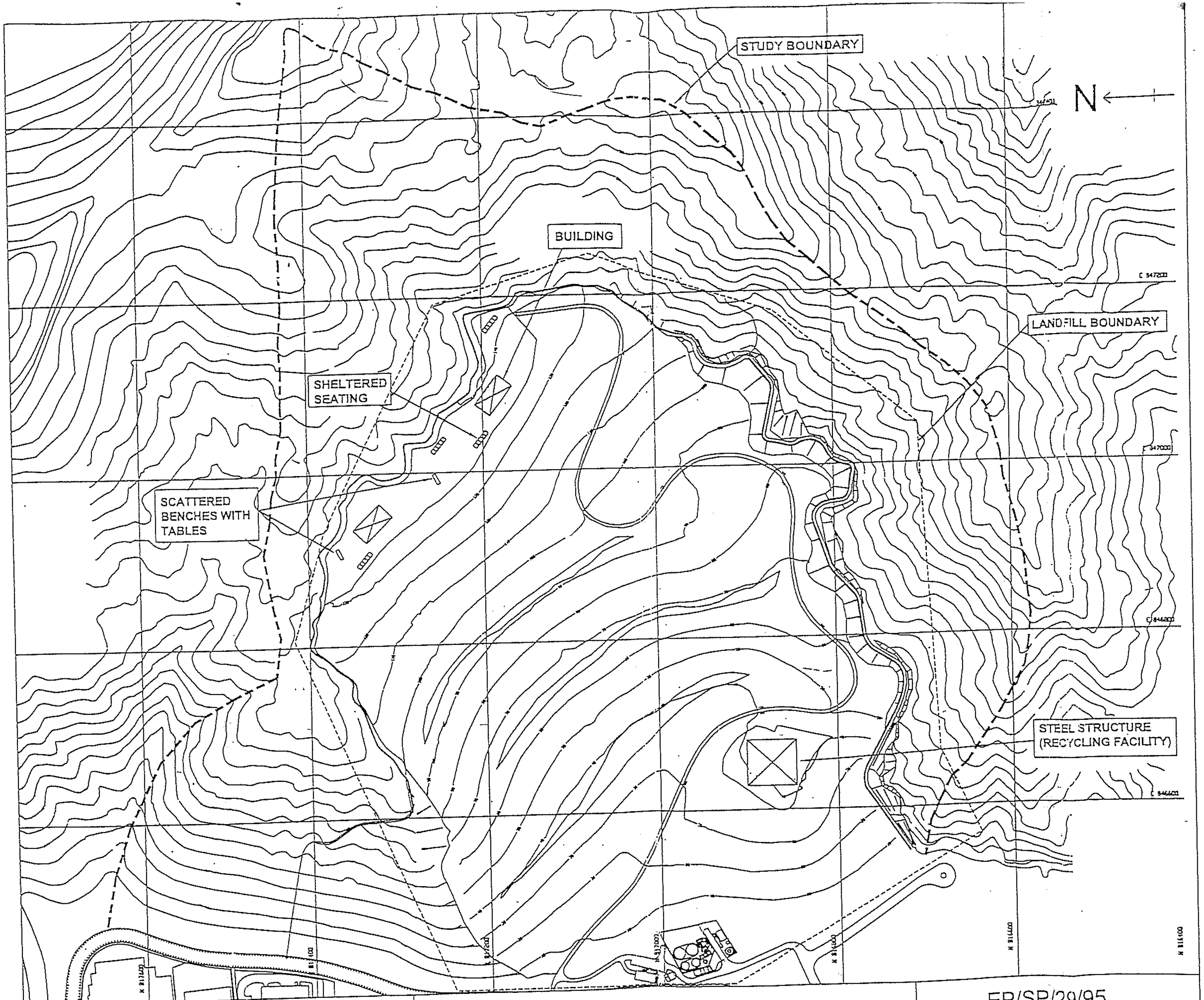

STUDY BOUNDARY
N
BUILDING
LANDFILL BOUNDARY
SHELTERED SEATING
SCATTERED BENCHES WITH TABLES
STEEL STRUCTURE (RECYCLING FACILITY)

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

FIGURE 8 - Tseung Kwan O Landfill Stage II/III Conceptual Design

EP/SP/29/95

2001-29D.DWG

20 JULY 2001

TABLES

Table 4.1 Summary of Aerial Photographs

Level of Photograph	Photo No. (Year)
High-Flight	Y00432-3 (1945), Y12906-8 (1964), 8038-9 (1973), 9709-10 (1974), A01724-A01725 (1985), CN16263-CN16264 (1996), CN18613-CN18615 (1997) and CN25715-CN25715 (1999).
Low-Flight	Y08353-4 (1963), Y13343-4 (1967), 9303-9305 (1974), 14973-14974 (1976), 30720 (1980), 44300 (1982), 47500-47501 (1983), A07542-A07543 (1986), A07375-A07376 (1986), A10847-A10848 (1987), A14141 (1988), A16794-A16796 (1989), A20554-A20555 (1990), A25266-A25267 (1991), A32763-A32764 (1992), A37384-A37386 (1993), A38017-A38019 (1994), CN10018-CN10020 (1995), CN14306-CN14307 (1996) CN17111-CN17112 (1997), CN21382-CN21383 (1998) A48421-A48423 (1998) and A49687-A49688 (1999).

Table 6.1 No. of Natural Slope Landslide reports for the period 1992 - 1998

Year	No. of Natural Slope Landslide Reported	No. of Landslide Volume < $50m^3$	List of Landslide Volume > $50m^3$					
1992	51	49	200	300				
1993	94	83	65	450	94	422	72	245
			450	500	84	300	750	
1994	59	55	500	200	100	55		
1995	26	23	95	50	100			
1996	9	9						
1997	88	70	400	150	2000	750	500	200
			100	100	170	150	78	80
			100	150	500	750	3000	100
1998	28	19	<100	560	150	225	50	300
			900	80	60			
(total)	**355**	**308**						

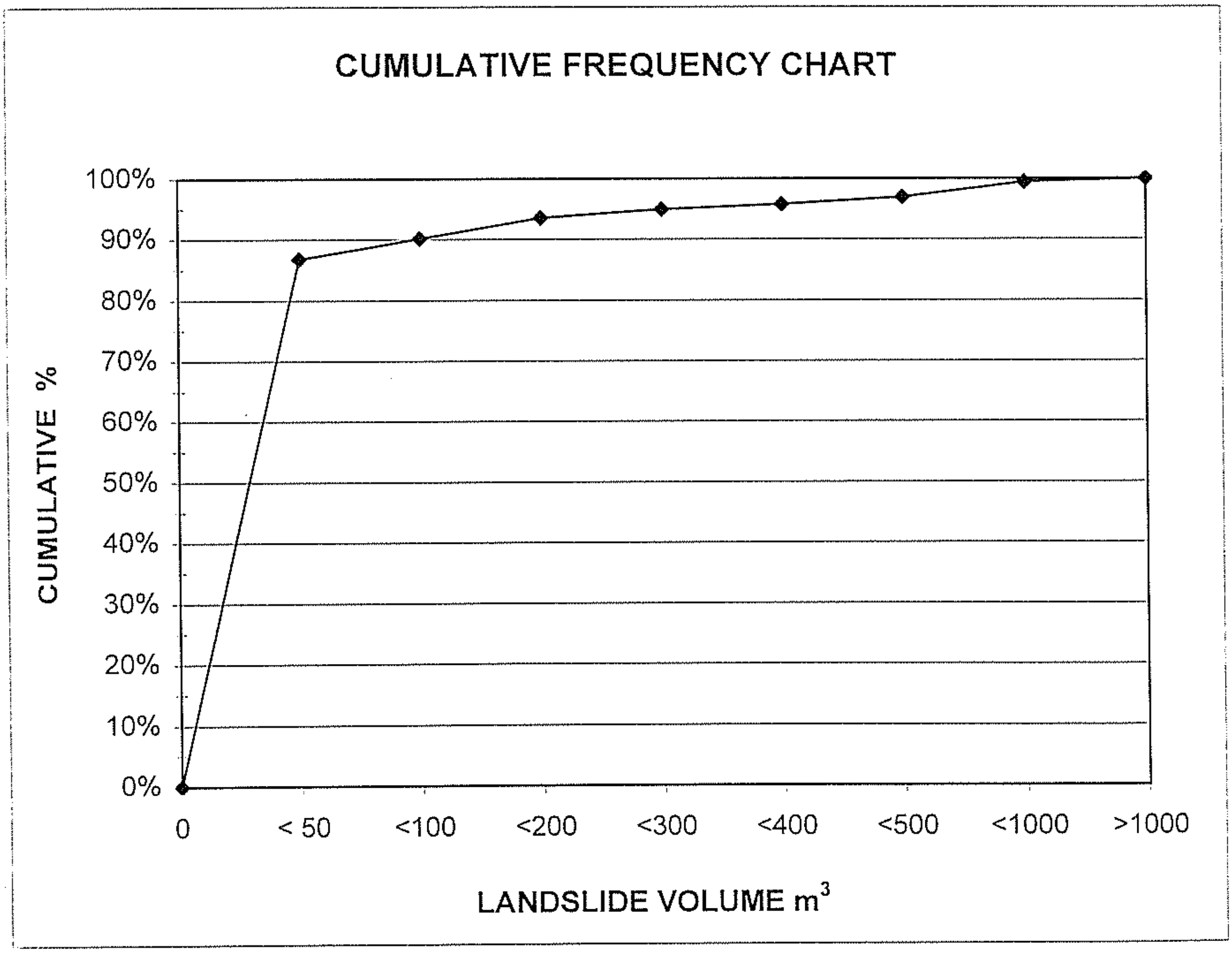


Table 6.2 Inventory of Landslide Scars (to be continued)

Landslide No	Estimate slip scar volume (m^3) (See Note 2)	Width (m) (See Note 1)	From API	From NTLI	Remarks
1	132.3	9 (3.5)		1945, 1964	NTLI Tag No. 97
2	50	7 (1.7)		1945, 1964	NTLI Tag No. 98
3	72	12 (1.0)	Yes	1945	NTLI Tag No. 19
4	90	15 (1.0)	Yes	1945	NTLI Tag No. 18
5	54	10 (1.0)		1974, 1975	NTLI Tag No. 124
6	92.4	13 (1.0)	Yes	1964, 1973	NTLI Tag No. 96
7	72.9	9 (1.5)	Yes		
8	162	15 (1.5)	Yes		
9	60	10	Yes - 1997		
10	163.8	13 (1.5)	Yes		
11	129.6	12 (1.5)	Yes		
12	50.4	8 (1.5)	Yes - 2000		Rock slope failure
13	176.4	14 (1.5)	Yes	1945, 1964	NTLI Tag No. 93
14	72.6	11 (1.0)	Yes		
15	135	15 (1.0)	Yes	1945, 1964	NTLI Tag No. 92
16	108	15 (1.0)	Yes	1945, 1964	NTLI Tag No. 91
17	108	12 (1.5)		1945, 1964	NTLI Tag No. 90
18	135	15 (1.0)	Yes		
19	168	20 (1.0)	Yes		
20	86.4	12 (1.0)	Yes	1945	NTLI Tag No. 6
21	100.8	14 (1.0)	Yes	1945	NTLI Tag No. 5
22	48	10 (1.0)		1945, 1964	NTLI Tag No. 94

Notes:

1 The width refers to the maximum width of the scar, assuming a roughly circular plan area (thickness of colluvium from GI information or 1.5 for WCE and 1.0 for CE).

2 Circular slip surface is assumed for the source volume estimation (i.e. 60% of W x L x D).

Table 6.2 Inventory of Landslide Scars (continued)

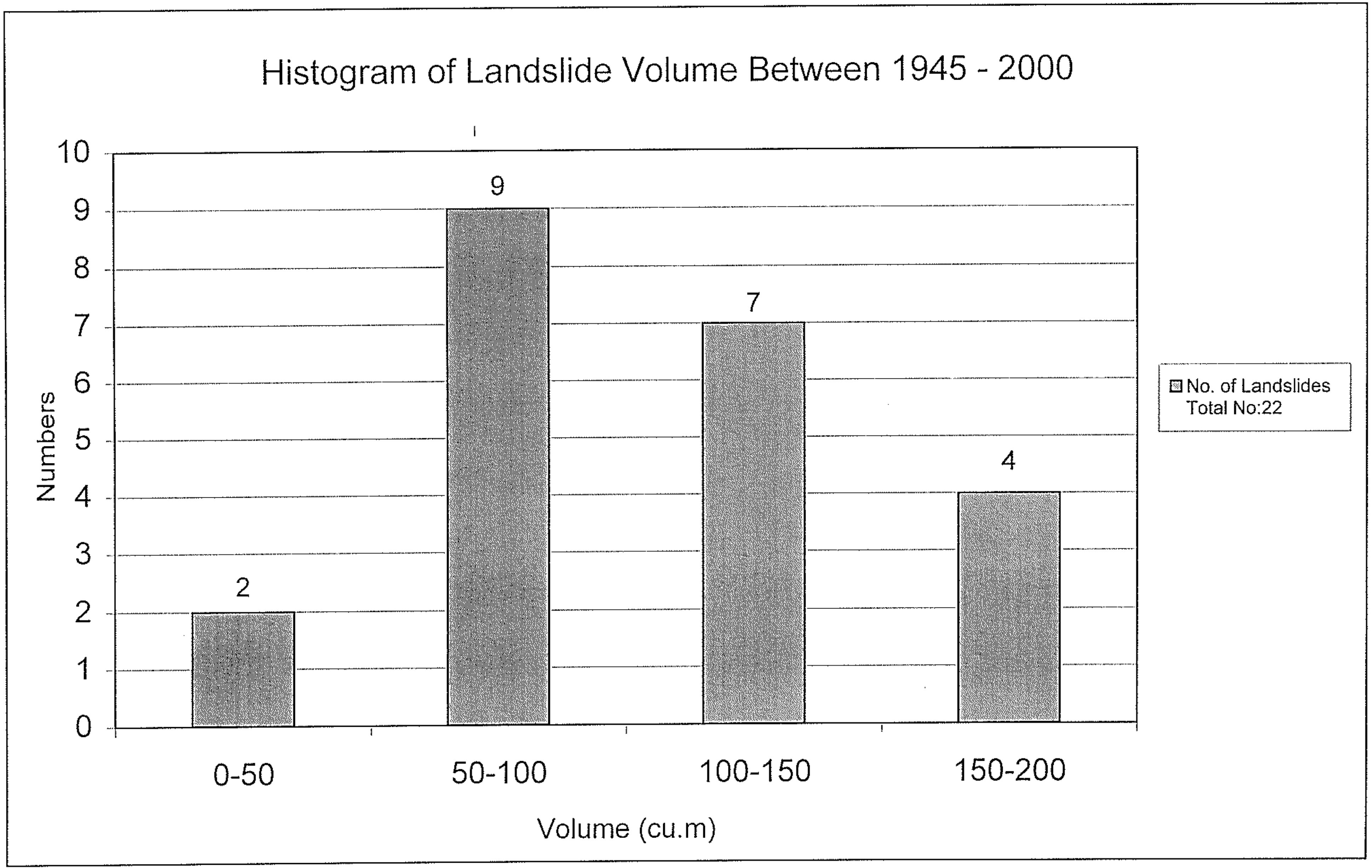


Table 6.2 Inventory of Landslide Scars (continued)

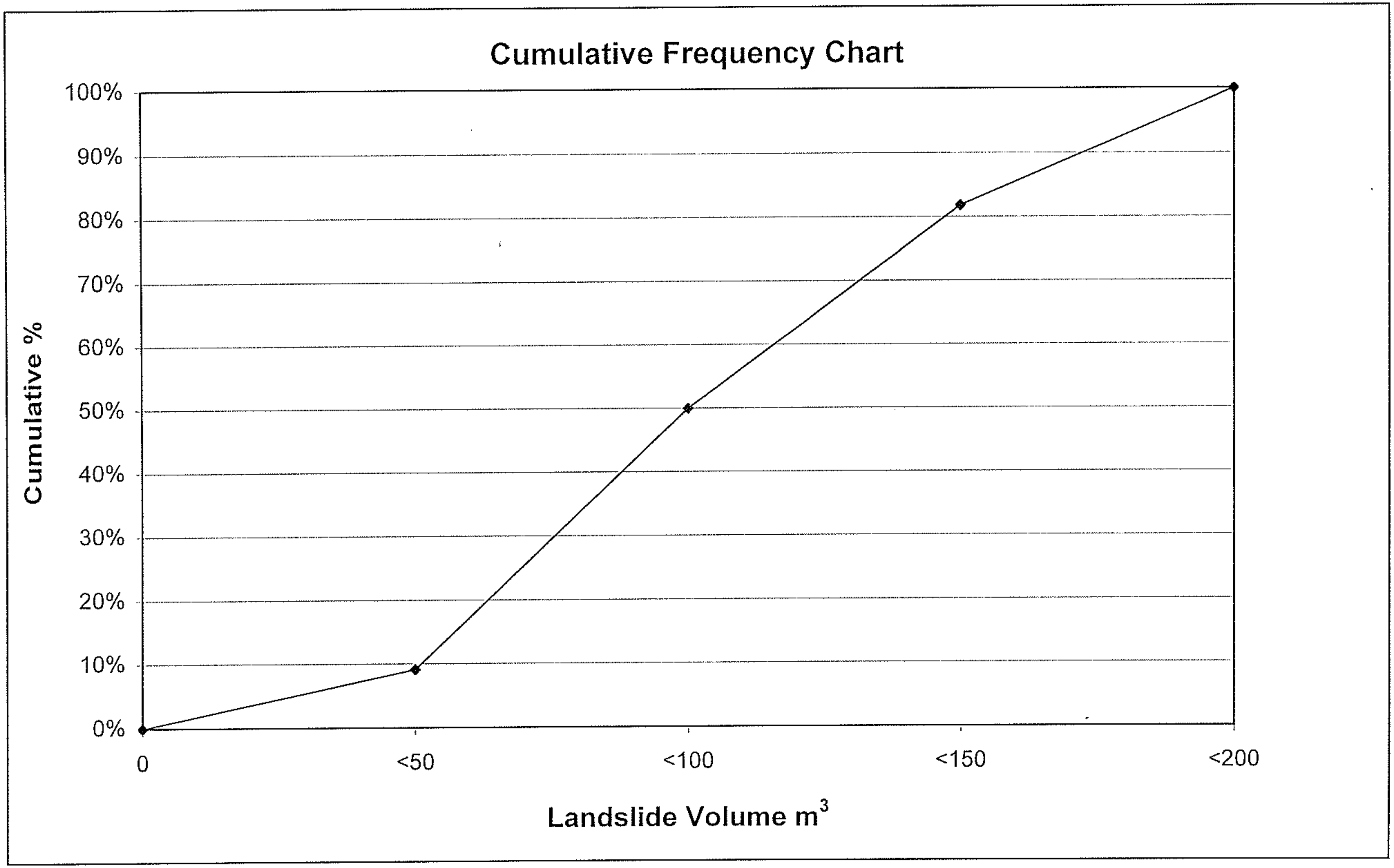


Table 6.3 Design Requirements Summary Table

Catchment	Facility	Facility Group [1]	Consequence Class [3]	Susceptibility Class [4]	Design Requirements [2]
1	Built-up area	3	II - Moderately close	X	N
2	Formed slope	3	II - Very close	D	N
3	Temporary offices	1	II - Moderately close	C	CE
4	Access Road	1	II - Moderately close	C	CE
5	Access Road	3	III - Moderately close	C	CE
6A	Access Road	3	III - Moderately close	C	CE
6B	Access Road	3	III - Moderately close	C	CE
7	Access Road	3	III - Moderately close	B	CE
8	Access Road	3	III - Moderately close	C	CE
9	Access Road	3	III - Moderately close	B	CE
	Steel Structure	1	III-Far	B	CE

Note:
(1) Please refer to Table 1
(2) Please refer to Table 2
(3) Please refer to Table 3
(4) Please refer to Table 4
X Does not affect landfill platform

Table 6.4 Estimation of Channelised Debris Flow Volume for Each Catchment

Catchment No.	Susceptibility Class	Design Landslide Event	Upper Drainage Line Angle (degrees)	Lower Drainage Line Angle (degrees)	Source Volume (m^3)	9% Deposition of Initial Volume from Main Scrap	Length of Drainage Line (m)	Possible Length of Erosion (i.e.Colluvium in Drainage Line & gradient >20°) (m)	Designed Erosion Rate (m^3/m)	Entrainment Volume (m^3)	Run-out Volume (m^3)	Trail Width (m)	Thickness of Deposition (m)	Length of Deposition (streambed gradient <20°) (m)	Total Volume of Deposition on Channel (m^3)	Final Run-out Volume (m^3)	Expected Run-out Distance (m)
3	C	CE	28	5	240	22	208	208	2.3	478.4	697	6	3.22	0	0	**697**	36.05
4 (Case 2)	C	CE	36	5	240	22	145	145	2.3	333.5	552	6	2.96	0	0	**552**	31.06
5	C	CE	29	5	240	22	208	208	2.3	478.4	697	6	3.27	0	0	**697**	35.48
6A	C	CE	41	10	240	22	144	144	2.3	331.2	550	6	2.02	0	0	**550**	45.34
6B	C	CE	32	10	240	22	144	144	2.3	331.2	550	6	1.71	0	0	**550**	53.48
7	B	CE	32	10	240	22	178	178	2.3	409.4	628	6	1.96	0	0	**628**	53.48
8	C	CE	32	10	240	22	190	190	2.3	437	655	6	2.04	0	0	**655**	53.48
9	B	CE	31	15	240	21.6	210	210	2.3	483	701	6	1.07	0	0	**701**	109.37

Note:

1. Refer to Table 9, GEO Report No. 57, of channelised failure:
   % deposition of initial volume from main scrap = **9%**
   Erosion Rate = **2.3 m^3/m (CE)**
   Trail width = **6m** (CE)
   Thickness of deposition should be read in conjunction with summary table of debris flow calculation in Appendix I
2. N/A = Not Applicable because out of project area.

Table 6.5
Summary Table for Channelised Debris Flows

Catchment No.	Design Landslide Event	Entry Channel Slope Angle (°)	Final Run-Out Volume (m^3)	Expected Run-Out Distance (m)
3	CE	56	697	36.05
4 (Case 1)	CE	42	0	-
4 (Case 2)	CE	36	552	31.06
5	CE	29	697	35.48
6A	CE	41	550	45.34
6B	CE	32	550	53.48
7	WCE	32	1,197	81.85
8	CE	32	655	53.48
9	CE	31	701	109.37

Table 6.6
Summary Table for Open Hillslope Landslides

Catchment No.	Design Landslide Event	Slope Angle (°) at Slope Toe	Final Run-Out Volume (m^3/m)	Expected Run-Out Distance (m)
3	CE	56	24	11.84
4	CE	60	24	12.06
5	CE	59	24	12.01
6A	CE	57	24	15.08
6B	CE	70	24	15.64
7	WCE	50	30	16.39
8	CE	55	24	14.97
9	CE	60	24	22.38

Table 7.1
Summary of Boulder Survey

Boulder No.	Size (m^3)	Catchment No.	Shape	Stability Rating (1)	Risk Rating (2)	Potential failure Mechanism (3)	Stabilisation/ Preventive Works
1	2.88	2	Cubic-subrounded	M	H	R	Removal
2	1.44	4	Cubic-subangular	M	H	T	Dentition

Notes: (1) M-Medium (3) R- Rolling
(2) H-High T-Toppling

APPENDICES

APPENDIX A

Summary of GASP Report VII and Existing Borehole Records

GASP Report VII

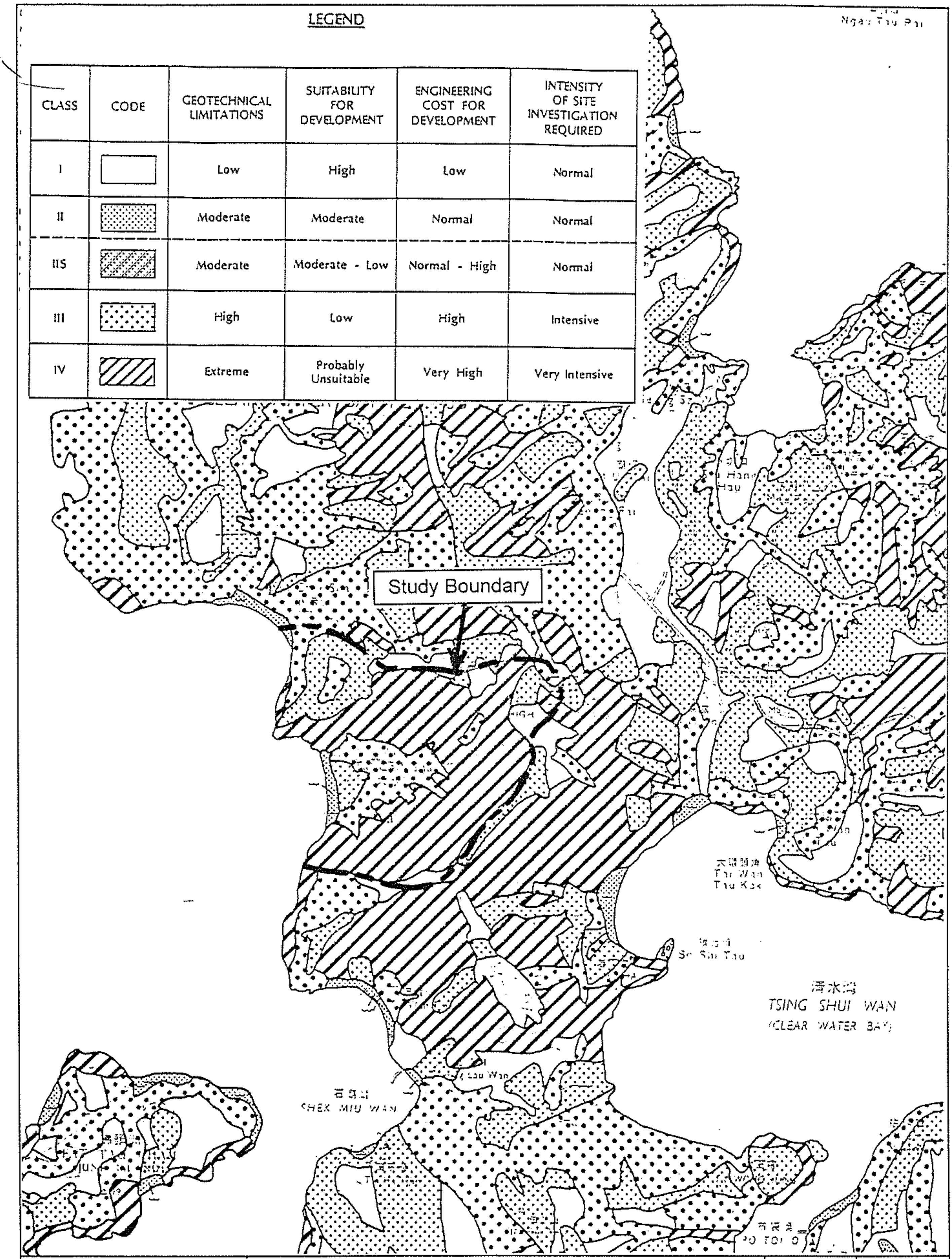
The Geotechnical Area Studies Programme (GASP) Report VII for the Clear Water Bay area (1988), issued by the Geotechnical Engineering Office, has been consulted and relevant information is summarised below with relevant maps shown as Figures B1 to B3. It should be noted that this information only discusses the site during its pre-operation condition.

Maps (Figure No.)	Remarks
GLUM (Figure A1)	1. The site is classified as having predominantly extreme geotechnical limitations, probably unsuitable for development requiring a very high engineering cost and very intensive site investigation. Localised areas of moderate to high geotechnical limitations are situated in the western portion of the site which require a normal to high engineering cost and normal to intensive site investigation.
Physical Constraints Map (Figure A2)	1. The central region of the site is identified as zones of colluvium which are subject to overland flow and periodic inundation with evidence of unusual groundwater regime. The majority of the site surrounding this central region is identified as zones of general instability associated with predominantly insitu terrain. 2. Localised zones of general instability associated with predominantly colluvial terrain is situated in the southern portion of the site and slopes on insitu terrain which are generally steeper than 30° occur in the westernmost region of the site.
Engineering Geology Map (Figure A3)	1. The site is shown to be located on the Repulse Bay Formation of mainly banded acid lavas, some welded tuffs in the east and dominantly pyroclastic rocks in the west. The two rock types usually produces a thin (<1m) soil horizon followed downwards by yellowish brown sandy completely weathered material overlying less weathered, locally strongly jointed rock below an average depth of 11m. The stability of the weathered material and of highly jointed rock masses may be suspect, especially during or immediately after prolonged rainfall. Failures are quite common and rapid surface run-off predicted. There are few opportunities for creation of platforms with usable sites small and fragmented. 2. The central region of the site is located in colluvium which occur as independent deposits of a unique age such that one deposit overlies another. The older deposits may be subject to severe weathering. The depth of such weathering may be in the order of 10m or more. This material has moved in the geologic past and is prone to reactivation if not carefully treated by such measures as low batter angles, drainage and surface protection, especially when saturated. Has low to moderate bearing capacity characteristics and should always be drained. Voids may cause settlement of roads, services and buildings.

	3. In the southernmost tip of the site, granophyric microgranite occurs which weathers to produce a clayey silty sand with corestones. Depths of weathering in excess of 20m can occur. Weathered material may be unstable if undercut. Joints control stability in any rock cutting. 4. Several geological photolineaments cut the site, trending approximately East-West, North-South and NW-SE.

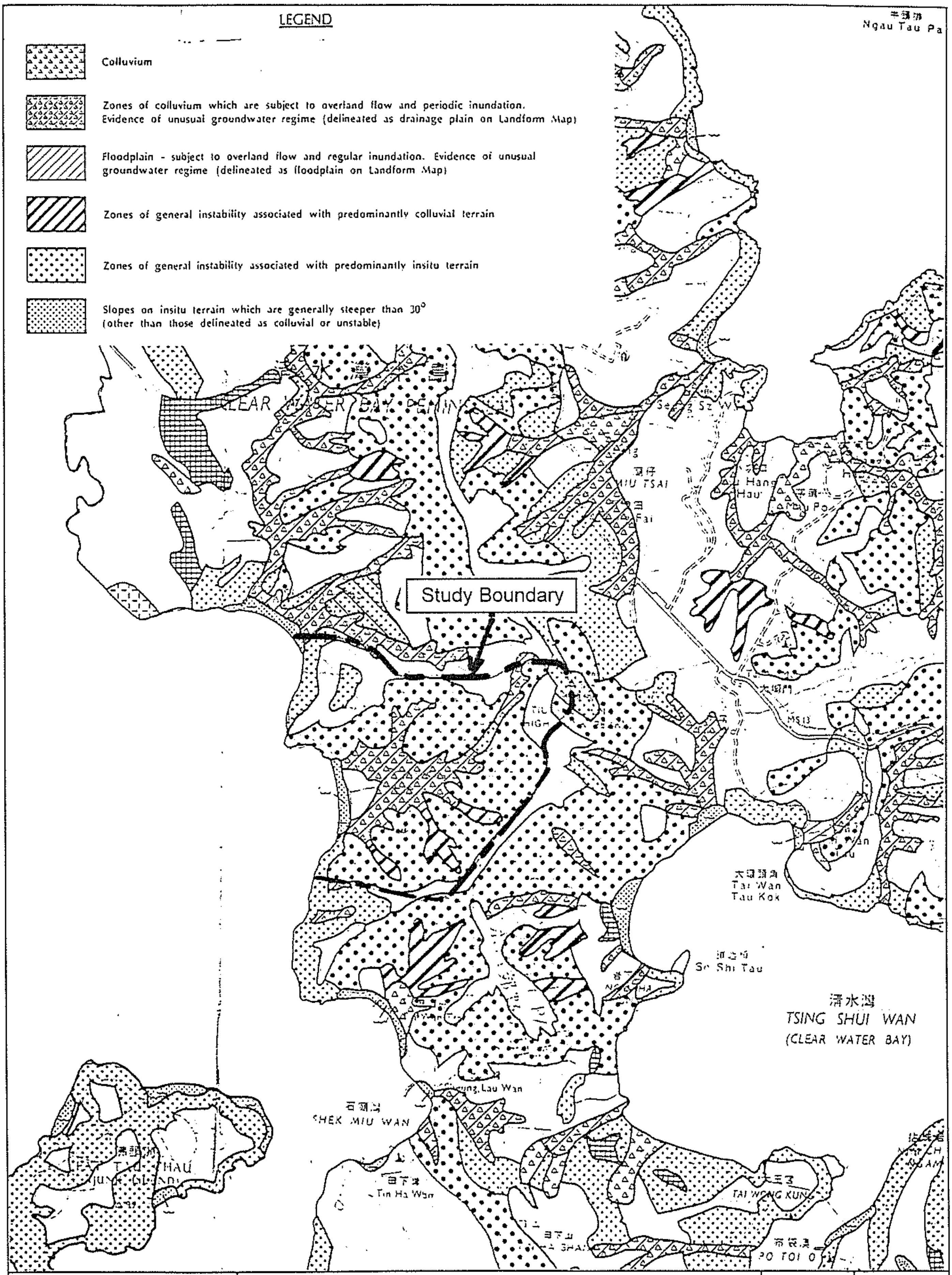
LEGEND

CLASS	CODE	GEOTECHNICAL LIMITATIONS	SUITABILITY FOR DEVELOPMENT	ENGINEERING COST FOR DEVELOPMENT	INTENSITY OF SITE INVESTIGATION REQUIRED
I	☐	Low	High	Low	Normal
II	░	Moderate	Moderate	Normal	Normal
IIS	▨	Moderate	Moderate - Low	Normal - High	Normal
III	▒	High	Low	High	Intensive
IV	▧	Extreme	Probably Unsuitable	Very High	Very Intensive

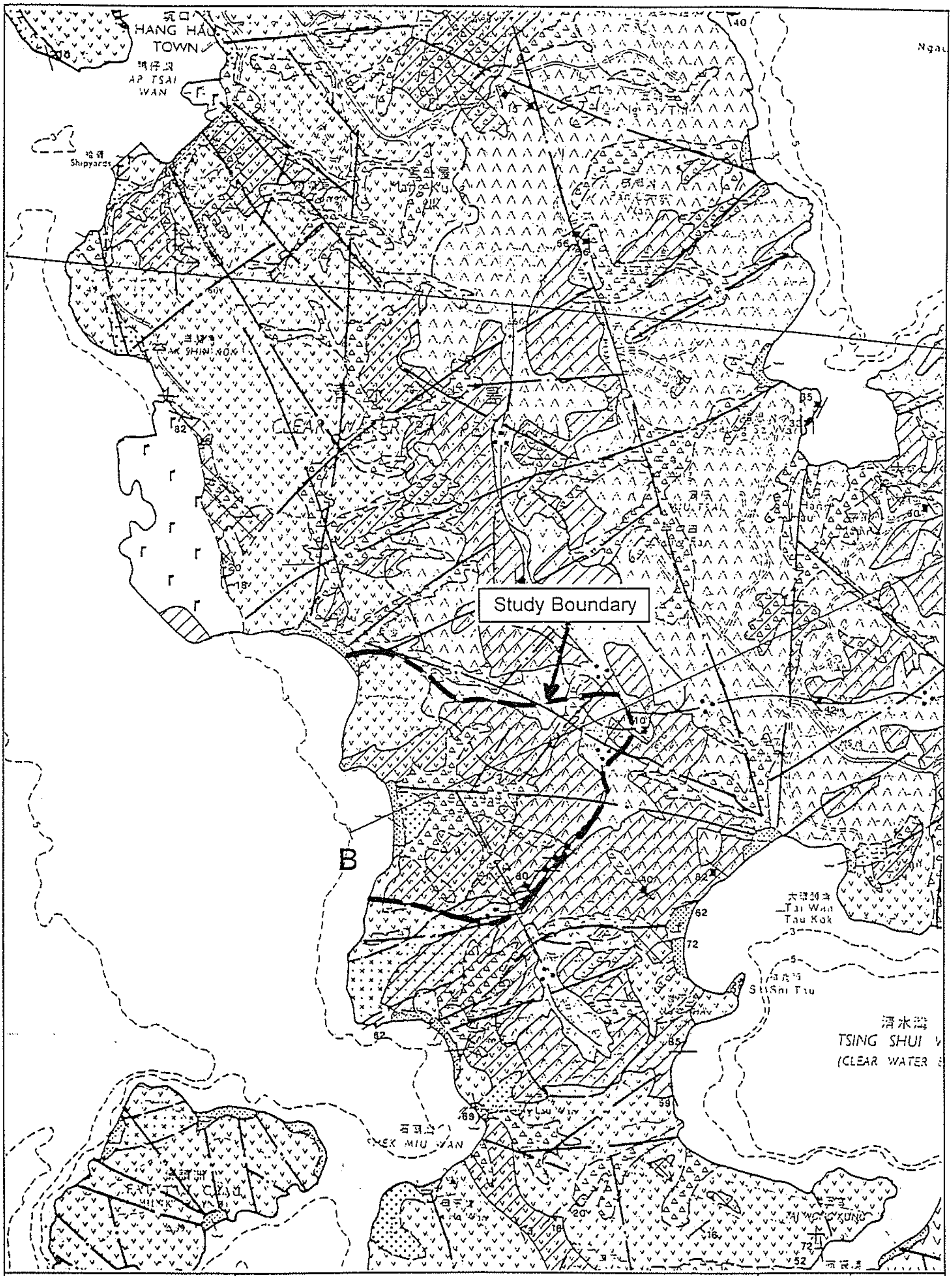

Study Boundary
Hang Hau
Tai Wan Tau Kok
清水灣
TSING SHUI WAN
(CLEAR WATER BAY)
SHEK MIU WAN
Lau Wan
Po Toi O

Binnie

	Project Tseung Kwan O Stage II/III Landfill Afteruse Development	Prepared by SMO	Date Nov 01
Figure No A1	Title Geotechnical Land Use Map	Scale 1:20 000	


LEGEND
Colluvium
Zones of colluvium which are subject to overland flow and periodic inundation. Evidence of unusual groundwater regime (delineated as drainage plain on Landform Map)
Floodplain - subject to overland flow and regular inundation. Evidence of unusual groundwater regime (delineated as floodplain on Landform Map)
Zones of general instability associated with predominantly colluvial terrain
Zones of general instability associated with predominantly insitu terrain
Slopes on insitu terrain which are generally steeper than 30° (other than those delineated as colluvial or unstable)
Study Boundary
Ngau Tau Pa
CLEAR WATER BAY PENIN
Hang Hau
Tai Wan Tau Kok
清水灣
TSING SHUI WAN
(CLEAR WATER BAY)
SHEK MIU WAN
Tin Ha Wan
JUNK ISLAND
TAI WONG KUNG
PO TOI O

Binnie	Project Tseung Kwan O Stage II/III Landfill Afteruse Development	Prepared by SMO	Date Nov 01
Figure No A2	Title Physical Constraints Map	Scale 1:20 000	



坑口
HANG HAU
TOWN
AP TSAI
WAN
Shipyards
Ngau
CLEAR WATER BAY
Study Boundary
B
Tai Wan
Tau Kok
TSING SHUI W
(CLEAR WATER B
SHEK MIU WAN
TAI WONG KUNG
清水灣

Binnie	Project Tseung Kwan O Stage II/III Landfill Afteruse Development	Prepared by SMO	Date Nov 01
Figure No A3a	Title Engineering Geology Map	Scale 1:20 000	

Map unit	Weathering and Soil Development	Engineering Comment (Stability, Foundation, Hydrogeology)	Material Uses and Excavation Characteristics
RECLAMATION FILL	These materials placed by man have no soil (pedogenic) or weathering profile but may contain weathered rocks or be underlain by natural superficial deposits and/or a pre-existing weathered profile.	Few problems if properly compacted. Old fill slopes may be poorly compacted and subject to failure. Steep excavations require support. High groundwater requires special drainage. Low bearing pressures can be accepted directly, high loads need raft, spread or piled foundations. Settlement problems minor except in sanitary landfill which may have associated leachate and gas problems.	These areas, when properly formed, provide platforms with high development potential. Care should be taken in excavation of sanitary landfill when biodegradation is incomplete.
LITTORAL DEPOSITS	Nil	Materials are usually saturated and saline. Raised beaches may be leached by rainwater but may remain saline at depth. Groundwater extraction may induce incursion of saline water. Poor grading characteristics—low fines. Low bearing pressures can be accepted directly, moderate and high loads need raft, spread or piled foundations.	Main development potential is as beaches for recreational purposes. Excavation of these materials is usually prohibited.
ALLUVIAL DEPOSITS	In subaerial locations very minor development of soil horizon. Relict deposits may be more weathered. Very old deposits may contain completely weathered boulders.	Locally low-lying terrain may be subject to flooding. Materials are usually saturated and of a low density – clay layers are normally consolidated. Buried channels may pose local problems of high water flows into tunnels or excavations. Steep excavations require support. Groundwater may be saline if adjacent to coast. Incursion of saline groundwater following abstraction of fresh groundwater may occur. Low bearing pressures can be accepted directly, moderate and high loads need raft, spread or piled foundations.	Land deposits easily excavated. Marine deposits often form reasonable hydraulic fill. Excavation by cutter, suction or bucket dredger.
COLLUVIUM VOLCANIC DERIVED GRANITIC DERIVED MIXED	Colluvium can occur as independent deposits of a unique age such that one deposit overlies another. The older deposits may be subject to severe weathering and may be completely decomposed to a mottled, coloured sandy silt or clayey silt similar to the insitu residual deposits of their parent materials. The depth of such weathering may be in the order of 10 m or more.	This material has moved in its geologic past and is prone to reactivation if not carefully treated by such measures as low batter angles, drainage, and surface protection, especially when saturated. Has low to moderate bearing capacity characteristics but should always be carefully drained because it may be susceptible to failure when wet. Voids may cause settlement of roads, services and buildings. Tunnelling probably difficult. Site investigation likely to be difficult and expensive.	May be used for borrow due to its ease of excavation by machine, broad grading characteristics and relative ease of access on hillsides. Some stream fill bouldery deposits will be of limited use. Large boulders may require blasting or splitting.
SEDIMENTARY VOLCANICLASTIC AND EXTRUSIVE IGNEOUS ROCKS SEDIMENTARY AND WATER-LAID VOLCANICLASTIC ROCKS	Shallow to moderately deep, reddish to brown, fine, sandy to silty clay, i.e. residual soil sometimes with ferruginous gravel and weathered rock fragments, overlying completely to highly weathered rock which grades into less weathered strongly jointed volcanic rock at depths from 5–20 m.	The sediments are bedded and fissile and weather relatively rapidly to a grey silt when exposed. Some stability problems may arise. Groundwater regime may be controlled by the bedded character of the rock.	Can be scraped and ripped when weathered. Fresh rock will need pneumatic machines or blasting. Due to highly variable properties and presence of chert bands, this material would not make a good source of aggregate but is well suited for filling.
REPULSE BAY FORMATION ACID LAVAS	Rock usually develops a thin (< 1 m) soil horizon and a thin (< 10 m) weathered zone before passing rapidly into moderately to slightly weathered bedrock.	Stability of weathered material and also of highly jointed rock masses may be suspect, especially during or immediately after prolonged heavy rainfall. Failures are quite common, especially in over-steepened slopes. Rapid surface runoff is common. Stability of rock slopes controlled by relatively closely spaced discontinuities in moderately weathered to fresh rock mass. —Few opportunities for creation of platforms: usable sites may be small and fragmented. —Access route selection hampered by terrain. —Tunnelling probably easier than in granitoids. Deep weathering and close jointing should be anticipated near structural geological lineaments.	Very hard and abrasive when fresh, will require blasting which may result in brittle fracture. Inadvisable for aggregate unless tested for silica/cement reaction.
MAINLY BANDED ACID LAVAS, SOME WELDED TUFFS AGGLOMERATE DOMINANTLY PYROCLASTIC ROCKS	Rock usually produces a thin (< 1 m) soil horizon, followed downwards, especially on lower slopes, by yellowish brown sandy completely weathered material overlying less weathered, locally strongly jointed rock below an average depth of 11 m. On steep, high slopes considerable rock exposure occurs, with thin soil or weathering cover.		Material can be used for fill if it is weathered locally. It is possible to quarry, although very hard and not generally favoured. Coarse crystal tuff horizons may provide good aggregate.
INSTRUSIVE IGNEOUS ROCKS (PLUTONIC) GRANOPHYRIC MICROGRANIT	Weathers to produce a clayey silty sand with corestones. Depth of weathering similar to other granites. Fresh rock outcrops in stream beds on occasions.	Weathered material may be unstable if undercut. Joints control stability in any rock cutting.	Weathered material could be machine excavated for use as fill. Fresh rock will require blasting.

▨ General instability

Binnie	Project Tseung Kwan O Stage II/III Landfill Afteruse Development	Prepared by SMO	Date Nov 01
Figure No A3b	Title Engineering Geology Map	Scale 1:20 000	

Existing Borehole Records and GI Information

27 boreholes drilled in and adjacent to the proposed works area have been reviewed. Drillhole locations are shown in Figure 8. In general, the information indicates that the ground conditions at or near the area could be of 9 types of stratification. Materials encountered in the boreholes are summarised below:

Soil/Rock Types	Thickness (m) / (basal) mPD	SPT 'N' value	Descriptions
Fill (Landfill)	12.0- 18.0 / -6.54 to -10.15		Landfill material of layers of gravel, sand and rock fill.
Fill	1.15 / +18.75		Cobble, gravel with silty Sand.
Topsoil	0.7-1.0	10	Loose, reddish pink & brown, silty Sand to clayey sandy Silt with gravel & cobbles.
Colluvium	0.5-1.50	20	Soft, brownish red sandy silty Clay with gravel & cobbles of volcanic.
Marine Deposit	4.0-6.0 / -9.85 to –11.5		Very soft, greenish grey Silt/Clay to clayey silty Sand with shell fragments.
Alluvium	0.60-6.8 (at base; -13.21 to -16.65 and midslope +32.9)	43 – 90	At base of terrain – stiff, greenish yellow silty Clay. At midslope, 0.60m silty Sand with cobbles.
C-HDV PW 30 – 50	0.44 – 15.6 / At base; 11-16/ +8.9 to –29.85; 0.45-15.6/ +23.5 to +39.43; 4.53-8.8/ +70.10 to +88.90; 0.44 / +107.38	8 – 209	Dense to very dense, yellowish and reddish brown, grey, silty to clayey SAND to fine sandy clayey Silt with some gravel (completely to highly decomposed volcanic).
M/HDV	1.0-3.5/ -30.85 to –31.51; 6.6/+21.0; 1.0/+58.26; 2.9-5.3/ +78.48 - +81.1; 2.62/+133.68		Moderately weak to moderately strong, light purple & brown, grey fine to medium grained Volcanic.
Rockhead	+7.4 – +25.1; +31.35 - +39.43; +57.26 - +88.90; +107.38; +133.68 - +162.36 (mPD)		Moderately strong to very strong, grey, moderately to slightly decomposed (M-SD) fine to medium grained Volcanic with closely to very widely spaced joints.

Recent Borehole Records and GI Information

7 boreholes drilled and 14 trial pits excavated on the natural slopes surrounding the proposed development have been reviewed. Drillhole locations are shown in Figure 4. In general, the information indicates that the ground conditions at or near the area could be of 8 types of stratification. Materials encountered in the boreholes are summarised below:

Soil/Rock Types	Thickness (m) / (basal) mPD	SPT 'N' value	Descriptions
Fill	0.5 –2.59 / +84.87, +139.77, +152.68		Firm, greyish brown, sandy silt to silty fine to coarse Sand with gravel.
Topsoil	0.5 / +140.27		Firm, grey, silty fine to medium Sand with gravel.
Colluvium	1.0 / +40.69; 1.50 / +112.36 to +125.01	8	Soft to firm, yellowish to greyish brown, sandy Silt/Clay and silty fine to coarse Sand with gravel, cobbles & boulder sized volcanic.
Residual Soil	1.0 / +38.19, +111.86, +169.73		Firm, yellowish brown, sandy clayey Silt.
C-HD Rhyolite PW 30 – 50	>11.60 / +26.59 (SW)	42 - >100	Rhyolite; brown, dappled red and white, silty fine to coarse Sand to fine to coarse Gravel
C-HD Trachydacite Lava/Tuff PW 30 – 50	0.12 – 4.3 / +107.56 to +124.89; 1.30 / +138.47; 0.72 / +151.96; 7.60 / +162.13	17 - 67	Firm to very stiff, yellowish brown and light grey, sandy Silt to silty clayey fine to coarse Sand or fine to coarse Gravel sized rock fragments.
M/HD Trachydacite Lava/Tuff	4.96 – 9.53 / 79.91 to 98.03; 6.8 / +118.11; 2.83 /+135.64; 5.05/+157.08;		Moderately weak to moderately strong, light brown, dappled white and red, Trachydacite Lava; greenish grey fine ash Tuff.
Rockhead	7.55 bgl / 79.91; 8.40 bgl / +118.11; 5.13 bgl / +135.64; 1.22 to 13.65 bgl / +151.96 to +157.08		Moderately strong to very strong, grey, stripped dark grey, moderately to slightly decomposed (M-SD) Trachydacite Lava/Tuff with closely to medium spaced joints.

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO.	DH1
SHEET	1 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation		
METHOD	Rotary Cored	CO-ORDINATES E 846613.47 N 816705.21	Works Order No. GE/2001/13.10
MACHINE & No.	DR86		DATE from 11/06/2002 to 13/06/2002
FLUSHING MEDIUM	Air-Foam	ORIENTATION Vertical	GROUND LEVEL 41.69 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
11/06/2002	PX								41.69	0.00			Loose, greyish brown (10YR 5/2) mottled white, very silty fine to coarse SAND with occasional subangular fine to medium gravel sized rock fragments. (COLLUVIUM)
								1 ●	41.19	0.50			Soft, brown (7.5YR 5/4) dappled white, sandy SILT with occasional subrounded to subangular fine to coarse gravel sized rock fragments. (COLLUVIUM)
								2 ●	40.69	1.00		VI	Soft to firm, yellowish brown (10YR 5/8) dappled white, sandy SILT with occasional subrounded fine to coarse gravel sized rock fragments. (RESIDUAL SOIL)
			96					3 ● 4 ▨		1.50			
	PX 2.50 HX						1,1 2,2,2,2 N=8	5 ● 6 ▯		2.60			
11/06/2002 12/06/2002		3.00m at 18:00 Dry at 08:00						7 ●		3.05			
			100					8 ▨	38.19	3.50		V	Extremely weak, brown (7.5YR 5/4) dappled red and white, completely decomposed, RHYOLITE LAVA. (Silty fine to coarse SAND)
							5,9 9,10,11,12 N=42	9 ● 10 ▯		4.50			
								11 ●		5.05			
			90					12 ▨		5.50			
							7,7 9,10,13,15 N=47	13 ● 14 ▯		6.60			
								15 ●		7.05			
			97					16 ▨	34.19	7.50		V/IV	Extremely weak to very weak, brown (7.5YR 5/4) dappled red and white, completely to highly decomposed, RHYOLITE LAVA. (Subangular fine to coarse GRAVEL sized rock fragments with silty sand)
							10,14 20,24,25,27 N=96	17 ● 18 ▯	33.09	8.60		V	Extremely weak, brown (7.5YR 5/4) dappled red and white, completely decomposed, RHYOLITE LAVA. (Silty fine to coarse SAND)
								19 ●		9.05			
			100					20 ▨	32.19	9.50		V/IV	Extremely weak to very weak, brown (7.5YR 5/4) dappled red and white, completely to highly decomposed, RHYOLITE LAVA. (Subangular

- ● SMALL DISTURBED SAMPLE
- ↕ LARGE DISTURBED SAMPLE
- ▯ SPT LINER SAMPLE
- ▨ U76 UNDISTURBED SAMPLE
- ▮ U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- ▤ PISTON SAMPLE
- △ WATER SAMPLE
- PIEZOMETER TIP
- STANDPIPE
- STANDARD PENETRATION TEST
- PERMEABILITY TEST
- IMPRESSION PACKER TEST
- V IN-SITU VANE SHEAR TEST
- PACKER TEST

LOGGED	K.L. Lo
DATE	14/06/2002
CHECKED	Tom Lo
DATE	17/06/2002

REMARKS
1. Standpipe was installed at 15.10m depth.

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO.	DH1
SHEET	2 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

METHOD	Rotary Cored	CO-ORDINATES E 846613.47 N 816705.21	Works Order No. GE/2001/13.10
MACHINE & No.	DR86		DATE from 11/06/2002 to 13/06/2002
FLUSHING MEDIUM	Air-Foam	ORIENTATION Vertical	GROUND LEVEL 41.69 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
10	HX		▨							10.00			fine to coarse GRAVEL sized rock fragments with silty sand)
								21	31.09	10.60			
11		10.50m at 18:00					8,15 17,17,22,31 N=67	22 23		11.05		V	Extremely weak, brown (7.5YR 5/4) dappled red and white, completely decomposed, RHYOLITE LAVA. (Silty fine to coarse SAND)
12/06/2002 13/06/2002		10.96m at 08:00	0					24	30.19	11.50 11.80		V/IV	Extremely weak to very weak, brown (7.5YR 5/4) dappled red and white, completely to highly decomposed, RHYOLITE LAVA. (Subangular fine to coarse GRAVEL sized rock fragments with silty sand)
12 13			80				24,26/75mm 73,27/11mm (100bls/86mm)	25 26 27 28	29.69	12.00 13.00 13.10 13.34		V	Extremely weak, brown (7.5YR 5/4) locally dappled white, completely decomposed, RHYOLITE LAVA. (Very stiff, sandy SILT)
14 15 13/06/2002	HX 14.00	13.50m at 18:00	97				Δ	29 30	27.89	13.80		V	Extremely weak, brown (7.5YR 5/4) dappled white, completely decomposed, RHYOLITE LAVA. (Silty fine to coarse SAND)
									26.59	15.10			Hole completed at 15.10m.
16													
17													
18													
19													
20													

- • SMALL DISTURBED SAMPLE
- LARGE DISTURBED SAMPLE
- ▯ SPT LINER SAMPLE
- U76 UNDISTURBED SAMPLE
- ■ U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- PISTON SAMPLE
- Δ WATER SAMPLE
- PIEZOMETER TIP
- STANDPIPE
- STANDARD PENETRATION TEST
- PERMEABILITY TEST
- IMPRESSION PACKER TEST
- V IN-SITU VANE SHEAR TEST
- PACKER TEST

LOGGED	K.L. Lo
DATE	14/06/2002
CHECKED	Tom Lo
DATE	17/06/2002

REMARKS

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH2
SHEET 1 of 3

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation
METHOD	Rotary Cored
MACHINE & No.	DR129
FLUSHING MEDIUM	Air-Foam
CO-ORDINATES	E 846934.31 N 816760.17
ORIENTATION	Vertical
Works Order No.	GE/2001/13.10
DATE from	07/06/2002 to 10/06/2002
GROUND LEVEL	113.36 mPD

Drilling Progress	Casing size	Water level (m) & Time
07/06/2002 (0.00)	PX	
	PX 2.00	
	HX	
07/06/2002 (5.20)		Dry at 18:00
08/06/2002		Dry at 08:00
	HX 5.80	

Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index
92			
100			
95			
91	26	19	NI 10.5 NI
97	0	0	
100	0	0	
30	19	0	NR 8.7
90	90	0	
98	98	0	
94	0	0	NI
92	38	0	

Tests	Samples
	1 ●
	2 ●
	3 ●
	4 ▨
	5 ●
3,5 5,6,10,13 N=34	6 ▯
	7 ●
	8 ▨
	9 ●
	10 ▨
	11 ●
13,11 9,15,28,35 N=87	12 ▯
	13 ●
	T2101
	T2101
	T2101
	T2101
	T2101
	T2101
	T2101

Reduced Level	Depth (m)	Grade	Description
113.36	0.00 0.50		Firm to stiff, brown (7.5YR 5/4) dappled red and white, sandy SILT with occasional subangular to subrounded fine to coarse gravel sized rock fragments. (COLLUVIUM)
112.36	1.00	VI	Firm, brown (7.5YR 5/4) dappled white and red, sandy SILT. (RESIDUAL SOIL)
111.86	1.50	V	Extremely weak, yellowish brown (10YR 5/8) dappled white and red, completely decomposed, TRACHYDACITE LAVA. (Firm, sandy SILT)
110.76	2.60 3.05	V	Extremely weak, light grey (7.5YR 7/1) dappled white and streaked red, completely decomposed, TRACHYDACITE LAVA. (Stiff, slightly sandy SILT)
109.86	3.50 4.10	V/IV	Extremely weak to very weak, brown (7.5YR 5/4) dappled grey, white and red, completely to highly decomposed, TRACHYDACITE LAVA. (Subangular fine to coarse GRAVEL sized rock fragments with silty sand)
108.16	5.20 5.65	V/IV	Extremely weak to very weak, reddish brown (5YR 5/4) dappled white, completely to highly decomposed, TRACHYDACITE LAVA. (Silty SAND with some subangular fine to medium gravel sized rock fragments)
107.56	5.80 6.50 7.20	IV III IV	Weak, brown dappled white and red, highly decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough undulating and rough stepped, narrow, iron and manganese oxide stained, dipping at 40° to 50° and 60° to 70°, highly fractured. From 6.14m to 6.33m : Moderately strong and moderately decomposed.
106.01	7.35	V/IV	Extremely weak to very weak, brown (7.5YR 5/4) dappled white, completely to highly decomposed, TRACHYDACITE LAVA. (Silty SAND with some subangular fine to coarse gravel sized rock fragments)
105.86	7.50	III/IV	Moderately weak to weak, brown dappled white and red, moderately to highly decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough undulating and rough stepped, very narrow, iron and manganese oxide stained, kaolin infilled (<1mm thick), dipping at 20° to 30° and 60° to 70°, locally highly fractured. From 7.97m to 8.13m : No core recovered,
105.39	7.97	V/IV	
105.23	8.13 8.30 8.80 9.30	III/IV	
103.86	9.50	V/IV	
103.63	9.73 9.85	IV	

● SMALL DISTURBED SAMPLE	△ WATER SAMPLE	LOGGED K.L. Lo
↕ LARGE DISTURBED SAMPLE	PIEZOMETER TIP	DATE 11/06/2002
▯ SPT LINER SAMPLE	STANDPIPE	CHECKED Tom Lo
U76 UNDISTURBED SAMPLE	STANDARD PENETRATION TEST	DATE 12/06/2002
U100 UNDISTURBED SAMPLE	PERMEABILITY TEST	
▨ MAZIER SAMPLE	IMPRESSION PACKER TEST	
PISTON SAMPLE	V IN-SITU VANE SHEAR TEST	
	PACKER TEST	

REMARKS
1. Standpipe was installed at 15.33m depth.

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH2
SHEET 2 of 3

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation		
METHOD	Rotary Cored	CO-ORDINATES E 846934.31 N 816760.17	Works Order No. GE/2001/13.10
MACHINE & No.	DR129		DATE from 07/06/2002 to 10/06/2002
FLUSHING MEDIUM	Air-Foam	ORIENTATION Vertical	GROUND LEVEL 113.36 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
10										10.00	× ×	III	assumed to be completely to highly decomposed trachydacite lava. From 8.30m to 8.45m : A subvertical joint dipping at 80° to 90°. From 9.40m to 9.50m : Weak and highly decomposed.
								T2101				IV	
												III	
												IV	
										10.70	× ×	III/IV	
			100	37	25								
11						8.9		T2101			× ×		Extremely weak to very weak, brown (7.5YR 5/4) dappled white and red, completely to highly decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND with some subangular fine to medium gravel sized rock fragments)
										11.35	× ×		
			98	36	29	NI					× ×		
								T2101	101.40	11.96			Moderately weak to weak, brown (7.5YR 5/4) dappled red and white, moderately to highly decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough undulating and rough stepped, very narrow, iron and manganese oxide stained, kaolin infilled (<1mm), dipping at 20° to 30° and 60° to 70°, locally highly fractured. From 9.73m to 10.00m : Weak and highly decomposed. From 10.00m to 10.20m : Moderately strong and moderately decomposed. From 10.00m to 10.20m : A subvertical joint dipping at 80° to 90°. From 10.20m to 10.30m : Weak and highly decomposed. From 10.30m to 10.45m : Moderately strong and moderately decomposed. From 10.45m to 10.57m : Weak and highly decomposed.
12						NR						V/IV	
									101.05	12.31			
						1.9				12.45	× ×	II	
			96	78	56			T2101					
									100.51	12.85	×		
13			98	52	46	12.5		T2101			× ×	III/IV	
		Dry at 18:00				NI				13.40	× ×	IV	
09/06/2002 10/06/2002		Dry at 08:00	95	78	32	8.0		T2101			× ×	III/IV	
14										14.00			
			80	51	20	NI			99.22	14.14	×	IV	
						NR						V/IV	
									98.92	14.44			
									98.82	14.54		III/IV	
						9.0		T2101			× ×	III	
15		Dry at 18:00									× ×		
10/06/2002									98.03	15.33			No core recovered, assumed to be completely to highly decomposed TRACHYDACITE LAVA.
													Strong, grey mottled white and black slightly decomposed, TRACHYDACITE LAVA. Joints are medium spaced, rough stepped, very narrow to extremely narrow, iron and manganese oxide stained, dipping at 40° to 50° and 60° to 70°.
16													
17													Moderately weak, reddish brown dappled white, moderately to highly decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough undulating, very narrow, iron and manganese oxide stained, kaolin infilled (<1mm), dipping at 20° to 30° and 40° to 50°. From 13.17m to 13.50m : Weak and highly decomposed. From 14.00m to 14.14m : Weak and highly decomposed. From 14.14m to 14.44m : No core recovered, assumed to be completely to highly decomposed trachydacite lava.
18													
19													Moderately strong, purplish brown, moderately decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough undulating and rough stepped, very narrow, iron and manganese oxide stained, dipping at 20° to 30°
20													

- • SMALL DISTURBED SAMPLE
- ↕ LARGE DISTURBED SAMPLE
- ▯ SPT LINER SAMPLE
- ▨ U76 UNDISTURBED SAMPLE
- ■ U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- ▤ PISTON SAMPLE
- △ WATER SAMPLE
- ▲ PIEZOMETER TIP
- ▯ STANDPIPE
- ⊥ STANDARD PENETRATION TEST
- ⌶ PERMEABILITY TEST
- Ⅱ IMPRESSION PACKER TEST
- V IN-SITU VANE SHEAR TEST
- ↕ PACKER TEST

LOGGED	K.L. Lo
DATE	11/06/2002
CHECKED	Tom Lo
DATE	12/06/2002

REMARKS

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH2

SHEET 3 of 3

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation		
METHOD	Rotary Cored	CO-ORDINATES E 846934.31 N 816760.17	Works Order No. GE/2001/13.10
MACHINE & No.	DR129		DATE from 07/06/2002 to 10/06/2002
FLUSHING MEDIUM	Air-Foam	ORIENTATION Vertical	GROUND LEVEL 113.36 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
20										20.00			40° to 50° and 60° to 70°. Hole completed at 15.33m.
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													

• SMALL DISTURBED SAMPLE	△ WATER SAMPLE
⌶ LARGE DISTURBED SAMPLE	▲ PIEZOMETER TIP
▯ SPT LINER SAMPLE	⌂ STANDPIPE
▨ U76 UNDISTURBED SAMPLE	⊥ STANDARD PENETRATION TEST
■ U100 UNDISTURBED SAMPLE	I PERMEABILITY TEST
▨ MAZIER SAMPLE	II IMPRESSION PACKER TEST
▤ PISTON SAMPLE	V IN-SITU VANE SHEAR TEST
	⋮ PACKER TEST

LOGGED K.L. Lo

DATE 11/06/2002

CHECKED Tom Lo

DATE 12/06/2002

REMARKS

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH3

SHEET 1 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation
METHOD	Rotary Cored
MACHINE & No.	DR89
FLUSHING MEDIUM	Air-Foam
CO-ORDINATES	E 847010.71 N 816800.79
ORIENTATION	Vertical
Works Order No.	GE/2001/13.10
DATE from	01/06/2002 to 05/06/2002
GROUND LEVEL	87.46 mPD

Drilling Progress: 01/06/2002 (0.00 m); 01/06/2002 / 03/06/2002 (about 2.8 m); 03/06/2002 / 04/06/2002 (about 6.2 m)

Casing size: PX to 1.90; HX to 4.75

Water level (m) & Time: Dry at 18:00; Dry at 08:00; Dry at 18:00; Dry at 08:00

Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index
100			
100			
100	0	0	NI
100	11	0	
70	0	0	NR
100	100	96	7.5
90	80	0	NI 6.0
100	74	62	>20 4.3 NI 12.0
100	67	56	NI 4.0
100	93	69	NI
100	100	77	15.0 3.6 1.4
100	100	100	

Samples: 1, 2, 3, 4, 5; T2101 (core runs)

Depths marked: 2.75, 3.40, 4.25, 4.75, 6.47, 9.10

Reduced Level	Depth (m)	Grade	Description
87.46	0.00		Greyish brown (10YR 5/2) dappled white, silty fine to coarse SAND with some subangular to angular fine to coarse gravel sized rock fragments and occasional rootlets. (FILL)
86.96	0.50		Brown (7.5YR 5/4), silty fine to coarse SAND with much subangular to angular fine to coarse gravel sized rock fragments. (FILL)
86.46	1.00		Stiff, brown (7.5YR 5/4), sandy SILT with some subangular fine to medium gravel sized rock fragments. (FILL)
85.96	1.50		Greyish brown (10YR 5/2) mottled white, very silty fine to coarse SAND with much subangular fine to coarse gravel sized rock fragments. (FILL)
85.56	1.90		Grey (7.5YR 6/1) dappled pink, subangular BOULDER sized of no fine concrete with some subangular fine to coarse gravel sized no fine concrete fragments. (NO FINE CONCRETE)
84.87	2.59	III III/IV	Moderately weak, greenish grey streaked red and dappled white, moderately to highly decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough undulating, narrow, iron and manganese oxide stained, dipping at 40° to 50° and 50° to 60°, highly fractured. From 2.59m to 2.75m : Moderately strong and moderately decomposed. From 3.58m to 3.68m : With silty fine to coarse SAND matrix.
83.78	3.68	V/IV	No core recovered, assumed to be completely to highly decomposed TRACHYDACITE.
83.56	3.90	III III/IV III	Moderately strong, greenish grey streaked red and dappled brown, moderately decomposed, TRACHYDACITE LAVA. Joints are medium spaced locally closely spaced, rough undulating and rough stepped, narrow to very narrow, iron and manganese oxide stained, dipping at 30° to 40°, 40° to 50° and 70° to 80°. From 4.33m to 4.41m : Moderately weak and moderately to highly decomposed. From 5.25m to 5.35m : A subvertical joint dipping at 80° to 90°.
81.85	5.61	III/IV	Moderately weak, brown dappled light yellow, moderately to highly decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough stepped and rough undulating, narrow to very narrow, iron and manganese oxide stained, dipping at 20° to 30° and 50° to 60°.
81.35	6.11	IV	Weak, brown (7.5Y 5/4), highly decomposed, TRACHYDACITE LAVA. (Angular fine to coarse GRAVEL sized rock fragments with silty fine to coarse sand)
81.25	6.21	III III/IV III II III II	Moderately strong, grey, striped dark and light grey dappled brown, moderately decomposed, TRACHYDACITE LAVA. Joints are closely spaced locally medium
79.91	7.55		

- ● SMALL DISTURBED SAMPLE
- ↨ LARGE DISTURBED SAMPLE
- ▯ SPT LINER SAMPLE
- ▨ U76 UNDISTURBED SAMPLE
- ▮ U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- ▤ PISTON SAMPLE
- △ WATER SAMPLE
- PIEZOMETER TIP
- STANDPIPE
- STANDARD PENETRATION TEST
- PERMEABILITY TEST
- IMPRESSION PACKER TEST
- V IN-SITU VANE SHEAR TEST
- PACKER TEST

LOGGED K.L. Lo

DATE 07/06/2002

CHECKED Tom Lo

DATE 08/06/2002

REMARKS
1. The original core run from 1.90m to 2.75m was divided into two segments (1.90m to 2.59m and 2.59m to 2.75m), due to the existence of no fine concrete and moderately decomposed trachydacite lava simultaneously.
2. Standpipe was installed at 12.50m depth.

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD. GROUND INVESTIGATION DEPARTMENT	HOLE NO. DH3
	SHEET 2 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation
METHOD	Rotary Cored
MACHINE & No.	DR89
FLUSHING MEDIUM	Air-Foam
CO-ORDINATES	E 847010.71 N 816800.79
ORIENTATION	Vertical
Works Order No.	GE/2001/13.10
DATE from	01/06/2002 to 05/06/2002
GROUND LEVEL	87.46 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade
								T2101		10.00	× ×	III
			100	95	77	8.7 3.7		T2101		10.44	× ×	II
04/06/2002 05/06/2002		8.00m at 18:00 9.20m at 08:00 8.50m at 17:00	100	84	51	10.0 2.6		T2101		11.90	× ×	III
05/06/2002									74.80	12.66		

Description

spaced, rough undulating and rough stepped, very narrow, iron and manganese oxide stained, dipping at 10° to 20°, 20° to 30° and 40° to 50°.
From 7.45m to 7.55m : Moderately weak, brown, moderately to highly decomposed.

Moderately strong, grey stripped dark grey and light grey, dappled brown, moderately decomposed, TRACHYDACITE LAVA.
Joints are medium spaced locally closely spaced, rough undulating and rough stepped, very narrow to extremely narrow, iron and manganese oxide stained, soil infilling (<5mm thick), dipping at 20° to 30°, 40° to 50° and 60° to 70°.
From 8.33m to 8.96m : Strong and slightly decomposed.
From 9.12m to 9.60m : An incipient vertical joint.
From 9.60m to 10.18m : Strong and slightly decomposed.
From 11.13m to 11.82m : Strong and slightly decomposed.

Hole completed at 12.66m.

•	SMALL DISTURBED SAMPLE
Ī	LARGE DISTURBED SAMPLE
▯	SPT LINER SAMPLE
▨	U76 UNDISTURBED SAMPLE
▮	U100 UNDISTURBED SAMPLE
▧	MAZIER SAMPLE
▤	PISTON SAMPLE
△	WATER SAMPLE
▲	PIEZOMETER TIP
△	STANDPIPE
⊥	STANDARD PENETRATION TEST
I	PERMEABILITY TEST
II	IMPRESSION PACKER TEST
V	IN-SITU VANE SHEAR TEST
⁞	PACKER TEST

LOGGED K.L. Lo

DATE 07/06/2002

CHECKED Tom Lo

DATE 08/06/2002

REMARKS

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH4

SHEET 1 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

METHOD	Rotary Cored	CO-ORDINATES E 847032.27 N 816765.57	Works Order No. GE/2001/13.10
MACHINE & No.	DR87		DATE from 08/06/2002 to 12/06/2002
FLUSHING MEDIUM	Air-Foam	ORIENTATION Vertical	GROUND LEVEL 126.51 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Grade
08/06/2002	PX								126.51	0.00	
								1 ●	126.01	0.50	
								2 ●	125.51	1.00	
	PX 1.50 HX							3 ●	125.01	1.50	
			100					4		1.50	V/IV
			36	0	0	NI		T2101	124.89	1.62	IV/III
			85	0	0					2.20	
			100	73	31	14.6		T2101		2.40	III/IV
		3.50m at 18:00	100	80	55	>20 7.8		T2101		3.15	II
08/06/2002 10/06/2002		3.10m at 08:00	100	90	77			T2101		3.70	
			100	56	38	>20 11.1 NI		T2101		5.16	III/II IV/III
	HX 6.50	7.20m at 18:00	99	26	11	16.1		T2101		6.50	III/IV
10/06/2002 11/06/2002		6.50m at 08:00	98	27	13	NI >20		T2101		7.36	
			100	93	82	8.3 7.3		T2101	118.11	8.40	II
			100	100	87			T2101		9.40	

Description

Dense, brown (10YR 4/3), silty fine to coarse SAND with much angular to subangular fine to coarse gravel sized rock fragments. (COLLUVIUM)

Light yellowish brown (10YR 5/6), silty fine to coarse SAND with much angular to subangular fine to coarse gravel sized rock fragments. (COLLUVIUM)

Red (5R 5/6), silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized rock fragments. (COLLUVIUM)

Extremely weak, weak red (5R 4/2) mottled white, completely to highly decomposed, TRACHYDACITE LAVA. (Silty clayey fine to coarse SAND with much subangular to angular fine to coarse gravel sized rock fragments)

Strong, yellowish brown, locally dappled grey and white, slightly decomposed, TRACHYDACITE LAVA.
Joints are very closely to closely spaced, rough planar and rough undulating, very narrow, iron and manganese oxide stained with clay coating (<1mm), dipping at 15° to 25°, locally 80° to 90°.
From 1.62m to 2.40m : Moderately weak to moderately strong and highly to moderately decomposed.
From 2.40m to 3.05m : Moderately strong to moderately weak and moderately to highly decomposed.
From 4.54m to 4.78m : Subvertical joint.

From 5.28m to 5.61m : An 80° to 90° joint.
From 5.28m to 6.00m : Moderately strong to strong, moderately to slightly decomposed.

From 6.00m to 6.50m : Moderately weak to moderately strong and highly to moderately decomposed.
From 6.50m to 8.40m : Moderately strong to moderately weak and moderately to highly decomposed.

Strong, light greenish grey striped light grey, slightly decomposed, TRACHYDACITE LAVA.
Joints are closely spaced, locally medium spaced and very closely spaced, rough planar and rough undulating, very narrow, iron and manganese oxide stained, dipping at 15° to 25°, locally 80° to 90°.

● SMALL DISTURBED SAMPLE	△ WATER SAMPLE
LARGE DISTURBED SAMPLE	PIEZOMETER TIP
SPT LINER SAMPLE	STANDPIPE
U76 UNDISTURBED SAMPLE	STANDARD PENETRATION TEST
U100 UNDISTURBED SAMPLE	PERMEABILITY TEST
▨ MAZIER SAMPLE	IMPRESSION PACKER TEST
PISTON SAMPLE	V IN-SITU VANE SHEAR TEST
	PACKER TEST

LOGGED K.L. Lo

DATE 13/06/2002

CHECKED Tom Lo

DATE 14/06/2002

REMARKS
1. Standpipe was installed at 13.63m depth.

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH4

SHEET 2 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

METHOD	Rotary Cored	CO-ORDINATES E 847032.27 N 816765.57	Works Order No. GE/2001/13.10
MACHINE & No.	DR87		DATE from 08/06/2002 to 12/06/2002
FLUSHING MEDIUM	Air-Foam	ORIENTATION Vertical	GROUND LEVEL 126.51 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
11/06/2002		7.90m at 18:00				2.2		T2101		10.80	×		From 9.90m to 10.25m : Silicified.
12/06/2002		10.80m at 08:00	100	96	88	4.0		T2101		12.22	×		From 10.80m to 10.96m : Silicified. From 11.57m to 11.78m : An 80° to 90° joint.
12/06/2002		10.50m at 18:00	100	100	89	2.5 7.0	A	T2101	112.88	13.63	×		
													Hole completed at 13.63m.

• SMALL DISTURBED SAMPLE	△ WATER SAMPLE
⟟ LARGE DISTURBED SAMPLE	▲ PIEZOMETER TIP
▯ SPT LINER SAMPLE	⍓ STANDPIPE
▧ U76 UNDISTURBED SAMPLE	⊥ STANDARD PENETRATION TEST
■ U100 UNDISTURBED SAMPLE	⊤ PERMEABILITY TEST
▨ MAZIER SAMPLE	Ⅱ IMPRESSION PACKER TEST
▤ PISTON SAMPLE	V IN-SITU VANE SHEAR TEST
	! PACKER TEST

LOGGED K.L. Lo

DATE 13/06/2002

CHECKED Tom Lo

DATE 14/06/2002

REMARKS

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH5
SHEET 1 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

METHOD	Rotary Cored	CO-ORDINATES E 847179.35 N 816958.22	Works Order No. GE/2001/13.10
MACHINE & No.	DR129		DATE from 03/06/2002 to 03/06/2002
FLUSHING MEDIUM	Air-Foam	ORIENTATION Vertical	GROUND LEVEL 140.77 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Depth (m)
01/06/2002	PX								0.00
								1 ●	
								2 ●	
			70					3 ● 4 ▨	1.50
	PX 2.30							5 ●	2.30
			100	76	46	NI 6.9		T2101	
01/06/2002 03/06/2002		Dry at 19:00 Dry at 08:00	34	5	0	NI NR		T2101	3.35
			100	41	33	NI		T2101	4.40
			100	76	48	14.8		T2101	4.98
			97	86	81	NI 1.5		T2101	5.40
			100	89	85	10.0 2.6		T2101	6.38
			100	100	85	12.0 3.5		T2101	8.37
									9.93

Reduced Level	Depth (m)	Legend	Grade	Description
140.77	0.00			Firm, dark brownish grey (2.5Y 3/2), sandy SILT with occasional rootlets, subrounded to subangular fine to medium gravel sized quartz and rock fragments. (TOP SOIL)
140.27	0.50			Firm, greyish brown (10YR 5/2) dappled white, sandy SILT with occasional subrounded to subangular fine to medium gravel sized rock fragments. (FILL)
139.77	1.00		V	Extremely weak, yellowish brown (10YR 5/8) spotted and dappled white, completely decomposed, fine ash TUFF. (Silty fine to coarse SAND with some subangular fine to medium gravel sized rock fragments)
139.27	1.50		V	Extremely weak to very weak, brown (7.5YR 5/4), dappled light grey and black, completely decomposed, fine ash TUFF. (Subangular fine to coarse GRAVEL sized rock fragments with silty sand)
138.47	2.30		III/IV	Moderately weak to moderately strong, greenish grey, streaked red, dappled brown, moderately to highly decomposed, fine ash TUFF. Joints are closely spaced, rough undulating and rough stepped, narrow to very narrow, iron oxide and manganese oxide stained, dipping at 40° to 50°, 60° to 70° and 70° to 80°. From 3.45m to 3.55m : A subvertical joint dipping at 80° to 90°. From 4.23m to 4.40m : No core recovered, assumed to be completely to highly decomposed tuff. From 4.68m to 4.98m : A subvertical joint dipping at 80° to 90°.
136.54	4.23		V/IV	
136.37	4.40		III/IV	
135.64	5.13		III	Strong to moderately strong, greenish grey dappled brown, slightly to moderately decomposed, fine ash TUFF. Joints are medium spaced, locally closely spaced, rough undulating and rough stepped, very narrow to extremely narrow, iron and manganese oxide stained, dipping at 20° to 30°, 40° to 50° and 70° to 80°. From 5.13m to 5.30m : A incipient subvertical joint dipping at 80° to 90°. From 5.13m to 5.50m : Moderately strong and moderately decomposed. From 6.85m to 7.33m : Moderately strong and moderately decomposed.
	5.40		II/III	
	6.38		III	
133.44	7.33		II	Strong, greenish grey spotted black, stripped dark green, dappled brown, slightly decomposed, dappled brown, slightly decomposed, fine ash TUFF. Joints are medium spaced locally closely spaced, rough undulating and rough stepped, extremely narrow, iron and manganese oxide stained, dipping at 20° to 30° and 40° to 50°. From 7.33m to 8.82m : With chlorite vein (<1mm thick), closely spaced, dipping at 40° to 50° and 70° to 80°. From 8.93m to 9.18m : Moderately strong and
			III	
			II	
	9.93			

- ● SMALL DISTURBED SAMPLE
- LARGE DISTURBED SAMPLE
- SPT LINER SAMPLE
- U76 UNDISTURBED SAMPLE
- U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- PISTON SAMPLE
- △ WATER SAMPLE
- PIEZOMETER TIP
- STANDPIPE
- STANDARD PENETRATION TEST
- PERMEABILITY TEST
- IMPRESSION PACKER TEST
- V IN-SITU VANE SHEAR TEST
- PACKER TEST

LOGGED K.L. Lo
DATE 04/06/2002
CHECKED Tom Lo
DATE 05/06/2002

REMARKS
1. Standpipe was installed at 10.93m depth.

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH5
SHEET 2 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

METHOD	Rotary Cored	CO-ORDINATES E 847179.35 N 816958.22	Works Order No. GE/2001/13.10
MACHINE & No.	DR129		DATE from 03/06/2002 to 03/06/2002
FLUSHING MEDIUM	Air-Foam	ORIENTATION Vertical	GROUND LEVEL 140.77 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
03/06/2002		Dry at 18:00	100	100	95			T2101	129.84	10.00 10.93	V V V		moderately decomposed.
													Hole completed at 10.93m.

• SMALL DISTURBED SAMPLE	△ WATER SAMPLE
↕ LARGE DISTURBED SAMPLE	▲ PIEZOMETER TIP
▯ SPT LINER SAMPLE	⌂ STANDPIPE
▨ U76 UNDISTURBED SAMPLE	⊥ STANDARD PENETRATION TEST
■ U100 UNDISTURBED SAMPLE	I PERMEABILITY TEST
▨ MAZIER SAMPLE	II IMPRESSION PACKER TEST
☰ PISTON SAMPLE	V IN-SITU VANE SHEAR TEST
	! PACKER TEST

LOGGED K.L. Lo
DATE 04/06/2002
CHECKED Tom Lo
DATE 05/06/2002

REMARKS

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH6

SHEET 1 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

METHOD	Rotary Cored	CO-ORDINATES E 847214.42 N 817215.18	Works Order No. GE/2001/13.10
MACHINE & No.	DR86		DATE from 04/06/2002 to 07/06/2002
FLUSHING MEDIUM	Air-Foam	ORIENTATION Vertical	GROUND LEVEL 170.73 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
04/06/2002	PX								170.73	0.00		VI	Firm, yellowish brown (10YR 5/8), slightly sandy SILT. (RESIDUAL SOIL)
								1 ●		0.50			
								2 ●	169.73	1.00		V	Extremely weak, light yellowish brown (2.5Y 6/4) dappled white, completely decomposed, fine ash crystal TUFF. (Firm to stiff, sandy SILT)
04/06/2002 05/06/2002	PX 1.50 HX	1.20m at 18:00 Dry at 08:00	90					3 ● 4		1.50			
							1,3 5,3,4,5 N=17	5 6	168.13	2.60		V	Extremely weak, pale brown (10YR 6/3) dappled yellow and white, completely decomposed, fine ash crystal TUFF. (Silty fine to coarse SAND)
								7 ●		3.05			
			100					8		3.50			
							3,6 6,7,7,8 N=26	9 10	166.13	4.60		V	Extremely weak, light brownish grey (10YR 6/2), completely decomposed, fine ash crystal TUFF. (Silty fine to coarse SAND)
								11 ●		5.05			
			100					12	165.23	5.50		V	Extremely weak, yellowish brown (10YR 5/8), completely decomposed, fine ash crystal TUFF. (Silty fine to coarse SAND with occasional subangular fine to medium gravel sized rock fragments)
							4,5 10,13,13,15 N=51	13 14		6.60			
								15 ●		7.05			
			100					16	163.23	7.50		V/IV	Extremely weak to very weak, grey (7.5YR 6/1) dappled brown, completely to highly decomposed, fine ash crystal TUFF. (Subangular fine to coarse GRAVEL with silty sand)
05/06/2002 06/06/2002	HX 8.60	5.50m at 18:00 Dry at 08:00	100	44	11	11.8 NI		17 T2101	162.13	8.60		III/IV IV III/IV	Moderately weak, brownish grey spotted white, moderately to highly decomposed, fine ash crystal TUFF. Joints are closely to very closely spaced, rough undulating and rough stepped, narrow, iron and manganese oxide stained, dipping at 10° to 20°, 40° to 50° and 70° to 80°. From 8.90m to 9.08m : A subvertical joint
			100	41	0	20.0 NI		T2101		9.51		IV III/IV	

- ● SMALL DISTURBED SAMPLE
- LARGE DISTURBED SAMPLE
- SPT LINER SAMPLE
- U76 UNDISTURBED SAMPLE
- U100 UNDISTURBED SAMPLE
- MAZIER SAMPLE
- PISTON SAMPLE
- △ WATER SAMPLE
- PIEZOMETER TIP
- STANDPIPE
- STANDARD PENETRATION TEST
- PERMEABILITY TEST
- IMPRESSION PACKER TEST
- V IN-SITU VANE SHEAR TEST
- [PACKER TEST

LOGGED K.L. Lo

DATE 08/06/2002

CHECKED Tom Lo

DATE 10/06/2002

REMARKS
1. Standpipe was installed at 16.53m depth.

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH6

SHEET 2 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation
METHOD	Rotary Cored
MACHINE & No.	DR86
FLUSHING MEDIUM	Air-Foam
CO-ORDINATES	E 847214.42 N 817215.18
ORIENTATION	Vertical
Works Order No.	GE/2001/13.10
DATE from	04/06/2002 to 07/06/2002
GROUND LEVEL	170.73 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples
10						15.0		
11			100	66	46	NI 10.0 4.4		T2101
12			100	84	44	4.0		T2101
13 14 06/06/2002		Dry at 18:00	100	74	40	11.1 NI 13.5		T2101
07/06/2002 15		Dry at 08:00	100	80	48	>20 2.9 >20		T2101
16 07/06/2002		Dry at 18:00	100	90	86	11.8	Δ	T2101
17 18 19 20								

Reduced Level	Depth (m)	Grade	Description
	10.00	IV	dipping at 80° to 90°. From 9.08m to 9.20m : Weak and highly decomposed. From 9.44m to 9.53m : Weak and highly decomposed. From 9.95m to 10.10m : Weak and highly decomposed.
160.53	10.20 11.50 13.08	III/IV III III/IV III III/IV III III/IV	Moderately strong, brown grey spotted white, moderately decomposed, fine ash TUFF. Joints are closely spaced, rough undulating and rough stepped, very narrow, iron and manganese oxide stained, dipping at 20° to 30°, 40° to 50° and 70° to 80°. From 10.55m to 11.00m : Moderately weak and moderately to highly decomposed. From 11.50m to 12.12m : A subvertical joint dipping at 80° to 90°. From 11.80m to 12.40m : Moderately weak and moderately to highly decomposed. From 12.45m to 13.05m : A subvertical joint dipping at 80° to 90°. From 13.08m to 13.65m : Moderately weak and moderately to highly decomposed.
157.08	13.65 14.52	III	Moderately strong, brown grey spotted white, moderately decomposed, fine ash crystal TUFF. Joints are closely spaced, locally medium and very closely spaced, rough undulating and rough stepped, very narrow, iron and manganese oxide stained, dipping at 20° to 30°, 40° to 50° and 60° to 70°.
155.27	15.46 15.95	II III	Moderately strong, brownish grey spotted white, moderately decomposed, coarse ash crystal TUFF. Joints are closely spaced, locally medium and very closely spaced, rough undulating and rough stepped, very narrow, iron and manganese oxide stained, dipping at 20° to 30°, 40° to 50° and 60° to 70°. From 15.46m to 15.68m : Strong and slightly decomposed. From 16.43m to 16.53m : A subvertical joint dipping at 80° to 90°.
154.20	16.53		Hole completed at 16.53m.

- • SMALL DISTURBED SAMPLE
- ⌶ LARGE DISTURBED SAMPLE
- ▯ SPT LINER SAMPLE
- ▨ U76 UNDISTURBED SAMPLE
- ■ U100 UNDISTURBED SAMPLE
- ▧ MAZIER SAMPLE
- ☰ PISTON SAMPLE
- Δ WATER SAMPLE
- ⍊ PIEZOMETER TIP
- ⍋ STANDPIPE
- ⊥ STANDARD PENETRATION TEST
- ⌶ PERMEABILITY TEST
- Ⅱ IMPRESSION PACKER TEST
- V IN-SITU VANE SHEAR TEST
- ! PACKER TEST

LOGGED	K.L. Lo Lo
DATE	08/06/2002
CHECKED	Tom Lo
DATE	10/06/2002

REMARKS

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.

GROUND INVESTIGATION DEPARTMENT

HOLE NO. DH7

SHEET 1 of 1

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

METHOD	Rotary Cored	CO-ORDINATES E 847169.93 N 817230.31	Works Order No. GE/2001/13.10
MACHINE & No.	DR86		DATE from 30/05/2002 to 31/05/2002
FLUSHING MEDIUM	Air-Foam	ORIENTATION Vertical	GROUND LEVEL 153.18 mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
30/05/2002	HX							INSPECTION PIT 1 ●	152.68	0.50	▩		Dark greyish brown (10YR 4/2) dappled yellowish brown and locally white, slightly silty fine to coarse SAND with much angular to subangular fine to coarse gravel sized rock fragments and occasional rootlets. (FILL)
								2 ●	152.18	1.00		V	Extremely weak, yellowish brown (10YR 5/8) mottled white, locally dappled dark brown, completely decomposed, fine ash TUFF. (Silty fine to coarse SAND with some subangular fine to medium gravel sized quartz fragments)
	HX 1.22							3 ●	151.96	1.22	○ ○ ○	IV/V	Very weak to weak, grey (7.5YR 6/1) dappled brown, highly to completely decomposed, fine ash TUFF. (Angular to subangular fine to coarse GRAVEL with some cobble sized rock fragments)
		0.80m at 18:00	100	50	23	NI 12.3		T2101		1.96	V V V	III	Strong to moderately strong, greenish grey spotted white and dappled yellowish brown and dark brown, slightly to moderately decomposed, fine ash TUFF. Joints are closely to medium spaced, locally widely and very closely spaced, smooth planar and smooth undulating, extremely narrow to very narrow, iron and manganese oxide stained, dipping at 5° to 15°, 20° to 30°, 55° to 65° and 70° to 80°. From 1.22m to 1.27m : Moderately weak and moderately decomposed. From 1.27m to 3.74m : Moderately strong and moderately decomposed. From 3.26m to 3.59m : An 80° to 90° joint.
30/05/2002 31/05/2002		Dry at 08:00	95	83	68			T2101		3.26	V V V		
			100	86	86	3.7		T2101		4.09	V V V	II/III	
			100	100	100	1.0		T2101		5.58	V V V		
31/05/2002		– Dry at 18:00	100	99	89	6.1	Δ	T2101	146.16	7.02	V V V		
													Hole completed at 7.02m.

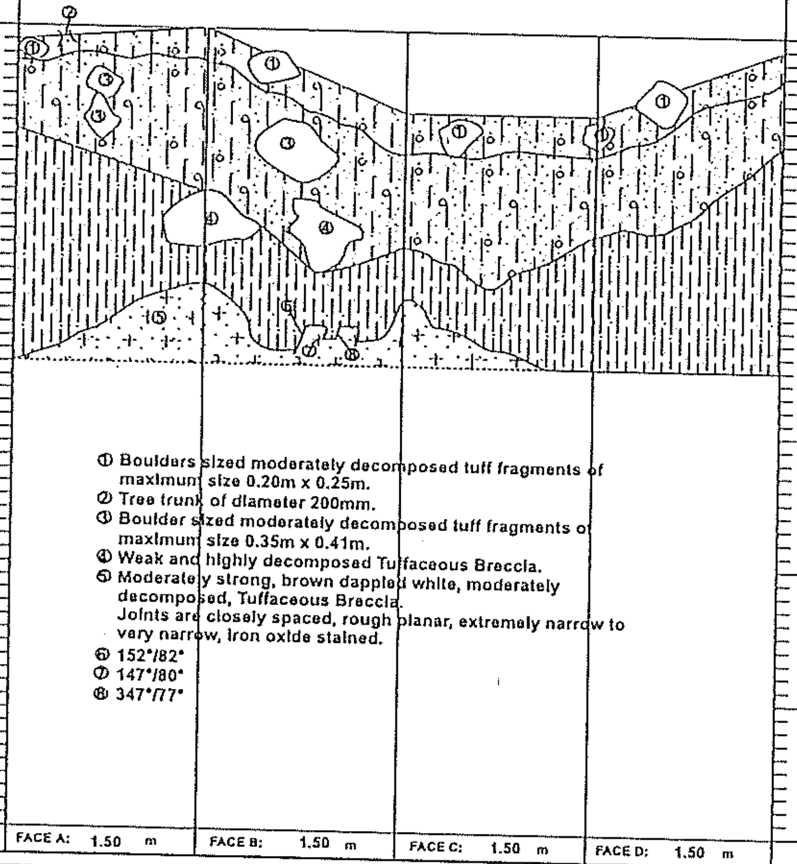
● SMALL DISTURBED SAMPLE	△ WATER SAMPLE	LOGGED	K.L. Lo
↨ LARGE DISTURBED SAMPLE	▲ PIEZOMETER TIP	DATE	01/06/2002
⁝ SPT LINER SAMPLE	△ STANDPIPE	CHECKED	Tom Lo
▢ U76 UNDISTURBED SAMPLE	⊥ STANDARD PENETRATION TEST	DATE	03/06/2002
■ U100 UNDISTURBED SAMPLE	⊤ PERMEABILITY TEST		
▨ MAZIER SAMPLE	‖ IMPRESSION PACKER TEST		
≡ PISTON SAMPLE	V IN-SITU VANE SHEAR TEST		
	⁝ PACKER TEST		

REMARKS

1. Standpipe was installed at 7.02m depth.

Samples & Test	Depth (m)
1 (Small Disturbed Sample)	0.5
2 (Small Disturbed Sample); 3 (Undisturbed Vertical Sample)	1.0
4 (Small Disturbed Sample)	1.5
5 (Undisturbed Vertical Sample)	2.0

Sketch



① Boulders sized moderately decomposed tuff fragments of maximum size 0.20m x 0.25m.
② Tree trunk of diameter 200mm.
③ Boulder sized moderately decomposed tuff fragments of maximum size 0.35m x 0.41m.
④ Weak and highly decomposed Tuffaceous Breccia.
⑤ Moderately strong, brown dappled white, moderately decomposed, Tuffaceous Breccia. Joints are closely spaced, rough planar, extremely narrow to very narrow, iron oxide stained.
⑥ 152°/82°
⑦ 147°/80°
⑧ 347°/77°

Depth (m)	Description	Grade
0.30	Loose, dry, dark grey (10YR 4/1), organic, silty fine to coarse SAND with much angular fine to coarse gravel and cobble sized quartz and rock fragments and occasional boulder sized moderately decomposed tuff fragments, also with much plant rootlets. (TOP SOIL)	
0.80	Dense, dry, brown (7.5YR 4/4) dappled red and dark grey, very silty fine to coarse SAND with much angular to subangular fine to coarse gravel and cobble sized quartz and rock fragments, also occasional boulder sized moderately decomposed tuff fragments. (COLLUVIUM)	
2.5	Extremely weak, dry, light grey (10YR 7/2) dappled white and yellowish brown, completely decomposed, TUFFACEOUS BRECCIA. (Stiff to very stiff, sandy SILT with occasional angular fine gravel sized quartz and rock fragments)	V

Trial pit terminated at 2.50m depth.

Notes:
1. Small disturbed samples were taken at 0.50m, 1.00m and 1.50m depths.
2. Undisturbed vertical samples (U100) were taken at 1.00m and 2.00m depths.

SYMBOLS

↕	Small Disturbed Sample
↕	Large Disturbed Sample
|	Undisturbed Vertical Sample
▬	Undisturbed Horizontal Sample
▨	Block Sample
⊔	Insitu Density Test
▲	Water Sample
↓	Water Seepage

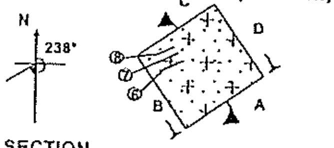
REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
Timber shoring over full height

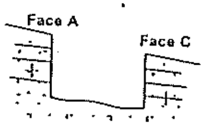
Stability
Stable

Depth at pit centre
2.00m
Others
Nil

PLAN (not to scale)



SECTION



Contract No. :	GE/2001/13	
Works Order No.	: GE/2001/13.10	
Co-ordinates	:	
E 846879.71	N 816764.24	
Ground Level	: 99.76	mPD
Logged by	: K.L. Lo	Lo
Date logged	: 03/07/2002	
Checked by	: Tom Lo	
Date Checked	: 04/07/2002	

PROJECT

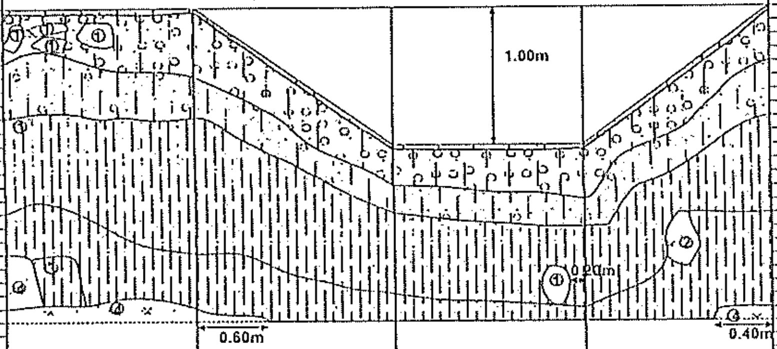
Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet	1	of	1	
Date excavated	24/06/2002	to	02/07/2002	
Date Reinstated	23/07/2002	to	23/07/2002	

TRIAL PIT NO.
TP1

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Sketch	Depth (m)	Legend	Description	Grade
1 ⌶ (0.5) 2 ⌶ (1.0) 3 ┃ (1.0) 4 ⌶ (1.5)	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0		0.03 0.40 0.5 0.80 1.0 1.5 2.0 2.30 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0		Loose, dry, dark brown (7.5YR 3/2), slightly silty fine to coarse SAND with occasional subangular fine to medium gravel sized quartz and rock fragments and some rootlets. (TOP SOIL) Loose, dry, organic, brownish grey (10YR 6/2), subangular to subrounded fine to coarse GRAVEL with much cobble and some boulder of maximum size 300m x 150mm sized moderately decomposed tuff and some matrix of loose, brown, silty fine to coarse sand and some plant rootlets and wood fragments. (COLLUVIUM) Loose, moist, dark brownish grey (2.5Y 3/2), silty fine to coarse SAND with some subangular to subrounded fine to coarse gravel sized rock fragments and some plant rootlets. (COLLUVIUM) Firm, moist, yellowish brown (10YR 5/8) dappled grey and white, sandy SILT with much angular to subangular fine to coarse gravel and occasional cobble and boulder of maximum size 0.20m x 0.15m sized rock fragments and occasional plant rootlets. (COLLUVIUM) Extremely weak, moist, light reddish brown (5YR 6/4) dappled white, completely decomposed, TRACHYDACITE LAVA. (Stiff, slightly sandy SILT with occasional angular to subangular fine to medium gravel sized quartz and rock fragments) Trial pit terminated at 2.30m depth.	V



FACE A: 1.50 m FACE B: 1.50 m FACE C: 1.50 m FACE D: 1.50 m

Remarks:

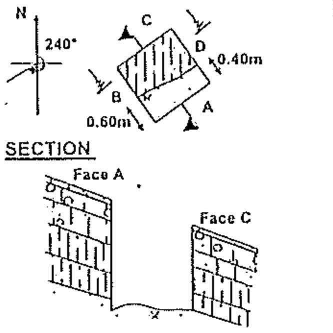
① Boulder sized rock fragment.
② Moderately strong, yellowish brown dappled white, moderately decomposed, TRACHYDACITE LAVA.(Core Stone)
③ Very weak, moist, light yellowish brown (2.5Y 6/4) dappled white, highly to completely decomposed, TRACHYDACITE LAVA. (Stiff, sandy SILT with much angular to subangular fine to coarse gravel and some cobble sized rock fragments)
④ Moderately strong, yellowish brown dappled white, moderately decomposed, TRACHYDACITE LAVA. (Massive, iron oxide stained).

Notes:
1. Small disturbed samples were taken at 0.50m, 1.00m and 1.50m depths.
2. Undisturbed vertical sample (U100) was taken at 1.00m depth.

SYMBOLS
- ⌶ Small Disturbed Sample
- ↕ Large Disturbed Sample
- ┃ Undisturbed Vertical Sample
- ━ Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS
Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
Timber shoring over full height
Stability
Stable
Depth at pit centre
1.80m
Others
Nil

PLAN (not to scale)



Contract No. : GE/2001/13
Works Order No. : GE/2001/13.10
Co-ordinates :
E 846966.44 N 816757.58
Ground Level : 103.24 mPD
Logged by : K.L. Lo
Date logged : 03/07/2002
Checked by : Tom Lo
Date Checked : 04/07/2002

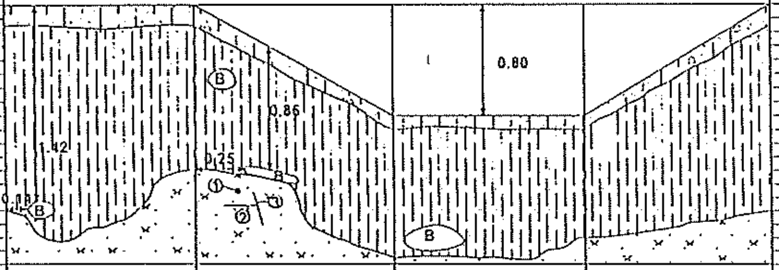
PROJECT
Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet 1 of 1
Date excavated 25/06/2002 to 02/07/2002
Date Reinstated 22/07/2002 to 22/07/2002

TRIAL PIT NO.
TP2

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Sketch	Depth (m)	Legend	Description	Grade
			0.15		Loose, dry, dark greyish brown (10YR 4/2), slightly silty fine to coarse SAND with some angular to subangular fine to coarse gravels sized rock fragments and much rootlets. (TOP SOIL)	
1 (0.5) 2, 3 (1.0) 4 (1.5)	0.5 1.0 1.5		0.5 1.0 1.5		Stiff, moist, yellowish brown (10YR 5/8) mottled white and dappled dark brown, sandy SILT with much subangualr to subrounded fine to coarse gravel and cobble and occasional boulder of maximum size 0.50m x 0.15m sized rock fragments. (COLLUVIUM)	
			1.90		Moderately strong, light grey spotted white and pink, dappled yellowish brown, moderately decomposed, TRACHYDACITE LAVA. Joints are closely spaced, smooth planar and smooth undulating, iron oxide stained, dipping at 20° to 30° and 70° to 80°.	III
	2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0		2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0		Trial pit terminated at 1.90m depth.	



Remarks:

B: Boulder sized rock fragments.
① 285°/22°
② 004°/70°
③ 070°/80°

FACE A: 1.50 m
FACE B: 1.50 m
FACE C: 1.50 m
FACE D: 1.50 m

Notes:
1. Small disturbed samples were taken at 0.50m, 1.00m and 1.50m depths.
2. Undisturbed vertical sample (U100) was taken at 1.00m depth.

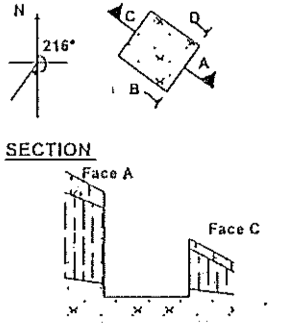
SYMBOLS

- Small Disturbed Sample
- Large Disturbed Sample
- Undisturbed Vertical Sample
- Undisturbed Horizontal Sample
- Block Sample
- Insitu Density Test
- Water Sample
- Water Seepage

REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
No shoring
Stability
Stable
Depth at pit centre
1.50m
Others
Nil

PLAN (not to scale)



Contract No. :	GE/2001/13
Works Order No.	: GE/2001/13.10
Co-ordinates	:
E 847079.36	N 816810.10
Ground Level	: 130.90 mPD
Logged by	: K.L. Lo
Date logged	: 05/07/2002
Checked by	: Tom Lo
Date Checked	: 06/07/2002

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

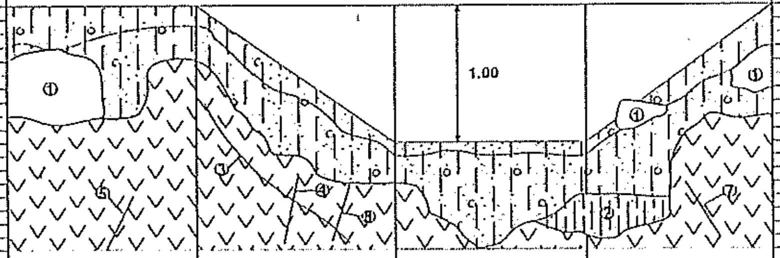
Sheet	1	of	1	
Date excavated	03/07/2002	to	04/07/2002	
Date Reinstated	26/07/2002	to	26/07/2002	

TRIAL PIT NO.
TP3

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Legend	Description	Grade
	0.30		Loose, dry, dark greyish brown (10YR 4/2), organic, slightly silty fine to coarse SAND with much angular to subangular fine to coarse gravel and some cobble sized quartz and rock fragments and with much plant rootlets. (TOP SOIL)	
1 (0.5)	0.5			
	0.80		Loose, dry, brown (10YR 4/3) dappled grey, silty fine to coarse SAND with much angular to subangular fine to coarse gravel and some cobble and occasional boulders sized moderately decomposed tuff fragments. (COLLUVIUM)	
2 (1.0)	1.0			
	1.5		Moderately strong, light grey dappled yellowish brown and mottled white and pink, moderately decomposed, fine ash TUFF. Joints are closely to medium spaced, smooth planar and rough undulating, extremely narrow to very narrow, occasionally narrow, iron and manganese oxide stained, soil of silty fine to coarse sand (<1mm) infilled.	III
	1.80		Trial pit terminated at 1.80m depth.	
	2.0			
	2.5			
	3.0		Note: 1. Small disturbed samples were taken at 0.50m and 1.00m depths.	
	3.5			
	4.0			
	4.5			
	5.0			
	5.5			
	6.0			

Sketch



① Boulders sized moderately decomposed tuff of maximum size 700mm x 420mm.
② Extremely weak, dry, yellowish brown (10YR 5/8) mottled white, completely decomposed, fine ash TUFF. (Very stiff, sandy SILT)
③ 276°/78°
④ 171°/78°
⑤ 092°/86°
⑥ 257°/70°
⑦ 298°/85°
⑧ 165°/62°

FACE A: 1.50 m | FACE B: 1.50 m | FACE C: 1.50 m | FACE D: 1.50 m

SYMBOLS

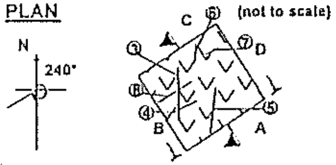
- ↕ Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- — Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS

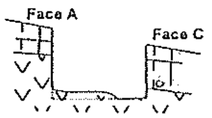
Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
No shoring
Stability
Stable
Depth at pit centre
1.30m
Others
Nil

PLAN

(not to scale)



SECTION



Contract No. :	GE/2001/13	
Works Order No.	:	GE/2001/13.10
Co-ordinates	:	
E 847199.76		N 816840.44
Ground Level	:	183.03 mPD
Logged by	:	K.L. Lo
Date logged	:	29/06/2002
Checked by	:	Tom Lo
Date Checked	:	02/07/2002

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

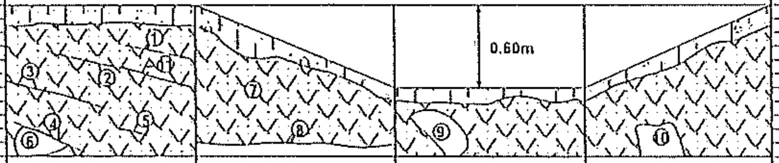
Sheet	1	of	1	
Date excavated	24/06/2002	to	28/06/2002	
Date Reinstated	23/07/2002	to	23/07/2002	

TRIAL PIT NO.
TP4

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Description	Grade
	0.15	Loose, dry, dark grey (10YR 4/1), organic, silty fine to coarse SAND with much angular to subangular fine to coarse gravel sized quartz and rock fragments, and occasional cobbles sized moderately decomposed tuff fragments, and also with much plant rootlets. (TOP SOIL)	
↧ 1 (0.5)	1.10	Moderately strong, brownish grey, moderately decomposed, fine ash TUFF. Joints are closely spaced, smooth planar and rough undulating, extremely narrow, iron and manganese oxide stained.	III
		Trial pit terminated at 1.10m depth.	
		Note: 1. Small disturbed sample was taken at 0.50m depth.	

Sketch



FACE A: 1.50 m　FACE B: 1.50 m　FACE C: 1.50 m　FACE D: 1.50 m

	Dip Direction/Dip angle		Staining
①	155°/53°	smooth planar	Iron and manganese oxide
②	165°/55°	smooth planar	Iron and manganese oxide
③	152°/65°	smooth planar	Iron and manganese oxide
④	154°/70°	smooth planar	Iron and manganese oxide
⑤	148°/78°	rough undulating	Iron and manganese oxide
⑥	357°/23°	rough undulating	Iron and manganese oxide
⑦	045°/52°	rough planar	Iron oxide
⑧	054°/82°	rough undualting	Iron and manganese oxide
⑨	043°/50°	rough undulating	Iron and manganese oxide
⑩	220°/40°	rough undulating	Iron and manganese oxide

SYMBOLS

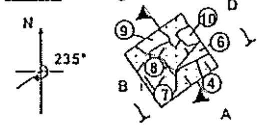
- ↧ Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- ― Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS

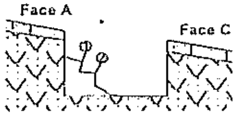
Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
No shoring
Stability
Stable
Depth at pit centre
0.80m
Others
Nil

PLAN

(not to scale)



SECTION



Contract No. :	GE/2001/13	
Works Order No.	: GE/2001/13.10	
Co-ordinates	:	
E 847244.97	N 817007.61	
Ground Level	: 163.51	mPD
Logged by	: K.L. Lo	
Date logged	: 03/07/2002	
Checked by	: Tom Lo	
Date Checked	: 04/07/2002	

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet	1	of	1	
Date excavated	20/06/2002	to	02/07/2002	
Date Reinstated	24/07/2002	to	24/07/2002	

TRIAL PIT NO.

TP5

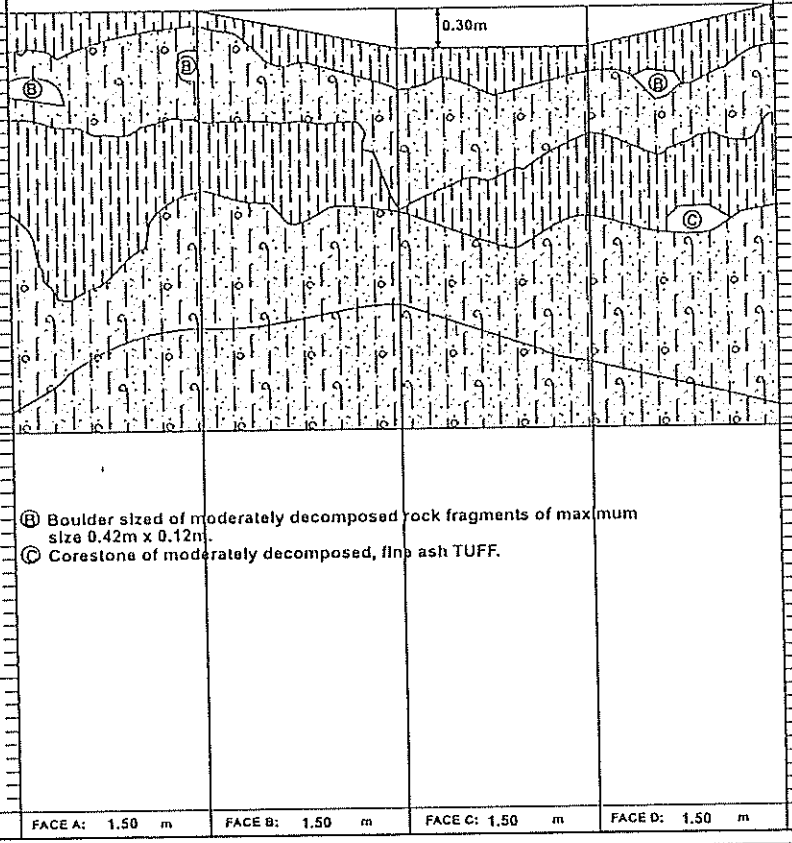
GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Legend	Description	Grade
1	0.30		Soft, dry, very dark greyish brown (10YR 3/2), sandy SILT with some subangular fine to coarse gravel and occasional boulder sized rock fragments and with some rootlets. (COLLUVIUM)	
2, 3	0.80		Loose, moist, yellowish brown (10YR 5/4) mottled light yellowish brown and white, very silty fine to coarse SAND with some subangular fine to coarse gravel and occasional boulder sized rock fragments and with occasional rootlets. (COLLUVIUM)	VI
4, 5, 6			Stiff, moist, yellowish brown (10YR 5/6) mottled pink and light yellowish brown, sandy SILT with occasional subangular fine gravel sized rock fragments and with some subrounded to rounded pocket of completely decomposed fine ash tuff of maximum size 0.50m x 0.40m. (RESIDUAL SOIL)	V
7			Extremely weak, yellowish brown (10YR 5/6) mottled pink and white, completely decomposed, fine ash TUFF. (Silty fine to coarse SAND with occasional fine gravel sized rock fragments)	
8, 9	3.15		Extremely weak to very weak, light grey (5Y 7/2) mottled yellowish brown and pink, completely to highly decomposed, fine ash TUFF. (Silty fine to coarse SAND with some angular fine gravel sized rock fragments)	V/IV

Trial pit terminated at maximum depth 3.15m.

Notes:
1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m, 2.00m, 2.50m and 3.00m depths.
2. Undisturbed vertical samples (U100) were taken at 1.00m, 2.00m and 3.00m (0% recovery) depths.

Sketch



Ⓑ Boulder sized of moderately decomposed rock fragments of maximum size 0.42m x 0.12m.
Ⓒ Corestone of moderately decomposed, fine ash TUFF.

SYMBOLS

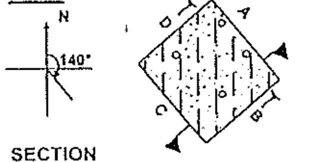
- ↕ Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- — Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS

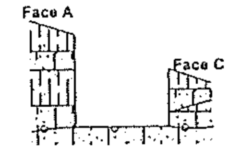
Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
Timber shoring over full height
Stability
Stable
Depth at pit centre
3.00m
Others
Nil

PLAN

(not to scale)



SECTION



Contract No. :	GE/2001/13
Works Order No. :	GE/2001/13.10
Co-ordinates :	E 847241.54 N 817206.07
Ground Level :	182.69 mPD
Logged by :	K.L. Lo
Date logged :	13/06/2002
Checked by :	Tom Lo
Date Checked :	14/06/2002

PROJECT

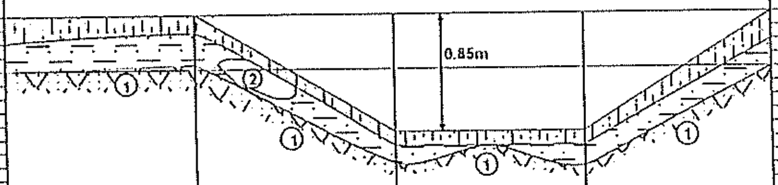
Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet 1	of 1		
Date excavated	10/06/2002	to	12/06/2002
Date Reinstated	05/07/2002	to	05/07/2002

TRIAL PIT NO.
TP6

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

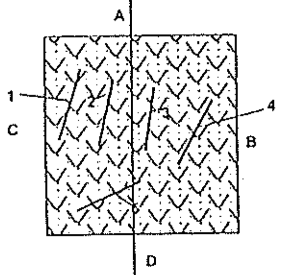
Samples & Test	Depth (m)	Sketch	Depth (m)	Legend	Description	Grade
			0.20		Firm, dry, dark grey (2.5Y 4/1), sandy SILT with some subangular fine to coarse gravel and occasional cobble sized rock fragments and some rootlets. (COLLUVIUM)	
			0.40		Stiff, moist, light brown (10YR 5/3) spotted white, slightly sandy CLAY with much subangular fine to coarse gravel and occasional cobble and boulder of maximum size 400mm sized rock fragments and with occasional rootlets. (COLLUVIUM)	
					Trial pit terminated at 0.40m depth.	



① Moderately strong, light brownish grey mottled yellowish brown and black, moderately decomposed lapilli bearing, fine ash TUFF.

② Boulder sized moderately decomposed tuff.

Top View



Joint number	Dip Direction/ Dip Angle
1	248°/076°
2	248°/078°
3	250°/080°
4	302°/068°
5	295°/076°

FACE A: 1.50 m FACE B: 1.50 m FACE C: 1.50 m FACE D: 1.50 m

Note:
1. Large disturbed sample was taken at 0.30m depth.

SYMBOLS

- ↕ Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- — Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

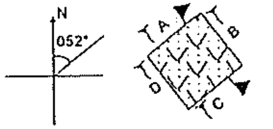
REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
No shoring

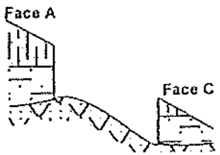
Stability
Stable

Depth at pit centre
0.40m
Others
Nil

PLAN (not to scale)



SECTION



Contract No. :	GE/2001/13
Works Order No. :	GE/2001/13.10
Co-ordinates :	E 847182.48 N 817253.88
Ground Level :	164.99 mPD
Logged by :	K.L. Lo
Date logged :	07/06/2002
Checked by :	Tom Lo
Date Checked :	08/06/2002

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet 1 of 1
Date excavated 06/06/2002 to 06/06/2002
Date Reinstated 03/07/2002 to 03/07/2002

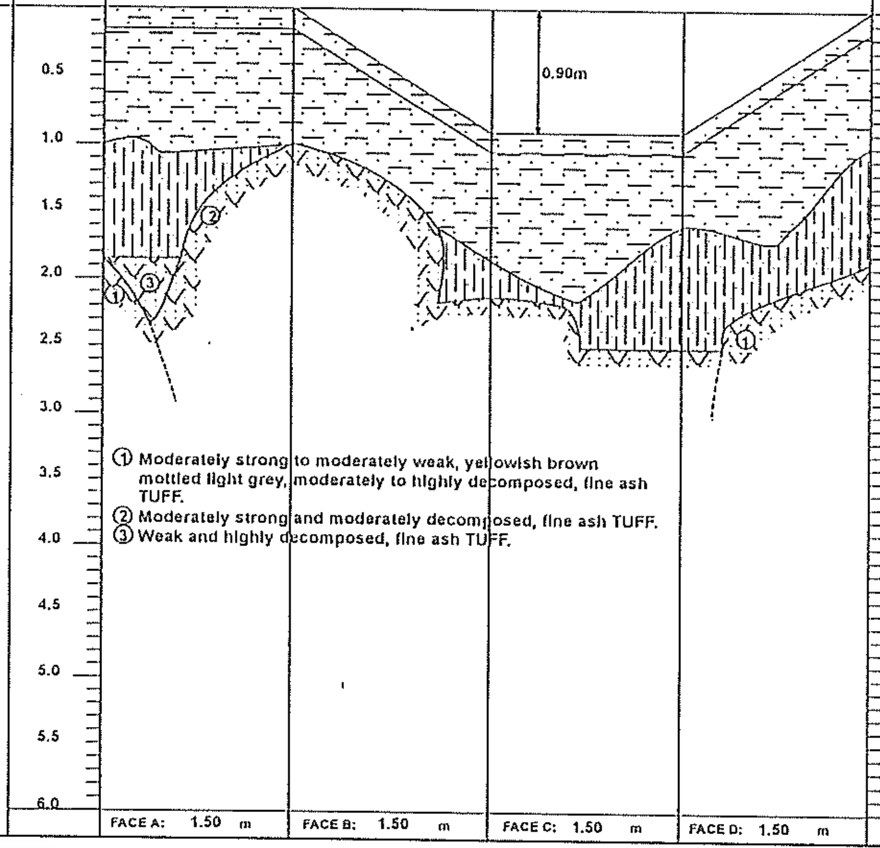
TRIAL PIT NO.
TP7

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Legend	Description	Grade
1 (0.5)	0.15		Firm, dry, dark grey (2.5Y 4/1), slightly sandy CLAY with some subangular fine to coarse gravel and occasional cobble sized rock fragments and with some rootlets. (COLLUVIUM)	
2 (1.0), 3 (1.0)	1.0		Firm, moist, light brown (10YR 5/3) spotted white, slightly sandy CLAY with much subangular fine to coarse gravel and cobble sized rock fragments and with occasional rootlets. (COLLUVIUM)	
4 (1.5), 5 (1.8)	1.85		Weak to very weak, yellowish brown (10YR 5/4) mottled light grey, highly to completely decomposed, fine ash TUFF. (Stiff, sandy SILT with much subangular fine to coarse gravel sized rock fragments)	IV/V
			Trial pit terminated at 1.85m depth.	

Notes:
1. Small disturbed samples were taken at 0.50m, 1.00m and 1.50m depths.
2. Undisturbed vertical sample (U100) samples were taken at 1.00m depth.
3. Large disturbed sample was taken at 1.80m depths.

Sketch



① Moderately strong to moderately weak, yellowish brown mottled light grey, moderately to highly decomposed, fine ash TUFF.
② Moderately strong and moderately decomposed, fine ash TUFF.
③ Weak and highly decomposed, fine ash TUFF.

SYMBOLS

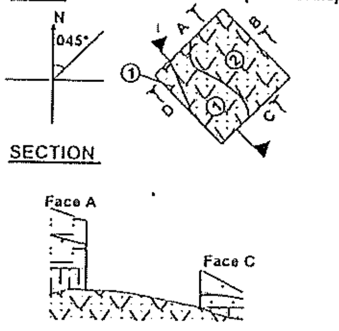
- ↕ Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- — Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
Timber shoring over full height
Stability
Stable
Depth at pit centre
1.30m
Others
Nil

PLAN (not to scale)

SECTION



Contract No. :	GE/2001/13
Works Order No. :	GE/2001/13.10
Co-ordinates :	E 847189.84 N 817265.01
Ground Level :	166.88 mPD
Logged by :	K.L. Lo Lo
Date logged :	11/06/2002
Checked by :	Tom Lo
Date Checked :	12/06/2002

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

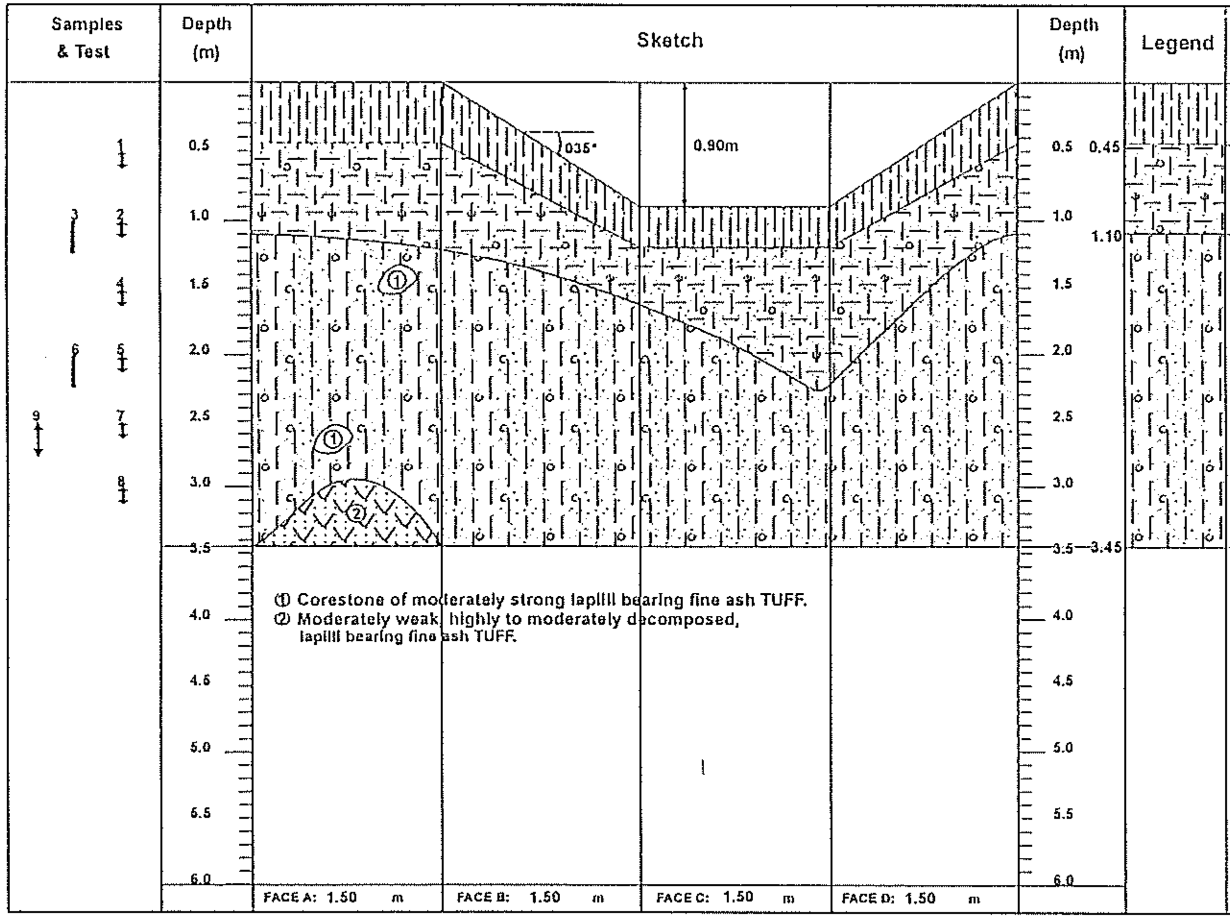
Sheet 1 of 1

Date excavated 10/06/2002 to 10/06/2002

Date Reinstated 03/07/2002 to 03/07/2002

TRIAL PIT NO.
TP7A

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT



① Corestone of moderately strong lapilli bearing fine ash TUFF.
② Moderately weak, highly to moderately decomposed, lapilli bearing fine ash TUFF.

Depth (m)	Description	Grade
0.45	Stiff, dry, dark grey (2.5Y 4/1) sandy SILT with some subangular fine to coarse gravel and occasional cobble sized rock fragment and some rootlets. (COLLUVIUM)	
1.10	Firm, moist, dark greyish brown (10YR 4/2) sandy SILT/CLAY with some subangular fine to coarse gravel and cobble sized rock fragments and some rootlets. (COLLUVIUM)	
3.45	Weak to extremely weak, dry, olive grey (5Y 5/2) mottled yellowish brown and brown, highly to completely decomposed, lapilli bearing fine ash TUFF. (Silty fine to medium SAND with occasional subangular fine gravel and occasional boulder of maximum size 300mm sized rock fragment.	IV/V

Trial pit terminated at 3.45m depth.

Notes:
1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m, 2.00m, 2.50m and 3.00m depths.
2. Undisturbed vertical samples (U100) were taken at 1.00m and 2.00m depths.
3. Large disturbed samples was taken at 3.00m depth.

SYMBOLS

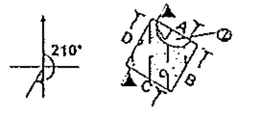
- I Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- — Undisturbed Horizontal Sample
- ▨ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS

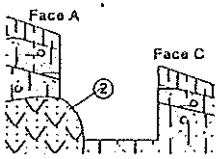
Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
Timber shoring over full height
Stability
Stable
Depth at pit centre
3.00m
Others
Nil

PLAN

(not to scale)



SECTION



Contract No. : GE/2001/13
Works Order No. : GE/2001/13.10
Co-ordinates :
E 847025.18 N 817334.69
Ground Level : 155.42 mPD
Logged by : K.L. Lo
Date logged : 06/06/2002
Checked by : Tom Lo
Date Checked : 07/06/2002

PROJECT

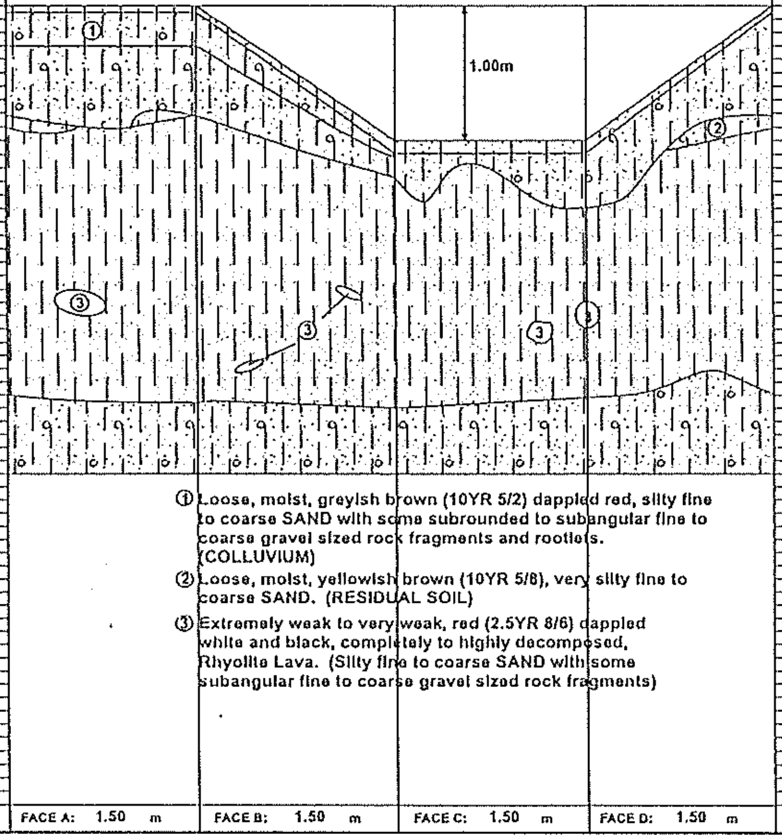
Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet	1	of	1	
Date excavated	03/06/2002	to	05/06/2002	
Date Reinstated	04/07/2002	to	04/07/2002	

TRIAL PIT NO.
TP8

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Sketch	Depth (m)	Legend	Description	Grade
1	0.5		0.05 0.30 0.5		Loose, dry, dark grey (2.5Y 4/1), silty fine to coarse SAND with occasional fine to medium gravel sized rock fragments and some rootlets. (TOP SOIL)	
3, 2	1.0		0.82 0.90 1.0		Dense, moist, reddish brown (5YR 5/4) dappled white, streaked black, silty fine to coarse SAND with some subrounded to subangular fine to coarse gravel and occasional cobble sized rock fragments. (COLLUVIUM)	
4	1.5		1.5		Extremely weak to very weak, moist, reddish brown (5YR 5/4) dappled white and streaked black, completely to highly decomposed, RHYOLITE LAVA. (Silty fine to coarse SAND)	V/IV
6, 5	2.0		2.0			
7	2.5		2.5			
10, 9, 8	3.0		3.0 2.90		Extremely weak to very weak, reddish brown (5YR 5/4) dappled white, completely to highly decomposed, Rhyolite Lava. (Silty fine to coarse SAND with some subangular fine to coarse gravel sized rock fragments)	V/IV
	3.5		3.5 3.50		Trial pit terminated at 3.50m depth.	
	4.0		4.0		Note: 1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m, 2.00m, 2.50m and 3.00m depths. 2. Undisturbed vertical samples (U100) were taken at 1.00m, 2.00m (0% recovery) and 3.00m (0% recovery) depths. 3. Large disturbed sample was taken at 3.00m depth.	
	4.5		4.5			
	5.0		5.0			
	5.5		5.5			
	6.0		6.0			



① Loose, moist, greyish brown (10YR 5/2) dappled red, silty fine to coarse SAND with some subrounded to subangular fine to coarse gravel sized rock fragments and rootlets. (COLLUVIUM)

② Loose, moist, yellowish brown (10YR 5/6), very silty fine to coarse SAND. (RESIDUAL SOIL)

③ Extremely weak to very weak, red (2.5YR 8/6) dappled white and black, completely to highly decomposed, Rhyolite Lava. (Silty fine to coarse SAND with some subangular fine to coarse gravel sized rock fragments)

SYMBOLS

↨	Small Disturbed Sample
↕	Large Disturbed Sample
|	Undisturbed Vertical Sample
—	Undisturbed Horizontal Sample
■	Block Sample
⊔	Insitu Density Test
▲	Water Sample
↓	Water Seepage

REMARKS

Ground Water
No Groundwater

Plant Used
Hand dug

Shoring
Timber shoring over full height

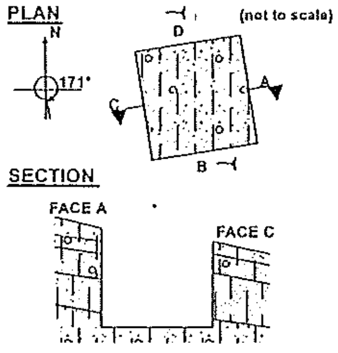
Stability
Stable

Depth at pit centre
3.00m

Others
Nil

PLAN (not to scale)

SECTION



Contract No. : GE/2001/13
Works Order No. : GE/2001/13.10
Co-ordinates :
E 846645.70 N 817404.81
Ground Level : 105.34 mPD
Logged by : K.L. Lo
Date logged : 07/06/2002
Checked by : Tom Lo
Date Checked : 08/06/2002

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet 1 of 1
Date excavated 03/06/2002 to 05/06/2002
Date Reinstated 06/07/2002 to 06/07/2002

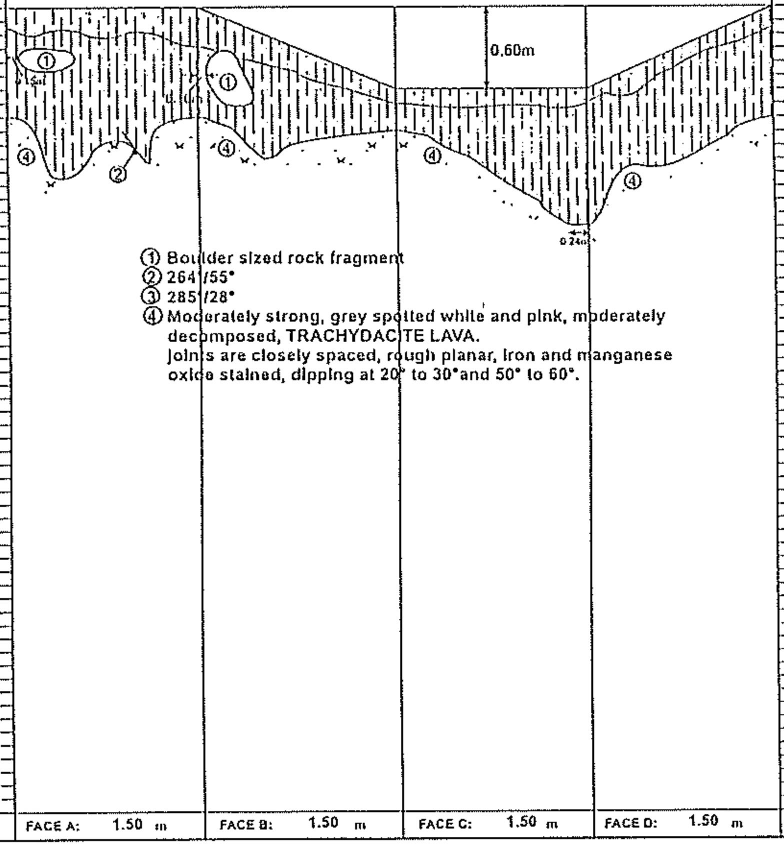
TRIAL PIT NO.
TP9

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Legend	Description	Grade
1 (Small Disturbed Sample)	0.5			
2 (Small Disturbed Sample), 3 (Undisturbed Vertical Sample)	1.0			
	0.15		Firm, dry, organic, dark brownish grey (2.5Y 3/2), sandy SILT with occasional angular to subangular fine gravel sized quartz and rock fragments and some plant rootlet. (TOP SOIL)	
	0.80		Stiff, dry, yellowish brown (10YR 5/8) dappled grey and white, slightly sandy SILT with some subangular to subrounded fine to coarse gravel and occasional cobble and boulder of maximum size 0.40m x 0.40m sized rock fragments and occasional plant rootlet. (COLLUVIUM) Trial pit terminated at 0.80m depth.	

Notes:
1. Small disturbed samples were taken at 0.50m and 1.00m depths.
2. Undisturbed vertical samples (U100) was taken at 1.00m depth.

Sketch



① Boulder sized rock fragment
② 264/55°
③ 285/28°
④ Moderately strong, grey spotted white and pink, moderately decomposed, TRACHYDACITE LAVA.
Joints are closely spaced, rough planar, iron and manganese oxide stained, dipping at 20° to 30° and 50° to 60°.

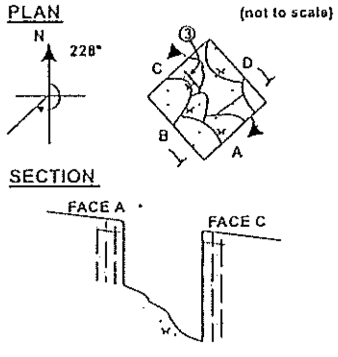
SYMBOLS

- ↥ Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- — Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
Timber shoring over full height
Stability
Stable
Depth at pit centre
1.20m
Others
Nil

PLAN (not to scale)



Contract No. :	GE/2001/13
Works Order No.	: GE/2001/13.10
Co-ordinates	:
E 846971.28	N 816690.45
Ground Level	: 153.75 mPD
Logged by	: K.L. Lo
Date logged	: 03/07/2002
Checked by	: Tom Lo
Date Checked	: 04/07/2002

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet 1 of 1

Date excavated 27/06/2002 to 02/07/2002

Date Reinstated 22/07/2002 to 22/07/2002

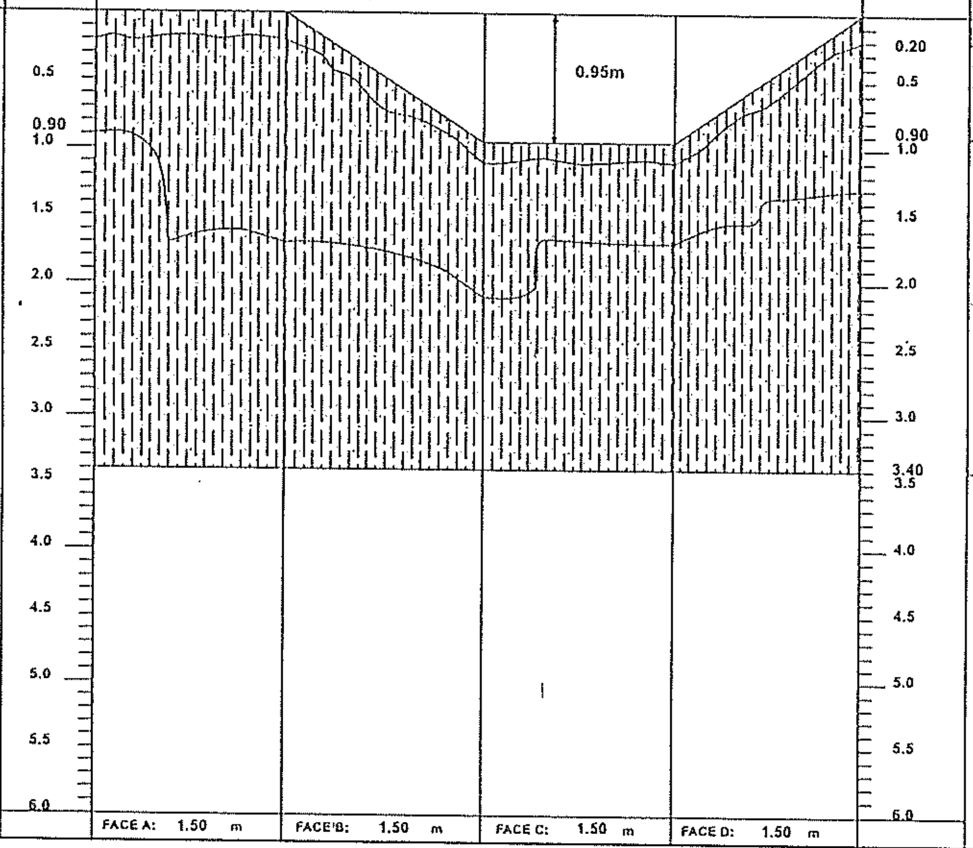
TRIAL PIT NO.
TP10

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Legend	Description	Grade
	0.20		Stiff, dry, very dark greyish brown (10YR 3/2), sandy SILT with some subangular fine to coarse gravel sized rock fragments. (COLLUVIUM)	
	0.90		Firm to stiff, moist, yellowish brown (10YR 5/4), sandy SILT with much angular to subangular fine to coarse gravel and occasional cobble sized rock and quartz fragments and with some rootlets. (COLLUVIUM)	
1, 2 (1.0) 3 (1.5) 4, 5 (2.0) 6 (2.5) 7, 8 (3.0)	3.40		Weak to extremely weak, yellowish brown (10YR 5/6) mottled pink and white, highly to completely decomposed, Rhyolite Lava. (Sandy SILT with some angular fine to medium gravel sized rock fragments)	IV/V
			Trial pit terminated at 3.40m depth.	

Notes:
1. Small disturbed samples were taken at 1.00m, 1.50m, 2.00m, 2.50m and 3.00m depths.
2. Undisturbed vertical samples (U100) were taken at 1.00m , 2.00m and 3.00m depths.

Sketch



SYMBOLS

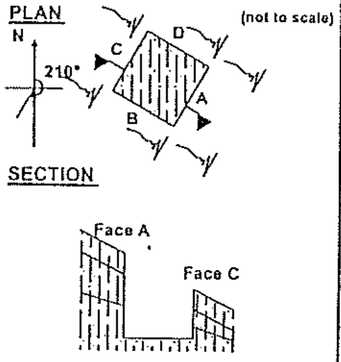
- ↕ Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- ▬ Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
Timber shoring over full height

Stability
Stable

Depth at pit centre
3.00m
Others
Nil



Contract No. :		GE/2001/13
Works Order No.	:	GE/2001/13.10
Co-ordinates	:	
E 846623.66		N 816715.59
Ground Level	:	48.21 mPD
Logged by	:	K.L. Lo
Date logged	:	03/07/2002
Checked by	:	Tom Lo
Date Checked	:	04/07/2002

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet	1	of	1
Date excavated	28/06/2002	to	02/07/2002
Date Reinstated	24/07/2002	to	24/07/2002

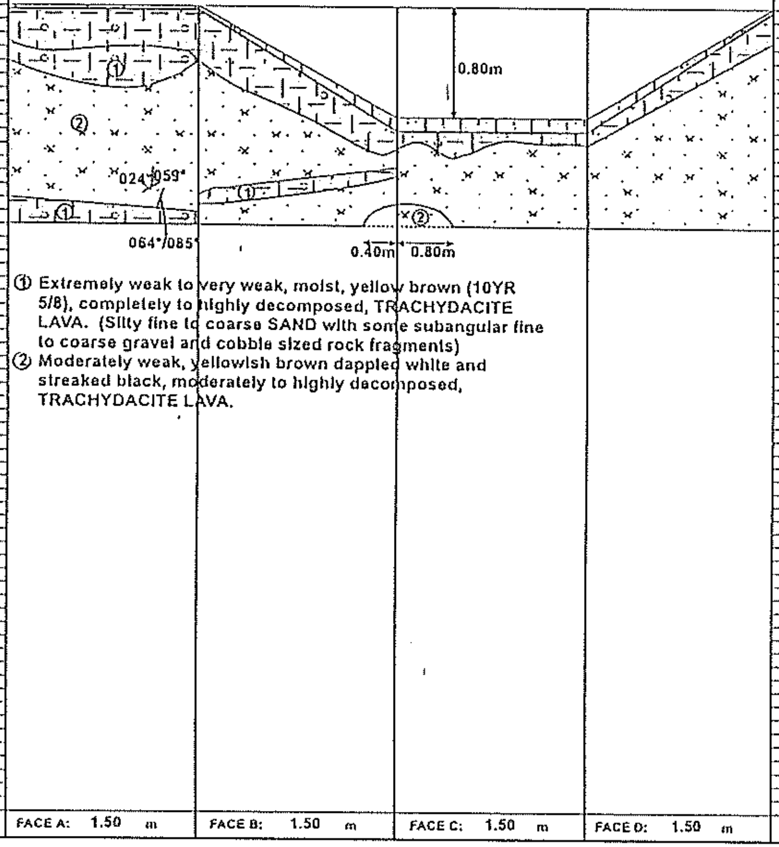
TRIAL PIT NO.
TP11

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Description	Grade
↕ (0.5) ↕2 (1.0)	0.03	Loose, dry, dark grey (2.5Y 4/1), silty fine to coarse SAND with occasional fine to medium gravel sized rock fragments and some rootlets. (TOP SOIL)	
	0.25	Loose, dry, dark brownish grey (2.5Y 3/2) dappled white and red, silty fine to coarse SAND with some subrounded to subangular fine to coarse gravel sized rock fragments, occasional cobble sized rock fragments. (COLLUVIUM)	
	1.60	Weak to moderately weak, dry, yellowish brown dappled white, red and black, highly decomposed, highly fractured, TRACHYDACITE LAVA.	IV
		Trial pit terminated at 1.60m.	

Note:
1. Small disturbed samples were taken at 0.50m and 1.00m depths.

Sketch



① Extremely weak to very weak, moist, yellow brown (10YR 5/8), completely to highly decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND with some subangular fine to coarse gravel and cobble sized rock fragments)
② Moderately weak, yellowish brown dappled white and streaked black, moderately to highly decomposed, TRACHYDACITE LAVA.

SYMBOLS

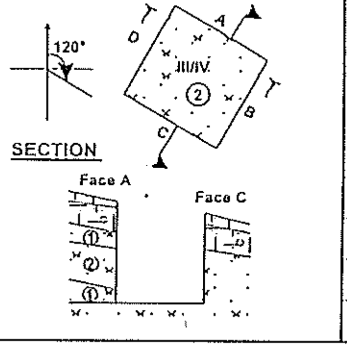
- ↕ Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- ▬ Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
No shoring
Stability
Stable
Depth at pit centre
1.20m
Others
Nil

PLAN (not to scale)

SECTION



Contract No. :	GE/2001/13
Works Order No. :	GE/2001/13.10
Co-ordinates :	E 846809.76 N 817411.30
Ground Level :	135.44 mPD
Logged by :	K.L. Lo
Date logged :	07/06/2002
Checked by :	Tom Lo
Date Checked :	08/06/2002

PROJECT

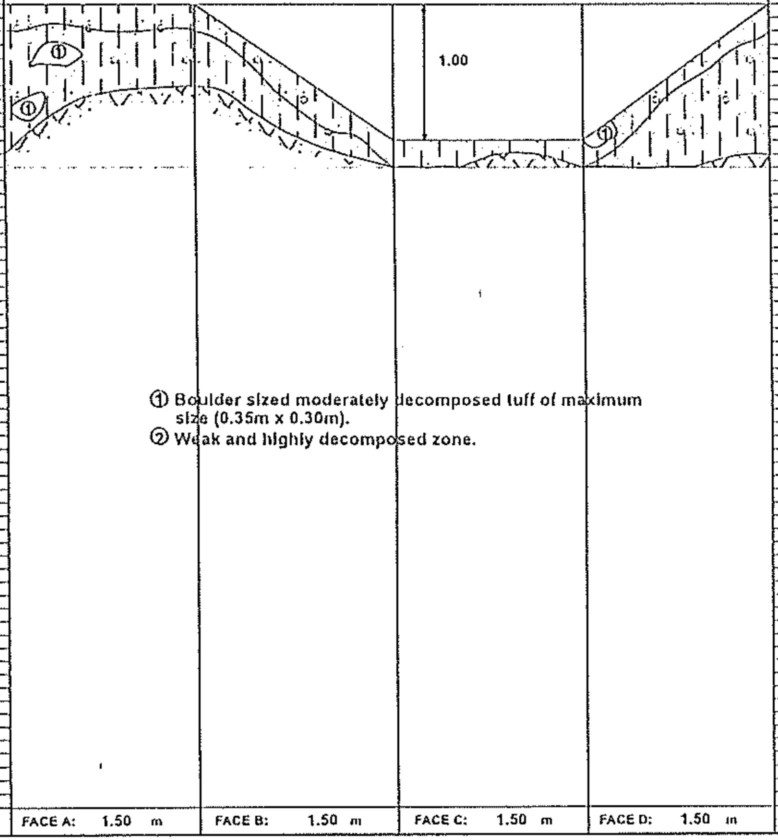
Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet 1 of 1
Date excavated 04/06/2002 to 06/06/2002
Date Reinstated 02/07/2002 to 02/07/2002

TRIAL PIT NO.
TP12

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Sketch	Depth (m)	Legend	Description	Grade
1 ↕	0.5		0.20 0.5		Loose, dry, dark grey (10YR 4/1), organic, silty fine to coarse SAND with much angular to subangular fine to medium gravel sized quartz and rock fragments, occasionally cobble sized rock fragments and with much plant rootlets. (TOP SOIL)	
2 ↕	1.0		1.0 1.10		Loose, dry, yellowish brown (10YR 5/6) dappled dark grey and mottled white, very silty fine to coarse SAND with much angular to subangular fine to coarse gravel sized quartz and rock fragments, some cobble and boulder sized moderately decomposed tuff fragments and occasional plant rootlets. (COLLUVIUM)	
			1.20		Moderately strong, grey dappled pink and brown, moderately decomposed, fine ash TUFF with iron and manganese oxide stained on the surface, massive.	III
	1.5 – 6.0		1.5 – 6.0		Trial pit terminated at 1.20m depth.	



① Boulder sized moderately decomposed tuff of maximum size (0.35m x 0.30m).
② Weak and highly decomposed zone.

Note:
1. Small disturbed samples were taken at 0.50m and 1.00m depths.

SYMBOLS

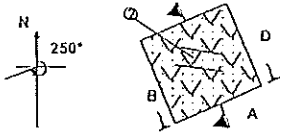
- ↕ Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- — Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS

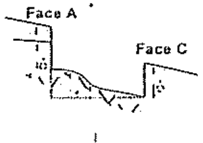
Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
No shoring
Stability
Stable
Depth at pit centre
0.70m
Others
Nil

PLAN

(not to scale)



SECTION



Contract No. : GE/2001/13
Works Order No. : GE/2001/13.10
Co-ordinates :
E 847078.00 N 816718.21
Ground Level : 154.28 mPD
Logged by : K.L. Lo
Date logged : 04/07/2002
Checked by : Tom Lo
Date Checked : 05/07/2002

PROJECT

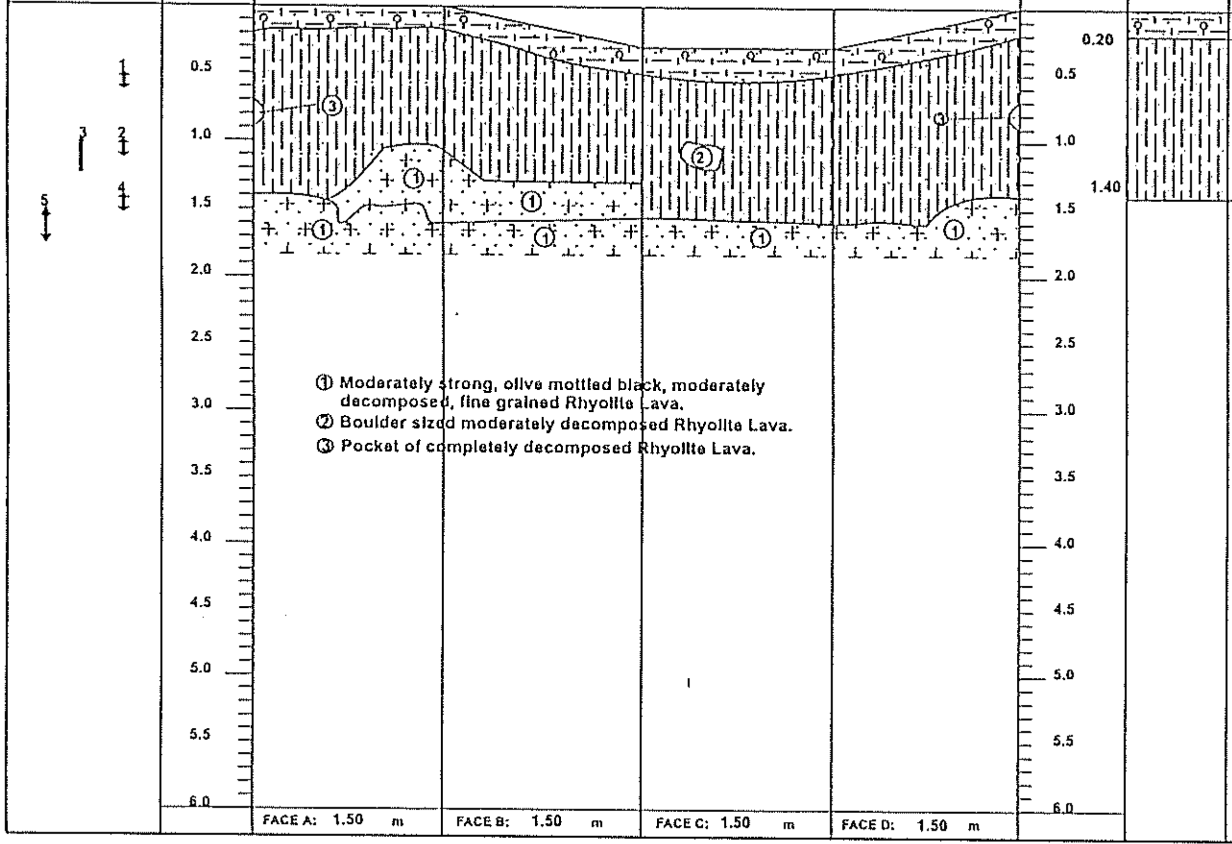
Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet 1 of 1
Date excavated 28/06/2002 to 03/07/2002
Date Reinstated 24/07/2002 to 24/07/2002

TRIAL PIT NO.
TP13

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Sketch	Depth (m)	Legend	Description	Grade



① Moderately strong, olive mottled black, moderately decomposed, fine grained Rhyolite Lava.
② Boulder sized moderately decomposed Rhyolite Lava.
③ Pocket of completely decomposed Rhyolite Lava.

Stiff, moist, dark grey (2.5Y 4/1), slightly sandy SILT/CLAY with occasional fine to coarse gravel and cobble sized rock fragments. (COLLUVIUM)

Stiff, moist, yellowish brown (10YR 5/4) mottled pink, slightly sandy SILT with some angular to subangular fine to coarse gravel and occasional cobble and boulder sized rock fragments (maximum size 350mm) with occasional pockets of completely decomposed Rhyolite Lava (maximum size 150mm). (COLLUVIUM)

Trial pit terminated at an average depth of 1.65m.

Notes:
1. Small disturbed samples were taken at 0.50m, 1.00m and 1.50m depths.
2. Undisturbed vertical sample (U100) was taken at 1.00m depth.
3. Large disturbed sample was taken at 1.60m depth.

SYMBOLS

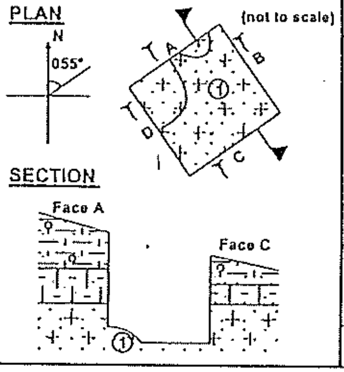
- ↕ Small Disturbed Sample
- ↕ Large Disturbed Sample
- | Undisturbed Vertical Sample
- — Undisturbed Horizontal Sample
- ■ Block Sample
- ⊔ Insitu Density Test
- ▲ Water Sample
- ↓ Water Seepage

REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
Timber shoring over full height

Stability
Stable

Depth at pit centre
1.65m
Others
Nil



Contract No. :	GE/2001/13
Works Order No. :	GE/2001/13.10
Co-ordinates :	
E 846585.94	N 817385.05
Ground Level :	75.60 mPD
Logged by :	K.L. Lo
Date logged :	08/06/2002
Checked by :	Tom Lo
Date Checked :	10/06/2002

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet 1 of 1

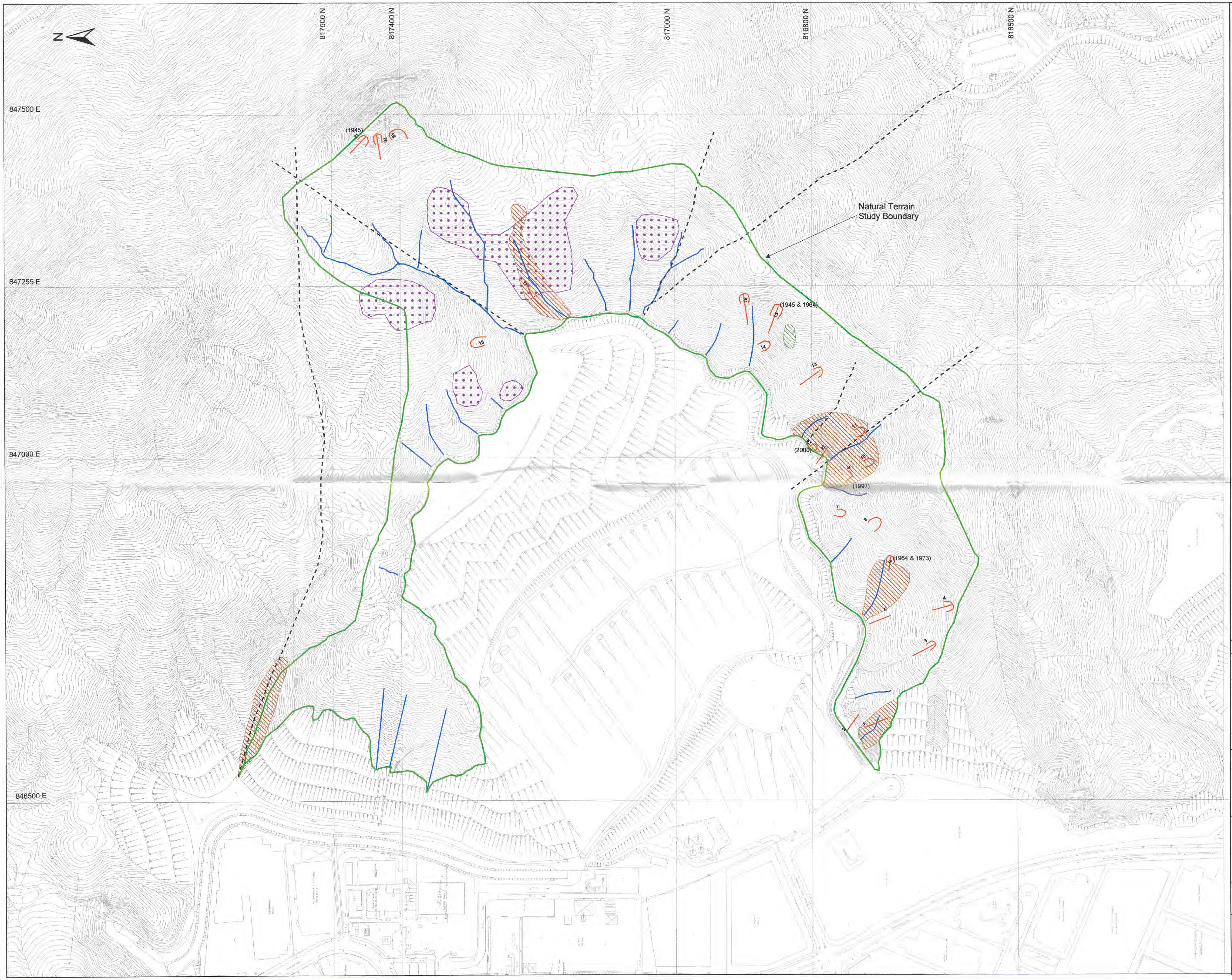
Date excavated	06/06/2002	to	07/06/2002
Date Reinstated	29/06/2002	to	29/06/2002

TRIAL PIT NO.
TP14

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

APPENDIX B

Aerial Photograph Interpretation And API Map


N
817500 N
817400 N
817000 N
816800 N
816500 N
847500 E
847255 E
847000 E
846500 E
Natural Terrain Study Boundary
(1945)
21
20
19
17
18
16
15
(1945 & 1964)
14
13
12
22
(2000)
11
10
9
(1997)
7
8
6
(1964 & 1973)
5
4
3
2
1

Legend

- (10) (1945) Landslide scar from API (year of landslide event(s))
- (1) Landslide from NTLI
- ▨ Colluvium
- - - - Photogeological lineament
- ● boulder fields
- ▨ Rock outcrops
- — drainage line

Revision	Date	Description		Initial
	Design	Check	Drawn	Check
Initial	SMo	JH	VN	JH
Date	08/2002	08/2002	08/2002	04/2002

Approved

AGREEMENT NO. FD01-052

Contract Title

**TSEUNG KWAN O STAGE II/III
AFTERUSE DEVELOPMENT**

Figure Title

**AERIAL PHOTO
INTERPRETATION MAP**

Drawing No.
APPENDIX B

Scale
1:2500

Consultant
Binnie Black & Veatch Hong Kong Limited

API - TSEUNG KWAN O STAGE II/III LANDFILL

Low Flight

Year	Reference No (Scale)	Description
1963	Y08353-4 (3900')	The landfill site is situated in a bowl shaped valley overlooking Tai Chik Sha (TCS) and a small embayment of Tseung Kwan O Bay. The TCS area was originally of a natural hillside surrounded by agricultural fields. The base of the hillside has been terraced for landuse. The slopes are vegetated, being more heavily vegetated in the south, with abundant boulders on hillslopes to the east and south. A number of large boulders can also be identified in the north. A NW-SE trending channel drains the valley. Relict landslide scars are present in the areas to the north-west and and south-west.
1967	Y13343-4 (6250')	Terracing activity on the hillslopes to the north and south and several areas where platforms are formed. Landslips identified on slopes adjacent to drainage paths on the southern slopes in the lower parts of the natural slope. Evidence of erosion along the rdigelines where slight regrowth of vegetation have occurred.
1974	9303-9305 (4000')	Further terracing and platform formation on slopes in the south. Evidence of previous rockfalls in the south and eastern portions of study area. Evidence of further erosion along ridgelines and on lower parts of slopes. Evidence of landslips on lower part of slope in the south and also adjacent to drainage lines in the south-west (identified in NTLI).
1976	14973-74 (5000')	No major changes to the TCS area but terraces to the south are excavated/stripped of vegetation. No changes to natural slope.
1980	30720 (4000')	Further excavation/stripping of vegetation in areas to the south and south-east of TCS to form terraces (probably for the cemetery). Surface of natural slopes to the south cleared of vegetation by hill fires.
1982	44300 (4000')	Vegetation growth on formed terraces and regrowth on previous hill fire areas of natural slope. Adjacent areas surrounding TCS area heavily vegetated.
1983	47500-501 (4000')	No changes to site area. Construction of landfill site (Stage I) further to the north has commenced and platform being formed.
1986	A07542-3 (4000') A07375-6 (4000')	A major portion of the existing agricultural land covered over by vegetation with only faint signs of the terraced landscape. Most of the TCS area heavily vegetated. Platform formed in the area to the west of Siu Chik Sha (to the north of TCS). No changes to natural terrain.
1987	A10847-8	Formation of access to TCS from the Stage I site in

	(4000')	the north and agricultural land has been excavated. Access roads to several parts (in the southern and eastern parts) of the proposed Stage II/III Landfill site have been formed cutting into the base of the natural terrain. Formation of cutslopes commenced in the southern portion of the study area.
1988	A14141 (4000')	Reclaimation for basal platform to the west of TCS commenced with lagoons formed and seawall constructed. Excavation of the TCS area continues and the catchwater channel along the southern perimeter has been formed. Natural terrain becoming heavily vegetated.
1989	A16794-6 (4000')	Reclaimation for basal platform and site formation within landfill site continues. Landfilling apparent at the basal area (in the west) of the site. Formation of cut slope in the southern portion of the study area commences.
1990	A20554-5 (4000')	Site formation into the northern parts of the natural terrain and construction of the catchwater around the northern perimeter has commenced. Landfilling apparent on the centre of the site.
1991	A25266-7 (4000')	Landfill Stage II/III site boundary has been formed and site formation within continues. Cut slope 12SW-A/F67 formed. No changes to natural terrain.
1992	A32763-4 (4000')	Formation of cut slope, 12SW-A/C203, in the north has commenced and other cut slopes continue. Major activity in the northern portion of the site – most probably landfilling. Reclaimation to form platform to the south-west has commenced.
1993	A37384-6 (4000')	Formation of cut slopes continue. Black membrane placed on formed slope 12SW-A/F68. Northernmost portion of the site filled and landfilling apparent in the eastern portion of the site. Formation of cut slopes, 12SW-A/C185 and 12SW-A/C203, to the north have been completed.
1994	A38107-9 (4000')	All cut slopes formed with only minor activity in the eastern portion of the landfill site.
1995	CN10018-20 (3500')	Cut slopes hydroseeded.
1996	CN14306-7 (4000')	Growth of hydroseeding on slopes.
1997	CN17111-2 (4000')	Increase in vegetation at the toe of natural terrain and growth of hydroseeding on cut slopes continue. Evidence of landslip at the southern area of the natural terrain.
1998	CN21382-3 (4000') A48421-3 (4000')	Surfaces of cut slopes covered with white/black membrane layers and then followed by a layer of soil. Landslip covered over by growth of vegetation.
1999	A49687-8 (4000')	Another phase of hydroseeding works emplaced on slope surfaces. Heavily vegetated natural terrain.

High Flight

Year	Reference No (Scale)	Description
1945	Y00432-3 (20,000')	The TCS area was originally of a natural hillside surrounded by agricultural fields. The base of the natural hillside have been terraced for landuse and beyond this, the natural slopes are heavily vegetated.
1964	Y12906-8 (12,500')	Extent of agricultural land increased with terracing along the base of the natural hillsides. Platforms formed for building structures in the north and south.
1973	8038-9 (12,500')	Evidence of a landslide on the slopes to the south (also identified by NTLI) and erosion. Further terracing activity on natural slopes. Platforms previously formed now vegetated.
1974	9709-10 (12,500')	No major changes form previous photograph. Regrowth of vegetation on slope surfaces.
1985	A01724-5 (10,000')	The TCS area was originally of a natural hillside surrounded by agricultural fields. The base of the natural hillside have been terraced for landuse and beyond this, the natural slopes are heavily vegetated.
1996	CN16263-4 (10,000')	Landfill site has been formed with south-west facing hydroseeded cut slopes and catchwater channels along the perimeter.
1997	CN18613-5 (10,000')	No changes to cut slopes with minor formation activity at the base of Slope 12SW-A/F67.
1999	CN25715-6 (8,000')	Growth of hyrodseeding on slope surfaces. Industrial complex constructed at toe of Slope 12SW-A/F67.

APPENDIX C

Catalogue of Natural Slope Landslide And Database

CATALOGUE OF NATURAL SLOPE LANDSLIDES

Map Sheet Report

Map Sheet Reference Number :	12SW-A
Date of Assessment :	5 - 7 February 1996
API Consultant:	G.I.Short API(Consultant)/5 Produced under Agreement No.CE 16/93 for CED
Description of Terrain :	Steep to rolling terrain on volcanic rocks. Vegetation cover is mainly grass.
Land Use :	A mixture of urban and country park.
Extent of Land Modifications :	Approximately 40% of lands has been modified for urban and infrastructure development.
Land Area of Map Sheet :	775 ha
Time Involved :	6.5 hours
No. of Aerial Photo. Sets Examined:	23
Mapping Criteria:	Widths of Landslides Class 1: Landslide less than 20m wide at widest point Class 2: Landslide more than 20m wide at widest point
AP's Showing Recent Landslide activity:	The earliest and complete set of photography flown of the area was in 1945. Very few fresh landslides were observed other than some activity recorded in 1975 and 1992.
Relict Landslips:	Descriptions as per standard. Relict landslides along the coast occurred in soil material.
Years for which Aerial Photographs are not available.	1972 Not flown 1974 One half of area not in GEO collection 1977 Not flown
Years for which Ground Coverage is obscured by Cloud:	
Years and Localities in which Natural Terrain was modified:	Most modifications were in the 1981 and 1994 time periods around Junk Island, Tin Ha and Tai Chik Sha.

1 Natural Terrain Landslide Catalogue, Summary Sheet for Sheet No. 12 SW-A

ID_MAX, Total number of landslides ~~129~~ 130. Unused Numbers between 0 and ID_MAX 0

Aerial Photograph Cover

YEAR	Coverage
1945	FC
1964	FC
1972	NF
1973	FC
1974	PC/NG
1975	FC
1976	FC
1977	NF
1978	FC
1979	FC
1980	FC
1981	FC
1982	FC
1983	FC
1984	FC
1985	FC
1986	FC
1987	FC
1988	FC
1989	FC
1990	FC
1991	FC
1992	FC
1993	FC
1994	FC

Full Aerial Photograph Cover	FC
Partial Aerial Photograph Cover	PC
No Aerial Photograph Cover	NF - Not Flown
	NG - Not in GEO Collection
	NA - Not Available for mapping

List of Aerial Photographs Used

Year	Height (ft)	Photograph Number	Date	Coverage
1945	20 000	Y527-30 Y431-5	11.11.45	A
1964	12 500	Y12906-8 Y12834-6		A
1973	12 500	8037-8	20.12.73	A
1974	12 500	9709-10 9700	21.11.74	B
1975	12 500	12054-6 12066-8	24.12.75	A
1976	12 500	15927-9 15837-9	4.11.76	A
1978	12 500	20762-4	10.1.78	A
1979	10 000	28028-9 28016-8	28.11.79	A
1980	10 000	33425-7	28.11.80	A
1981	10 000	39023-5 39037-8	26.10.81	A
1982	10 000	44464-6 44514-5	10.10.82	A
1983	10 000	51332-3	30.11.83	A
1984	10 000	56488-9	20.10.84	A
1985	10 000	A1714-6 67385-7	7.7.85 1.10.85	A
1986	10 000	A8258-9	21.12.86	A
1987	20 000	A8396-7	5.1.87	A
1988	10 000	A13650-3	4.6.88	A
1989	10 000	A19293-4	20.11.89	A
1990	10 000	A24427-8 A24680-1	3.12.90 4.12.90	A
1991	10 000	A28525-6	21.10.91	A
1992	10 000	A33156-8	11.11.92	A
1993	10 000	CN5341-3 CN5673-4	5.12.93 6.12.93	A
1994	10 000	A39512-4 A39724-6	24.10.94	A

A = full stereoscopic coverage
B = partial stereoscopic coverage

MAP SHEET NUMBER: 12SW - A

TAG NO.	SLOPE	YEAR	COVER	WIDTH	CROSS TAG NO.	LAST YR
0001	18	45	C	1		—
0002	27	45	C	1		—
0003	27	45	C	1		—
0004	30	45	C	2		—
0005	39	45	C	1		—
0006	45	45	C	1		—
0007	37	45	C	1		—
0008	39	45	C	1		—
0009	39	45	C	1		—
0010	39	64	B	1		45
0011	30	45	C	2		—
0012	39	45	C	1		—
0013	39	45	C	1		—
0014	34	45	C	1		—
0015	34	45	C	1		—
0016	45	45	C	2		—
0017	45	45	C	1		—
0018	34	45	C	1		—
0019	34	45	C	1		—
0020	30	45	C	1		—
0021	34	45	C	1		—
0022	27	45	C	1		—
0023	39	45	C	1		—
0024	34	45	C	1		—
0025	39	45	C	1		—
0026	39	45	C	1		—
0027	39	64	C	1		45
0028	39	45	C	1		—
0029	22.	45	D	1		—
0030	45	45	C	2		—
0031	39	45	B	2		—

12SW-A Pg 2

0032	34	45	B	1		–
0033	45	45	B	1		–
0034	39	45	B	1		–
0035	45	45	B	2		–
0036	45	45	B	1		–
0037	45	45	B	1		–
0038	27	45	C	1		–
0039	30	45	C	1		–
0040	34	45	C	1		–
0041	34	45	C	1		–
0042	39	45	C	1		–
0043	34	45	C	2		–
0044	39	45	C	2		–
0045	34	45	C	1		–
0046	34	45	C	1		–
0047	34	45	C	1		–
0048	45	64	C	1		45
0049	45	64	C	1		45
0050	39	45	C	1		–
0051	39	45	C	1		–
0052	39	45	C	1		–
0053	39	45	C	1		–
0054	45	45	C	1		–
0055	45	45	C	1		–
0056	45	45	C	1		–
0057	34	45	C	1		–
0058	39	45	C	1		–
0059	39	45	C	1		–
0060	39	45	C	1		–
0061	39	45	C	1		–
0062	39	45	C	1		–
0063	34	45	C	1		–
0064	45	45	C	2	–	–

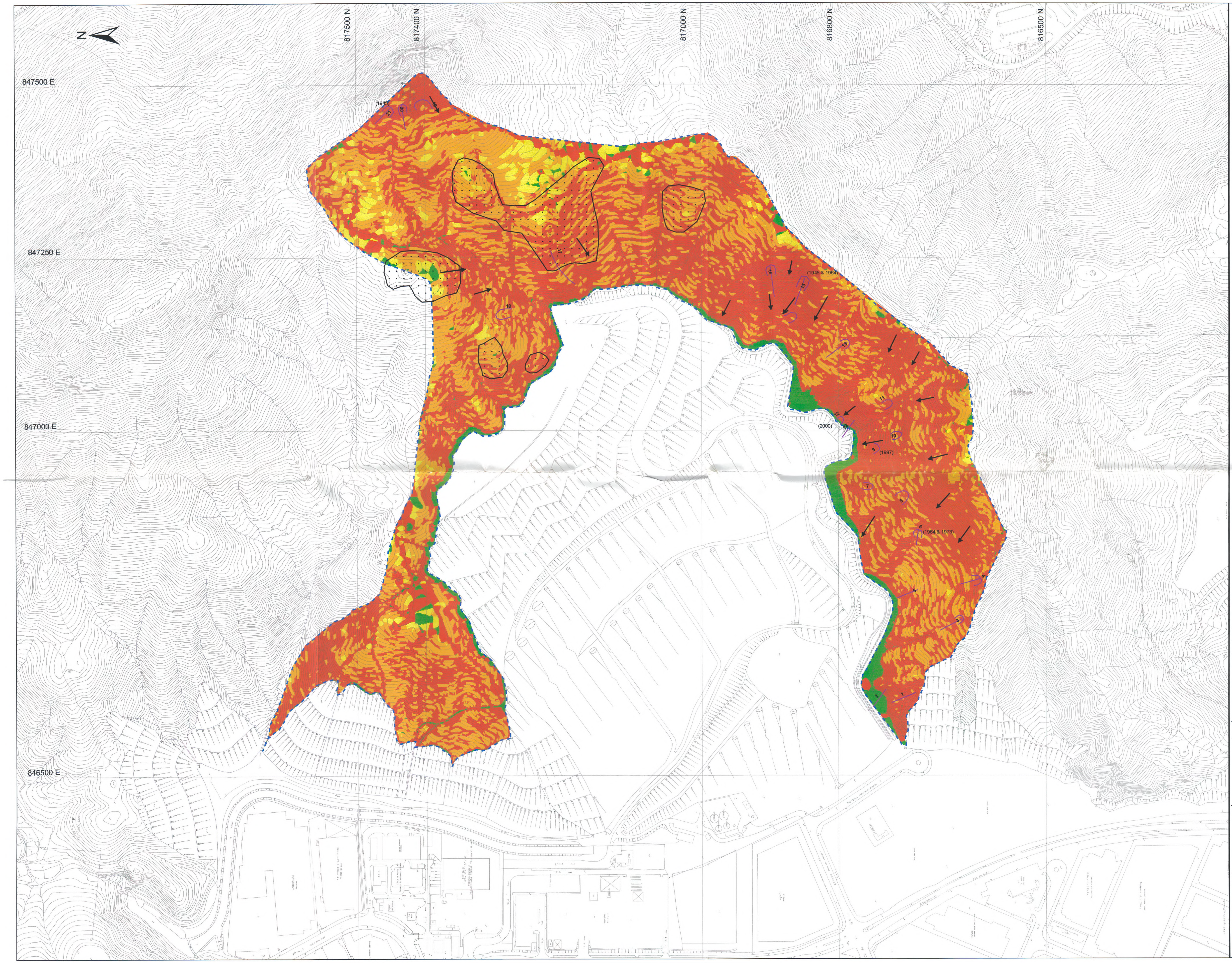
0065	30	45	C	1		—
0066	30	64	C	1		45
0067	45	45	C	2		—
0068	30	45	C	1		—
0069	20	45	C	1		—
0070	15	45	C	2		—
0071	34	45	C	1		—
0072	24	45	C	1		—
0073	20	45	C	1		—
0074	24	45	C	1		—
0075	27	45	C	2		—
0076	34	45	C	1		—
0077	39	45	C	1		—
0078	34	45	C	2		—
0079	39	45	C	2		—
0080	34	45	C	1		—
0081	30	45	C	1		—
0082	27	45	C	1		—
0083	39	45	C	1		—
0084	45	45	C	1		—
0085	45	45	C	1		—
0086	45	64	C	1		45
0087	30	45	C	2		—
0088	18	45	C	1		—
0089	24	45	C	1		—
0090	34	64	C	1		45
0091	45	64	C	1		45
0092	45	64	C	1		45
0093	30	64	C	1		45
0094	45	64	C	1		45
0095	30	73	A	1		64
0096	39	73	A	1		64
0097	24	64	C	1		45
0098	45	64	C	1		45

12SW-A Pg. 4

0099	45	64	c	/		45
0100	45	64	c	/		45
0101	45	64	C	/		45
0102	39	64	C	/		45
0103	39	64	c	/		45
0104	39	64	C	/		45
0105	45	64	c	/		45
0106	39	64	C	/		45
0107	45	64	C	/		45
0108	45	64	C	/		45
0109	45	64	C	2		45
0110	45	64	C	/		45
0111	39	64	C	/		45
0112	27	64	C	/		45
0113	34	64	C	/		45
0114	30	73	c	/		64
0115	34	64	c	/		45
0116	22	64	c	/		45
0117	22	64	c	/		45
0118	34	73	A	/		64
0119	39	64	c	/		45
0120	30	64	c	/		45
0121	39	64	C	/		45
0122	34	73	A	/		64
0123	34	45	D	/		—
0124	34	75	A	/		74
0125	30	75	A	/		74
0126	34	75	A	/		74
0127	30	75	A	/		74
0128	39	92	A	/		91
0129	39	92	A	/	10	91
0130	34	45	C	1		—
0131						
0132						

APPENDIX D

Natural Terrain Hazard Map


N
817500 N
817400 N
817000 N
816800 N
816500 N
847500 E
847250 E
847000 E
846500 E
(1945)
(1945 & 1964)
(2000)
(1997)
(1964 & 1973)
Legend
Slope Angle
0 - 7 degree
8 - 17 degree
18 - 29 degree
> 30 degree
Natural Terrain Study Boundary
Landslide scar from API (year of landslide event(s))
Landslide from NTLI
Potential landslide source and mobility direction
Boulder fields and trajectory direction

Revision	Description				Initial
	Design	Check	Drawn	Check	
Initial	SMo	JH	VN	JH	
Date	08/2002	08/2002	08/2002	08/2002	

Approved

AGREEMENT NO. FD01-052

Contract Title

TSEUNG KWAN O STAGE II/III
AFTERUSE DEVELOPMENT

Figure Title

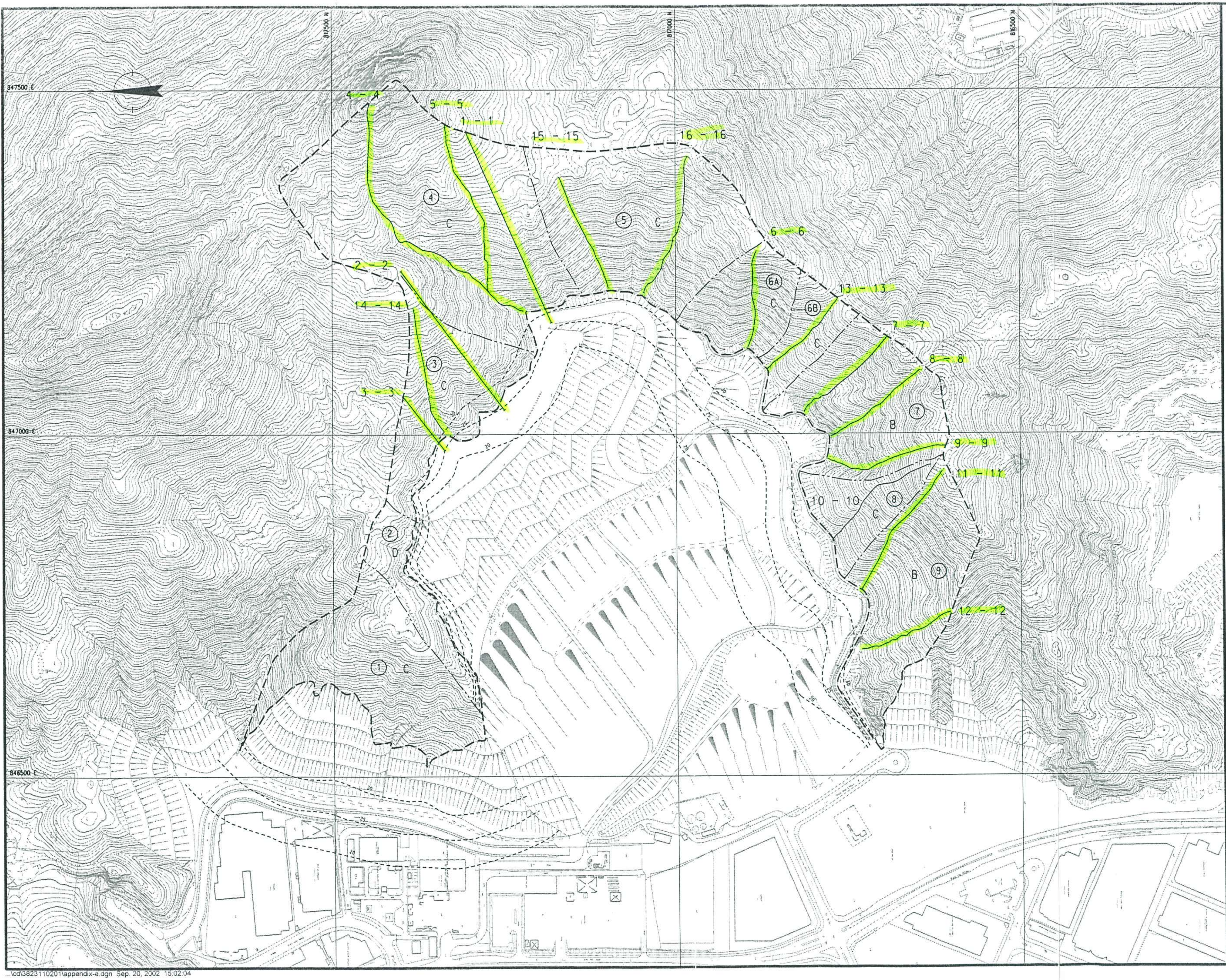
Natural Terrain Hazard Map

Drawing No.	Scale
APPENDIX D	1:2500

Consultant
Binnie Black & Veatch Hong Kong Limited

APPENDIX E

Landslide Susceptibility Map, Sections and Tables from GEO SPR 1/2002


817500 N
817000 N
816500 N
847500 E
847000 E
846500 E
4 - 4
5 - 5
1 - 1
15 - 15
16 - 16
6 - 6
2 - 2
14 - 14
13 - 13
7 - 7
8 - 8
3 - 3
9 - 9
11 - 11
10 - 10
12 - 12
④ C
⑤ C
③ C
6A C
6B C
⑦ B
⑧ C
⑨ B
② D
① C
30
25
20

...\cd\3823110201\appendix-e.dgn Sep. 20, 2002 15:02:04

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. ALL DIMENSIONS ARE TYPICAL AND TO BE CONFIRMED AT DETAILED DESIGN.

LEGENDS:

— — —	NATURAL TERRAIN BOUNDARY
2-2 ———	STREAM/ CROSS SECTIONS
①	CATCHMENT NUMBERS
—·—·—	CATCHMENT BOUNDARY
30 - - - -	ANGLE OF ELEVATION FROM PLATFORM TO SLOPE
B	SUSCEPTIBILITY CLASSES

Approved

ORIGINAL SIGNED BY C. DUTTON

CAD ref. MAIN : APPENDIX E.DGN
XREF : B12SW06B,D, B12SW01B,D,
B12SW02A,B,C,D & B12SW07A,B,C,D.DGN

Contract no. FD01-052

Contract

**GEOTECHNICAL REVIEW AND
SITE INVESTIGATION WORKS
FOR TSEUNG KWAN O STAGE II/III
AFTERUSE DEVELOPMENT**

Figure Title

LANDSLIDE SUSCEPTIBILITY MAP

Figure no. APPENDIX E

Scale (A3) 1:5000

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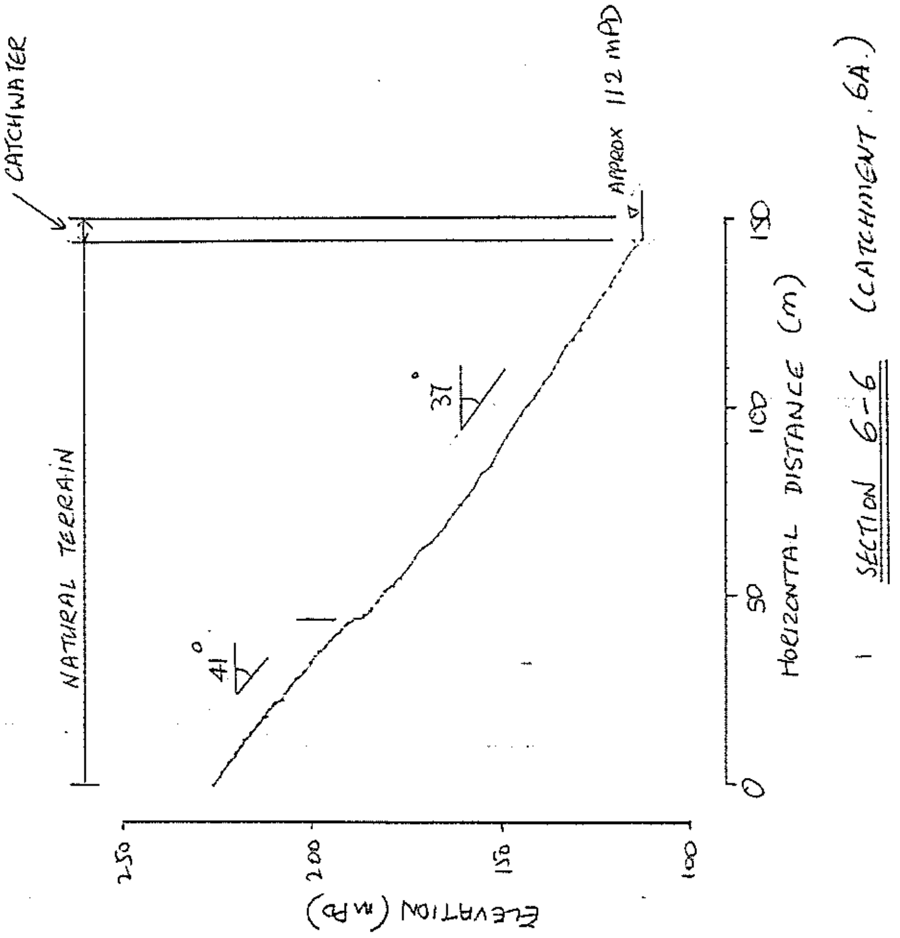
博威工程顧問有限公司
Engineers and Scientists

Project AGREEMENT NO. FD 01-052
TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject STREAM SECTION FOR NATURAL SLOPE
STREAM 6-6 (CATCHMENT 6A)

Job number 382311/0201

Page of


CATCHWATER
APPROX 112 mPD
NATURAL TERRAIN
41°
37°
0
50
100
150
HORIZONTAL DISTANCE (m)
250
200
150
100
ELEVATION (mPD)

SECTION 6-6 (CATCHMENT 6A)

SCALE: HORIZONTAL = VERTICAL
1 : 2000

Computed by

Checked by

Distribution

Filed in

Date

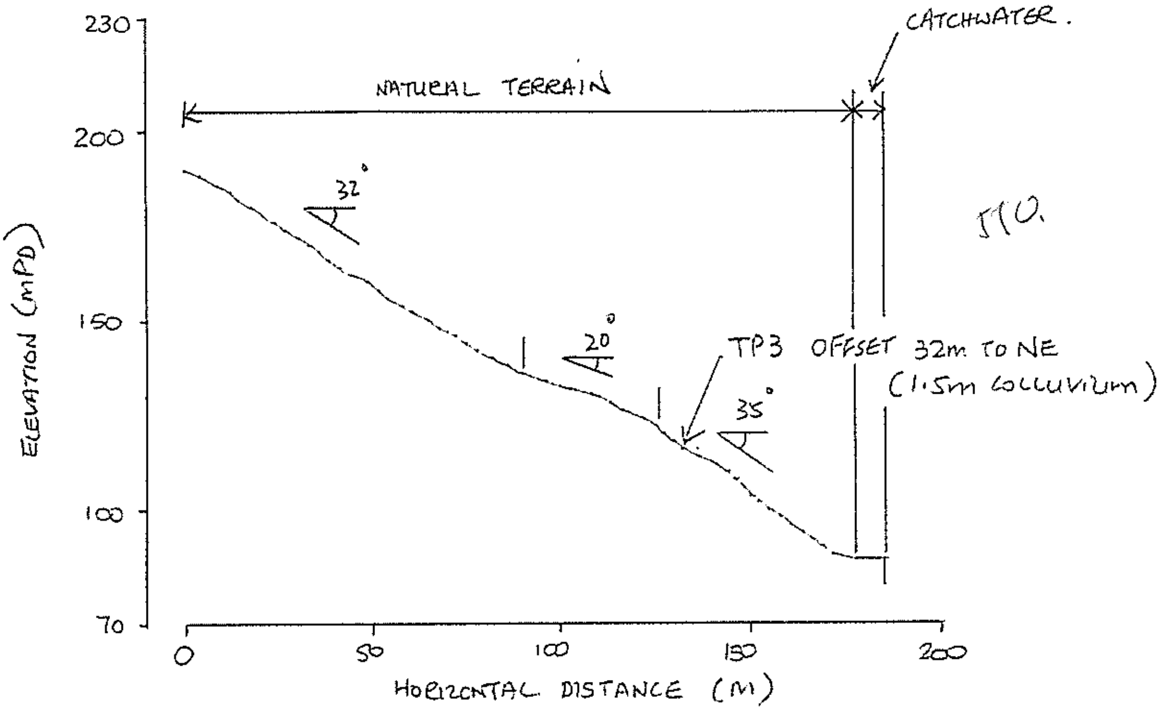
Date

Binnie Black & Veatch Hong Kong Limited
Engineers and Scientists

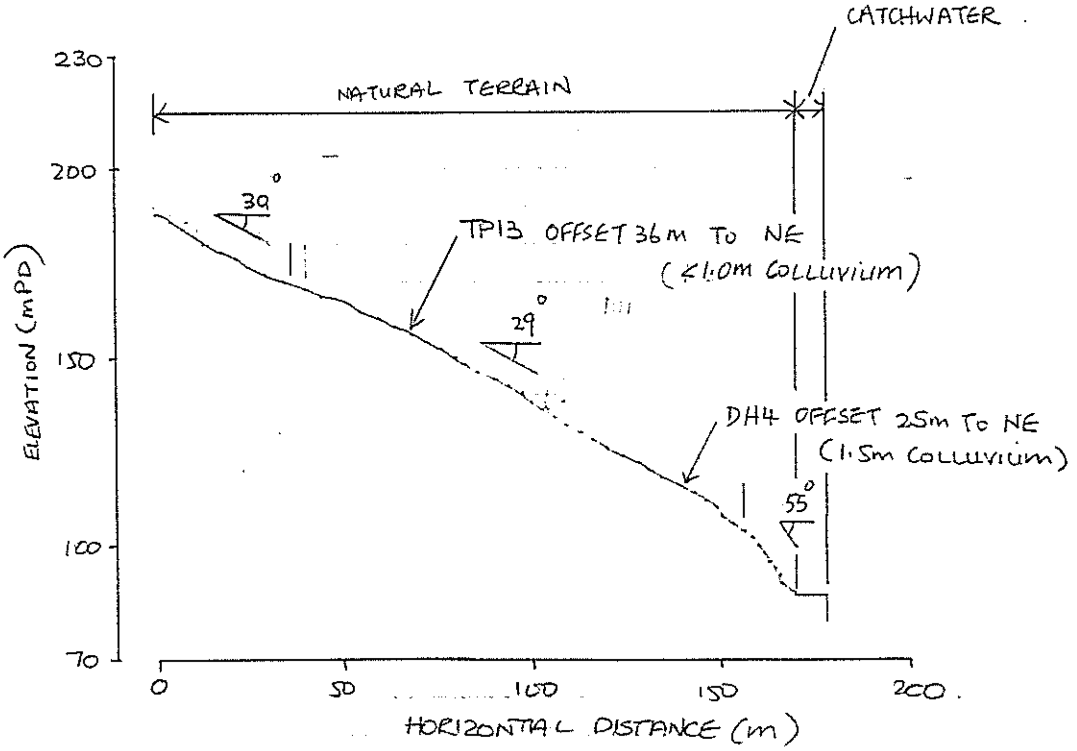
Project AGREEMENT NO FD 01-052
TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject STREAM SECTION FOR NATURAL SLOPE STREAMS 7-7 & 8-8 (CATCHMENT 7) Job number 382311/0201 Page of

SMO


CATCHWATER.
NATURAL TERRAIN
230
200
150
100
70
ELEVATION (mPD)
32°
20°
35°
TP3 OFFSET 32m TO NE (1.5m COLLUVIUM)
0
50
100
150
200
HORIZONTAL DISTANCE (M)

SECTION 7-7


CATCHWATER.
NATURAL TERRAIN
230
200
150
100
70
ELEVATION (mPD)
39°
29°
55°
TP13 OFFSET 36m TO NE (<1.0m COLLUVIUM)
DH4 OFFSET 25m TO NE (1.5m COLLUVIUM)
0
50
100
150
200.
HORIZONTAL DISTANCE (m)

SECTION 8-8

Computed by SMO Checked by Distribution Filed in

Date 07/02 Date

SCALE: HORIZONTAL=VERT 1:2000

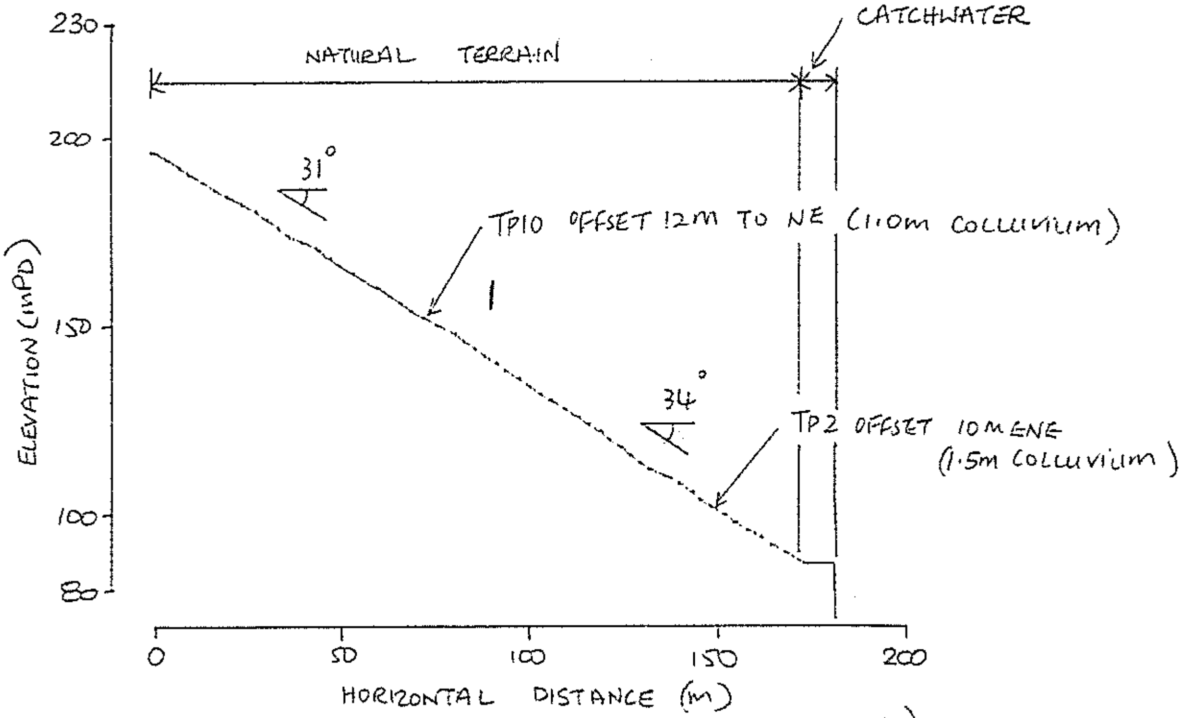
Binnie Black & Veatch Hong Kong Limited
Engineers and Scientists

Project AGREEMENT NO FD 01-052
TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject STREAM SECTIONS FOR NATURAL SLOPES

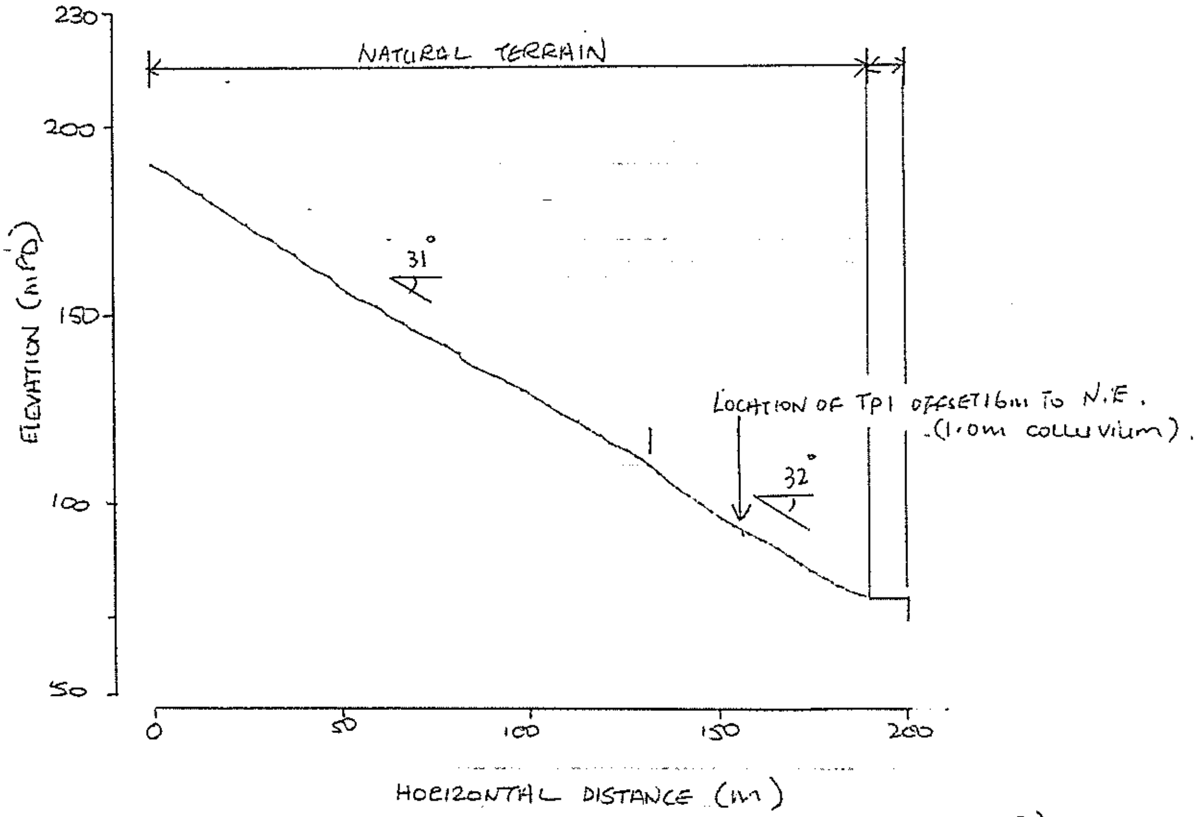
Job number 382311 /0201

Page of



230
200
150
100
80
ELEVATION (mPD)
CATCHWATER
NATURAL TERRAIN
31°
TP10 OFFSET 12m TO NE (1.0m COLLUVIUM)
34°
TP2 OFFSET 10m ENE (1.5m COLLUVIUM)
0
50
100
150
200
HORIZONTAL DISTANCE (m)

SECTION 9-9 (CATCHMENT 7)



230
200
150
100
50
ELEVATION (mPD)
NATURAL TERRAIN
31°
LOCATION OF TP1 OFFSET 16m TO N.E. (1.0m COLLUVIUM).
32°
0
50
100
150
200
HORIZONTAL DISTANCE (m)

SECTION 10-10 (CATCHMENT 8)

Computed by SMO

Date 07/02

Checked by

Date

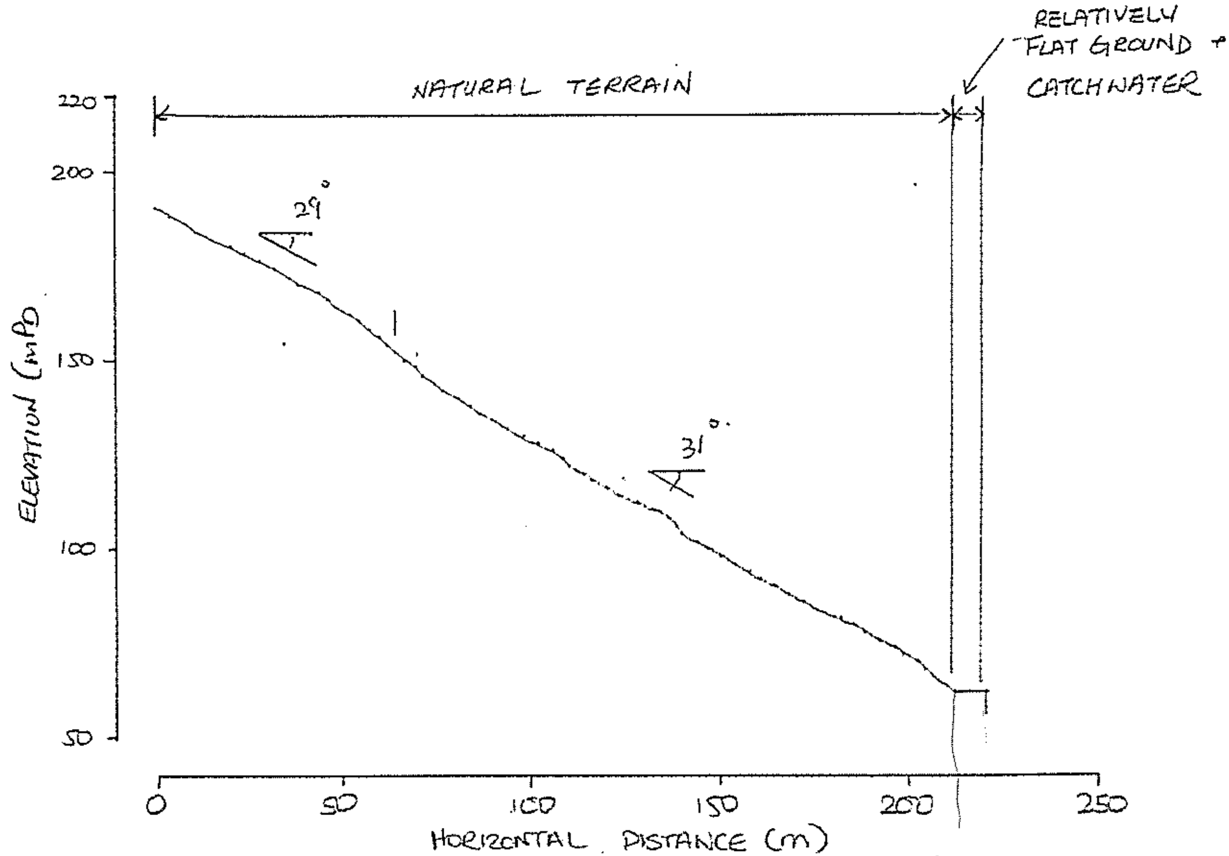
Distribution

Filed in

SCALE:
HORIZONTAL=VERTIC
1:2000

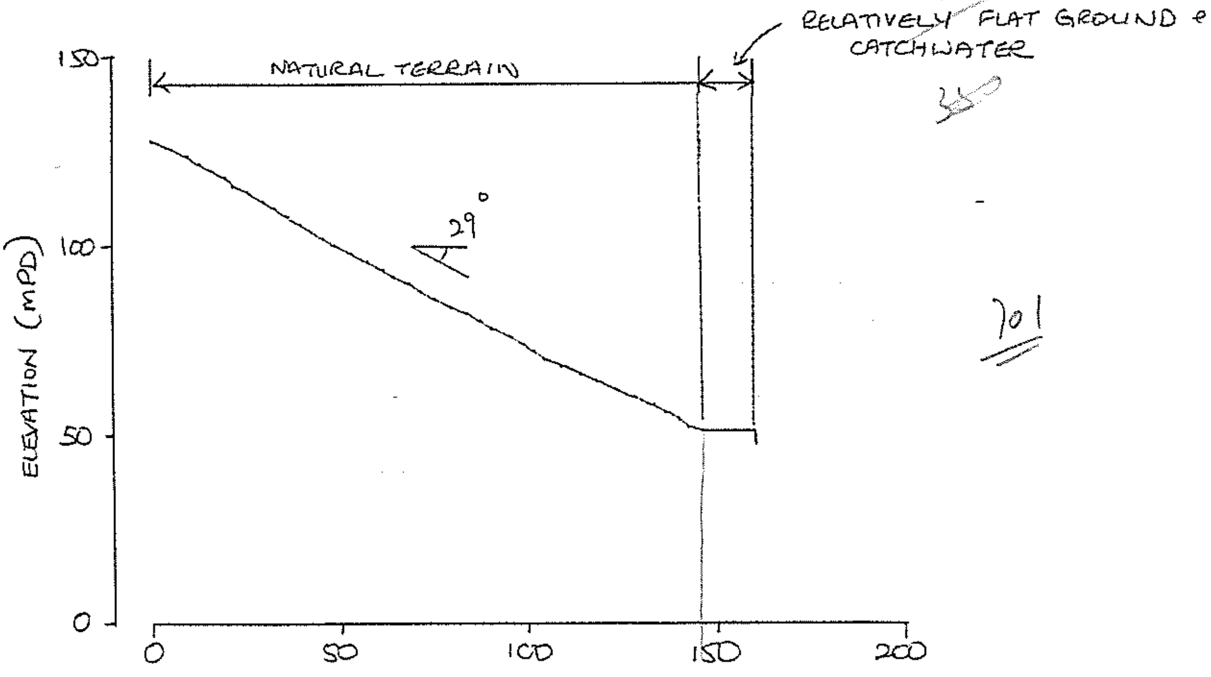
Project AGREEMENT NO. FD 01-052
TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject STREAM SECTIONS FOR NATURAL SLOPES CATCHMENT 9 Job number 382311/0201 Page of



SECTION 11-11

210.
140



~~350~~

701

SECTION 12-12

Computed by SM Checked by Distribution Filed in

Date 07/02 Date

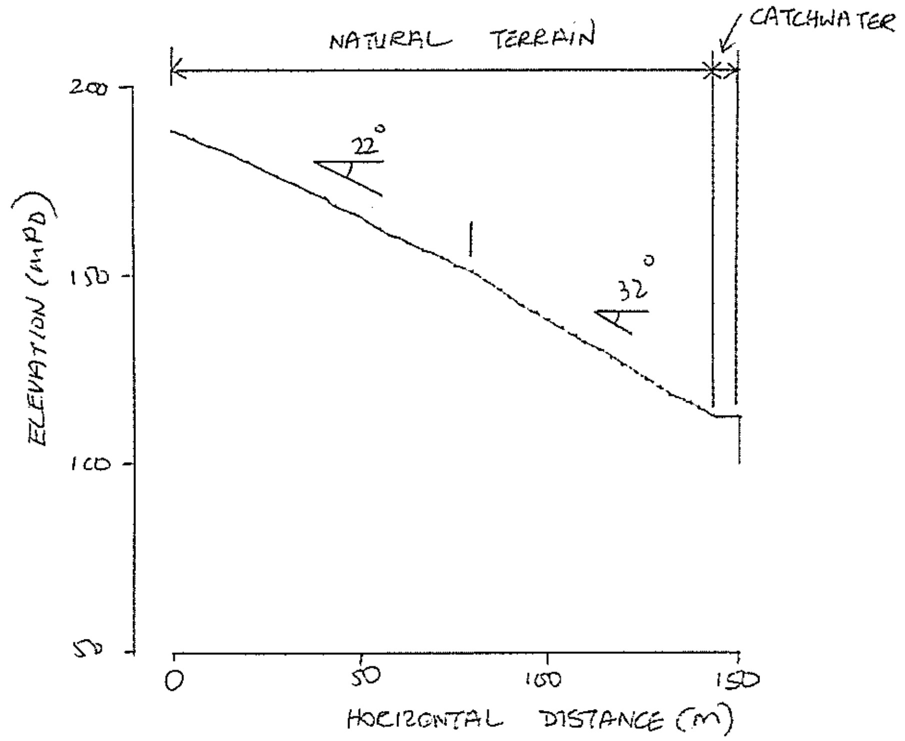
SCALE:
HORIZONTAL = VERTICAL
1:2000

Binnie Black & Veatch Hong Kong Limited
Engineers and Scientists

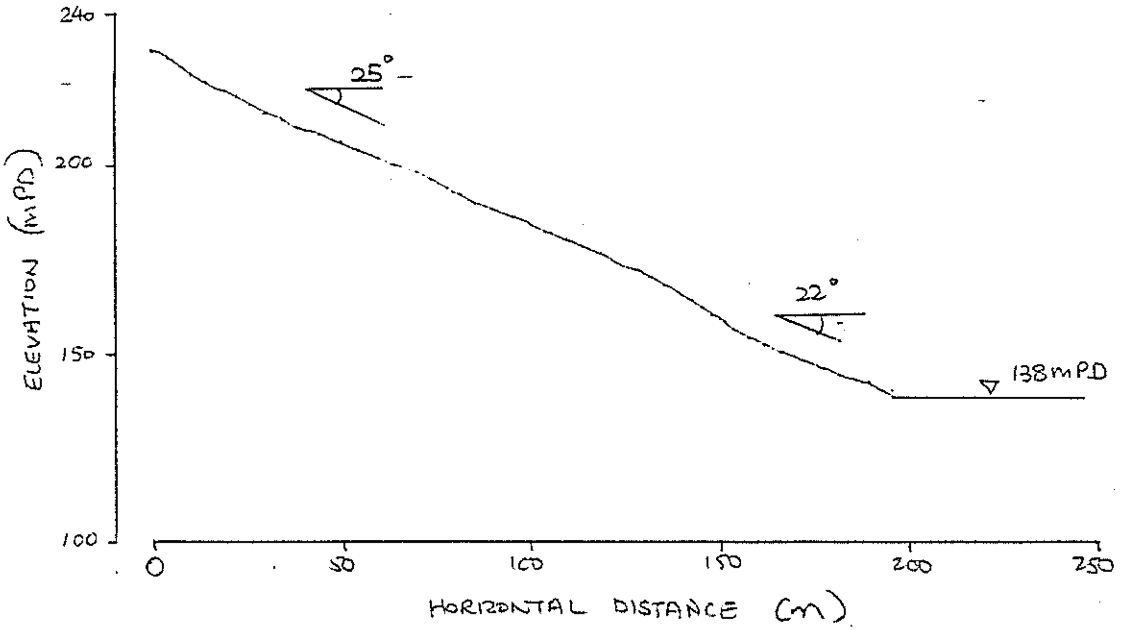
Binnie

Project AGREEMENT NO FD 01-052
TSEUNG ~~KWAN~~ O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject STREAM SECTIONS FOR NATURAL SLOPES Job number 382311/0201 Page of



SECTION 13-13 (CATCHMENT 6B)



SECTION 14-14 (CATCHMENT 3)

Computed by SMB Checked by Distribution Filed in

Date 07/02 Date

SCALE:
HORIZONTAL = VERTIC
1:2000

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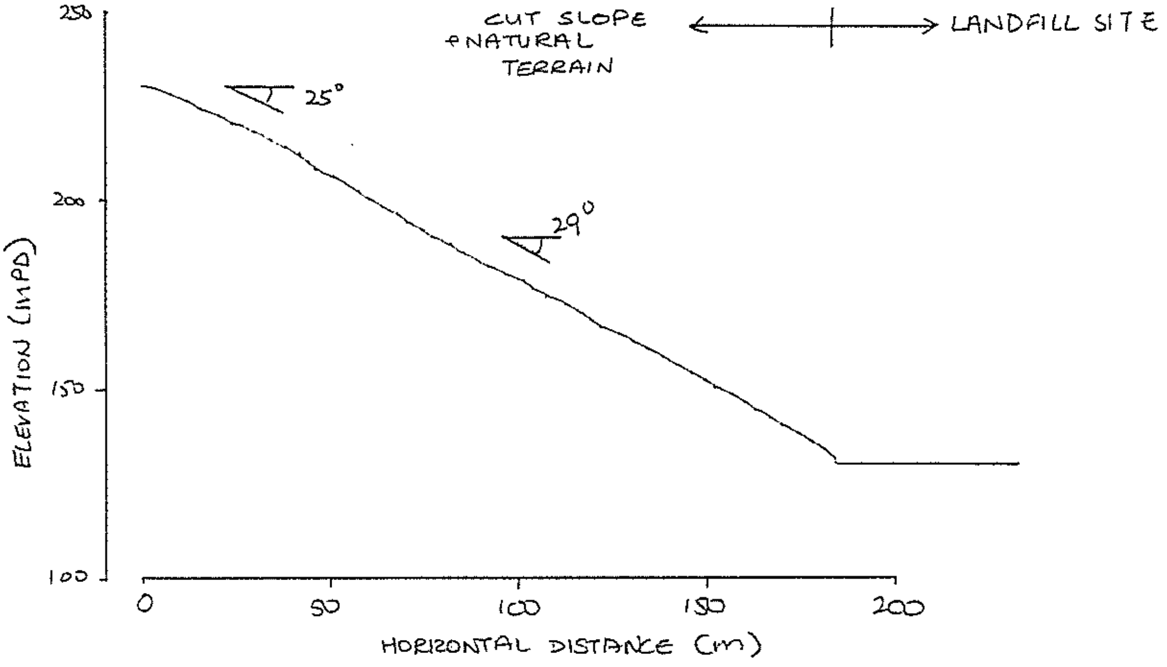
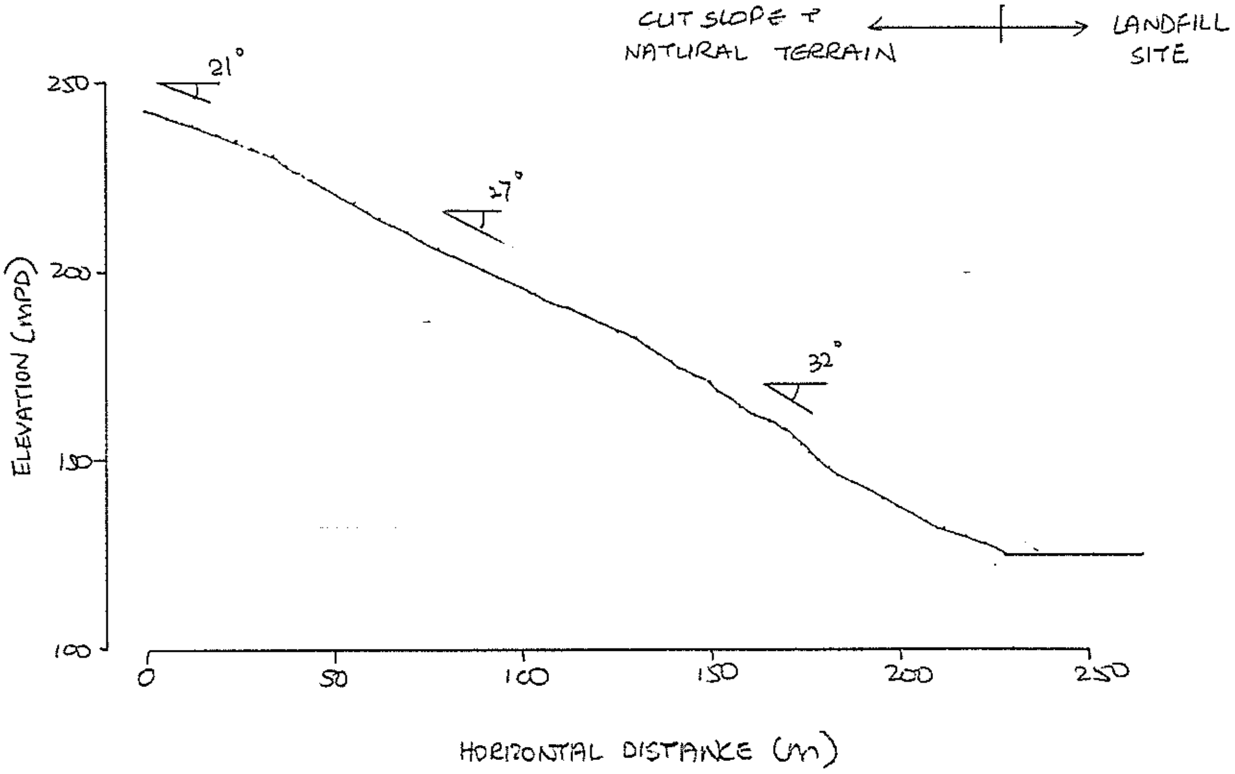
Project AGREEMENT NO FD01-052 TSEUNG KWAN O STAGE II/III AFTERUSE DEVELOPMENT

Subject STREAM SECTIONS (CATCHMENT 5) Job number 2311/0201 Page of



SECTION 15-15



SECTION 16-16

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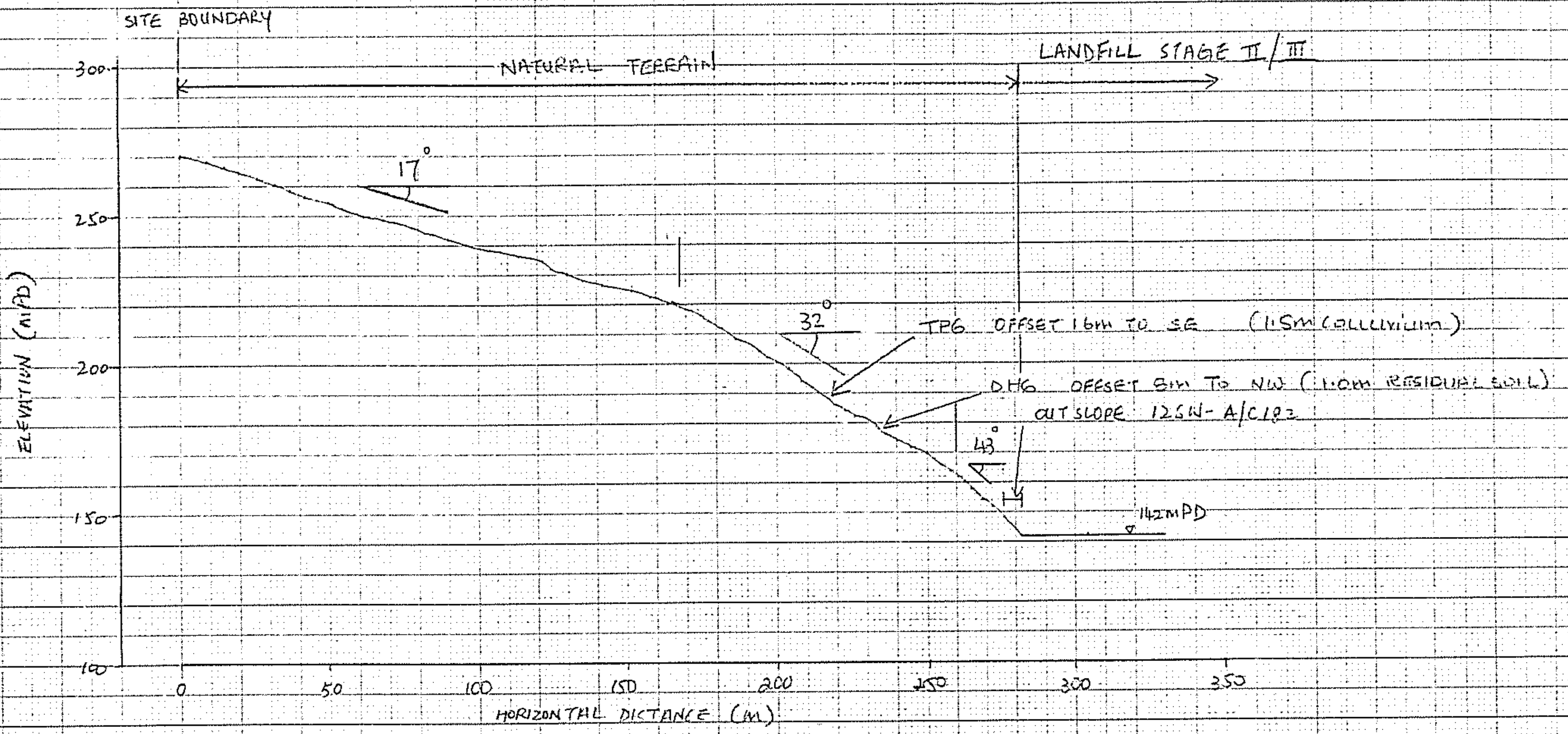
Project AGREEMENT NO. FD 01-052
TSEUNG KWAN O LANDFILL
STAGE II/III AFTERUSE

Subject SECTION FOR NATURAL SLOPE
SECTION 1-1

Job number 382311/0202

Page of


SITE BOUNDARY
NATURAL TERRAIN
LANDFILL STAGE II/III
300
250
200
150
100
ELEVATION (mPD)
17°
32°
TP6 OFFSET 16m TO SE (1.5m COLLUVIUM)
DH6 OFFSET 8m TO NW (1.0m RESIDUAL SOIL)
CUT SLOPE 12SW-A/C182
43°
142mPD
0
50
100
150
200
250
300
350
HORIZONTAL DISTANCE (m)

SECTION 1-1

SCALE: HORIZONTAL = VERTICAL
1:2000

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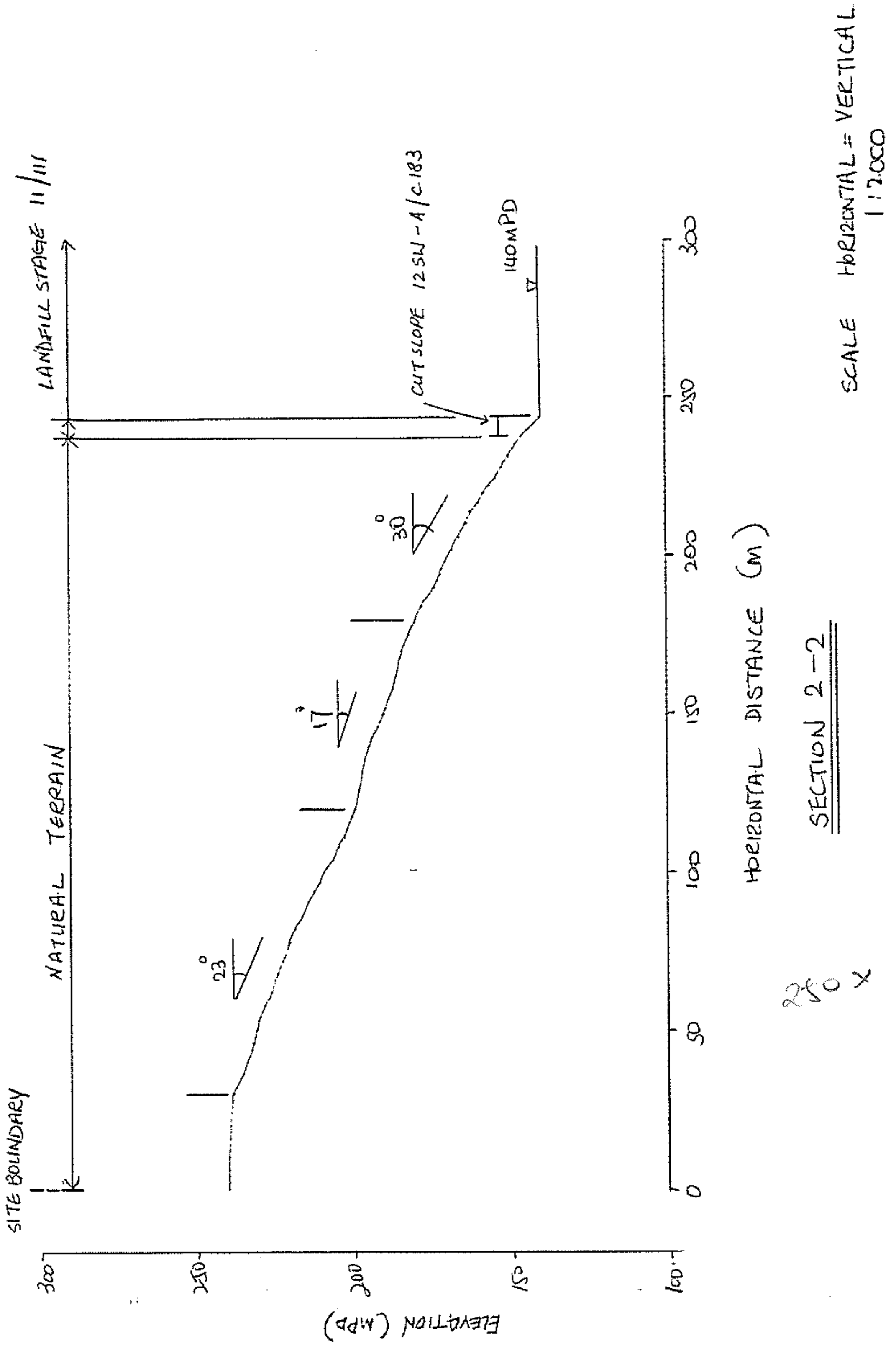
TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject SECTION FOR NATURAL SLOPE SECTION 2-2 Job number 382311/020·1 Page of


LANDFILL STAGE II/III
CUT SLOPE 12SW-A/C183
140mPD
30°
17°
23°
NATURAL TERRAIN
SITE BOUNDARY
0
50
100
150
200
250
300
HORIZONTAL DISTANCE (m)
300
250
200
150
100
ELEVATION (mPD)
SCALE HORIZONTAL = VERTICAL
1:2000
SECTION 2-2
250 x

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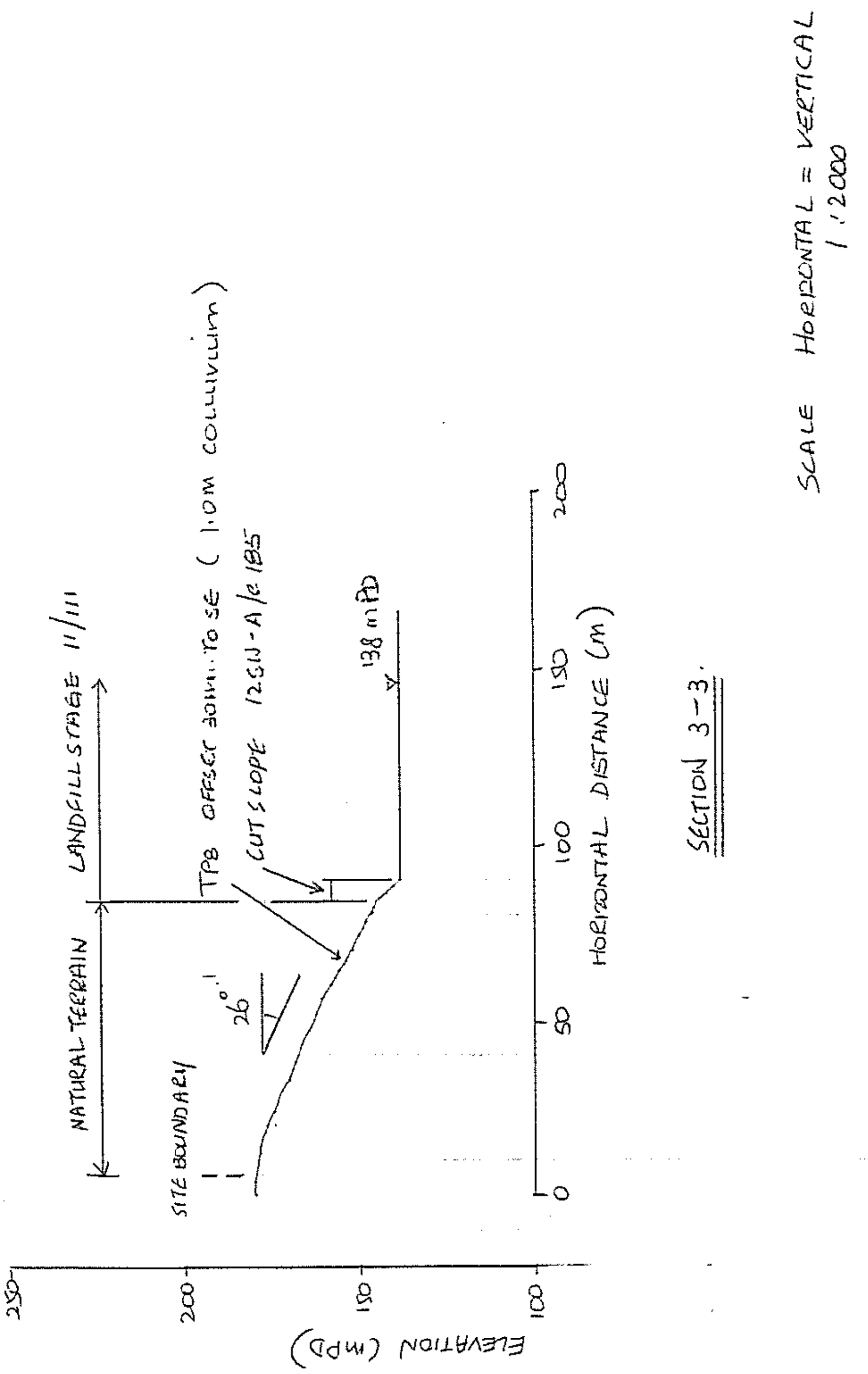
Project AGREEMENT NO. FD 01-052
TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE

Subject SECTION FOR NATURAL SLOPE SECTION 3-3 Job number 382311/0201 Page of


SCALE HORIZONTAL = VERTICAL
1:2000
LANDFILL STAGE II/III
NATURAL TERRAIN
TPB OFFSET 30m TO SE (1.0m COLLUVIUM)
CUT SLOPE 12SW-A/C 185
138 mPD
26°
SITE BOUNDARY
0
50
100
150
200
HORIZONTAL DISTANCE (m)
250
200
150
100
ELEVATION (mPD)

SECTION 3-3

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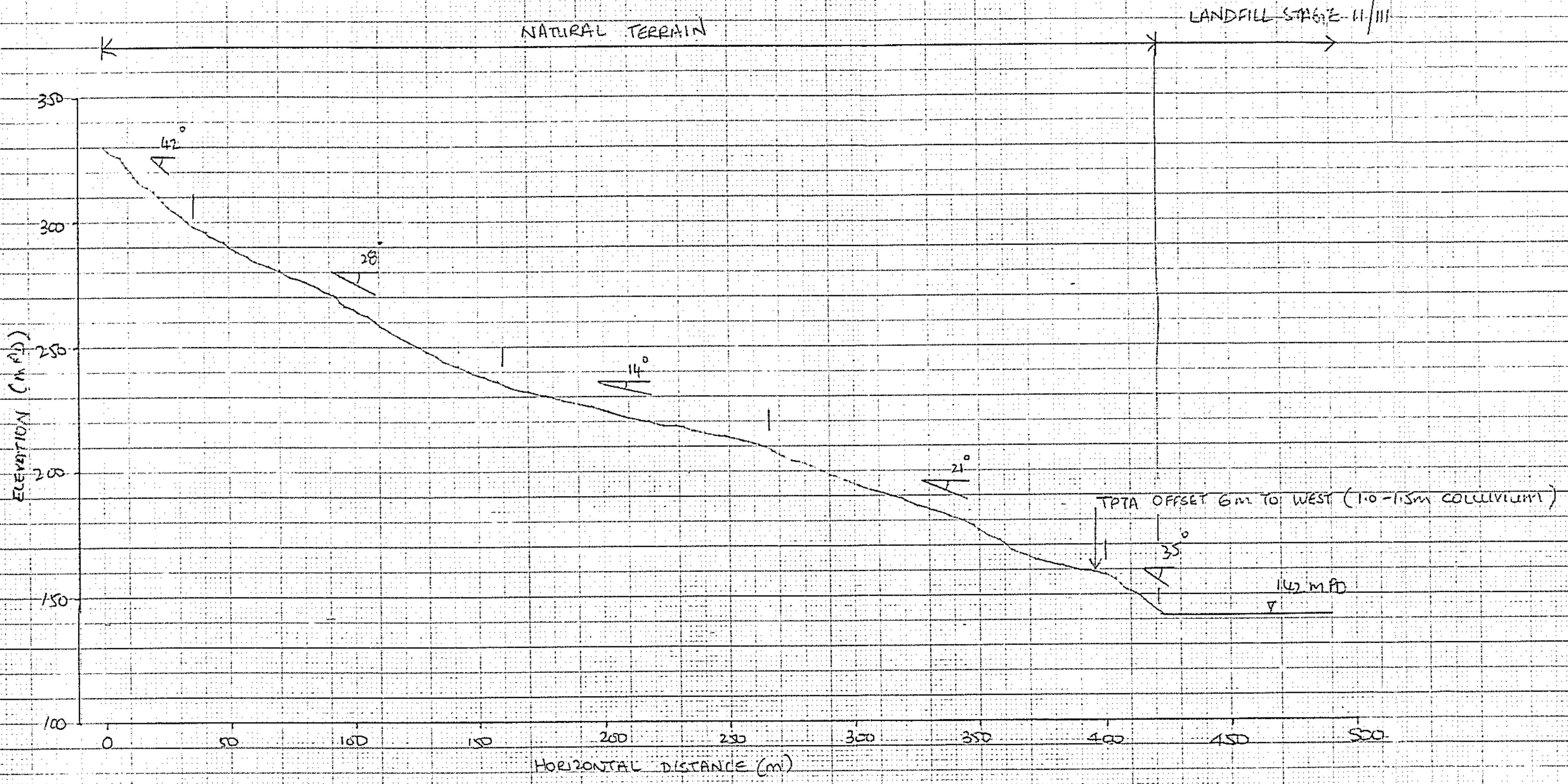
AGREEMENT No. FD 01-052

Project TSEUNG KWAN O LANDFILL Subject STREAM SECTION FOR NATURAL SLOPE Job number 382311/0201 Page of
STAGE II/III AFTERUSE DEVELOPMENT SECTION 4-4 (CATCHMENT 4)



SECTION 4-4

SCALE : HORIZONTAL = VERTICAL
1 : 2000

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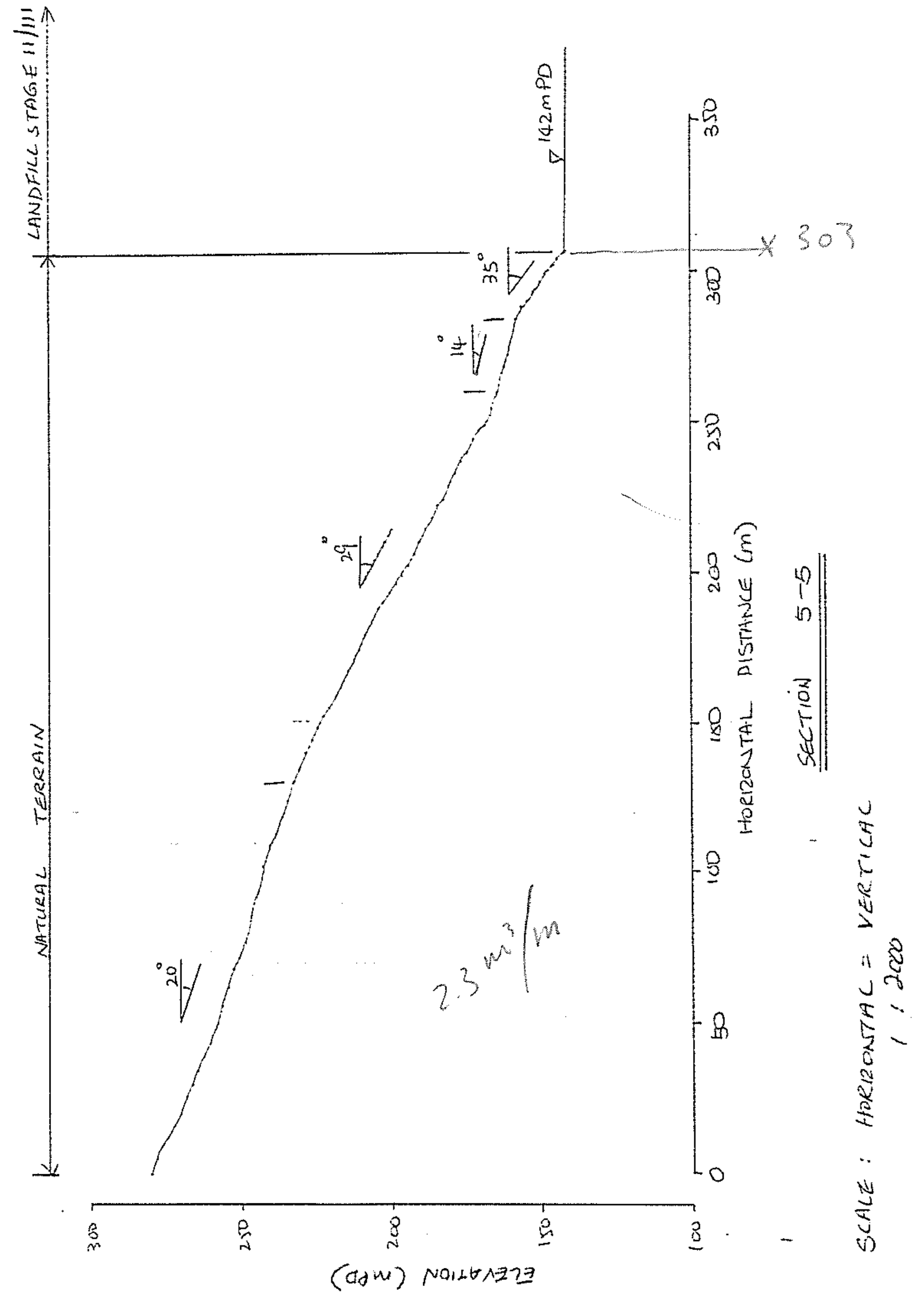
AGREEMENT NO FD 01-052
Project TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject STREAM SECTION FOR NATURAL SLOPE SECTION 5-5 (CATCHMENT 5)

Job number 38231/0201. Page of



LANDFILL STAGE II/III
NATURAL TERRAIN
142mPD
303
35°
14°
29°
20°
2.3 m³/m
0
50
100
150
200
250
300
350
HORIZONTAL DISTANCE (m)
300
250
200
150
100
ELEVATION (mPD)

SECTION 5-5

SCALE : HORIZONTAL = VERTICAL 1 : 2000

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Date 07/02 Date

Table 1 – Grouping of Facilities (adapted from Wong, 1998)

Group No.	Facilities
1	(a) Buildings – any residential building, commercial office, store and shop, hotel, factory, school, power station, ambulance depot, market, hospital/polyclinic/clinic, welfare centre
	(b) Others – bus shelter, railway platform and other sheltered public waiting area – cottage, licensed and squatter area – dangerous goods storage site (e.g. petrol station) – road with very heavy vehicular or pedestrian traffic density
2	(c) Buildings – built-up area (e.g. indoor car park, building within barracks, abattoir, incinerator, indoor games' sport hall, sewage treatment plant, refuse transfer station, church, temple, monastery, civic centre, manned substation)
	(b) Others – road with heavy vehicular or pedestrian traffic density – major infrastructure facility (e.g. railway, tramway, flyover, subway, tunnel portal, service reservoir)
3	– densely-used open space and public waiting area (e.g. densely-used playground, open car park, densely-used sitting out area, horticultural garden) – quarry – road with moderate vehicular or pedestrian traffic density
4	– lightly-used open-air recreation area (e.g. district open space, lightly-used playground, cemetery, columbarium) – non-dangerous goods storage site – road with low vehicular or pedestrian traffic density
5	– remote area (e.g. country park, undeveloped green belt, abandoned quarry) – road with very low vehicular or pedestrian traffic density

Notes : For roads, the Facility Group should be based on Figure A13 (Wong, 1998) taking into account the actual Annual Average Daily Traffic and the number of road lanes. For footpaths alongside roads, it may be assumed that footpaths are within the same group as the adjoining roads, except for Expressways (EX), Urban Trunk Roads (UT) and Rural Trunk Roads (RT). Footpaths alongside EX, UT and RT roads may be taken, by default, as a Group 5 facility, unless dictated otherwise by site-specific conditions.

Table 2 - Design Requirements for the Design Event Approach

Susceptibility Class (see Table 4)	Consequence Class (see Table 3)			
	I	II	III	IV
A	WCE	WCE	WCE	CE
B	WCE	WCE	CE	CE
C	WCE	CE	CE	N
D	N	N	N	N

Notes :

(1) The recommended minimum design requirements are given in this Table. The designer may adopt a more conservative design or provision of other precautionary/warning measures if considered necessary.

(2) This Table will be applied to each sub-catchment and normally the predominant type of hazard will control the design requirements.

(3) WCE = Adopt a "worst credible event" as the design event.
CE = Adopt a "conservative event" as the design event
N = Further study is not required

Table 3 - Consequence Classes

Proximity	Facility Group	
	1 & 2	3
Very Close (e.g. if angular elevation from the site is ≥ 30°)	I	II
Moderately Close (e.g. if angular elevation from the site is ≥ 25°)	II	III
Far (e.g. if angular elevation from the site is < 25°)	III	IV

Notes :

(1) Facility groups are given in Table 1. Facilities of Groups 4 and 5 normally do not require natural terrain hazard study and hence they are not included in Table 3.

(2) For channelized debris flow, if the worst credible event affecting the site is judged to have a volume exceeding 2000 m^3, the angular elevation given in the above examples should be reduced by 5°.

(3) The examples given above are for general guidance only. Other factors, such as credible debris path, topographical conditions and site-specific historical data, should also be taken into account in assessing the "proximity" of the natural terrain to the site.

(4) This Table is applicable only to sites that require natural terrain hazard study.

Table 4 - Susceptibility Classes

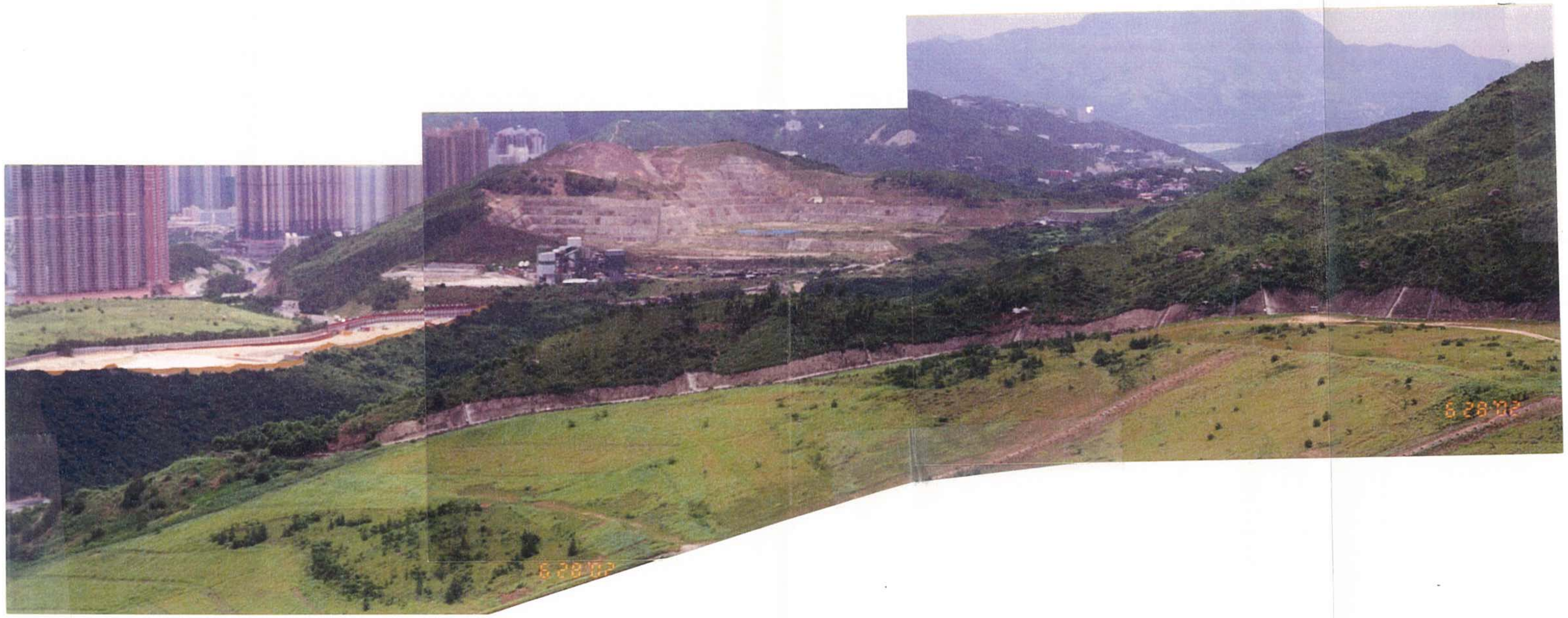
Susceptibility Class	Description
A	The natural terrain is extremely susceptible to the type of failure under consideration, with a notional annual probability of occurrence in the order of 1/10 or higher. For example: there are signs of instability, continued movement, or records of repeated recent failures (say over the past 50 to 100 years as observed from aerial photographs) in the catchment and its relevant vicinity.
B	The natural terrain is highly susceptible to the type of failure under consideration, with a notional annual probability of occurrence within the order of 1/10 to 1/100. For example: there are records of occasional recent failures in the catchment and its relevant vicinity.
C	The natural terrain is moderately susceptible to the type of failure under consideration, with a notional annual probability of occurrence within the order of 1/100 to 1/1000. For example: there are few records of recent failures, but there are indications of relict failures, or geomorphological evidence of potential problems in the catchment and its relevant vicinity, or any other evidence from similar terrain in Hong Kong.
D	The natural terrain is of low susceptibility to the type of failure under consideration, with a notional annual probability of occurrence less than 1/1000. For example: there are no records of recent and relict failures, little geomorphological and other evidence of potential problems in the catchment and its relevant vicinity, and little other evidence from similar terrain in Hong Kong.

Notes :

(1) In assessing the susceptibility of the hillside to failure, consideration should be taken of the potential effects of changes in environmental factors, e.g. any changes to the overall setting of the terrain such as hill fires and construction upslope, and the relevance of the available historical landslide records.

APPENDIX F

Photographic Plates



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Project

Tseung Kwan O Landfill Stage II/III Afteruse Development

Prepared By: Smo

Checked By: JH

Title

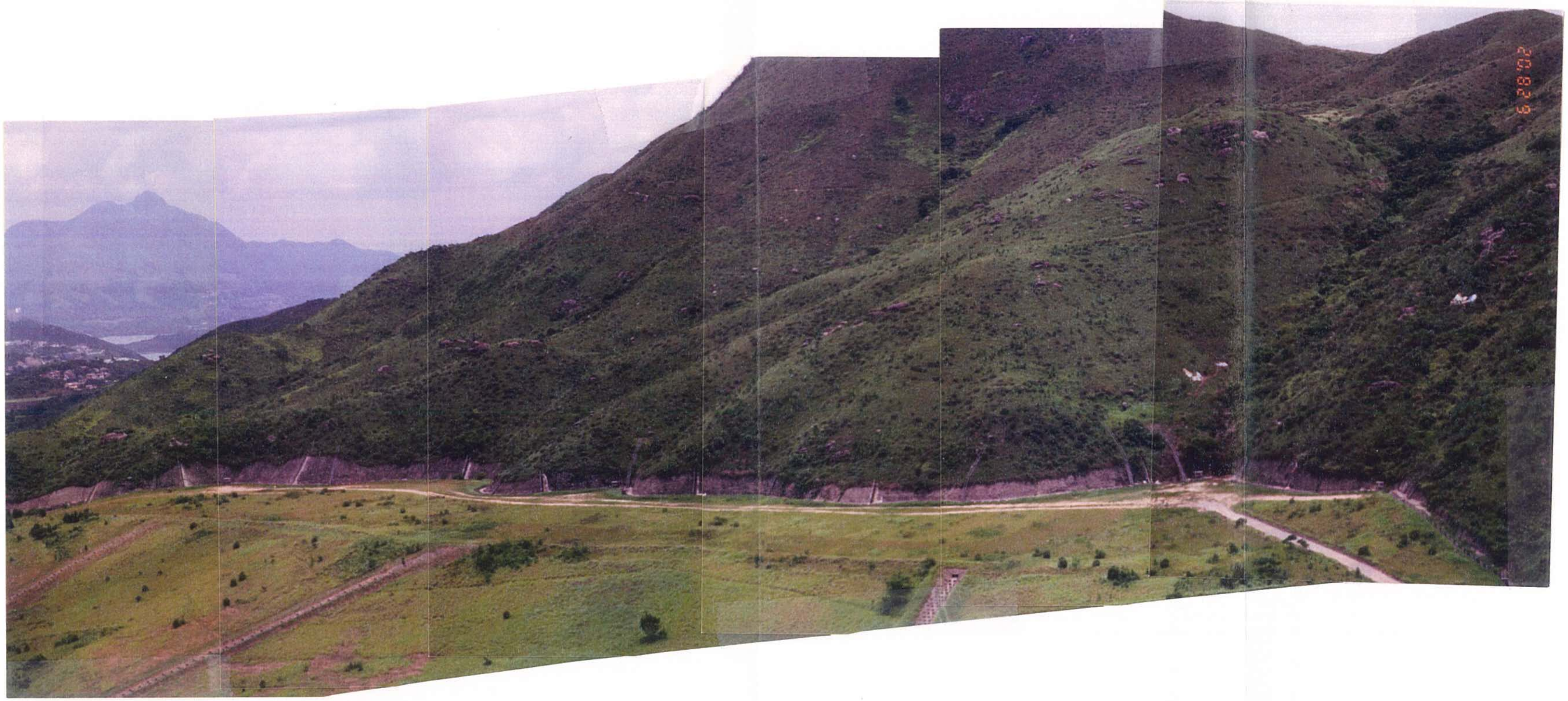
General View of Catchment Nos. 1 and 2

Plate No.

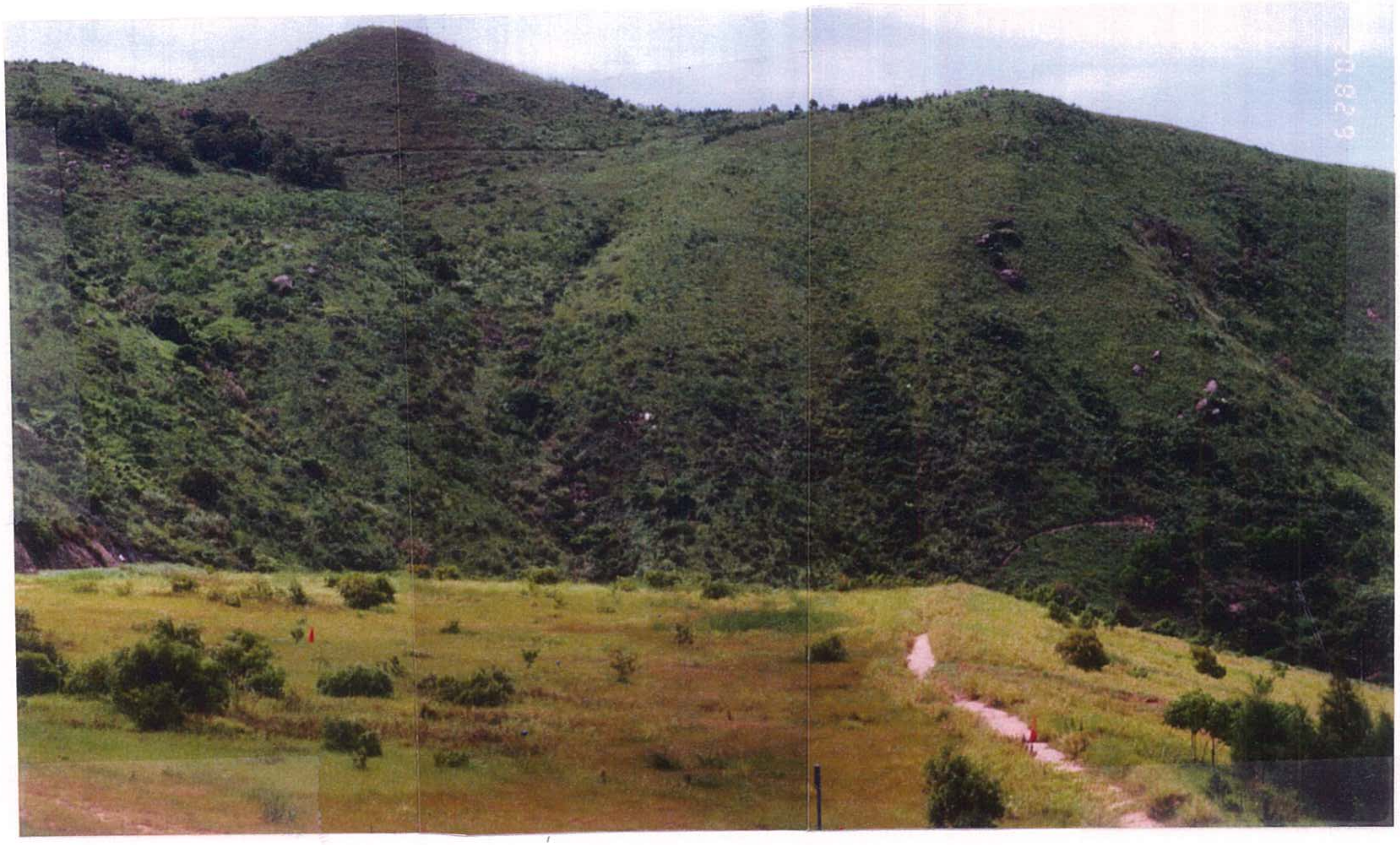
1

Scale

N.T.S



Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan O Landfill Stage II/III Afteruse Development Prepared By: Smo Checked By: JH	Title General View of Catchment Nos. 3 and 4	Plate No. 2 Scale N.T.S



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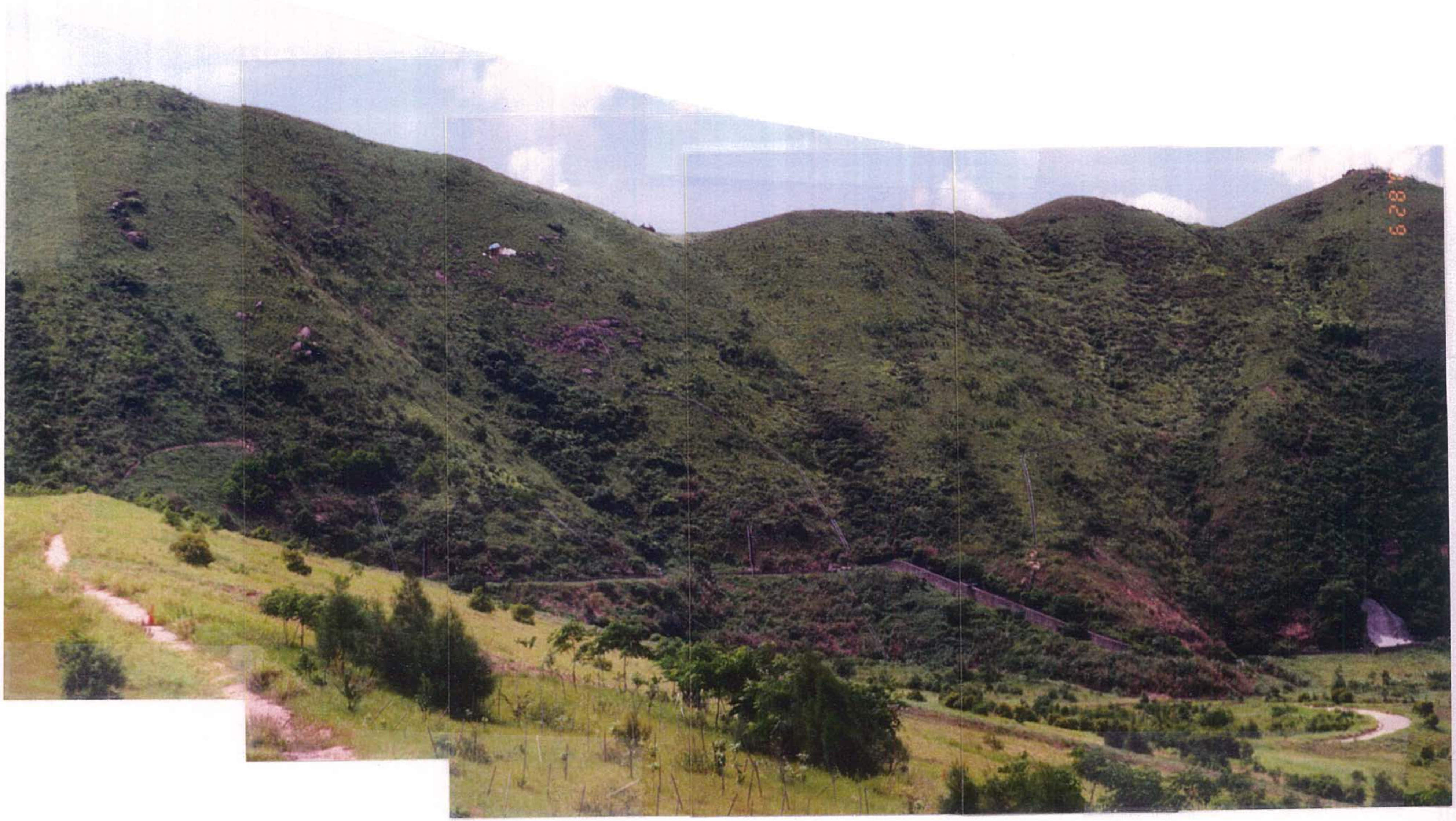
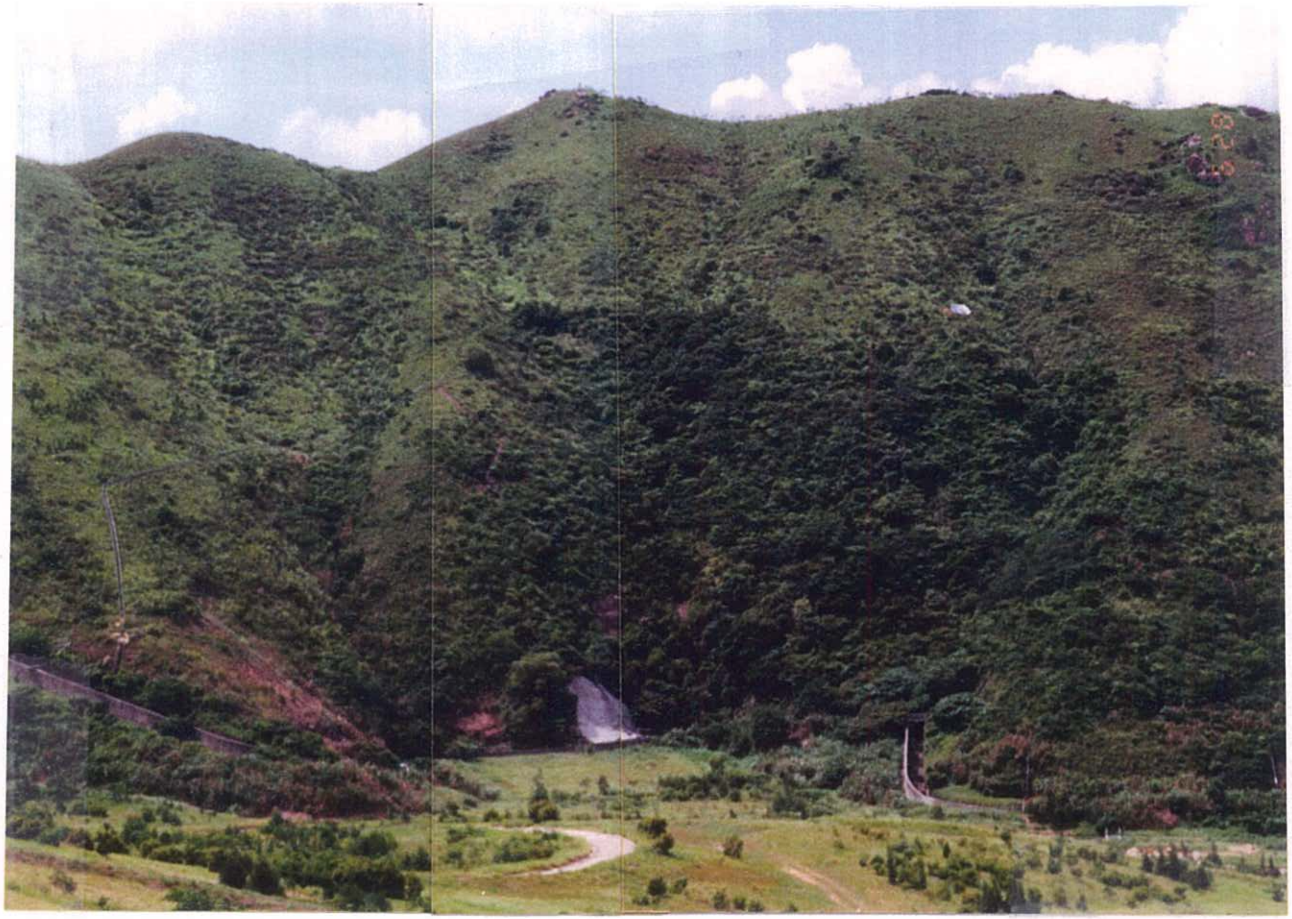
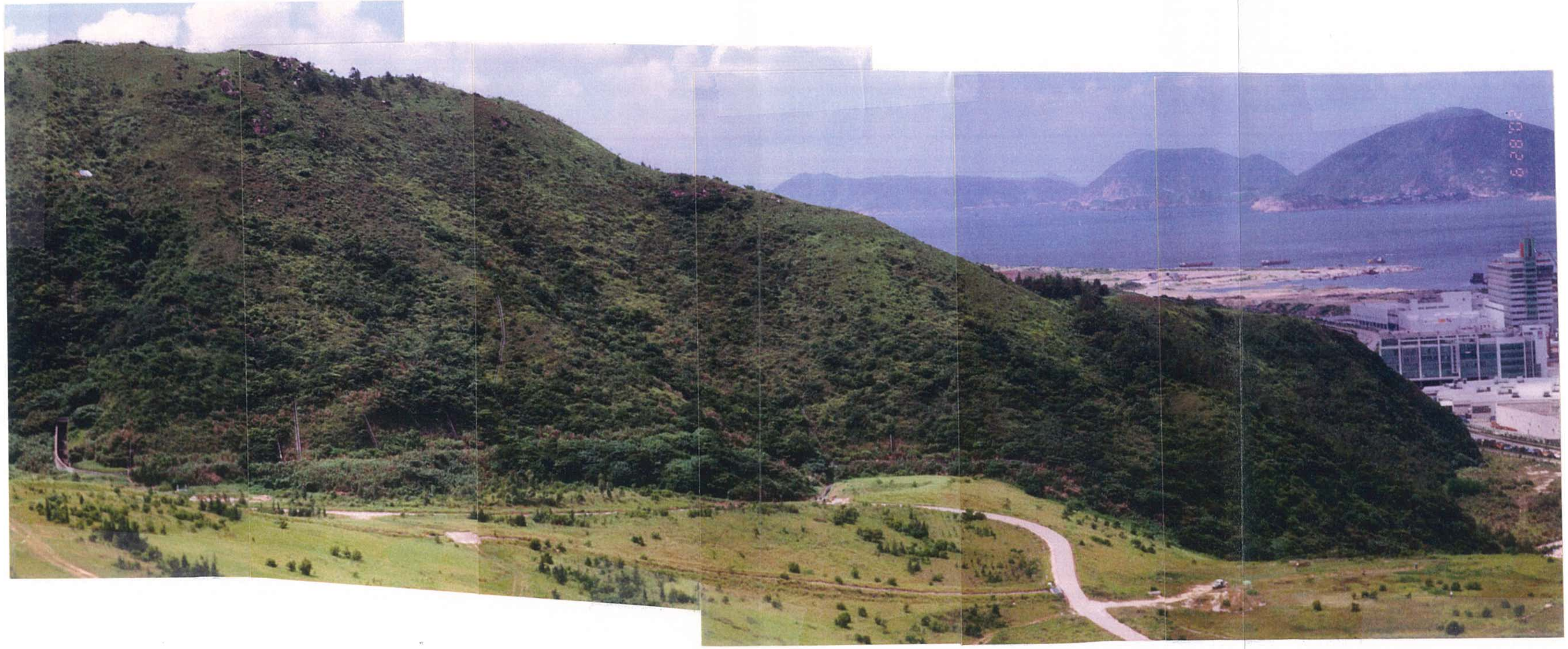
Project Tseung Kwan Landfill O Stage II/III Afteruse Development		Title General View of Catchment No. 5	Plate No. 3
Prepared By: Smo	Checked By: JH		Scale N.T.S



Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan Landfill O Stage II/III Afteruse Development	Title General View of Catchment Nos. 6A and 6B	Plate No. 4
	Prepared By: Smo Checked By: JH		Scale N.T.S



Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan Landfill O Stage II/III Afteruse Development Prepared By: Smo Checked By: JH	Title General View of Catchment No. 7	Plate No. 5 Scale N.T.S



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Tseung Kwan O Landfill Stage II/III Afteruse Development

Prepared By: Smo

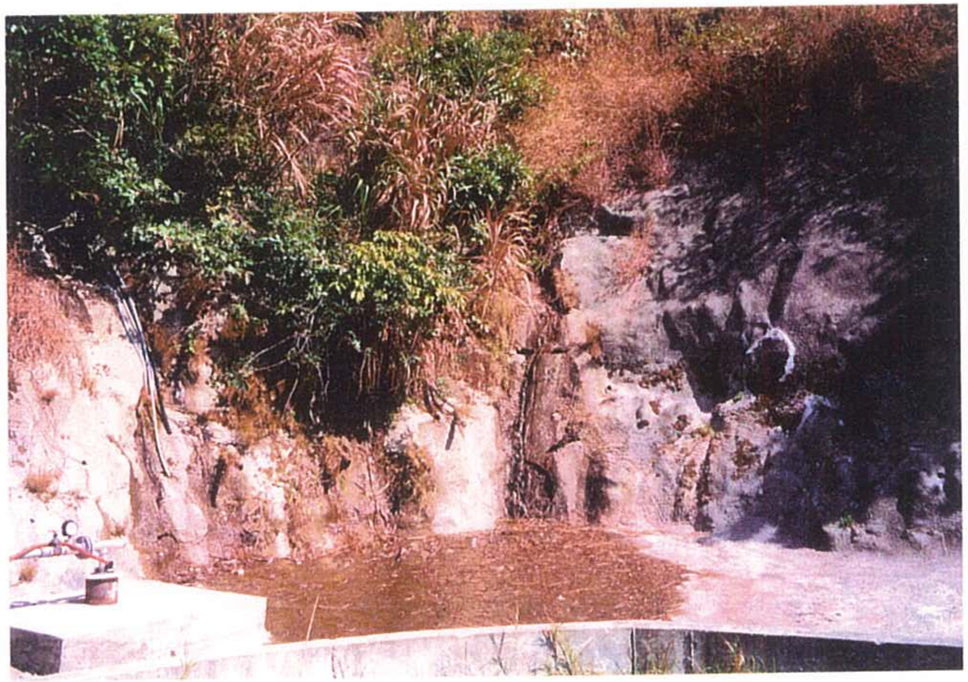
Checked By: JH

Title

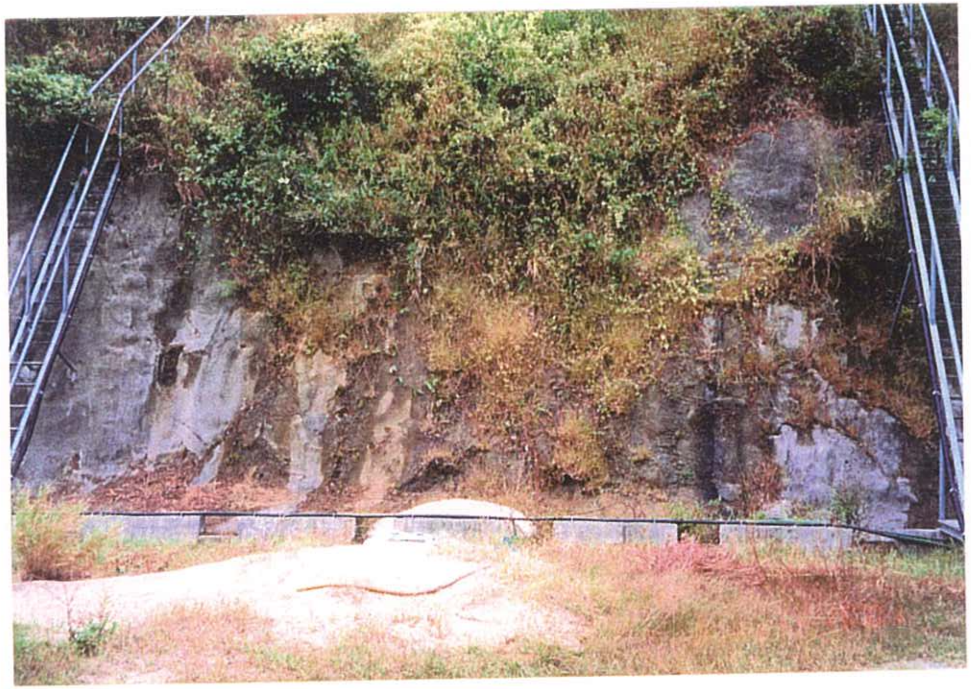
General View of Catchment Nos. 8 and 9

Plate No. 6

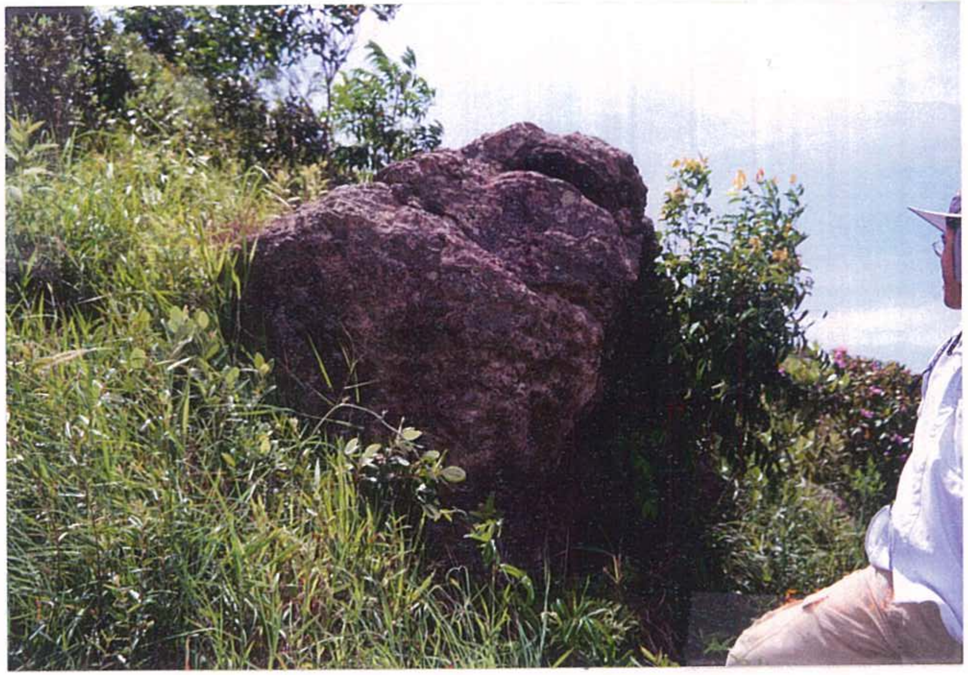
Scale N.T.S



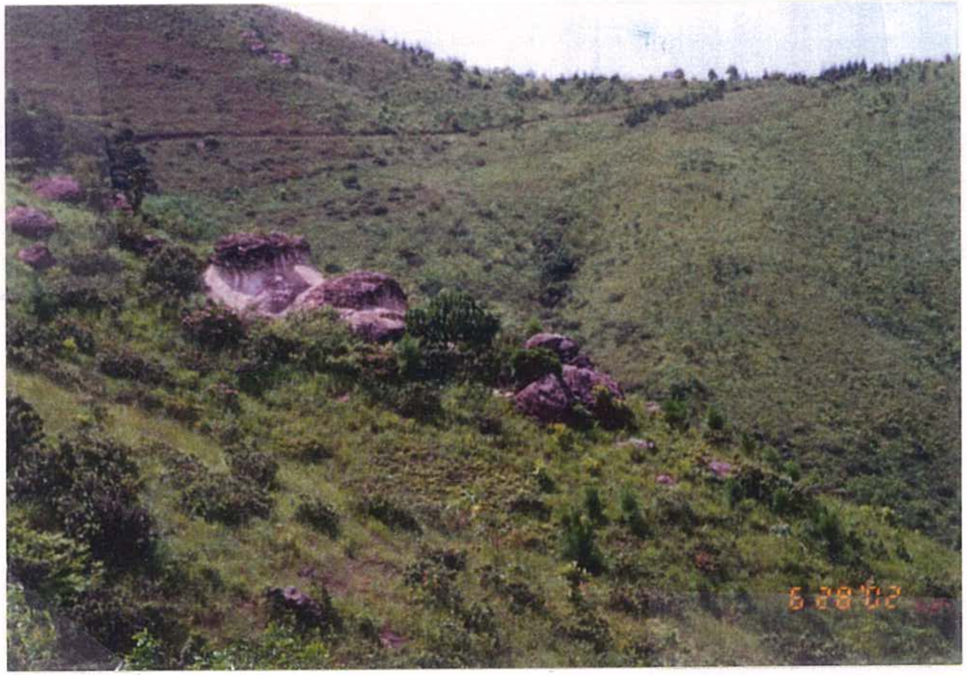
Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan O Stage II/III Landfill Afteruse Development Prepared By: MH Checked By: LTC	Title Seepage on Slope No.12SW-A/C182 and 12SW-A/C183	Plate No. 7 Scale N/A



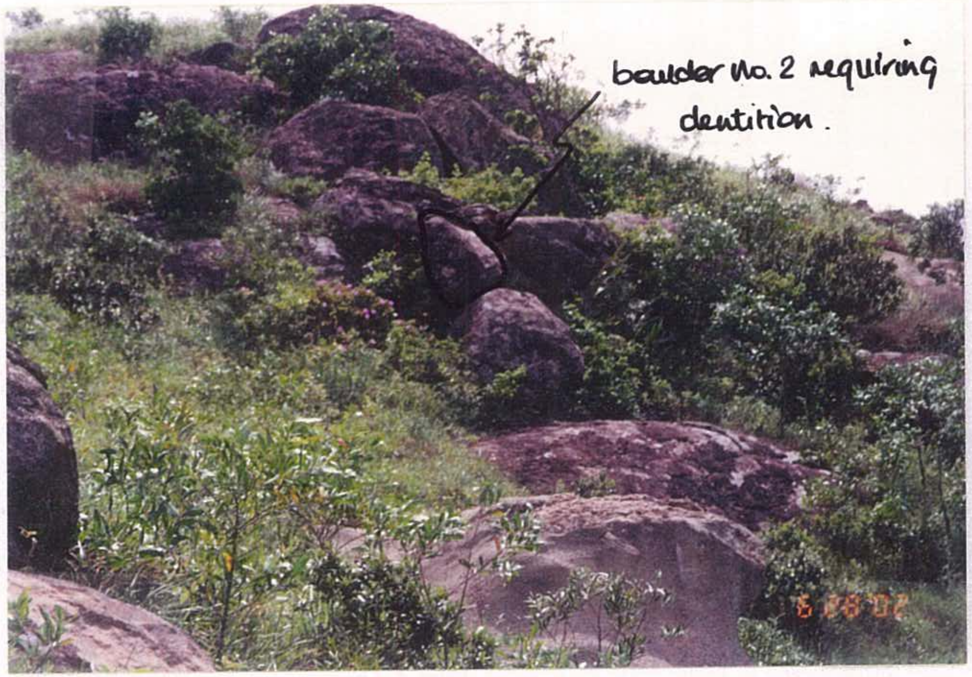
Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan O Stage II/III Landfill Afteruse Development Prepared By: MH Checked By: LTC	Title Seepage on Slope No.12SW-A/C183	Plate No. 8 Scale N/A



Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan Landfill O Stage II/III Afteruse Development Prepared By: Smo Checked By: JH	Title Boulder B1 in Catchment No. 2 requiring stabilisation measures	Plate No. 9 Scale N.T.S



Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan Landfill O Stage II/III Afteruse Development	Title Boulders with stabilisation measures carried out in Catchment No.3	Plate No. 10
	Prepared By: Smo Checked By: JH		Scale N.T.S



boulder No. 2 requiring dentition.

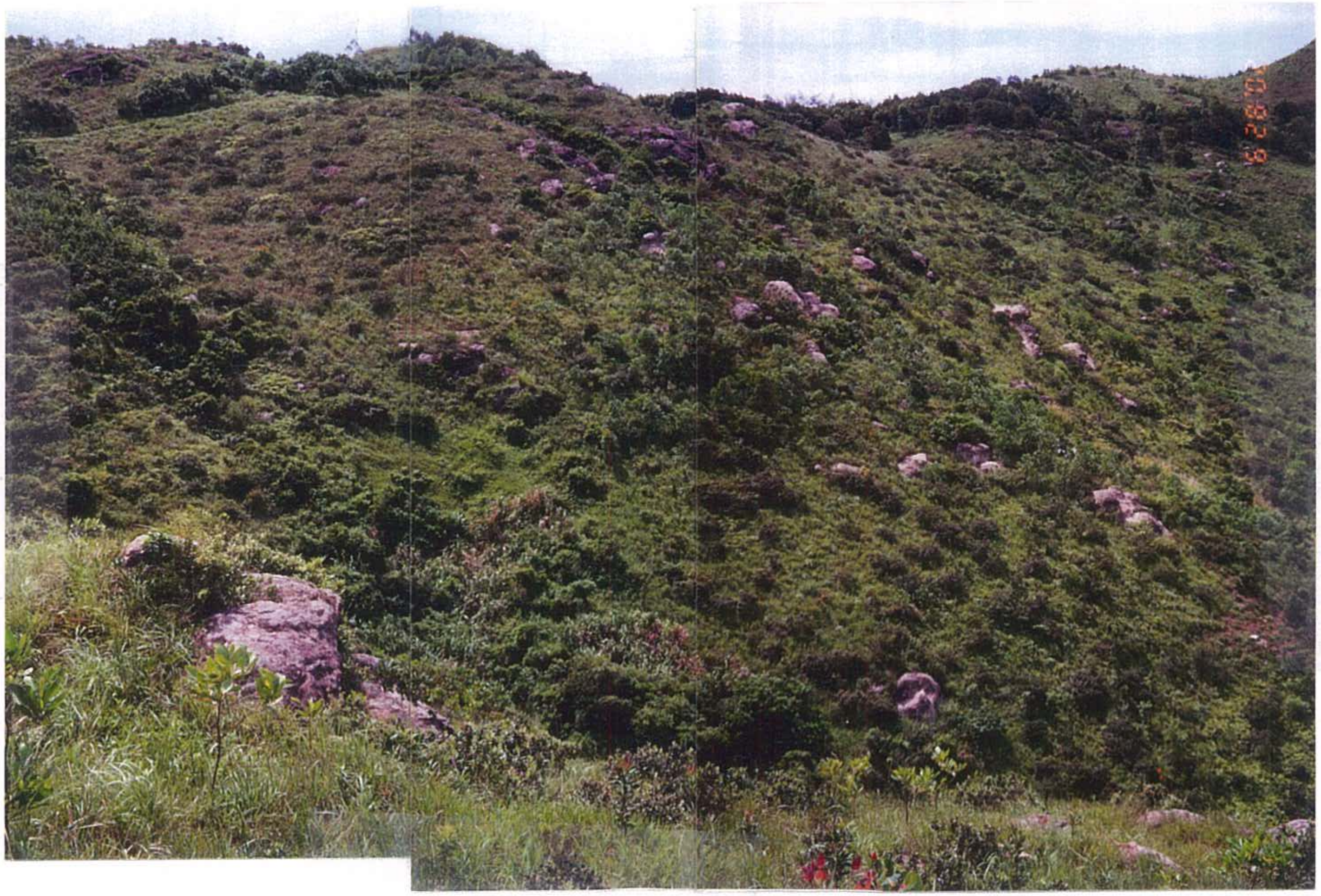
6 28 '02

Boulder B2 in Catchment No.4 requiring stabilisation measures

6 28 '02

Man-made wall structure on natural slope

Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan Landfill O Stage II/III Afteruse Development Prepared By: Smo Checked By: JH	Title Boulders and Man-Made structure in Catchement No.4	Plate No. 11 Scale N.T.S



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Tseung Kwan Landfill O Stage II/III Afteruse Development

Prepared By: Smo
Checked By: JH

Title
Boulder Field with stabilisation measures carried out in Catchment No. 4

Plate No. 12

Scale N.T.S

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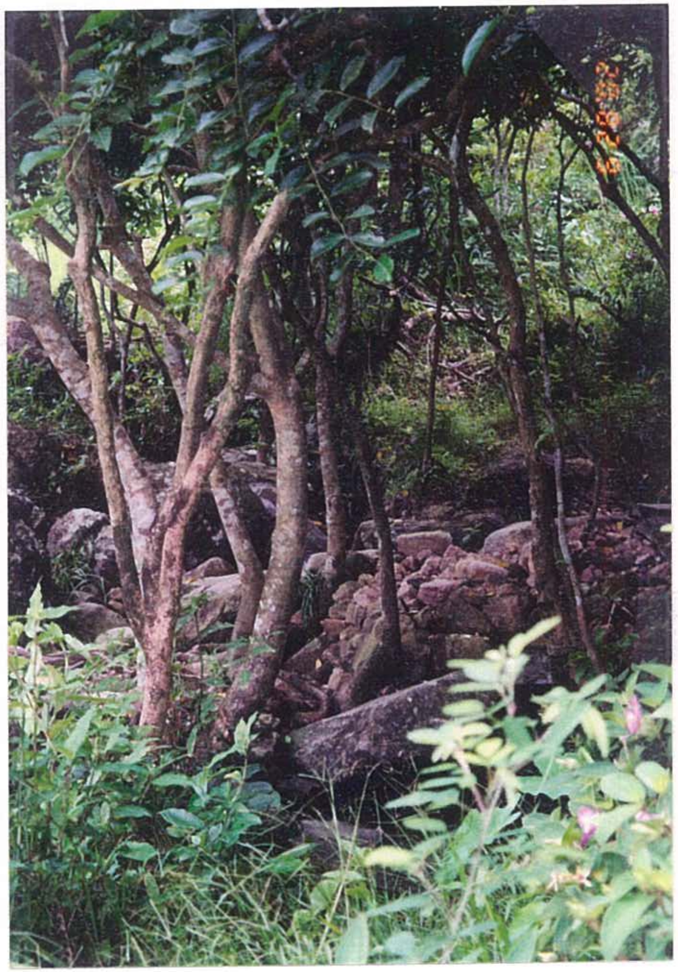
Prepared By: Smo
Checked By: JH

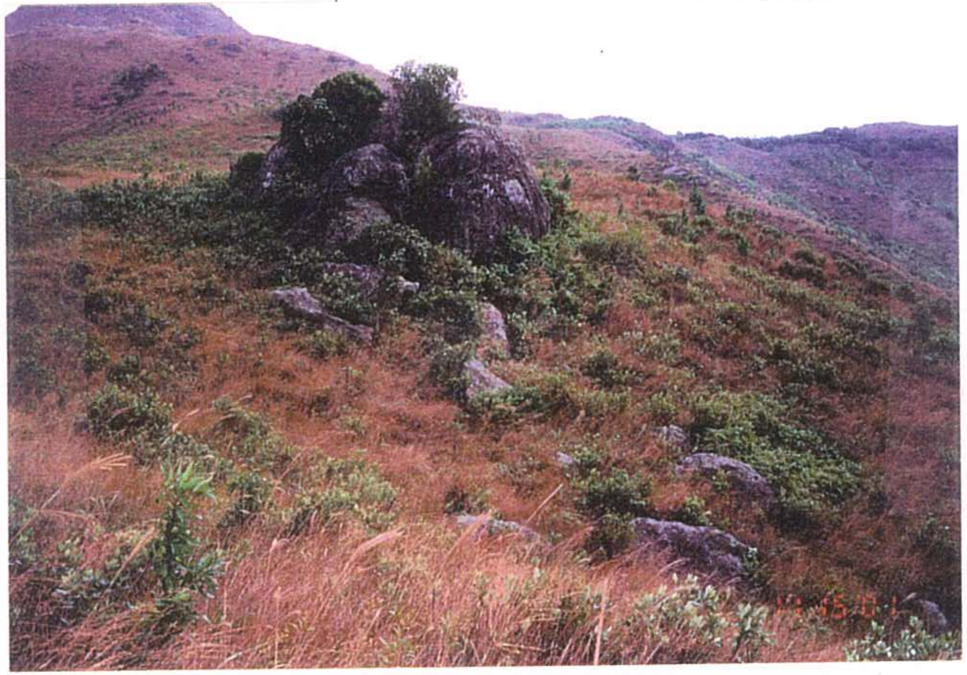
Title
General View of drainage channel in Catchment No.4

Plate No. 13

Scale N.T.S



Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan Landfill O Stage II/III Afteruse Development	Title General View of drainage channel in Catchment No.4	Plate No. 14
	Prepared By: Smo / Checked By: JH		Scale N.T.S



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Tseung Kwan O Stage II/III Landfill
Afteruse Development

Prepared By: Smo

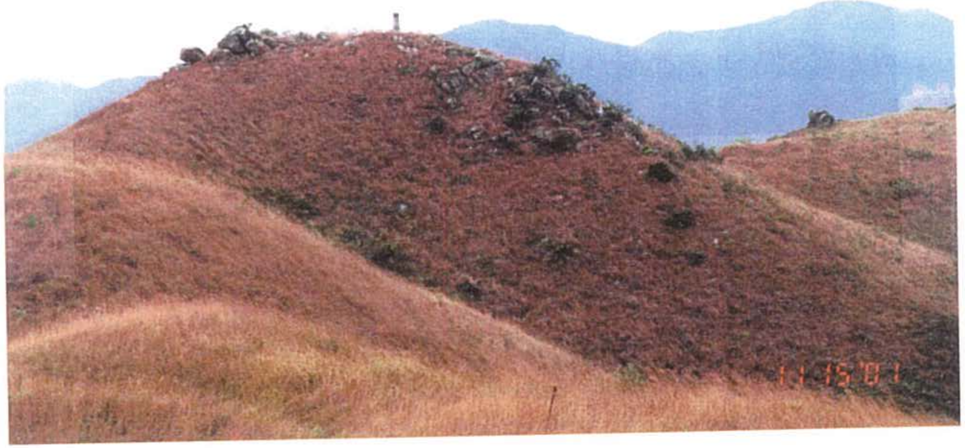
Checked By: KWK

Title

Tor of boulders along the crest of the northern ridge of the study area

Plate No. 15

Scale N/A



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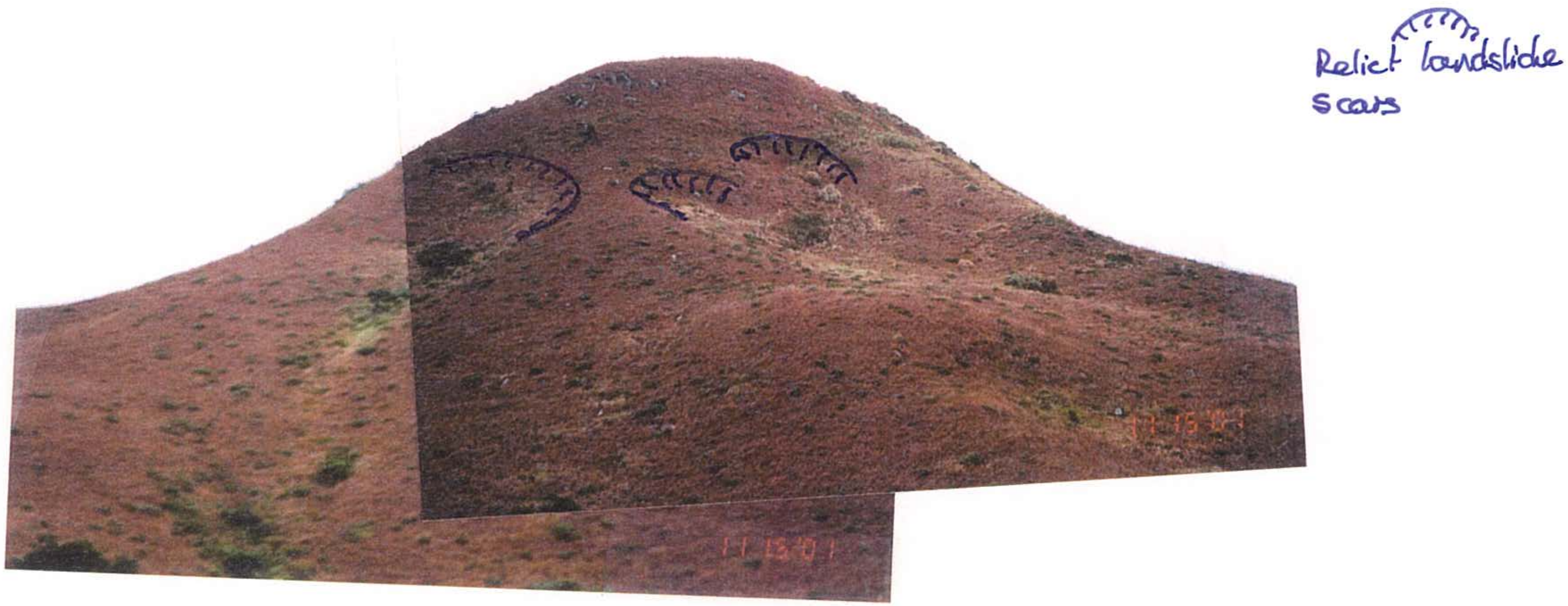
Project
Tseung Kwan O Stage II/III Landfill
Afteruse Development

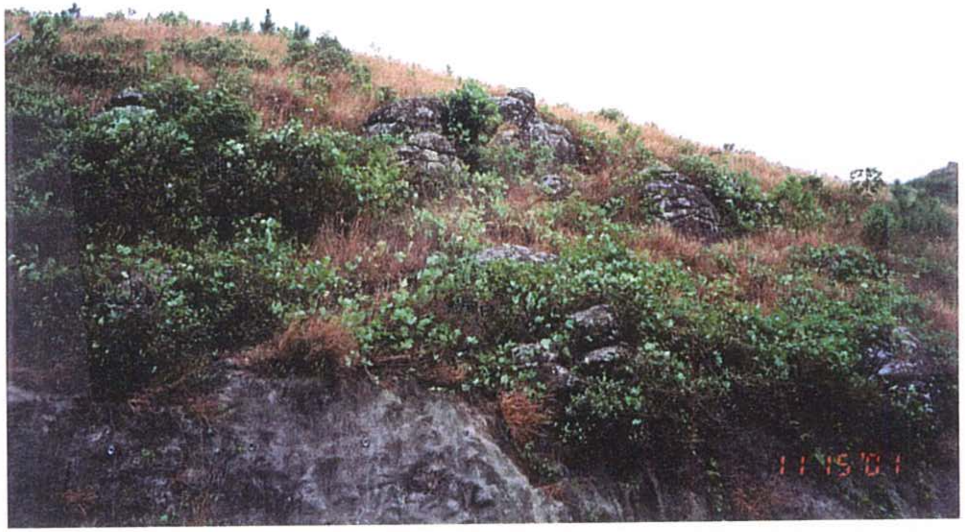
Prepared By: Smo
Checked By: KWK

Title
Cluster of boulders along the crest of the southern ridge of the study area

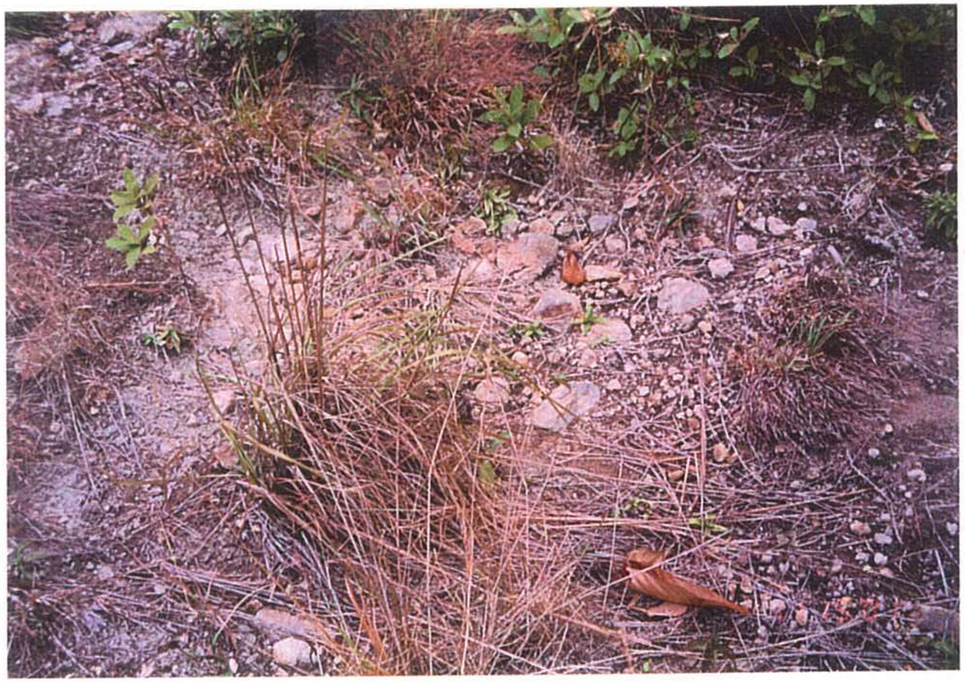
Plate No. 16
Scale N/A



Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan O Stage II/III Landfill Afteruse Development	Title Slip scars in the north-east of the study area	Plate No. I7
	Prepared By: Smo	Checked By: KWK	Scale N/A



Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan O Stage II/III Landfill Afteruse Development		Title Boulders at the toe of the natural slope in the north	Plate No. 18
	Prepared By: Smo	Checked By: KWK		Scale N/A



Binnie Binnie Black & Veatch Hong Kong Limited Engineers and Scientists	Project Tseung Kwan O Stage II/III Landfill Afteruse Development	Title Colluvium observed in the north-east	Plate No. 19
	Prepared By: Smo Checked By: KWK		Scale N/A

APPENDIX G

Run-Out Calculations for Open Hillslope Landslides And Channelised Debris Flows

Table G1 - Summary Table for Channelised Debris Flows

Catchment No.	Design Landslide Event [1]	Entry Channel Slope Angle (°)	Final Run-Out Volume (m^3) [2]	Expected Run-Out Distance (m)
3	CE	28	697	36.05
4 (Case 2)	CE	36	552	31.06
5	CE	29	697	35.48
6A	CE	41	550	45.34
6B	CE	32	550	53.48
7	CE	32	628	53.48
8	CE	32	655	53.48
9	CE	31	701	109.37

Notes: CE - Conservative Event
WCE - Worst Credible Event
[1] - Refer to Table 6.3
[2] - Refer to Table 6.4

DEBRIS FLOW CHARACTERISATION OF DESIGN EVENTS

Location: **Catchment 3 (total landslide volume 697 m^3)**

Design Assumption:

1. The density of the debris has been estimated as follows:
values of 5% carried debris have been quoted, but to be on the safe side 20% will be assumed, and this gives a debris density of (20% of 2000 kg/m^3 and 80% of 1000 kg/m^3) 1200 kg/m^3.

Therefore, unit weight of debris flow (γ_{df}) = 1200 kg/m^3
unit weight of water (γ_w) = 1000 kg/m^3
unit weight of debris solid (γ_{ds}) = 2000 kg/m^3

2. The peak discharge of debris flow has been estimated assuming debris building up behind a temporary dam at a location in the channel, which subsequently fails and produces a wave of debris (Hungr et al. 1984; Frenette *et al.* 1997).

3. The channelised debris flow is assumed and the channel debris yield rate observed in some natural terrian landslides on Lantau Island was estimated to be about 2.3 m³/m to 3.66 m³/m (Franks 1998).Therefore, cross-sectional area for this channelised debris is assumed:

X-section area for the channelised debris (A) = 3.5 m^2
channel width (b) = 6 m
channel depth (for trapezoid channel, h) = 1.0 m (base width = 1m is assumed)

4. Estimation of debris velocity, run-out distance, vertical runup distance and debris impact load are based on GEO Report 104, Review of Natural Terrian Landslide Debris-Resisting Barrier Design, GEO, January 2000, by D.O.K. Lo'.

5. ***Design Parameters***

Flow (channel) Depth	h	=	1.0	m
Gradient of Channel Bed (Table 3, GEO SPR 1/2000)	S	=	15	°
Density of Debris Flow	ρ_{df}	=	1200	kg/m^3
Debris Flow Viscosity (Hungr et al. 1984 recommend)	υ_{df}	=	3	kPa.s
Channel Shape (trapezium) Coefficient	k	=	5	
Manning's Channel Roughness Coefficient (natural channel)	n	=	0.04	
Coefficient accounting for grain properties & concent. of solids	ξ	=	2.17	m$^{-1/2}$ s^{-1}
Gravitational Acceleration	g	=	9.81	m/s^2
Apparent Friction Angle of Debris (debris volume ≥ 400 m^3)	ϕ_a	=	20	°
Entry Channel Slope Angle	θ_{cs}	=	28	°
Assumed Run out Slope Angle	θ_R	=	5	°
Assumed Runup Slope Angle	θ_{up}	=	32	°

Prepared: Snc Date: Jun 03 Checked: Date:

1. Determination of Debris Discharge

Apply Hydraulic Theory: $$Q = \sqrt{\frac{g \times A^3}{b}} \quad (m^3/s)$$

given:
g = 9.81 m/s^2
A = 3.5 m^2
b = 6 m

$\therefore Q$ = 8.37 m^3/s ⇐

2. Determination of Debris Velocity (v)

Calculation is based on Lo (2000), GEO Report 104, Review of Natural Terrain Landslide Debris-Resisting Barrier Design)

(a) Apply Newtonian Laminar Flow:

$$v = \frac{\rho_{df}\, g\, h^2 S}{k\, \upsilon_{df}} = \mathbf{0.205} \quad m/s$$

(b) Apply Newtonian Turbulent Flow:

$$v = \frac{1}{n} h^{2/3} S^{1/2} = \mathbf{12.79} \quad m/s$$

(c) Apply Dilatant Flow:

$$v = \xi h^{3/2} S^{1/2} = \mathbf{1.11} \quad m/s$$

(d) Empirical:

$$v = k^* h^{2/3} S^{1/5} = \mathbf{7.65} \quad m/s$$

⇐ (Du et al. (1987) suggested when h<2.5m, k* =10)

(e) Basic Flow Equation

$v = Q / A$ = **2.39** m/s ⇐ (from above Q = 8.37 m^3/s)

CONCLUSION:

GEO, Report 104, Fig 21, show that slip volume < 2000m^3, the debris max. velocity = 10.5 m/s
From the above, the most likely result of the velocity = **7.65** m/s

Prepared: 8mo Date: Jan 03 Checked: Date:

3. Determination of Runout Distance (X_L)

(a) Apply Lumped-mass Model:

$$X_L = \frac{v_0^2}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L = **19.70** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)

X_L = **10.45** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Leading-edge Model:

$$X_L = v_0^2 \cos^2(\theta_{cs} - \theta_R)\left[1 + \frac{g\,h\cos\theta_{cs}}{2\,v_0^2}\right]^2 \times \frac{1}{G}$$

where $G = g\,(S_f\cos\theta_R - \sin\theta_R)$

$S_f = \tan\phi_a$ (Hungr & McClung (1987) suggested)

$\Rightarrow$ G = 2.7989

$\therefore$ X_L = **36.05** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)

X_L = **20.43** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Constant Rate of Deposition (Van Gassen & Cruden 1989):

$$X_L = \frac{3}{2} \times \frac{v_0^2}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L = **29.54** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)

X_L = **15.68** (when V_0 = **7.65** m/s, Empirical Eq.)

Expected max. run-out (X_L) = **36.05** m (No mitigation measures taken into account)

Prepared: SMb Date: Jan 03 Checked: Date:

4. Determination of Vertical Runup Distance (Δh)

(a) Apply Lumped-mass Model:

$$\Delta h = \frac{v_0^{\,2} \tan \theta_{up}}{2g\left(\tan \phi_a + \tan \theta_{up}\right)}$$

Δh = **3.52** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
Δh = **1.87** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Lumped-mass Model Corrected for Momentum Change (Perla et al, 1980):

$$\Delta h = \frac{v_0^{\,2} \cos^2\left(\theta_{cs} + \theta_{up}\right) \tan \theta_{up}}{2\,g\left(\tan \varphi_a + \tan \theta_{up}\right)}$$

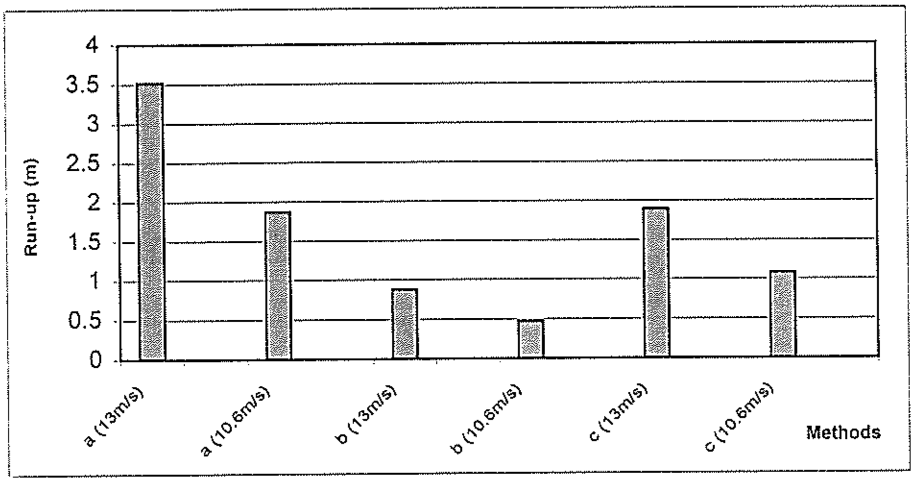
Δh = **0.88** m (when V_0 = **10.5** m/s, GEO Report 104,Fig 21)
Δh = **0.47** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Leading-edge Model (Hungr & McClung, 1987; Takahashi & Yoshida, 1979):

$$\Delta h = \frac{v_0^{\,2} \cos^2\left(\theta_{cs} + \theta_{up}\right) \tan \theta_{up}}{g\left(\tan \phi_a + \tan \theta_{up}\right)} \left(1 + \frac{gh \cos \theta_{cs}}{2 v_0^{\,2}}\right)^2$$

Δh = **1.90** m (when V_0 = **10.5** m/s, GEO, Report 104, Fig 21)
Δh = **1.08** m (when V_0 = **7.65** m/s, Empirical Eq.)

Run-up (m)						
(Method)-						
a (13m/s)	a (10.6m/s)	b (13m/s)	b (10.6m/s)	c (13m/s)	c (10.6m/s)	**Average**
3.52	1.87	0.88	0.47	1.9	1.08	**1.62** (m)



Prepared: smb Date: Jan03 Checked: Date:

Black & Veatch Hong Kong Limited

Project: *Agreement No. FD 01-052 Tseung Kwan O Stage II/III*
Subject: *Debris Run-out Calculations* Job number *2311/0201* Page 1 of 4

DEBRIS FLOW CHARACTERISATION OF DESIGN EVENTS

Location: **Catchment 4 (total landslide volume 552 m^3)**

Design Assumption:

1. The density of the debris has been estimated as-follows:
values of 5% carried debris have been quoted, but to be on the safe side 20% will be assumed, and this gives a debris density of (20% of 2000 kg/m^3 and 80% of 1000 kg/m^3) 1200 kg/m^3.

Therefore,
unit weight of debris flow (γ_{df}) = 1200 kg/m^3
unit weight of water (γ_w) = 1000 kg/m^3
unit weight of debris solid (γ_{ds}) = 2000 kg/m^3

2. The peak discharge of debris flow has been estimated assuming debris building up behind a temporary dam at a location in the channel, which subsequently fails and produces a wave of debris (Hungr et al. 1984; Frenette *et al.* 1997).

3. The channelised debris flow is assumed and the channel debris yield rate observed in some natural terrian landslides on Lantau Island was estimated to be about 2.3 m³/m to 3.66 m³/m (Franks 1998).Therefore, cross-sectional area for this channelised debris is assumed:
X-section area for the channelised debris (A) = 3.5 m^2
channel width (b) = 6 m
channel depth (for trapezoid channel, h) = 1.0 m (base width = 1m is assumed)

4. Estimation of debris velocity, run-out distance, vertical runup distance and debris impact load are based on GEO Report 104, Review of Natural Terrian Landslide Debris-Resisting Barrier Design, GEO, January 2000, by D.O.K. Lo'.

5. ***Design Parameters***

Flow (channel) Depth h = 1.0 m
Gradient of Channel Bed (Table 3, GEO SPR 1/2000) S = 15 °
Density of Debris Flow ρ_{df} = 1200 kg/m^3
Debris Flow Viscosity (Hungr et al. 1984 recommend) υ_{df} = 3 kPa.s
Channel Shape (trapezium) Coefficient k = 5
Manning's Channel Roughness Coefficient (natural channel) n = 0.04
Coefficient accounting for grain properties & concent. of solids ξ = 2.17 m$^{-1/2}$ s^{-1}
Gravitational Acceleration g = 9.81 m/s^2
Apparent Friction Angle of Debris (debris volume ≥ 400 m^3) ϕ_a = 20 °
Entry Channel Slope Angle θ_{cs} = 36 °
Assumed Run out Slope Angle θ_R = 5 °
Assumed Runup Slope Angle θ_{up} = 32 °

Prepared: SMb Date: Jan 03 Checked: Date:

1. Determination of Debris Discharge

Apply Hydraulic Theory:

$$Q = \sqrt{\frac{g \times A^3}{b}} \quad (m^3/s)$$

given:
g = 9.81 m/s^2
A = 3.5 m^2
b = 6 m

$$\therefore Q = \mathbf{8.37} \ \mathbf{m^3/s} \quad \Leftarrow$$

2. Determination of Debris Velocity (v)

Calculation is based on Lo (2000), GEO Report 104, Review of Natural Terrain Landslide Debris-Resisting Barrier Design)

(a) Apply Newtonian Laminar Flow:

$$v = \frac{\rho_{df}\, g\, h^2 S}{k\, \upsilon_{df}} = \mathbf{0.205} \ m/s$$

(b) Apply Newtonian Turbulent Flow:

$$v = \frac{1}{n} h^{2/3} S^{1/2} = \mathbf{12.79} \ m/s$$

(c) Apply Dilatant Flow:

$$v = \xi h^{3/2} S^{1/2} = \mathbf{1.11} \ m/s$$

(d) Empirical:

$$v = k^* h^{2/3} S^{1/5} = \mathbf{7.65} \ m/s \quad \Leftarrow$$

(Du et al. (1987) suggested when h<2.5m, k* =10)

(e) Basic Flow Equation

$$v = Q / A = \mathbf{2.39} \ m/s \quad \Leftarrow$$

(from above Q = 8.37 m^3/s)

CONCLUSION:

GEO, Report 104, Fig 21, show that slip volume < 2000m^3, the debris max. velocity = 10.5 m/s
From the above, the most likely result of the velocity = **7.65** m/s

Prepared: SMo Date: Jan 03 Checked: Date:

3. Determination of Runout Distance (X_L)

(a) Apply Lumped-mass Model:

$$X_L = \frac{v_0^2}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L = **19.70** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **10.45** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Leading-edge Model:

$$X_L = v_0^2\cos^2(\theta_{cs} - \theta_R)\left[1 + \frac{g\,h\cos\theta_{cs}}{2\,v_0^2}\right]^2 \times \frac{1}{G}$$

where $G = g\,(S_f\cos\theta_R - \sin\theta_R)$
$S_f = \tan\phi_a$ (Hungr & McClung (1987) suggested)

$\Rightarrow$ G = 2.7989
$\therefore$ X_L = **31.06** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **17.51** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Constant Rate of Deposition (Van Gassen & Cruden 1989):

$$X_L = \frac{3}{2} \times \frac{v_0^2}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L = **29.54** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **15.68** (when V_0 = **7.65** m/s, Empirical Eq.)

Expected max. run-out (X_L) = **31.06** m (No mitigation measures taken into account)

Prepared: smo Date: Jan 03 Checked: Date:

4. Determination of Vertical Runup Distance (Δh)

(a) Apply Lumped-mass Model:

$$\Delta h = \frac{v_0^{\,2} \tan\theta_{up}}{2g(\tan\phi_a + \tan\theta_{up})}$$

Δh = **3.52** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
Δh = **1.87** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Lumped-mass Model Corrected for Momentum Change (Perla et al, 1980):

$$\Delta h = \frac{v_0^{\,2} \cos^2(\theta_{cs} + \theta_{up}) \tan\theta_{up}}{2g(\tan\varphi_a + \tan\theta_{up})}$$

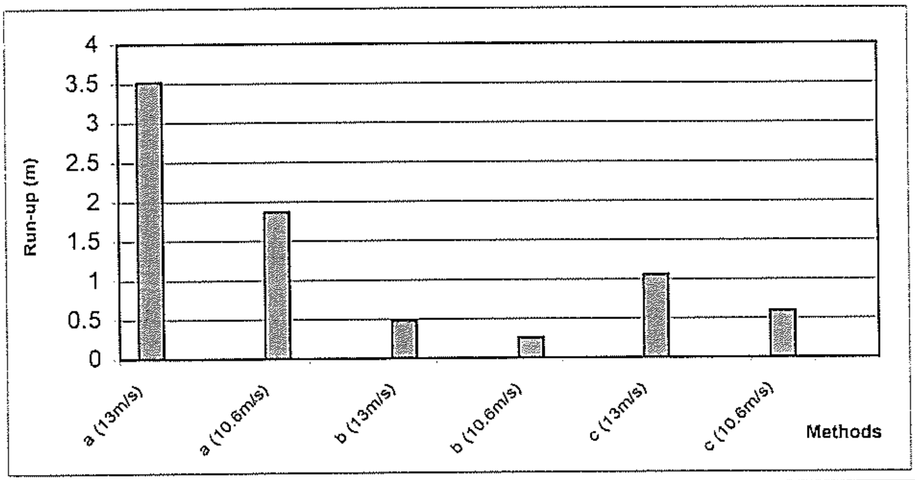
Δh = **0.49** m (when V_0 = **10.5** m/s, GEO Report 104,Fig 21)
Δh = **0.26** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Leading-edge Model (Hungr & McClung, 1987; Takahashi & Yoshida, 1979):

$$\Delta h = \frac{v_0^{\,2} \cos^2(\theta_{cs} + \theta_{up}) \tan\theta_{up}}{g(\tan\phi_a + \tan\theta_{up})}\left(1 + \frac{gh\cos\theta_{cs}}{2v_0^{\,2}}\right)^2$$

Δh = **1.06** m (when V_0 = **10.5** m/s, GEO, Report 104, Fig 21)
Δh = **0.60** m (when V_0 = **7.65** m/s, Empirical Eq.)

Run-up (m)						
(Method)						
a (13m/s)	a (10.6m/s)	b (13m/s)	b (10.6m/s)	c (13m/s)	c (10.6m/s)	**Average**
3.52	1.87	0.49	0.26	1.06	0.6	**1.3** (m)



Prepared: SMo Date: Jan 03 Checked: Date:

DEBRIS FLOW CHARACTERISATION OF DESIGN EVENTS

Location: **Catchment 5 (total landslide volume 697 m^3)**

Design Assumption:

1. The density of the debris has been estimated as follows:
values of 5% carried debris have been quoted, but to be on the safe side 20% will be assumed, and this gives a debris density of (20% of 2000 kg/m^3 and 80% of 1000 kg/m^3) 1200 kg/m^3.

Therefore,
unit weight of debris flow (γ_{df}) = 1200 kg/m^3
unit weight of water (γ_w) = 1000 kg/m^3
unit weight of debris solid (γ_{ds}) = 2000 kg/m^3

2. The peak discharge of debris flow has been estimated assuming debris building up behind a temporary dam at a location in the channel, which subsequently fails and produces a wave of debris (Hungr et al. 1984; Frenette *et al.* 1997).

3. The channelised debris flow is assumed and the channel debris yield rate observed in some natural terrian landslides on Lantau Island was estimated to be about 2.3 m^3/m to 3.66 m^3/m (Franks 1998).Therefore, cross-sectional area for this channelised debris is assumed:
X-section area for the channelised debris (A) = 3.5 m^2
channel width (b) = 6 m
channel depth (for trapezoid channel, h) = 1.0 m (base width = 1m is assumed)

4. Estimation of debris velocity, run-out distance, vertical runup distance and debris impact load are based on GEO Report 104, Review of Natural Terrian Landslide Debris-Resisting Barrier Design, GEO, January 2000, by D.O.K. Lo'.

5. ***Design Parameters***

Flow (channel) Depth	h	=	1.0 m
Gradient of Channel Bed (Table 3, GEO SPR 1/2000)	S	=	15 °
Density of Debris Flow	ρ_{df}	=	1200 kg/m^3
Debris Flow Viscosity (Hungr et al. 1984 recommend)	υ_{df}	=	3 kPa.s
Channel Shape (trapezium) Coefficient	k	=	5
Manning's Channel Roughness Coefficient (natural channel)	n	=	0.04
Coefficient accounting for grain properties & concent. of solids	ξ	=	2.17 $m^{-1/2} s^{-1}$
Gravitational Acceleration	g	=	9.81 m/s^2
Apparent Friction Angle of Debris (debris volume ≥ 400 m^3)	ϕ_a	=	20 °
Entry Channel Slope Angle	θ_{cs}	=	29 °
Assumed Run out Slope Angle	θ_R	=	5 °
Assumed Runup Slope Angle	θ_{up}	=	32 °

Prepared: SMb Date: Jan 03 Checked: Date:

1. Determination of Debris Discharge

Apply Hydraulic Theory: $$Q = \sqrt{\frac{g \times A^3}{b}} \quad (m^3/s)$$

given:
$g = 9.81$ m/s^2
$A = 3.5$ m^2
$b = 6$ m

$\therefore Q = 8.37$ m^3/s ⇐

2. Determination of Debris Velocity (v)

Calculation is based on Lo (2000), GEO Report 104, Review of Natural Terrain Landslide Debris-Resisting Barrier Design)

(a) Apply Newtonian Laminar Flow:

$$v = \frac{\rho_{df}\, g\, h^2 S}{k\, \upsilon_{df}} = \mathbf{0.205} \text{ m/s}$$

(b) Apply Newtonian Turbulent Flow:

$$v = \frac{1}{n} h^{2/3} S^{1/2} = \mathbf{12.79} \text{ m/s}$$

(c) Apply Dilatant Flow:

$$v = \xi h^{3/2} S^{1/2} = \mathbf{1.11} \text{ m/s}$$

(d) Empirical:

$$v = k^* h^{2/3} S^{1/5} = \mathbf{7.65} \text{ m/s}$$ ⇐ (Du et al. (1987) suggested when h<2.5m, k* =10)

(e) Basic Flow Equation

$$v = Q / A = \mathbf{2.39} \text{ m/s}$$ ⇐ (from above Q = 8.37 m^3/s)

CONCLUSION:

GEO, Report 104, Fig 21, show that slip volume < 2000m^3, the debris max. velocity = 10.5 m/s
From the above, the most likely result of the velocity = **7.65** m/s

3. Determination of Runout Distance (X_L)

(a) Apply Lumped-mass Model:

$$X_L = \frac{v_0^{\,2}}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L	=	**19.70**	m	(when V_0	=	**10.5**	m/s, GEO Report 104, Fig 21)
X_L	=	**10.45**	m	(when V_0	=	**7.65**	m/s, Empirical Eq.)

(b) Apply Leading-edge Model:

$$X_L = v_0^{\,2}\cos^2(\theta_{cs} - \theta_R)\left[1 + \frac{g\,h\cos\theta_{cs}}{2\,v_0^{\,2}}\right]^2 \times \frac{1}{G}$$

where $G = g\,(S_f\cos\theta_R - \sin\theta_R)$
$S_f = \tan\phi_a$ (Hungr & McClung (1987) suggested)

$\Rightarrow$ G = 2.7989

$\therefore$ X_L =	**35.48**	m	(when V_0	=	**10.5**	m/s, GEO Report 104, Fig 21)
X_L =	**20.10**	m	(when V_0	=	**7.65**	m/s, Empirical Eq.)

(c) Apply Constant Rate of Deposition (Van Gassen & Cruden 1989):

$$X_L = \frac{3}{2} \times \frac{v_0^{\,2}}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L =	**29.54**	m	(when V_0	=	**10.5**	m/s, GEO Report 104, Fig 21)
X_L =	**15.68**		(when V_0	=	**7.65**	m/s, Empirical Eq.)

Expected max. run-out (X_L) = **35.48** m (No mitigation measures taken into account)

Prepared: SMO Date: Jan 03 Checked: Date:

4. Determination of Vertical Runup Distance (Δh)

(a) Apply Lumped-mass Model:

$$\Delta h = \frac{v_0^{\ 2} \tan \theta_{up}}{2g(\tan \phi_a + \tan \theta_{up})}$$

Δh	=	**3.52**	m	(when V_0	=	**10.5**	m/s, GEO Report 104, Fig 21)
Δh	=	**1.87**	m	(when V_0	=	**7.65**	m/s, Empirical Eq.)

(b) Apply Lumped-mass Model Corrected for Momentum Change (Perla et al, 1980):

$$\Delta h = \frac{v_0^{\ 2} \cos^2 (\theta_{cs} + \theta_{up}) \tan \theta_{up}}{2\, g(\tan \varphi_a + \tan \theta_{up})}$$

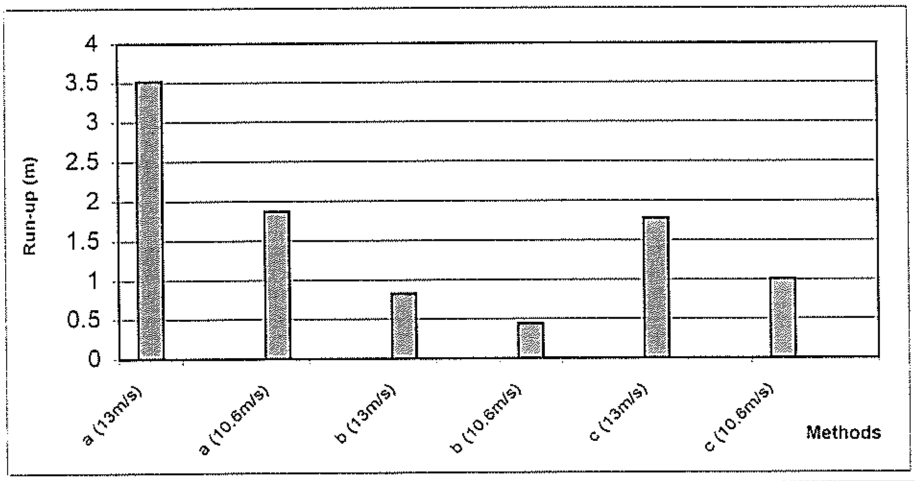
Δh	=	**0.83**	m	(when V_0	=	**10.5**	m/s, GEO Report 104,Fig 21)
Δh	=	**0.44**	m	(when V_0	=	**7.65**	m/s, Empirical Eq.)

(c) Apply Leading-edge Model (Hungr & McClung, 1987; Takahashi & Yoshida, 1979):

$$\Delta h = \frac{v_0^{\ 2} \cos^2(\theta_{cs} + \theta_{up}) \tan \theta_{up}}{g(\tan \phi_a + \tan \theta_{up})} \left(1 + \frac{gh \cos \theta_{cs}}{2 v_0^{\ 2}} \right)^2$$

Δh	=	**1.78**	m	(when V_0	=	**10.5**	m/s, GEO, Report 104, Fig 21)
Δh	=	**1.01**	m	(when V_0	=	**7.65**	m/s, Empirical Eq.)

Run-up (m)						
(Method)						
a (13m/s)	a (10.6m/s)	b (13m/s)	b (10.6m/s)	c (13m/s)	c (10.6m/s)	**Average**
3.52	1.87	0.83	0.44	1.78	1.01	**1.575** (m)



Prepared: SMO Date: Jan03 Checked: Date:

DEBRIS FLOW CHARACTERISATION OF DESIGN EVENTS

Location: **Catchment 6A (total landslide volume 550 m^3)**

Design Assumption:

1. The density of the debris has been estimated as follows:
values of 5% carried debris have been quoted, but to be on the safe side 20% will be assumed, and this gives a debris density of (20% of 2000 kg/m^3 and 80% of 1000 kg/m^3) 1200 kg/m^3.

Therefore, unit weight of debris flow (γ_{df}) = 1200 kg/m^3
unit weight of water (γ_w) = 1000 kg/m^3
unit weight of debris solid (γ_{ds}) = 2000 kg/m^3

2. The peak discharge of debris flow has been estimated assuming debris building up behind a temporary dam at a location in the channel, which subsequently fails and produces a wave of debris (Hungr et al. 1984; Frenette *et al.* 1997).

3. The channelised debris flow is assumed and the channel debris yield rate observed in some natural terrian landslides on Lantau Island was estimated to be about 2.3 m^3/m to 3.66 m^3/m (Franks 1998).Therefore, cross-sectional area for this channelised debris is assumed:

X-section area for the channelised debris (A) = 3.5 m^2
channel width (b) = 6 m
channel depth (for trapezoid channel, h) = 1.0 m (base width = 1m is assumed)

4. Estimation of debris velocity, run-out distance, vertical runup distance and debris impact load are based on GEO Report 104, Review of Natural Terrian Landslide Debris-Resisting Barrier Design, GEO, January 2000, by D.O.K. Lo'.

5. ***Design Parameters***

Flow (channel) Depth h = 1.0 m
Gradient of Channel Bed (Table 3, GEO SPR 1/2000) S = 15 °
Density of Debris Flow ρ_{df} = 1200 kg/m^3
Debris Flow Viscosity (Hungr et al. 1984 recommend) υ_{df} = 3 kPa.s
Channel Shape (trapezium) Coefficient k = 5
Manning's Channel Roughness Coefficient (natural channel) n = 0.04
Coefficient accounting for grain properties & concent. of solids ξ = 2.17 $m^{-1/2} s^{-1}$
Gravitational Acceleration g = 9.81 m/s^2
Apparent Friction Angle of Debris (debris volume ≥ 400 m^3) ϕ_a = 20 °
Entry Channel Slope Angle θ_{cs} = 41 °
Assumed Run out Slope Angle θ_R = 10 °
Assumed Runup Slope Angle θ_{up} = 32 °

Prepared: SMC Date: Jan 03 Checked: Date:

1. Determination of Debris Discharge

Apply Hydraulic Theory: $$Q = \sqrt{\frac{g \times A^3}{b}} \quad (m^3/s)$$

given:
g = 9.81 m/s^2
A = 3.5 m^2
b = 6 m

$\therefore$ Q = 8.37 m^3/s ⇐

2. Determination of Debris Velocity (v)

Calculation is based on Lo (2000), GEO Report 104, Review of Natural Terrain Landslide Debris-Resisting Barrier Design)

(a) Apply Newtonian Laminar Flow:

$$v = \frac{\rho_{df}\, g\, h^2 S}{k\, \upsilon_{df}} = \mathbf{0.205} \text{ m/s}$$

(b) Apply Newtonian Turbulent Flow:

$$v = \frac{1}{n} h^{2/3} S^{1/2} = \mathbf{12.79} \text{ m/s}$$

(c) Apply Dilatant Flow:

$$v = \xi h^{3/2} S^{1/2} = \mathbf{1.11} \text{ m/s}$$

(d) Empirical:

$$v = k^* h^{2/3} S^{1/5} = \mathbf{7.65} \text{ m/s}$$ ⇐ (Du et al. (1987) suggested when h<2.5m, k* =10)

(e) Basic Flow Equation

$v = Q / A$ = **2.39** m/s ⇐ (from above Q = 8.37 m^3/s)

CONCLUSION:

GEO, Report 104, Fig 21, show that slip volume < 2000m^3, the debris max. velocity = 10.5 m/s
From the above, the most likely result of the velocity = **7.65** m/s

3. Determination of Runout Distance (X_L)

(a) Apply Lumped-mass Model:

$$X_L = \frac{v_0^2}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L = **28.88** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **15.33** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Leading-edge Model:

$$X_L = v_0^2\cos^2(\theta_{cs} - \theta_R)\left[1 + \frac{g\,h\cos\theta_{cs}}{2\,v_0^2}\right]^2 \times \frac{1}{G}$$

where $G = g\,(S_f\cos\theta_R - \sin\theta_R)$
$S_f = \tan\phi_a$ (Hungr & McClung (1987) suggested)

$\Rightarrow$ G = 1.9086
$\therefore$ X_L = **45.34** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **25.46** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Constant Rate of Deposition (Van Gassen & Cruden 1989):

$$X_L = \frac{3}{2} \times \frac{v_0^2}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L = **43.32** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **22.99** (when V_0 = **7.65** m/s, Empirical Eq.)

Expected max. run-out (X_L) = **45.34** m (No mitigation measures taken into account)

Prepared: SMO Date: Jan 03 Checked: Date:

4. Determination of Vertical Runup Distance (Δh)

(a) Apply Lumped-mass Model:

$$\Delta h = \frac{v_0{}^2 \tan\theta_{up}}{2g(\tan\phi_a + \tan\theta_{up})}$$

Δh = **3.52** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
Δh = **1.87** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Lumped-mass Model Corrected for Momentum Change (Perla et al, 1980):

$$\Delta \mathrm{h} = \frac{\mathrm{v}_0{}^2 \cos^2(\theta_{cs} + \theta_{up}) \tan\theta_{up}}{2\,\mathrm{g}(\tan\varphi_a + \tan\theta_{up})}$$

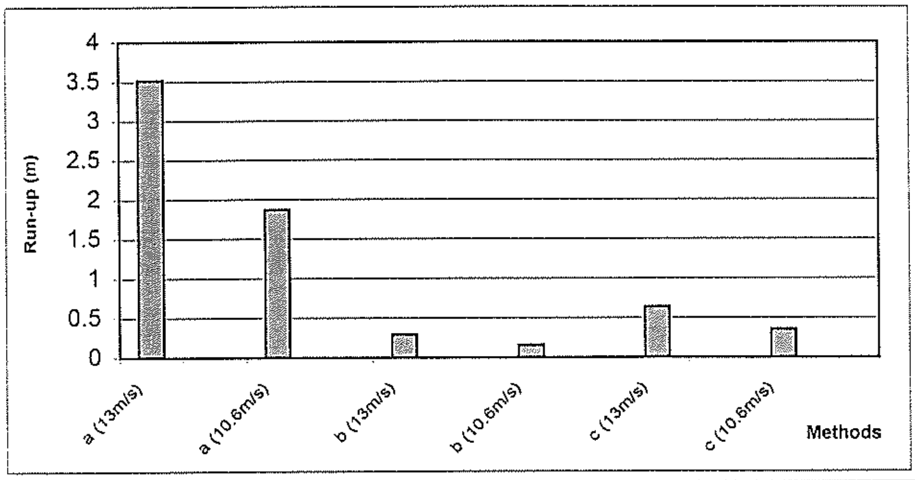
Δh = **0.30** m (when V_0 = **10.5** m/s, GEO Report 104,Fig 21)
Δh = **0.16** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Leading-edge Model (Hungr & McClung, 1987; Takahashi & Yoshida, 1979):

$$\Delta h = \frac{v_0{}^2 \cos^2(\theta_{cs} + \theta_{up}) \tan\theta_{up}}{g(\tan\phi_a + \tan\theta_{up})}\left(1 + \frac{gh\cos\theta_{cs}}{2v_0{}^2}\right)^2$$

Δh = **0.64** m (when V_0 = **10.5** m/s, GEO, Report 104, Fig 21)
Δh = **0.36** m (when V_0 = **7.65** m/s, Empirical Eq.)

Run-up (m)						
(Method)						
a (13m/s)	a (10.6m/s)	b (13m/s)	b (10.6m/s)	c (13m/s)	c (10.6m/s)	**Average**
3.52	1.87	0.3	0.16	0.64	0.36	**1.14167** (m)



Prepared: Date: Jan 03 Checked: Date:

DEBRIS FLOW CHARACTERISATION OF DESIGN EVENTS

Location: **Catchment 6B (total landslide volume 550 m^3)**

Design Assumption:

1. The density of the debris has been estimated as follows:
values of 5% carried debris have been quoted, but to be on the safe side 20% will be assumed, and this gives a debris density of (20% of 2000 kg/m^3 and 80% of 1000 kg/m^3) 1200 kg/m^3.
Therefore, unit weight of debris flow (γ_{df}) = 1200 kg/m^3
unit weight of water (γ_w) = 1000 kg/m^3
unit weight of debris solid (γ_{ds}) = 2000 kg/m^3

2. The peak discharge of debris flow has been estimated assuming debris building up behind a temporary dam at a location in the channel, which subsequently fails and produces a wave of debris (Hungr et al. 1984; Frenette *et al.* 1997).

3. The channelised debris flow is assumed and the channel debris yield rate observed in some natural terrian landslides on Lantau Island was estimated to be about 2.3 m³/m to 3.66 m³/m (Franks 1998).Therefore, cross-sectional area for this channelised debris is assumed:
X-section area for the channelised debris (A) = 3.5 m^2
channel width (b) = 6 m
channel depth (for trapezoid channel, h) = 1.0 m (base width = 1m is assumed)

4. Estimation of debris velocity, run-out distance, vertical runup distance and debris impact load are based on GEO Report 104, Review of Natural Terrian Landslide Debris-Resisting Barrier Design, GEO, January 2000, by D.O.K. Lo'.

5. ***Design Parameters***

Flow (channel) Depth	h	=	1.0 m
Gradient of Channel Bed (Table 3, GEO SPR 1/2000)	S	=	15 °
Density of Debris Flow	ρ_{df}	=	1200 kg/m^3
Debris Flow Viscosity (Hungr et al. 1984 recommend)	υ_{df}	=	3 kPa.s
Channel Shape (trapezium) Coefficient	k	=	5
Manning's Channel Roughness Coefficient (natural channel)	n	=	0.04
Coefficient accounting for grain properties & concent. of solids	ξ	=	2.17 $m^{-1/2} s^{-1}$
Gravitational Acceleration	g	=	9.81 m/s^2
Apparent Friction Angle of Debris (debris volume ≥ 400 m^3)	ϕ_a	=	20 °
Entry Channel Slope Angle	θ_{cs}	=	32 °
Assumed Run out Slope Angle	θ_R	=	10 °
Assumed Runup Slope Angle	θ_{up}	=	32 °

Prepared: smb Date: Jan 03 Checked: Date:

1. Determination of Debris Discharge

Apply Hydraulic Theory: $Q = \sqrt{\frac{g \times A^3}{b}}$ (m^3/s)

given: g = 9.81 m/s^2
A = 3.5 m^2
b = 6 m

$\therefore Q$ = 8.37 m^3/s ⇐

2. Determination of Debris Velocity (v)

Calculation is based on Lo (2000), GEO Report 104, Review of Natural Terrain Landslide Debris-Resisting Barrier Design)

(a) Apply Newtonian Laminar Flow:

$$v = \frac{\rho_{df}\, g\, h^2 S}{k\, \upsilon_{df}} = \mathbf{0.205} \text{ m/s}$$

(b) Apply Newtonian Turbulent Flow:

$$v = \frac{1}{n} h^{2/3} S^{1/2} = \mathbf{12.79} \text{ m/s}$$

(c) Apply Dilatant Flow:

$$v = \xi h^{3/2} S^{1/2} = \mathbf{1.11} \text{ m/s}$$

(d) Empirical:

$$v = k^* h^{2/3} S^{1/5} = \mathbf{7.65} \text{ m/s}$$

⇐ (Du et al. (1987) suggested when h<2.5m, k^* =10)

(e) Basic Flow Equation

$v = Q / A$ = **2.39** m/s ⇐ (from above Q = 8.37 m^3/s)

CONCLUSION:

GEO, Report 104, Fig 21, show that slip volume < 2000m^3, the debris max. velocity = 10.5 m/s
From the above, the most likely result of the velocity = **7.65** m/s

Prepared: SMo Date: Jan 03 Checked: Date:

3. Determination of Runout Distance (X_L)

(a) Apply Lumped-mass Model:

$$X_L = \frac{v_0^2}{2 g \cos \theta_R (\tan \varphi_a - \tan \theta_R)}$$

X_L = **28.88** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **15.33** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Leading-edge Model:

$$X_L = v_0^2 \cos^2(\theta_{cs} - \theta_R)\left[1 + \frac{g\, h \cos \theta_{cs}}{2 v_0^2}\right]^2 \times \frac{1}{G}$$

where $G = g\,(S_f \cos\theta_R - \sin \theta_R)$
$S_f = \tan \phi_a$ (Hungr & McClung (1987) suggested)

$\Rightarrow$ G = 1.9086
$\therefore$ X_L = **53.48** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **30.23** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Constant Rate of Deposition (Van Gassen & Cruden 1989):

$$X_L = \frac{3}{2} \times \frac{v_0^2}{2 g \cos\theta_R (\tan \varphi_a - \tan \theta_R)}$$

X_L = **43.32** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **22.99** (when V_0 = **7.65** m/s, Empirical Eq.)

Expected max. run-out (X_L) = 53.48 m (No mitigation measures taken into account)

Prepared: SMB Date: Jan 03 Checked: Date:

4. Determination of Vertical Runup Distance (Δh)

(a) Apply Lumped-mass Model:

$$\Delta h = \frac{v_0^{\,2} \tan\theta_{up}}{2g\left(\tan\phi_a + \tan\theta_{up}\right)}$$

Δh = **3.52** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
Δh = **1.87** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Lumped-mass Model Corrected for Momentum Change (Perla et al, 1980):

$$\Delta h = \frac{v_0^{\,2} \cos^2\left(\theta_{cs} + \theta_{up}\right) \tan\theta_{up}}{2\,g\left(\tan\varphi_a + \tan\theta_{up}\right)}$$

Δh = **0.68** m (when V_0 = **10.5** m/s, GEO Report 104,Fig 21)
Δh = **0.36** m (when V_0 = **7.65** m/s, Empirical Eq.)

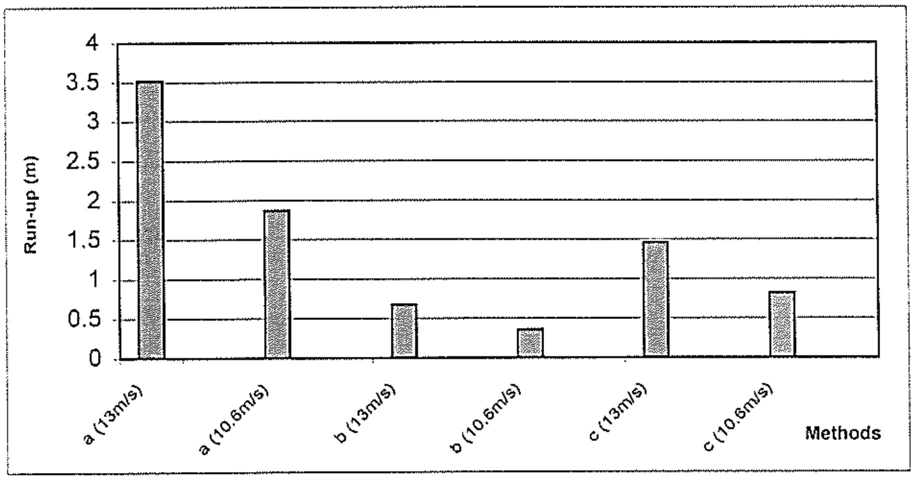
(c) Apply Leading-edge Model (Hungr & McClung, 1987; Takahashi & Yoshida, 1979):

$$\Delta h = \frac{v_0^{\,2} \cos^2\left(\theta_{cs} + \theta_{up}\right) \tan\theta_{up}}{g\left(\tan\phi_a + \tan\theta_{up}\right)} \left(1 + \frac{gh\cos\theta_{cs}}{2v_0^{\,2}}\right)^2$$

Δh = **1.46** m (when V_0 = **10.5** m/s, GEO, Report 104, Fig 21)
Δh = **0.82** m (when V_0 = **7.65** m/s, Empirical Eq.)

Run-up (m)					
(Method)					
a (13m/s)	a (10.6m/s)	b (13m/s)	b (10.6m/s)	c (13m/s)	c (10.6m/s)
3.52	1.87	0.68	0.36	1.46	0.82

Average
1.45167 (m)



Prepared: SMo Date: Jan 03 Checked: Date:

DEBRIS FLOW CHARACTERISATION OF DESIGN EVENTS

Location: **Catchment 7 (total landslide volume 628 m^3)**

Design Assumption:

1. The density of the debris has been estimated as follows:
values of 5% carried debris have been quoted, but to be on the safe side 20% will be assumed, and this gives a debris density of (20% of 2000 kg/m^3 and 80% of 1000 kg/m^3) 1200 kg/m^3.

Therefore, unit weight of debris flow (γ_{df}) = 1200 kg/m^3
unit weight of water (γ_w) = 1000 kg/m^3
unit weight of debris solid (γ_{ds}) = 2000 kg/m^3

2. The peak discharge of debris flow has been estimated assuming debris building up behind a temporary dam at a location in the channel, which subsequently fails and produces a wave of debris (Hungr et al. 1984; Frenette *et al.* 1997).

3. The channelised debris flow is assumed and the channel debris yield rate observed in some natural terrian landslides on Lantau Island was estimated to be about 2.3 m^3/m to 3.66 m^3/m (Franks 1998).Therefore, cross-sectional area for this channelised debris is assumed:

X-section area for the channelised debris (A) = 3.5 m^2
channel width (b) = 6 m
channel depth (for trapezoid channel, h) = 1.0 m (base width = 1m is assumed)

4. Estimation of debris velocity, run-out distance, vertical runup distance and debris impact load are based on GEO Report 104, Review of Natural Terrian Landslide Debris-Resisting Barrier Design, GEO, January 2000, by D.O.K. Lo'.

5. ***Design Parameters***

Flow (channel) Depth h = 1.0 m
Gradient of Channel Bed (Table 3, GEO SPR 1/2000) - S = 15 °
Density of Debris Flow ρ_{df} = 1200 kg/m^3
Debris Flow Viscosity (Hungr et al. 1984 recommend) υ_{df} = 3 kPa.s
Channel Shape (trapezium) Coefficient k = 5
Manning's Channel Roughness Coefficient (natural channel) n = 0.04
Coefficient accounting for grain properties & concent. of solids ξ = 2.17 $m^{-1/2} s^{-1}$
Gravitational Acceleration g = 9.81 m/s^2
Apparent Friction Angle of Debris (debris volume ≥ 400 m^3) ϕ_a = 20 °
Entry Channel Slope Angle θ_{cs} = 32 °
Assumed Run out Slope Angle θ_R = 10 °
Assumed Runup Slope Angle θ_{up} = 32 °

Prepared: SMB Date: Jan 03 Checked: Date:

1. Determination of Debris Discharge

Apply Hydraulic Theory: $$Q = \sqrt{\frac{g \times A^3}{b}} \quad (m^3/s)$$

given:
g = 9.81 m/s^2
A = 3.5 m^2
b = 6 m

$\therefore Q$ = **8.37** m^3/s ⇐

2. Determination of Debris Velocity (v)

Calculation is based on Lo (2000), GEO Report 104, Review of Natural Terrain Landslide Debris-Resisting Barrier Design)

(a) Apply Newtonian Laminar Flow:

$$v = \frac{\rho_{df}\, g\, h^2 S}{k\, \upsilon_{df}} = \mathbf{0.205} \text{ m/s}$$

(b) Apply Newtonian Turbulent Flow:

$$v = \frac{1}{n} h^{2/3} S^{1/2} = \mathbf{12.79} \text{ m/s}$$

(c) Apply Dilatant Flow:

$$v = \xi h^{3/2} S^{1/2} = \mathbf{1.11} \text{ m/s}$$

(d) Empirical:

$$v = k^* h^{2/3} S^{1/5} = \mathbf{7.65} \text{ m/s}$$ ⇐ (Du et al. (1987) suggested when h<2.5m, k* =10)

(e) Basic Flow Equation

$v = Q / A$ = **2.39** m/s ⇐ (from above Q = 8.37 m^3/s)

CONCLUSION:

GEO, Report 104, Fig 21, show that slip volume < 2000m^3, the debris max. velocity = **10.5 m/s**
From the above, the most likely result of the velocity = **7.65** m/s

Prepared: SMo Date: Jan 03 Checked: Date:

3. Determination of Runout Distance (X_L)

(a) Apply Lumped-mass Model:

$$X_L = \frac{v_0^2}{2 g \cos \theta_R (\tan \varphi_a - \tan \theta_R)}$$

X_L = **28.88** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **15.33** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Leading-edge Model:

$$X_L = v_0^2 \cos^2(\theta_{cs} - \theta_R)\left[1 + \frac{g h \cos \theta_{cs}}{2 v_0^2}\right]^2 \times \frac{1}{G}$$

where $G = g (S_f \cos\theta_R - \sin \theta_R)$
$S_f = \tan \phi_a$ (Hungr & McClung (1987) suggested)

$\Rightarrow$ G = 1.9086
$\therefore$ X_L = **53.48** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **30.23** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Constant Rate of Deposition (Van Gassen & Cruden 1989):

$$X_L = \frac{3}{2} \times \frac{v_0^2}{2 g \cos\theta_R (\tan \varphi_a - \tan \theta_R)}$$

X_L = **43.32** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **22.99** (when V_0 = **7.65** m/s, Empirical Eq.)

Expected max. run-out (X_L) = 53.48 m (No mitigation measures taken into account)

Prepared: SMo Date: Jan 03 Checked: Date:

4. Determination of Vertical Runup Distance (Δh)

(a) Apply Lumped-mass Model:

$$\Delta h = \frac{v_0^2 \tan\theta_{up}}{2g\left(\tan\phi_a + \tan\theta_{up}\right)}$$

Δh = **3.52** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
Δh = **1.87** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Lumped-mass Model Corrected for Momentum Change (Perla et al, 1980):

$$\Delta h = \frac{v_0^2 \cos^2\left(\theta_{cs} + \theta_{up}\right) \tan\theta_{up}}{2g\left(\tan\varphi_a + \tan\theta_{up}\right)}$$

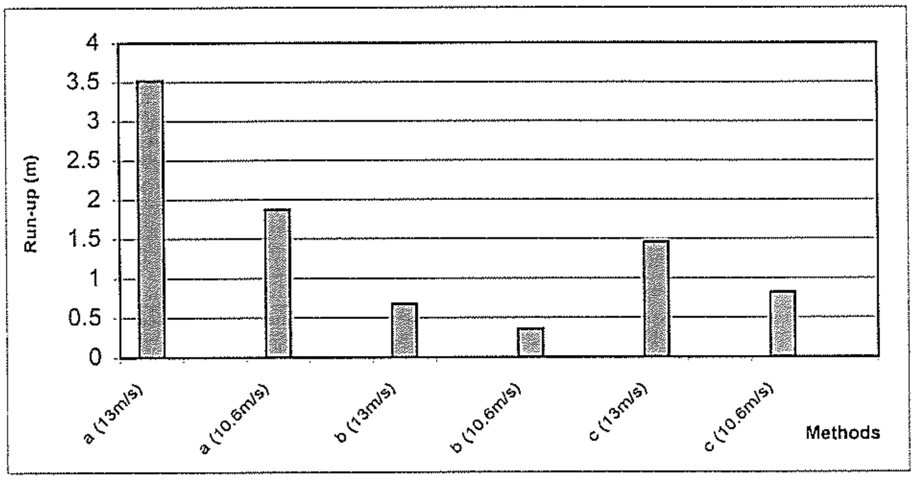
Δh = **0.68** m (when V_0 = **10.5** m/s, GEO Report 104,Fig 21)
Δh = **0.36** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Leading-edge Model (Hungr & McClung, 1987; Takahashi & Yoshida, 1979):

$$\Delta h = \frac{v_0^2 \cos^2\left(\theta_{cs} + \theta_{up}\right) \tan\theta_{up}}{g\left(\tan\phi_a + \tan\theta_{up}\right)} \left(1 + \frac{gh\cos\theta_{cs}}{2v_0^2}\right)^2$$

Δh = **1.46** m (when V_0 = **10.5** m/s, GEO, Report 104, Fig 21)
Δh = **0.82** m (when V_0 = **7.65** m/s, Empirical Eq.)

Run-up (m)						
(Method)						
a (13m/s)	a (10.6m/s)	b (13m/s)	b (10.6m/s)	c (13m/s)	c (10.6m/s)	**Average**
3.52	1.87	0.68	0.36	1.46	0.82	**1.45167** (m)



Prepared: SMb Date: Jun 03 Checked: Date:

DEBRIS FLOW CHARACTERISATION OF DESIGN EVENTS

Location: **Catchment 8 (total landslide volume 655 m^3)**

Design Assumption:

1. The density of the debris has been estimated as follows:
values of 5% carried debris have been quoted, but to be on the safe side 20% will be assumed, and this gives a debris density of (20% of 2000 kg/m^3 and 80% of 1000 kg/m^3) 1200 kg/m^3.

Therefore, unit weight of debris flow (γ_{df}) = 1200 kg/m^3
unit weight of water (γ_w) = 1000 kg/m^3
unit weight of debris solid (γ_{ds}) = 2000 kg/m^3

2. The peak discharge of debris flow has been estimated assuming debris building up behind a temporary dam at a location in the channel, which subsequently fails and produces a wave of debris (Hungr et al. 1984; Frenette *et al.* 1997).

3. The channelised debris flow is assumed and the channel debris yield rate observed in some natural terrian landslides on Lantau Island was estimated to be about 2.3 m^3/m to 3.66 m^3/m (Franks 1998).Therefore, cross-sectional area for this channelised debris is assumed:

X-section area for the channelised debris (A) = 3.5 m^2
channel width (b) = 6 m
channel depth (for trapezoid channel, h) = 1.0 m (base width = 1m is assumed)

4. Estimation of debris velocity, run-out distance, vertical runup distance and debris impact load are based on GEO Report 104, Review of Natural Terrian Landslide Debris-Resisting Barrier Design, GEO, January 2000, by D.O.K. Lo'.

5. ***Design Parameters***

Flow (channel) Depth h = 1.0 m
Gradient of Channel Bed (Table 3, GEO SPR 1/2000) S = 15 °
Density of Debris Flow ρ_{df} = 1200 kg/m^3
Debris Flow Viscosity (Hungr et al. 1984 recommend) υ_{df} = 3 kPa.s
Channel Shape (trapezium) Coefficient k = 5
Manning's Channel Roughness Coefficient (natural channel) n = 0.04
Coefficient accounting for grain properties & concent. of solids ξ = 2.17 $m^{-1/2} s^{-1}$
Gravitational Acceleration g = 9.81 m/s^2
Apparent Friction Angle of Debris (debris volume $\geq$ 400 m^3) ϕ_a = 20 °
Entry Channel Slope Angle θ_{cs} = 32 °
Assumed Run out Slope Angle θ_R = 10 °
Assumed Runup Slope Angle θ_{up} = 32 °

Prepared: smb Date: Jan 03 Checked: Date:

1. Determination of Debris Discharge

Apply Hydraulic Theory:

$$Q = \sqrt{\frac{g \times A^3}{b}} \qquad (\mathrm{m^3/s})$$

given: $g = 9.81$ $\mathrm{m/s^2}$
$A = 3.5$ $\mathrm{m^2}$
$b = 6$ m

$\therefore$ **Q = 8.37 $\mathrm{m^3/s}$** ⇐

2. Determination of Debris Velocity (v)

Calculation is based on Lo (2000), GEO Report 104, Review of Natural Terrain Landslide Debris-Resisting Barrier Design)

(a) Apply Newtonian Laminar Flow:

$$v = \frac{\rho_{df}\, g\, h^2 S}{k\, \upsilon_{df}} = \mathbf{0.205} \quad \mathrm{m/s}$$

(b) Apply Newtonian Turbulent Flow:

$$v = \frac{1}{n} h^{2/3} S^{1/2} = \mathbf{12.79} \quad \mathrm{m/s}$$

(c) Apply Dilatant Flow:

$$v = \xi\, h^{3/2} S^{1/2} = \mathbf{1.11} \quad \mathrm{m/s}$$

(d) Empirical:

$$v = k^*\, h^{2/3} S^{1/5} = \mathbf{7.65} \quad \mathrm{m/s}$$

⇐ (Du et al. (1987) suggested when h<2.5m, k* =10)

(e) Basic Flow Equation

$$v = Q / A = \mathbf{2.39} \quad \mathrm{m/s}$$

⇐ (from above Q = 8.37 $\mathrm{m^3/s}$)

CONCLUSION:

GEO, Report 104, Fig 21, show that slip volume < 2000m^3, the debris max. velocity = **10.5 m/s**
From the above, the most likely result of the velocity = **7.65** m/s

Prepared: gmb Date: Jan 03 Checked: Date:

3. Determination of Runout Distance (X_L)

(a) Apply Lumped-mass Model:

$$X_L = \frac{v_0^2}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L = **28.88** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **15.33** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Leading-edge Model:

$$X_L = v_0^2\cos^2(\theta_{cs} - \theta_R)\left[1 + \frac{g\,h\cos\theta_{cs}}{2\,v_0^2}\right]^2 \times \frac{1}{G}$$

where $G = g\,(S_f\cos\theta_R - \sin\theta_R)$
$S_f = \tan\phi_a$ (Hungr & McClung (1987) suggested)

$\Rightarrow$ G = 1.9086
$\therefore$ X_L = **53.48** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **30.23** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Constant Rate of Deposition (Van Gassen & Cruden 1989):

$$X_L = \frac{3}{2}\times\frac{v_0^2}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L = **43.32** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **22.99** (when V_0 = **7.65** m/s, Empirical Eq.)

Expected max. run-out (X_L) = **53.48** **m** (No mitigation measures taken into account)

Prepared: SMO Date: Jan 03 Checked: Date:

4. Determination of Vertical Runup Distance (Δh)

(a) Apply Lumped-mass Model:

$$\Delta h = \frac{v_0^{\,2} \tan\theta_{up}}{2g\left(\tan\phi_a + \tan\theta_{up}\right)}$$

Δh = **3.52** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
Δh = **1.87** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Lumped-mass Model Corrected for Momentum Change (Perla et al, 1980):

$$\Delta h = \frac{v_0^{\,2} \cos^2\left(\theta_{cs} + \theta_{up}\right) \tan\theta_{up}}{2\,g\left(\tan\varphi_a + \tan\theta_{up}\right)}$$

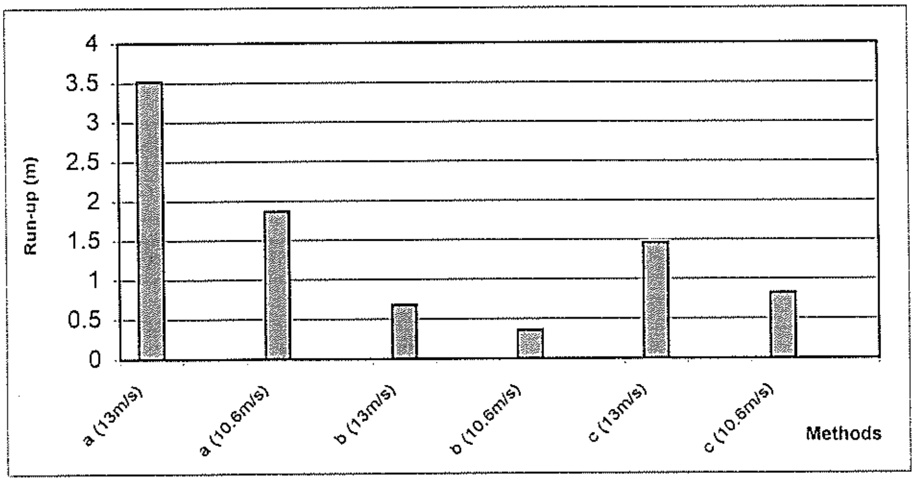
Δh = **0.68** m (when V_0 = **10.5** m/s, GEO Report 104,Fig 21)
Δh = **0.36** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Leading-edge Model (Hungr & McClung, 1987; Takahashi & Yoshida, 1979):

$$\Delta h = \frac{v_0^{\,2} \cos^2\left(\theta_{cs} + \theta_{up}\right)\tan\theta_{up}}{g\left(\tan\phi_a + \tan\theta_{up}\right)}\left(1 + \frac{gh\cos\theta_{cs}}{2v_0^{\,2}}\right)^2$$

Δh = **1.46** m (when V_0 = **10.5** m/s, GEO, Report 104, Fig 21)
Δh = **0.82** m (when V_0 = **7.65** m/s, Empirical Eq.)

Run-up (m)						
(Method)						
a (13m/s)	a (10.6m/s)	b (13m/s)	b (10.6m/s)	c (13m/s)	c (10.6m/s)	**Average**
3.52	1.87	0.68	0.36	1.46	0.82	**1.45167** (m)



Prepared: gmo Date: Jan 03 Checked: Date:

DEBRIS FLOW CHARACTERISATION OF DESIGN EVENTS

Location: **Catchment 9 (total landslide volume 701 m^3)**

Design Assumption:

1. The density of the debris has been estimated as follows:
values of 5% carried debris have been quoted, but to be on the safe side 20% will be assumed, and this gives a debris density of (20% of 2000 kg/m^3 and 80% of 1000 kg/m^3) 1200 kg/m^3.
Therefore,
unit weight of debris flow (γ_{df}) = 1200 kg/m^3
unit weight of water (γ_w) = 1000 kg/m^3
unit weight of debris solid (γ_{ds}) = 2000 kg/m^3

2. The peak discharge of debris flow has been estimated assuming debris building up behind a temporary dam at a location in the channel, which subsequently fails and produces a wave of debris (Hungr et al. 1984; Frenette *et al.* 1997).

3. The channelised debris flow is assumed and the channel debris yield rate observed in some natural terrian landslides on Lantau Island was estimated to be about 2.3 m^3/m to 3.66 m^3/m (Franks 1998).Therefore, cross-sectional area for this channelised debris is assumed:
X-section area for the channelised debris (A) = 3.5 m^2
channel width (b) = 6 m
channel depth (for trapezoid channel, h) = 1.0 m (base width = 1m is assumed)

4. Estimation of debris velocity, run-out distance, vertical runup distance and debris impact load are based on GEO Report 104, Review of Natural Terrian Landslide Debris-Resisting Barrier Design, GEO, January 2000, by D.O.K. Lo'.

5. ***Design Parameters***

Flow (channel) Depth	h	=	1.0 m
Gradient of Channel Bed (Table 3, GEO SPR 1/2000)	S	=	15 °
Density of Debris Flow	ρ_{df}	=	1200 kg/m^3
Debris Flow Viscosity (Hungr et al. 1984 recommend)	υ_{df}	=	3 kPa.s
Channel Shape (trapezium) Coefficient	k	=	5
Manning's Channel Roughness Coefficient (natural channel)	n	=	0.04
Coefficient accounting for grain properties & concent. of solids	ξ	=	2.17 m$^{-1/2}$ s^{-1}
Gravitational Acceleration	g	=	9.81 m/s^2
Apparent Friction Angle of Debris (debris volume ≥ 400 m^3)	ϕ_a	=	20 °
Entry Channel Slope Angle	θ_{cs}	=	31 °
Assumed Run out Slope Angle	θ_R	=	15 °
Assumed Runup Slope Angle	θ_{up}	=	32 °

Prepared: SMb Date: Jan 03 Checked: Date:

1. Determination of Debris Discharge

Apply Hydraulic Theory: $Q = \sqrt{\dfrac{g \times A^3}{b}}$ (m^3/s)

given:
$g = 9.81$ m/s^2
$A = 3.5$ m^2
$b = 6$ m

$\therefore Q = $ **8.37** m^3/s ⇐

2. Determination of Debris Velocity (v)

Calculation is based on Lo (2000), GEO Report 104, Review of Natural Terrain Landslide Debris-Resisting Barrier Design)

(a) Apply Newtonian Laminar Flow:

$$v = \frac{\rho_{df}\, g\, h^2 S}{k\, \upsilon_{df}} = \mathbf{0.205} \text{ m/s}$$

(b) Apply Newtonian Turbulent Flow:

$$v = \frac{1}{n} h^{2/3} S^{1/2} = \mathbf{12.79} \text{ m/s}$$

(c) Apply Dilatant Flow:

$$v = \xi\, h^{3/2} S^{1/2} = \mathbf{1.11} \text{ m/s}$$

(d) Empirical:

$$v = k^* h^{2/3} S^{1/5} = \mathbf{7.65} \text{ m/s}$$ ⇐ (Du et al. (1987) suggested when h<2.5m, k* =10)

(e) Basic Flow Equation

$v = Q / A$ = **2.39** m/s ⇐ (from above Q = 8.37 m^3/s)

CONCLUSION:

GEO, Report 104, Fig 21, show that slip volume < 2000m^3, the debris max. velocity = 10.5 m/s
From the above, the most likely result of the velocity = **7.65** m/s

Prepared: smb Date: Jan 03 Checked: Date:

3. Determination of Runout Distance (X_L)

(a) Apply Lumped-mass Model:

$$X_L = \frac{v_0^{\,2}}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L = **54.92** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **29.14** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Leading-edge Model:

$$X_L = v_0^{\,2}\cos^2(\theta_{cs} - \theta_R)\left[1 + \frac{g\,h\cos\theta_{cs}}{2\,v_0^{\,2}}\right]^2 \times \frac{1}{G}$$

where $G = g\,(S_f\cos\theta_R - \sin\theta_R)$
$S_f = \tan\phi_a$ (Hungr & McClung (1987) suggested)

$\Rightarrow$ G = 1.0038
$\therefore$ X_L = **109.37** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **61.87** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Constant Rate of Deposition (Van Gassen & Cruden 1989):

$$X_L = \frac{3}{2} \times \frac{v_0^{\,2}}{2\,g\cos\theta_R(\tan\varphi_a - \tan\theta_R)}$$

X_L = **82.37** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
X_L = **43.71** (when V_0 = **7.65** m/s, Empirical Eq.)

Expected max. run-out (X_L) = **109.37** m (No mitigation measures taken into account)

Prepared: SMo Date: Jan 03 Checked: Date:

4. Determination of Vertical Runup Distance (Δh)

(a) Apply Lumped-mass Model:

$$\Delta h = \frac{v_0^{\;2}\tan\theta_{up}}{2g\left(\tan\phi_a + \tan\theta_{up}\right)}$$

Δh = **3.52** m (when V_0 = **10.5** m/s, GEO Report 104, Fig 21)
Δh = **1.87** m (when V_0 = **7.65** m/s, Empirical Eq.)

(b) Apply Lumped-mass Model Corrected for Momentum Change (Perla et al, 1980):

$$\Delta \mathrm{h} = \frac{\mathrm{v}_0^{\;2}\cos^2(\theta_{cs}+\theta_{up})\tan\theta_{up}}{2\,\mathrm{g}\left(\tan\varphi_a + \tan\theta_{up}\right)}$$

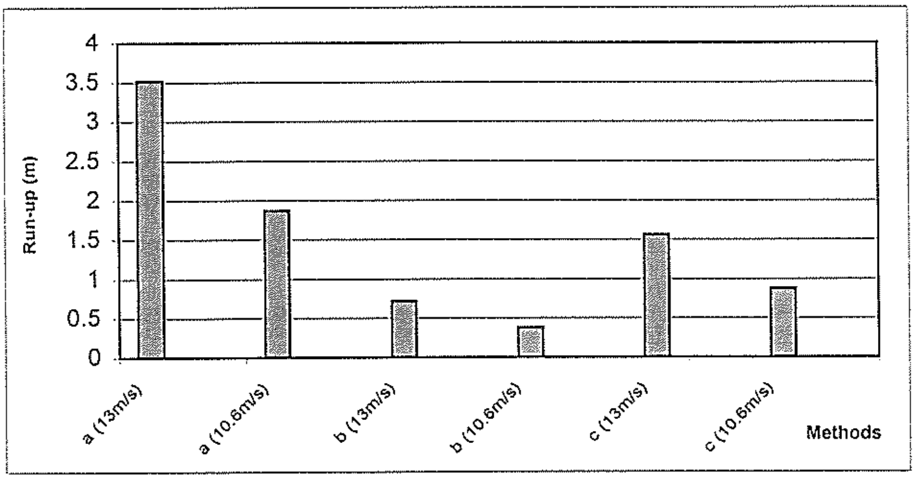
Δh = **0.72** m (when V_0 = **10.5** m/s, GEO Report 104,Fig 21)
Δh = **0.38** m (when V_0 = **7.65** m/s, Empirical Eq.)

(c) Apply Leading-edge Model (Hungr & McClung, 1987; Takahashi & Yoshida, 1979):

$$\Delta h = \frac{v_0^{\;2}\cos^2\left(\theta_{cs}+\theta_{up}\right)\tan\theta_{up}}{g\left(\tan\phi_a + \tan\theta_{up}\right)}\left(1 + \frac{gh\cos\theta_{cs}}{2v_0^{\;2}}\right)^2$$

Δh = **1.56** m (when V_0 = **10.5** m/s, GEO, Report 104, Fig 21)
Δh = **0.88** m (when V_0 = **7.65** m/s, Empirical Eq.)

Run-up (m)						
(Method)						
a (13m/s)	a (10.6m/s)	b (13m/s)	b (10.6m/s)	c (13m/s)	c (10.6m/s)	**Average**
3.52	1.87	0.72	0.38	1.56	0.88	**1.48833** (m)



Prepared: smb Date: Jan 03 Checked: Date:

Table G2 - Summary of Calculations

	OPEN HILLSLOPE LANDSLIDES			CHANNELISED DEBRIS FLOWS		
		Capacity of Bund (2)			Capacity of Bund (2)	
Catchment No.	Run-Out Distance (m) (1)	Height (m)	Distance (m)	Run-Out Distance (m) (1)	Height (m)	Distance (m)
3	11.84	2.5	1.7	36.05	2.5	13.2
4	12.06	2.5	2	31.06	2.5	11.5
5	12.01	2.5	1.9	35.48	2.5	13.6
6A	15.08	2.5	1.7	45.34	2.5	11.5
6B	15.64	2.5	2.6	53.48	2.5	12
7	14.66	2.5	1.2	53.48	2.5	11.6
8	14.97	2.5	1.6	53.48	2.5	12.8
9	22.38	2.5	2	109.37	2.5	13.8

Notes : (1) Run-Out Distance of hazards excluding mitigation measures
(2) Height and Distance from slope toe

Conclusions:

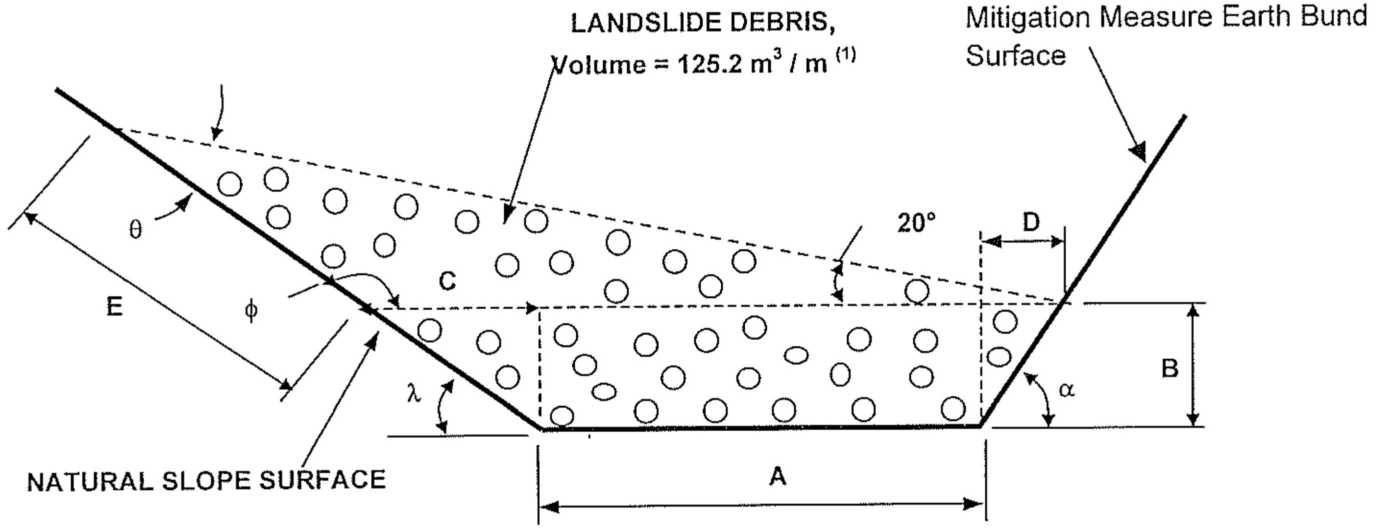
Say 3m

Calculations for Open Hillslope Landslides reveal that mitigation measures in the form of a 2.5 m height barrier should be constructed at minimum distances between 1.2 and 2.6m from the slope toe to contain the landslide debris. Calculations for Channelised Debris Flows reveal that mitigation measures in the form of a 2.5 m height barrier should be constructed at minimum distances between 11.5 and 13.8m from the drainage mouth to contain the landslide debris.

Say 14m.

3m

Thus, for consistency of construction and to contain both open hillslope landslide and channelised debris flow hazards, the proposed mitigation measure in the form of a ramp-up barrier is recommended at a minimum distance of ~~4m~~ from the slope toe. Taking into consideration the locations of existing formed slopes at the toe of the natural terrain and channel structures, the exact location of the proposed mitigation measures is shown in the Mitigation Strategy Map in Appendix H.


LANDSLIDE DEBRIS,
Volume = 125.2 m³ / m ⁽¹⁾
Mitigation Measure Earth Bund Surface
θ
E
ϕ
C
20°
D
B
α
λ
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	56	°
α	32	°
A	13.2	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 36.00$

$D = B \ / \ \tan \alpha \quad = \quad 4.00$

$C = B \ / \ \tan \lambda \quad = \quad 1.69$

$H = A + C + D \quad = \quad 18.89$

$\phi = 180 - \lambda \quad = \quad 124.00$

$E = H \sin 20 \ / \ \sin \theta \quad = \quad 10.99$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \ / \ 2$

$= \quad 40.1089 \ \text{m}^3$

Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \ \sin \phi \ / \ 2$

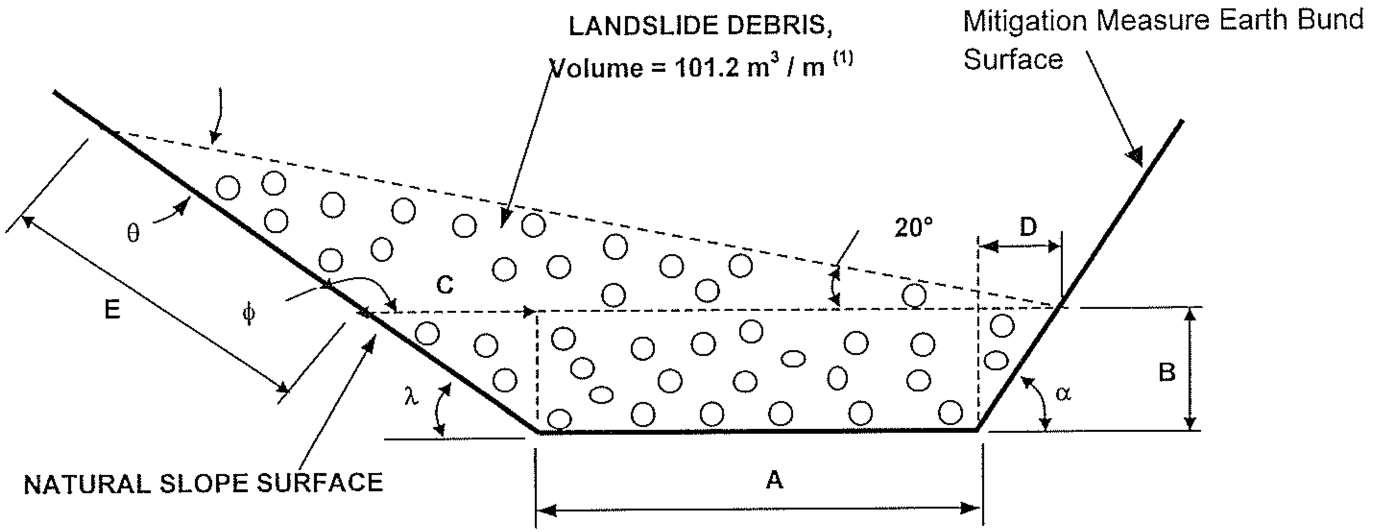
$= \quad 86.04 \ \text{m}^3$

Total Volume = Area $_T$ + Area $_\Delta$ = **126.15** m^3 / m

(Therefore, a 2.5m ~~barrier of a minimum~~ distance of 13.2m from slope toe will contain CE of 125.2m³ / m)

Notes: (1) Volume = Final Run-Out Volume / Trail Width (6m)

Subject Capacity Against Channelised Debris Flow (Catchment 3)	Prepared Smo	Checked KWK		
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.	


LANDSLIDE DEBRIS,
Volume = 101.2 m³ / m (1)
Mitigation Measure Earth Bund Surface
NATURAL SLOPE SURFACE
θ
E
ϕ
C
λ
20°
D
B
α
A

INPUT DATA

λ	60	°
α	32	°
A	11.5	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 40.00$

$D = B \ / \ \tan\alpha \quad = \quad 4.00$

$C = B \ / \ \tan\lambda \quad = \quad 1.44$

$H = A + C + D \quad = \quad 16.94$

$\phi = 180 - \lambda \quad = \quad 120.00$

$E = H \ \sin 20 \ / \ \sin\theta \quad = \quad 9.02$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \ / \ 2$

$= \quad 35.5553 \ m^3$

Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \ \sin\phi \ / \ 2$

$= \quad 66.15 \ m^3$

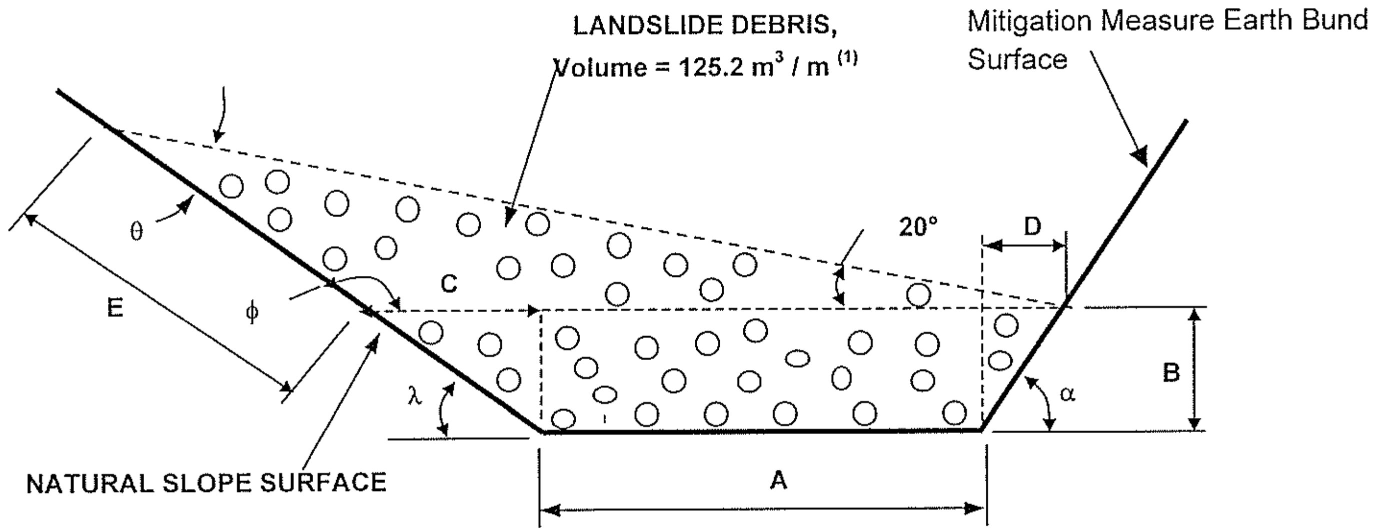
101 + 6

Total Volume = Area$_T$ + Area$_\Delta$ = 101.70 m^3 / m

(Therefore, a 2.5m barrier of a minimum distance of 11.5m from slope toe will contain CE of 101.2 m^3 / m)

Notes: (1) Volume = Final Run-Out Volume / Trail Width (6m)

Subject Capacity Against Channelised Debris Flow (Catchment 4)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 125.2 m³ / m (1)
Mitigation Measure Earth Bund Surface
θ
E
ϕ
C
20°
D
B
α
λ
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	59	°
α	32	°
A	13.6	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 39.00$

$D = B \ / \ \tan\alpha \quad = \quad 4.00$

$C = B \ / \ \tan\lambda \quad = \quad 1.50$

$H = A + C + D \quad = \quad 19.10$

$\phi = 180 - \lambda \quad = \quad 121.00$

$E = H \sin 20 \ / \ \sin\theta \quad = \quad 10.38$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \ / \ 2$

$= \quad 40.8787 \ \text{m}^3$

Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \ \sin\phi \ / \ 2$

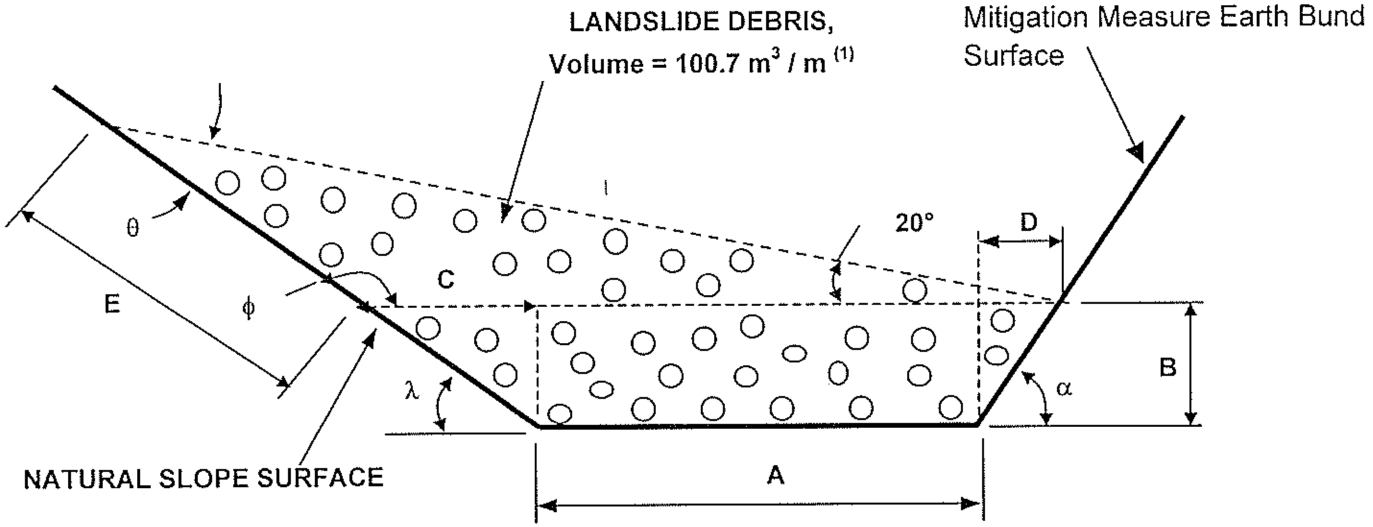
$= \quad 85.00 \ \text{m}^3$

Total Volume = Area$_T$ + Area$_\Delta$ = **125.88** m^3/m

(Therefore, a 2.5m barrier of a minimum distance of 13.6m from slope toe will contain CE of 125.20m^3 / m)

Notes: (1) Volume = Final Run-Out Volume / Trail Width (6m)

Subject Capacity Against Channelised Debris Flow (Catchment 5)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 100.7 m³ / m (1)
Mitigation Measure Earth Bund Surface
θ
E
ϕ
C
20°
D
B
α
λ
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	60	°
α	32	°
A	11.5	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 40.00$

$D = B \ / \ \tan\alpha \quad = \quad 4.00$

$C = B \ / \ \tan\lambda \quad = \quad 1.44$

Volume of Basal Trapezoid

$\text{Area}_{T} = (2A + D + C) \times B \ / \ 2$

$= \quad 35.5553 \ \text{m}^3$

$H = A + C + D \quad = \quad 16.94$

$\phi = 180 - \lambda \quad = \quad 120.00$

$E = H \sin 20 \ / \ \sin\theta \quad = \quad 9.02$

Volume of Upper Triangle

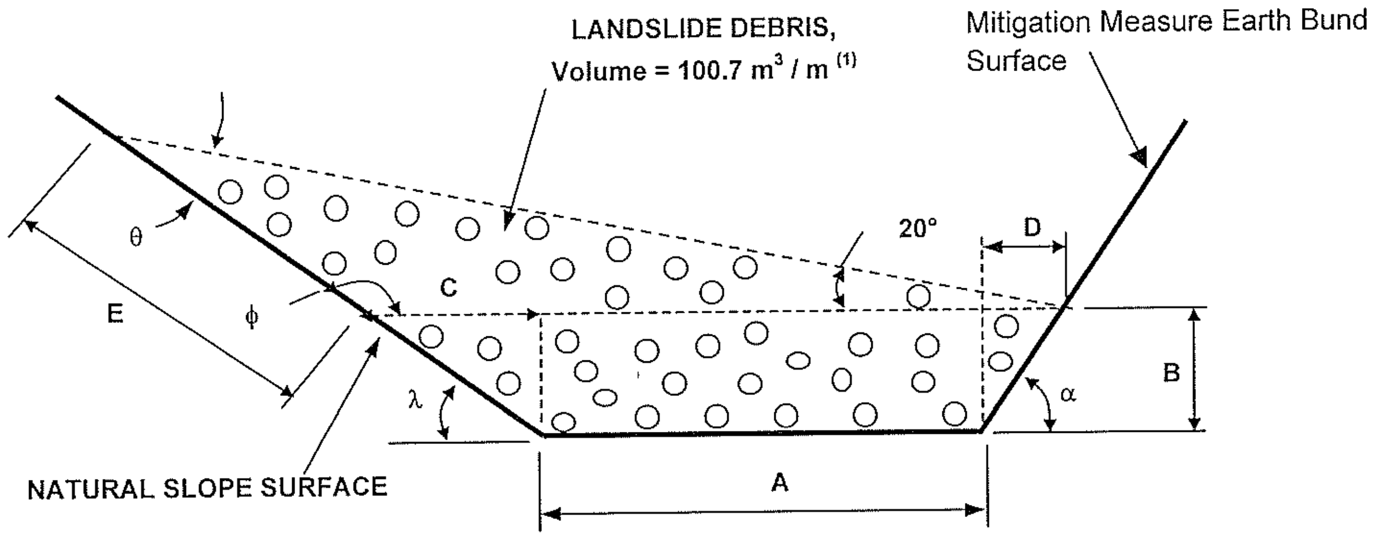
$\text{Area}_{\Delta} = E \ H \ \sin\phi \ / \ 2$

$= \quad 66.15 \ \text{m}^3$

Total Volume = Area$_{T}$ + Area$_{\Delta}$ = 101.70 m^3 / m (Therefore, a 2.5m barrier of a minimum distance of 11.5m from slope toe will contain CE of $100.7\text{m}^3 / \text{m}$)

Notes: (1) Volume = Final Run-Out Volume / Trail Width (6m)

Subject Capacity Against Channelised Debris Flow (Catchment 6A)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 100.7 m³ / m (1)
Mitigation Measure Earth Bund Surface
θ
E
ϕ
C
20°
D
B
α
λ
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	65	°
α	32	°
A	12	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 45.00$

$D = B \;/\; \tan\alpha \quad = \quad 4.00$

$C = B \;/\; \tan\lambda \quad = \quad 1.17$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \;/\; 2$

$= \quad 36.4583 \; m^3$

$H = A + C + D \quad = \quad 17.17$

$\phi = 180 - \lambda \quad = \quad 115.00$

$E = H \sin 20 \;/\; \sin\theta \quad = \quad 8.30$

Volume of Upper Triangle

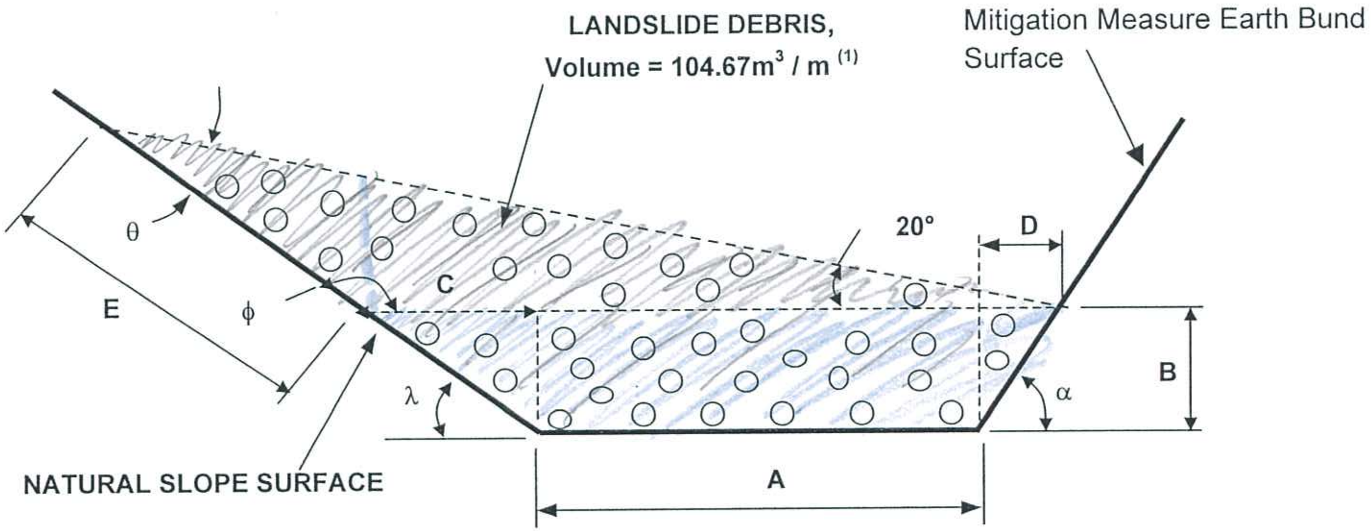
$\text{Area}_\Delta = E \; H \; \sin\phi \;/\; 2$

$= \quad 64.59 \; m^3$

Total Volume = Area$_T$ + Area$_\Delta$ = 101.05 m^3 / m (Therefore, a 2.5m barrier of a minimum distance of 12m from slope toe will contain CE of $100.7 m^3 / m$)

Notes: (1) Volume = Final Run-Out Volume / Trail Width (6m)

Subject Capacity Against Channelised Debris Flow (Catchment 6B)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 104.67m³ / m (1)
Mitigation Measure Earth Bund Surface
NATURAL SLOPE SURFACE
θ
E
ϕ
C
λ
20°
D
B
α
A

INPUT DATA

λ	**58**	°
α	**32**	°
A	**11.6**	m
B	**2.5**	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 38.00$

$D = B \ / \ \tan\alpha \quad = \quad 4.00$

$C = B \ / \ \tan\lambda \quad = \quad 1.56$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \ / \ 2$

$= \quad 35.9538 \ \text{m}^3$

$H = A + C + D \quad = \quad 17.16$

$\phi = 180 - \lambda \quad = \quad 122.00$

$E = H \sin 20 \ / \ \sin\theta \quad = \quad 9.53$

Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \ \sin\phi \ / \ 2$

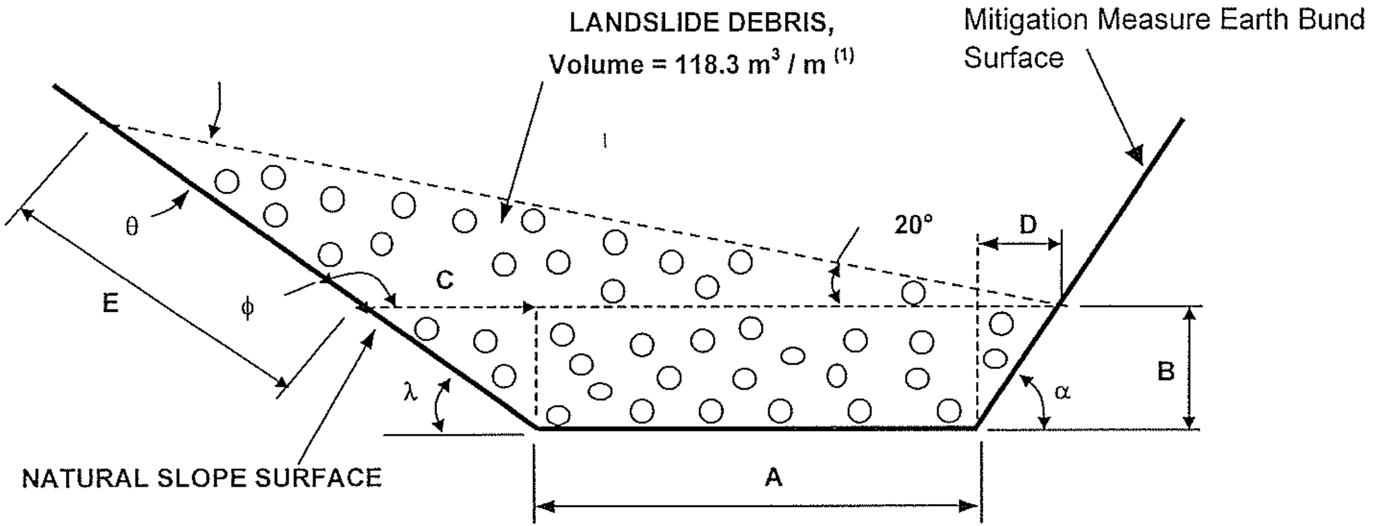
$= \quad 69.39 \ \text{m}^3$

Total Volume = Area $_T$ + Area $_\Delta$ = **105.34** m³ / m

(Therefore, a 2.5m barrier of a minimum distance of 11.6m from slope toe will contain CE of 104.67m³ / m)

Notes: (1) Volume = Final Run-Out Volume / Trail Width (6m)

Subject	Capacity Against Channelised Debris Flow (Catchment 7)	Prepared Smo	Checked JH	
Project	Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 118.3 m³ / m (1)
Mitigation Measure Earth Bund Surface
θ
E
ϕ
C
20°
D
B
λ
α
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	58	°
α	32	°
A	12.8	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 38.00$

$D = B \ / \ \tan\alpha \quad = \quad 4.00$

$C = B \ / \ \tan\lambda \quad = \quad 1.56$

$H = A + C + D \quad = \quad 18.36$

$\phi = 180 - \lambda \quad = \quad 122.00$

$E = H \ \sin 20 \ / \ \sin\theta \quad = \quad 10.20$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \ / \ 2$

$= \quad 38.9538 \ \ m^3$

Volume of Upper Triangle

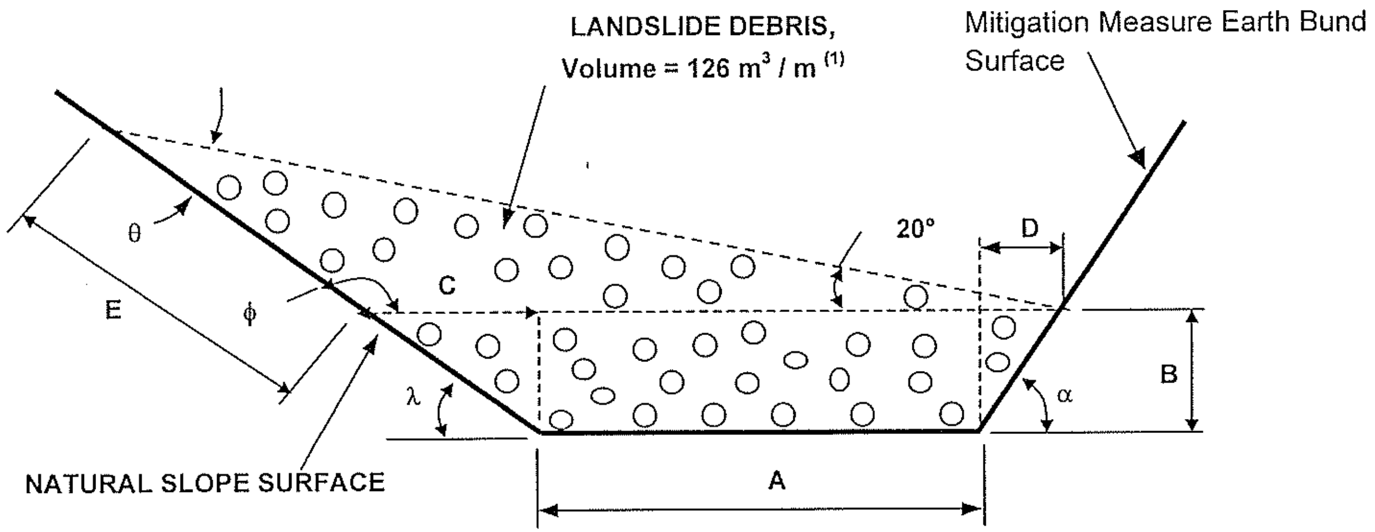
$\text{Area}_\Delta = E \ H \ \sin\phi \ / \ 2$

$= \quad 79.43 \ \ m^3$

Total Volume = Area$_T$ + Area$_\Delta$ $\quad = \quad$ **118.38** m^3/m (Therefore, a 2.5m barrier of a minimum distance of 12.8m from slope toe will contain CE of 118.3m^3 / m)

Notes: (1) Volume = Final Run-Out Volume / Trail Width (6m)

Subject Capacity Against Channelised Debris Flow (Catchment 8)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 126 m³ / m (1)
Mitigation Measure Earth Bund Surface
NATURAL SLOPE SURFACE
θ
E
φ
C
λ
20°
D
B
α
A

INPUT DATA

λ	60	°
α	32	°
A	13.8	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 40.00$

$D = B \;/\; \tan\alpha \quad = \quad 4.00$

$C = B \;/\; \tan\lambda \quad = \quad 1.44$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \;/\; 2$

$= \quad 41.3053 \quad m^3$

$H = A + C + D \quad = \quad 19.24$

$\phi = 180 - \lambda \quad = \quad 120.00$

$E = H \sin 20 \;/\; \sin\theta \quad = \quad 10.24$

Volume of Upper Triangle

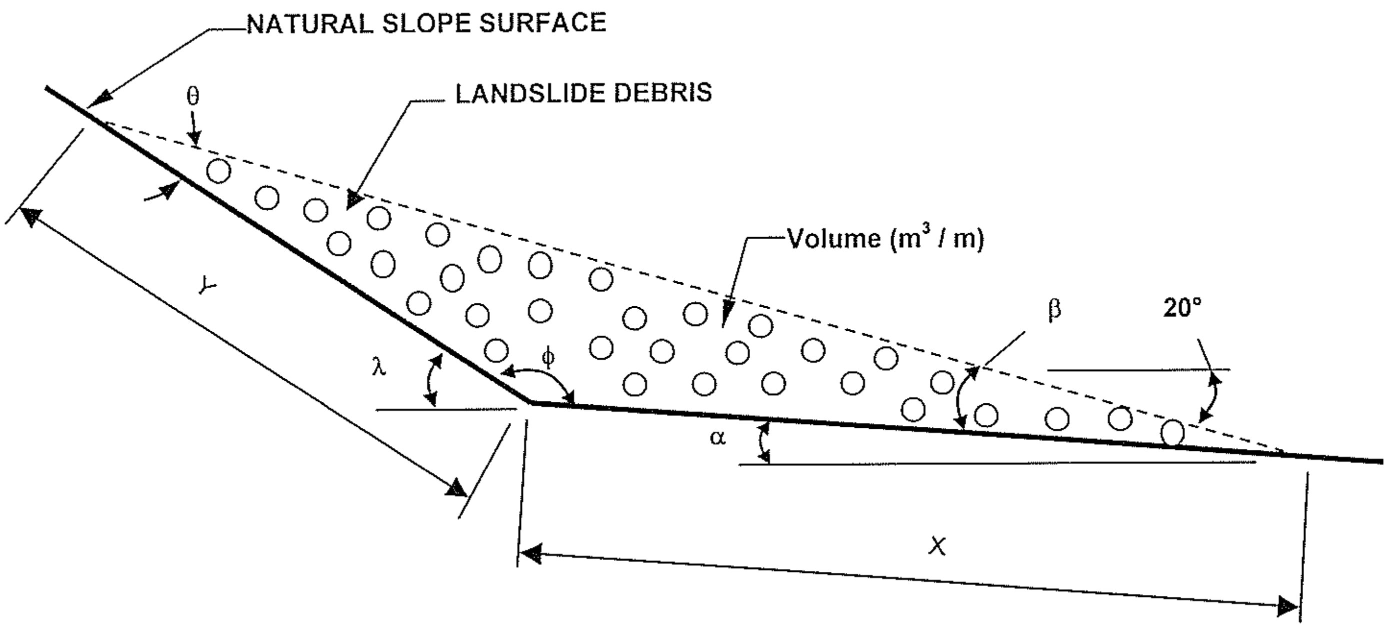
$\text{Area}_\Delta = E\ H \sin\phi \;/\; 2$

$= \quad 85.33 \quad m^3$

Total Volume = Area$_T$ + Area$_\Delta$ = **126.63** m^3/m (Therefore, a 2.5m barrier of a minimum distance of 13.8m from slope toe will contain CE of $126m^3/m$)

Notes: (1) Volume = Final Run-Out Volume / Trail Width (6m)

Subject Capacity Against Channelised Debris Flow (Catchment 9)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.



INPUT DATA

$\text{Volume}^{(1)} = 24\ m^3/m$

$\alpha = 5°$

$\lambda = 56°$

CALCULATION

$$\phi = 180 - 56 + 5 = \mathbf{129}$$
$$\beta = 20 - \alpha = \mathbf{15}$$
$$\theta = \lambda - 20 = \mathbf{36}$$

$$\textbf{Volume} = \tfrac{1}{2} X Y \sin\phi \qquad (1)$$

$$\frac{\sin\beta}{Y} = \frac{\sin\theta}{X} \Rightarrow Y = \frac{X\sin\beta}{\sin\theta} \qquad (2)$$

sub (2) into (1)

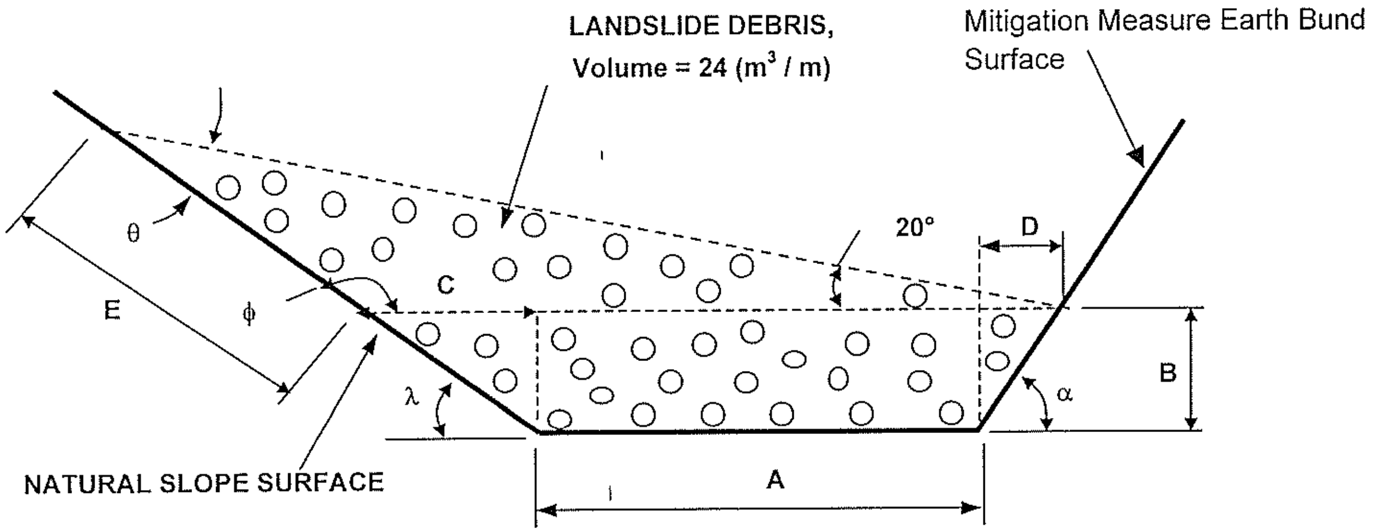
$$\text{Volume} = \frac{1}{2} \times \frac{X\sin\beta}{\sin\theta} \times \sin\phi$$

$$X^2 = \frac{2 \times 24 \times \sin 36}{\sin 15 \times \sin 129}$$

$$X = \underline{\underline{11.84}}\ m$$

Notes: (1) Volume = Source Volume/10 m (Average figure taken from Mid-Level Studies)

Subject OPEN HILLSLOPE LANDSLIDE RUN-OUT CALCULATION (Catchment 3)	Prepared Smo	Checked JH	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 24 (m³ / m)
Mitigation Measure Earth Bund
Surface
θ
E
ϕ
C
20°
D
B
α
λ
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	56	°
α	32	°
A	1.7	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 36.00$

$D = B \ / \ \tan\alpha \quad = \quad 4.00$

$C = B \ / \ \tan\lambda \quad = \quad 1.69$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \ / \ 2$

$= \quad 11.3589 \ m^3$

$H = A + C + D \quad = \quad 7.39$

$\phi = 180 - \lambda \quad = \quad 124.00$

$E = H \ \sin 20 \ / \ \sin\theta \quad = \quad 4.30$

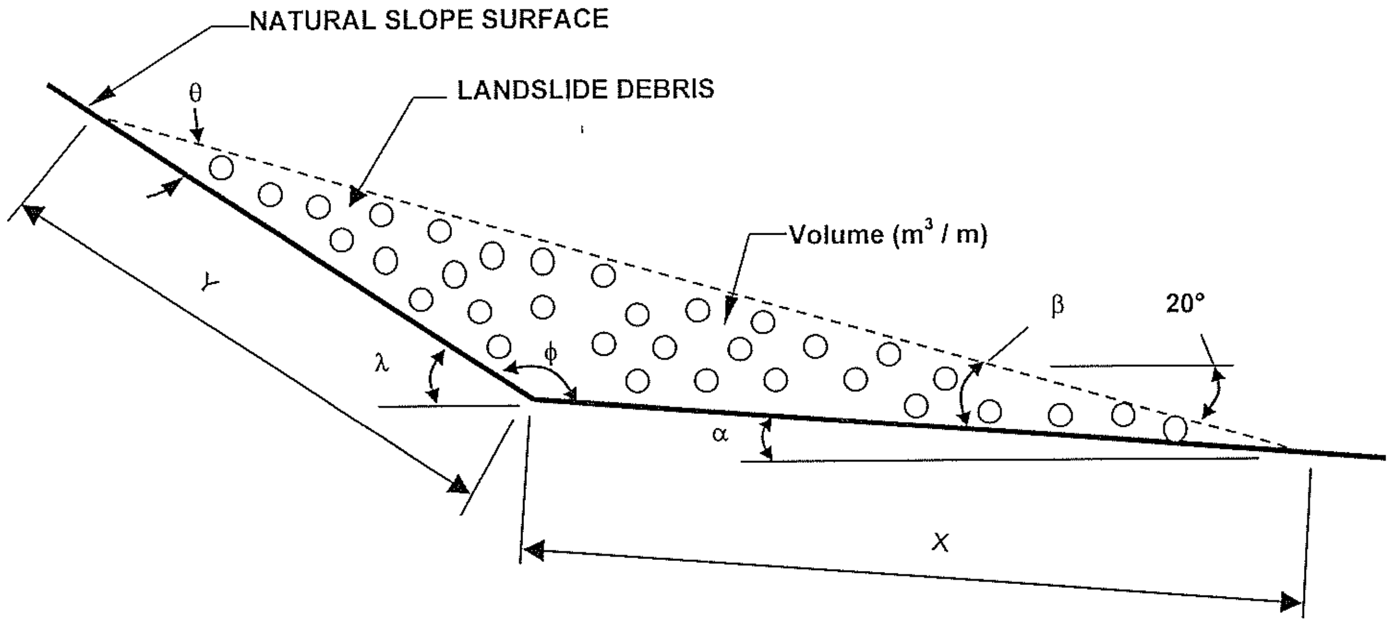
Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \ \sin\phi \ / \ 2$

$= \quad 13.16 \ m^3$

Total Volume = Area$_T$ + Area$_\Delta$ = 24.52 m^3 / m (Therefore, a 2.5m height barrier of a minimum distance of 1.7m from slope toe will contain $24m^3$ / m)

Subject CAPACITY AGAINST OPEN HILLSLOPE LANDSLIDE (Catchment 3)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.



INPUT DATA

$\text{Volume}^{(1)} = 24\ \text{m}^3/\text{m}$
$\alpha = 5°$
$\lambda = 60°$

CALCULATION

$$\begin{array}{llllllll} \phi & = 180 & - & 60 & + & 5 & = & \mathbf{125} \\ \beta & = 20 & - & \alpha & & & = & \mathbf{15} \\ \theta & = \lambda & - & 20 & & & = & \mathbf{40} \end{array}$$

$$\textbf{Volume} = \tfrac{1}{2}\, \mathbf{X\,Y \sin\phi} \qquad (1)$$

$$\frac{\sin\beta}{Y} = \frac{\sin\theta}{X} \Rightarrow \quad Y = \frac{\mathbf{X \sin\beta}}{\mathbf{\sin\theta}} \qquad (2)$$

sub (2) into (1)

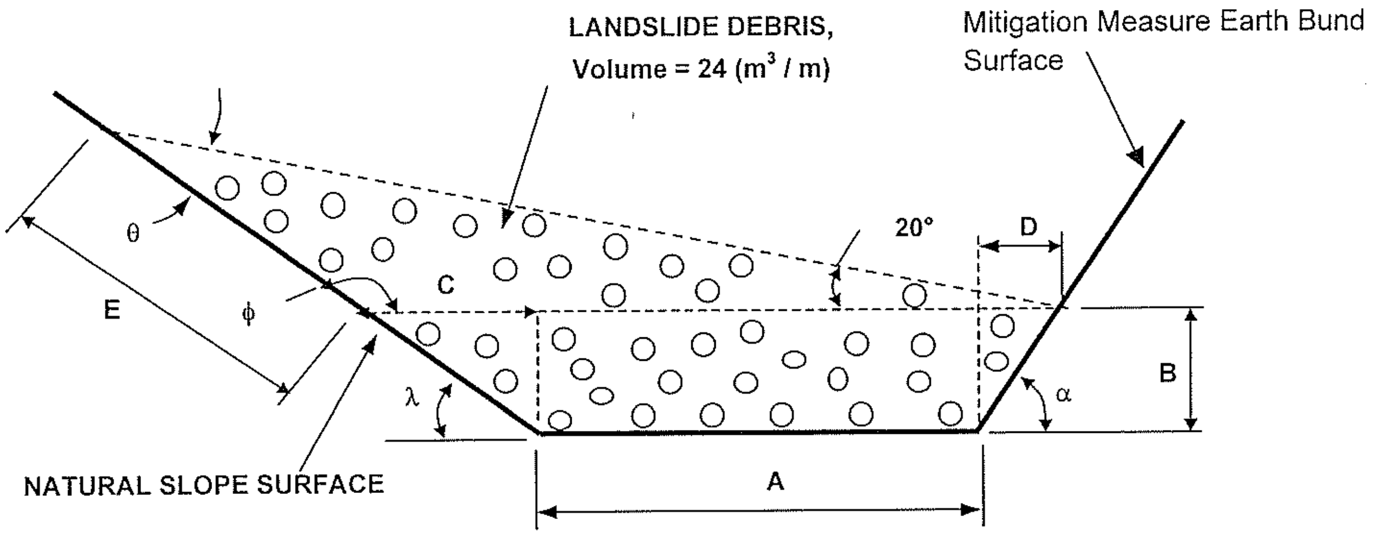
$$\text{Volume} = \frac{1}{2} \times \frac{X \sin\beta}{\sin\theta} \times \sin\phi$$

$$X^2 = \frac{2 \times 24 \times \sin 40}{\sin 15 \times \sin 125}$$

$$X = \underline{\underline{12.06}}\ \text{m}$$

Notes: (1) Volume = Source Volume/10 m (Average figure taken from Mid-Level Studies)

Subject OPEN HILLSLOPE LANDSLIDE RUN-OUT CALCULATION (Catchment 4)	Prepared Smo	Checked JH	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 24 (m³ / m)
Mitigation Measure Earth Bund Surface
θ
E
ϕ
C
20°
D
B
α
λ
NATURAL SLOPE SURFACE
A

INPUT DATA

λ	60	°
α	32	°
A	2	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 40.00$

$D = B \;/\; \tan\alpha \quad = \quad 4.00$

$C = B \;/\; \tan\lambda \quad = \quad 1.44$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \;/\; 2$

$= \quad 11.8053 \text{ m}^3$

$H = A + C + D \quad = \quad 7.44$

$\phi = 180 - \lambda \quad = \quad 120.00$

$E = H \sin 20 \;/\; \sin\theta \quad = \quad 3.96$

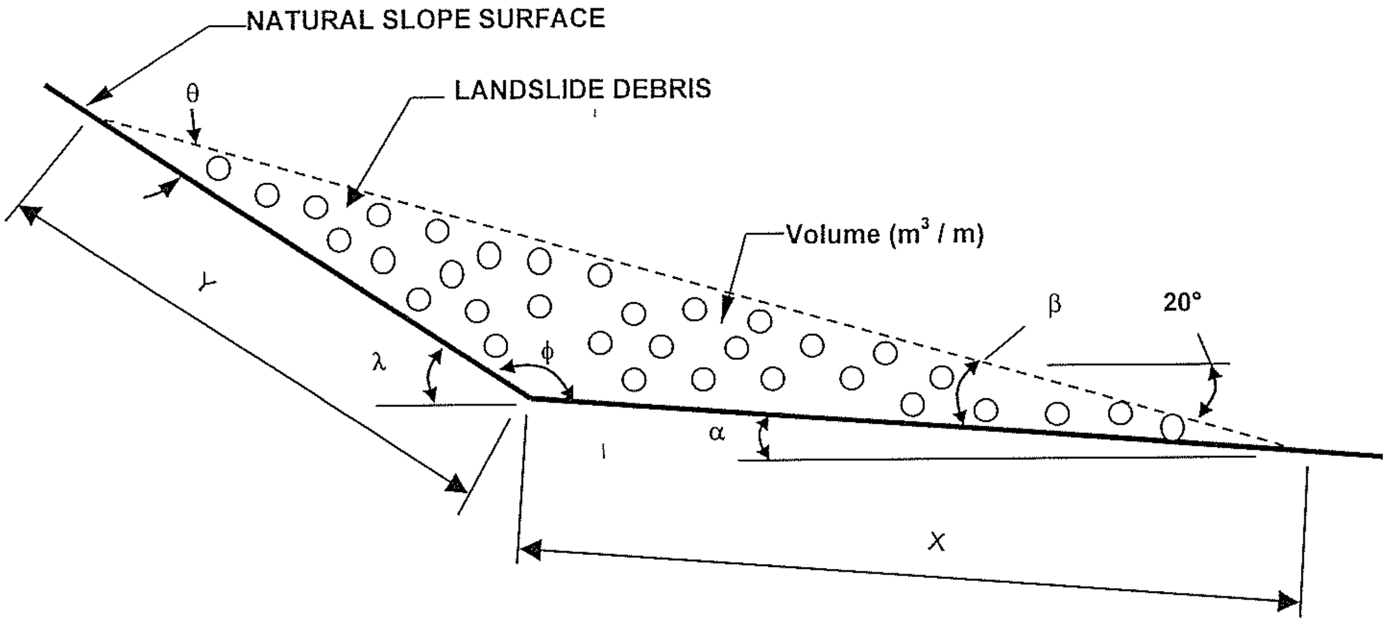
Volume of Upper Triangle

$\text{Area}_\Delta = E\ H\ \sin\phi \;/\; 2$

$= \quad 12.77 \text{ m}^3$

Total Volume = Area$_T$ + Area$_\Delta$ = **24.57** m^3/m (Therefore, a 2.5m height barrier of a minimum distance of 2.0m from slope toe will contain 24m^3 / m)

Subject CAPACITY AGAINST OPEN HILLSLOPE LANDSLIDE (Catchment 4)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.



INPUT DATA

Volume [(1)] **= 24 m^3 / m**
α = **5 °**
λ = **59 °**

CALCULATION

$$\phi = 180 - 59 + 5 = \mathbf{126}$$
$$\beta = 20 - \alpha = \mathbf{15}$$
$$\theta = \lambda - 20 = \mathbf{39}$$

$$\textbf{Volume} = \tfrac{1}{2}\,X\,Y \sin\phi \qquad (1)$$

$$\frac{\sin\beta}{Y} = \frac{\sin\theta}{X} \Rightarrow Y = \frac{X\sin\beta}{\sin\theta} \qquad (2)$$

sub (2) into (1)

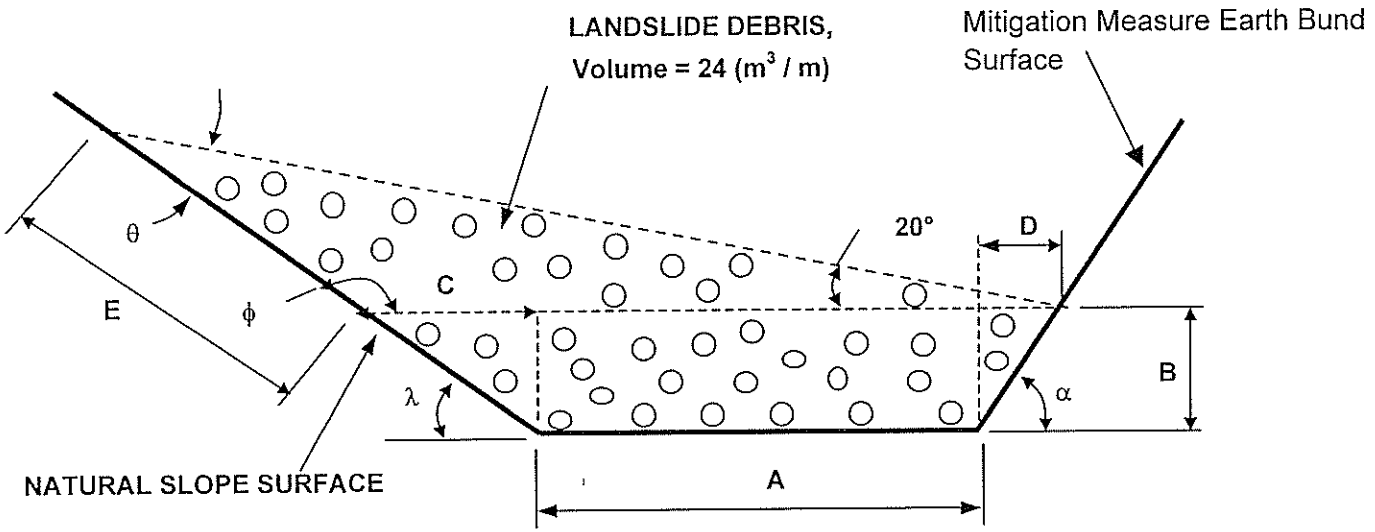
$$\text{Volume} = \frac{1}{2} \times \frac{X\sin\beta}{\sin\theta} \times \sin\phi$$

$$X^2 = \frac{2 \times 24 \times \sin 39}{\sin 15 \times \sin 126}$$

$$X = \underline{\underline{12.01}} \text{ m}$$

Notes: (1) Volume = Source Volume/10 m (Average figure taken from Mid-Level Studies)

Subject OPEN HILLSLOPE LANDSLIDE RUN-OUT CALCULATION (Catchment 5)	Prepared Smo	Checked JH	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 24 (m³ / m)
Mitigation Measure Earth Bund Surface
NATURAL SLOPE SURFACE
θ
E
ϕ
C
λ
20°
D
B
α
A

INPUT DATA

λ	59	°
α	32	°
A	1.9	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 39.00$

$D = B \;/\; \tan\alpha \quad = \quad 4.00$

$C = B \;/\; \tan\lambda \quad = \quad 1.50$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \;/\; 2$

$= \quad 11.6287 \ \text{m}^3$

$H = A + C + D \quad = \quad 7.40$

$\phi = 180 - \lambda \quad = \quad 121.00$

$E = H \sin 20 \;/\; \sin\theta \quad = \quad 4.02$

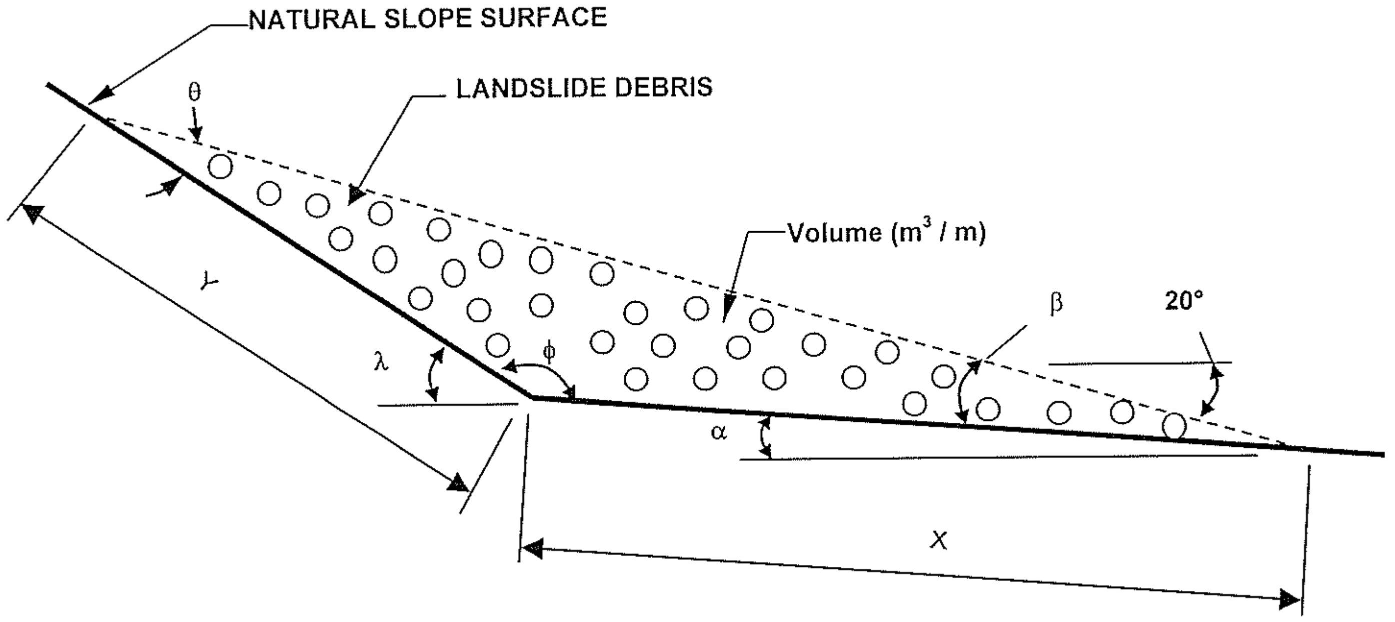
Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \sin\phi \;/\; 2$

$= \quad 12.77 \ \text{m}^3$

Total Volume = Area$_T$ + Area$_\Delta$ = **24.39** m^3/m (Therefore, a barrier of a minimum distance of 1.9m from slope toe will contain $24\text{m}^3/\text{m}$)

Subject	Prepared	Checked	
CAPACITY AGAINST OPEN HILLSLOPE LANDSLIDE (Catchment 5)	Smo	KWK	
Project	**Date**	**Scale**	**Figure No.**
Tseung Kwan O Landfill Stage II/III Afteruse Development	Jan-03		



INPUT DATA

$\text{Volume}^{(1)} = 24\ \text{m}^3/\text{m}$

$\alpha = 10°$

$\lambda = 57°$

CALCULATION

$\phi = 180 - 57 + 10 = \mathbf{133}$

$\beta = 20 - \alpha = \mathbf{10}$

$\theta = \lambda - 20 = \mathbf{37}$

$$\textbf{Volume} = \tfrac{1}{2} X Y \sin\phi \qquad (1)$$

$$\frac{\sin\beta}{Y} = \frac{\sin\theta}{X} \Rightarrow Y = \frac{X\sin\beta}{\sin\theta} \qquad (2)$$

sub (2) into (1)

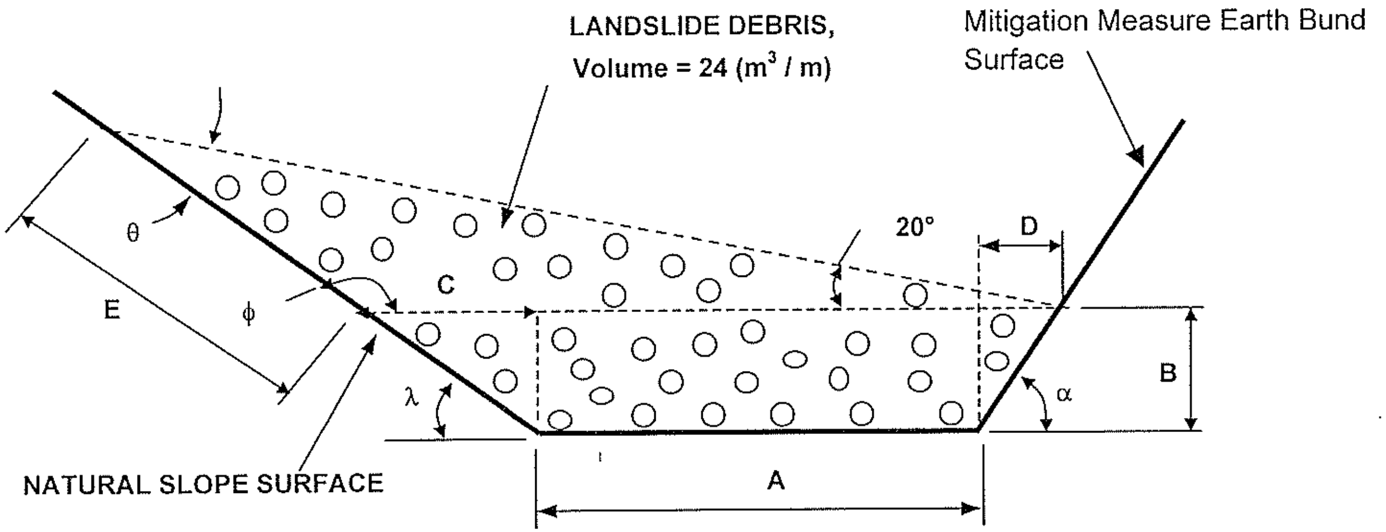
$$\text{Volume} = \frac{1}{2} \times \frac{X\sin\beta}{\sin\theta} \times \sin\phi$$

$$X^2 = \frac{2 \times 24 \times \sin 37}{\sin 10 \times \sin 133}$$

$$X = \underline{\underline{15.08}}\ \text{m}$$

Notes: (1) Volume = Source Volume/10 m (Average figure taken from Mid-Level Studies)

Subject OPEN HILLSLOPE LANDSLIDE RUN-OUT CALCULATION (Catchment 6A)	Prepared Smo	Checked JH	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 24 (m³ / m)
Mitigation Measure Earth Bund Surface
θ
E
φ
C
20°
D
B
α
λ
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	57	°
α	32	°
A	1.7	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 37.00$

$D = B \ / \ \tan\alpha \quad = \quad 4.00$

$C = B \ / \ \tan\lambda \quad = \quad 1.62$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \ / \ 2$

$= \quad 11.2804 \ \text{m}^3$

$H = A + C + D \quad = \quad 7.32$

$\phi = 180 - \lambda \quad = \quad 123.00$

$E = H \sin 20 \ / \ \sin\theta \quad = \quad 4.16$

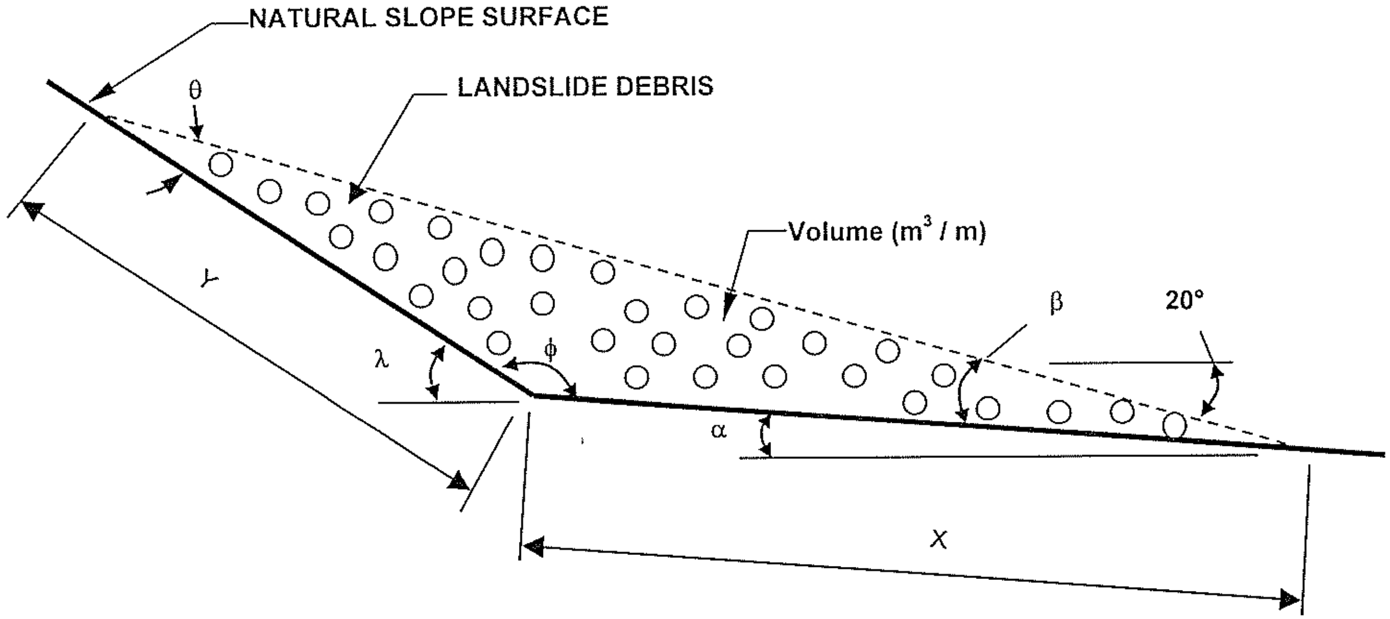
Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \ \sin\phi \ / \ 2$

$= \quad 12.78 \ \text{m}^3$

Total Volume = Area$_T$ + Area$_\Delta$ = **24.07** m^3 / m (Therefore, a 2.5m barrier with a minimum distance of 1.7m from slope toe will contain 24m^3 / m)

Subject CAPACITY AGAINST OPEN HILLSLOPE LANDSLIDE (Catchment 6A)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.



INPUT DATA

Volume [1]	**=**	**24 m^3 / m**
α	=	**10 °**
λ	=	**70 °**

CALCULATION

$$\phi = 180 - 70 + 10 = \mathbf{120}$$
$$\beta = 20 - \alpha = \mathbf{10}$$
$$\theta = \lambda - 20 = \mathbf{50}$$

$$\textbf{Volume} = \tfrac{1}{2} X\, Y \sin\phi \qquad (1)$$

$$\frac{\sin\beta}{Y} = \frac{\sin\theta}{X} \Rightarrow Y = \frac{X\sin\beta}{\sin\theta} \qquad (2)$$

sub (2) into (1)

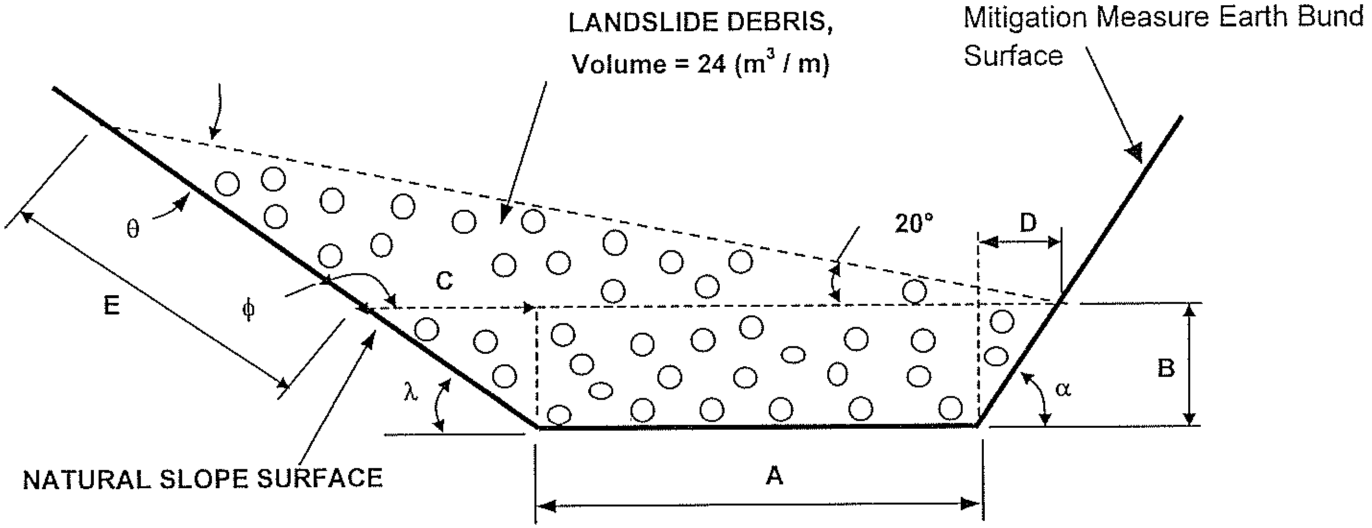
$$\text{Volume} = \frac{1}{2} \times \frac{X\sin\beta}{\sin\theta} \times \sin\phi$$

$$X^2 = \frac{2 \times 24 \times \sin 50}{\sin 10 \times \sin 120}$$

$$X = \underline{\underline{15.64}}\ \text{m}$$

Notes: (1) Volume = Source Volume/10 m (Average figure taken from Mid-Level Studies)

Subject OPEN HILLSLOPE LANDSLIDE RUN-OUT CALCULATION (Catchment 6B)	Prepared Smo	Checked JH	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 24 (m³ / m)
Mitigation Measure Earth Bund Surface
θ
E
φ
C
20°
D
B
α
λ
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	70	°
α	32	°
A	2.6	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 50.00$

$D = B \ / \ \tan\alpha \quad = \quad 4.00$

$C = B \ / \ \tan\lambda \quad = \quad 0.91$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \ / \ 2$

$= \quad 12.6385 \ \text{m}^3$

$H = A + C + D \quad = \quad 7.51$

$\phi = 180 - \lambda \quad = \quad 110.00$

$E = H \ \sin 20 \ / \ \sin\theta \quad = \quad 3.35$

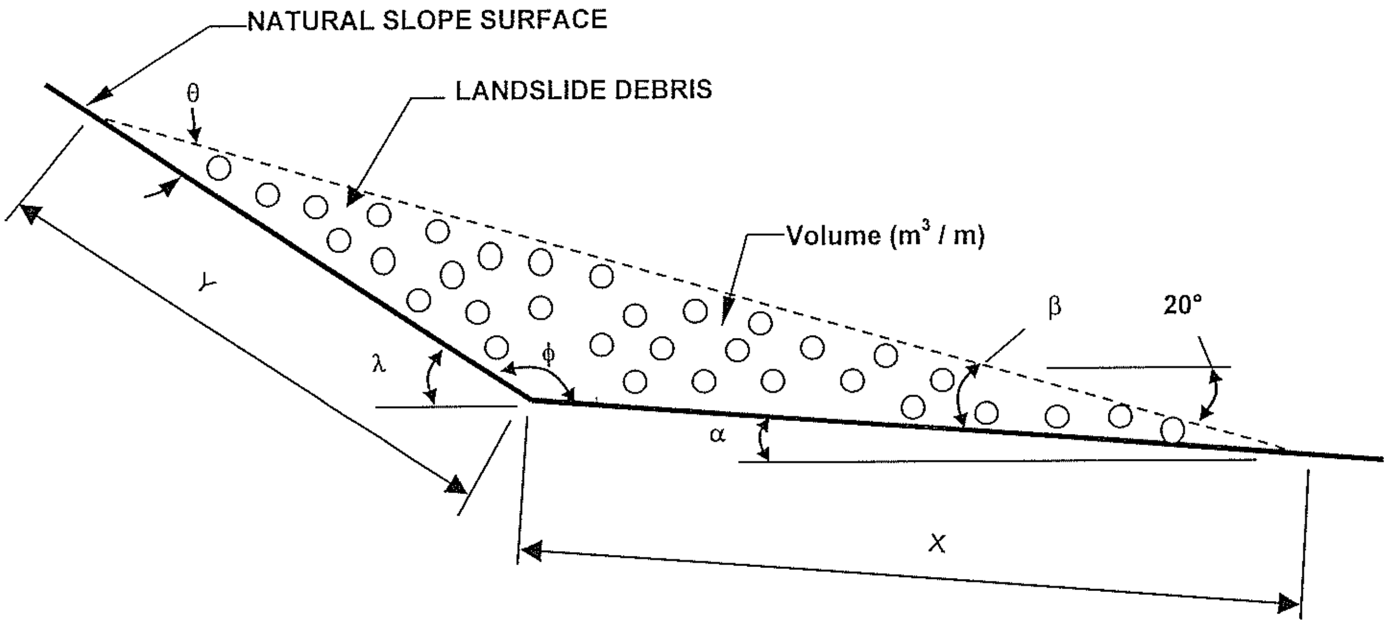
Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \ \sin\phi \ / \ 2$

$= \quad 11.83 \ \text{m}^3$

Total Volume = Area $_T$ + Area $_\Delta$ = 24.47 m^3/m (Therefore, a 2.5m barrier with a minimum distance of 2.6m from slope toe will contain $24\text{m}^3/\text{m}$)

Subject CAPACITY AGAINST OPEN HILLSLOPE LANDSLIDE (Catchment 6B)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.



INPUT DATA

Volume $^{(1)}$ = **24** m^3 / m
α = **10** °
λ = **50** °

CALCULATION

$$\phi = 180 - 50 + 10 = \mathbf{140}$$
$$\beta = 20 - \alpha = \mathbf{10}$$
$$\theta = \lambda - 20 = \mathbf{30}$$

$$\textbf{Volume} = \tfrac{1}{2} X Y \sin\phi \qquad (1)$$

$$\frac{\sin\beta}{Y} = \frac{\sin\theta}{X} \Rightarrow Y = \frac{X\sin\beta}{\sin\theta} \qquad (2)$$

sub (2) into (1)

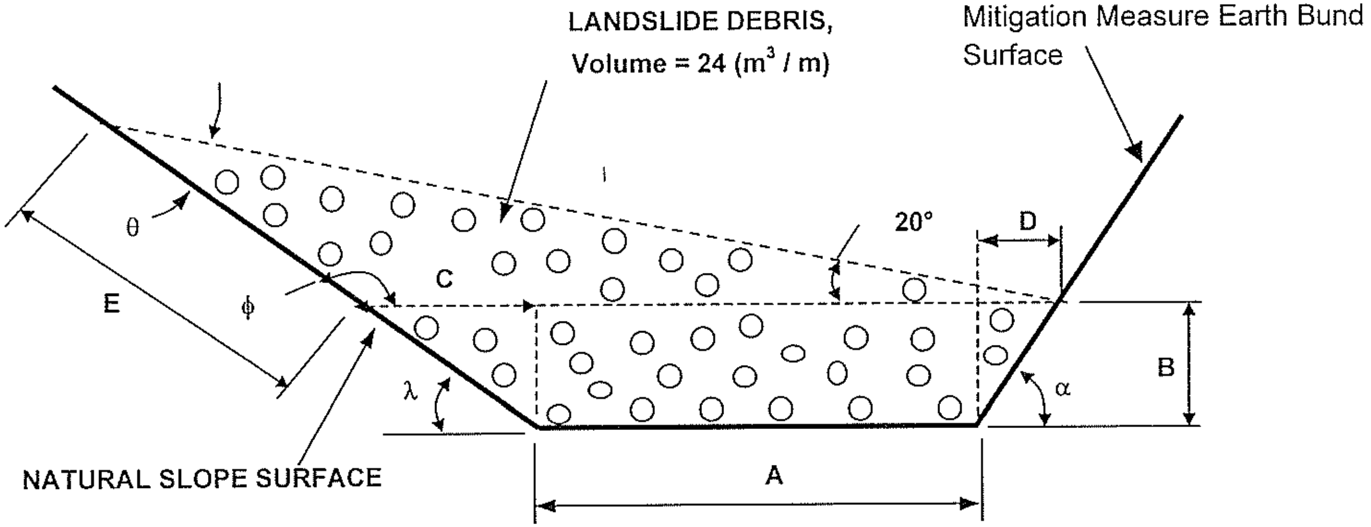
$$\text{Volume} = \frac{1}{2} \times \frac{X\sin\beta}{\sin\theta} \times \sin\phi$$

$$X^2 = \frac{2 \times 24 \times \sin 30}{\sin 10 \times \sin 140}$$

$$X = \underline{\underline{14.66}} \text{ m}$$

Notes: (1) Volume = Source Volume/10 m (Average figure taken from Mid-Level Studies)

Subject	Prepared	Checked	
OPEN HILLSLOPE LANDSLIDE RUN-OUT CALCULATION (Catchment 7)	Smo	KWK	
Project	**Date**	**Scale**	**Figure No.**
Tseung Kwan O Landfill Stage II/III Afteruse Development	Jan-03		


LANDSLIDE DEBRIS,
Volume = 24 (m^3 / m)
Mitigation Measure Earth Bund Surface
20°
D
θ
C
E
φ
λ
α
B
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	50	°
α	32	°
A	1.2	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 30.00$

$D = B \ / \ \tan \alpha \quad = \quad 4.00$

$C = B \ / \ \tan \lambda \quad = \quad 2.10$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \ / \ 2$

$= \quad 10.6232 \ m^3$

$H = A + C + D \quad = \quad 7.30$

$\phi = 180 - \lambda \quad = \quad 130.00$

$E = H \sin 20 \ / \ \sin \theta \quad = \quad 4.99$

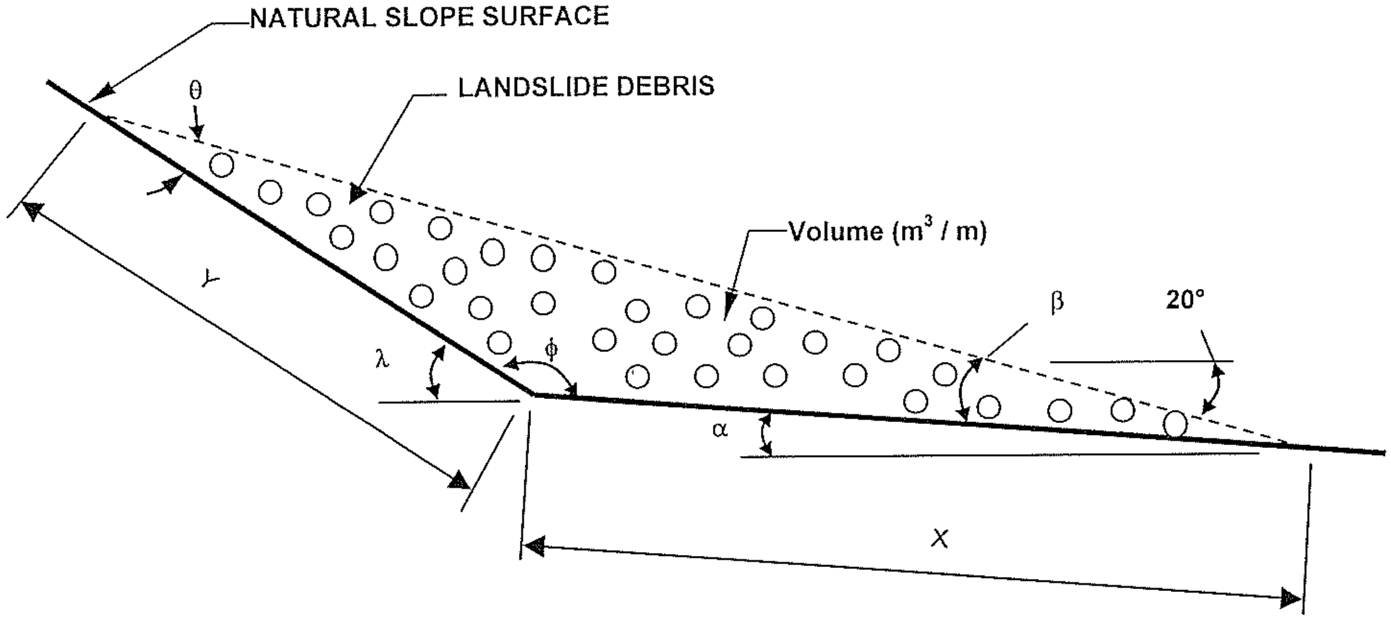
Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \ \sin \phi \ / \ 2$

$= \quad 13.96 \ m^3$

Total Volume = Area $_T$ + Area $_\Delta$ = **24.58** m^3 / m (Therefore, a barrier of a minimum distance of 1.2m from slope toe will contain 24m^3 / m)

Subject CAPACITY AGAINST OPEN HILLSLOPE LANDSLIDE (Catchment 7)	Prepared Smo	Checked JH	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.



INPUT DATA

Volume [1] = 24 m^3 / m
α = 10 °
λ = 55 °

CALCULATION

ϕ = 180 - 55 + 10 = **135**
β = 20 - α = **10**
θ = λ - 20 = **35**

$$\text{Volume} = \tfrac{1}{2} X Y \sin\phi \qquad (1)$$

$$\frac{\sin\beta}{Y} = \frac{\sin\theta}{X} \Rightarrow Y = \frac{X\sin\beta}{\sin\theta} \qquad (2)$$

sub (2) into (1)

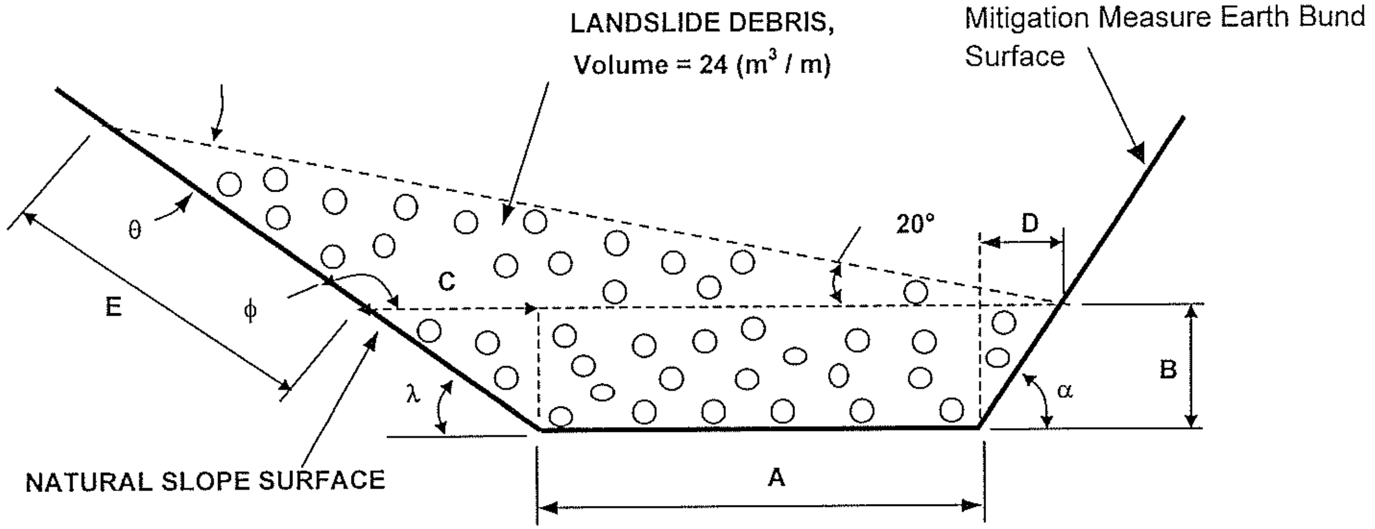
$$\text{Volume} = \frac{1}{2} \times \frac{X\sin\beta}{\sin\theta} \times \sin\phi$$

$$X^2 = \frac{2 \times 24 \times \sin 35}{\sin 10 \times \sin 135}$$

$$X = \underline{\underline{14.97}} \text{ m}$$

Notes: (1) Volume = Source Volume/10 m (Average figure taken from Mid-Level Studies)

Subject OPEN HILLSLOPE LANDSLIDE RUN-OUT CALCULATION (Catchment 8)	Prepared Smo	Checked JH	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 24 (m³ / m)
Mitigation Measure Earth Bund
Surface
θ
E
φ
C
20°
D
λ
α
B
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	55	°
α	32	°
A	1.6	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 35.00$

$D = B \ / \ \tan\alpha \quad = \quad 4.00$

$C = B \ / \ \tan\lambda \quad = \quad 1.75$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \ / \ 2$

$= \quad 11.1892 \ m^3$

$H = A + C + D \quad = \quad 7.35$

$\phi = 180 - \lambda \quad = \quad 125.00$

$E = H \sin 20 \ / \ \sin\theta \quad = \quad 4.38$

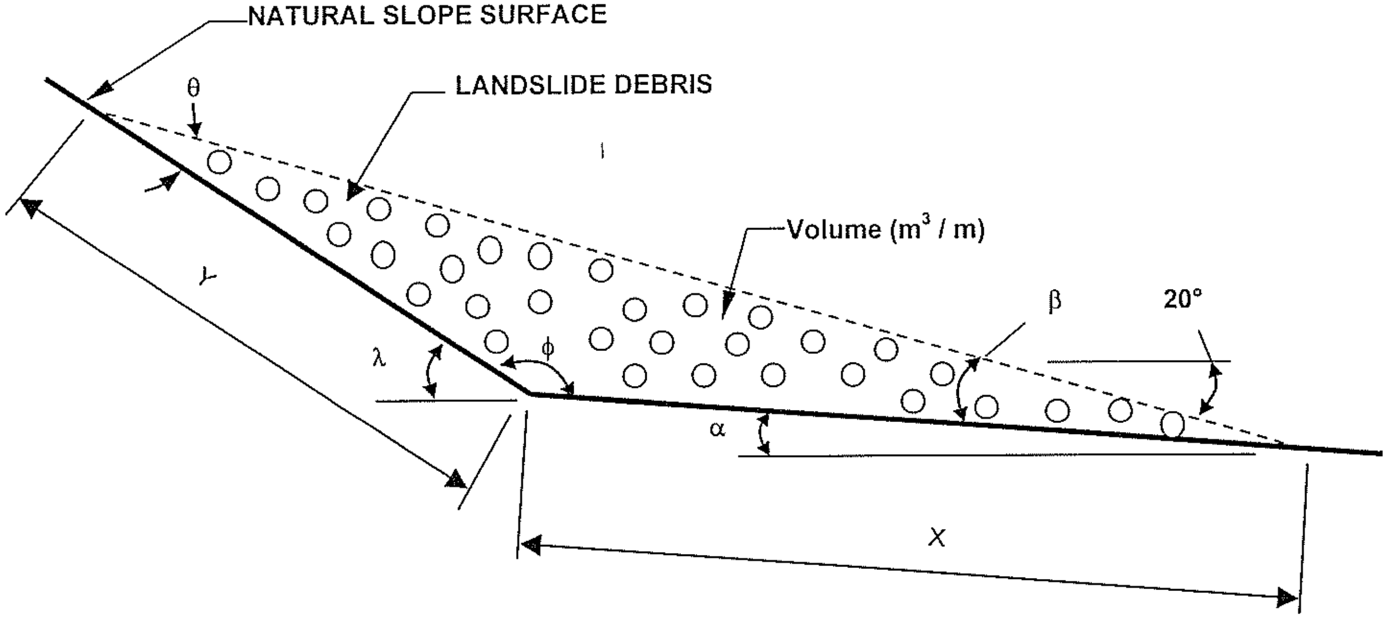
Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \sin\phi \ / \ 2$

$= \quad 13.20 \ m^3$

Total Volume = Area$_T$ + Area$_\Delta$ = 24.39 m^3 / m (Therefore, a 2.5m barrier with a minimum distance of 1.6m from slope toe will contain $24m^3 / m$)

Subject CAPACITY AGAINST OPEN HILLSLOPE LANDSLIDE (Catchment 8)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.



INPUT DATA

$\text{Volume}^{(1)} = 24\ \text{m}^3/\text{m}$

$\alpha = 15°$

$\lambda = 60°$

CALCULATION

$$\phi = 180 - 60 + 15 = 135$$

$$\beta = 20 - \alpha = 5$$

$$\theta = \lambda - 20 = 40$$

$$\text{Volume} = \tfrac{1}{2}\, X\, Y \sin\phi \qquad (1)$$

$$\frac{\sin\beta}{Y} = \frac{\sin\theta}{X} \Rightarrow Y = \frac{X\sin\beta}{\sin\theta} \qquad (2)$$

sub (2) into (1)

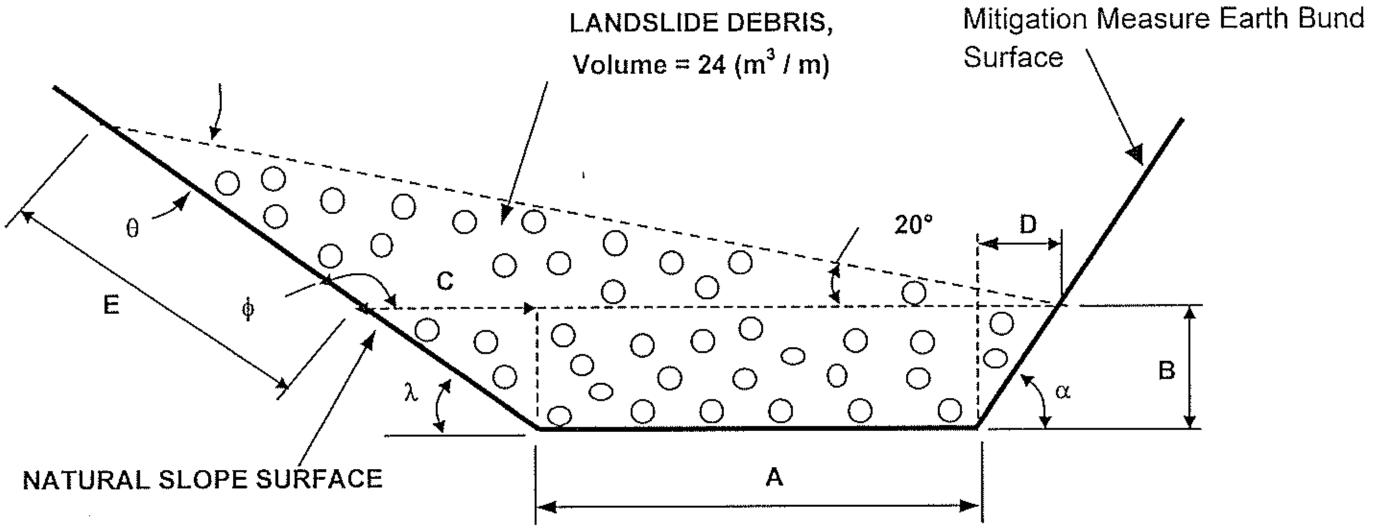
$$\text{Volume} = \frac{1}{2} \times \frac{X\sin\beta}{\sin\theta} \times \sin\phi$$

$$X^2 = \frac{2 \times 24 \times \sin 40}{\sin 5 \times \sin 135}$$

$$X = \underline{\underline{22.38}}\ \text{m}$$

Notes: (1) Volume = Source Volume/10 m (Average figure taken from Mid-Level Studies)

Subject OPEN HILLSLOPE LANDSLIDE RUN-OUT CALCULATION (Catchment 9)	Prepared Smo	Checked JH	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.


LANDSLIDE DEBRIS,
Volume = 24 (m^3 / m)
Mitigation Measure Earth Bund Surface
θ
E
φ
C
20°
D
λ
α
B
A
NATURAL SLOPE SURFACE

INPUT DATA

λ	60	°
α	32	°
A	2	m
B	2.5	m

CALCULATION

$\theta = \lambda - 20 \quad = \quad 40.00$

$D = B \;/\; \tan\alpha \quad = \quad 4.00$

$C = B \;/\; \tan\lambda \quad = \quad 1.44$

Volume of Basal Trapezoid

$\text{Area}_T = (2A + D + C) \times B \;/\; 2$

$= \quad 11.8053 \ m^3$

$H = A + C + D \quad = \quad 7.44$

$\phi = 180 - \lambda \quad = \quad 120.00$

$E = H \sin 20 \;/\; \sin\theta \quad = \quad 3.96$

Volume of Upper Triangle

$\text{Area}_\Delta = E \ H \ \sin\phi \;/\; 2$

$= \quad 12.77 \ m^3$

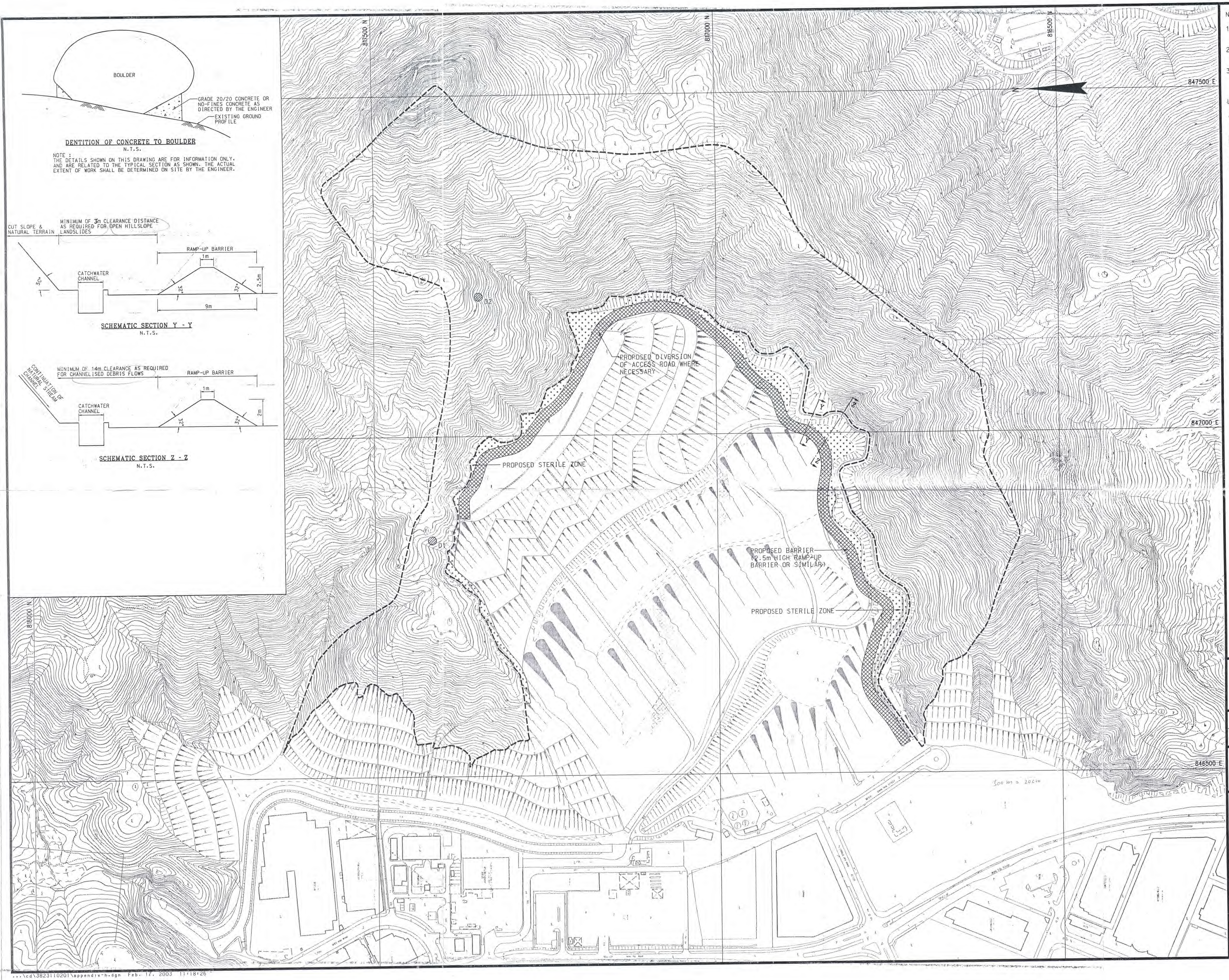
Total Volume = Area$_T$ + Area$_\Delta$ = **24.57** m^3 / m

(Therefore, a 2.5m barrier with a minimum distance of 2.0m from slope toe will contain 24m^3 / m)

Subject CAPACITY AGAINST OPEN HILLSLOPE LANDSLIDE (Catchment 9)	Prepared Smo	Checked KWK	
Project Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jan-03	Scale	Figure No.

APPENDIX H

Mitigation Strategy Map


BOULDER
GRADE 20/20 CONCRETE OR NO-FINES CONCRETE AS DIRECTED BY THE ENGINEER
EXISTING GROUND PROFILE
DENTITION OF CONCRETE TO BOULDER
N.T.S.
NOTE :
THE DETAILS SHOWN ON THIS DRAWING ARE FOR INFORMATION ONLY, AND ARE RELATED TO THE TYPICAL SECTION AS SHOWN. THE ACTUAL EXTENT OF WORK SHALL BE DETERMINED ON SITE BY THE ENGINEER.
CUT SLOPE & NATURAL TERRAIN
MINIMUM OF 3m CLEARANCE DISTANCE AS REQUIRED FOR OPEN HILLSLOPE LANDSLIDES
RAMP-UP BARRIER
1m
CATCHWATER CHANNEL
50°
32°
32°
2.5m
9m
SCHEMATIC SECTION Y - Y
N.T.S.
CONTINUATION OF NATURAL STREAM CHANNEL
MINIMUM OF 14m CLEARANCE AS REQUIRED FOR CHANNELISED DEBRIS FLOWS
RAMP-UP BARRIER
1m
CATCHWATER CHANNEL
32°
32°
2m
SCHEMATIC SECTION Z - Z
N.T.S.
817500 N
817000 N
816500 N
818000 N
847500 E
847000 E
846500 E
N
D1
D2
Y
Z
PROPOSED DIVERSION OF ACCESS ROAD WHERE NECESSARY
PROPOSED STERILE ZONE
PROPOSED BARRIER (2.5m HIGH RAMP-UP BARRIER OR SIMILAR)
PROPOSED STERILE ZONE
500 m = 20cm

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. ALL DIMENSIONS ARE TYPICAL AND TO BE CONFIRMED AT DETAILED DESIGN.

LEGENDS:

- - - - -	NATURAL TERRAIN STUDY BOUNDARY
▨	RAMP UP BARRIER, 2.5m HIGH BASAL WIDTH OF 9.0m
░	PROPOSED STERILE ZONE
◍ D1	LOCATIONS OF BOULDERS REQUIRING REMOVAL/ DENTITION

Approved

CAD ref. MAIN : APPENDIX-H.DGN
XREF : B12SW06B,D, B12SW01B,D,
B12SW02A,B,C,D & B12SW07A,B,C,D.DGN

Contract no. FD01-052

Contract
GEOTECHNICAL REVIEW AND
SITE INVESTIGATION WORKS
FOR TSEUNG KWAN O STAGE II/III
AFTERUSE DEVELOPMENT

Figure Title
MITIGATION STRATEGY MAP

Figure no. APPENDIX H

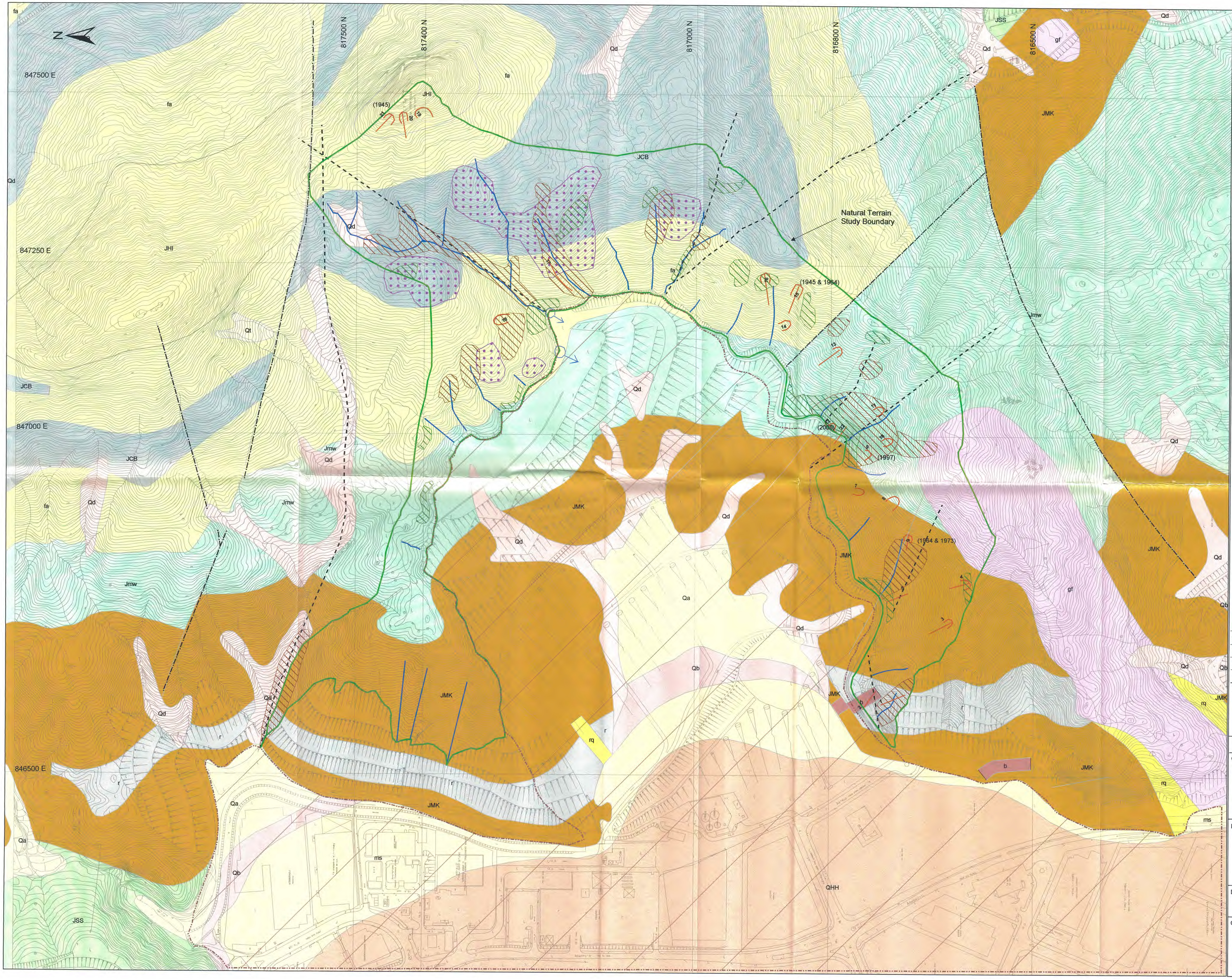
Scale 1:2500

BLACK & VEATCH HONG KONG LIMITED
博威工程顧問有限公司

...\cd\3823110201\appendix-h.dgn Feb. 17, 2003 11:18:26

APPENDIX I

Engineering Geology Map


N
817500 N
817400 N
817000 N
816800 N
816500 N
847500 E
847250 E
847000 E
846500 E
Natural Terrain Study Boundary
(1945)
(1945 & 1964)
(2000)
(1997)
(1964 & 1973)
JHI
fa
Qd
JCB
Jmw
Qt
JMK
JSS
gf
Qa
Qb
r
rq
b
ms
QHH

Legend

- Landslide scar from API (year of landslide event(s))
- Landslide from NTLI
- ▨ colluvium
- ▨ Rock at or near surface
- fault
- Photogeological lineament
- drainage line
- seepage
- boulder fields
- Existing Fill

Superficial Geology

- Qa - Allumium
- Qb - Beach deposits
- Qd-Debris flow deposits
- Qt - Talus deposits
- QHH - Undivided, mainly dark grey marine mud

Solid Geology

- JHI - Fine ash tuff (High Island Formation)
- JMK-Tuffaceous mudstone, siltstone and breccia
- Jmw - Trachydacity lava
- JCB - Trachydacite and Rhyolite lava
- b - Basalt
- fa - Fine ash tuff Clear Water Bay Formation
- gf - Fine-grained granite
- r - Rhyolite Lava
- rq-Quartzphyric rhyolite

Notes: Map shows the geology of the site during pre-operation stage

Revision	Description			Initial
	Design	Check	Drawn	Check
Initial	SMo	JH	VN	JH
Date	08/2002	08/2002	08/2002	08/2002

Approved

AGREEMENT NO. FD01-052

Contract Title

TSEUNG KWAN O STAGE II/III AFTERUSE DEVELOPMENT

Figure Title

ENGINEERING GEOLOGY MAP

Drawing No.	Scale
APPENDIX I	1:2500

Consultant

Binnie Black & Veatch Hong Kong Limited

Appendix B

Previous GAR 2004

Agreement No. FD 01-052
Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development

Final Geotechnical Assessment Report

[Report No. 382311/FGAP/Issue 1]

Report Authorized For Issue By:	
Raymond P.C. Chan	For and on Behalf of Binnie Black & Veatch Hong Kong Limited

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January 04

DOCUMENT CONTROL AMENDMENT RECORD	**Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development**	Job No: 382311/0201 Prepared By: BV
Final Geotechnical Assessment Report	Client: Environmental Protection Department	Initial: TC Date: February 2003

Pages	Date	Issue No	Description	Initials
All	17 February 2003	A	Draft A submitted to EPD for comment	TC
All	6 May 2003	B	EPD comments incorporated. Submitted to GEO.	TC
All	2 January 2004	1	GEO comments incorporated. Submitted to EPD	TC

SUMMARY

The Hong Kong Environmental Protection Department (EPD) launched in 1996 a Landfill Restoration Programme (LRP) for 13 closed landfills. Tseung Kwan O Landfill II/III is one of the 13 closed landfills.

Tseung Kwan O Landfill Stage II/III (TKO II/III) is located near Tseung Kwan O Bay and was formed by infilling of the Tai Chik Sha Valley. The landfill profile now dips at a gradient of approximately 1 in 3 to the west from the top platform of about 140mPD to 5mPD at the toe, over a horizontal distance of about 750m. The site comprises several waste slopes and is bound by a series of cut slopes, and beyond these cuttings, natural terrain.The restoration works for TKO II/III were completed in 1999 and the landfill is considered safe and environmentally acceptable for afteruse. At present, there are several afteruse proposals for the landfill being explored, including an option to develop the landfill into a recreational facility with material recycling facility for educational purposes (the Park).

In October 2001, the Environmental Protection Department appointed Black & Veatch Hong Kong Ltd. (formerly Binnie Black & Veatch Hong Kong Ltd.) to study the geotechnical feasibility of the Park.

This report summarises the findings of this Assignment and covers the geotechnical design including upgrading/preventive works and cost estimate for the works. The major conclusions and recommendations of this study are summarised below:

Waste slopes

The proposed facilities associated with the Park (with a structural load of not greater than 50 kPa) will not compromise the stability of the waste slopes. Therefore, no upgrading works are required for the waste slopes. It is recommended that good maintenance continue for the waste slopes so that they will meet the required minimum factor of safety within the context of the Park.

Cut slopes

Several soil cut slopes possess minimum calculated factors of safety less than the required value and therefore require upgrading works. These substandard soil slopes can be upgraded by prescriptive measures using soil nails and raking drains, as shown in Table 4.3 and Drawing No. BV/TKO/382311/001.

Several rock cut slopes have loose blocks and open joints on the slope surface. These substandard rock slopes can be upgraded by removal of loose blocks and concrete infilling of open joints, as shown in Table 4.4.

However, these upgrading works would be superseded where adjacent preventive measures against natural terrain hazards will also accommodate the debris expected from cut slope failure.

Natural slopes

Based on the natural terrain hazard assessment results, it is considered that channelised debris flows, open hillslope landslides and boulder falls all form potential harzards to the proposed development.

Site inspection revealed that two potentially high-risk boulders (i.e. Boulders D1 and D2 as shown in Dwawing No. BBV/TKO/382311/002) in Catchment Nos. 2 and 4 require stabilising/preventive measures. It is recommended that Boulder D1 be removed and dentition be carried out on Boulder D2. Removal and breaking up of boulder D1 should be by splitting using pneumatic percussive drilling using either dynamic or chemical means. Care should be taken to avoid dislodging the boulder during splitting. The removal of Boulder D2 would affect the stability of the surrounding boulders and thus dentition has been considered the best stabilising measure.

Two preventive options against open hillslope landslides and channelized debris flows have been proposed. Option 1 is to construct an earth bund as shown in Dwg No. BV/TKO/382311/002, and option 2 is to define a no-build-zone to allow for safe development outside of this zone, as shown in Drawing No. BV/TKO/382311/003.

Conceptual foundation design

The existence of the capping system precludes the use of deep foundations and calls for the use of shallow foundations to support the buildings. It is recommended that each building be supported on a single raft foundation founded on the CDV cover layer.

Calculation results have shown that allowable settlement, rather than bearing capacity, is likely to control the size of a raft foundation. It is recommended that the allowable settlement be determined in the detailed design of the buildings, with due consideration of associated piping and cabling systems.

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Appendix F Bearing Capacity and Settlement Calculations
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	Name	Signature	Date
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Checked by	Tony Chen	Tony Chen	Dec. 2004
Reviewed by	Raymond Chan		Dec 2004

1 INTRODUCTION

1.1 Background

The Hong Kong Environmental Protection Department (EPD) launched in 1996 a Landfill Restoration Programme (LRP) for 13 closed landfills. Tseung Kwan O Landfill II/III is one of the 13 closed landfills.

The restoration works for TKO II/III were completed in 1999 and the landfill is considered safe and environmentally acceptable for afteruse. At present, there are several afteruse proposals for the landfill being explored, including an option to develop the landfill into a recreational facility with material recycling facility for educational purposes (the Park).

In October 2001, the Environmental Protection Department appointed Black & Veatch Hong Kong Ltd. (formerly Binnie Black & Veatch Hong Kong Ltd.) to study the geotechnical feasibility of the Park..

1.2 Site description

Tseung Kwan O Landfill Stage II/III (TKO II/III) is located near Tseung Kwan O Bay, as shown in Figure 1, and was formed by infilling of the Tai Chik Sha Valley. The area was formerly a west facing, bowl shaped valley overlooking Tai Chik Sha Wan and a small embayment to Tseung Kwan O Bay. Only a small part of the landfill extends over the original seabed.

The landfill operations filled the northern side of the valley, to the top platform level of 140mPD. The landfill profile now dips at a gradient of approximately 1 in 3 to the west from the top platform at the valley head to 5mPD at the toe, over a horizontal distance of about 750m. The site comprises several waste slopes and is bound by a series of cut slopes, and beyond these cuttings, natural terrain as shown in Figure 2. Table 1.1 lists the waste slopes and cut slopes within the site.

Table 1.1 List of study slopes

Slope	**Maintenance Responsibility**	**Slope**	**Maintenance Responsibility**	**Slope**	**Maintenance Responsibility**
GEO Ref. No.		**GEO Ref. No.**		**GEO Ref. No.**	
Waste Slopes		**Cut Slopes**			
12SW-A/F67	EPD	12SW-A/C76	DSD	12SW-A/C182	EPD
12SW-A/F68	EPD	12SW-A/C173	EPD	12SW-A/C183	EPD
12SW-A/F69	EPD	12SW-A/C174	EPD	12SW-A/C184	EPD
12SW-A/F70	EPD	12SW-A/C175	EPD	12SW-A/C185	EPD
12SW-A/F72	EPD	12SW-A/C176	EPD	12SW-A/C186	EPD
12SW-A/F73	EPD	12SW-A/C177	EPD	12SW-A/C187	EPD
12SW-A/F74	EPD	12SW-A/C178	EPD	12SW-A/C188	EPD
		12SW-A/C180	EPD	12SW-A/C203	DSD
		12SW-A/C181	EPD	12SW-A/C165	Lands D

1.3 Site geology

The geology of the site comprises tuffs, ash and lavas of Upper Jurassic age (Figure 3). The original landform, prior to the construction and operation of the landfill, was a basin enclosed by hills on three sides with a bay on the shore to the west of the site boundary. To the sides of the valley are volcanic rocks of the Repulse Bay Formation, weathered in places to form decomposed volcanic material and covered in part by superficial deposits. The valley floor consists of alluvium, comprising clays, silts and sands. Existing boreholes located around the site show that the volcanic tuff is fractured and jointed.

1.4 Site hydrogeology

The steep hillsides and relatively high permeability of the superficial deposits indicates that the groundwater regime must be highly transient, responding not only to seasonal variation in infiltration but also to rainfall events. Limited groundwater monitoring data indicates that, prior to the restoration of the landfill, the ground water level was below 122mPD.

The basal leachate collection systems on the back face of the formation slopes are on natural ground. Hence the exterior sub-surface water regime is intimately connected with that of the leachate regime.

A sub-soil water abstraction system has been installed as part of the restoration works. This system is designed to limit the amount of groundwater infiltration from the surrounding hillsides into the waste mass, to control leachate generation.

1.5 Conceptual design of the Park

The conceptual design of the Park is shown in Appendix A. The design includes the provision of two buildings and several seating areas at the north-west edge of the landfill on the 140mPD platform, and a steel structure as a recycling facility at the south-east part of the landfill on the 40mPD platform.

1.6 Objective

This draft final report summarises the findings of this Assignment and covers the geotechnical design including upgrading/preventive works and cost estimate for the works. In addition, an alternative 'no-build zone' option is also proposed. The objective is to seek GEO's in-principal approval of the proposed Afteruse so that future development with loadings within the surcharge loads specified in this report would not require re-submission to GEO for comment.

2 SITE INVESTIGATION

A ground investigation programme was carried out by the GEO's Term Contractor in June to July 2002, supervised full time by BV. The investigation comprised 7 drillholes with installations of standpipe/piezometers, 14 trial pits on the natural slopes, and 35 chunam strips on the cut slopes. The locations of the current investigation stations, together with those from the previous investigations, are shown in Appendix B.

Samples of soil and rock were taken for laboratory tests to derive engineering properties. The laboratory test programme included single and multiple stage consolidated undrained triaxial tests with pore water pressure measurement, Atterberg Limits, particle size distribution, moisture content and density tests.

The key results of the ground investigation works and laboratory tests are briefly described below and more details can be referred to Geotechnical Investigation and Laboratory Testing Report (Report No. 382311/GILTR).

2.1 Soil strata and groundwater levels

The deposits forming the slopes can be classified into seven strata types, namely colluvium, completely decomposed rhyolite lava, completely to highly decomposed rhyolite lava, completely decomposed trachdacite lava, completely to highly decomposed trachydacite lava, completely decomposed tuff and completely to highly decomposed tuff.

The derived geological sections and measured groundwater levels are shown in Appendix B.

2.2 Soil and rock strength parameters

The soil shear strength parameters derived from the triaxial tests are summaried in Table 2.1 whilst rock strength parameters derived from point load tests are summarized in Table 2.2.

Table 2.1 Summary of soil strength parameters

Type of material	Calculated Parameters		Recommended Parameters	
	Friction angle ϕ'	Cohesion c' kPa	Friction angle ϕ'	Cohesion c' kPa
Colluvium	39	3	39	3
CD volcanics	39	7	38	7
C/HD volcanics	43	7	38	7

Note: volcanics include tuff, trachydacite lava and rhyolite lava.

2.2 Summary of uniaxial compressive strength for rocks

Rock Type	Max. σ_c (MPa)	Min. σ_c (MPa)
Trachydacite Lava	139.2	34.08
Tuff	179.04	19.2

3 WASTE SLOPES

As documented in Preliminary Geotechnical Assessment Report (Report No. 382311/PGAP), the proposed facilities associated with the Park (with a structural load of not greater than 50kPa) would not compromise the stability of the waste slopes. Furthermore, no signs of slope failure have been observed from visual inspections. It can therefore be concluded that, provided good maintenance continues, the waste slopes will meet the required minimum factor of safety within the context of the Park.

Therefore, no upgrading works are required for the waste slopes.

The relevant stability assessment results presented in Preliminary Geotechnical Assessment Report are summarized in Sections 3.1 to 3.4 for easy reference.

3.1 Summary of Slope Information

The relevant information given by SIRST reports and the designed factors of safety are summarized in Table 3.1.

Table 3.1 Summary of Waste Slope Information

Slope	**Year of Construction**	**Maintenance Responsibility**	**Total Length (m)**	**Max. Height (m)**	**Max. Angle (degree)**	**Nature of slope**	**Designed FoS**
GEO Ref. No.							
12SW-A/F67	1984-1995	EPD	440	32	20	fill	1.425
12SW-A/F68	1992-1995	EPD	396	28	25	fill	1.665
12SW-A/F69	1992-1995	EPD	170	80	25	fill	not available
12SW-A/F70	1992-1995	EPD	210	20	20	fill	1.665
12SW-A/F72	1992-1995	EPD	470	28	25	fill	1.665
12SW-A/F73	1992-1995	EPD	145	30	25	fill	1.665
12SW-A/F74	1993-1995	EPD	140	15	20	fill	not available

3.2 Stability Criteria

As the Stage II/III landfill overlooks the new reclamation and industrial area of Area 86 immediately to the west of the western boundary, the potential risk associated with a mass failure of the landfill waste slopes should be classified as high. In accordance with Geotechnical Manual for Slopes (GEO, 1994 and GEO Circular No. 5/97, Geotechnical Manual for Slopes – Guidance on Interpretation, the minimum factor of safety for high risk category is 1.4.

For the Registered Design, all the waste slopes were designed to achieve a minimum factor of safety of 1.4 for a designed surcharge load of 5kPa. For the development of the Park, it is considered that the waste slopes should continue to possess a minimum factor of safety of 1.4.

3.3 Registered Design

Stage II/III landfill is characterized by several waste slopes facing south-west towards the toe of the landfill, and a platform at 40mPD located on the south western corner of the landfill. In the Registered Design, the stability of the landfill was assessed using two cross-sections of the site, i.e. Sections 1-1 and 2-2, as indicated in Figure 2. The waste slopes were designed to achieve a minimum factor of safety of 1.4 for a designed surcharge of 5kPa.

The results of aerial photograph interpretation (API) indicate that no failures have occurred within the landfill site after restoration.

3.4 Impact of the Park

The conceptual design of the Park (Appendix A) illustrates several structures located around the Park. To assess the potential impact of structural loads on the stability of the waste slopes, the stability analyses undertaken for the Registered Design have been re-visited in the current study. A surcharge load of up to 50kPa was applied to Sections 1-1 and 2-2 to simulate each proposed structure. The surcharge load was placed approximately at the location corresponding to the proposed structure. The stability analyses were carried out using SLOPE/W Version 4.0 (BD Ref. No. G0051), adopting the Morgenstern and Price rigorous method to compute the factor of safety.

The calculated minimum factors of safety for different surcharge loads are presented in Table 3.2. It can be seen that all the calculated minimum factors of safety are greater than 1.4 and that the surcharge load of up to 50kPa has insignificant effect on the calculated minimum factors of safety. These stability analyses will need to be reviewed if the structures are to be located at different locations and/or if each structural load is greater than 50kPa.

Table 3.2 Calculated Minimum Factors of Safety for Waste Slopes

Section	Minimum Factor of Safety		
	Designed surcharge	Additional structural surcharge	
	5kPa	10kPa	50kPa
1-1	1.665	1.664	1.660
2-2	1.425	1.425	1.425

4 CUT SLOPES

4.1 General information

The general information about the cut slopes is summarized in Table 4.1

Table 4.1 Summary of general information about cut slopes

Slope	Slope Stripping Log	Maximum Depth of Stripping (m)	Maximum Slope Angle from Stripping Data (degrees)	Nature of Slope	Surface Cover	Special Comments on Strippings	Consequence-to-life category (w.r.t the park)	Required FoS
GEO Ref. No.								
12SW-A/C76	SS1, SS2, SS3	6.1	78	cut	Vegetation		3	1.1
12SW-A/C173	SS4, SS5, SS6	10.5	58	cut	Vegetation	1) Very closely to closely spaced rock joint	3	1.1
12SW-A/C174	SS7, SS8	37	Varies	cut	50% Bare rock, 50% Vegetation		3	1.1
12SW-A/C175				cut	70% Bare rock, 30% Vegetation		3	1.1
12SW-A/C176	SS9	8.2	65	cut	50%Chunam, 50%Vegetation		3	1.1
12SW-A/C177	SS10, SS11, SS12	9.0	67	cut	Chunam	1) Very closely to closely spaced rock joint	3	1.1
12SW-A/C178	SS14, SS15	3.0	64	cut	Chunam		3	1.1
12SW-A/C180	SS13	8.4	64	cut	Chunam	1) From 3.7 to 4.0m quartzphyric rhyolite dyke	3	1.1
12SW-A/C181	not studied because stability not affect the Park							
12SW-A/C182	SS16, SS17	6.3 to 7.2	50 to 71	cut	Chunam		1	1.2
12SW-A/C183	SS18, SS19, SS20	5.1 to 6.9	50 to 68	cut	Chunam	1) Seepage at 4.1m (SS18) 2) Rock joints, closely to medium spaced	1	1.2
12SW-A/C184	SS21, SS22, SS23	5.3 to 6.8	48 to 52	cut	Chunam	1) Rock joints are closely to medium spaced	1	1.2
12SW-A/C185	SS24	11.7	46	cut	Chunam	1) Medimum spaced rock joints	1	1.2
12SW-A/C186	SS25, SS26	9.4	55	cut	Chunam		1	1.2
12SW-A/C187	SS27	7.0	40	cut	Chunam		3	1.1
12SW-A/C188	SS28, SS29, SS30	7.8	52	cut	Chunam		3	1.1
12SW-A/C203	not studied, newly constructed slope with adequate design FoS							
12SW-A/C165	not studied, newly constructed slope with adequate design FoS							

4.2 Stability criteria

The minimum factor of safety required for each cut slope is determined based on consequence to life associated with the conceptual design of the Park (Appendix B), and in accordance with both Geotechnical Manual for Slopes (GEO, 1994, Ref. 10) and WBTC No. 13/99, Geotechnical Manual for Slopes – Guidance on Interpretation (Ref. 9). We have taken the view that the cut slopes located adjacent to the buildings and seating areas should have a consequence-to-life category of 1 for which the minimum factor of safety is 1.2, and that the other cut slopes should have a consequence-to-life category of 3 for which the minimum factor of safety is >1.0. Nevertheless, we have adopted 1.1 as the minimum factor of safety for the cut slopes having a consequence-to-life category of 3.

4.3 Soil Slopes

Most of the cut slopes are in soil and their stability analyses and proposed upgrading works are described in Sections 4.3.1 to 4.3.3.

4.3.1 Adopted soil strength parameters

Table 4.2 shows the soil strength parameters used for stability analyses of the cut slopes, adopted based on the triaxial testing results presented in Table 2.1.

Table 4.2 Adopted soil strength parameters

Type of soil	Friction angle ϕ'	Cohesion c' kPa
Colluvium	39	3
C/HD volcanics	38	7
C/HD Tuffaceous breccia/siltstone*	35	5

* Tuffaceous breccia/siltstone was only observed at Slope No. 12SW-A/C173. The stability analysis results (see Appendix C) indicate that the adopted $\phi'=35°$ and $c'=5$ kPa are reasonable.

4.3.2 Stability analyses

For the purpose of stability analyses, a series of cross-sections are cut at the critical locations of the cut slopes, as shown in Appendix C. The cross-sections are drawn based on the ground investigation results.

Where a perched water table is considered possible, a 2 m perched water table is assumed above the rock head or the CDV layer.

Stability analyses are carried out on the critical cross-sections using SLOPE/W Version 4.0 (BD Ref. No. G0051), adopting the Morgenstern and Price rigorous method to compute the factor of safety. The computed minimum factors of safety are shown in Appendix C and are summarised in Table 4.3.

The calculation results indicate that Slope Nos. 12SW-A/C76, 12SW-A/C173, 12SW-A/C176, 12SW-A/C177, 12SW-A/C182, 12SW-A/C183 and 12SW-A/C188 all have a calculated minimum safety factor less than the required value and hence require upgrading works.

The other slopes all have a calculated minimum safety factor greater than the required value and therefore do not need to be upgraded.

Table 4.3 Calculated factor of safety and recommended remedial measure for soil slopes

Slope No.	Required FoS	Section	Calculated FoS	Does the slope meet required FoS?	Are prescriptive measures applicable?	Recommended prescriptive measure
12SW-A/C76	1.1	SS2	1.024	No	Yes (Height of slope < 18m)	soil nails
		SS1	1.644	Yes	-	-
		SS3	1.321	Yes	-	-
12SW-A/C173	1.1	SS4	0.890	No	Yes (Height of slope < 18m)	soil nails
		SS5	1.298	Yes	-	-
		SS6	1.026	No	Yes (Height of slope < 18m)	soil nails
12SW-A/C174	1.1	SS7	1.613	Yes	-	-
12SW-A/C175	1.1			-	-	-
12SW-A/C176	1.1	SS9	0.977	No	Yes (Height of slope < 18m)	soil nails
12SW-A/C177	1.1	SS12	1.032	No	Yes (Height of slope < 18m)	soil nails
		SS10	1.231	Yes	-	-
		SS11	1.180	Yes	-	-
12SW-A/C178	1.1	SS15	1.743	Yes	-	-
12SW-A/C180	1.1	SS13	1.312	Yes	-	-
12SW-A/C182	1.2	SS16	0.863	No and seepage is observed	Yes (Height of slope < 10m)	soil nails and raking drains
		SS17	1.254	Yes	-	-
12SW-A/C183	1.2	SS19	1.765	Yes but seepage is observed	Yes (Height of slope < 10m)	raking drains
12SW-A/C184	1.2	SS22	1.451	Yes	-	-
12SW-A/C185	1.2	SS24	1.335	Yes	-	-
12SW-A/C186	1.2	SS25	1.230	Yes	-	-
12SW-A/C187	1.1	SS27	1.456	Yes	-	-
12SW-A/C188	1.1	SS30	1.643	Yes but seepage is observed	Yes (Height of slope < 18m)	raking drains

4.4 Rock slopes

Some portions of Slope Nos. 12SW-A/C76, 12SW-A/C174, 12SW-A/C180 and 12SW-A/C177 are in rock and their stability analyses and proposed upgrading works are described in Sections 4.4.1 to 4.4.2.

4.4.1 Stability analyses

Joint data from rock mapping and chunam stripping from the cut slopes at the base of the natural terrain are analyzed using stereographic hemispherical projection methods, and the results are presented in the form of pole, contour and major planes plots for each of the slope orientations, included in Appendix E.

A kinematic check is carried out to examine whether the major joint sets and individual joints identified will adversely affect the stability of the slope. The rock joints are generally surface stained and therefore a friction angle of 30° for volcanics has been assumed in all the analyses.

The stereographic projections and kinematic stability checks are carried out using the computer software DIPS 4.0 (Diedrichs & Hoek). The stereoplots show potential unstable zones as:

W - potential wedge failure

P - potential planar failure

T – potential toppling failure

4.4.1.1 Feature No. 12SW-A/C76

Rock mapping and along Strip S33

Summary of Kinematic Analyses

	Kinematically Feasible Failure Mechanism		
Slope Face Dip/Dip Direction	Planar	Wedge	Toppling
70/305	Individual Joint	-	-

1. A total of 7 joints were taken from rock mapping and stripping S33 of predominantly moderately decomposed rock.

2. Individual joint #1 (50/330) falls within the daylight envelope for planar failure. However, the overlying block indicates movement and remedial measures are required.

3. It is therefore recommended that loose blocks be removed or remedial measures such as concrete infilling be carried out.

Along Strips S1, S3 and S32

Orientation of Major Joint Sets and Intersections

Mean of major Joint Sets and Joint Intersections	Mean Dip/Dip Direction
1	74/293
2	39/340
3	80/081
4	65/218
12	35/011
13	50/003
14	63/237
23	37/358
24	29/293
34	49/160

Summary of Kinematic Analyses

	Kinematically Feasible Failure Mechanism		
Slope Face Dip/Dip Direction	Planar	Wedge	Toppling
63/005	#2, 12, 13, 23	Individual joints	Individual joints

1. A total of 24 joints have been taken from rocks ranging from highly to moderately decomposed.
2. Major joint set #2 and the intersection of joint sets 12, 13 and 23 fall within the daylight envelope for planar and wedge failure mechanism.
3. Individual joints (78/165 & 79/200) lie within the daylight envelope for toppling failure.
4. Therefore, planar, wedge and toppling failure mechanisms are kinematically feasible along this slope. However, site inspection did not reveal any obvious potential failures.

4.4.1.2 Feature No. 12SW-A/C174

Rock mapping and along Strip S7

Orientation of Major Joint Sets and Intersections

Mean of major Joint Sets and Joint Intersections	Mean Dip/Dip Direction
1	12/002
2	87/239
3	78/345
4	82/310
12	11/328
13	04/074
14	10/038
23	76/317
24	83/305
34	77/000

Summary of Kinematic Analyses

	Kinematically Feasible Failure Mechanism		
Slope Face Dip/Dip Direction	Planar	Wedge	Toppling
45/270	Individual joint	Individual joint	Individual joints

1. A total of 66 joints were taken from rock mapping and the stripping S7 of predominantly moderately to slightly decomposed rock.

2. Individual joints fall within the daylight envelope for toppling failure indicating that toppling failure mechanism is kinematically feasible.

3. Individual joints (30/323 and 32/300) lie within the daylight envelope for planar and wedge failures respectively. However, potential failures have been removed. The intersection between joints #12 falls within the daylight envelope but within the friction circle.

4. The rock face is generally fractured with loose blocks and open joints. It is therefore highly recommended that the slope be cut back with removal of the loose blocks. Further slope inspection should be carried to ascertain whether stabilisation measures will be required.

Rock mapping and along Strip S8

Orientation of Major Joint Sets and Intersections

Mean of major Joint Sets and Joint Intersections	Mean Dip/Dip Direction
1	85/144
2	85/245
3	14/082
4	56/013
12	82/192
13	13/055
14	46/059
23	04/155
24	47/329
34	13/092

Summary of Kinematic Analyses

	Kinematically Feasible Failure Mechanism		
Slope Face Dip/Dip Direction	Planar	Wedge	Toppling
70/335	-	#4	#1

1. A total of 16 joints were taken from the rock mapping and stripping S8 of highly to moderately decomposed rock.

2. Major joint set #1 (85/144) falls within the daylight envelope for toppling failure indicating that toppling failure mechanisms is kinematically feasible.

3. Major joint set #4 (56/013) falls within the daylight envelope for planar and wedge failure indicating that planar failure mechanism is kinematically feasible.

4. Site inspection did not reveal any obvious toppling, plannar or wedge failures.

5. Open joints and loose blocks were identified on the rock face which will need to be cleared before any remedial measures are carried out.

4.4.1.3 Feature No. 12SW-A/C180

Along Strip S13

Summary of Kinematic Analyses

	Kinematically Feasible Failure Mechanism		
Slope Face Dip/Dip Direction	Planar	Wedge	Toppling
64/320	-	Individual joint	-

1. A total of 4 joints have been taken from moderately decomposed rock.
2. An individual joint (59/290) falls within the daylight envelope for planar and wedge failure indicating that planar failure mechanism is kinematically feasible. However, site inspection did not identify any obvious potential failures.
3. Loose blocks were observed on slope face and these should be removed.

4.4.1.4 Feature No. 12SW-A/C177

Along Strips S11 & S12

Summary of Kinematic Analyses

	Kinematically Feasible Failure Mechanism		
Slope Face Dip/Dip Direction	Planar	Wedge	Toppling
67/320	-	Individual joints	-

With a mean slope face of 67/320:

1. A total of 26 joints have been taken from highly to moderately decomposed rock.
2. Individual joints (60/290 and 52/275) fall within the daylight envelope for planar and wedge failure indicating that planar failure mechanism is kinematically feasible.
3. The intersection of joint set 13 falls within the daylight envelope but within the friction circle.
4. Site inspection did not reveal any obvious potential failures.

4.4.2 Upgrading Works

In accordance with GEO Report No. 56, all the above-mentioned sub-standard soil slopes can be upgraded by prescriptive measures, as shown in Table 4.3. The recommended prescriptive measures are soil nailing for increasing the factor of safety and raking drains for releasing groundwater.

The record sheets for prescriptive measures application are presented in Appendix D, whilst the layout of the proposed soil nails and raking drains are shown in Drawing No. BV/TKO/382311/001.

The proposed upgrading works for the rock cut slopes are summarized in Table 4.4.

Table 4.4 Recommended upgrading works for rock cut slopes

Feature No.	Results of Stability Analysis and Recommended Works
12SW-A/C174	• Potential toppling and planar failures, fractured slope surface and open joints. • Cutting back of slope and removal of loose blocks. • Further slope inspection should be carried out after removal of loose blocks to ascertain whether stabilization measures will be required.
12SW-A/C76	• Planar, wedge and toppling failure mechanisms kinematically feasible but no potential failures observed during site inspections. • removal of loose blocks and concrete infilling of open joints
12SW-A/C180	• Planar failure mechanisms kinematically feasible, however, no obvious potential failures identified. • Removal of loose blocks.
12SW-A/C177	• planar failure mechanism kinematically feasible, however, site inspections did not reveal any obvious potential failures. • No upgrading works required.

However, these upgrading works would be superseded where adjacent preventive measures against natural terrain hazards will also accommodate the debris expected from cut slope failure. As will be discussed in Section 5, two preventive options against natural terrain hazards are proposed, namely, option 1 to construct an earth bund and option 2 to define a no-build-zone.

With option 1, because the proposed earth bund covers all the cut slopes except Slope No. 12SW-A/C188, upgrading works are only required for Slope No. 12SW-A/C188.

With option 2, because the proposed no-build-zone covers all the cut slopes, no upgrading works are required.

5 NATURAL SLOPES

5.1 General

A detailed natural terrain hazard assessment has been carried out and the findings are summarized in the Natural Terrain Hazard Assessment Report, Report No. 382311/NTHA. The main findings are briefly described below.

5.2 Natural terrain hazard assessment

The API in association with the NTLI Datebase and site walkover confirm that there is evidence of relict and recent landslides within the study area.

Based on the assessment results, it is considered that channelised debris flows, open hillslope landslides and boulder falls all form potential hazards to the proposed development.

5.2.1 Boulder and rock falls

Previous boulder stabilisation works had been carried out. However, site inspection revealed that two potentially high-risk boulders (i.e. Boulders D1 and D2 as shown in Dwawing No. BBV/TKO/382311/002) in Catchment Nos. 2 and 4 require stabilising/preventive measures. It is recommended that Boulder D1 be removed and dentition be carried out on Boulder D2. Removal and breaking up of boulder D1 should be by splitting using pneumatic percussive drilling using either dynamic or chemical means. Care should be taken to avoid dislodging the boulder during splitting. The removal of Boulder D2 would affect the stability of the surrounding boulders and thus dentition has been considered the best stabilising measure.

The only location where rockfalls are considered a possibility is in Catchment 4 where numerous rock outcrops occur within the 80m high natural terrain, which slopes at an angle of between 23o to 32° (predominantly <30o) and are covered by vegetation. Given that the friction angle between boulder and slope surface would have greater than 30o (i.e. slope angle predominantly < friction angle) boulder movement triggered by erosion or thermal effects are unlikely to occur.

The relevant assessment results are reproduced in Tables 5.1 to 5.5 for easy reference.

Table 5.1 Design Requirements Summary Table
(after Natural Terrain Hazard Assessment Report)

Catchment	Facility	Facility Group (1)	Consequence Class (3)	Susceptibility Class (4)	Design Requirements (2)
1	Built-up area	3	II - Moderately close	X	N
2	Formed slope	3	II - Very close	D	N
3	Temporary offices	1	II - Moderately close	C	CE
4	Access Road	3	III - Moderately close	C	CE
5	Access Road	3	III - Moderately close	C	CE
6A	Access Road	3	III - Moderately close	C	CE
6B	Access Road	3	III - Moderately close	C	CE
7	Access Road	3	III - Moderately close	B	CE
8	Access Road	3	III - Moderately close	C	CE
9	Access Road	3	III - Moderately close	B	CE
	Steel Structure	3	III-Far	B	CE

Note:
(1) Please refer to Table 1 of GEO SPR 1/2002
(2) Please refer to Table 2 of GEO SPR 1/2002
(3) Please refer to Table 3 of GEO SPR 1/2002
(4) Please refer to Table 4 of GEO SPR 1/2002
X Does not affect landfill platform

Table 5.2 Estimation of Channelised Debris Flow Volume for Each Catchment (after Natural Terrain Hazard Assessment Report)

Catchment No.	Susceptibility Class	Design Landslide Event	Upper Drainage Line Angle (degrees)	Lower Drainage Line Angle (degrees)	Source Volume (m^3)	9% Deposition of Initial Volume from Main Scrap	Length of Drainage Line (m)	Possible Length of Erosion (i.e.Colluvium in Drainage Line & gradient >20°) (m)	Designed Erosion Rate (m^3/m)	Entrainment Volume (m^3)	Run-out Volume (m^3)	Trail Width (m)	Thickness of Deposition (m)	Length of Deposition (streambed gradient <20°) (m)	Total Volume of Deposition on Channel (m^3)	Final Run-out Volume (m^3)	Expected Run-out Distance (m)
3	C	CE	28	5	240	22	208	208	2.3	478.4	697	6	3.22	0	0	**697**	36.05
4 (Case 2)	C	CE	36	5	240	22	145	145	2.3	333.5	552	6	2.96	0	0	**552**	31.06
5	C	CE	29	5	240	22	208	208	2.3	478.4	697	6	3.27	0	0	**697**	35.48
6A	C	CE	41	10	240	22	144	144	2.3	331.2	550	6	2.02	0	0	**550**	45.34
6B	C	CE	32	10	240	22	144	144	2.3	331.2	550	6	1.71	0	0	**550**	53.48
7	B	CE	32	10	240	22	178	178	2.3	409.4	628	6	1.96	0	0	**628**	53.48
8	C	CE	32	10	240	22	190	190	2.3	437	655	6	2.04	0	0	**655**	53.48
9	B	CE	31	15	240	21.6	210	210	2.3	483	701	6	1.07	0	0	**701**	109.37

Note:

1. Refer to Table 9, GEO Report No. 57, of channelised failure:
   % deposition of initial volume from main scrap = **9%**
   Erosion Rate = **3.66 m^3/m (WCE) or 2.3 m^3/m (CE)**
   Trail width = **6m** (CE), **8m** (WCE)
   Thickness of deposition should be read in conjunction with summary table of debris flow calculation in Appendix I
2. N/A = Not Applicable because out of project area.

Table 5.3
Summary Table for Channelised Debris Flows
(after Natural Terrain Hazard Assessment Report)

Catchment No.	Design Landslide Event	Entry Channel Slope Angle (°)	Final Run-Out Volume (m^3)	Expected Run-Out Distance (m)
3	CE	56	697	36.05
4 (Case 1)	CE	42	0	-
4 (Case 2)	CE	36	552	31.06
5	CE	29	697	35.48
6A	CE	41	550	45.34
6B	CE	32	550	53.48
7	CE	32	628	53.48
8	CE	32	655	53.48
9	CE	31	701	109.37

Table 5.4
Summary Table for Open Hillslope Landslides
(after Natural Terrain Hazard Assessment Report)

Catchment No.	Design Landslide Event	Slope Angle (°) at Slope Toe	Final Run-Out Volume (m^3/m)	Expected Run-Out Distance (m)
3	CE	56	24	11.84
4	CE	60	24	12.06
5	CE	59	24	12.01
6A	CE	57	24	15.08
6B	CE	70	24	15.64
7	CE	50	24	14.66
8	CE	55	24	14.97
9	CE	60	24	22.38

Table 5.5
Summary of Boulder Survey
(after Natural Terrain Hazard Assessment Report)

Boulder No.	Size (m^3)	Catchment No.	Shape	Stability Rating (1)	Risk Rating (2)	Potential failure Mechanism (3)	Stabilisation/ Preventive Works
1	2.88	2	Cubic-subrounded	M	H	R	Removal
2	1.44	4	Cubic-subangular	M	H	T	Dentition

Notes: (1) M-Medium
(2) H-High
(3) R- Rolling
T-Toppling

5.2.2 *Open hillslope landslides and channelised debris flows*

The perimeter enclosing the run-out distances due to both open hillslope landslides and channelised debris flows is marked in Drawing No. BV/TKO/382311/002. Based on the calculation results, it is recommended that a 2.5m high earth bund, located at a minimum distance of 4m from the toe of the slopes, be constructed to contain any debris flows, as also shown in Drawing No. BV/TKO/382311/002. However, parts of the existing access road which is the only access road leading to the top 140mPD platform, would be blocked by the proposed earth bund and need to be diverted.

An alternative option that does not require diversion of the access road is discussed in Section 5.3.

5.3 'No build zone' option

An alternative option that does not require diversion of the access road is to define a 'no-build zone', outside of which no development will be affected by any potential hazards, even if the total area of the development has to be reduced upon the establishment of the 'no-build-zone' within the landfill site.

Such a no-build-zone can be defined based on the calculated run-distances discussed in Section 5.2 and is shown in Drawing No. BV/TKO/382311/003, with its boundary being defined as one meter further away from the calculated run-out distance boundary. Note the following points:

- The majority of the platform at 140 mPD is located outside of the no-build-zone and can therefore be used for development, as per the conceptual design which would only require the set up of a couple of movable containers as offices.
- The entire platform at 40 mPD is located outside of the no-build-zone and can therefore be used for development. The conceptual design indicates that a steel structure for recycling facility is to be constructed on this platform.
- Some parts of the access road are located within the no-build-zone. Instead of carrying out extensive road diversion works and slope stabilization works, it is recommended to close the road on signs (e.g. bad weather) indicating a potential danger to the road.

5.4 Adopted Option

The 'no-build-zone' option, as shown in Drawing No. BV/TKO/382311/003, is considered an economic and feasible approach to safeguard the proposed Park, and is therefore the adopted option.

6 CONCEPTUAL FOUNDATION DESIGN

6.1 General

The conceptual design of the Park (Appendix B) illustrates one steel structure located on the 40 mPD platform, and two structures and some seating areas located on the 140 mPD platform.

As documented in Registered Design No. STG2/STE/SUB/003/Issue 2, the restored Stage II/III landfill site consists of a linear low density polyethylene (LLDPE) geomembrane as a capping system, overlying a single cover layer of CDV placed over the waste. The CDV cover layer is generally 850 mm thick and is compacted to 90% of the standard Proctor density. The use of this capping system is to minimise water infiltration, reduce leachate generation and control leachate levels.

6.2 Foundation Options

It is recommended that shallow foundations, instead of deep foundations, should be used to support the proposed buildings in order not to damage the capping system.

In order to minimise settlement, in particular differential settlement, it is further recommended that each building be supported on a single raft foundation of adequate size.

The size of the raft foundation can be determined based on the acceptable settlement and bearing capacity, as described below:

- Bearing Capacity: Figure 6.1 shows the relationship between the ultimate bearing capacity and the width of a raft foundation, for two different embedded depths, i.e. at ground surface and at 0.65 m below the ground surface. It shows that the ultimate bearing capacity increases with both foundation width and embedded foundation depth. It further shows that the ultimate bearing capacity is substantially reduced if the underlying waste is taken into account and any beneficial contribution from the synthetic capping layer to the bearing capacity is ignored. However, even for this worse case scenario, a 5m wide by 40m long raft foundation still has an ultimate bearing capacity of approximately 100 kPa; for a safety factor of 3 as normally adopted for shallow foundations, this ultimate bearing capacity translates to an allowable bering capacity of approximately 33 kPa.

- Settlement: Figures 6.2(a) and (b) indicate that settlement increases with increasing applied loading, as expected. If the beneficial effect of the foundation stiffness is conservatively ignored, the calculated settlement reaches approximately 0.5 m for an applied loading of approximately 30 kPa. Due consideration should be given to piping and cabling systems associated with a building when assessing whether this magnitude of settlement is acceptable or not.

It is likely that the settlement, rather than bearing capacity, will control the size of the raft foundation.

More details of the bearing capacity and settlement calculations are presented in Appendix F.

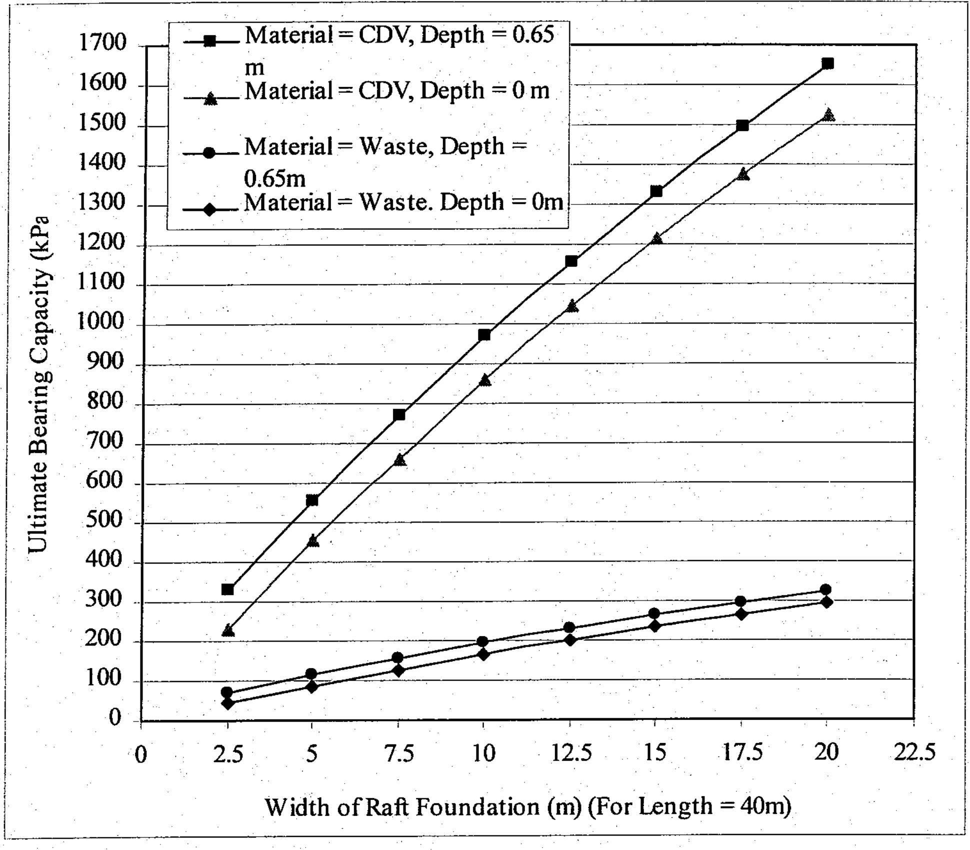
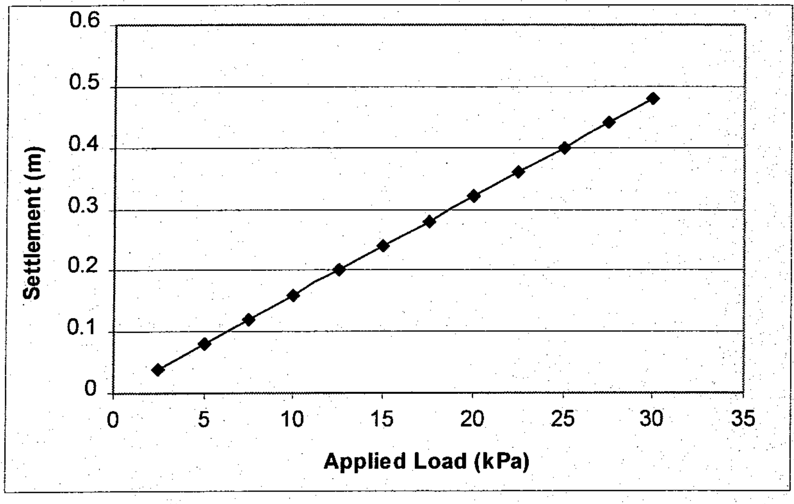
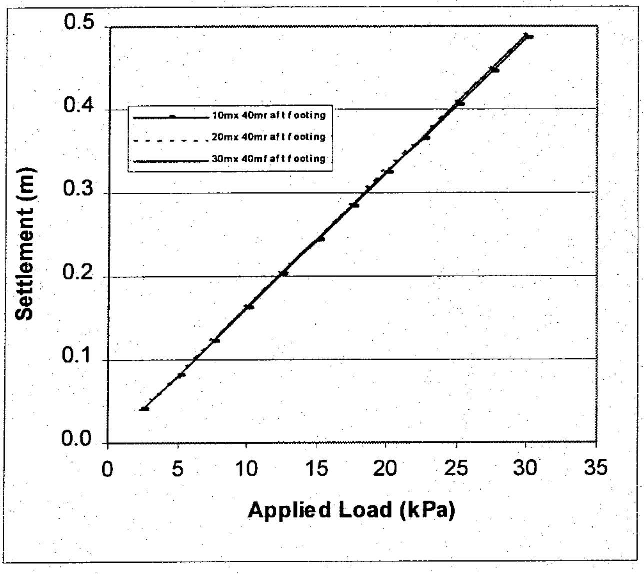


Figure 6.1 Relationship between calculated ultimate bearing capacity and foundation width



(a) 140 mPD platform



(b) 40 mPD platform

Figure 6.2 Relationship between calculated settlement and applied loading

7 COST ESTIMATE

The cost estimates for various construction works are presented in Appendix G.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Waste slopes

The proposed facilities associated with the Park (with a structural load of not greater than 50 kPa) will not compromise the stability of the waste slopes. Therefore, no upgrading works are required for the waste slopes. It is recommended that good maintenance be continued for the waste slopes so that they can meet the required minimum factor of safety within the context of the Park.

8.2 Cut slopes

Several soil cut slopes possess minimum calculated factors of safety less than the required value and therefore require upgrading works. These substandard soil slopes can be upgraded by prescriptive measures using soil nails and raking drains, as shown in Table 4.3 and Drawing No. BV/TKO/382311/001.

Several rock cut slopes have loose blocks and open joints on the slope surface. These substandard rock slopes can be upgraded by removal of loose blocks and concrete infilling of open joints, as shown in Table 4.4.

However, these upgrading works would be superseded where adjacent preventive measures against natural terrain hazards will also accommodate the debris expected from cut slope failure. Two preventive options against natural terrain hazards are proposed in Section 5, namely, option 1 to construct an earth bund and option 2 to define a no-build-zone.

With option 1, because the proposed earth bund covers all the cut slopes except Slope No. 12SW-A/C188, upgrading works are only required for Slope No. 12SW-A/C188.

With option 2, because the proposed no-build-zone covers all the cut slopes, no upgrading works are required.

8.3 Natural slopes

Based on the natural terrain hazard assessment results, it is considered that channelised debris flows, open hillslope landslides and boulder falls all form potential harzards to the proposed development.

Site inspection revealed that two potentially high-risk boulders (i.e. Boulders D1 and D2 as shown in Dwawing No. BBV/TKO/382311/002) in Catchment Nos. 2 and 4 require stabilising/preventive measures. It is recommended that Boulder D1 be removed and dentition be carried out on Boulder D2. Removal and breaking up of boulder D1 should be by splitting using pneumatic percussive drilling using either dynamic or chemical means. Care should be taken to avoid dislodging the boulder during splitting. The removal of Boulder D2 would affect the stability of the surrounding boulders and thus dentition is considered the best stabilising measure.

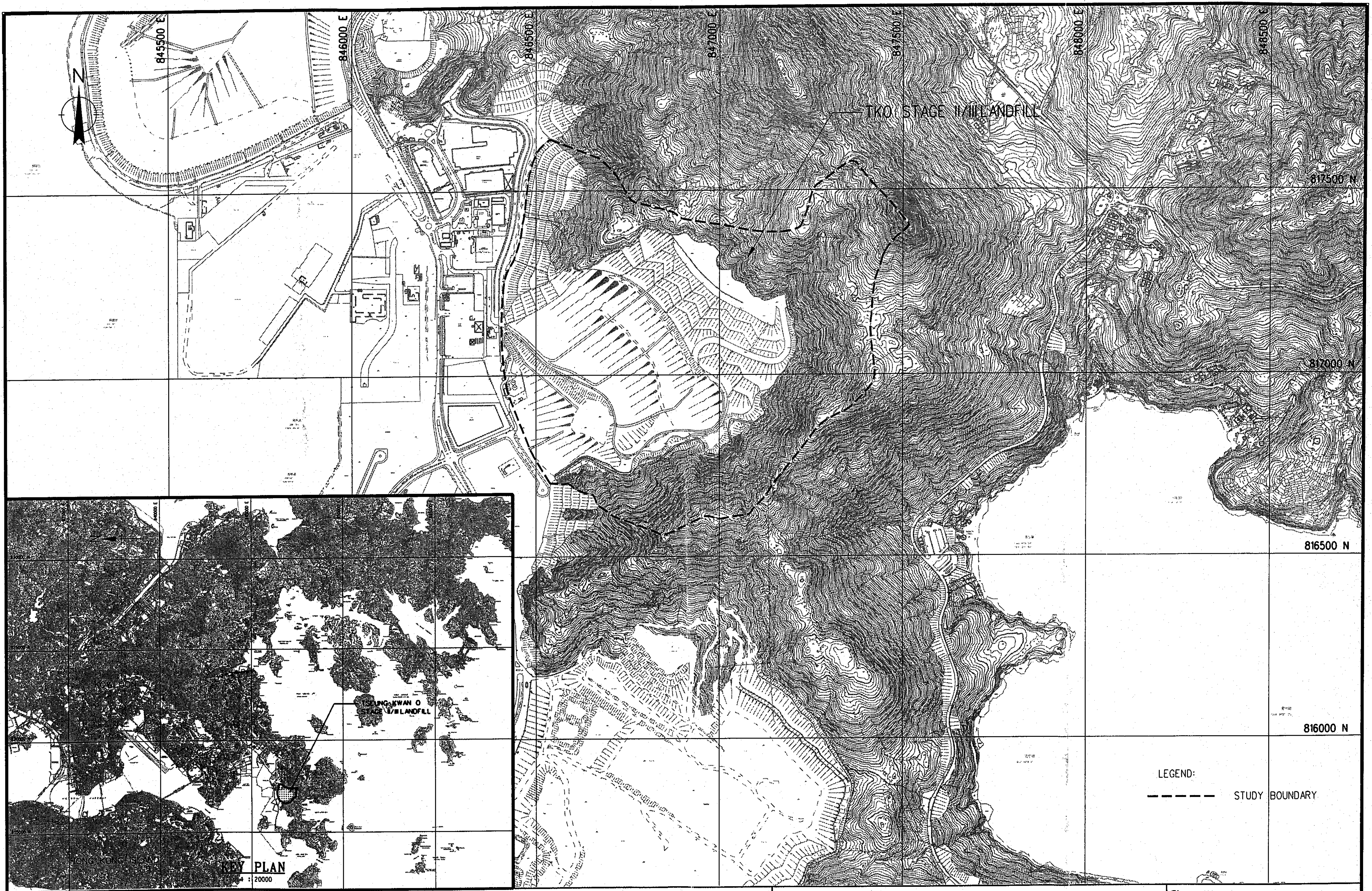
Two preventive options against open hillslope landslides and channelized debris flows have been proposed. Option 1 is to construct an earth bund as shown in Dwg No. BV/TKO/382311/002, and option 2 is to define a no-build-zone to allow for safe development outside of this zone, as shown in Drawing No. BV/TKO/382311/003. Option 2 is considered to be economic and feasible.

8.4 Conceptual foundation design

The existence of the capping system precludes the use of deep foundations and calls for the use of shallow foundations to support the buildings. It is recommended that each building be supported on a single raft foundation founded on the CDV cover layer.

Calculation results have shown that allowable settlement, rather than bearing capacity, is likely to control the size of a raft foundation. It is recommended that the allowable settlement be determined in the detailed design of the buildings, with due consideration of associated piping and cabling systems.

FIGURES



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STUDY BOUNDARY
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KEY PLAN
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BLACK & VEATCH HONG KONG LIMITED
博威工程顧問有限公司

Project
Tseung Kwan O Stage II/III Landfill Afteruse Development

Prepared By: SMO

Checked By: KWK

Title
SITE LOCATION PLAN

Figure No.
1

Scale
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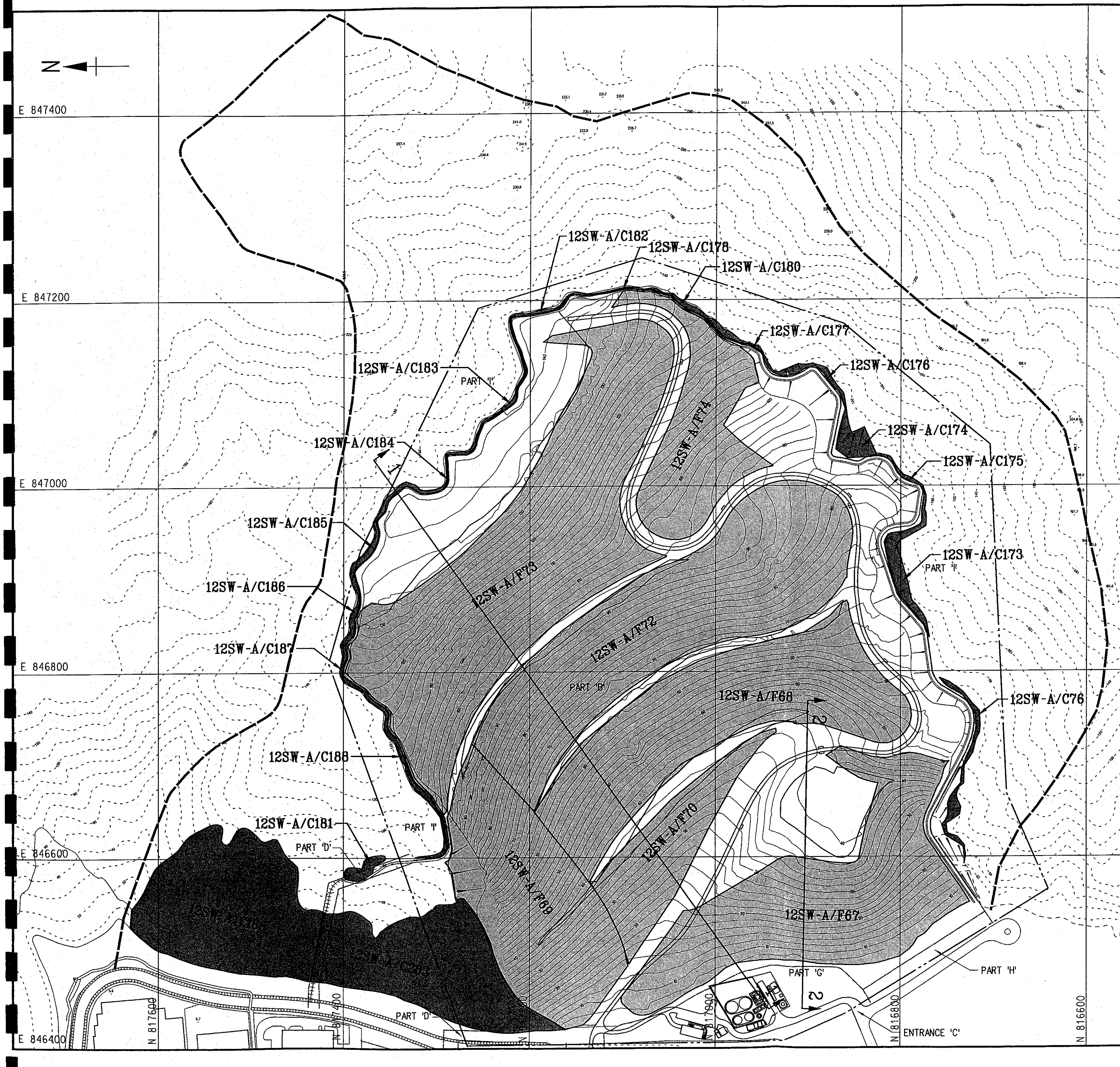
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12SW-A/F67
PART 'I'
PART 'B'
PART 'D'
PART 'G'
PART 'H'
ENTRANCE 'C'
1
2

LEGEND:

— · — · —	LANDFILL BOUNDARY
— — —	STUDY BOUNDARY
▨	GEO REGISTERED FILL SLOPE
■	GEO REGISTERED CUT SLOPE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. ALL DIMENSIONS ARE TYPICAL AND TO BE CONFIRMED AT DETAILED DESIGN.

Approved

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XREF : tkosf-ab.dgn, 2-ptrd.dgn, s2fccon.dgn & A1-title.dgn

Contract no.

Contract
GEOTECHNICAL REVIEW AND
SITE INVESTIGATION WORKS
FOR TSEUNG KWAN O STAGE II/III
AFTERUSE DEVELOPMENT

Figure Title

TSEUNG KWAN O
STAGE II/III LANDFILL
GEO REGISTERED SLOPES

Figure no. 2

Scale
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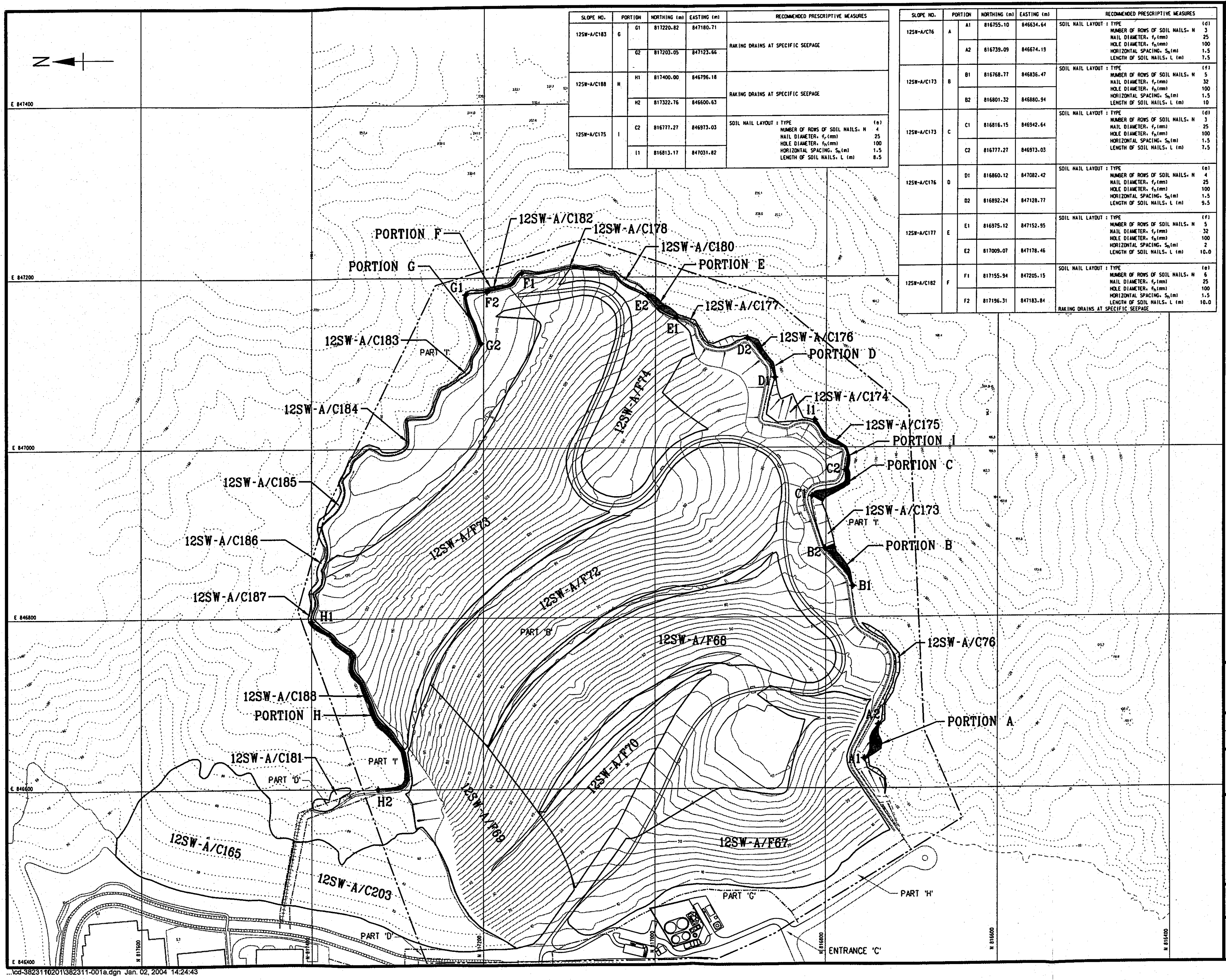
DRAWINGS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12SW-A/C178
12SW-A/C180
PORTION E
PORTION G
G1
F1
F2
E2
12SW-A/C177
E1
12SW-A/C183
PART 'I'
G2
12SW-A/C176
D2
PORTION D
D1
12SW-A/C174
I1
12SW-A/F74
12SW-A/C184
12SW-A/C175
PORTION I
C2
PORTION C
C1
12SW-A/C185
12SW-A/C173
PART 'I'
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12SW-A/C186
B2
PORTION B
12SW-A/F72
B1
12SW-A/C187
H1
PART 'B'
12SW-A/F68
12SW-A/C76
12SW-A/C188
PORTION H
A2
PORTION A
12SW-A/F70
A1
12SW-A/C181
PART 'I'
PART 'D'
H2
12SW-A/F69
12SW-A/C165
12SW-A/F67
12SW-A/C203
PART 'G'
PART 'H'
PART 'D'
ENTRANCE 'C'

SLOPE NO.	PORTION		NORTHING (m)	EASTING (m)	RECOMMENDED PRESCRIPTIVE MEASURES
12SW-A/C183	G	G1	817220.82	847180.71	RAKING DRAINS AT SPECIFIC SEEPAGE
		G2	817203.05	847123.66	
12SW-A/C188	H	H1	817400.00	846796.18	RAKING DRAINS AT SPECIFIC SEEPAGE
		H2	817322.76	846600.63	
12SW-A/C175	I	C2	816777.27	846973.03	SOIL NAIL LAYOUT : TYPE (e) NUMBER OF ROWS OF SOIL NAILS, N 4 NAIL DIAMETER, f_r(mm) 25 HOLE DIAMETER, f_h(mm) 100 HORIZONTAL SPACING, S_h(m) 1.5 LENGTH OF SOIL NAILS, L (m) 8.5
		I1	816813.17	847031.82	

SLOPE NO.	PORTION		NORTHING (m)	EASTING (m)	RECOMMENDED PRESCRIPTIVE MEASURES
12SW-A/C76	A	A1	816755.10	846634.64	SOIL NAIL LAYOUT : TYPE (d) NUMBER OF ROWS OF SOIL NAILS, N 3 NAIL DIAMETER, f_r(mm) 25 HOLE DIAMETER, f_h(mm) 100 HORIZONTAL SPACING, S_h(m) 1.5 LENGTH OF SOIL NAILS, L (m) 7.5
		A2	816739.09	846674.19	
12SW-A/C173	B	B1	816768.77	846836.47	SOIL NAIL LAYOUT : TYPE (f) NUMBER OF ROWS OF SOIL NAILS, N 5 NAIL DIAMETER, f_r(mm) 32 HOLE DIAMETER, f_h(mm) 100 HORIZONTAL SPACING, S_h(m) 1.5 LENGTH OF SOIL NAILS, L (m) 10
		B2	816801.32	846880.94	
12SW-A/C173	C	C1	816816.15	846942.64	SOIL NAIL LAYOUT : TYPE (d) NUMBER OF ROWS OF SOIL NAILS, N 3 NAIL DIAMETER, f_r(mm) 25 HOLE DIAMETER, f_h(mm) 100 HORIZONTAL SPACING, S_h(m) 1.5 LENGTH OF SOIL NAILS, L (m) 7.5
		C2	816777.27	846973.03	
12SW-A/C176	D	D1	816860.12	847082.42	SOIL NAIL LAYOUT : TYPE (e) NUMBER OF ROWS OF SOIL NAILS, N 4 NAIL DIAMETER, f_r(mm) 25 HOLE DIAMETER, f_h(mm) 100 HORIZONTAL SPACING, S_h(m) 1.5 LENGTH OF SOIL NAILS, L (m) 9.5
		D2	816892.24	847128.77	
12SW-A/C177	E	E1	816975.12	847152.95	SOIL NAIL LAYOUT : TYPE (f) NUMBER OF ROWS OF SOIL NAILS, N 5 NAIL DIAMETER, f_r(mm) 32 HOLE DIAMETER, f_h(mm) 100 HORIZONTAL SPACING, S_h(m) 2 LENGTH OF SOIL NAILS, L (m) 10.0
		E2	817009.07	847178.46	
12SW-A/C182	F	F1	817155.94	847205.15	SOIL NAIL LAYOUT : TYPE (e) NUMBER OF ROWS OF SOIL NAILS, N 6 NAIL DIAMETER, f_r(mm) 25 HOLE DIAMETER, f_h(mm) 100 HORIZONTAL SPACING, S_h(m) 1.5 LENGTH OF SOIL NAILS, L (m) 10.0 RAKING DRAINS AT SPECIFIC SEEPAGE
		F2	817196.31	847183.84	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. ALL DIMENSIONS ARE TYPICAL AND TO BE CONFIRMED AT DETAILED DESIGN.
4. FOR DETAILS PF SOIL NAIL ARRANGEMENT, REFER TO GEO REPORT NO. 56 (SECOND EDITION), FIGURE A12.
5. FOR SOIL NAIL DETAILS, REFER TO CED DRAWING NOS. C2106/1E, 2B & 3C.
6. FOR RAKING DRAIN DETAILS, REFER TO CED DRAWING NO. C2403.
7. EXACT LOCATIONS OF SOIL NAILS AND RAKING DRAINS TO BE SPECIFIED BY ENGINEER ON SITE.

LEGEND:

— · · —	LANDFILL BOUNDARY
▨	PORTION

Approved

CAD ref. MAIN : 382311-001.dgn
XREF : tkosf-ob.dgn, 2-ptrd.dgn, s2fccon.dgn & A1-title.dgn

Contract no. F001-052

Contract
GEOTECHNICAL REVIEW AND
SITE INVESTIGATION WORKS
FOR TSEUNG KWAN O STAGE II/III
AFTERUSE DEVELOPMENT

Drawing Title
TSEUNG KWAN O
STAGE II/III LANDFILL
RECOMMENDED MEASURES FOR
EXISTING CUT SLOPES

Drawing no. BV/TKO/382311/001

Scale 1:2000(A1)
1:4000(A3)

BLACK & VEATCH HONG KONG LIMITED
博威工程顧問有限公司

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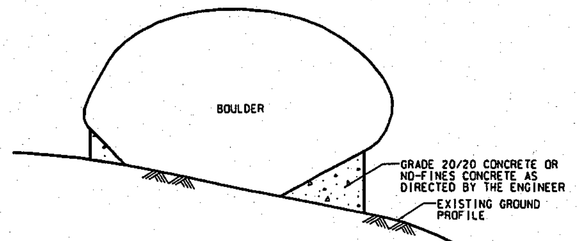
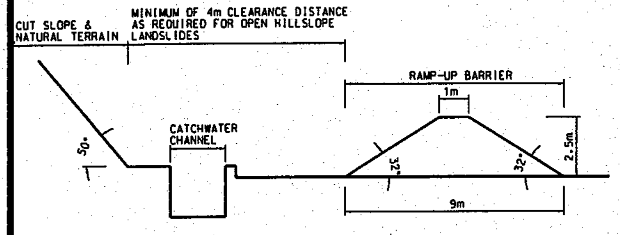

BOULDER
GRADE 20/20 CONCRETE OR NO-FINES CONCRETE AS DIRECTED BY THE ENGINEER
EXISTING GROUND PROFILE

DENTITION OF CONCRETE TO BOULDER

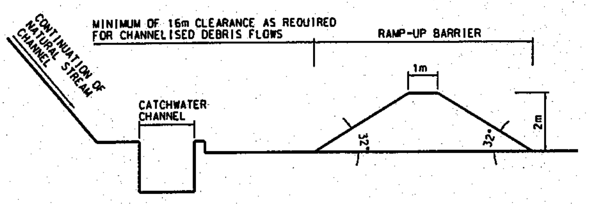
N.T.S.

NOTE :
THE DETAILS SHOWN ON THIS DRAWING ARE FOR INFORMATION ONLY. AND ARE RELATED TO THE TYPICAL SECTION AS SHOWN. THE ACTUAL EXTENT OF WORK SHALL BE DETERMINED ON SITE BY THE ENGINEER.


CUT SLOPE & NATURAL TERRAIN
MINIMUM OF 4m CLEARANCE DISTANCE AS REQUIRED FOR OPEN HILLSLOPE LANDSLIDES
RAMP-UP BARRIER
1m
CATCHWATER CHANNEL
50°
32°
32°
2.5m
9m

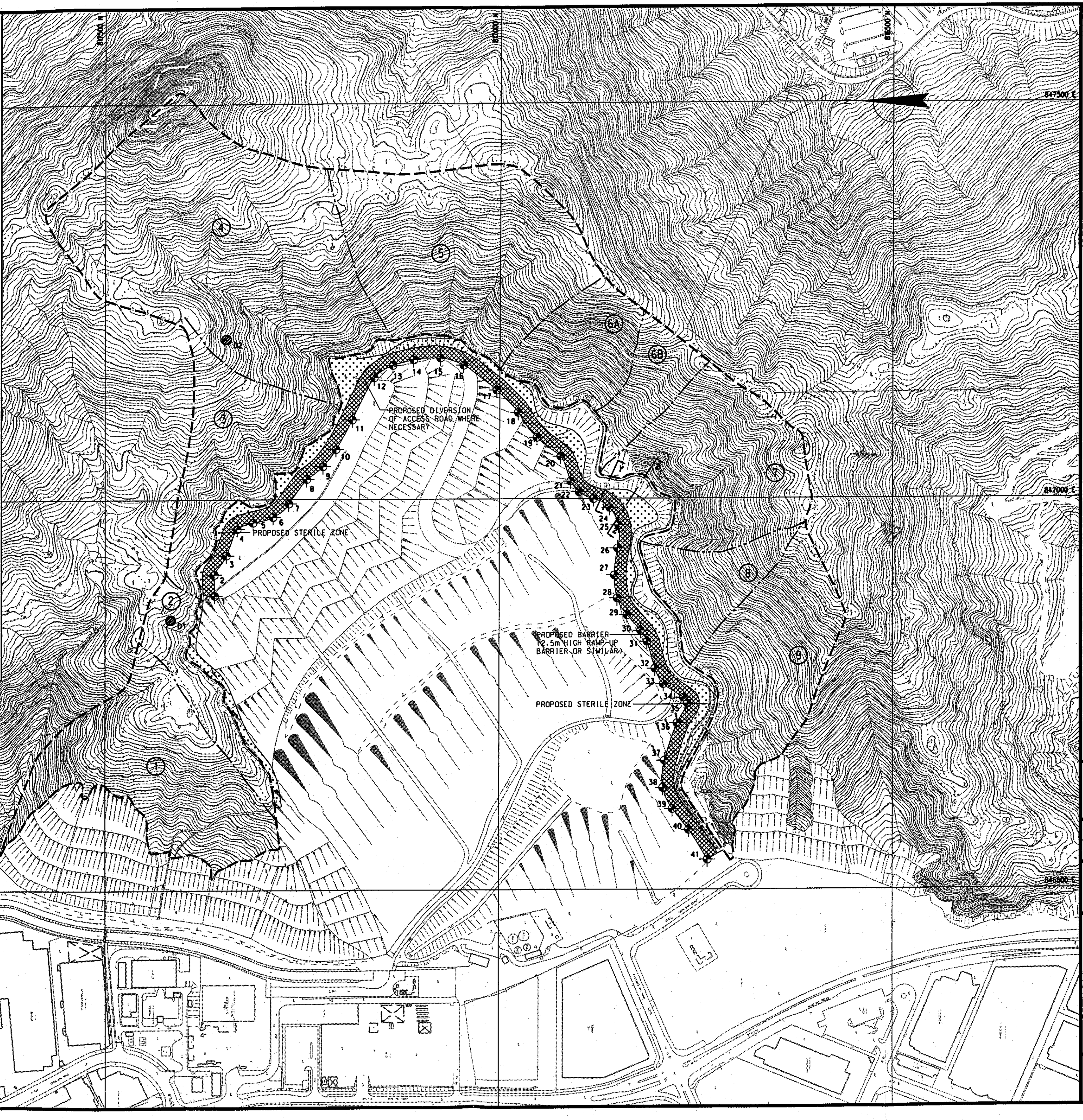
SCHEMATIC SECTION Y - Y

N.T.S.


CONTINUATION OF NATURAL STREAM CHANNEL
MINIMUM OF 16m CLEARANCE AS REQUIRED FOR CHANNELISED DEBRIS FLOWS
RAMP-UP BARRIER
1m
CATCHWATER CHANNEL
32°
32°
2m

SCHEMATIC SECTION 2 - 2

N.T.S.


817500 N
817000 N
816500 N
818000 N
847500 E
847000 E
846500 E
1
2
3
4
5
6A
6B
7
8
9
D1
D2
PROPOSED DIVERSION OF ACCESS ROAD WHERE NECESSARY
PROPOSED STERILE ZONE
PROPOSED BARRIER (2.5m HIGH RAMP-UP BARRIER OR SIMILAR)
PROPOSED STERILE ZONE
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. ALL DIMENSIONS ARE TYPICAL AND TO BE CONFIRMED AT DETAILED DESIGN.

LEGENDS:

— — —	NATURAL TERRAIN STUDY BOUNDARY
▩	RAMP UP BARRIER, 2.5m HIGH BASAL WIDTH OF 9.0m
⠿	PROPOSED STERILE ZONE
● D1	LOCATIONS OF BOULDERS REQUIRING REMOVAL/ DENTITION

SETTING OUT POINTS :

POINT	EASTING (m)	NORTHING (m)
1	846876.78	817361.76
2	846903.88	817362.17
3	846928.43	817346.75
4	846962.29	817333.39
5	846970.32	817313.26
6	846977.43	817288.06
7	846994.54	817267.82
8	847025.85	817245.22
9	847042.25	817224.74
10	847064.09	817208.17
11	847101.78	817187.53
12	847155.32	817159.75
13	847171.18	817135.70
14	847178.17	817109.34
15	847180.15	817075.42
16	847171.2	817045.83
17	847139.19	817003.79
18	847110.44	816976.84
19	847078.55	816953.17
20	847054.33	816922.90
21	847022.32	816910.10
22	847008.49	816899.33
23	846999.72	816880.86
24	846988.19	816860.24
25	846965.69	816848.75
26	846936.17	816849.95
27	846901.46	816854.07
28	846871.96	816850.42
29	846850.51	816837.81
30	846830.2	816820.45
31	846816.29	816812.04
32	846781.75	816802.04
33	846761.9	816791.36
34	846744.19	816765.82
35	846736.86	816760.34
36	846711.64	816773.79
37	846663.89	816789.67
38	846629.16	816791.78
39	846602.16	816779.71
40	846575.75	816758.75
41	846537.75	816734.75

Approved

CAD ref. MAIN : 382311-002.DGN
XREF : B12SW06B,D, B12SW01B,D, B12SW02A,B,C,D & B12SW07A,B,C,D.DGN

Contract no. FD01-052

Contract
GEOTECHNICAL REVIEW AND SITE INVESTIGATION WORKS FOR TSEUNG KWAN O STAGE II/III AFTERUSE DEVELOPMENT

Drawing Title
MITIGATION STRATEGY MAP

Drawing no.	Scale
BV/TKO/382311/002	1:2500(A1) 1:5000(A3)

BLACK & VEATCH HONG KONG LIMITED
博威工程顧問有限公司

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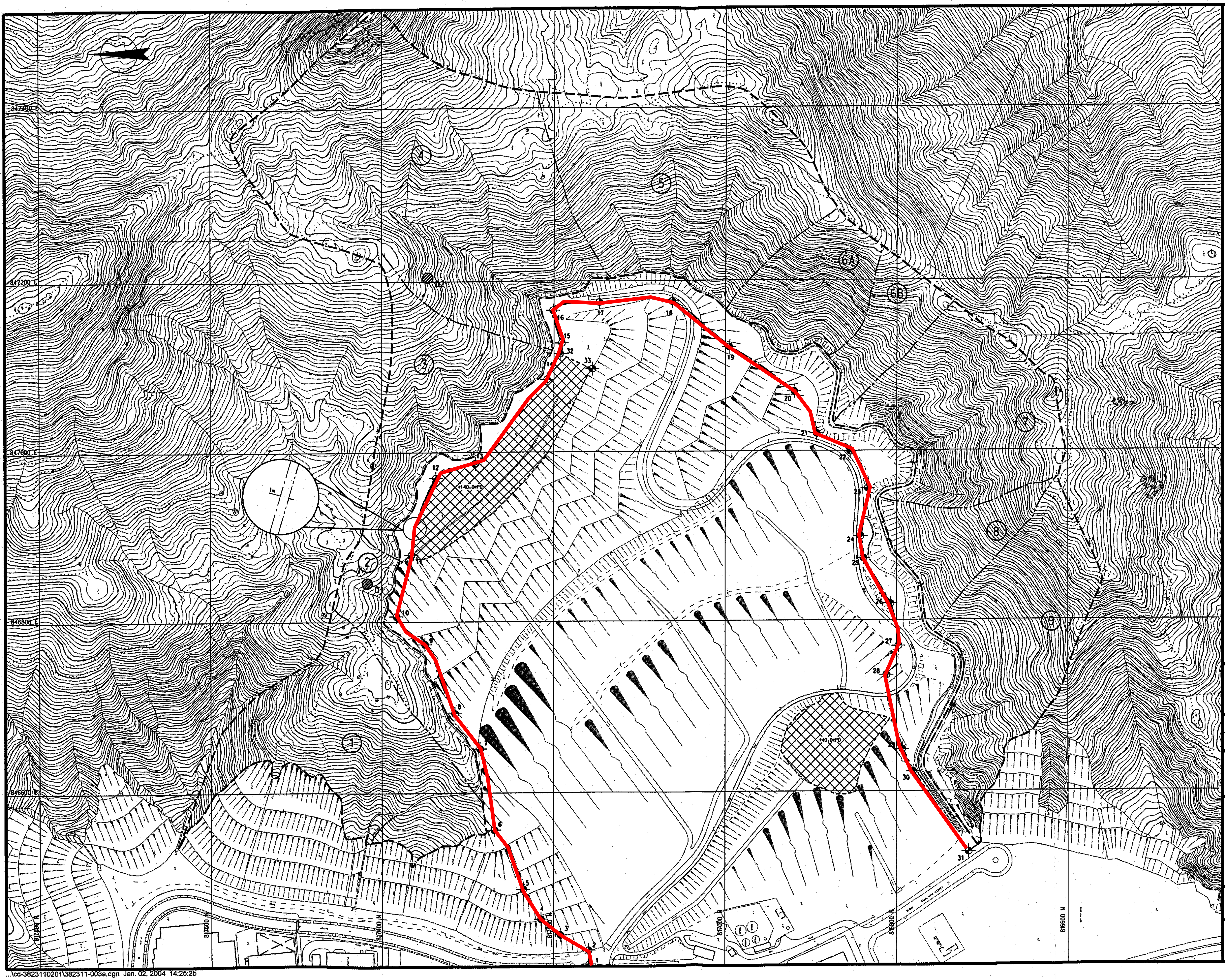
847400 E
847200 E
847000 E
846800 E
846600 E
817800 N
817600 N
817400 N
817200 N
817000 N
816800 N
816600 N
①
②
③
④
⑤
6A
6B
⑦
⑧
⑨
D1
D2
+140.0mPD
+40.0mPD
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. ALL DIMENSIONS ARE TYPICAL AND TO BE CONFIRMED AT DETAILED DESIGN.

LEGENDS:

— — — —	NATURAL TERRAIN STUDY BOUNDARY
— · — · —	CALCULATED RUN OUT DISTANCE
—— - - —— - -	BOUNDARY OF NO BUILD ZONE
▨	AREA ALLOCATED FOR AFTERUSE FACILITIES

SETTING OUT POINTS :

POINT	EASTING (m)	NORTHING (m)
1	846398.63	817158.37
2	846415.36	817159.10
3	846433.88	817192.23
4	846452.62	817215.13
5	846487.81	817236.03
6	846557.08	817269.72
7	846651.36	817286.20
8	846692.52	817315.39
9	846773.61	817350.23
10	846806.75	817383.30
11	846878.89	817365.81
12	846969.65	817337.49
13	846986.49	817291.61
14	847085.52	817208.02
15	847127.78	817190.65
16	847165.91	817201.15
17	847175.40	817146.64
18	847176.17	817062.23
19	847122.56	816995.76
20	847070.11	816919.40
21	847020.52	816892.83
22	846999.29	816853.53
23	846955.69	816833.14
24	846899.21	816841.21
25	846873.23	816838.01
26	846819.56	816807.12
27	846769.79	816797.75
28	846735.86	816811.46
29	846649.06	816793.15
30	846622.94	816780.44
31	846529.60	816715.87
32	847115.15	817193.49
33	847097.40	817155.26

Approved

CAD ref.

Contract no. F001-052

Contract

GEOTECHNICAL REVIEW AND
SITE INVESTIGATION WORKS
FOR TSEUNG KWAN O STAGE II/III
AFTERUSE DEVELOPMENT

Drawing Title

MAP FOR NO BUILD
ZONE OPTION

Drawing no. BV/TKO/382311/003

Scale 1:2000(A1)
1:4000(A3)

BLACK & VEATCH HONG KONG LIMITED
博威工程顧問有限公司

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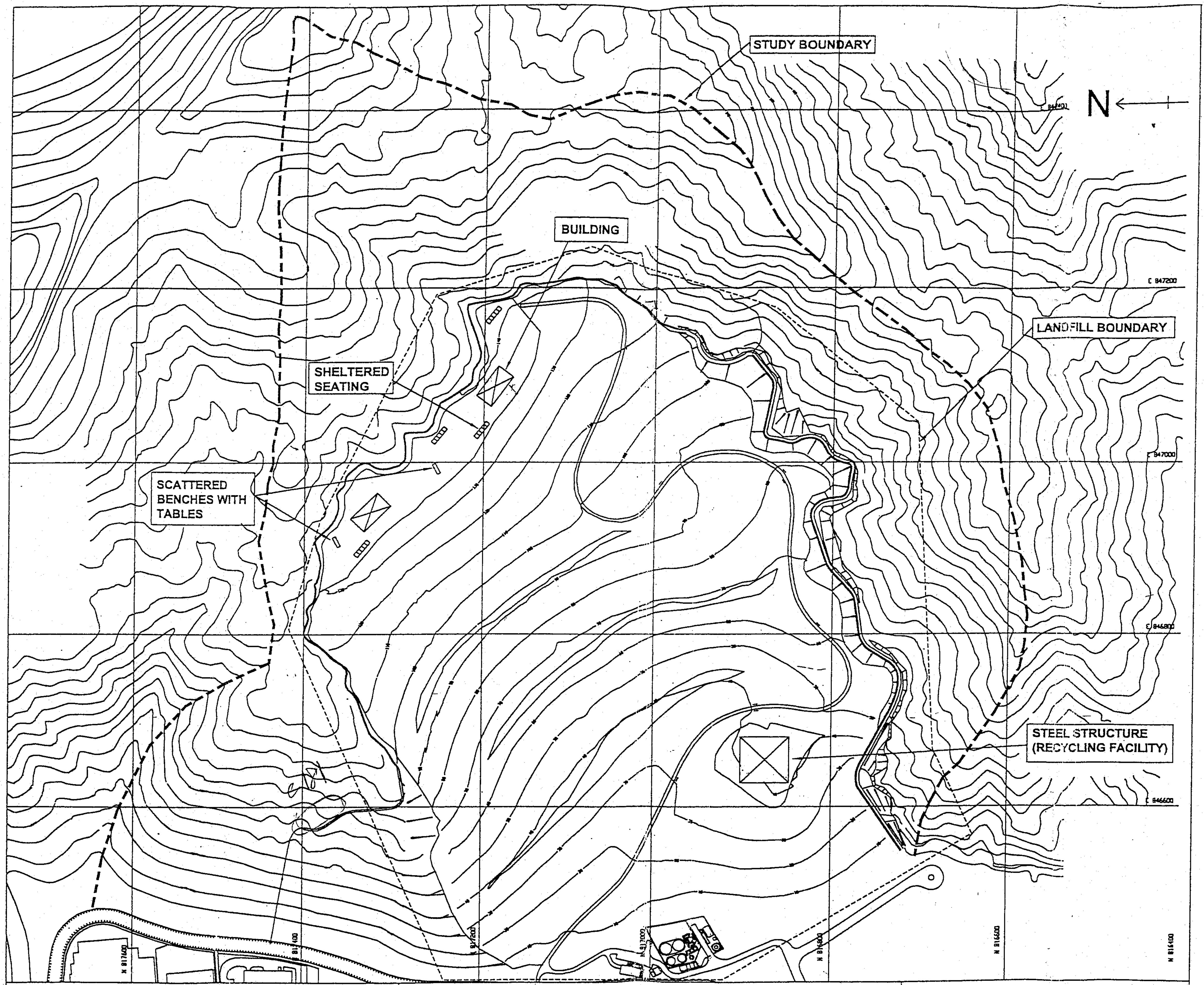
APPENDIX A
Conceptual Design of the Park


STUDY BOUNDARY
N
BUILDING
E 847200
LANDFILL BOUNDARY
SHELTERED SEATING
E 847000
SCATTERED BENCHES WITH TABLES
E 846800
STEEL STRUCTURE (RECYCLING FACILITY)
E 846600
N 817600
N 817400
N 817200
N 817000
N 816800
N 816600
N 816400

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Appendix 2 - Tseung Kwan O Landfill Stage II/III
Conceptual Design

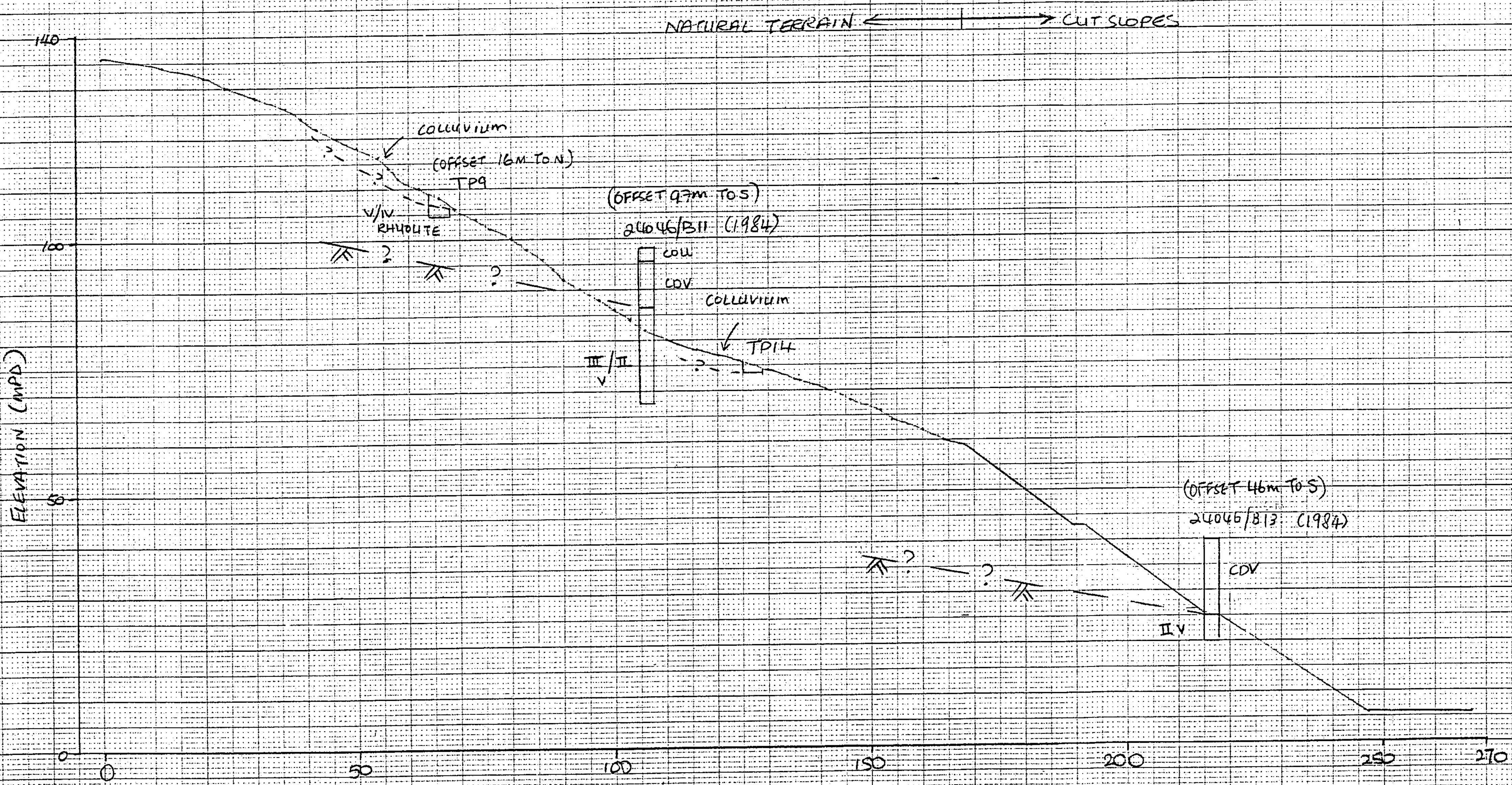
EP/SP/29/95

2001-29D.DWG

20 JULY 2001

APPENDIX B
Ground Investigation Results

AGREEMENT NO. FD01-052
Project TSEUNG KWAN O LANDFILL Subject SECTION A-A Job number 2311/0202 Page of
STAGE II/III AFTERUSE DEVELOPMENT


NATURAL TERRAIN ← | → CUT SLOPES
140
100
50
0
ELEVATION (mPD)
COLLUVIUM
(OFFSET 16m TO N)
TP9
V/IV
RHYOLITE
?
?
(OFFSET 9.7m TO S)
24046/B11 (1984)
COLL
CDV
COLLUVIUM
TP14
III/II
V
?
(OFFSET 46m TO S)
24046/B13 (1984)
CDV
II V
?
?
0
50
100
150
200
250
270

HORIZONTAL DISTANCE (m)

SCALE HORIZONTAL = VERTICAL

1:1000

Computed by SMG Checked by Distribution Filed in

Date 08/02 Date

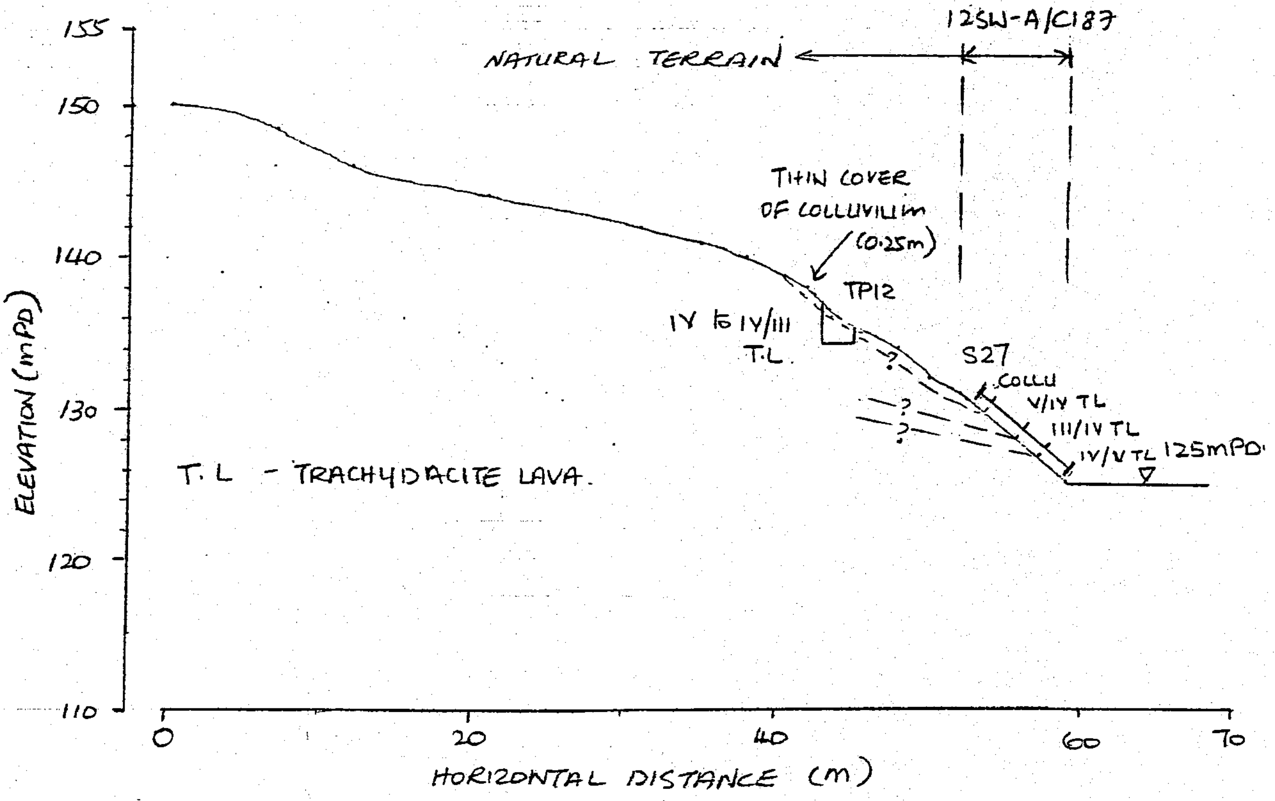
Binnie Black & Veatch Hong Kong Limited
Engineers and Scientists

Project AGREEMENT No. FD01-052
TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject SECTION B-B.

Job number 2311|0202

Page of


155
150
140
130
120
110
ELEVATION (mPD)
NATURAL TERRAIN
12SW-A/C187
THIN COVER OF COLLUVIUM (0.25m)
TP12
IV to IV/III T.L.
?
?
?
S27
COLLU
V/IV TL
III/IV TL
IV/V TL
125mPD
T.L - TRACHYDACITE LAVA.
0
20
40
60
70
HORIZONTAL DISTANCE (m)

SECTION B-B

SCALE 1:500

Computed by SMB

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Date 08/02

Date

Binnie Black & Veatch Hong Kong Limited
Engineers and Scientists

Project AGREEMENT No. FD 01-052
TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject SECTION C-C

Job number

Page of

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Date

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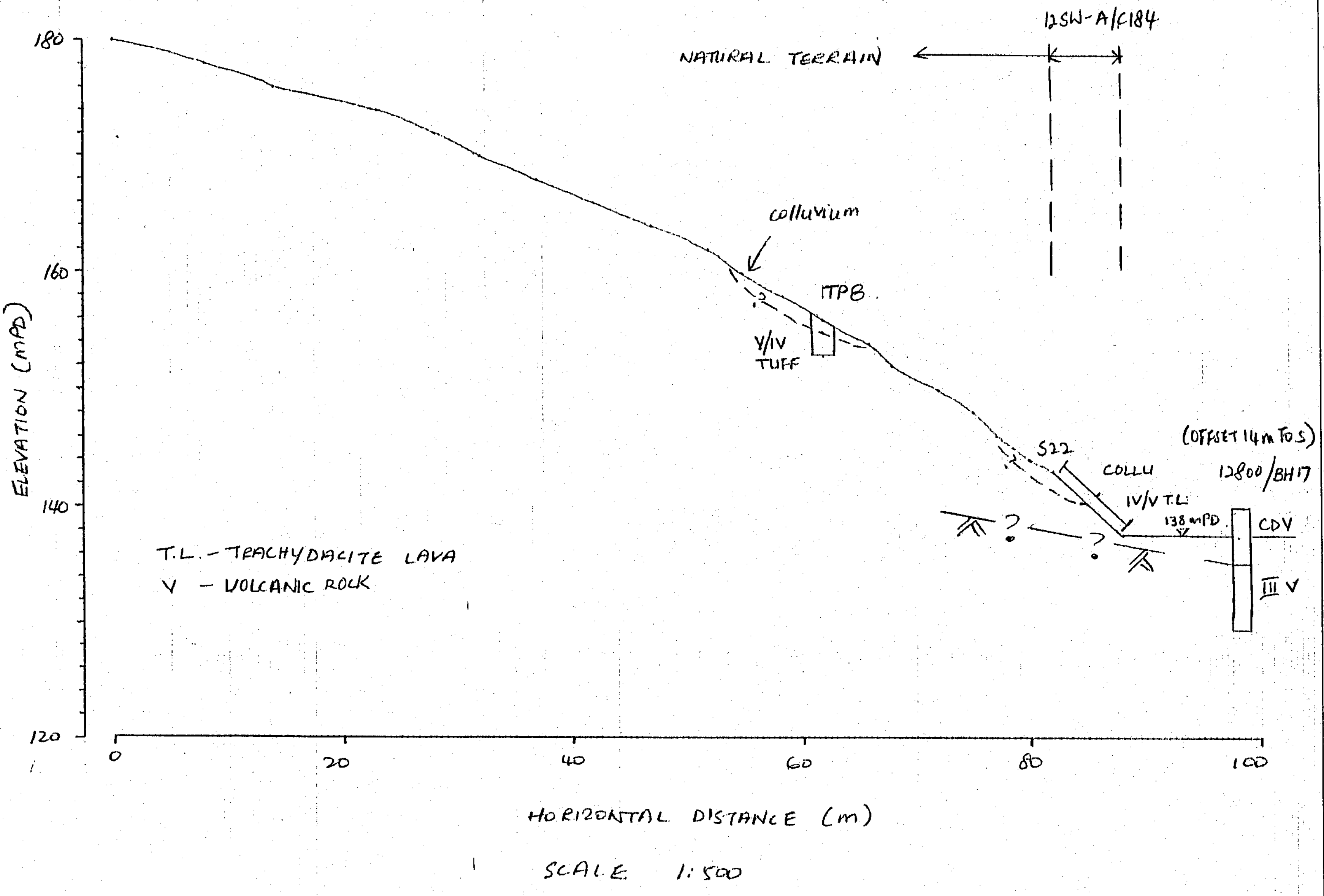

12SW-A/CF184
NATURAL TERRAIN
colluvium
ITPB
V/IV TUFF
S22
COLLU
IV/V T.L.
138 mPD
?
?
(OFFSET 14m TO S)
12800/BH17 (1988)
CDV
III V
T.L. - TRACHYDACITE LAVA
V - VOLCANIC ROCK
ELEVATION (mPD)
180
160
140
120
0
20
40
60
80
100
HORIZONTAL DISTANCE (m)

SCALE 1:500

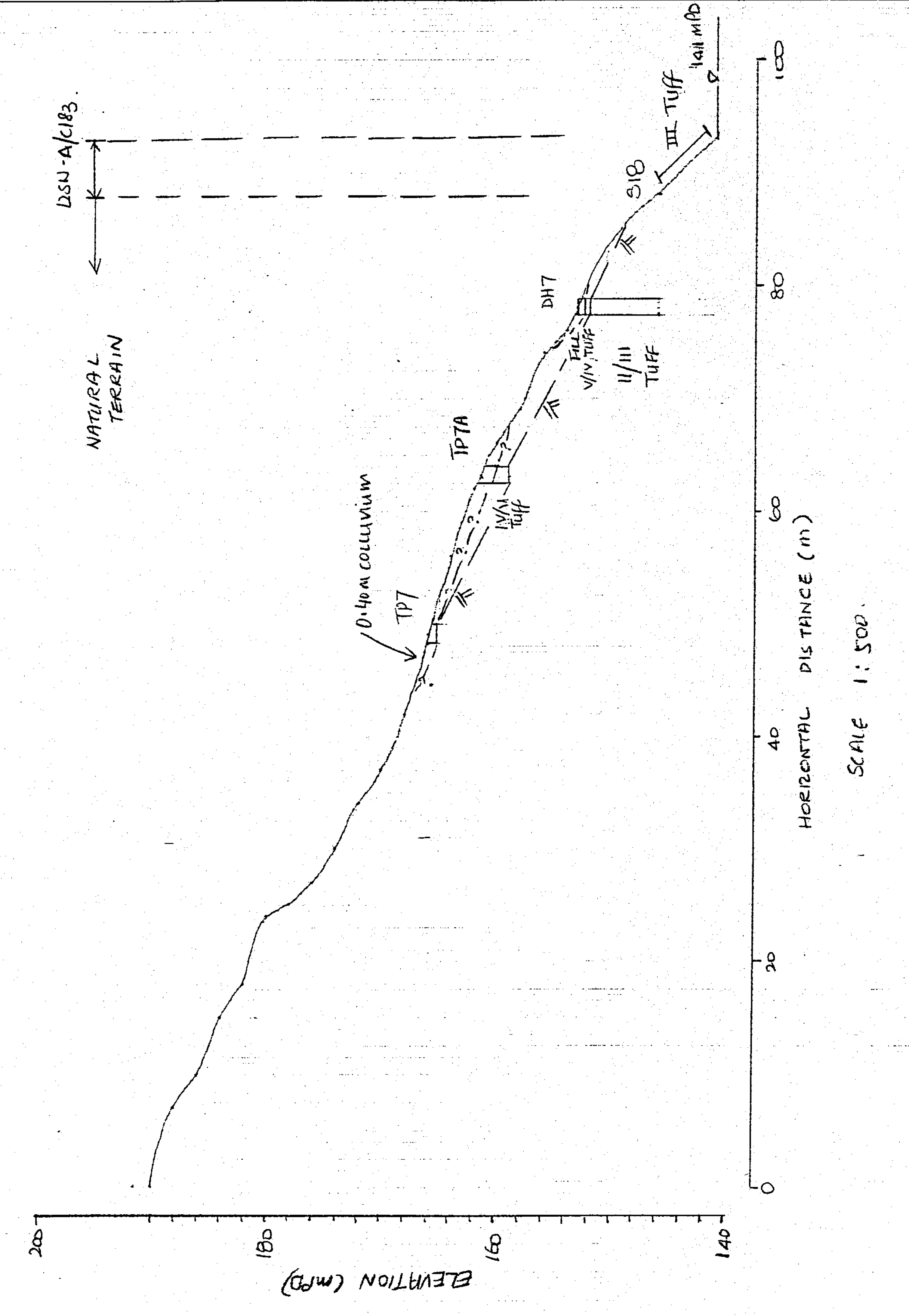
Binnie Black & Veatch Hong Kong Limited
Engineers and Scientists

Project AGREEMENT NO. FD 01/052
TSEUNG KWAN O LANDFILL ~~STAGE~~ II/III AFTERUSE
DEVELOPMENT

Subject SECTION D-D

Job number

Page of



DSN-A/C183.
NATURAL TERRAIN
0.40m colluvium
TP7
TP7A
IV/VI Tuff
DH7
FILL
V/IV TUFF
II/III TUFF
S18
III TUFF
141 mPD
ELEVATION (mPD)
200
180
160
140
0
20
40
60
80
100
HORIZONTAL DISTANCE (m)
SCALE 1:500.

Computed by

Checked by

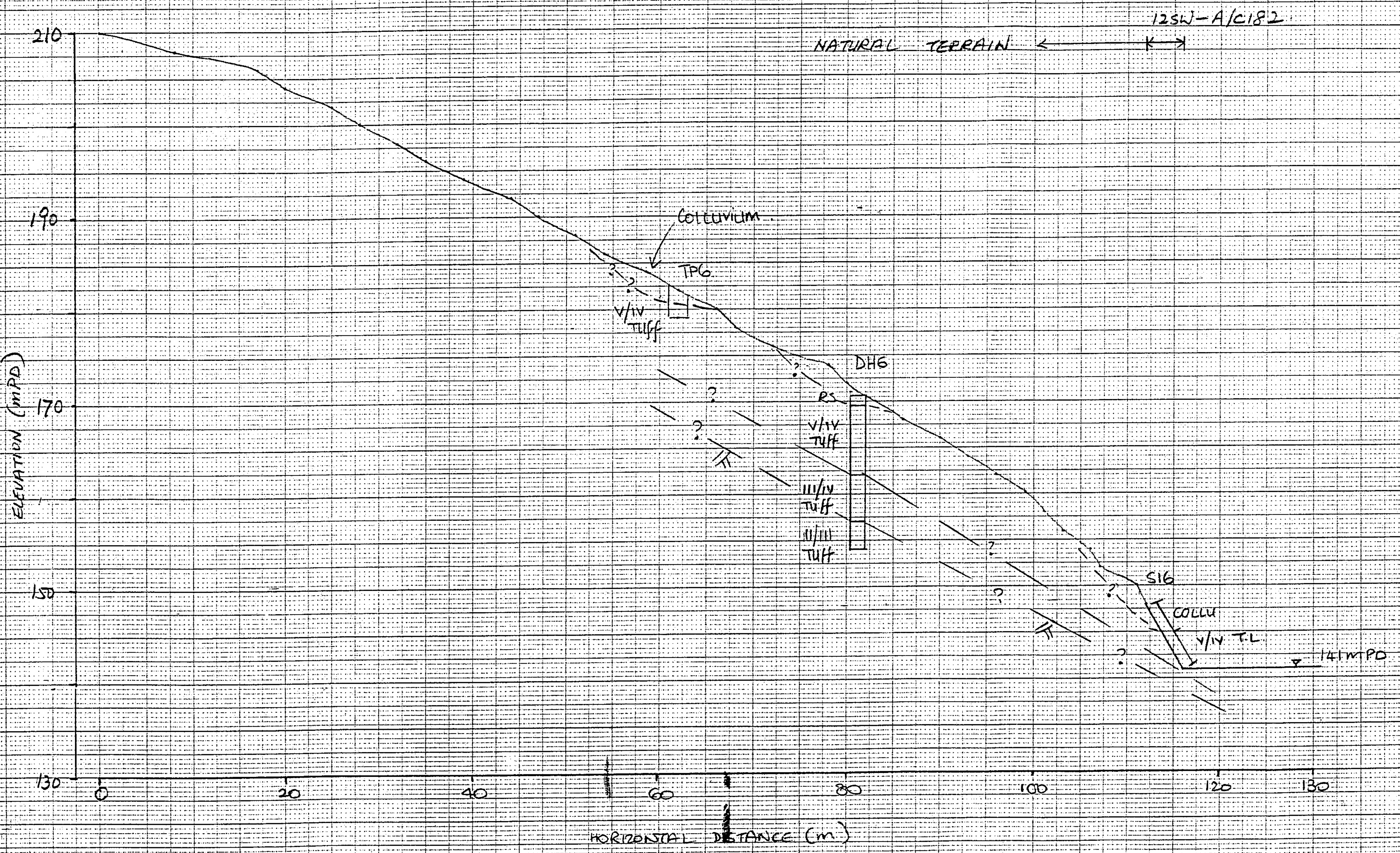
Distribution

Filed in

Date

Date

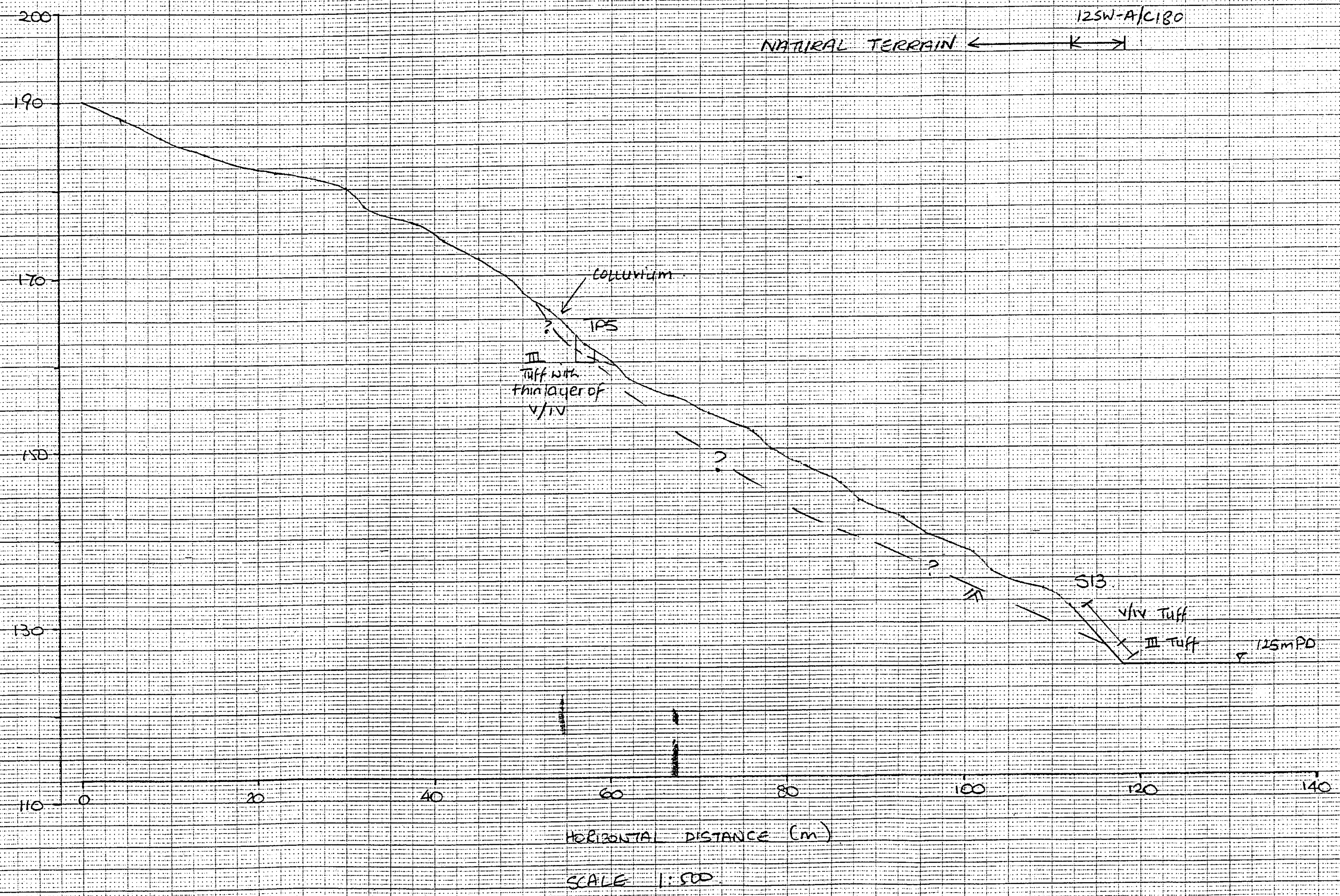
AGREEMENT NO. FD01-052
Project TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT
Subject SECTION E - E
Job number 2311/0201
Page of


12SW-A/C182
NATURAL TERRAIN
210
190
170
150
130
ELEVATION (mPD)
COLLUVIUM
TP6
?
V/IV TUFF
DH6
RS
V/IV TUFF
III/IV TUFF
II/III TUFF
S16
COLLU
V/IV T.L
141mPD
0
20
40
60
80
100
120
130
HORIZONTAL DISTANCE (m)

SCALE 1:500

Computed by SMO
Date 08/02
Checked by
Date
Distribution
Filed in

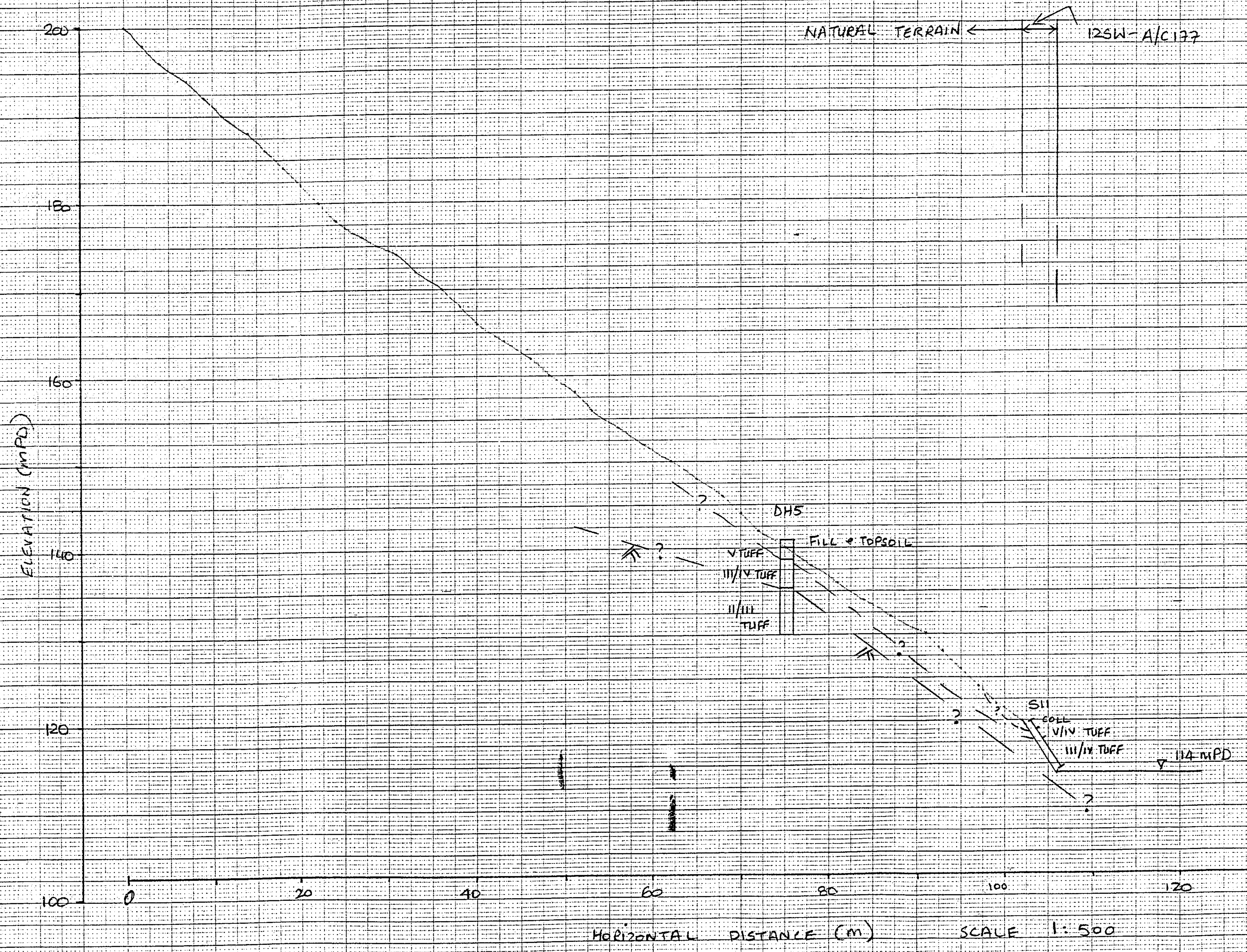
AGREEMENT NO. FD01-052
Project TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT Subject SECTION F-F Job number 2311/0201 Page of


12SW-A/C180
NATURAL TERRAIN
200
190
170
150
130
110
colluvium
TP5
?
III
Tuff with thin layer of V/IV
?
?
III
S13
V/IV Tuff
III Tuff
125mPD
0
20
40
60
80
100
120
140
HORIZONTAL DISTANCE (m)
SCALE 1:500

Computed by SMo Checked by Distribution Filed in
Date 08/02 Date

AGREEMENT No FD 01-052
Project TSEUNG KWAN O LANDFILL Subject SECTION G-G
STAGE II/III AFTERUSE DEVELOPMENT

Job number 382311/0201 Page of


NATURAL TERRAIN
12SW-A/C177
DH5
FILL & TOPSOIL
V TUFF
III/IV TUFF
II/III TUFF
?
?
?
?
?
S11
COLL
V/IV TUFF
III/IV TUFF
114 mPD
200
180
160
140
120
100
ELEVATION (mPD)
0
20
40
60
80
100
120
130
HORIZONTAL DISTANCE (m)
SCALE 1:500

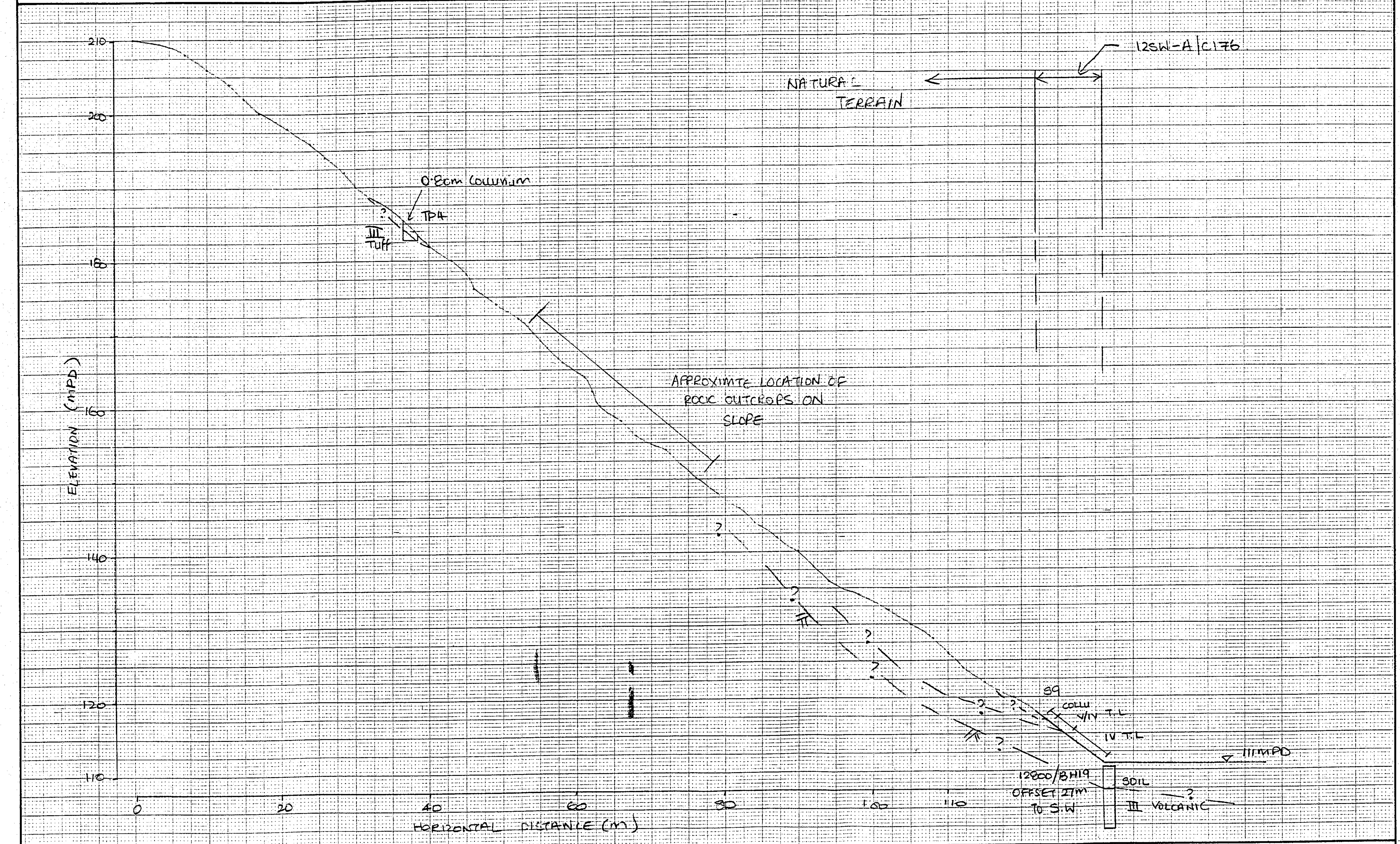
Computed by SMc
Date 08/02

Checked by
Date

Distribution

Filed in

AGREEMENT NO. FD01-052
Project TSEUNG KWAN O LANDFILL Subject SECTION H-H Job number 382311/0201 Page of
STAGE II/III AFTERUSE DEVELOPMENT


210
200
180
160
140
120
110
ELEVATION (mPD)
0
20
40
60
80
100
110
HORIZONTAL DISTANCE (m)
12SW-A/C176
NATURAL TERRAIN
0·8cm Colluvium
TP4
?
III Tuff
APPROXIMATE LOCATION OF ROCK OUTCROPS ON SLOPE
?
?
III
?
?
?
?
III
?
59
COLLU
V/IV T.L
IV T.L
111mPD
12800/BH19
OFFSET 27m
TO S.W
SOIL
?
III VOLCANIC

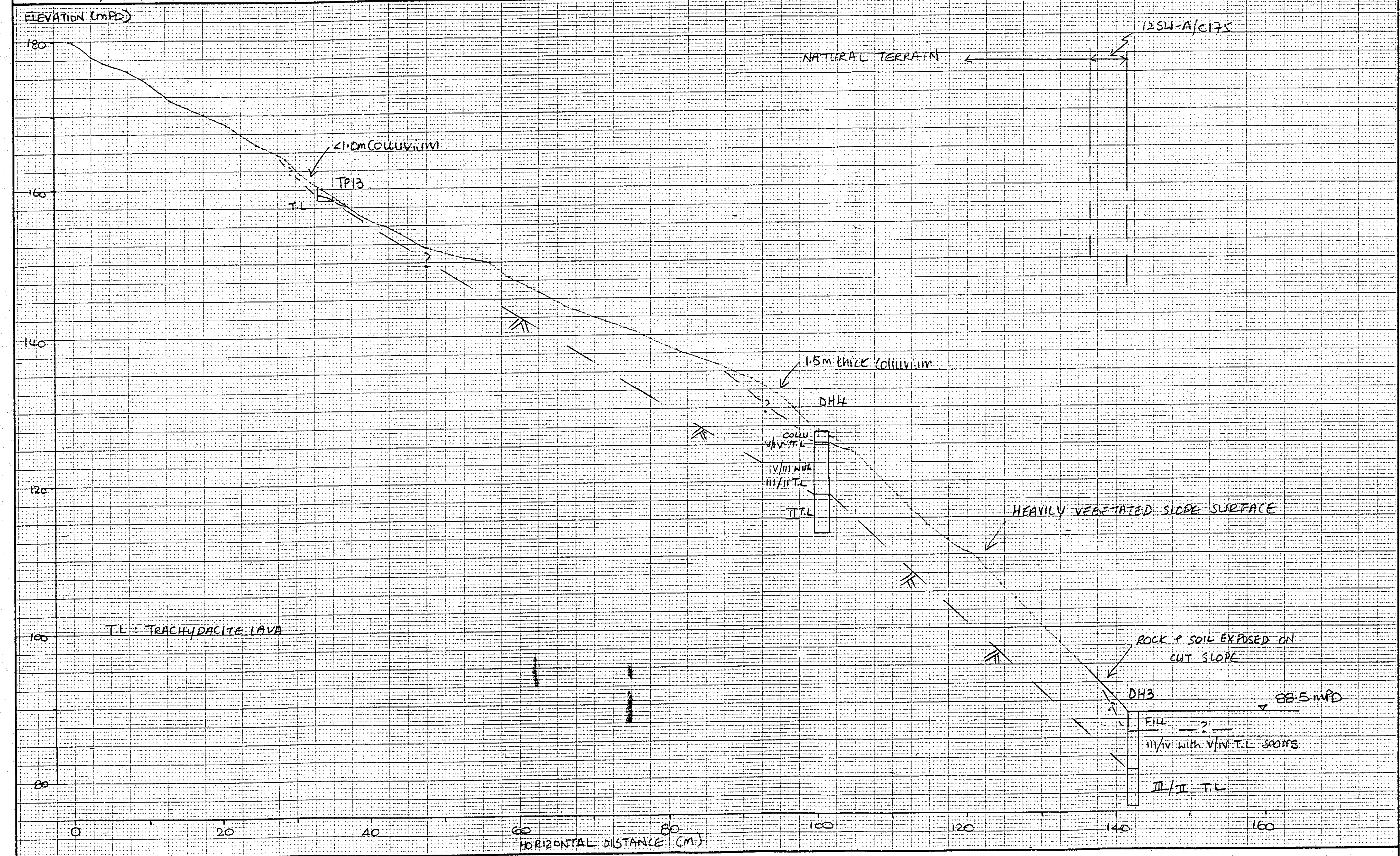
Computed by SMB Checked by Distribution Filed in SCALE 1:500

Date 08/02 Date

Binnie Black & Veatch Hong Kong Limited
Engineers and Scientists

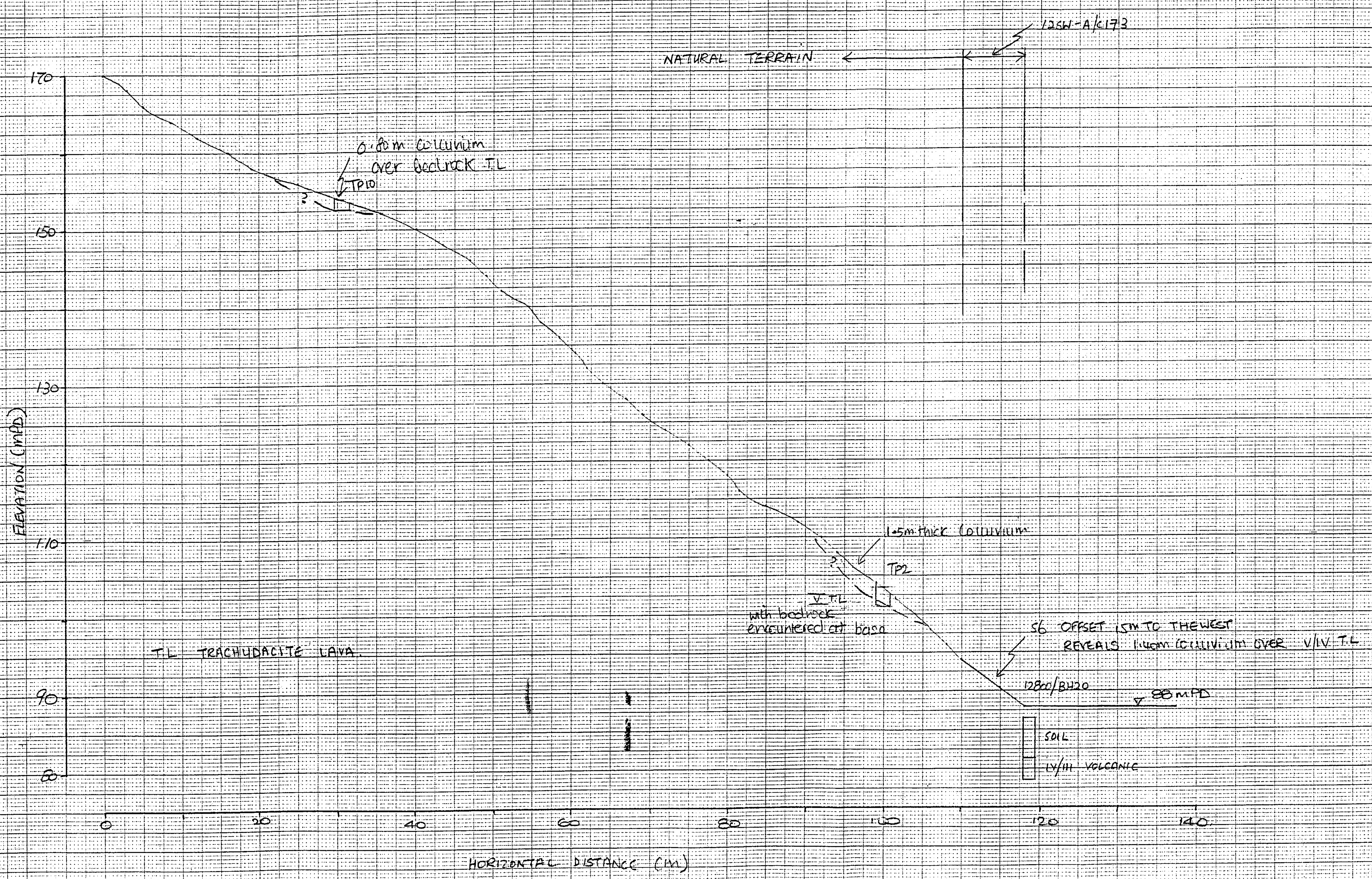
Binnie

AGREEMENT NO. FD01-C52
Project TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT
Subject SECTION I - I
Job number 382311/0201
Page of


ELEVATION (mPD)
180
160
140
120
100
80
12SW-A/C175
NATURAL TERRAIN
<1.0m COLLUVIUM
TP13
T.L
?
1.5m thick colluvium
DH4
COLLU
V/IV T.L
IV/III with III/II T.L
II T.L
HEAVILY VEGETATED SLOPE SURFACE
T.L : TRACHYDACITE LAVA
ROCK & SOIL EXPOSED ON CUT SLOPE
DH3
88.5 mPD
FILL
?
III/IV with V/IV T.L seams
III/II T.L
0
20
40
60
80
100
120
140
160
HORIZONTAL DISTANCE (m)

Computed by SMO
Date 08/02
Checked by
Date
Distribution
Filed in

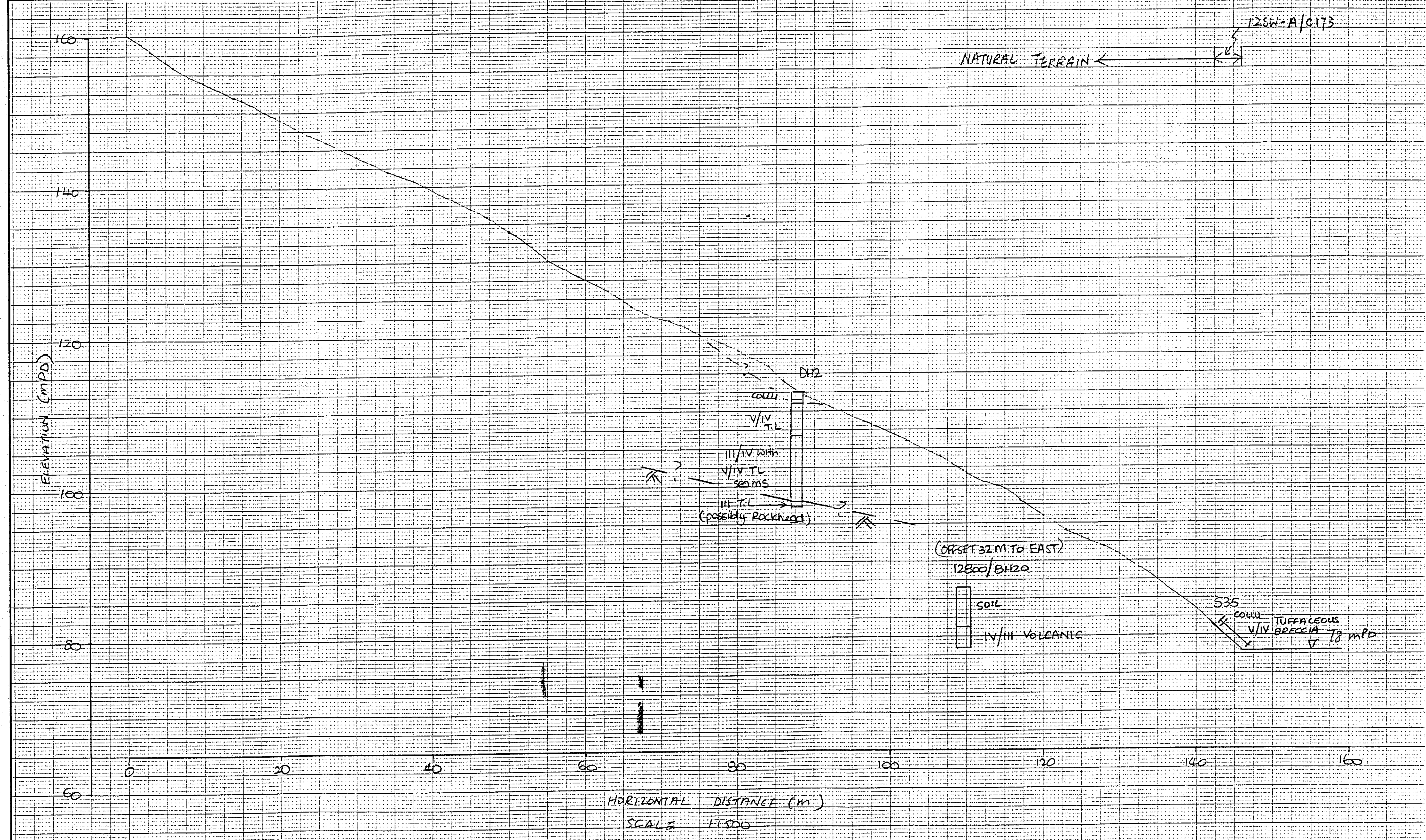
AGREEMENT NO. FD01-052
Project TSEUNG KWAN O LANDFILL Subject SECTION J-J Job number 382311/0201 Page of
STAGE II/III AFTERUSE DEVELOPMENT


12SW-A/C173
NATURAL TERRAIN
170
150
130
110
90
80
ELEVATION (mPD)
0.80m colluvium over bedrock T.L
TP10
?
1.5m thick Colluvium
TP2
?
V T.L with bedrock encountered at base
S6 OFFSET 15M TO THE WEST REVEALS 1.40m COLLUVIUM OVER V/IV T.L
12800/BH20
88 mPD
SOIL
IV/III VOLCANIC
T.L TRACHYDACITE LAVA
0
20
40
60
80
100
120
140
HORIZONTAL DISTANCE (m)

SCALE 1:500

Computed by SMG Checked by Distribution Filed in
Date 08/02 Date

AGREEMENT NO. FD 01-052
Project TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT
Subject SECTION K-K
Job number 382311/0201
Page of


12SW-A/C173
NATURAL TERRAIN
ELEVATION (mPD)
160
140
120
100
80
60
DH2
COLLU
V/IV T.L
III/IV with V/IV T.L seams
III T.L (possibly Rockhead)
?
(OFFSET 32 M TO EAST)
12800/BH20
SOIL
IV/III VOLCANIC
S35
COLLU
V/IV
TUFFACEOUS BRECCIA
78 mPD
0
20
40
60
80
100
120
140
160
HORIZONTAL DISTANCE (m)
SCALE 1:500

Computed by SMO
Date 08/02
Checked by
Date
Distribution
Filed in

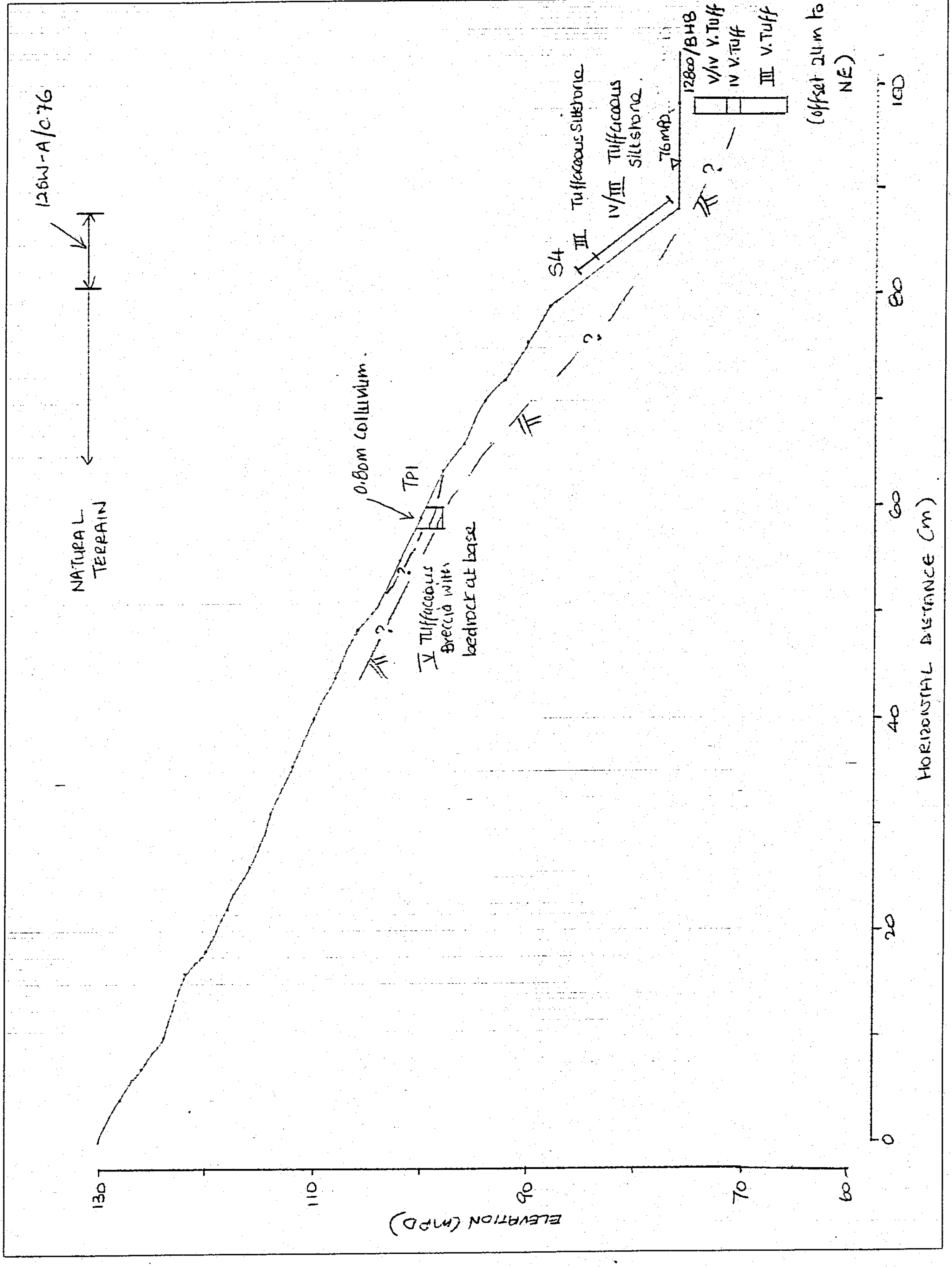
Binnie Black & Veatch Hong Kong Limited
Engineers and Scientists

Project AGREEMENT NO. FD01-052
TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject SECTION L-L

Job number 382311/0201

Page of



126W-A/C76
NATURAL TERRAIN
0.80m Colluvium.
TP1
V Tuffaceous Breccia with bedrock at base
?
S4
III Tuffaceous Siltstone
IV/III Tuffaceous Siltstone.
76mPD
12800/BHB
V/IV V.Tuff
IV V.Tuff
III V.Tuff
(offset 24m to NE)
130
110
90
70
60
ELEVATION (mPD)
0
20
40
60
80
100
HORIZONTAL DISTANCE (m)

SCALE: 1:500

Computed by EMC

Date 08/02

Checked by

Date

Distribution

Filed in

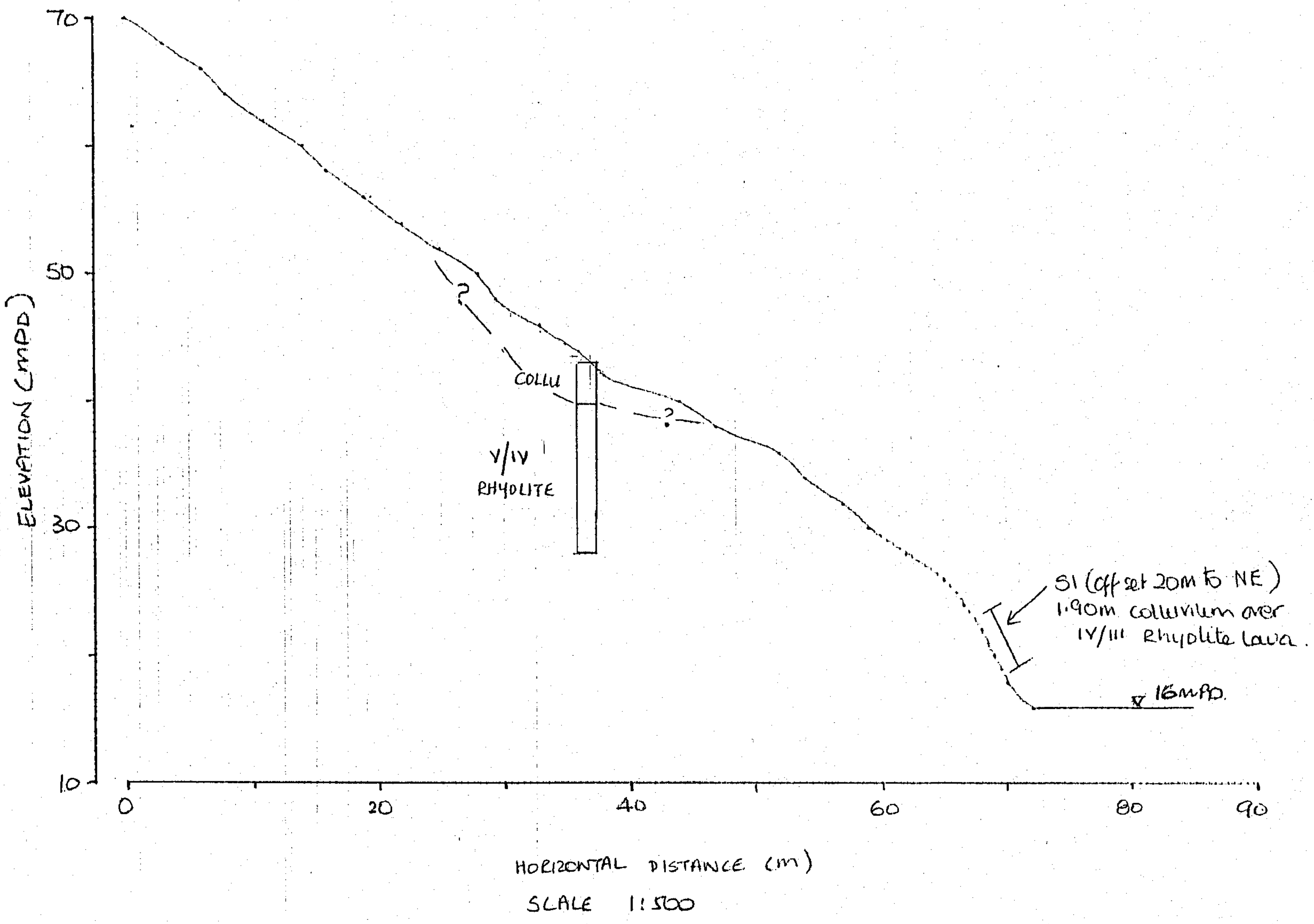
Binnie Black & Veatch Hong Kong Limited
Engineers and Scientists

Project AGREEMENT NO. FD01-052
TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT

Subject SECTION M-M

Job number 38231/0201

Page of


70
50
30
10
ELEVATION (mPD)
?
COLLU
?
V/IV
RHYOLITE
S1 (off set 20m to NE)
1.90m colluvium over
IV/III Rhyolite Lava.
▽ 16mPD.
0
20
40
60
80
90
HORIZONTAL DISTANCE (m)
SCALE 1:500

Computed by SMO

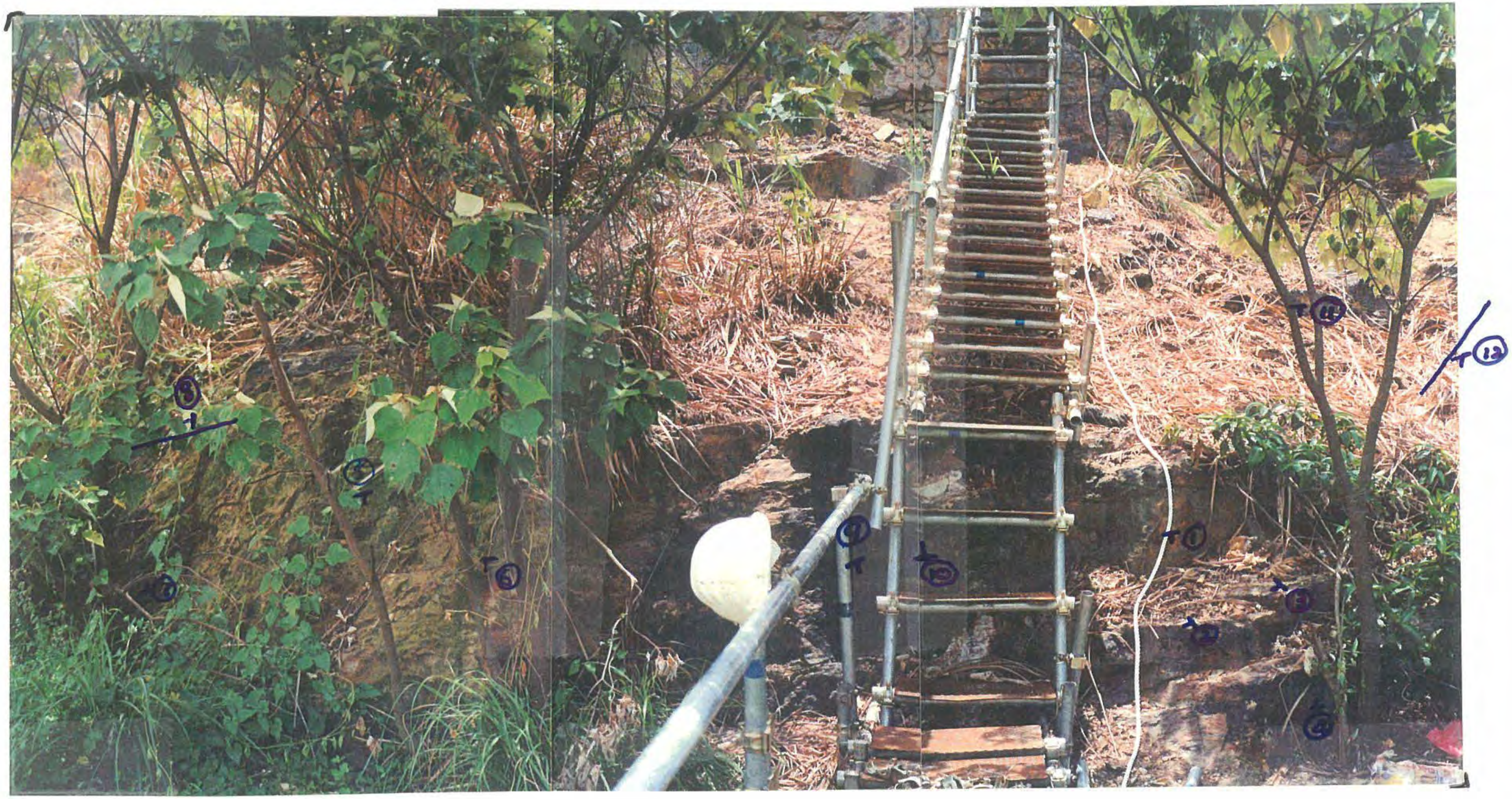
Date 08/02

Checked by

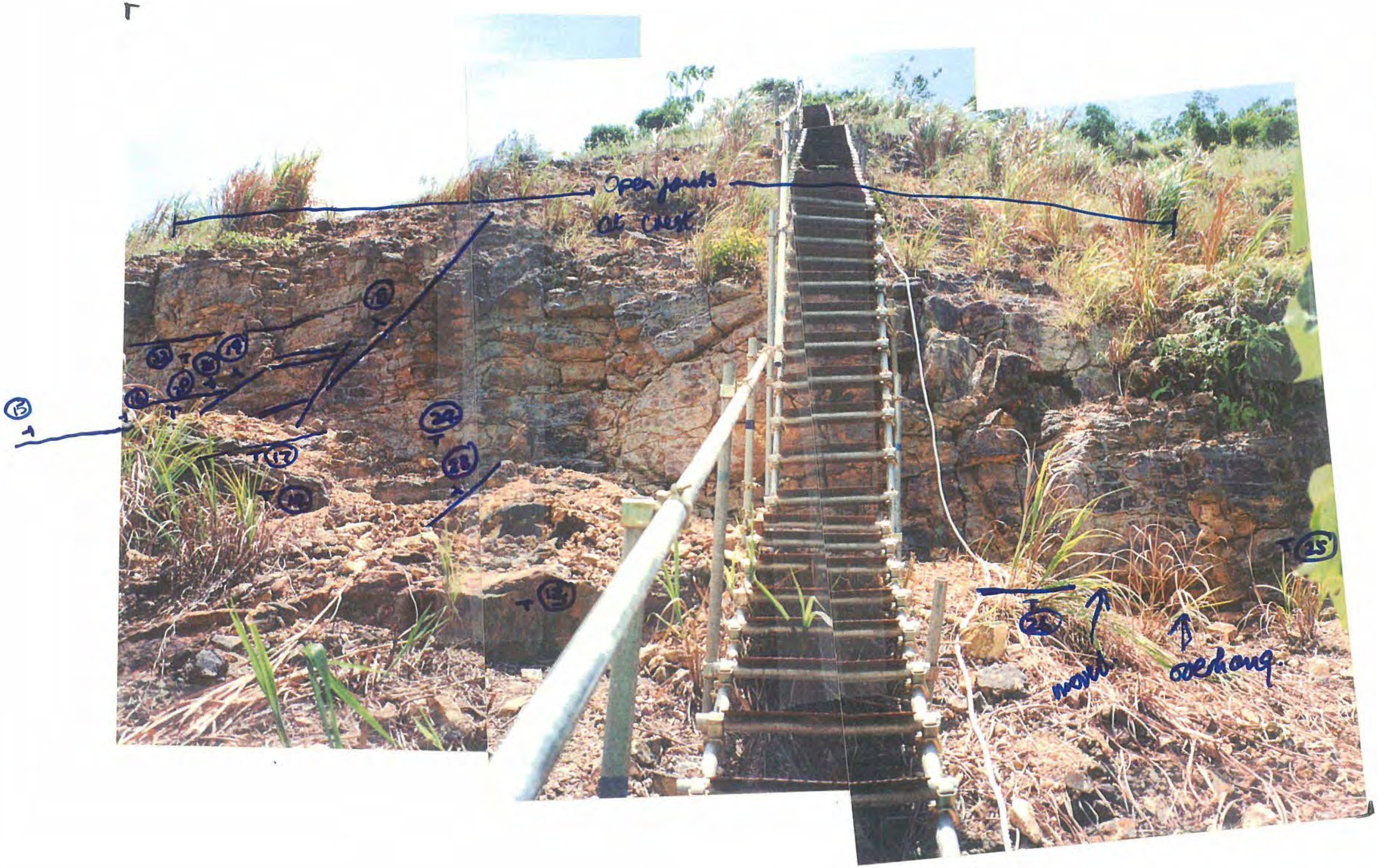
Date

Distribution

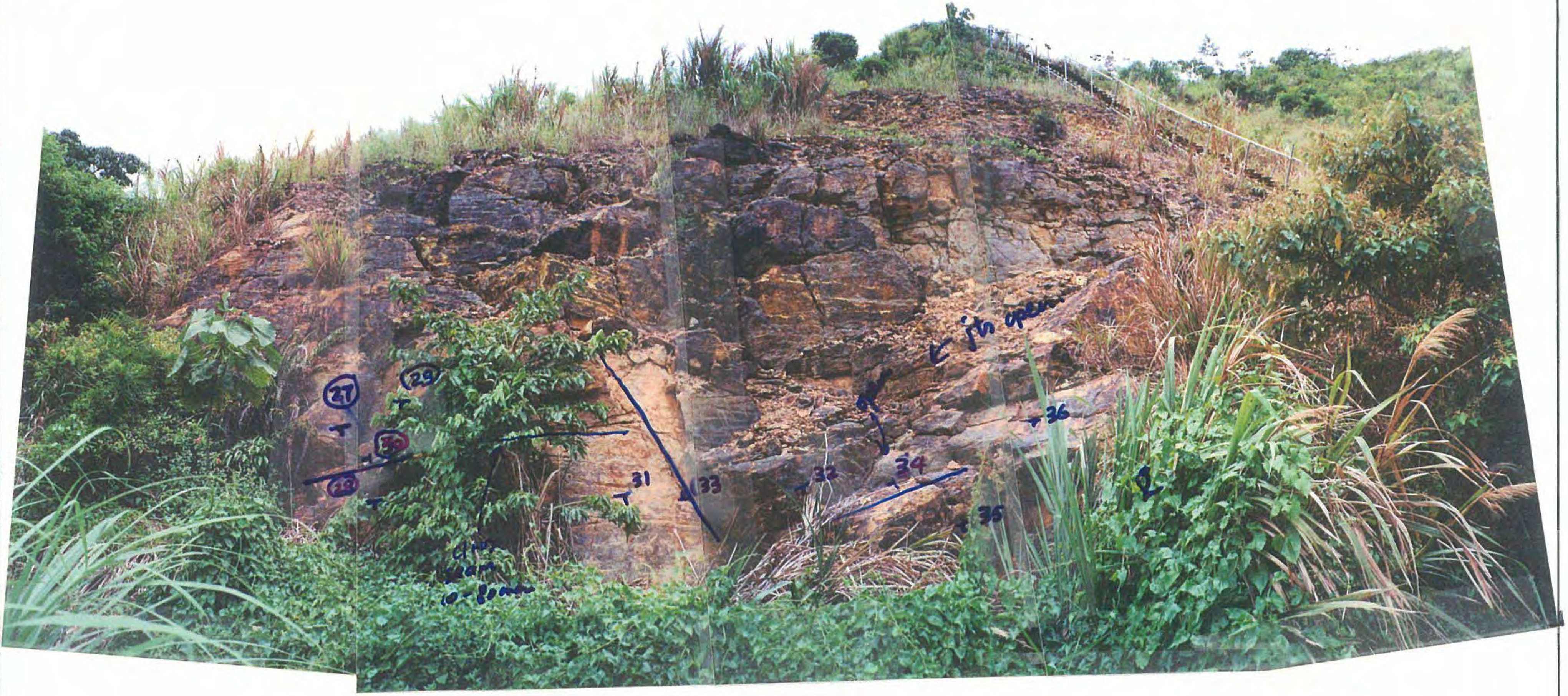
Filed in



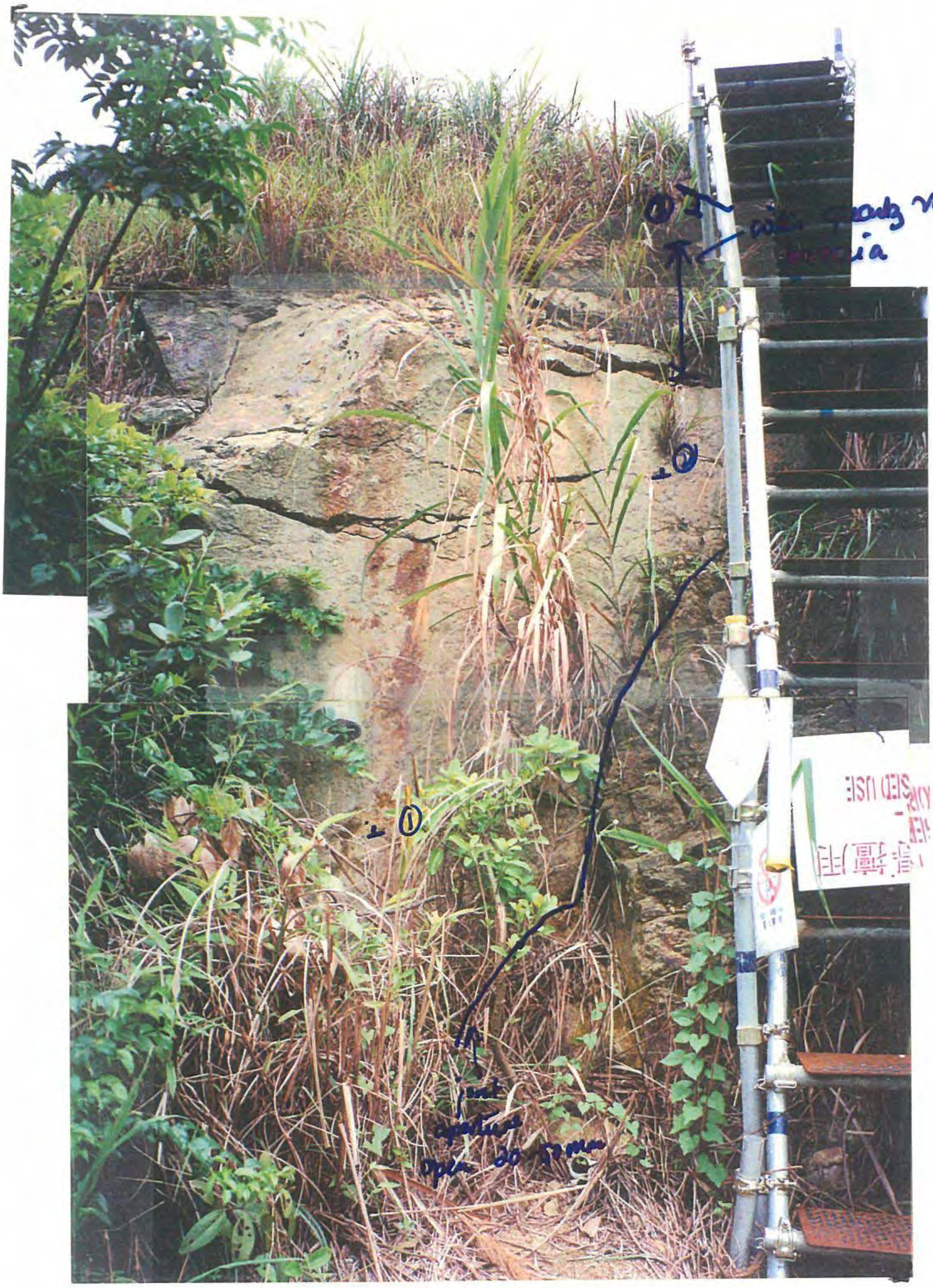
Subject	Feature No. 12SW-A/C174 (Along Strip S7)	Prepared Smo	Checked KWK	Binnie
Project	Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jul-02	Scale N/A	Photo No. 1


Open joints at crest
18
19
20
16
15
17
24
28
25
26
moved
overhang.

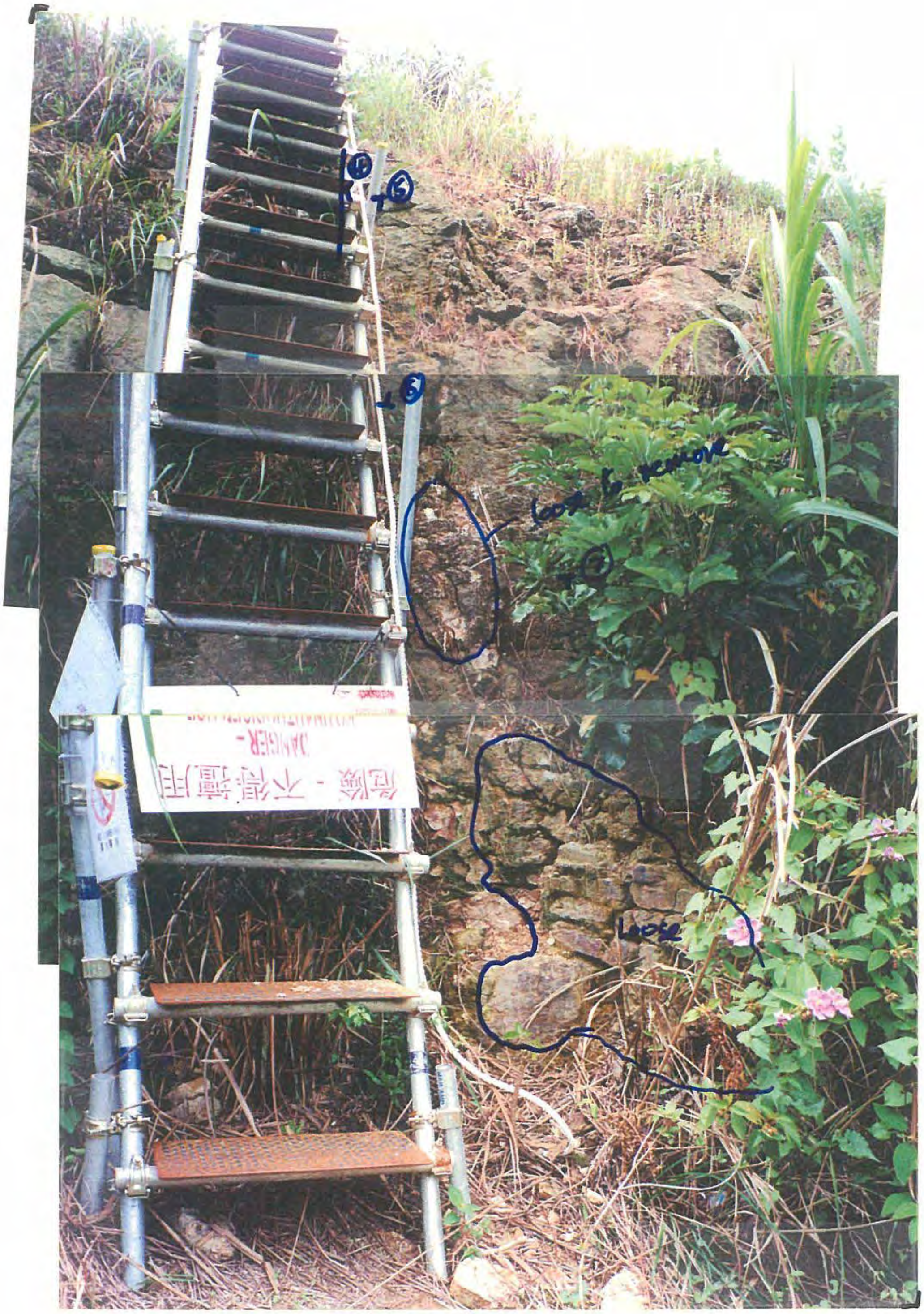
Subject Feature No. 12SW-A/C174 (Along Strip S7)	Prepared Smo	Checked KWK	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jul-02	Scale N/A	Photo No. 2


27
29
30
28
31
33
32
34
35
36
jts open
Clay seam 10-80mm

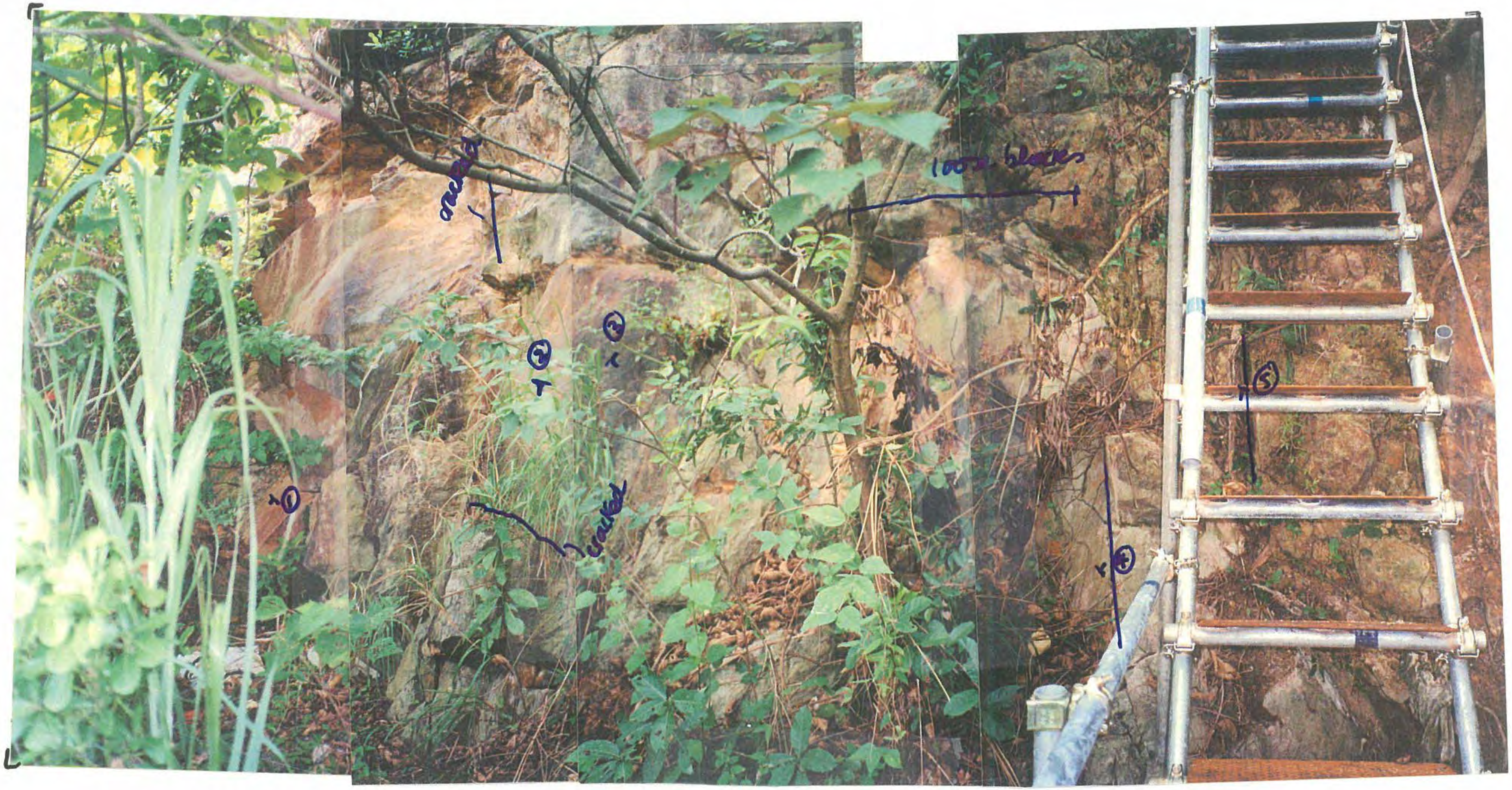
Subject Feature No. 12SW-A/C174 (Along Strip S7)	Prepared Smo	Checked KWK	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jul-02	Scale N/A	Photo No. 3


① I
with quartz vein + breccia
②
①
joint aperture open 20-50mm

Subject FEATURE NO. 12SW-A/C174 (along Strip S8)	Prepared Smo	Checked KWK	Binnie
Project Agreement No. FD01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date 7 / 2002	Scale N/A	Photo No. 4

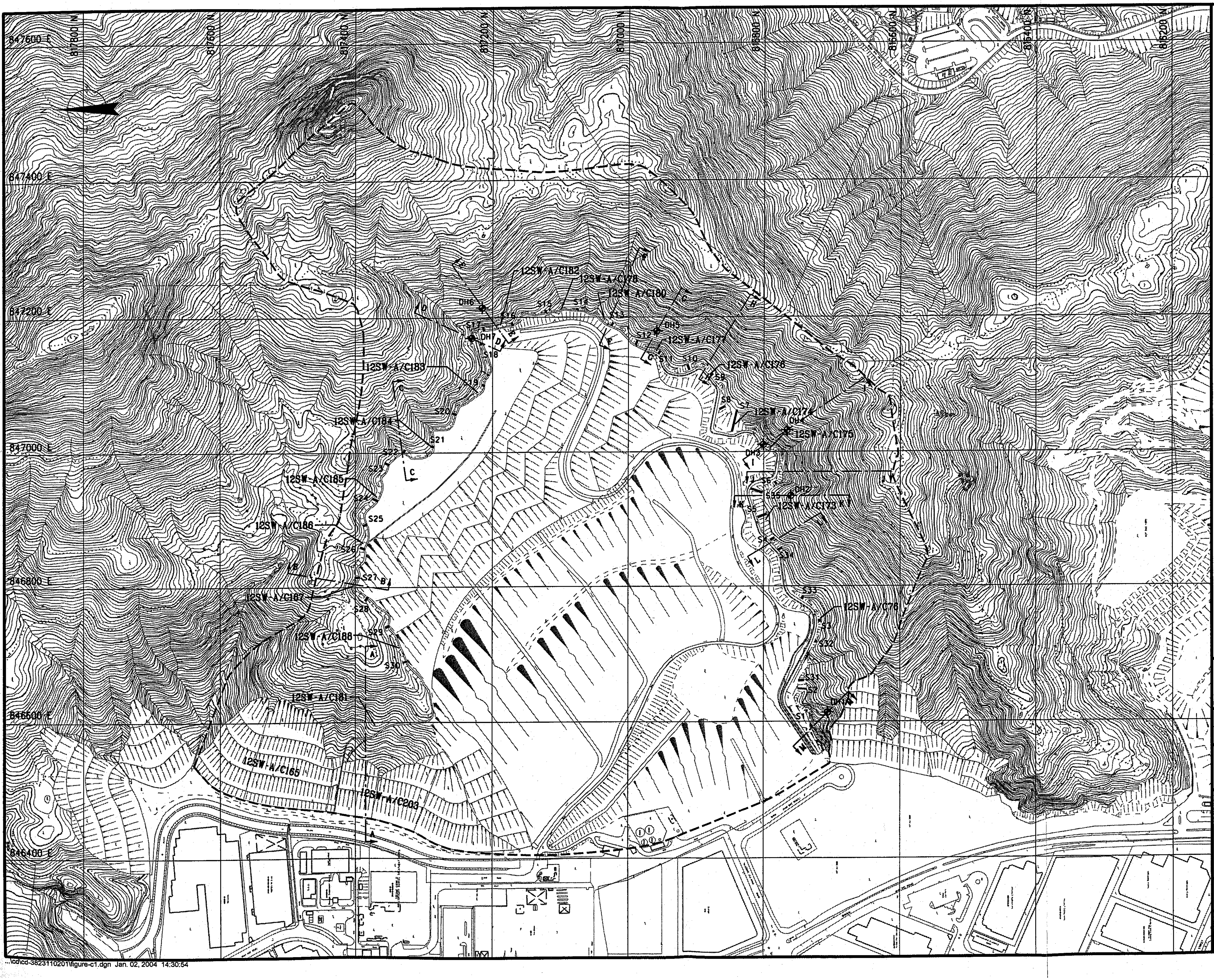

④
⑤
⑥
loose to remove
⑦
loose

Subject FEATURE NO. 12SW-A/C174 (along Strip S8)	Prepared Smo	Checked KWK	Binnie
Project Agreement No. FD01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date 7 / 2002	Scale N/A	Photo No. 5


cracked
loose blocks
②
③
①
cracked
④
⑤

Subject Feature No. 12SW-A/C76 (Along Strip S33)	Prepared Smo	Checked KWK	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jul-02	Scale N/A	Photo No. 6

APPENDIX C
Stability Analyses of Soil Slopes


847600 E
847400 E
847200 E
847000 E
846800 E
846600 E
846400 E
817800 N
817600 N
817400 N
817200 N
817000 N
816800 N
816600 N
816400 N
816200 N
12SW-A/C182
12SW-A/C178
12SW-A/C180
12SW-A/C177
12SW-A/C176
12SW-A/C174
12SW-A/C175
12SW-A/C173
12SW-A/C76
12SW-A/C183
12SW-A/C184
12SW-A/C185
12SW-A/C186
12SW-A/C187
12SW-A/C188
12SW-A/C181
12SW-A/C165
12SW-A/C203
DH1
DH2
DH3
DH4
DH5
DH6
DH7
S1
S2
S4
S5
S6
S7
S8
S9
S10
S11
S12
S13
S14
S15
S16
S17
S18
S19
S20
S21
S22
S23
S24
S25
S26
S27
S28
S29
S30
S31
S32
S33
S34
S35
A
B
C
D
E
F
G
H
I
J
K
L
M

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. ALL DIMENSIONS ARE TYPICAL AND TO BE CONFIRMED AT DETAILED DESIGN.

LEGENDS:

⌖ DH1	RECENT DRILLHOLES
S1 ▬	RECENT SLOPE STRIPPING AND LOCATION OF GEOLOGICAL SECTION FOR CUT SLOPE
— — —	STUDY BOUNDARY

Approved

CAD ref. MAIN : FIGURE-C1.DGN
XREF : B12SW06B,D, B12SW01B,D,
B12SW02A,B,C,D & B12SW07A,B,C,D.DGN

Contract no. FD01-052

Contract

GEOTECHNICAL REVIEW AND SITE INVESTIGATION WORKS FOR TSEUNG KWAN O STAGE II/III AFTERUSE DEVELOPMENT

Figure Title

LOCATIONS OF GEOLOGICAL SECTIONS FOR STABILITY ANALYSIS OF CUT SLOPES

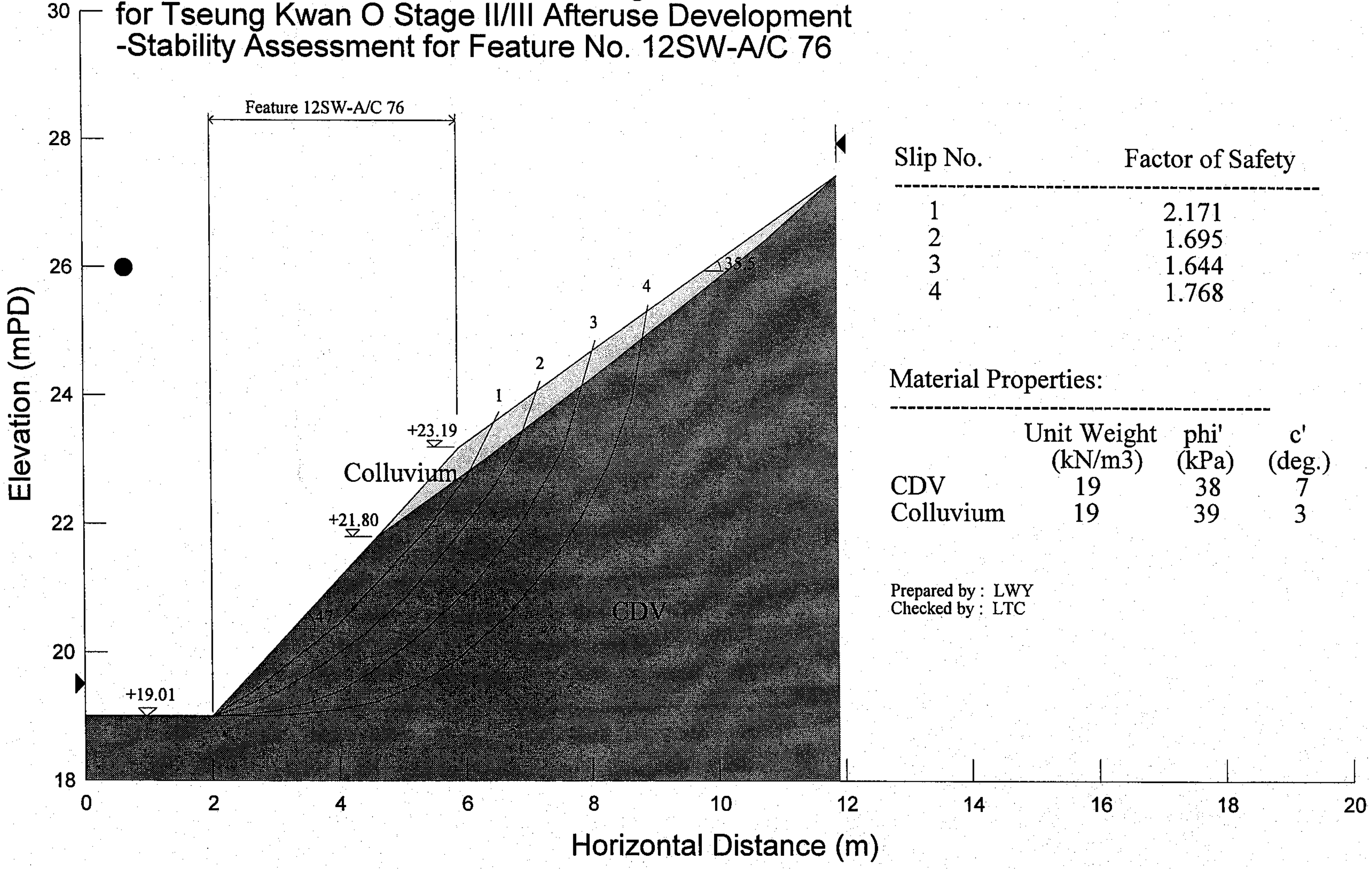
Figure no. C1

Scale 1 : 5000

BLACK & VEATCH HONG KONG LIMITED
博威工程顧問有限公司

...\cd\cd-3823110201\figure-c1.dgn Jan. 02, 2004 14:30:54

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 76


Feature 12SW-A/C 76
+23.19
+21.80
+19.01
Colluvium
CDV
1
2
3
4
35.5
47
Elevation (mPD)
30
28
26
24
22
20
18
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	2.171
2	1.695
3	1.644
4	1.768

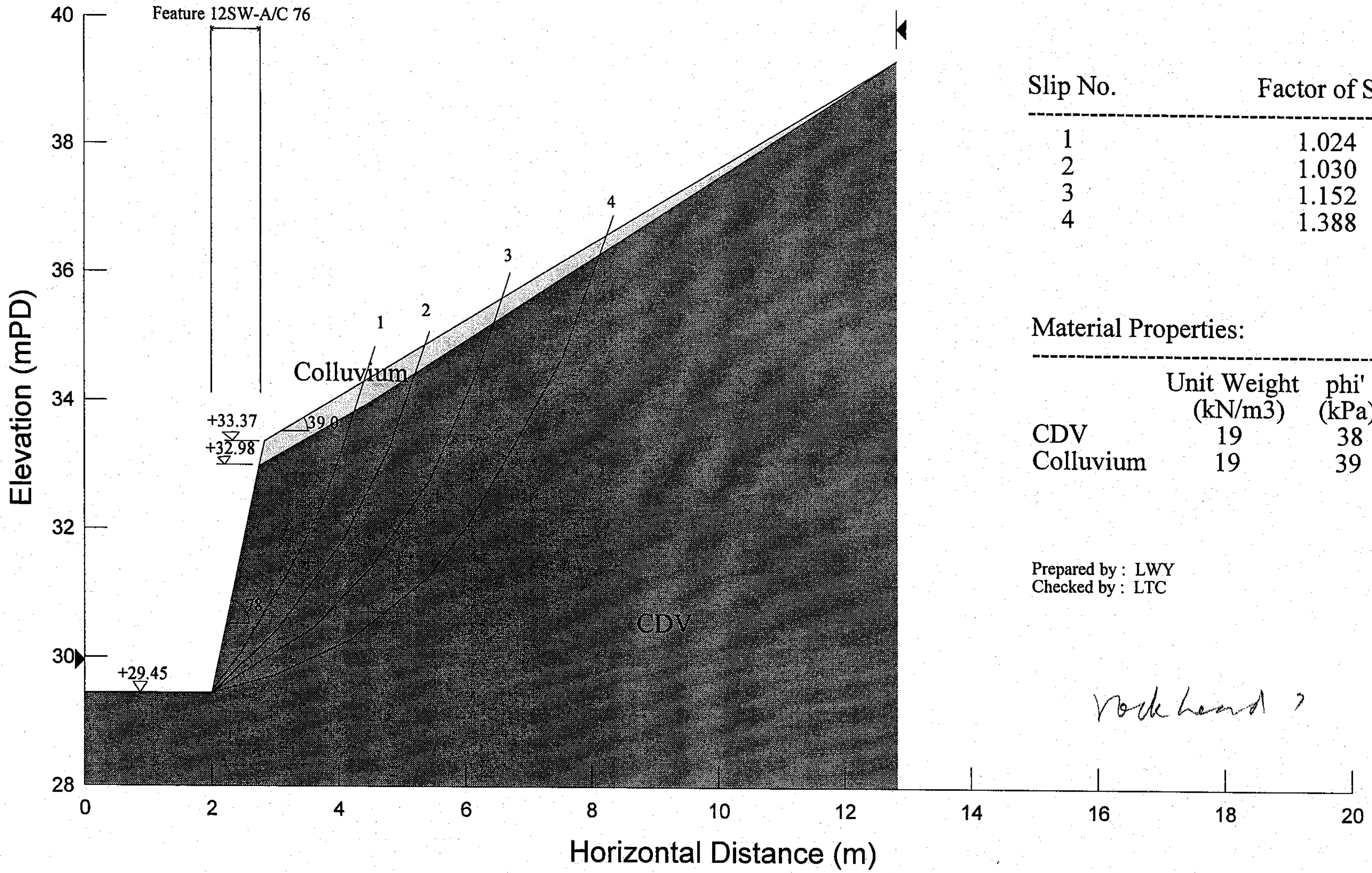
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS1

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 76


Feature 12SW-A/C 76
Elevation (mPD)
40
38
36
34
32
30
28
+33.37
+32.98
39.0
78
+29.45
Colluvium
CDV
1
2
3
4
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	1.024
2	1.030
3	1.152
4	1.388

Material Properties:

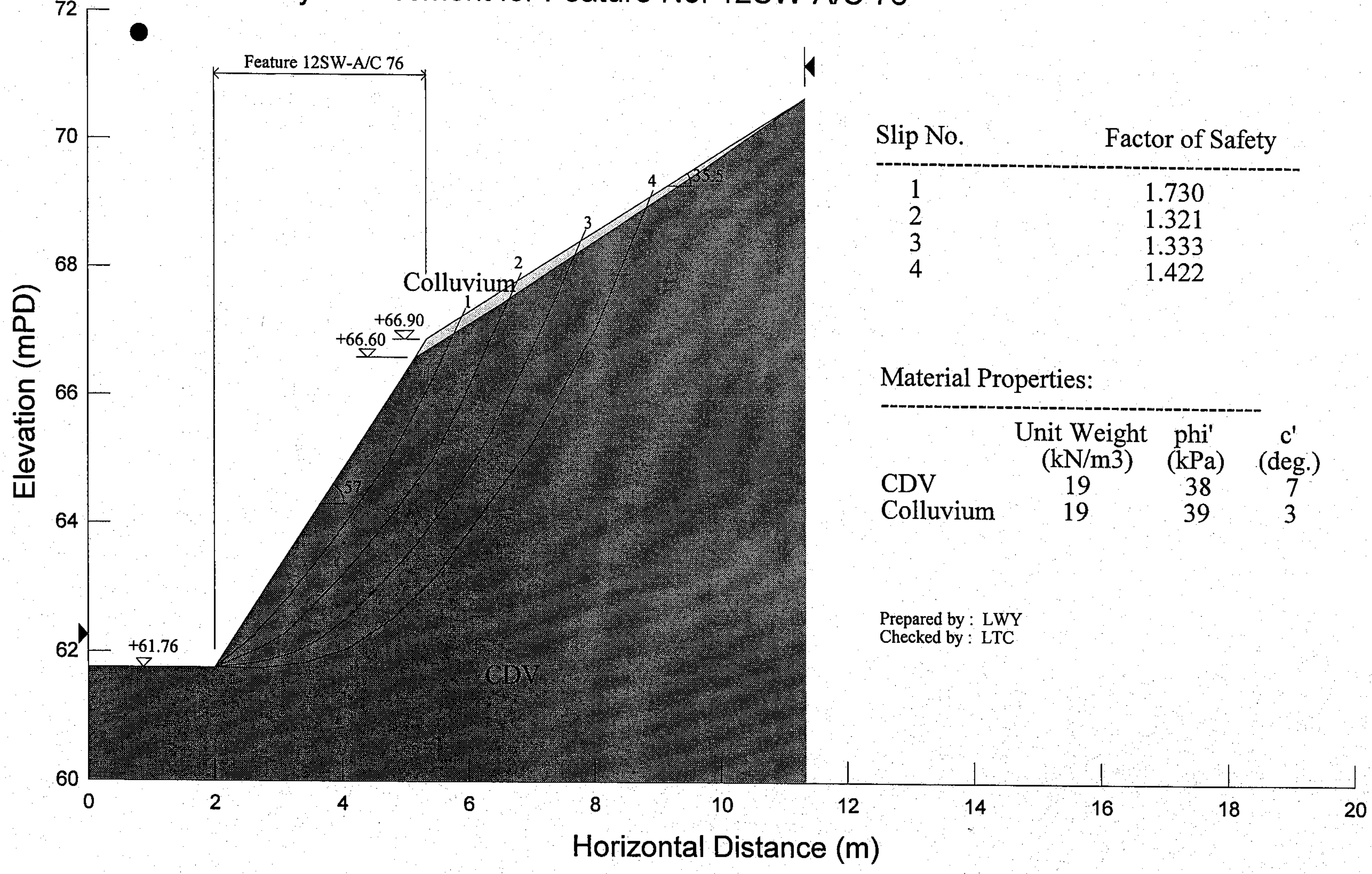
	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

rock head ?

Section SS2

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 76


72
70
68
66
64
62
60
Elevation (mPD)
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)
Feature 12SW-A/C 76
Colluvium
CDV
+66.90
+66.60
+61.76
57
35.5
1
2
3
4

Slip No.	Factor of Safety
1	1.730
2	1.321
3	1.333
4	1.422

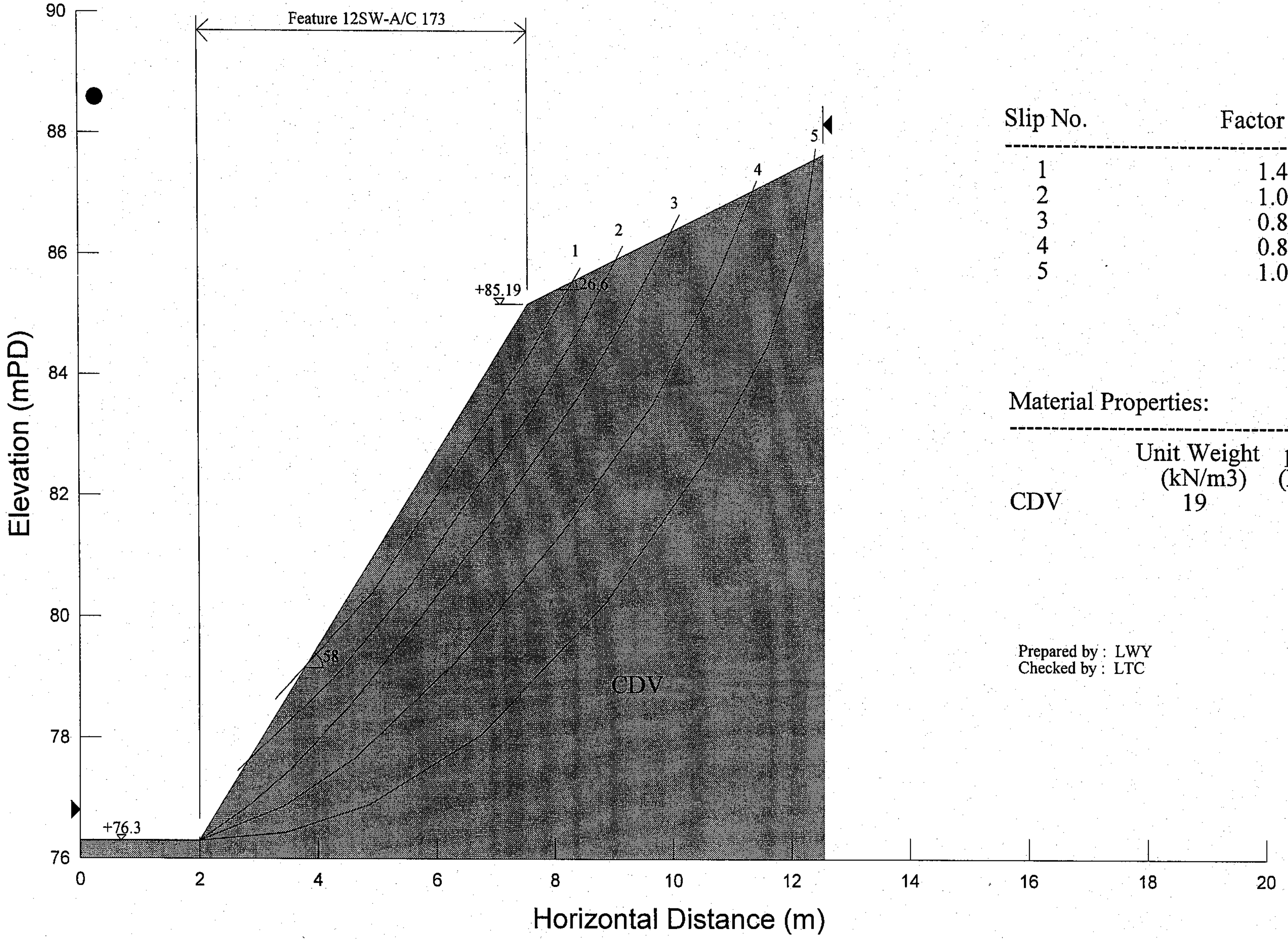
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS3

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 173



Slip No.	Factor of Safety
1	1.469
2	1.016
3	0.890
4	0.898
5	1.060

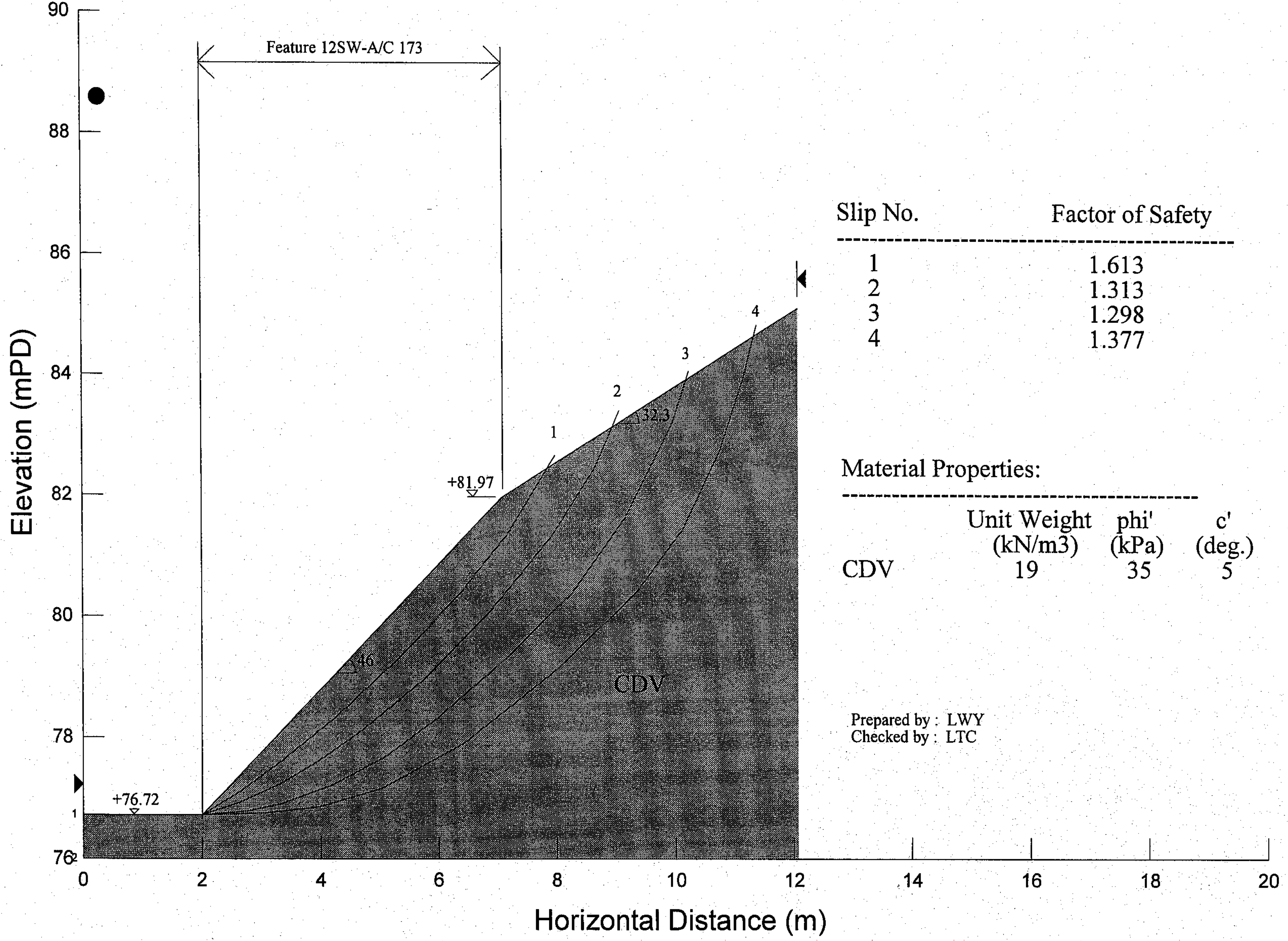
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	35	5

Prepared by : LWY
Checked by : LTC

Section SS4

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 173


Feature 12SW-A/C 173
+81.97
+76.72
46
32.3
1
2
3
4
CDV
Elevation (mPD)
90
88
86
84
82
80
78
76
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	1.613
2	1.313
3	1.298
4	1.377

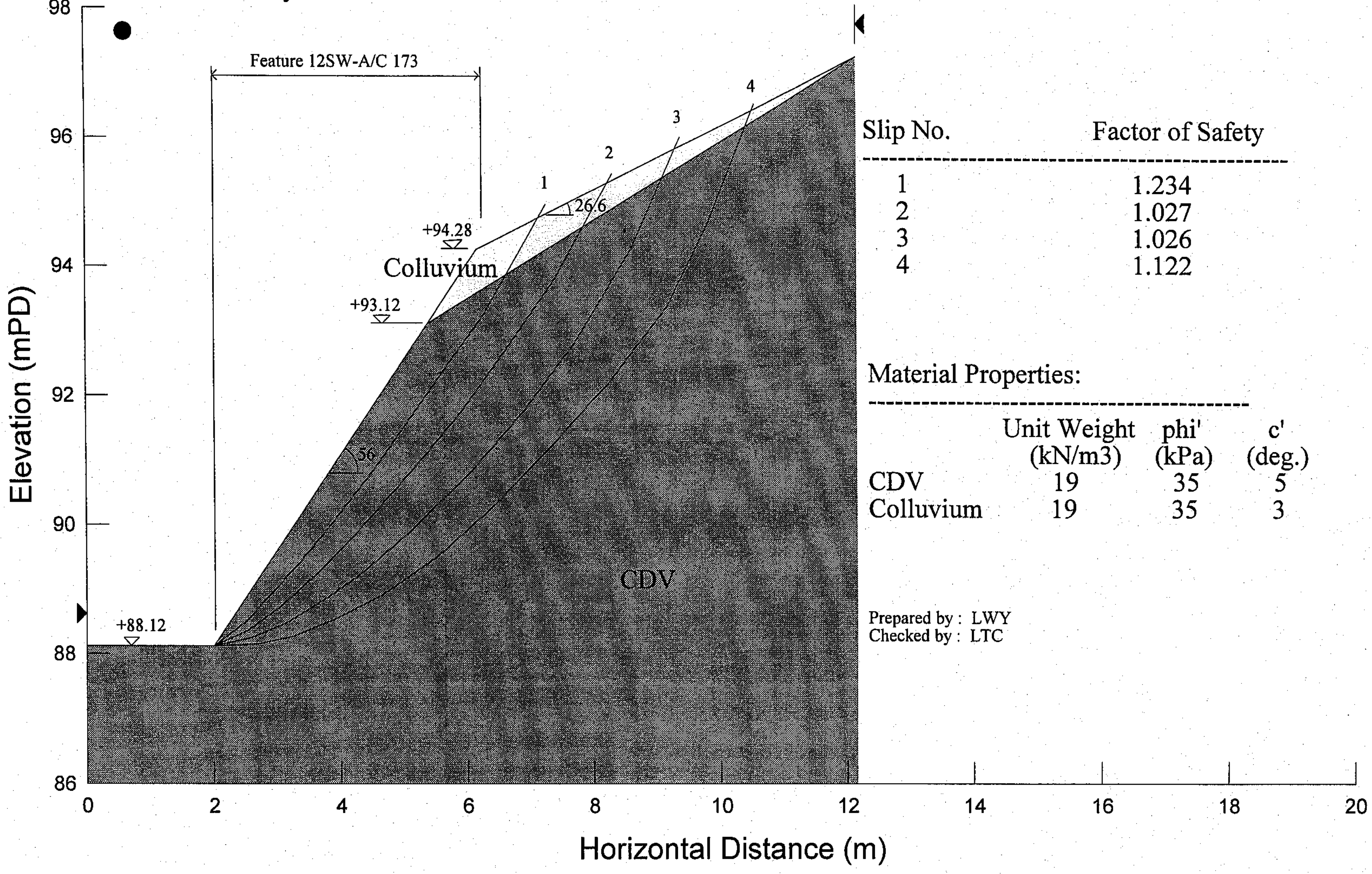
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	35	5

Prepared by : LWY
Checked by : LTC

Section SS5

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 173


Feature 12SW-A/C 173
1
2
3
4
26.6
+94.28
Colluvium
+93.12
56
CDV
+88.12
Elevation (mPD)
98
96
94
92
90
88
86
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	1.234
2	1.027
3	1.026
4	1.122

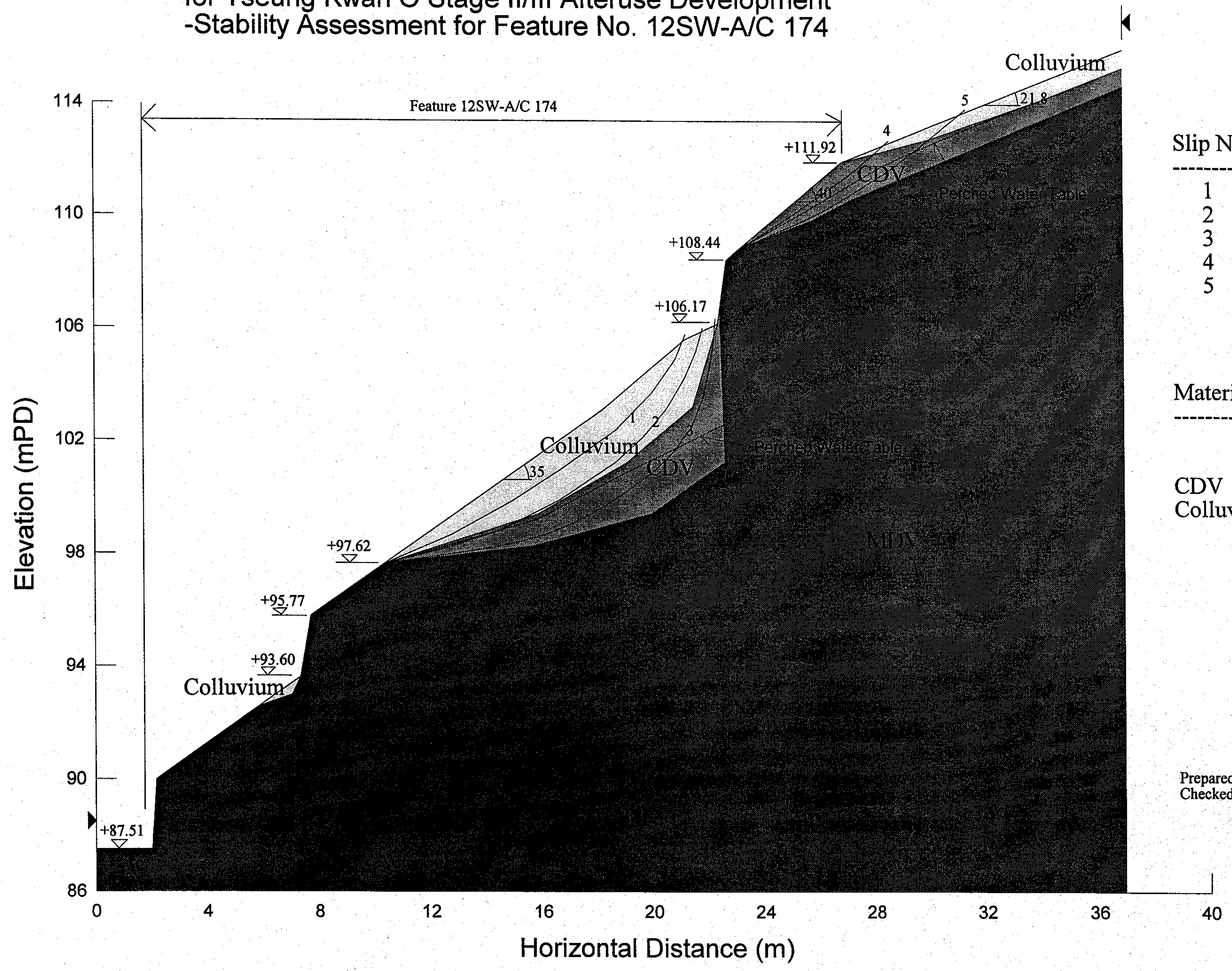
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	35	5
Colluvium	19	35	3

Prepared by : LWY
Checked by : LTC

Section SS6

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 174


Feature 12SW-A/C 174
Colluvium
Colluvium
Colluvium
CDV
CDV
MDV
Perched Water Table
Perched Water Table
+111.92
+108.44
+106.17
+97.62
+95.77
+93.60
+87.51
1
2
3
4
5
35
40
21.8
Elevation (mPD)
86
90
94
98
102
106
110
114
0
4
8
12
16
20
24
28
32
36
40
Horizontal Distance (m)

Section SS7

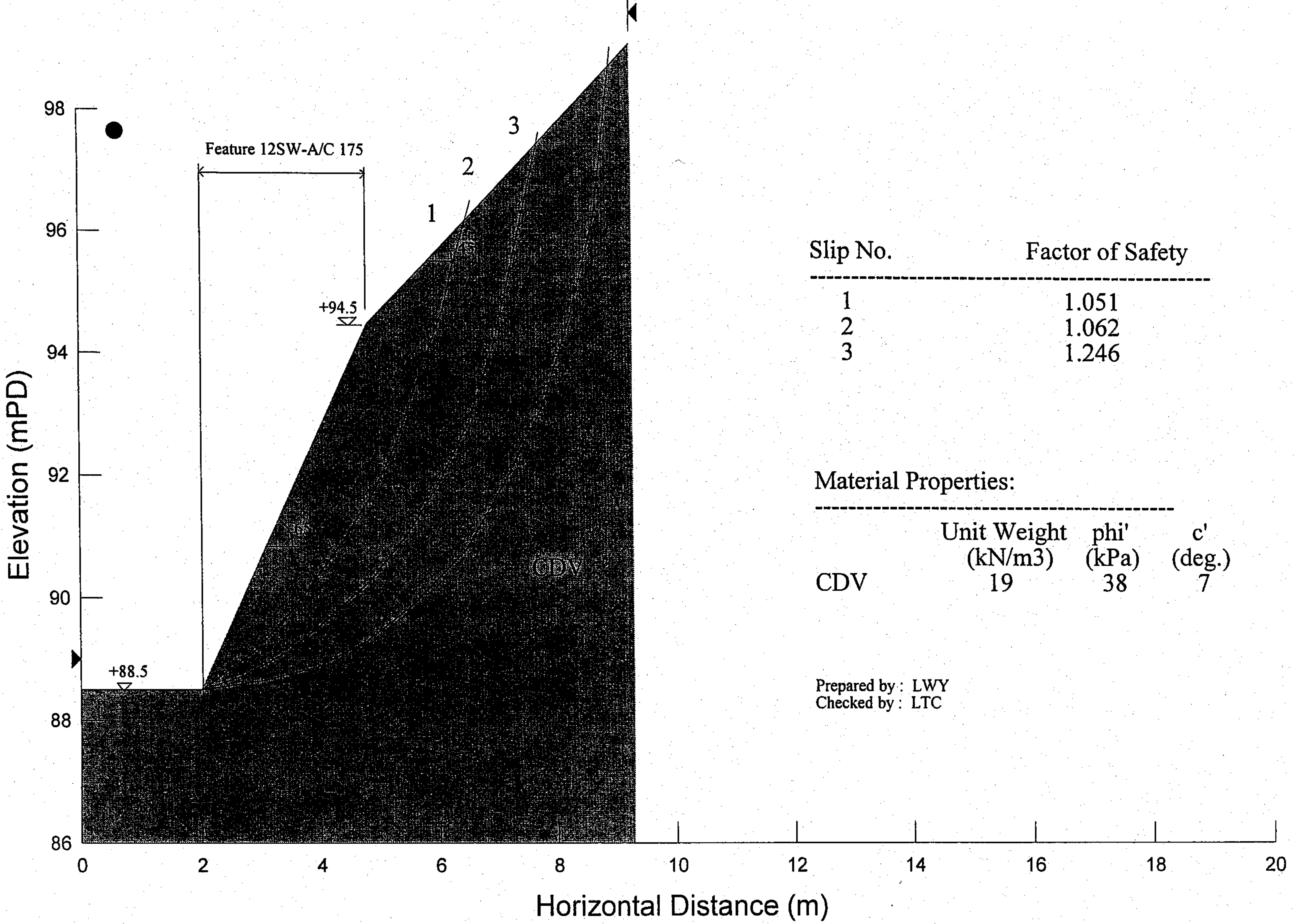
Slip No.	Factor of Safety
1	1.613
2	1.635
3	1.728
4	3.215
5	2.143

Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 175



Slip No.	Factor of Safety
1	1.051
2	1.062
3	1.246

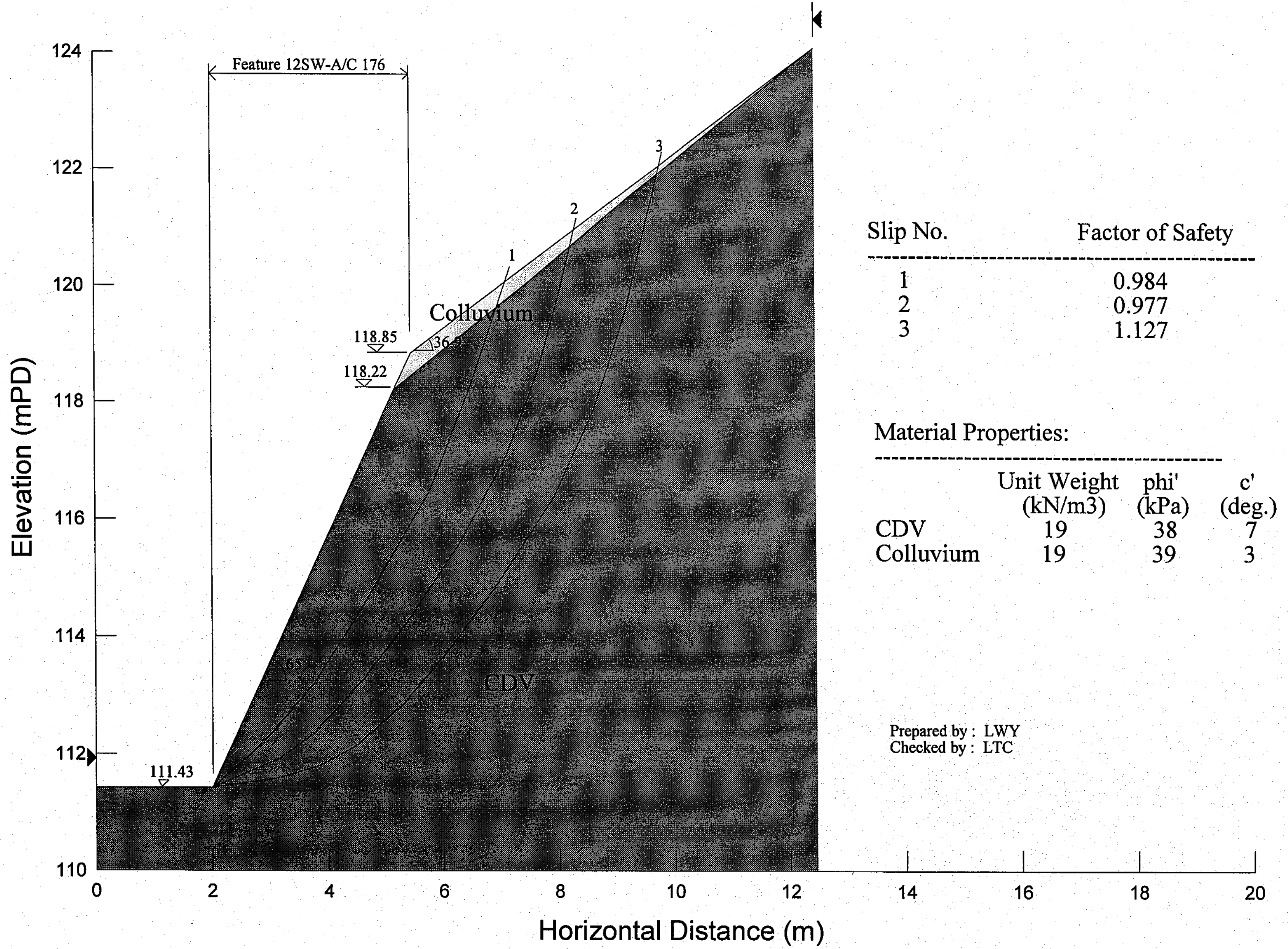
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7

Prepared by : LWY
Checked by : LTC

Section I-I

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 176



Feature 12SW-A/C 176
124
122
120
118
116
114
112
110
Elevation (mPD)
118.85
118.22
111.43
36.9
65
1
2
3
Colluvium
CDV
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	0.984
2	0.977
3	1.127

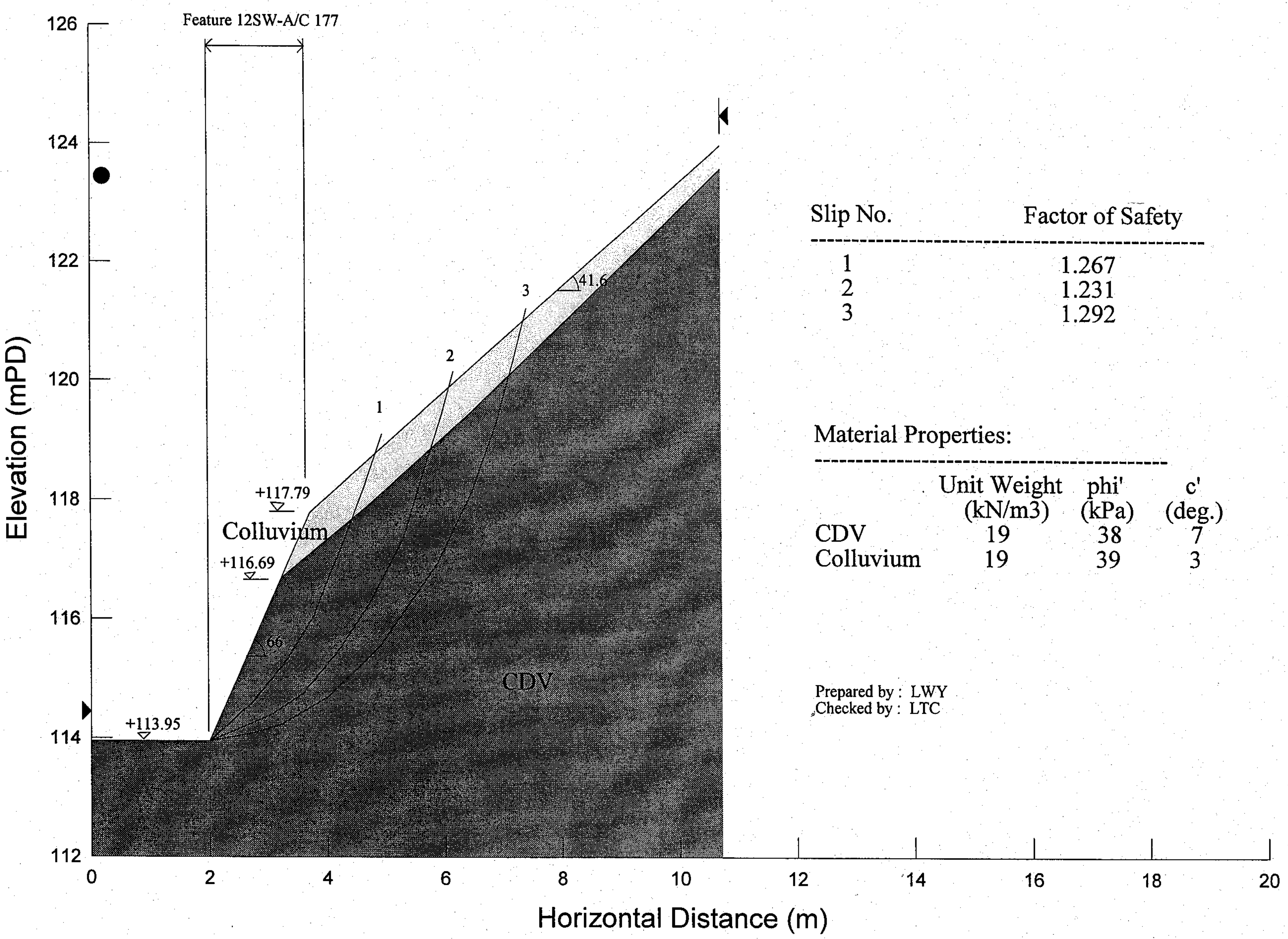
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS9

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 177


Feature 12SW-A/C 177
Elevation (mPD)
126
124
122
120
118
116
114
112
Horizontal Distance (m)
0
2
4
6
8
10
12
14
16
18
20
+117.79
Colluvium
+116.69
66
+113.95
1
2
3
41.6
CDV

Slip No.	Factor of Safety
1	1.267
2	1.231
3	1.292

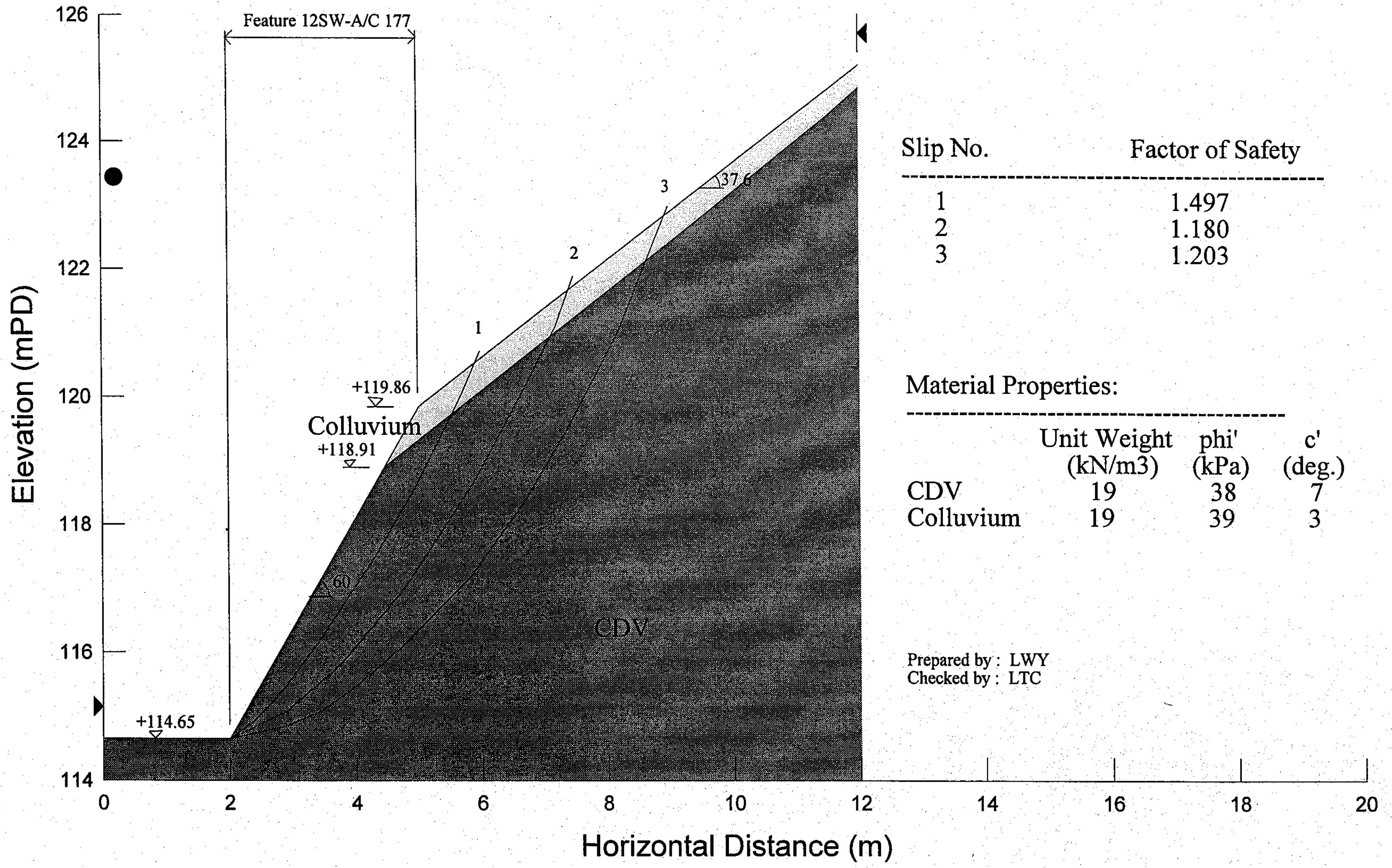
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS10

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 177


Elevation (mPD)
126
124
122
120
118
116
114
Feature 12SW-A/C 177
+119.86
Colluvium
+118.91
60
37.6
1
2
3
CDV
+114.65
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	1.497
2	1.180
3	1.203

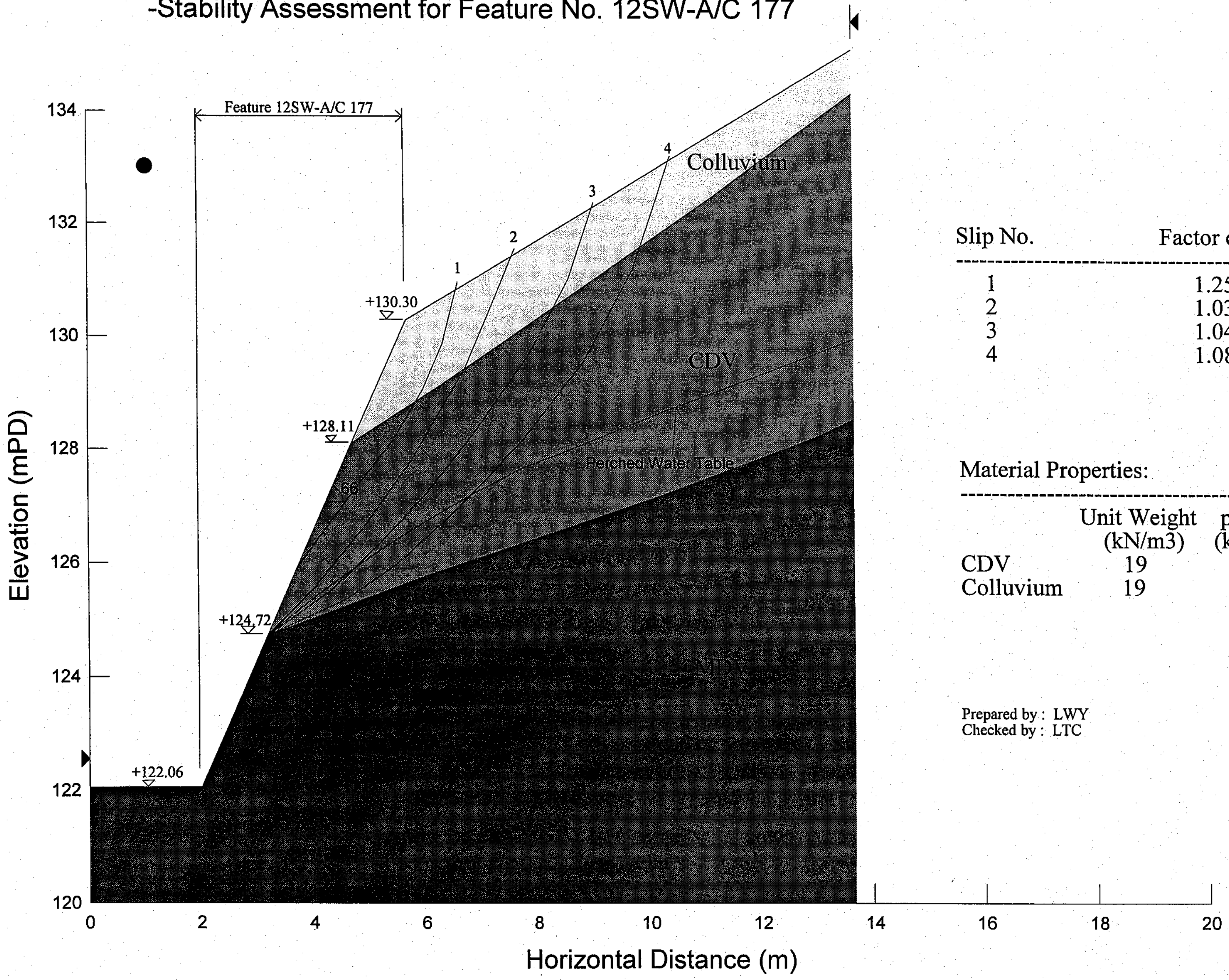
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS11

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 177


Feature 12SW-A/C 177
+130.30
+128.11
+124.72
+122.06
66
1
2
3
4
Colluvium
CDV
Perched Water Table
MDV
134
132
130
128
126
124
122
120
Elevation (mPD)
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Section SS12

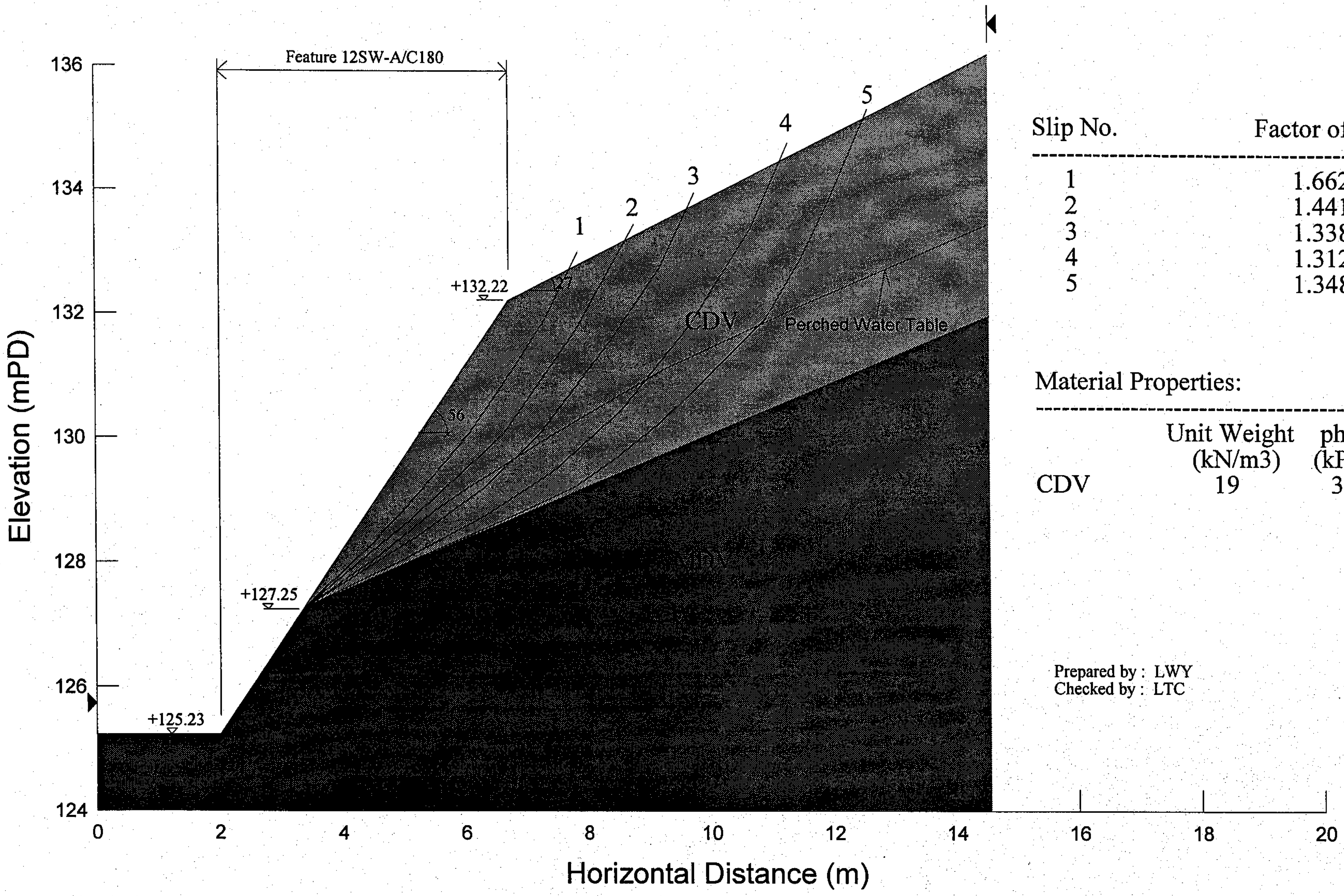
Slip No.	Factor of Safety
1	1.250
2	1.032
3	1.040
4	1.087

Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 180


Feature 12SW-A/C180
+132.22
+127.25
+125.23
27
56
1
2
3
4
5
CDV
Perched Water Table
MDV
136
134
132
130
128
126
124
Elevation (mPD)
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	1.662
2	1.441
3	1.338
4	1.312
5	1.348

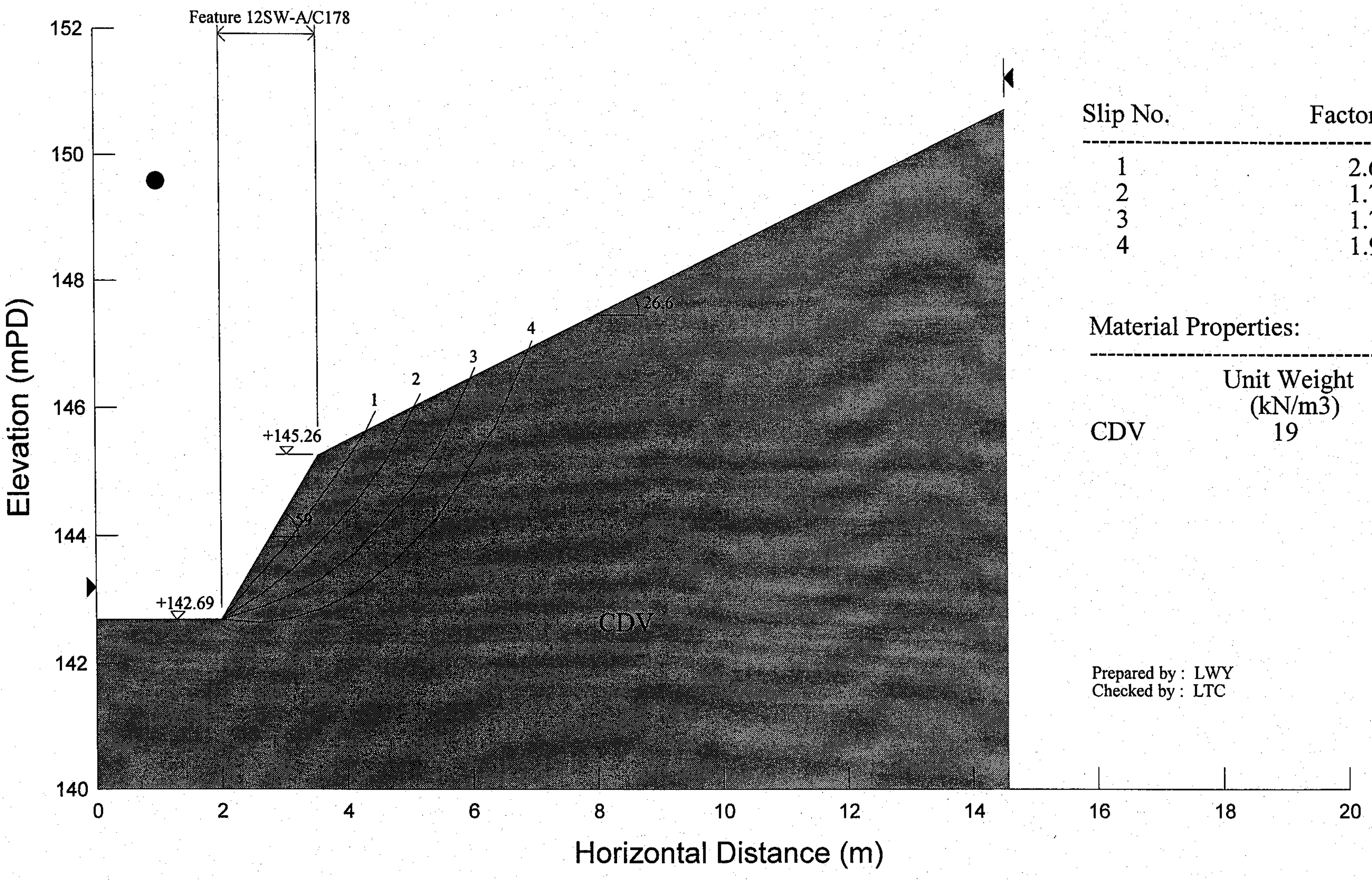
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7

Prepared by : LWY
Checked by : LTC

Section SS13

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 178


Feature 12SW-A/C178
+145.26
+142.69
26.6
59
1
2
3
4
CDV
Elevation (mPD)
152
150
148
146
144
142
140
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Section SS15

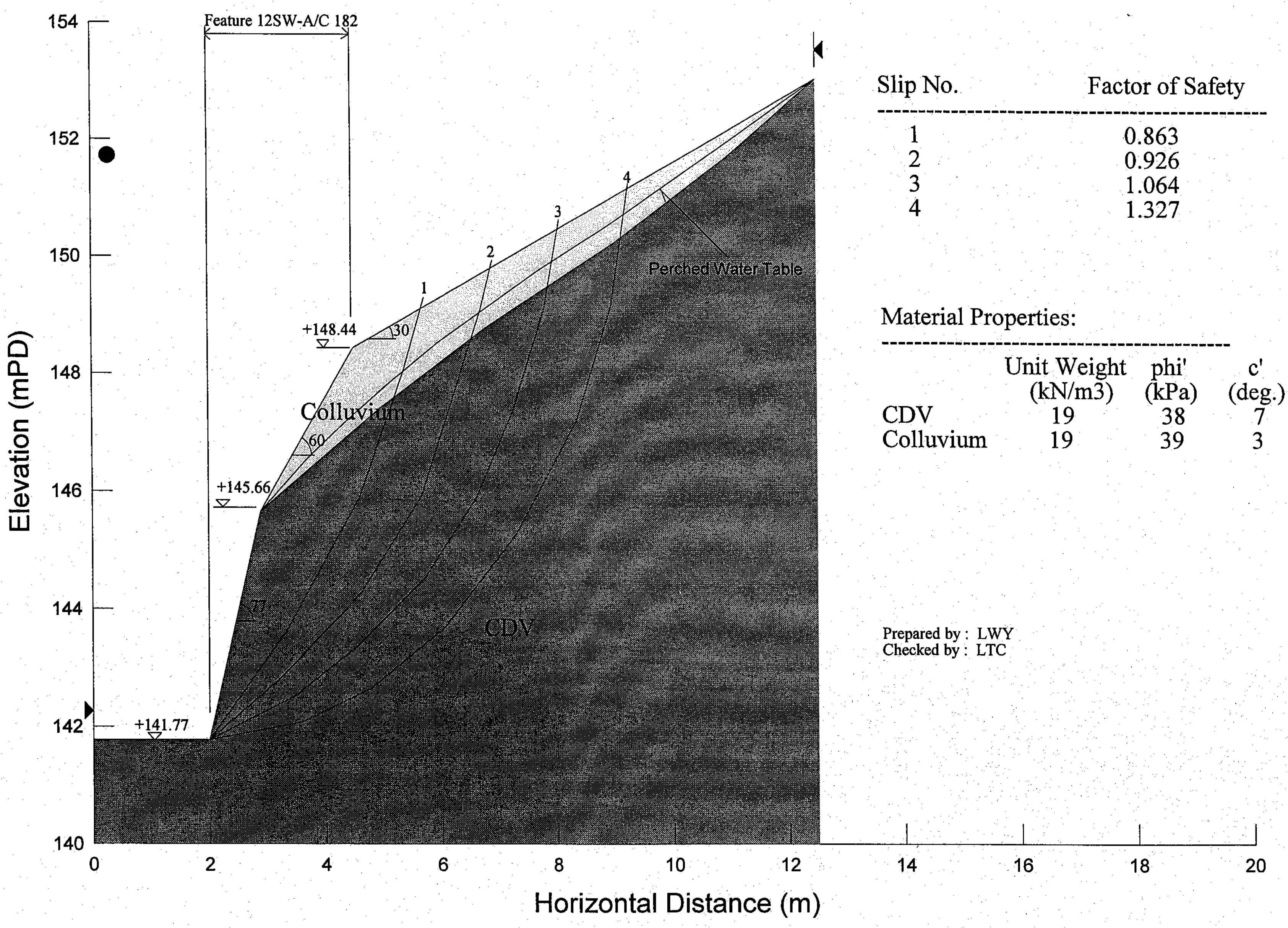
Slip No.	Factor of Safety
1	2.611
2	1.758
3	1.743
4	1.927

Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7

Prepared by : LWY
Checked by : LTC

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 182


Feature 12SW-A/C 182
+148.44
30
+145.66
60
77
+141.77
Colluvium
CDV
Perched Water Table
1
2
3
4
Elevation (mPD)
154
152
150
148
146
144
142
140
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	0.863
2	0.926
3	1.064
4	1.327

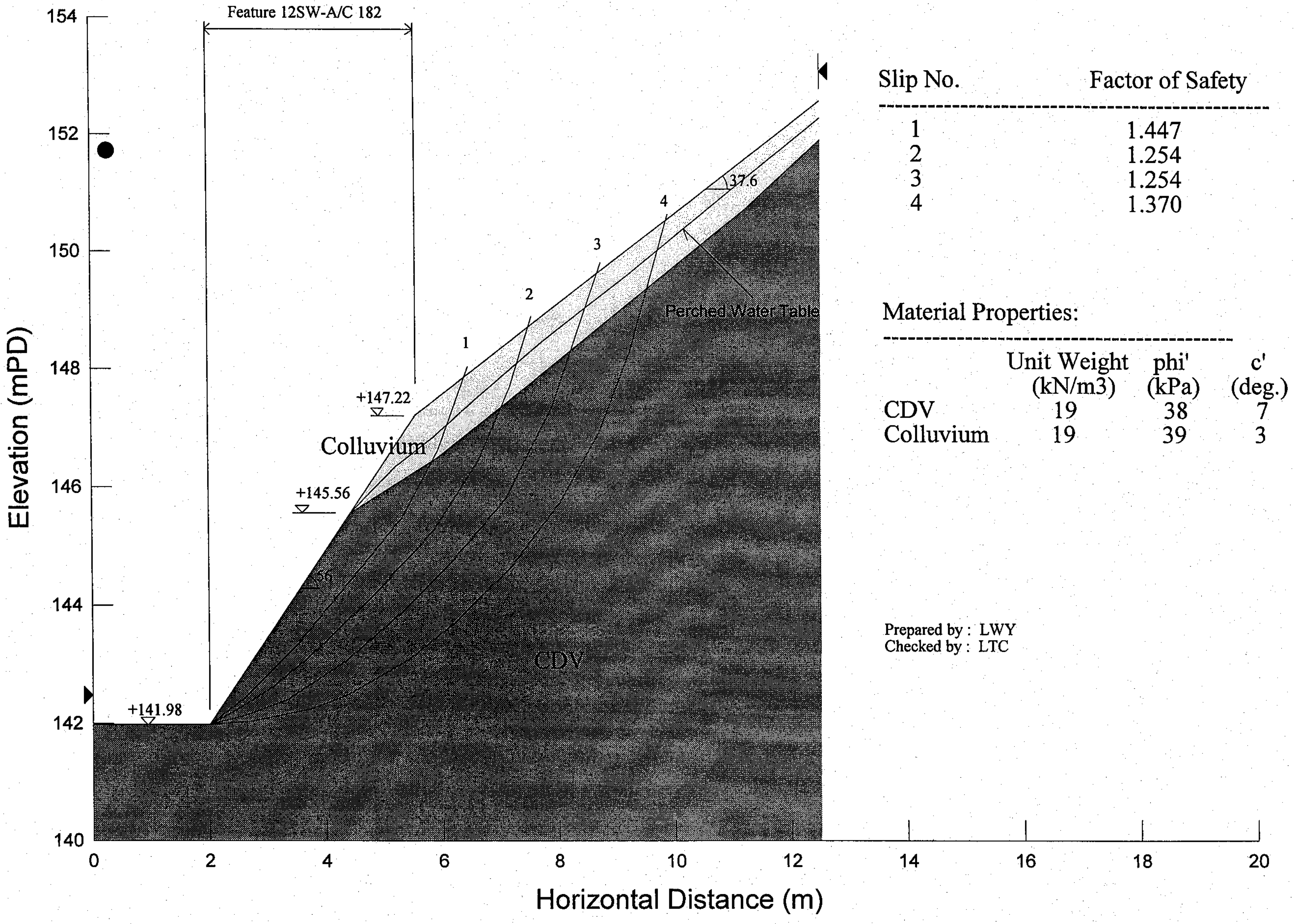
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS16

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 182


Feature 12SW-A/C 182
154
152
150
148
146
144
142
140
Elevation (mPD)
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)
+147.22
+145.56
+141.98
Colluvium
CDV
Perched Water Table
56
37.6
1
2
3
4

Slip No.	Factor of Safety
1	1.447
2	1.254
3	1.254
4	1.370

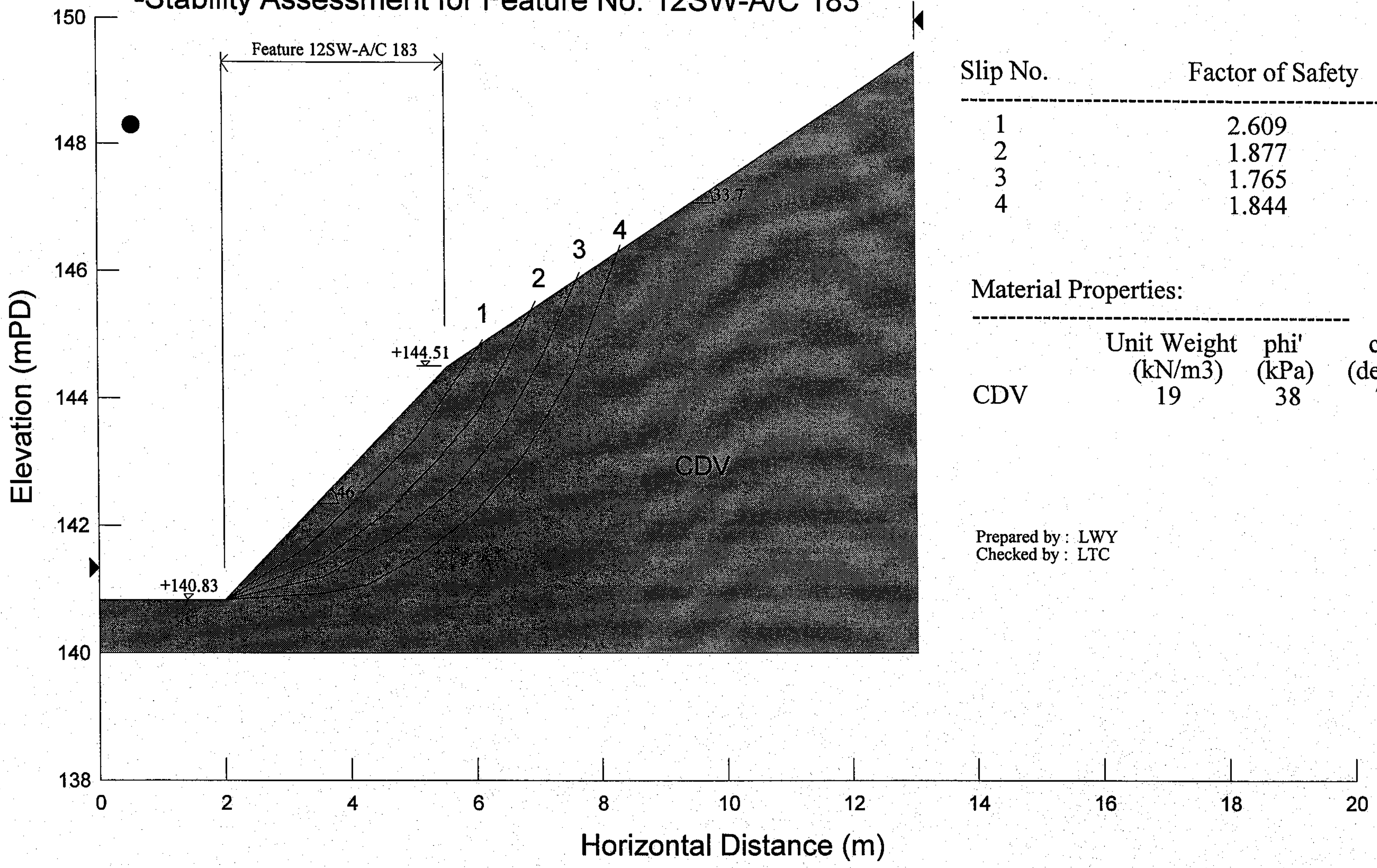
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS17

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 183


Feature 12SW-A/C 183
+144.51
+140.83
1
2
3
4
33.7
46
CDV
Elevation (mPD)
150
148
146
144
142
140
138
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	2.609
2	1.877
3	1.765
4	1.844

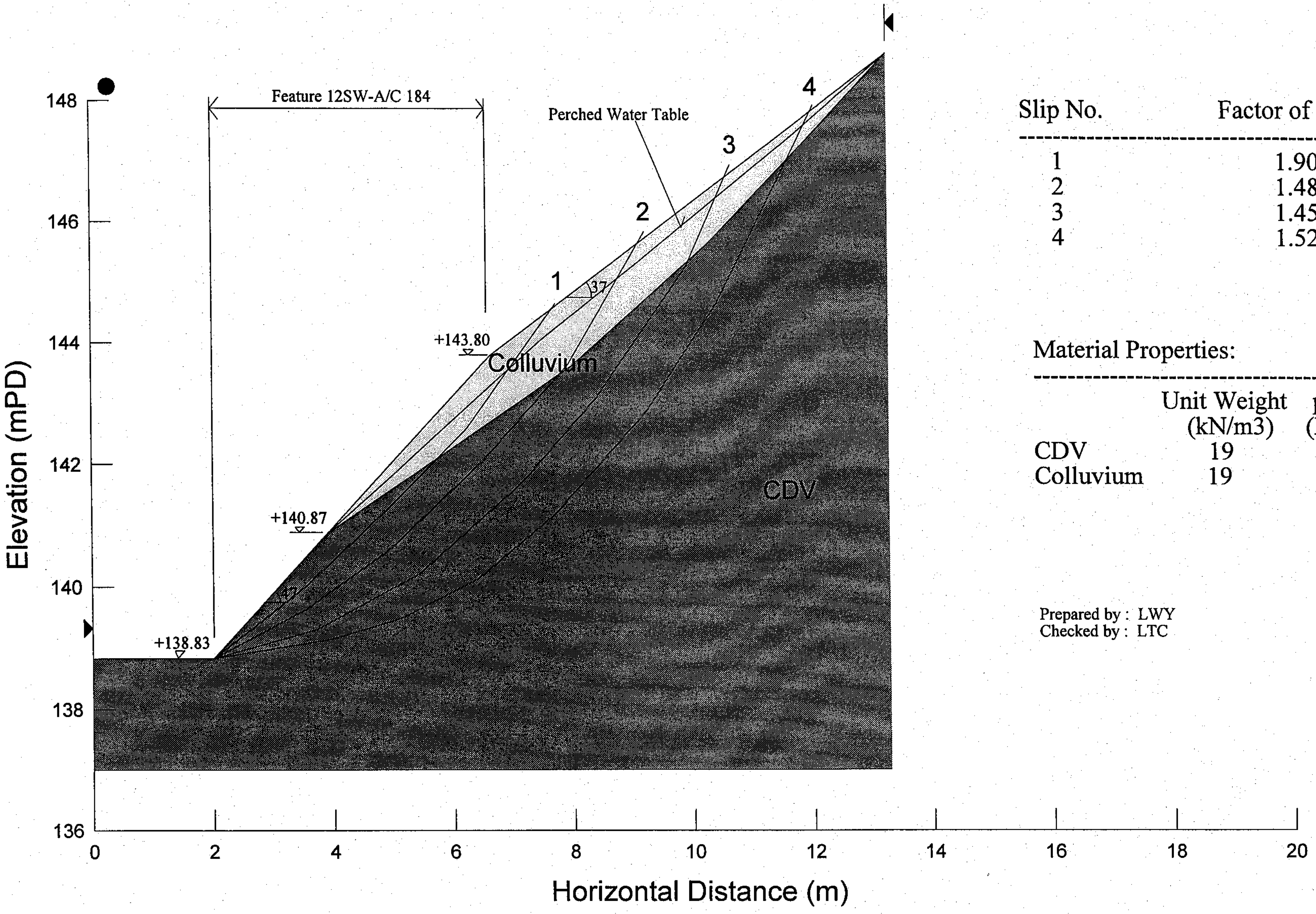
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7

Prepared by : LWY
Checked by : LTC

Section SS19

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 184


Feature 12SW-A/C 184
Perched Water Table
1
2
3
4
37
47
+143.80
+140.87
+138.83
Colluvium
CDV
Elevation (mPD)
148
146
144
142
140
138
136
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	1.902
2	1.480
3	1.451
4	1.522

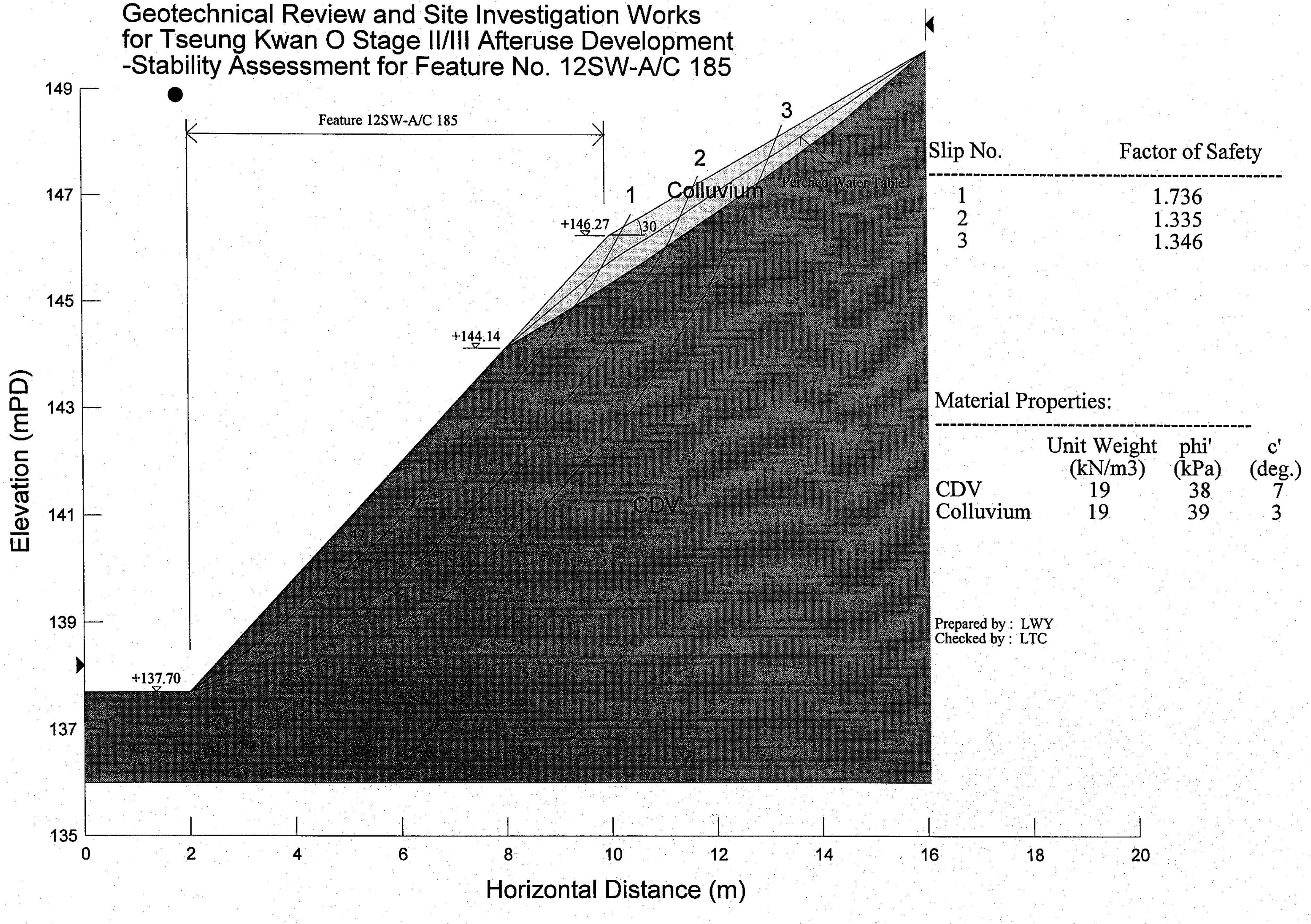
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS22

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 185


Feature 12SW-A/C 185
+146.27
30
+144.14
47
+137.70
1
2
3
Colluvium
Perched Water Table
CDV
Elevation (mPD)
149
147
145
143
141
139
137
135
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	1.736
2	1.335
3	1.346

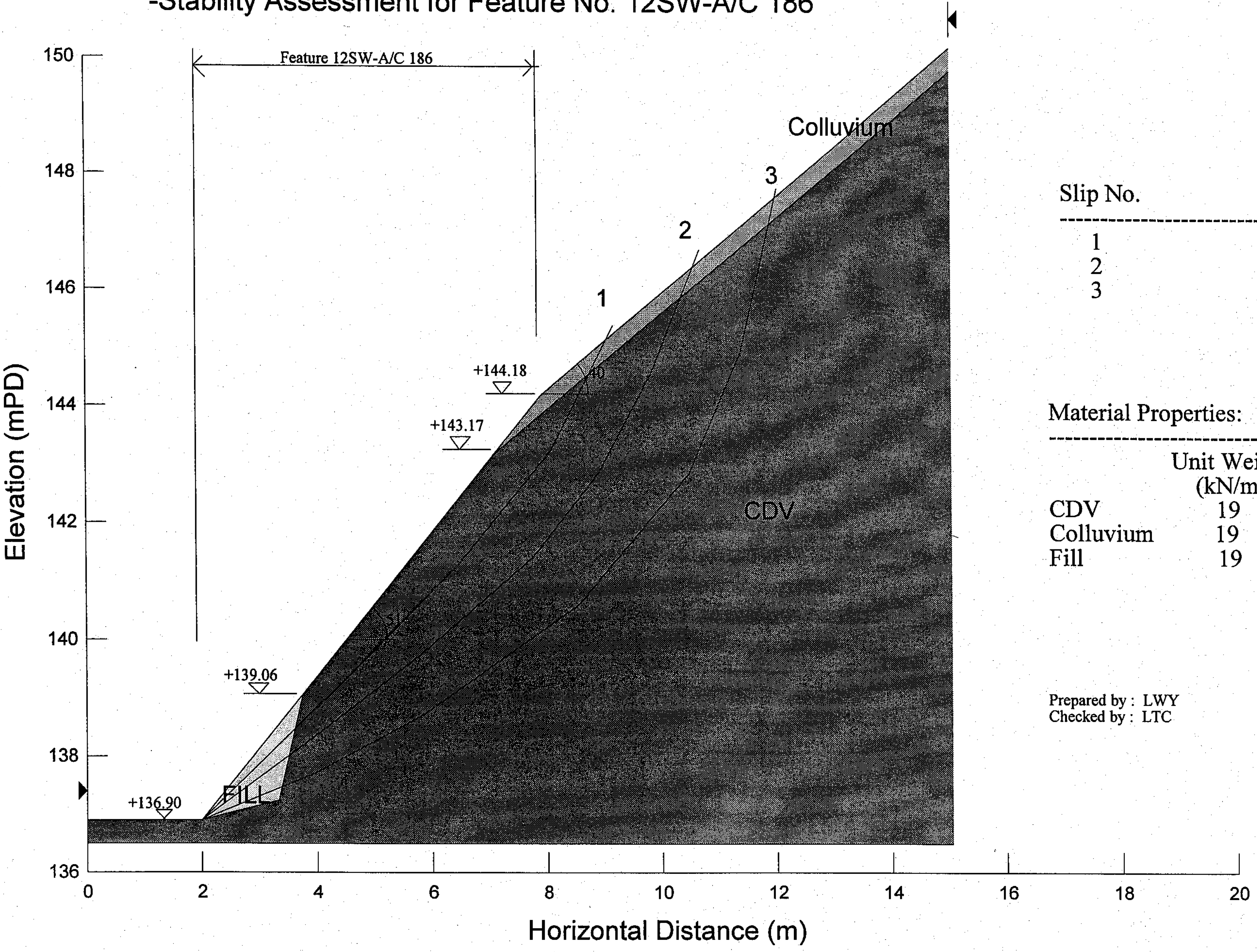
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS24

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 186



Section SS25

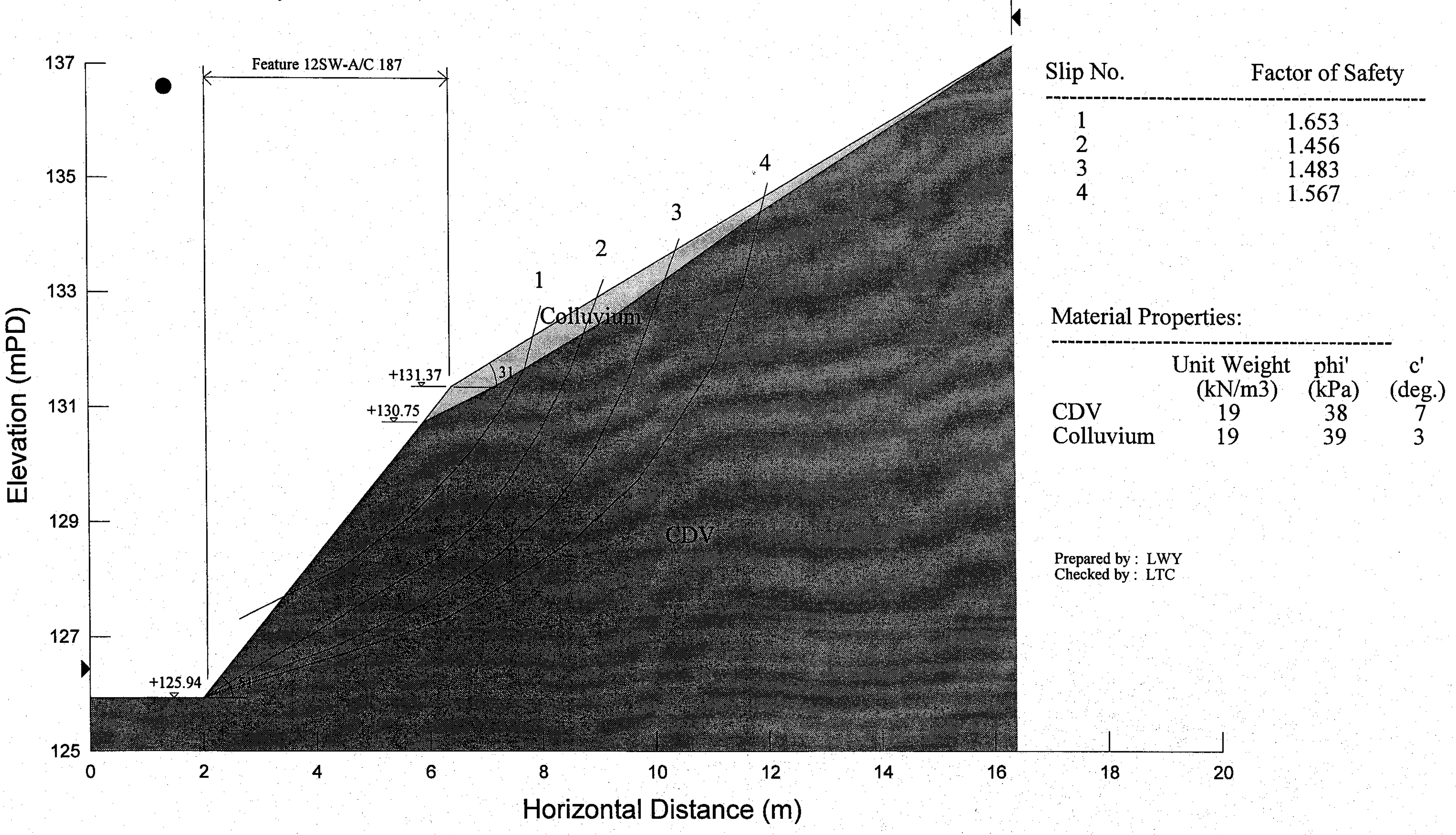
Slip No.	Factor of Safety
1	1.517
2	1.230
3	1.240

Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3
Fill	19	38	0

Prepared by : LWY
Checked by : LTC

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 187


137
135
133
131
129
127
125
Elevation (mPD)
Feature 12SW-A/C 187
+131.37
+130.75
+125.94
31
51
1
2
3
4
Colluvium
CDV
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	1.653
2	1.456
3	1.483
4	1.567

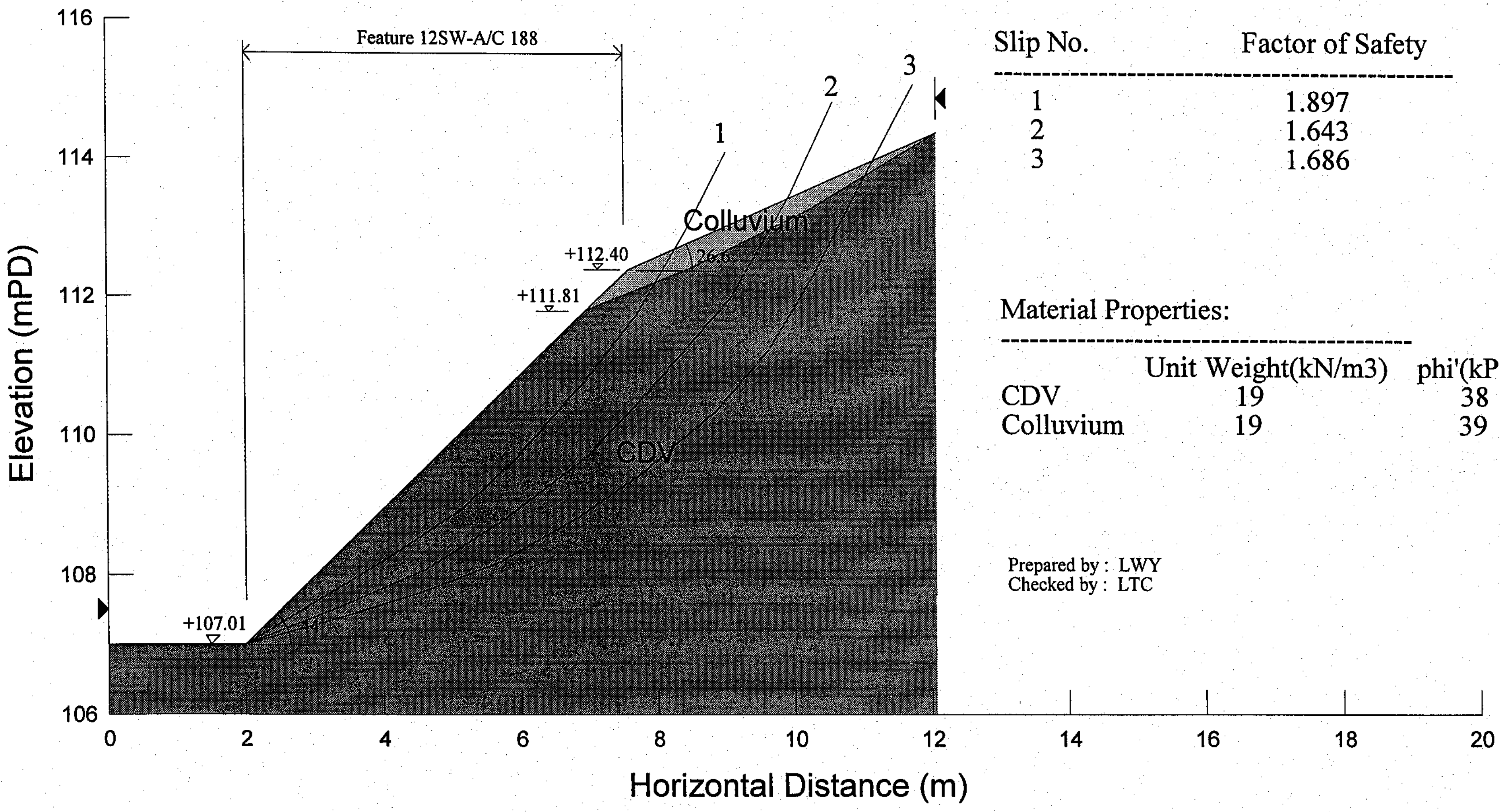
Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS27

● Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 188


Feature 12SW-A/C 188
1
2
3
Colluvium
+112.40
26.6
+111.81
CDV
+107.01
44
Elevation (mPD)
116
114
112
110
108
106
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	1.897
2	1.643
3	1.686

Material Properties:

	Unit Weight(kN/m3)	phi'(kPa)	c'(deg.)
CDV	19	38	7
Colluvium	19	39	3

Prepared by : LWY
Checked by : LTC

Section SS30

APPENDIX D
Prescriptive Measures Application Record Sheets

Feature No.	Recommended Prescriptive Measures				
12SW-A/C76 (Section SS2)	Soil nail	Layout:	Type	(d)	
			Number of rows of soil nails, N	3	
			Nail diameter, f_r(mm)	25	mm
			Hole diameter, f_h (mm)	100	mm
			Horizontal spacing, S_h (m)	1.5	m
			Length of soil nails, L (m)	7.5	m
12SW-A/C173 (Section SS4)	Soil nail	Layout:	Type	(f)	
			Number of rows of soil nails, N	5	
			Nail diameter, f_r(mm)	32	mm
			Hole diameter, f_h (mm)	100	mm
			Horizontal spacing, S_h (m)	1.5	m
			Length of soil nails, L (m)	10	m
12SW-A/C173 (Section SS6)	Soil nail	Layout:	Type	(d)	
			Number of rows of soil nails, N	3	
			Nail diameter, f_r(mm)	25	mm
			Hole diameter, f_h (mm)	100	mm
			Horizontal spacing, S_h (m)	1.5	m
			Length of soil nails, L (m)	7.5	m
12SW-A/C176	Soil nail	Layout:	Type	(e)	
			Number of rows of soil nails, N	4	
			Nail diameter, f_r(mm)	25	mm
			Hole diameter, f_h (mm)	100	mm
			Horizontal spacing, S_h (m)	1.5	m
			Length of soil nails, L (m)	9.5	m
12SW-A/C177 (Section SS12)	Soil nail	Layout:	Type	(f)	
			Number of rows of soil nails, N	5	
			Nail diameter, f_r(mm)	32	mm
			Hole diameter, f_h (mm)	100	mm
			Horizontal spacing, S_h (m)	2	m
			Length of soil nails, L (m)	10.0	m
12SW-A/C182 (Section SS16)	Soil nail	Layout:	Type	(e)	
			Number of rows of soil nails, N	6	
			Nail diameter, f_r(mm)	25	mm
			Hole diameter, f_h (mm)	100	mm
			Horizontal spacing, S_h (m)	1.5	m
			Length of soil nails, L (m)	10.0	m
	Raking drains at specific seepage				
12SW-A/C183	Raking drains at specific seepage				
12SW-A/C188	Raking drains at specific seepage				

Record Sheet for Prescriptive Measures Application

Slope Reference No.: 12SW-A/C76 (Section SS2)	**Location:** Tseung Kwan O Landfill Stage II/III
Geometry/Consequence:	**Qualifying criteria:**
Slope Gradient: 78° Slope Height: 3.92 m Upslope Gradient: 39° Group of Facilities Affected: ~~1 / 2 / 3~~ / 4 ~~/ 5~~ Consequence to life Category: ~~1 / 2~~ / 3 Record of Engineer Inspection: ~~YES~~ / NO If Yes, Inspection Date: - Geology Map No: 12	1) Pre-GCO Slope? ☑ YES ☐ NO 2) Within Consequence and Geometry Limits? ☑ YES ☐ NO 3) Within Area of selected formations of Granite or Volcanics? ☑ YES ☐ NO 4) Adverse Geological conditions present? ☐ YES ☑ NO 5) Adverse Groundwater Conditions? ☐ YES ☑ NO

Record of Landslides

Date:	Scar Height (m)	Failure Volume (m^3)	GEO Incident No.
1) None			
2)			
3)			

Type Of Improvement Works

☐ Preventive Maintenance ☐ Urgent Repair to the current Landslide ☑ Upgrading works (~~LPM~~)

Design Objective	Prescriptive Measure Recommended	Figure No.
☐ Improve surface protection ☐ Improve local stability	☐ 1.1.1 Cover slope face with shotcrete.	A1
	☐ 1.1.2 Locally trim and remove loose materials	-
	1.1.3 Fill local areas with no-fines concrete:	
	☐ (a) at upper part of slope	A2
	☐ (b) at lower part of slope	A2
	☐ 1.1.4 Cover upslope area with shotcrete	A3
☐ Improve surface drainage	☐ 1.2.1 Provide surface drainage channels	-
	☐ 1.2.2 Provide slope crest channel with upstand	A3
☐ Improve subsurface drainage ☐ Provide contingency subsurface drainage measures	2.1 Provide drainage behind impermeable surface cover:	
	☐ (a) with no fines concrete toe	A4
	☐ (b) with relief drains	A5
	2.2 Cover slope face with no-fines concrete:	
	☐ (a) at upper part of slope	A6
	☐ (b) at lower part of slope or on berm	A7
	2.3 Provide raking drains:	
	☐ (a) at upper part of slope	A8
	☐ (b) at lower part of slope	A9
	☐ (c) at specific seepage or potential seepage areas	-
	☐ 2.4 Provide cut-off drain above slope crest	A10
	☐ 2.5 Provide toe drain	A10
	☐ 2.6 Provide counterfort drains at upper part of slope	A11
☑ Provide support to improve overall slope stability.	☑ 3.1 Provide soil nails with a FOS increase in range: ~~A / B~~ / C	A12
☐ Others (please specify)	☐ Other measures (please specify)	

Attachments:

☐ Site Location Plan ☐ Photographs ☐ Records of Engineer Inspection

☐ Plan, sketches/drawings showing locations/layout/key dimensions of the proposed prescriptive measures

Designed: W. Y. Law **Post: AE**	**Signature:** **Date:**	**Checked: Tony Chen** **Post: SE**	**Signature:** **Date:**

Feature 12SW-A/C76 (Section SS2)

From SLOPE/W Analysis

Consequence-to-life Category	3
Required FoS	1.1
Calculated FoS	1.024
Range of FoS Increase for Prescriptive Application of Soil Nailing	C

Refer to Section SS2

maximum height of the feature, H = 3.92 m

Upslope gradient β = 39 °

Surcharge q = 5 kPa

Maximum effective height

$$H_e = H \times (1 + 0.35\tan\beta) + q/20$$

$$= 5.28 \text{ m}$$

From Table A2 of GEO Report No. 56 (Issue 2),

Soil Nail Layout is as follows:

Type	(d)	
Number of rows of soil nails, N	3	
Nail diameter, ϕ_r(mm)	25	mm
Hole diameter, ϕ_h (mm)	100	mm
Horizontal spacing, S_h (m)	1.5	m
Length of soil nails, L (m)	7.5	m

Computed by:

Date

Checked by:

Date

Table A2 - Standard Soil Nail Layout

Standard Soil Nail Layout	H_e (m)	ϕ_r (mm)	ϕ_h (mm)	A			B			C		
				N	L(m)	S_h(m)	N	L(m)	S_h(m)	N	L(m)	S_h(m)
(a)	3.0	25	100	2	3.5	1.5	2	3.5	1.5	2	3.5	1.5
(b)	4.0	25	100	2	4.5	1.5	2	4.5	1.5	2	4.5	1.5
(c)	5.0	25	100	3	6.0	1.5	3	6.0	1.5	3	6.0	2.0
(d)	7.5	25	100	4	9.0	1.5	3	8.5	1.5	3	7.5	1.5
(e)	10.0	25	100	6	10.0	1.5	4	9.5	1.5	4	8.5	1.5
(f)	12.5	32	100	6	11.0	1.5	5	10.0	1.5	5	10.0	2.0
(g)	15.0	32	100	7	12.0	1.5	6	11.0	1.5	6	11.0	2.0
(h)	17.5	32	100	8	13.0	1.5	8	11.5	2.0	7	11.5	2.0
(i)	20.0	32	100	10	13.5	2.0	9	12.0	2.0	8	12.0	2.0
(j)	22.5	32	100	11	14.0	2.0	9	12.0	2.0	8	12.0	2.0
(k)	25.0	32	100	12	14.5	2.0	10	12.0	2.0	8	12.0	2.0

Notes:

(1) H_e is the maximum effective slope height, ϕ_r the nail diameter, ϕ_h the hole diameter S_h the horizontal spacing of nails, and N & L the number of rows and length of the soil nails respectively.

(2) For H_e between any of the two consecutive values, the soil nail layout corresponding to the higher H_e value should be adopted.

(3) Soil nails should be evenly spaced over the slope face.

(4) N is the number of soil nails per vertical column required at the critical section, i.e. the section with the maximum effective height, H_e. At other parts of the slope, soil nails should be provided at vertical and horizontal spacings similar to that at the critical section. Alternatively, different soil nail layouts according to the maximum H_e of that part of the slope may be adopted.

(5) 'A', 'B' and 'C' refer to a large factor of safety increase ($0.3 < \Delta FOS \leq 0.5$), a medium factor of safety increase ($0.1 < \Delta FOS \leq 0.3$) and a small factor of safety increase ($0 < \Delta FOS \leq 0.1$) respectively.

(6) If in the process of drilling rock is encountered such that part of the soil nails will be installed in rock (e.g. installation through a PW50/90 zone or better, see Geoguide 3), the designer may exercise professional judgement to reduce the nail length L. In the absence of site-specific ground investigation, sound engineering judgement is required to ensure that the nails are not prematurely terminated in corestone boulders.

(7) The designer should check the land status to see whether the nails encroach into adjoining land and if so whether this is acceptable to the land owner.

Record Sheet for Prescriptive Measures Application

Slope Reference No.: 12SW-A/C173 (Section SS4)

Location: Tseung Kwan O Landfill Stage II/III

Geometry/Consequence:

Slope Gradient: 58°
Slope Height: 9 m
Upslope Gradient: 26.6°
Group of Facilities Affected: ~~1 / 2 / 3~~ / 4 ~~/ 5~~
Consequence to life Category: ~~1 / 2~~ / 3
Record of Engineer Inspection: ~~YES~~ / NO
If Yes, Inspection Date: -
Geology Map No: 12

Qualifying criteria:

1) Pre-GCO Slope? ☑ YES ☐ NO
2) Within Consequence and Geometry Limits? ☑ YES ☐ NO
3) Within Area of selected formations of Granite or Volcanics? ☑ YES ☐ NO
4) Adverse Geological conditions present? ☐ YES ☑ NO
5) Adverse Groundwater Conditions? ☐ YES ☑ NO

Record of Landslides

Date:	Scar Height (m)	Failure Volume (m^3)	GEO Incident No.
1) None			
2)			
3)			

Type Of Improvement Works

☐ Preventive Maintenance ☐ Urgent Repair to the current Landslide ☑ Upgrading works (~~LPM~~)

Design Objective	Prescriptive Measure Recommended	Figure No.
☐ Improve surface protection	☐ 1.1.1 Cover slope face with shotcrete.	A1
	☐ 1.1.2 Locally trim and remove loose materials	-
☐ Improve local stability	1.1.3 Fill local areas with no-fines concrete:	
	☐ (a) at upper part of slope	A2
	☐ (b) at lower part of slope	A2
	☐ 1.1.4 Cover upslope area with shotcrete	A3
☐ Improve surface drainage	☐ 1.2.1 Provide surface drainage channels	-
	☐ 1.2.2 Provide slope crest channel with upstand	A3
☐ Improve subsurface drainage	2.1 Provide drainage behind impermeable surface cover:	
☐ Provide contingency subsurface drainage measures	☐ (a) with no fines concrete toe	A4
	☐ (b) with relief drains	A5
	2.2 Cover slope face with no-fines concrete:	
	☐ (a) at upper part of slope	A6
	☐ (b) at lower part of slope or on berm	A7
	2.3 Provide raking drains:	
	☐ (a) at upper part of slope	A8
	☐ (b) at lower part of slope	A9
	☐ (c) at specific seepage or potential seepage areas	-
	☐ 2.4 Provide cut-off drain above slope crest	A10
	☐ 2.5 Provide toe drain	A10
	☐ 2.6 Provide counterfort drains at upper part of slope	A11
☑ Provide support to improve overall slope stability.	☑ 3.1 Provide soil nails with a FOS increase in range: ~~A~~ / B / ~~C~~	A12
☐ Others (please specify)	☐ Other measures (please specify)	

Attachments:

☐ Site Location Plan ☐ Photographs ☐ Records of Engineer Inspection
☐ Plan, sketches/drawings showing locations/layout/key dimensions of the proposed prescriptive measures

Designed: W. Y. Law	**Signature:**	**Checked: Tony Chen**	**Signature:**
Post: AE	**Date:**	**Post: SE**	**Date:**

Feature 12SW-A/C173 (Section SS4)

From SLOPE/W Analysis

Consequence-to-life Category	3
Required FoS	1.1
Calculated FoS	0.89
Range of FoS Increase for Prescriptive Application of Soil Nailing	B

Refer to Section SS4

maximum height of the feature, $H =$ 9 m

Upslope gradient $\beta =$ 26.6 °

Surcharge $q =$ 5 kPa

Maximum effective height

$$H_e = H \times (1 + 0.35\tan\beta) + q/20$$
$$= 10.83 \text{ m}$$

From Table A2 of GEO Report No. 56 (Issue 2),

Soil Nail Layout is as follows:

Type	(f)	
Number of rows of soil nails, N	5	
Nail diameter, ϕ_r(mm)	32	mm
Hole diameter, ϕ_h (mm)	100	mm
Horizontal spacing, S_h (m)	1.5	m
Length of soil nails, L (m)	10.0	m

Computed by:

Date

Checked by:

Date

Table A2 - Standard Soil Nail Layout

Standard Soil Nail Layout	H_e (m)	ϕ_r (mm)	ϕ_h (mm)	A			B			C		
				N	L(m)	S_h(m)	N	L(m)	S_h(m)	N	L(m)	S_h(m)
(a)	3.0	25	100	2	3.5	1.5	2	3.5	1.5	2	3.5	1.5
(b)	4.0	25	100	2	4.5	1.5	2	4.5	1.5	2	4.5	1.5
(c)	5.0	25	100	3	6.0	1.5	3	6.0	1.5	3	6.0	2.0
(d)	7.5	25	100	4	9.0	1.5	3	8.5	1.5	3	7.5	1.5
(e)	10.0	25	100	6	10.0	1.5	4	9.5	1.5	4	8.5	1.5
(f)	12.5	32	100	6	11.0	1.5	5	10.0	1.5	5	10.0	2.0
(g)	15.0	32	100	7	12.0	1.5	6	11.0	1.5	6	11.0	2.0
(h)	17.5	32	100	8	13.0	1.5	8	11.5	2.0	7	11.5	2.0
(i)	20.0	32	100	10	13.5	2.0	9	12.0	2.0	8	12.0	2.0
(j)	22.5	32	100	11	14.0	2.0	9	12.0	2.0	8	12.0	2.0
(k)	25.0	32	100	12	14.5	2.0	10	12.0	2.0	8	12.0	2.0

Notes:

(1) H_e is the maximum effective slope height, ϕ_r the nail diameter, ϕ_h the hole diameter S_h the horizontal spacing of nails, and N & L the number of rows and length of the soil nails respectively.

(2) For H_e between any of the two consecutive values, the soil nail layout corresponding to the higher H_e value should be adopted.

(3) Soil nails should be evenly spaced over the slope face.

(4) N is the number of soil nails per vertical column required at the critical section, i.e. the section with the maximum effective height, H_e. At other parts of the slope, soil nails should be provided at vertical and horizontal spacings similar to that at the critical section. Alternatively, different soil nail layouts according to the maximum H_e of that part of the slope may be adopted.

(5) 'A', 'B' and 'C' refer to a large factor of safety increase ($0.3 < \Delta FOS \leq 0.5$), a medium factor of safety increase ($0.1 < \Delta FOS \leq 0.3$) and a small factor of safety increase ($0 < \Delta FOS \leq 0.1$) respectively.

(6) If in the process of drilling rock is encountered such that part of the soil nails will be installed in rock (e.g. installation through a PW50/90 zone or better, see Geoguide 3), the designer may exercise professional judgement to reduce the nail length L. In the absence of site-specific ground investigation, sound engineering judgement is required to ensure that the nails are not prematurely terminated in corestone boulders.

(7) The designer should check the land status to see whether the nails encroach into adjoining land and if so whether this is acceptable to the land owner.

Record Sheet for Prescriptive Measures Application

Slope Reference No.: 12SW-A/C173 (Section SS6)	**Location:** Tseung Kwan O Landfill Stage II/III
Geometry/Consequence:	**Qualifying criteria:**
Slope Gradient: 56° Slope Height: 6.16 m Upslope Gradient: 26.6° Group of Facilities Affected: ~~1 / 2 / 3~~ / 4 / ~~5~~ Consequence to life Category: ~~1 / 2~~ / 3 Record of Engineer Inspection: ~~YES~~ / NO If Yes, Inspection Date: - Geology Map No: 12	1) Pre-GCO Slope? ☑ YES ☐ NO 2) Within Consequence and Geometry Limits? ☑ YES ☐ NO 3) Within Area of selected formations of Granite or Volcanics? ☑ YES ☐ NO 4) Adverse Geological conditions present? ☐ YES ☑ NO 5) Adverse Groundwater Conditions? ☐ YES ☑ NO

Record of Landslides

Date:	Scar Height (m)	Failure Volume (m^3)	GEO Incident No.
1) None			
2)			
3)			

Type Of Improvement Works

☐ Preventive Maintenance ☐ Urgent Repair to the current Landslide ☑ Upgrading works (~~LPM~~)

Design Objective	Prescriptive Measure Recommended	Figure No.
☐ Improve surface protection ☐ Improve local stability	☐ 1.1.1 Cover slope face with shotcrete. ☐ 1.1.2 Locally trim and remove loose materials 1.1.3 Fill local areas with no-fines concrete: ☐ (a) at upper part of slope ☐ (b) at lower part of slope ☐ 1.1.4 Cover upslope area with shotcrete	A1 - A2 A2 A3
☐ Improve surface drainage	☐ 1.2.1 Provide surface drainage channels ☐ 1.2.2 Provide slope crest channel with upstand	- A3
☐ Improve subsurface drainage ☐ Provide contingency subsurface drainage measures	2.1 Provide drainage behind impermeable surface cover: ☐ (a) with no fines concrete toe ☐ (b) with relief drains 2.2 Cover slope face with no-fines concrete: ☐ (a) at upper part of slope ☐ (b) at lower part of slope or on berm 2.3 Provide raking drains: ☐ (a) at upper part of slope ☐ (b) at lower part of slope ☐ (c) at specific seepage or potential seepage areas ☐ 2.4 Provide cut-off drain above slope crest ☐ 2.5 Provide toe drain ☐ 2.6 Provide counterfort drains at upper part of slope	 A4 A5 A6 A7 A8 A9 - A10 A10 A11
☑ Provide support to improve overall slope stability.	☑ 3.1 Provide soil nails with a FOS increase in range: ~~A / B /~~ C	A12
☐ Others (please specify)	☐ Other measures (please specify)	

Attachments:

☐ Site Location Plan ☐ Photographs ☐ Records of Engineer Inspection

☐ Plan, sketches/drawings showing locations/layout/key dimensions of the proposed prescriptive measures

Designed: W. Y. Law **Post:** AE	**Signature:** **Date:**	**Checked:** Tony Chen **Post:** SE	**Signature:** **Date:**

Feature 12SW-A/C173 (Section SS6)

From SLOPE/W Analysis

Consequence-to-life Category	3
Required FoS	1.1
Calculated FoS	1.026
Range of FoS Increase for Prescriptive Application of Soil Nailing	C

Refer to Section SS6

maximum height of the feature, H = 6.16 m

Upslope gradient β = 26.6 °

Surcharge q = 5 kPa

Maximum effective height

$H_e = H \times (1 + 0.35\tan\beta) + q/20$

$= 7.49$ m

From Table A2 of GEO Report No. 56 (Issue 2),

Soil Nail Layout is as follows:

Type	(d)	
Number of rows of soil nails, N	3	
Nail diameter, ϕ_r(mm)	25	mm
Hole diameter, ϕ_h (mm)	100	mm
Horizontal spacing, S_h (m)	1.5	m
Length of soil nails, L (m)	7.5	m

Computed by:

Date

Checked by:

Date

Table A2 - Standard Soil Nail Layout

Standard Soil Nail Layout	H_e (m)	ϕ_r (mm)	ϕ_h (mm)	A			B			C		
				N	L(m)	S_h(m)	N	L(m)	S_h(m)	N	L(m)	S_h(m)
(a)	3.0	25	100	2	3.5	1.5	2	3.5	1.5	2	3.5	1.5
(b)	4.0	25	100	2	4.5	1.5	2	4.5	1.5	2	4.5	1.5
(c)	5.0	25	100	3	6.0	1.5	3	6.0	1.5	3	6.0	2.0
(d)	7.5	25	100	4	9.0	1.5	3	8.5	1.5	3	7.5	1.5
(e)	10.0	25	100	6	10.0	1.5	4	9.5	1.5	4	8.5	1.5
(f)	12.5	32	100	6	11.0	1.5	5	10.0	1.5	5	10.0	2.0
(g)	15.0	32	100	7	12.0	1.5	6	11.0	1.5	6	11.0	2.0
(h)	17.5	32	100	8	13.0	1.5	8	11.5	2.0	7	11.5	2.0
(i)	20.0	32	100	10	13.5	2.0	9	12.0	2.0	8	12.0	2.0
(j)	22.5	32	100	11	14.0	2.0	9	12.0	2.0	8	12.0	2.0
(k)	25.0	32	100	12	14.5	2.0	10	12.0	2.0	8	12.0	2.0

Notes:

(1) H_e is the maximum effective slope height, ϕ_r the nail diameter, ϕ_h the hole diameter S_h the horizontal spacing of nails, and N & L the number of rows and length of the soil nails respectively.

(2) For H_e between any of the two consecutive values, the soil nail layout corresponding to the higher H_e value should be adopted.

(3) Soil nails should be evenly spaced over the slope face.

(4) N is the number of soil nails per vertical column required at the critical section, i.e. the section with the maximum effective height, H_e. At other parts of the slope, soil nails should be provided at vertical and horizontal spacings similar to that at the critical section. Alternatively, different soil nail layouts according to the maximum H_e of that part of the slope may be adopted.

(5) 'A', 'B' and 'C' refer to a large factor of safety increase ($0.3 < \Delta FOS \leq 0.5$), a medium factor of safety increase ($0.1 < \Delta FOS \leq 0.3$) and a small factor of safety increase ($0 < \Delta FOS \leq 0.1$) respectively.

(6) If in the process of drilling rock is encountered such that part of the soil nails will be installed in rock (e.g. installation through a PW50/90 zone or better, see Geoguide 3), the designer may exercise professional judgement to reduce the nail length L. In the absence of site-specific ground investigation, sound engineering judgement is required to ensure that the nails are not prematurely terminated in corestone boulders.

(7) The designer should check the land status to see whether the nails encroach into adjoining land and if so whether this is acceptable to the land owner.

Record Sheet for Prescriptive Measures Application

Slope Reference No.: 12SW-A/C175	**Location:** Tseung Kwan O Landfill Stage II/III

Geometry/Consequence:	**Qualifying criteria:**
Slope Gradient: 65° Slope Height: 6 m Upslope Gradient: 45° Group of Facilities Affected: ~~1 / 2 / 3~~ / 4 ~~/ 5~~ Consequence to life Category: ~~1 / 2~~ / 3 Record of Engineer Inspection: ~~YES~~ / NO If Yes, Inspection Date: - Geology Map No: 12	1) Pre-GCO Slope? ☑ YES ☐ NO 2) Within Consequence and Geometry Limits? ☑ YES ☐ NO 3) Within Area of selected formations of Granite or Volcanics? ☑ YES ☐ NO 4) Adverse Geological conditions present? ☐ YES ☑ NO 5) Adverse Groundwater Conditions? ☐ YES ☑ NO

Record of Landslides

Date:	Scar Height (m)	Failure Volume (m^3)	GEO Incident No.
1) None			
2)			
3)			

Type Of Improvement Works

☐ Preventive Maintenance ☐ Urgent Repair to the current Landslide ☑ Upgrading works (~~LPM~~)

Design Objective	Prescriptive Measure Recommended			Figure No.
☐ Improve surface protection ☐ Improve local stability	☐	1.1.1	Cover slope face with shotcrete.	A1
	☐	1.1.2	Locally trim and remove loose materials	-
		1.1.3	Fill local areas with no-fines concrete:	
	☐		(a) at upper part of slope	A2
	☐		(b) at lower part of slope	A2
	☐	1.1.4	Cover upslope area with shotcrete	A3
☐ Improve surface drainage	☐	1.2.1	Provide surface drainage channels	-
	☐	1.2.2	Provide slope crest channel with upstand	A3
☐ Improve subsurface drainage ☐ Provide contingency subsurface drainage measures		2.1	Provide drainage behind impermeable surface cover:	
	☐		(a) with no fines concrete toe	A4
	☐		(b) with relief drains	A5
		2.2	Cover slope face with no-fines concrete:	
	☐		(a) at upper part of slope	A6
	☐		(b) at lower part of slope or on berm	A7
		2.3	Provide raking drains:	
	☐		(a) at upper part of slope	A8
	☐		(b) at lower part of slope	A9
	☐		(c) at specific seepage or potential seepage areas	-
	☐	2.4	Provide cut-off drain above slope crest	A10
	☐	2.5	Provide toe drain	A10
	☐	2.6	Provide counterfort drains at upper part of slope	A11
☑ Provide support to improve overall slope stability.	☑	3.1	Provide soil nails with a FOS increase in range: ~~A / B /~~ C	A12
☐ Others (please specify)	☐		Other measures (please specify)	

Attachments:

☐ Site Location Plan ☐ Photographs ☐ Records of Engineer Inspection

☐ Plan, sketches/drawings showing locations/layout/key dimensions of the proposed prescriptive measures

Designed: W. Y. Law **Post: AE**	**Signature:** **Date:**	**Checked: Tony Chen** **Post: SE**	**Signature:** **Date:**

Agreement No. FD 01-052
Geotechnical Review and Site Investigation Works
For Tseung Kwan O Landfill Stage II/III
Afteruse Development

Feature 12SW-A/C175

From SLOPE/W Analysis

Consequence-to-life Category	3
Required FoS	1.1
Calculated FoS	1.051
Range of FoS Increase for Prescriptive Application of Soil Nailing	C

Refer to Section I-I

maximum height of the feature, H =	6	m
Upslope gradient β =	45	°
Surcharge q =	5	kPa

Maximum effective height

$$H_e = H \times (1 + 0.35\tan\beta) + q/20$$
$$= 8.35 \text{ m}$$

From Table A2 of GEO Report No. 56 (Issue 2),

Soil Nail Layout is as follows:

Type	(e)	
Number of rows of soil nails, N	4	
Nail diameter, ϕ_r(mm)	25	mm
Hole diameter, ϕ_h (mm)	100	mm
Horizontal spacing, S_h (m)	1.5	m
Length of soil nails, L (m)	8.5	m

Computed by:

Date

Checked by:

Date

Table A2 - Standard Soil Nail Layout

Standard Soil Nail Layout	H_e (m)	ϕ_r (mm)	ϕ_h (mm)	A			B			C		
				N	L(m)	S_h(m)	N	L(m)	S_h(m)	N	L(m)	S_h(m)
(a)	3.0	25	100	2	3.5	1.5	2	3.5	1.5	2	3.5	1.5
(b)	4.0	25	100	2	4.5	1.5	2	4.5	1.5	2	4.5	1.5
(c)	5.0	25	100	3	6.0	1.5	3	6.0	1.5	3	6.0	2.0
(d)	7.5	25	100	4	9.0	1.5	3	8.5	1.5	3	7.5	1.5
(e)	10.0	25	100	6	10.0	1.5	4	9.5	1.5	4	8.5	1.5
(f)	12.5	32	100	6	11.0	1.5	5	10.0	1.5	5	10.0	2.0
(g)	15.0	32	100	7	12.0	1.5	6	11.0	1.5	6	11.0	2.0
(h)	17.5	32	100	8	13.0	1.5	8	11.5	2.0	7	11.5	2.0
(i)	20.0	32	100	10	13.5	2.0	9	12.0	2.0	8	12.0	2.0
(j)	22.5	32	100	11	14.0	2.0	9	12.0	2.0	8	12.0	2.0
(k)	25.0	32	100	12	14.5	2.0	10	12.0	2.0	8	12.0	2.0

Notes:

(1) H_e is the maximum effective slope height, ϕ_r the nail diameter, ϕ_h the hole diameter S_h the horizontal spacing of nails, and N & L the number of rows and length of the soil nails respectively.

(2) For H_e between any of the two consecutive values, the soil nail layout corresponding to the higher H_e value should be adopted.

(3) Soil nails should be evenly spaced over the slope face.

(4) N is the number of soil nails per vertical column required at the critical section, i.e. the section with the maximum effective height, H_e. At other parts of the slope, soil nails should be provided at vertical and horizontal spacings similar to that at the critical section. Alternatively, different soil nail layouts according to the maximum H_e of that part of the slope may be adopted.

(5) 'A', 'B' and 'C' refer to a large factor of safety increase ($0.3 < \Delta FOS \leq 0.5$), a medium factor of safety increase ($0.1 < \Delta FOS \leq 0.3$) and a small factor of safety increase ($0 < \Delta FOS \leq 0.1$) respectively.

(6) If in the process of drilling rock is encountered such that part of the soil nails will be installed in rock (e.g. installation through a PW50/90 zone or better, see Geoguide 3), the designer may exercise professional judgement to reduce the nail length L. In the absence of site-specific ground investigation, sound engineering judgement is required to ensure that the nails are not prematurely terminated in corestone boulders.

(7) The designer should check the land status to see whether the nails encroach into adjoining land and if so whether this is acceptable to the land owner.

Record Sheet for Prescriptive Measures Application

Slope Reference No.: 12SW-A/C176	**Location:** Tseung Kwan O Landfill Stage II/III
Geometry/Consequence:	**Qualifying criteria:**
Slope Gradient: 65° Slope Height: 7.42 m Upslope Gradient: 36.9° Group of Facilities Affected: ~~1 / 2 / 3~~ / 4 / ~~5~~ Consequence to life Category: ~~1 / 2~~ / 3 Record of Engineer Inspection: ~~YES~~ / NO If Yes, Inspection Date: - Geology Map No: 12	1) Pre-GCO Slope? ☑ YES ☐ NO 2) Within Consequence and Geometry Limits? ☑ YES ☐ NO 3) Within Area of selected formations of Granite or Volcanics? ☑ YES ☐ NO 4) Adverse Geological conditions present? ☐ YES ☑ NO 5) Adverse Groundwater Conditions? ☐ YES ☑ NO

Record of Landslides

Date:	Scar Height (m)	Failure Volume (m^3)	GEO Incident No.
1) None			
2)			
3)			

Type Of Improvement Works

☐ Preventive Maintenance ☐ Urgent Repair to the current Landslide ☑ Upgrading works (~~LPM~~)

Design Objective	Prescriptive Measure Recommended	Figure No.
☐ Improve surface protection ☐ Improve local stability	☐ 1.1.1 Cover slope face with shotcrete. ☐ 1.1.2 Locally trim and remove loose materials 1.1.3 Fill local areas with no-fines concrete: ☐ (a) at upper part of slope ☐ (b) at lower part of slope ☐ 1.1.4 Cover upslope area with shotcrete	A1 - A2 A2 A3
☐ Improve surface drainage	☐ 1.2.1 Provide surface drainage channels ☐ 1.2.2 Provide slope crest channel with upstand	- A3
☐ Improve subsurface drainage ☐ Provide contingency subsurface drainage measures	2.1 Provide drainage behind impermeable surface cover: ☐ (a) with no fines concrete toe ☐ (b) with relief drains 2.2 Cover slope face with no-fines concrete: ☐ (a) at upper part of slope ☐ (b) at lower part of slope or on berm 2.3 Provide raking drains: ☐ (a) at upper part of slope ☐ (b) at lower part of slope ☐ (c) at specific seepage or potential seepage areas ☐ 2.4 Provide cut-off drain above slope crest ☐ 2.5 Provide toe drain ☐ 2.6 Provide counterfort drains at upper part of slope	 A4 A5 A6 A7 A8 A9 - A10 A10 A11
☑ Provide support to improve overall slope stability.	☑ 3.1 Provide soil nails with a FOS increase in range: ~~A~~ / B / ~~C~~	A12
☐ Others (please specify)	☐ Other measures (please specify)	

Attachments:

☐ Site Location Plan ☐ Photographs ☐ Records of Engineer Inspection

☐ Plan, sketches/drawings showing locations/layout/key dimensions of the proposed prescriptive measures

Designed: W. Y. Law	**Signature:**	**Checked: Tony Chen**	**Signature:**
Post: AE	**Date:**	**Post: SE**	**Date:**

Feature 12SW-A/C176

From SLOPE/W Analysis

Consequence-to-life Category	3
Required FoS	1.1
Calculated FoS	0.977
Range of FoS Increase for Prescriptive Application of Soil Nailing	B

Refer to Section SS9

maximum height of the feature, H = 7.42 m

Upslope gradient β = 36.9 °

Surcharge q = 5 kPa

Maximum effective height

$$H_e = H \times (1 + 0.35\tan\beta) + q/20$$
$$= 9.62 \text{ m}$$

From Table A2 of GEO Report No. 56 (Issue 2),

Soil Nail Layout is as follows:

Type	(e)	
Number of rows of soil nails, N	4	
Nail diameter, ϕ_r(mm)	25	mm
Hole diameter, ϕ_h (mm)	100	mm
Horizontal spacing, S_h (m)	1.5	m
Length of soil nails, L (m)	9.5	m

Computed by:

Date

Checked by:

Date

Table A2 - Standard Soil Nail Layout

Standard Soil Nail Layout	H_e (m)	ϕ_r (mm)	ϕ_h (mm)	A			B			C		
				N	L(m)	S_h(m)	N	L(m)	S_h(m)	N	L(m)	S_h(m)
(a)	3.0	25	100	2	3.5	1.5	2	3.5	1.5	2	3.5	1.5
(b)	4.0	25	100	2	4.5	1.5	2	4.5	1.5	2	4.5	1.5
(c)	5.0	25	100	3	6.0	1.5	3	6.0	1.5	3	6.0	2.0
(d)	7.5	25	100	4	9.0	1.5	3	8.5	1.5	3	7.5	1.5
(e)	10.0	25	100	6	10.0	1.5	4	9.5	1.5	4	8.5	1.5
(f)	12.5	32	100	6	11.0	1.5	5	10.0	1.5	5	10.0	2.0
(g)	15.0	32	100	7	12.0	1.5	6	11.0	1.5	6	11.0	2.0
(h)	17.5	32	100	8	13.0	1.5	8	11.5	2.0	7	11.5	2.0
(i)	20.0	32	100	10	13.5	2.0	9	12.0	2.0	8	12.0	2.0
(j)	22.5	32	100	11	14.0	2.0	9	12.0	2.0	8	12.0	2.0
(k)	25.0	32	100	12	14.5	2.0	10	12.0	2.0	8	12.0	2.0

Notes:

(1) H_e is the maximum effective slope height, ϕ_r the nail diameter, ϕ_h the hole diameter S_h the horizontal spacing of nails, and N & L the number of rows and length of the soil nails respectively.

(2) For H_e between any of the two consecutive values, the soil nail layout corresponding to the higher H_e value should be adopted.

(3) Soil nails should be evenly spaced over the slope face.

(4) N is the number of soil nails per vertical column required at the critical section, i.e. the section with the maximum effective height, H_e. At other parts of the slope, soil nails should be provided at vertical and horizontal spacings similar to that at the critical section. Alternatively, different soil nail layouts according to the maximum H_e of that part of the slope may be adopted.

(5) 'A', 'B' and 'C' refer to a large factor of safety increase ($0.3 < \Delta FOS \leq 0.5$), a medium factor of safety increase ($0.1 < \Delta FOS \leq 0.3$) and a small factor of safety increase ($0 < \Delta FOS \leq 0.1$) respectively.

(6) If in the process of drilling rock is encountered such that part of the soil nails will be installed in rock (e.g. installation through a PW50/90 zone or better, see Geoguide 3), the designer may exercise professional judgement to reduce the nail length L. In the absence of site-specific ground investigation, sound engineering judgement is required to ensure that the nails are not prematurely terminated in corestone boulders.

(7) The designer should check the land status to see whether the nails encroach into adjoining land and if so whether this is acceptable to the land owner.

Record Sheet for Prescriptive Measures Application

Slope Reference No.: 12SW-A/C177 (Section SS12)	**Location:** Tseung Kwan O Landfill Stage II/III
Geometry/Consequence:	**Qualifying criteria:**
Slope Gradient: 66° Slope Height: 8.24 m Upslope Gradient: 30° Group of Facilities Affected: ~~1 / 2 / 3~~ / 4 / ~~5~~ Consequence to life Category: ~~1 / 2~~ / 3 Record of Engineer Inspection: ~~YES~~ / NO If Yes, Inspection Date: - Geology Map No: 12	1) Pre-GCO Slope? ☑ YES ☐ NO 2) Within Consequence and Geometry Limits? ☑ YES ☐ NO 3) Within Area of selected formations of Granite or Volcanics? ☑ YES ☐ NO 4) Adverse Geological conditions present? ☐ YES ☑ NO 5) Adverse Groundwater Conditions? ☐ YES ☑ NO

Record of Landslides

Date:	Scar Height (m)	Failure Volume (m^3)	GEO Incident No.
1) None			
2)			
3)			

Type Of Improvement Works

☐ Preventive Maintenance ☐ Urgent Repair to the current Landslide ☑ Upgrading works (~~LPM~~)

Design Objective	Prescriptive Measure Recommended	Figure No.
☐ Improve surface protection ☐ Improve local stability	☐ 1.1.1 Cover slope face with shotcrete.	A1
	☐ 1.1.2 Locally trim and remove loose materials	-
	1.1.3 Fill local areas with no-fines concrete:	
	☐ (a) at upper part of slope	A2
	☐ (b) at lower part of slope	A2
	☐ 1.1.4 Cover upslope area with shotcrete	A3
☐ Improve surface drainage	☐ 1.2.1 Provide surface drainage channels	-
	☐ 1.2.2 Provide slope crest channel with upstand	A3
☐ Improve subsurface drainage ☐ Provide contingency subsurface drainage measures	2.1 Provide drainage behind impermeable surface cover:	
	☐ (a) with no fines concrete toe	A4
	☐ (b) with relief drains	A5
	2.2 Cover slope face with no-fines concrete:	
	☐ (a) at upper part of slope	A6
	☐ (b) at lower part of slope or on berm	A7
	2.3 Provide raking drains:	
	☐ (a) at upper part of slope	A8
	☐ (b) at lower part of slope	A9
	☐ (c) at specific seepage or potential seepage areas	-
	☐ 2.4 Provide cut-off drain above slope crest	A10
	☐ 2.5 Provide toe drain	A10
	☐ 2.6 Provide counterfort drains at upper part of slope	A11
☑ Provide support to improve overall slope stability.	☑ 3.1 Provide soil nails with a FOS increase in range: ~~A / B~~ / C	A12
☐ Others (please specify)	☐ Other measures (please specify)	

Attachments:

☐ Site Location Plan ☐ Photographs ☐ Records of Engineer Inspection

☐ Plan, sketches/drawings showing locations/layout/key dimensions of the proposed prescriptive measures

Designed: W. Y. Law **Post: AE**	**Signature:** **Date:**	**Checked: Tony Chen** **Post: SE**	**Signature:** **Date:**

Feature 12SW-A/C177 (Section SS12)

From SLOPE/W Analysis

Consequence-to-life Category	3
Required FoS	1.1
Calculated FoS	1.032
Range of FoS Increase for Prescriptive Application of Soil Nailing	C

Refer to Section SS12

maximum height of the feature, H = 8.24 m

Upslope gradient β = 30 °

Surcharge q = 5 kPa

Maximum effective height

$$H_e = H \times (1 + 0.35\tan\beta) + q/20$$

$$= 10.15 \text{ m}$$

From Table A2 of GEO Report No. 56 (Issue 2),

Soil Nail Layout is as follows:

Type	(f)	
Number of rows of soil nails, N	5	
Nail diameter, ϕ_r(mm)	32	mm
Hole diameter, ϕ_h (mm)	100	mm
Horizontal spacing, S_h (m)	2	m
Length of soil nails, L (m)	10.0	m

Computed by:

Date

Checked by:

Date

Table A2 - Standard Soil Nail Layout

Standard Soil Nail Layout	H_e (m)	ϕ_r (mm)	ϕ_h (mm)	A			B			C		
				N	L(m)	S_h(m)	N	L(m)	S_h(m)	N	L(m)	S_h(m)
(a)	3.0	25	100	2	3.5	1.5	2	3.5	1.5	2	3.5	1.5
(b)	4.0	25	100	2	4.5	1.5	2	4.5	1.5	2	4.5	1.5
(c)	5.0	25	100	3	6.0	1.5	3	6.0	1.5	3	6.0	2.0
(d)	7.5	25	100	4	9.0	1.5	3	8.5	1.5	3	7.5	1.5
(e)	10.0	25	100	6	10.0	1.5	4	9.5	1.5	4	8.5	1.5
(f)	12.5	32	100	6	11.0	1.5	5	10.0	1.5	5	10.0	2.0
(g)	15.0	32	100	7	12.0	1.5	6	11.0	1.5	6	11.0	2.0
(h)	17.5	32	100	8	13.0	1.5	8	11.5	2.0	7	11.5	2.0
(i)	20.0	32	100	10	13.5	2.0	9	12.0	2.0	8	12.0	2.0
(j)	22.5	32	100	11	14.0	2.0	9	12.0	2.0	8	12.0	2.0
(k)	25.0	32	100	12	14.5	2.0	10	12.0	2.0	8	12.0	2.0

Notes:

(1) H_e is the maximum effective slope height, ϕ_r the nail diameter, ϕ_h the hole diameter S_h the horizontal spacing of nails, and N & L the number of rows and length of the soil nails respectively.

(2) For H_e between any of the two consecutive values, the soil nail layout corresponding to the higher H_e value should be adopted.

(3) Soil nails should be evenly spaced over the slope face.

(4) N is the number of soil nails per vertical column required at the critical section, i.e. the section with the maximum effective height, H_e. At other parts of the slope, soil nails should be provided at vertical and horizontal spacings similar to that at the critical section. Alternatively, different soil nail layouts according to the maximum H_e of that part of the slope may be adopted.

(5) 'A', 'B' and 'C' refer to a large factor of safety increase ($0.3 < \Delta FOS \leq 0.5$), a medium factor of safety increase ($0.1 < \Delta FOS \leq 0.3$) and a small factor of safety increase ($0 < \Delta FOS \leq 0.1$) respectively.

(6) If in the process of drilling rock is encountered such that part of the soil nails will be installed in rock (e.g. installation through a PW50/90 zone or better, see Geoguide 3), the designer may exercise professional judgement to reduce the nail length L. In the absence of site-specific ground investigation, sound engineering judgement is required to ensure that the nails are not prematurely terminated in corestone boulders.

(7) The designer should check the land status to see whether the nails encroach into adjoining land and if so whether this is acceptable to the land owner.

Record Sheet for Prescriptive Measures Application

Slope Reference No.: 12SW-A/C182 (Section SS16)	**Location:** Tseung Kwan O Landfill Stage II/III

Geometry/Consequence:

Slope Gradient: 71°
Slope Height: 6.67 m
Upslope Gradient: 30°
Group of Facilities Affected: 1 / ~~2 / 3 / 4 / 5~~
Consequence to life Category: 1 / ~~2 / 3~~
Record of Engineer Inspection: ~~YES~~ / NO
If Yes, Inspection Date: -
Geology Map No: 12

Qualifying criteria:

1) Pre-GCO Slope? ☑ YES ☐ NO
2) Within Consequence and Geometry Limits? ☑ YES ☐ NO
3) Within Area of selected formations of Granite or Volcanics? ☑ YES ☐ NO
4) Adverse Geological conditions present? ☐ YES ☑ NO
5) Adverse Groundwater Conditions? ☐ YES ☑ NO

Record of Landslides

Date:	Scar Height (m)	Failure Volume (m^3)	GEO Incident No.
1) None			
2)			
3)			

Type Of Improvement Works

☐ Preventive Maintenance ☐ Urgent Repair to the current Landslide ☑ Upgrading works (~~LPM~~)

Design Objective	Prescriptive Measure Recommended	Figure No.
☐ Improve surface protection	☐ 1.1.1 Cover slope face with shotcrete.	A1
	☐ 1.1.2 Locally trim and remove loose materials	-
☐ Improve local stability	1.1.3 Fill local areas with no-fines concrete:	
	☐ (a) at upper part of slope	A2
	☐ (b) at lower part of slope	A2
	☐ 1.1.4 Cover upslope area with shotcrete	A3
☐ Improve surface drainage	☐ 1.2.1 Provide surface drainage channels	-
	☐ 1.2.2 Provide slope crest channel with upstand	A3
☑ Improve subsurface drainage	2.1 Provide drainage behind impermeable surface cover:	
☐ Provide contingency subsurface drainage measures	☐ (a) with no fines concrete toe	A4
	☐ (b) with relief drains	A5
	2.2 Cover slope face with no-fines concrete:	
	☐ (a) at upper part of slope	A6
	☐ (b) at lower part of slope or on berm	A7
	2.3 Provide raking drains:	
	☐ (a) at upper part of slope	A8
	☐ (b) at lower part of slope	A9
	☑ (c) at specific seepage or potential seepage areas	-
	☐ 2.4 Provide cut-off drain above slope crest	A10
	☐ 2.5 Provide toe drain	A10
	☐ 2.6 Provide counterfort drains at upper part of slope	A11
☑ Provide support to improve overall slope stability.	☑ 3.1 Provide soil nails with a FOS increase in range:-A / ~~B / C~~	A12
☐ Others (please specify)	☐ Other measures (please specify)	

Attachments:

☐ Site Location Plan ☐ Photographs ☐ Records of Engineer Inspection
☐ Plan, sketches/drawings showing locations/layout/key dimensions of the proposed prescriptive measures

Designed: W. Y. Law **Post: AE**	**Signature:** **Date:**	**Checked: Tony Chen** **Post: SE**	**Signature:** **Date:**

Feature 12SW-A/C182 (Section SS16)

From SLOPE/W Analysis

Consequence-to-life Category	1
Required FoS	1.2
Calculated FoS	0.863
Range of FoS Increase for Prescriptive Application of Soil Nailing	A

Refer to Section SS16

maximum height of the feature, H = 6.67 m

Upslope gradient β = 30 °

Surcharge q = 5 kPa

Maximum effective height

$$H_e = H \times (1 + 0.35\tan\beta) + q/20$$
$$= 8.27 \text{ m}$$

From Table A2 of GEO Report No. 56 (Issue 2),

Soil Nail Layout is as follows:

Type	(e)	
Number of rows of soil nails, N	6	
Nail diameter, ϕ_r(mm)	25	mm
Hole diameter, ϕ_h (mm)	100	mm
Horizontal spacing, S_h (m)	1.5	m
Length of soil nails, L (m)	10.0	m

Computed by:

Date

Checked by:

Date

Table A2 - Standard Soil Nail Layout

Standard Soil Nail Layout	H_e (m)	ϕ_r (mm)	ϕ_h (mm)	A			B			C		
				N	L(m)	S_h(m)	N	L(m)	S_h(m)	N	L(m)	S_h(m)
(a)	3.0	25	100	2	3.5	1.5	2	3.5	1.5	2	3.5	1.5
(b)	4.0	25	100	2	4.5	1.5	2	4.5	1.5	2	4.5	1.5
(c)	5.0	25	100	3	6.0	1.5	3	6.0	1.5	3	6.0	2.0
(d)	7.5	25	100	4	9.0	1.5	3	8.5	1.5	3	7.5	1.5
(e)	10.0	25	100	6	10.0	1.5	4	9.5	1.5	4	8.5	1.5
(f)	12.5	32	100	6	11.0	1.5	5	10.0	1.5	5	10.0	2.0
(g)	15.0	32	100	7	12.0	1.5	6	11.0	1.5	6	11.0	2.0
(h)	17.5	32	100	8	13.0	1.5	8	11.5	2.0	7	11.5	2.0
(i)	20.0	32	100	10	13.5	2.0	9	12.0	2.0	8	12.0	2.0
(j)	22.5	32	100	11	14.0	2.0	9	12.0	2.0	8	12.0	2.0
(k)	25.0	32	100	12	14.5	2.0	10	12.0	2.0	8	12.0	2.0

Notes:

(1) H_e is the maximum effective slope height, ϕ_r the nail diameter, ϕ_h the hole diameter S_h the horizontal spacing of nails, and N & L the number of rows and length of the soil nails respectively.

(2) For H_e between any of the two consecutive values, the soil nail layout corresponding to the higher H_e value should be adopted.

(3) Soil nails should be evenly spaced over the slope face.

(4) N is the number of soil nails per vertical column required at the critical section, i.e. the section with the maximum effective height, H_e. At other parts of the slope, soil nails should be provided at vertical and horizontal spacings similar to that at the critical section. Alternatively, different soil nail layouts according to the maximum H_e of that part of the slope may be adopted.

(5) 'A', 'B' and 'C' refer to a large factor of safety increase ($0.3 < \Delta FOS \leq 0.5$), a medium factor of safety increase ($0.1 < \Delta FOS \leq 0.3$) and a small factor of safety increase ($0 < \Delta FOS \leq 0.1$) respectively.

(6) If in the process of drilling rock is encountered such that part of the soil nails will be installed in rock (e.g. installation through a PW50/90 zone or better, see Geoguide 3), the designer may exercise professional judgement to reduce the nail length L. In the absence of site-specific ground investigation, sound engineering judgement is required to ensure that the nails are not prematurely terminated in corestone boulders.

(7) The designer should check the land status to see whether the nails encroach into adjoining land and if so whether this is acceptable to the land owner.

Record Sheet for Prescriptive Measures Application

Slope Reference No.: 12SW-A/C183	**Location:** Tseung Kwan O Landfill Stage II/III

Geometry/Consequence:

Slope Gradient: 46°
Slope Height: 3.68 m
Upslope Gradient: 33.7°
Group of Facilities Affected: 1 / ~~2 / 3 / 4 / 5~~
Consequence to life Category: 1 / ~~2 / 3~~
Record of Engineer Inspection: ~~YES~~ / NO
If Yes, Inspection Date: -
Geology Map No: 12

Qualifying criteria:

1) Pre-GCO Slope? ☑ YES ☐ NO
2) Within Consequence and Geometry Limits? ☑ YES ☐ NO
3) Within Area of selected formations of Granite or Volcanics? ☑ YES ☐ NO
4) Adverse Geological conditions present? ☐ YES ☑ NO
5) Adverse Groundwater Conditions? ☐ YES ☑ NO

Record of Landslides

Date:	Scar Height (m)	Failure Volume (m^3)	GEO Incident No.
1) None			
2)			
3)			

Type Of Improvement Works

☐ Preventive Maintenance ☐ Urgent Repair to the current Landslide ☑ Upgrading works (~~LPM~~)

Design Objective	Prescriptive Measure Recommended		Figure No.
☐ Improve surface protection	☐ 1.1.1	Cover slope face with shotcrete.	A1
	☐ 1.1.2	Locally trim and remove loose materials	-
☐ Improve local stability	1.1.3	Fill local areas with no-fines concrete:	
	☐	(a) at upper part of slope	A2
	☐	(b) at lower part of slope	A2
	☐ 1.1.4	Cover upslope area with shotcrete	A3
☐ Improve surface drainage	☐ 1.2.1	Provide surface drainage channels	-
	☐ 1.2.2	Provide slope crest channel with upstand	A3
☑ Improve subsurface drainage	2.1	Provide drainage behind impermeable surface cover:	
☐ Provide contingency subsurface drainage measures	☐	(a) with no fines concrete toe	A4
	☐	(b) with relief drains	A5
	2.2	Cover slope face with no-fines concrete:	
	☐	(a) at upper part of slope	A6
	☐	(b) at lower part of slope or on berm	A7
	2.3	Provide raking drains:	
	☐	(a) at upper part of slope	A8
	☐	(b) at lower part of slope	A9
	☑	(c) at specific seepage or potential seepage areas	-
	☐ 2.4	Provide cut-off drain above slope crest	A10
	☐ 2.5	Provide toe drain	A10
	☐ 2.6	Provide counterfort drains at upper part of slope	A11
☐ Provide support to improve overall slope stability.	☐ 3.1	Provide soil nails with a FOS increase in range:-A / B / C	A12
☐ Others (please specify)	☐	Other measures (please specify)	

Attachments:

☐ Site Location Plan ☐ Photographs ☐ Records of Engineer Inspection
☐ Plan, sketches/drawings showing locations/layout/key dimensions of the proposed prescriptive measures

Designed: W. Y. Law	**Signature:**	**Checked: Tony Chen**	**Signature:**
Post: AE	**Date:**	**Post: SE**	**Date:**

Record Sheet for Prescriptive Measures Application

Slope Reference No.: 12SW-A/C188	**Location:** Tseung Kwan O Landfill Stage II/III
Geometry/Consequence:	**Qualifying criteria:**
Slope Gradient: 44° Slope Height: 5.39 m Upslope Gradient: 26.6° Group of Facilities Affected: ~~1 / 2 / 3~~ / 4 /~~5~~ Consequence to life Category: ~~1 / 2~~ / 3 Record of Engineer Inspection: ~~YES~~ / NO If Yes, Inspection Date: - Geology Map No: 12	1) Pre-GCO Slope? ☑ YES ☐ NO 2) Within Consequence and Geometry Limits? ☑ YES ☐ NO 3) Within Area of selected formations of Granite or Volcanics? ☑ YES ☐ NO 4) Adverse Geological conditions present? ☐ YES ☑ NO 5) Adverse Groundwater Conditions? ☐ YES ☑ NO

Record of Landslides

Date:	Scar Height (m)	Failure Volume (m^3)	GEO Incident No.
1) None			
2)			
3)			

Type Of Improvement Works

☐ Preventive Maintenance ☐ Urgent Repair to the current Landslide ☑ Upgrading works (~~LPM~~)

Design Objective	Prescriptive Measure Recommended	Figure No.
☐ Improve surface protection ☐ Improve local stability	☐ 1.1.1 Cover slope face with shotcrete. ☐ 1.1.2 Locally trim and remove loose materials 1.1.3 Fill local areas with no-fines concrete: ☐ (a) at upper part of slope ☐ (b) at lower part of slope ☐ 1.1.4 Cover upslope area with shotcrete	A1 - A2 A2 A3
☐ Improve surface drainage	☐ 1.2.1 Provide surface drainage channels ☐ 1.2.2 Provide slope crest channel with upstand	- A3
☑ Improve subsurface drainage ☐ Provide contingency subsurface drainage measures	2.1 Provide drainage behind impermeable surface cover: ☐ (a) with no fines concrete toe ☐ (b) with relief drains 2.2 Cover slope face with no-fines concrete: ☐ (a) at upper part of slope ☐ (b) at lower part of slope or on berm 2.3 Provide raking drains: ☐ (a) at upper part of slope ☐ (b) at lower part of slope ☑ (c) at specific seepage or potential seepage areas ☐ 2.4 Provide cut-off drain above slope crest ☐ 2.5 Provide toe drain ☐ 2.6 Provide counterfort drains at upper part of slope	 A4 A5 A6 A7 A8 A9 - A10 A10 A11
☐ Provide support to improve overall slope stability.	☐ 3.1 Provide soil nails with a FOS increase in range:-A / B / C	A12
☐ Others (please specify)	☐ Other measures (please specify)	

Attachments:

☐ Site Location Plan ☐ Photographs ☐ Records of Engineer Inspection

☐ Plan, sketches/drawings showing locations/layout/key dimensions of the proposed prescriptive measures

Designed: W. Y. Law **Post: AE**	**Signature:** **Date:**	**Checked: Tony Chen** **Post: SE**	**Signature:** **Date:**

APPENDIX E
Rock Mapping Results

DISCONTINUITY SURVEY DATA SHEET

Project: **Agreement No.FD 01-052, Tseung Kwan O Landfill Stage II/III**
Location: **Feature No. 12SW-A/C76 (along Strip S33)**
Date: **10th July 2002**
Geologist: **Smo** Ref. no.: **2311/0201**

No.	Chainage	Type	Dip	Dip Direction	Persistence	Aperture	Nature of Filling	Consistence of infilling	Surface Roughness	Width of Differentially Weathered Zone (mm)	Water	Joint Spacing	Frequency	Remarks
1		2	50	330	4		2		1		1	1	1	open joint
2		2	70	355	2	6	2		2		1	1	2	
3		2	71	275	2	6	2		1		1	1	1	
4		2	85	213	1.5	5-6	2		1		1	1	1	
5		2	84	213	1	5-6	1/2		3		1	1	1	
6		2	88	210										joint from S33
7		2	63	215										joint from S33
8		2	60	215										Strip S3
9		2	75	265										
10		2	72	290										
11		2	70	293										
12		2	80	295										
13		2	70	220										
14		2	50	315										
15		2	75	60										
16		2	45	330										
17		2	40	270										
18		2	40	14										Strip S32
19		2	88	15										
20		2	79	84										
21		2	80	330										
22		2	88	333										
23		2	39	340										
24		2	80	255										
25		2	30	349										
26		2	13	24										
27		2	82	78										
28		2	60	360										
29		2	80	50										
30		2	78	165										Strip S1
31		2	79	200										

Type
0 Fault Zone
1. Fault
2. Joint
3. Cleavage
4. Shear
6. Fissure
7. Tension Crack
8. Foliation
9. Bedding

Dip, Dip Direction
(Expressed in degrees)

Persistence
(Expressed in meters)

Aperture
1. Wide (>200mm)
2. Mod. wide (60-200mm)
3. Mod. narrow (20-60mm)
4. Narrow (6-20mm)
5. Very narrow (2-6mm)
6. Ext. narrow (<2mm)
7. Tight

Nature of infilling
1. Clean
2. Surface staining
3. Non-cohesive
4. Cohesive
5. Cemented
6. Calcite
7. Chlorite, Tale
8. Others-clay
9. Manganese

Consistency of

Soil strength	*Rock strength*
1. Soft	5. Weak
2. Firm	6. Mod. strong
3. Stiff	7. Strong
4. Hard	8. Very strong

Roughness
1. Rough stepped
2. Rough undulating
3. Rough planar
4. Smooth stepped
5. Smooth undulating
6. Smooth planar
7. Slickensided stepped
8. Slickensided undulating
9. Slickensided planar

Water
1. Dry
2. Seepage
3. Slight flow <0.1 l/sec.
4. Mod. flow 0.1 - 1 l/sec.
5. High flow >1 l/sec.

Set Joint Spacing
1. Widely >600mm
2. Medium 200-600mm
3. Closely 60-200mm
4. V.closely 20-60mm
5. E.closely <20mm

Frequency
no. of joints/m

DISCONTINUITY SURVEY DATA SHEET

Project: **Agreement No.FD 01-052, Tseung Kwan O Landfill Stage II/III**
Location: **Feature No. 12SW-A/C174**
Date: **8th July 2002**
Geologist: **Smo** Ref. no.: **2311/0202**

No.	Chainage	Type	Dip	Dip Direction	Persistence	Aperture	Nature of Filling	Consistence of infilling	Surface Roughness	Width of Differentially Weathered Zone (mm)	Water	Joint Spacing	Frequency	Remarks
1		2	84	53	3	5	2		2		1	1-2	2	
2		2	10	1	1	5-6	2		1		1	2-3	3	
3		2	3	328	2	5-6	2		1		1	2-3	3	
4		2	81	50	1-2	5-6	2/9		2		1	1-2	2	
5		2	70	231	2	5	2		1		1	1	2	slightly open joint (3mm)
6		2	88	240	2-3	5	2		1		1	1	2	slightly open joint (5mm)
7		2	86	53	1	6	9		2		1	3	2	
8		2	23	28	1.5	6	2		2		1	1	2	
9		2	75	233	1.5	6	9		2		1	2	2-3	
10		2	74	105	1.5	6	9		1-2		1	1	1	
11		2	90	245	3	6	9		2		1	1	2	
12		2	90	220	2	6	2		2		1	1-2	2-3	
13		2	73	52	2	6	2/9		2		1	1	1	
14		2	80	60	4	6	2/9		1		1	1	2	
15		2	12	31	4	6	2/9		1-2		1	1	1	
16		2	10	357	4	6	2/9		1-2		1	1	1	
17		2	89	10	1.5	6	2/9		2		1	1	2	
18		2	50	316	2	5-6	2/9		1		1	1	1	
19		2	22	337	2	5	2/9		2		1	1-2	2	HD and soil along joint
20		2	82	263	3-4	5-6	2/9		1		1	1	2	
21		2	12	27	3-4	6	2/9		1		1	1	2	
22		2	78	256	5	6	2/9		1		1	1	2	
23		2	80	345	1-2	5-6	2/9		1		1	1	1	
24		2	84	85	>5	6	2/9		1		1	1	1-2	
25		2	85	92	>5	6	2/9		1		1	1	1-2	
26		2	88	45	1-2	6	9		1		1	1	1	
27		2	81	245	>5		2/9		3		1	2	3	open joint 10mm
28		2	87	231	2		2/9		1		1	2	2	open joint 3-5mm
29		2	90	310	1	5-6	2/9		1		1	1	1	
30		2	30	323	1.5	5	2/9		1		1	1	2	
31		2	73	242	4-5	4	2/9		1		1	2	3	open joint 10mm
32		2	88	245	>5	5	9		1		1	2	3	open joint <3mm
33		2	58	149	4	4-5	2		1		1	1	1	
34		2	18	10	3-4	5	2/9		1		1	2	2	
35		2	88	248	3	5	9		2		1	1	2	open joint <3mm
36		2	32	300	2	6	9		2		1	1	1	
37		2	80	310										joints from chunam strip S7
38		2	85	310										
39		2	76	234										
40		2	76	325										
41		2	88	54										
42		2	88	240										
43		2	80	240										
44		2	76	234										

Type
0. Fault Zone
1. Fault
2. Joint
3. Cleavage
4. Shear
6. Fissure
7. Tension Crack
8. Foliation
9. Bedding

Dip, Dip Direction
(Expressed in degrees)

Persistence
(Expressed in meters)

Aperture
1. Wide (>200mm)
2. Mod. wide (60-200mm)
3. Mod. narrow (20-60mm)
4. Narrow (6-20mm)
5. Very narrow (2-6mm)
6. Ext. narrow (<2mm)
7. Tight

Nature of infilling
1. Clean
2. Surface staining
3. Non-cohesive
4. Cohesive
5. Cemented
6. Calcite
7. Chlorite, Talc
8. Others-clay
9. Manganese

Consistency of

Soil strength	*Rock strength*
1. Soft	5. Weak
2. Firm	6. Mod. strong
3. Stiff	7. Strong
4. Hard	8. Very strong

Roughness
1. Rough stepped
2. Rough undulating
3. Rough planar
4. Smooth stepped
5. Smooth undulating
6. Smooth planar
7. Slickensided stepped
8. Slickensided undulating
9. Slickensided planar

Water
1. Dry
2. Seepage
3. Slight flow <0.1 l/sec.
4. Mod. flow 0.1 - 1 l/sec.
5. High flow >1 l/sec.

Set Joint Spacing
1. Widely >600mm
2. Medium 200-600mm
3. Closely 60-200mm
4. V.closely 20-60mm
5. E.closely <20mm

Frequency
no. of joints/m

DISCONTINUITY SURVEY DATA SHEET

Project: **Agreement No.FD 01-052, Tseung Kwan O Landfill Stage II/III**
Location: **Feature No. 12SW-A/C174**
Date: **8th July 2002**
Geologist: **Smo**
Ref. no.: **2311/0202**

No.	Chainage	Type	Dip	Dip Direction	Persistence	Aperture	Nature of Filling	Consistence of infilling	Surface Roughness	Width of Differentially Weathered Zone (mm)	Water	Joint Spacing	Frequency	Remarks
45		2	78	229										
46		2	29	30										
47		2	87	290										
48		2	2	15										
49		2	78	265										
50		2	88	265										
51		2	81	256										
52		2	78	170										
53		2	77	350										
54		2	88	40										
55		2	77	340										
56		2	15	10										
57		2	88	250										
58		2	79	69										
59		2	80	57										
60		2	88	34										
61		2	62	120										
62		2	80	220										
63		2	80	230										
64		2	5	318										
65		2	5	275										
66		2	83	55										

Type
0. Fault Zone
1. Fault
2. Joint
3. Cleavage
4. Shear
6. Fissure
7. Tension Crack
8. Foliation
9. Bedding

Dip, Dip Direction
(Expressed in degrees)

Persistence
(Expressed in meters)

Aperture
1. Wide (>200mm)
2. Mod. wide (60-200mm)
3. Mod. narrow (20-60mm)
4. Narrow (6-20mm)
5. Very narrow (2-6mm)
6. Ext. narrow (<2mm)
7. Tight

Nature of infilling
1. Clean
2. Surface staining
3. Non-cohesive
4. Cohesive
5. Cemented
6. Calcite
7. Chlorite, Tale
8. Others-clay
9. Manganese

Consistency of
Soil strength
1. Soft
2. Firm
3. Stiff
4. Hard

Rock strength
5. Weak
6. Mod. strong
7. Strong
8. Very strong

Roughness
1. Rough stepped
2. Rough undulating
3. Rough planar
4. Smooth stepped
5. Smooth undulating
6. Smooth planar
7. Slickensided stepped
8. Slickensided undulating
9. Slickensided planar

Water
1. Dry
2. Seepage
3. Slight flow <0.1 l/sec.
4. Mod. flow 0.1 - 1 l/sec.
5. High flow >1 l/sec.

Set Joint Spacing
1. Widely >600mm
2. Medium 200-600mm
3. Closely 60-200mm
4. V.closely 20-60mm
5. E.closely <20mm

Frequency
no. of joints/m

DISCONTINUITY SURVEY DATA SHEET

Project: **Agreement No.FD 01-052, Tseung Kwan O Landfill Stage II/III**
Location: **Feature No. 12SW-A/C174 (along Strip S8)**
Date: **10th July 2002**
Geologist: **Smo** Ref. no.: **2311/0202**

No.	Chainage	Type	Dip	Dip Direction	Persistence	Aperture	Nature of Filling	Consistence of infilling	Surface Roughness	Width of Differentially Weathered Zone (mm)	Water	Joint Spacing	Frequency	Remarks
1		2	80	147	5		2		2		1	1	1	open 20-50mm
2		2	89	148	5		2		2		1	1	1	open 20-50mm
3		2	80	239	1-2	6	2		1		1	2	2	
4		2	87	136	1	5-6	2		1		1	2	2	
5		2	80	86	1	5-6	2		2		1	2	2	
6		2	65	228	1	6	1/2		1		1	1	1	
7		2	90	70	2	5-6	1/2		1		1	2	2	
8		2	15	81										
9		2	14	83										
10		2	15	330										
11		2	72	89										
12		2	56	12										
13		2	56	13										
14		2	85	245										
15		2	88	202										
16		2	62	227										

Type
0. Fault Zone
1. Fault
2. Joint
3. Cleavage
4. Shear
6. Fissure
7. Tension Crack
8. Foliation
9. Bedding

Dip, Dip Direction
(Expressed in degrees)

Persistence
(Expressed in meters)

Aperture
1. Wide (>200mm)
2. Mod. wide (60-200mm)
3. Mod. narrow (20-60mm)
4. Narrow (6-20mm)
5. Very narrow (2-6mm)
6. Ext. narrow (<2mm)
7. Tight

Nature of infilling
1. Clean
2. Surface staining
3. Non-cohesive
4. Cohesive
5. Cemented
6. Calcite
7. Chlorite, Talc
8. Others-clay
9. Manganese

Consistency of
Soil strength
1. Soft
2. Firm
3. Stiff
4. Hard

Rock strength
5. Weak
6. Mod. strong
7. Strong
8. Very strong

Roughness
1. Rough stepped
2. Rough undulating
3. Rough planar
4. Smooth stepped
5. Smooth undulating
6. Smooth planar
7. Slickensided stepped
8. Slickensided undulating
9. Slickensided planar

Water
1. Dry
2. Seepage
3. Slight flow <0.1 l/sec.
4. Mod. flow 0.1 - 1 l/sec.
5. High flow >1 l/sec.

Set Joint Spacing
1. Widely >600mm
2. Medium 200-600mm
3. Closely 60-200mm
4. V.closely 20-60mm
5. E.closely <20mm

Frequency
no. of joints/m

DISCONTINUITY SURVEY DATA SHEET

Project: **Agreement No.FD 01-052, Tseung Kwan O Landfill Stage II/III**
Location: **Feature No. 12SW-A/C180 (Strip C13) & C177 (along Strips S11& S12)**
Date: **10th July 2002**
Geologist: **Smo**
Ref. no.: **2311/0201**

No.	Chainage	Type	Dip	Dip Direction	Persistence	Aperture	Nature of Filling	Consistence of infilling	Surface Roughness	Width of Differentially Weathered Zone (mm)	Water	Joint Spacing	Frequency	Remarks
Feature No. 12SW-A/C180														
1		2	59	290										Strip S13
2		2	80	296										
3		2	88	255										
4		2	73	296										
Feature No. 12SW-A/C177														
1		2	69	294										Strip S12
2		2	85	281										
3		2	81	102										
4		2	80	104										
5		2	85	195										
6		2	78	87										
7		2	78	88										
8		2	80	87										
9		2	81	2										
10		2	82	233										
11		2	84	89										
12		2	86	248										
13		2	80	88										
14		2	86	253										
15		2	87	255										
16		2	80	99										
17		2	78	103										
18		2	85	20										Strip S11
19		2	87	40										
20		2	52	275										
21		2	60	290										
22		2	70	20										
23		2	75	244										
24		2	77	30										
25		2	83	290										
26		2	70	0										

Type
0. Fault Zone
1. Fault
2. Joint
3. Cleavage
4. Shear
6. Fissure
7. Tension Crack
8. Foliation
9. Bedding

Dip, Dip Direction
(Expressed in degrees)

Persistence
(Expressed in meters)

Aperture
1. Wide (>200mm)
2. Mod. wide (60-200mm)
3. Mod. narrow (20-60mm)
4. Narrow (6-20mm)
5. Very narrow (2-6mm)
6. Ext. narrow (<2mm)
7. Tight

Nature of infilling
1. Clean
2. Surface staining
3. Non-cohesive
4. Cohesive
5. Cemented
6. Calcite
7. Chlorite, Tale
8. Others-clay
9. Manganese

Consistency of
Soil strength
1. Soft
2. Firm
3. Stiff
4. Hard

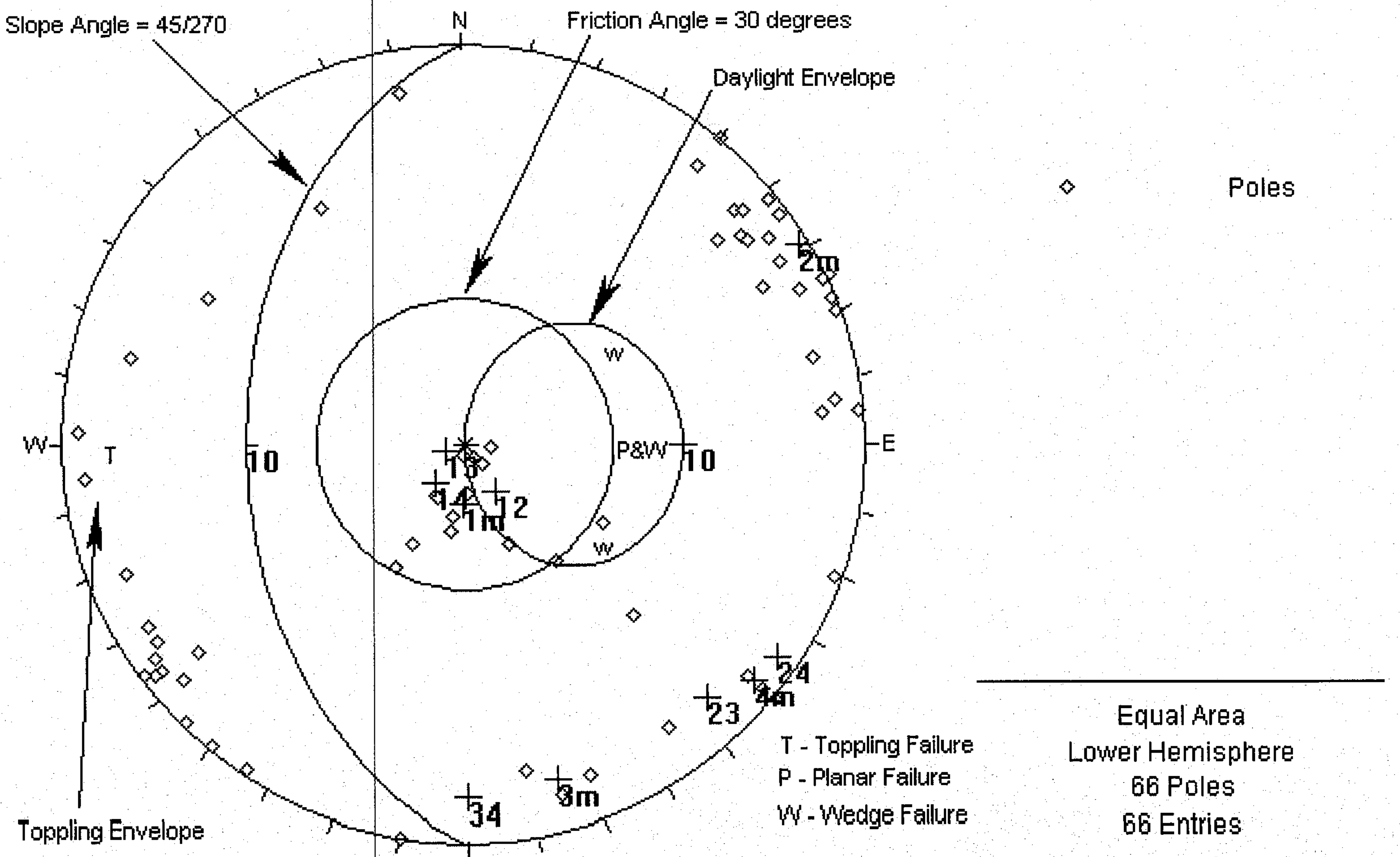
Rock strength
5. Weak
6. Mod. strong
7. Strong
8. Very strong

Roughness
1. Rough stepped
2. Rough undulating
3. Rough planar
4. Smooth stepped
5. Smooth undulating
6. Smooth planar
7. Slickensided stepped
8. Slickensided undulating
9. Slickensided planar

Water
1. Dry
2. Seepage
3. Slight flow <0.1 l/sec.
4. Mod. flow 0.1 - 1 l/sec.
5. High flow >1 l/sec.

Set Joint Spacing
1. Widely >600mm
2. Medium 200-600mm
3. Closely 60-200mm
4. V.closely 20-60mm
5. E.closely <20mm

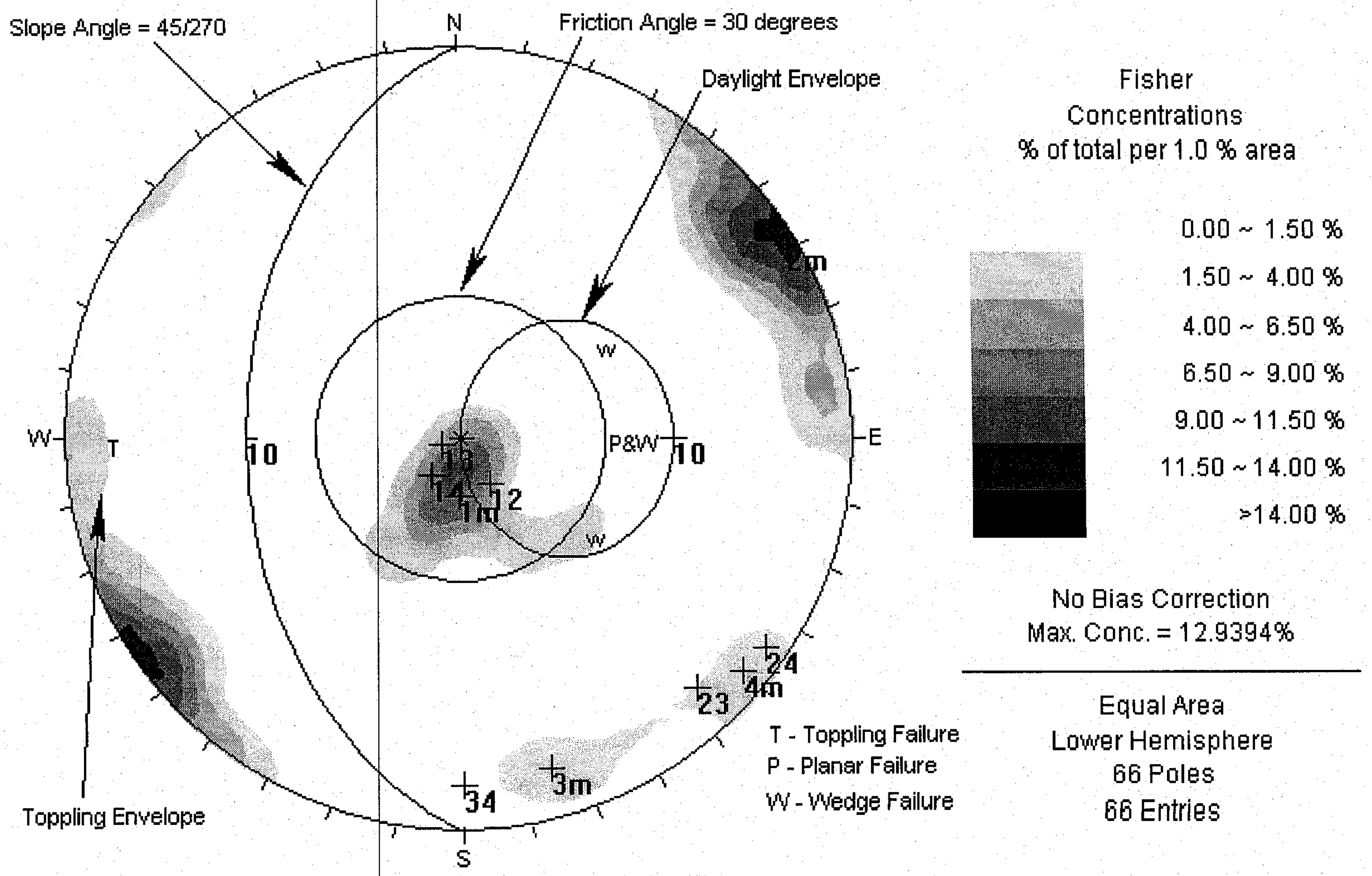
Frequency
no. of joints/m



Slope Angle = 45/270
N
Friction Angle = 30 degrees
Daylight Envelope
Poles
W
T
10
w
P&W
10
E
15
14
12
1m
w
2m
24
4m
23
3m
34
S
Toppling Envelope
T - Toppling Failure
P - Planar Failure
W - Wedge Failure
Equal Area
Lower Hemisphere
66 Poles
66 Entries

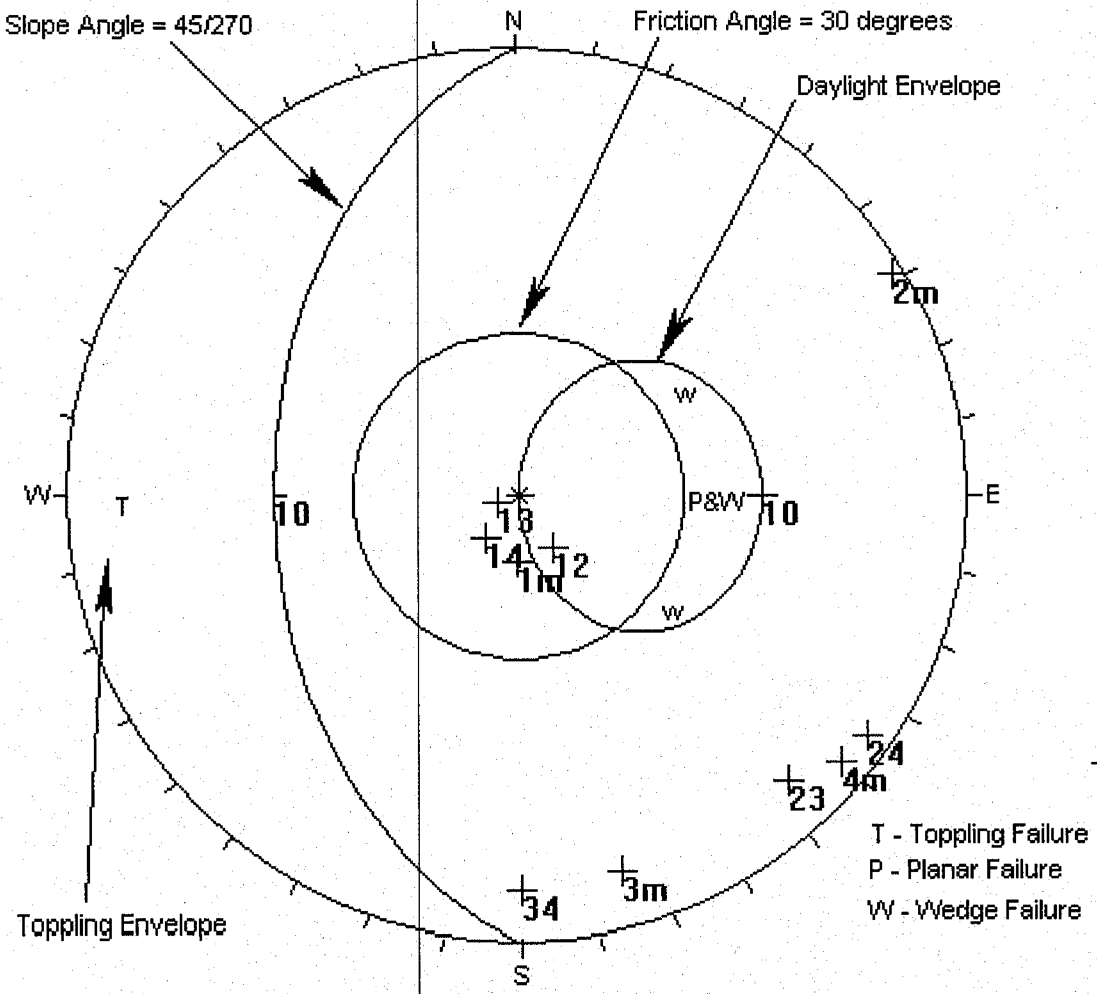
FEATURE NO. 12SW-A/C174 - Rock Mapping and Strip S7

Subject	Feature No. 12SW-A/C174 POLE PLOT	Prepared Smo	Checked JH	Binnie
Project	Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 1



FEATURE NO. 12SW-A/C174 - Rock Mapping and Strip S7

Subject Feature No. 12SW-A/C174 CONTOUR PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 2


Slope Angle = 45/270
N
Friction Angle = 30 degrees
Daylight Envelope
2m
w
W
T
10
P&W
10
E
13
14
12
1m
w
24
4m
23
T - Toppling Failure
P - Planar Failure
W - Wedge Failure
3m
34
Toppling Envelope
S

FEATURE NO. 12SW-A/C174 - Rock Mapping and Strip S7

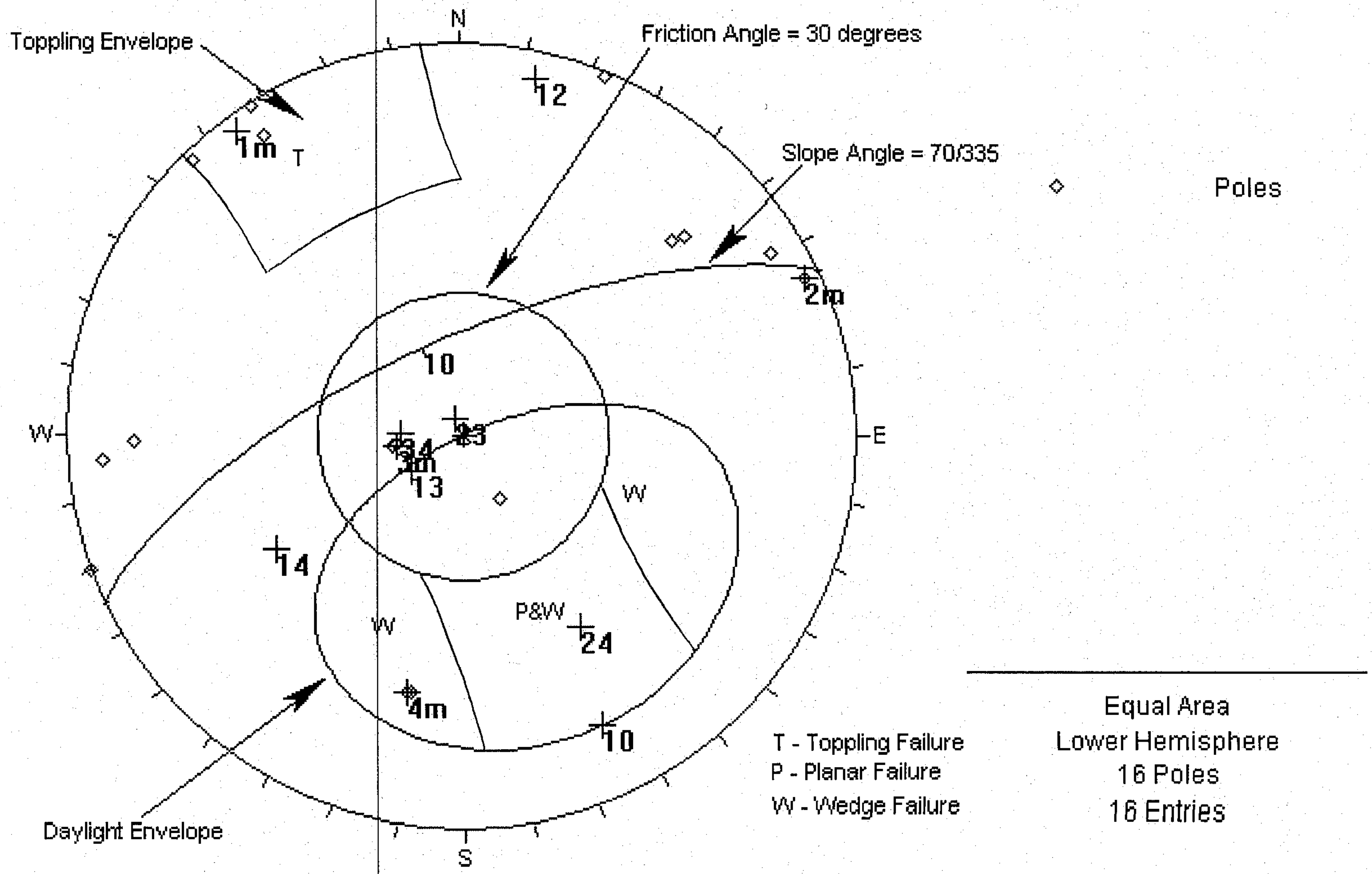
Orientations

ID		Dip / Direction
12		011 / 328
13		004 / 74
14		010 / 38
23		076 / 317
24		083 / 305
34		077 / 360
10		045 / 270
1	m	012 / 2
1	w	012 / 2
2	m	087 / 239
2	w	087 / 239

More... (See text)

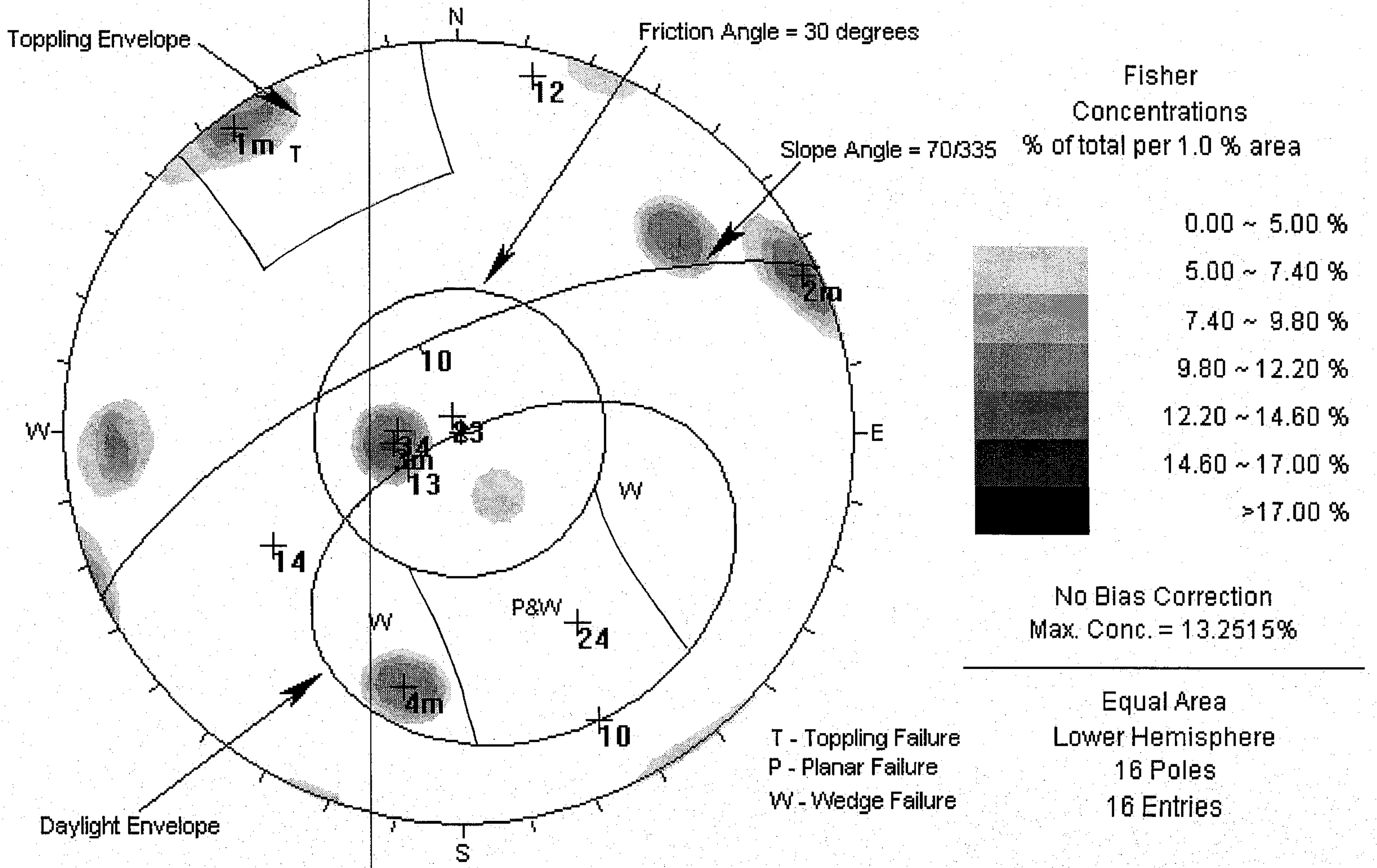
Equal Area
Lower Hemisphere
66 Poles
66 Entries

Subject Feature No. 12SW-A/C174 MAJOR PLANES PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 3


Toppling Envelope
N
Friction Angle = 30 degrees
12
1m
T
Slope Angle = 70/335
◇ Poles
2m
10
W
E
34
23
3m
13
W
14
P&W
24
W
4m
10
Daylight Envelope
S
T - Toppling Failure
P - Planar Failure
W - Wedge Failure
Equal Area
Lower Hemisphere
16 Poles
16 Entries

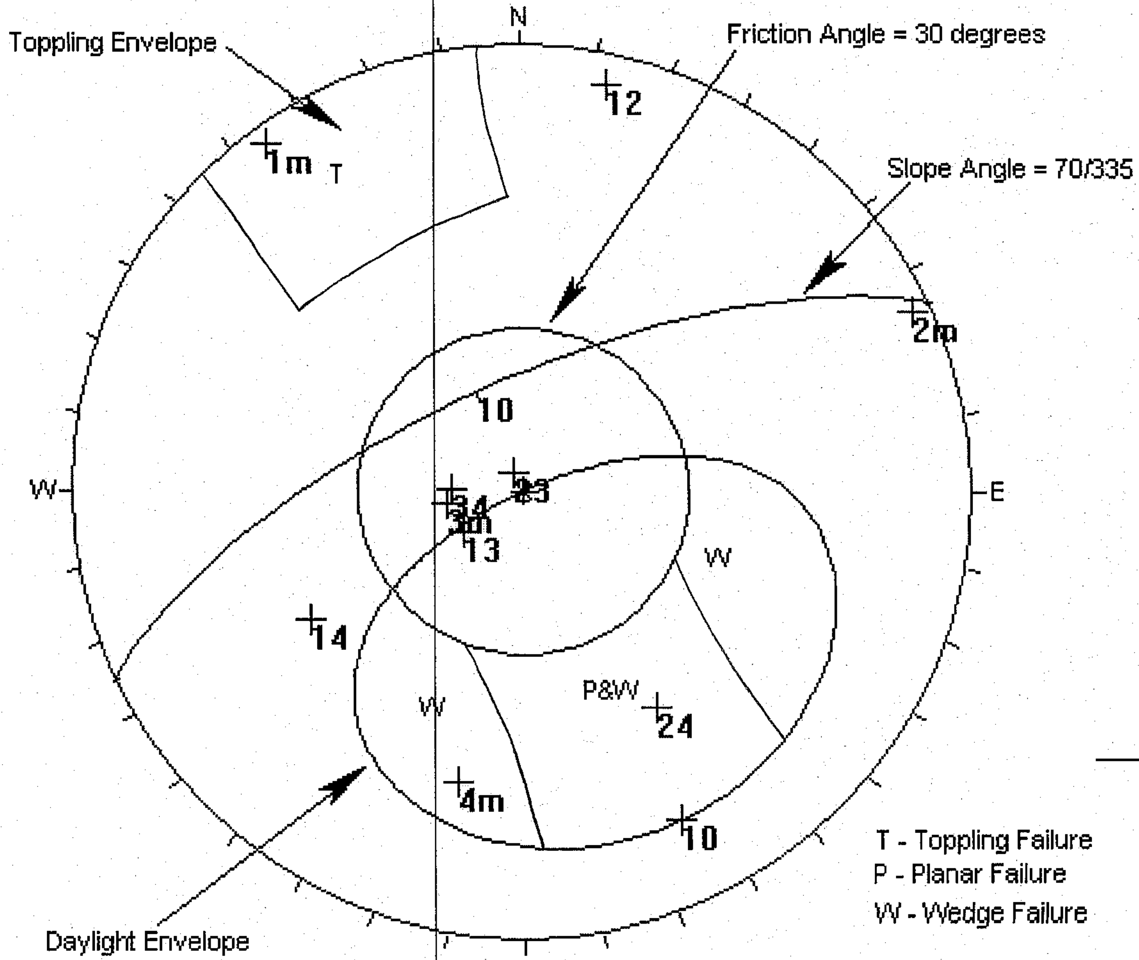
FEATURE NO. 12SW-A/C174 - Along Strip S8 and Mapping

Subject Feature No. 12SW-A/C174 (Along Strip S8) POLE PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 4



FEATURE NO. 12SW-A/C174 - Along Strip S8 and Mapping

Subject Feature No. 12SW-A/C174 (Along Strip S8) CONTOUR PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 5


N
Toppling Envelope
Friction Angle = 30 degrees
Slope Angle = 70/335
12
1m
T
2m
10
W
34
3m
23
13
E
W
14
P&W
24
W
4m
10
Daylight Envelope
S

FEATURE NO. 12SW-A/C174 - Along Strip S8 and Mapping

Orientations

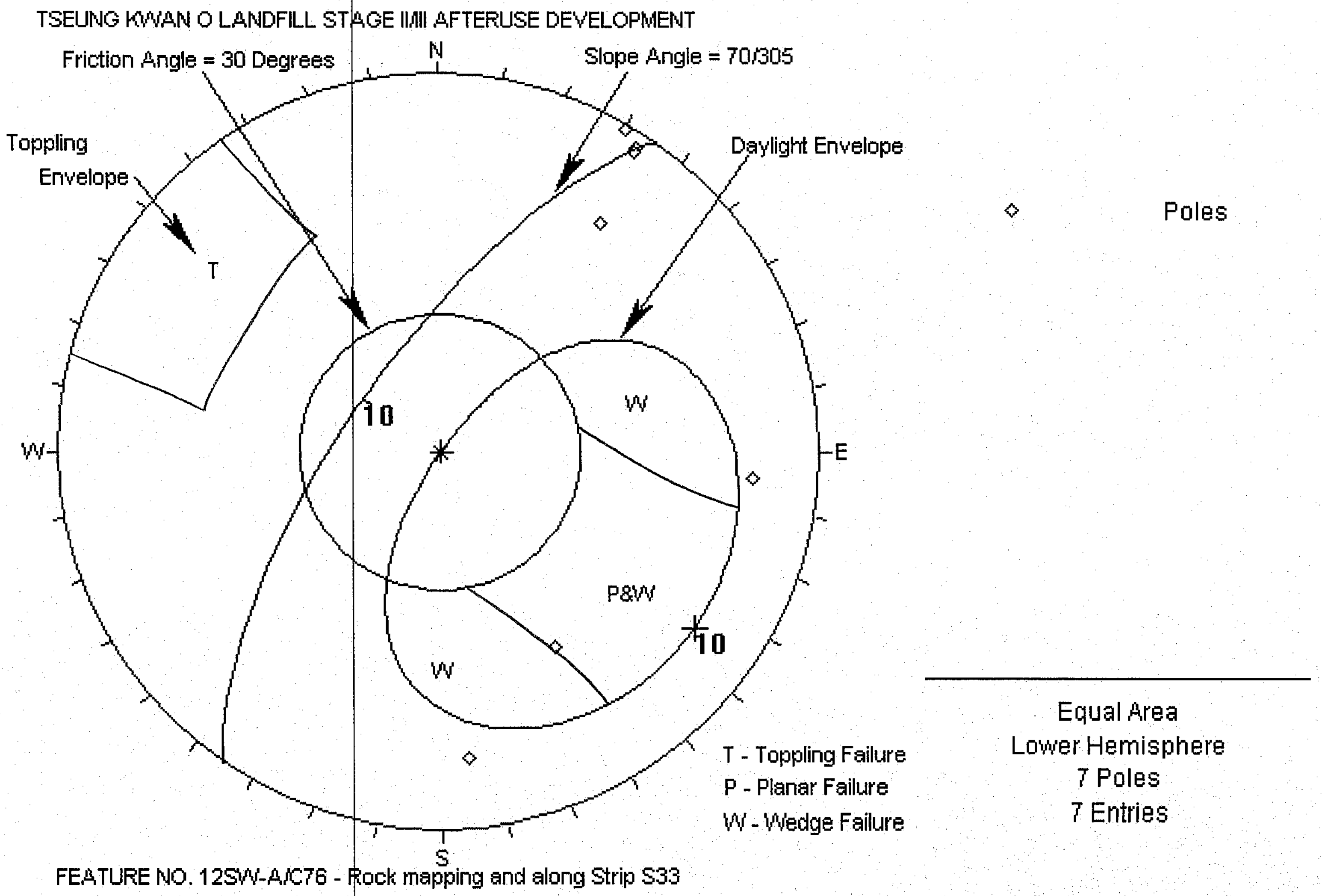
ID		Dip / Direction
12		082 / 192
13		013 / 55
14		046 / 59
23		004 / 155
24		047 / 329
34		013 / 92
10		070 / 335
1	m	085 / 144
1	w	085 / 144
2	m	085 / 245
2	w	085 / 245

More... (See text)

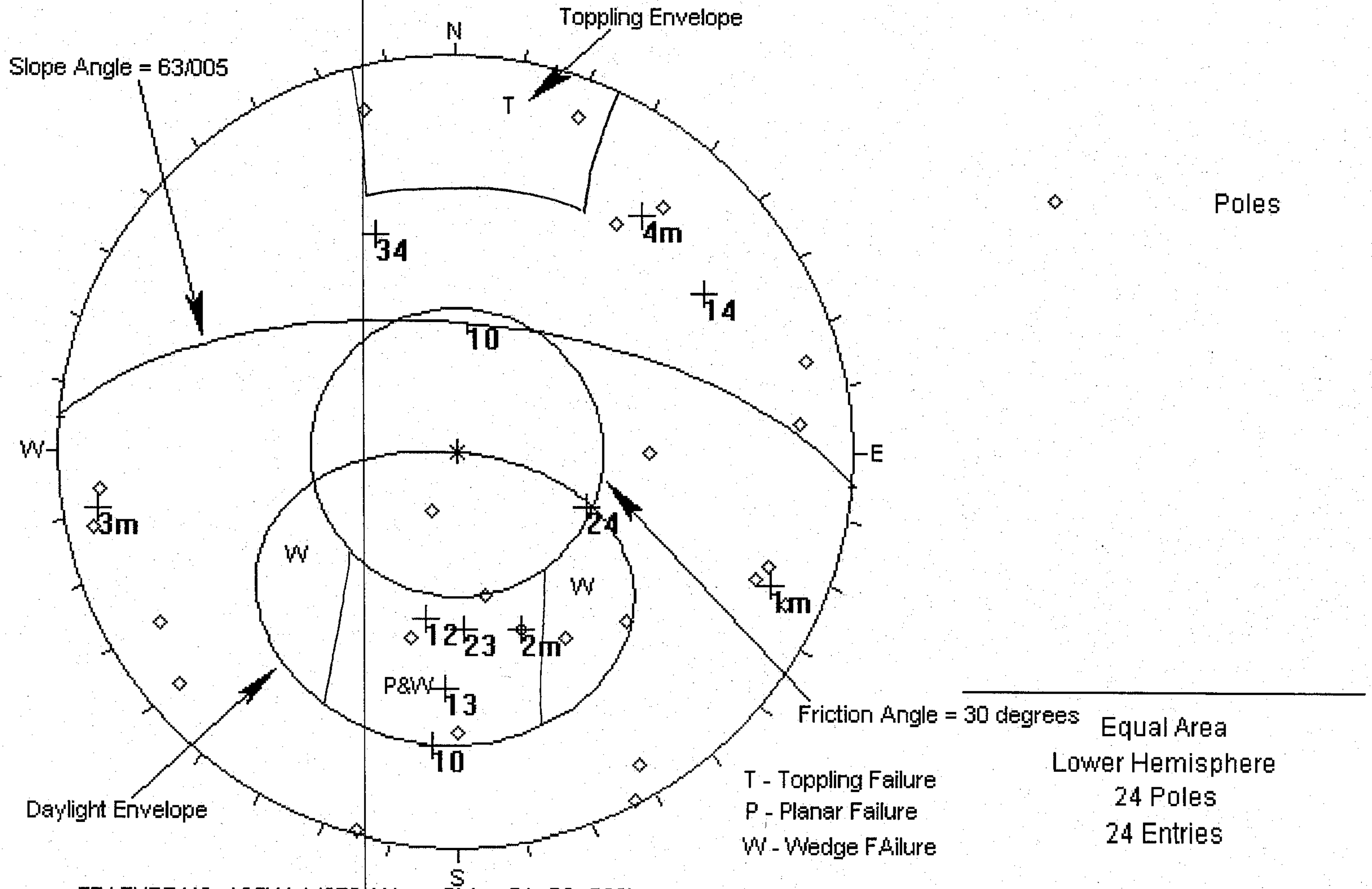
T - Toppling Failure
P - Planar Failure
W - Wedge Failure

Equal Area
Lower Hemisphere
16 Poles
16 Entries

Subject Feature No. 12SW-A/C174 (Along Strip S8) MAJOR PLANES PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 6

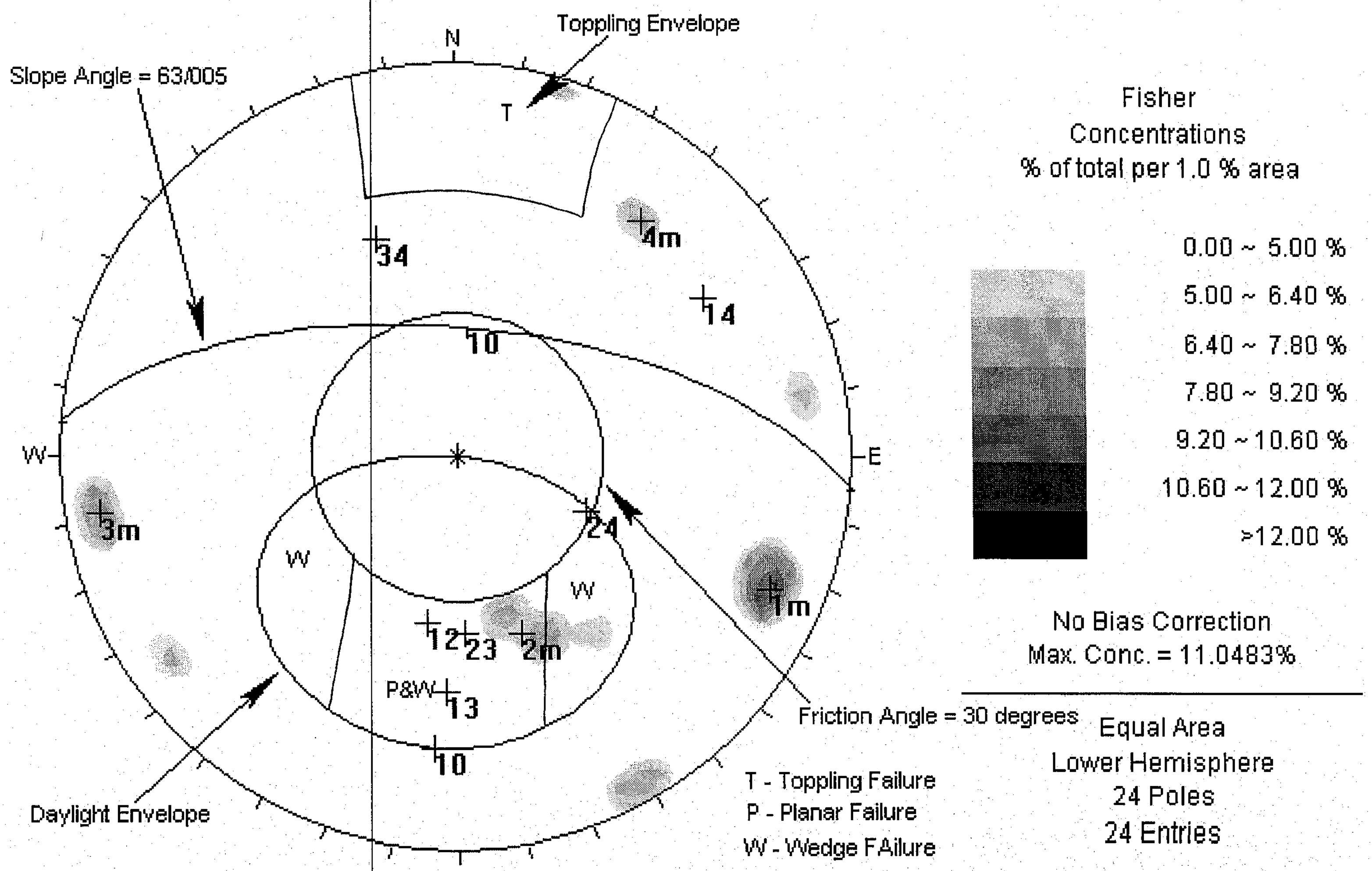

TSEUNG KWAN O LANDFILL STAGE II/III AFTERUSE DEVELOPMENT
Friction Angle = 30 Degrees
N
Slope Angle = 70/305
Toppling
Envelope
Daylight Envelope
Poles
T
10
W
W
E
P&W
10
W
Equal Area
Lower Hemisphere
7 Poles
7 Entries
T - Toppling Failure
P - Planar Failure
W - Wedge Failure
S
FEATURE NO. 12SW-A/C76 - Rock mapping and along Strip S33

Subject Feature No. 12SW-A/C76 (Along Strip S33) POLE PLOT	Prepared Smo	Checked KWK	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Jul-02	Scale N/A	Figure No. 7



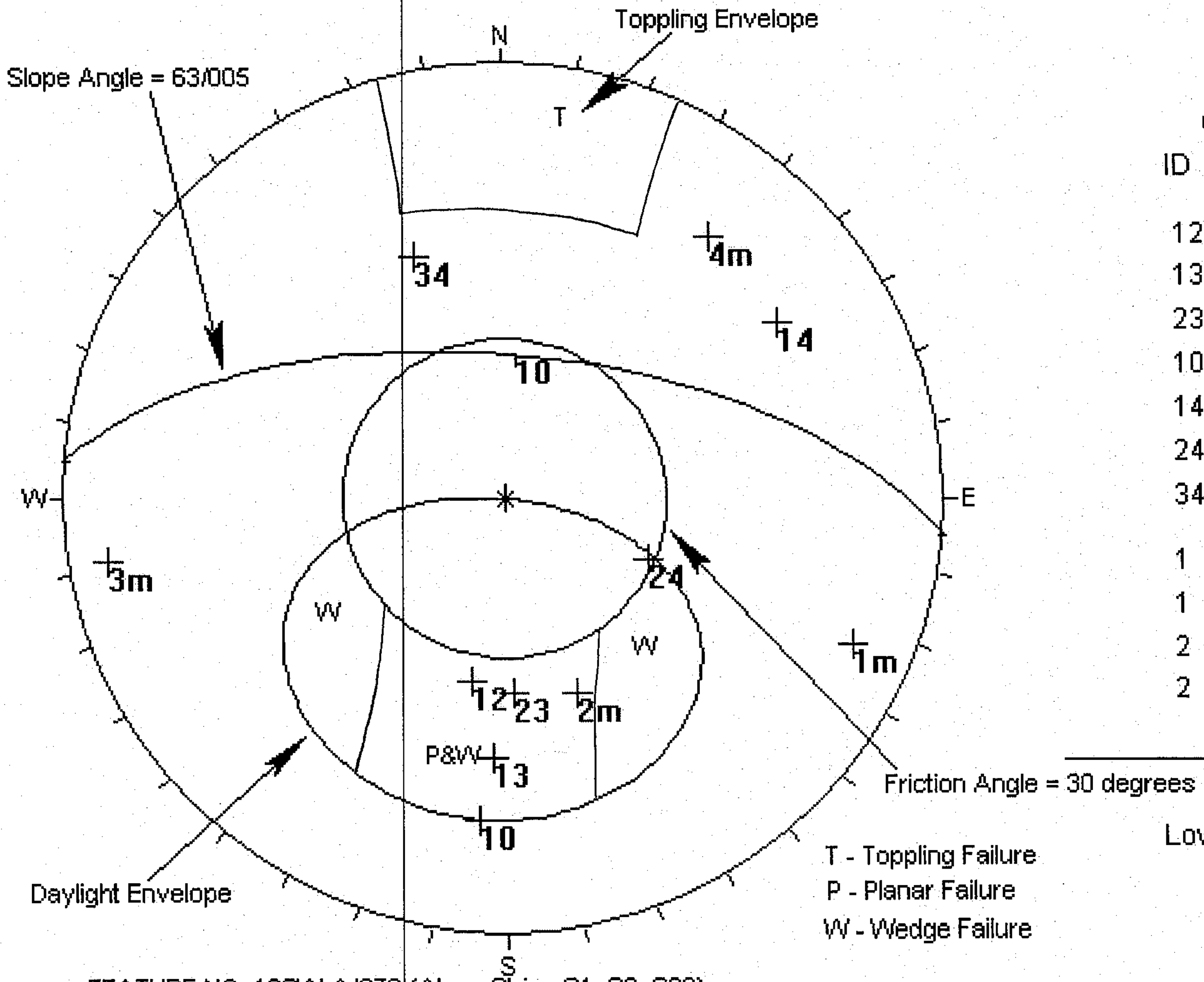
FEATURE NO. 12SW-A/C76 (Along Strips S1, S3, S32)

Subject Feature No. 12SW-A/C76 (Along Strips S1,S3, & S32) POLE PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 8


Toppling Envelope
Slope Angle = 63/005
N
T
34
4m
14
10
W
E
3m
24
W
W
1m
12
23
2m
P&W
13
10
S
Friction Angle = 30 degrees
Daylight Envelope
T - Toppling Failure
P - Planar Failure
W - Wedge FAilure
Fisher
Concentrations
% of total per 1.0 % area
0.00 ~ 5.00 %
5.00 ~ 6.40 %
6.40 ~ 7.80 %
7.80 ~ 9.20 %
9.20 ~ 10.60 %
10.60 ~ 12.00 %
>12.00 %
No Bias Correction
Max. Conc. = 11.0483%
Equal Area
Lower Hemisphere
24 Poles
24 Entries

FEATURE NO. 12SW-A/C76 (Along Strips S1, S3, S32)

Subject	Feature No. 12SW-A/C76 (Along Strips S1,S3, & S32) CONTOUR PLOT	Prepared Smo	Checked JH	Binnie
Project	Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 9


N
Toppling Envelope
Slope Angle = 63/005
T
34
4m
14
10
W
E
3m
24
1m
W
W
12
23
2m
P&W
13
10
Friction Angle = 30 degrees
Daylight Envelope
T - Toppling Failure
P - Planar Failure
W - Wedge Failure
S

FEATURE NO. 12SW-A/C76 (Along Strips S1, S3, S32)

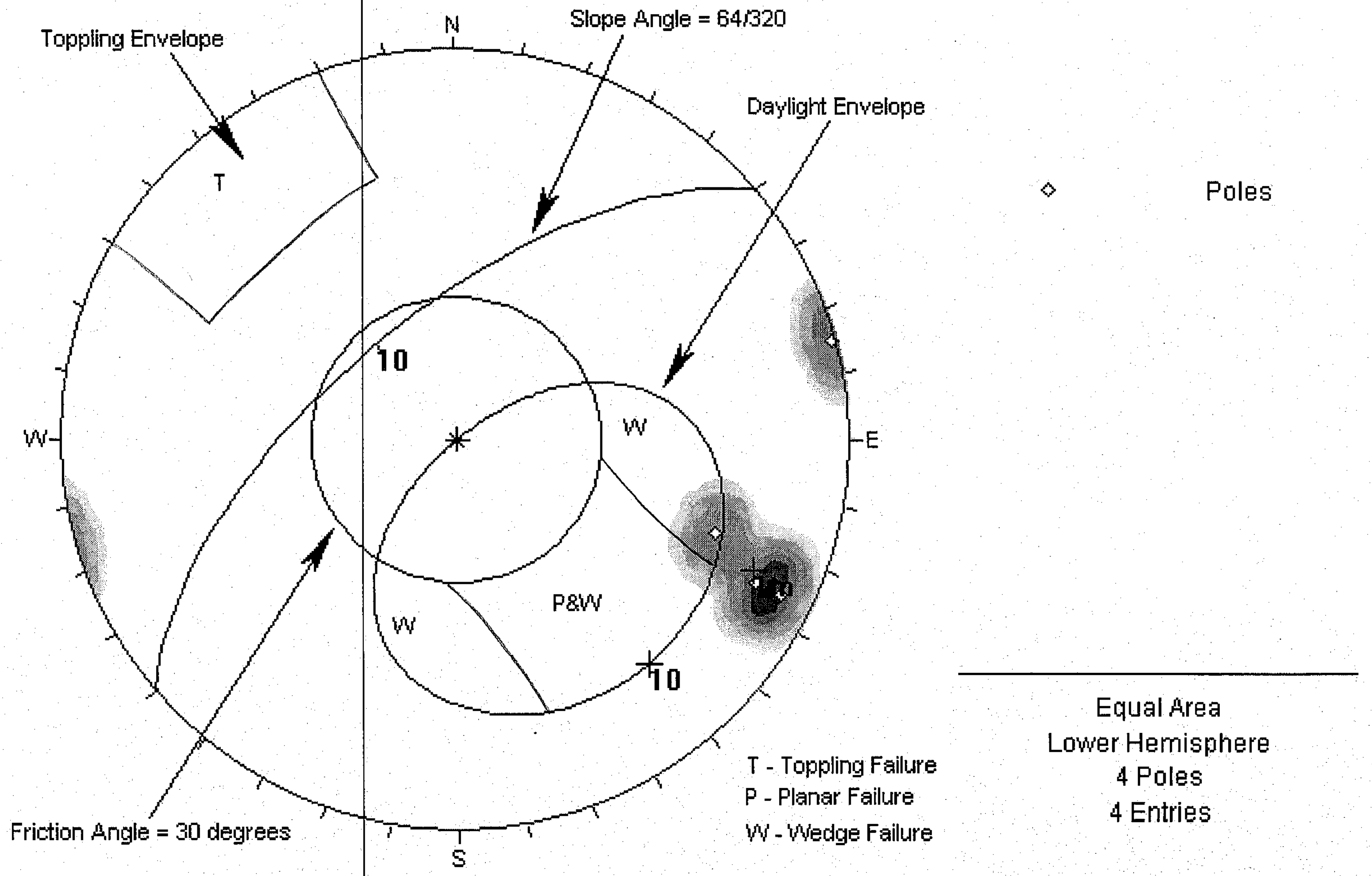
Orientations

ID		Dip / Direction
12		035 / 11
13		050 / 3
23		037 / 358
10		063 / 5
14		063 / 237
24		029 / 293
34		049 / 160
1	m	074 / 293
1	w	074 / 293
2	m	039 / 340
2	w	039 / 340

More... (see text)

Equal Area
Lower Hemisphere
24 Poles
24 Entries

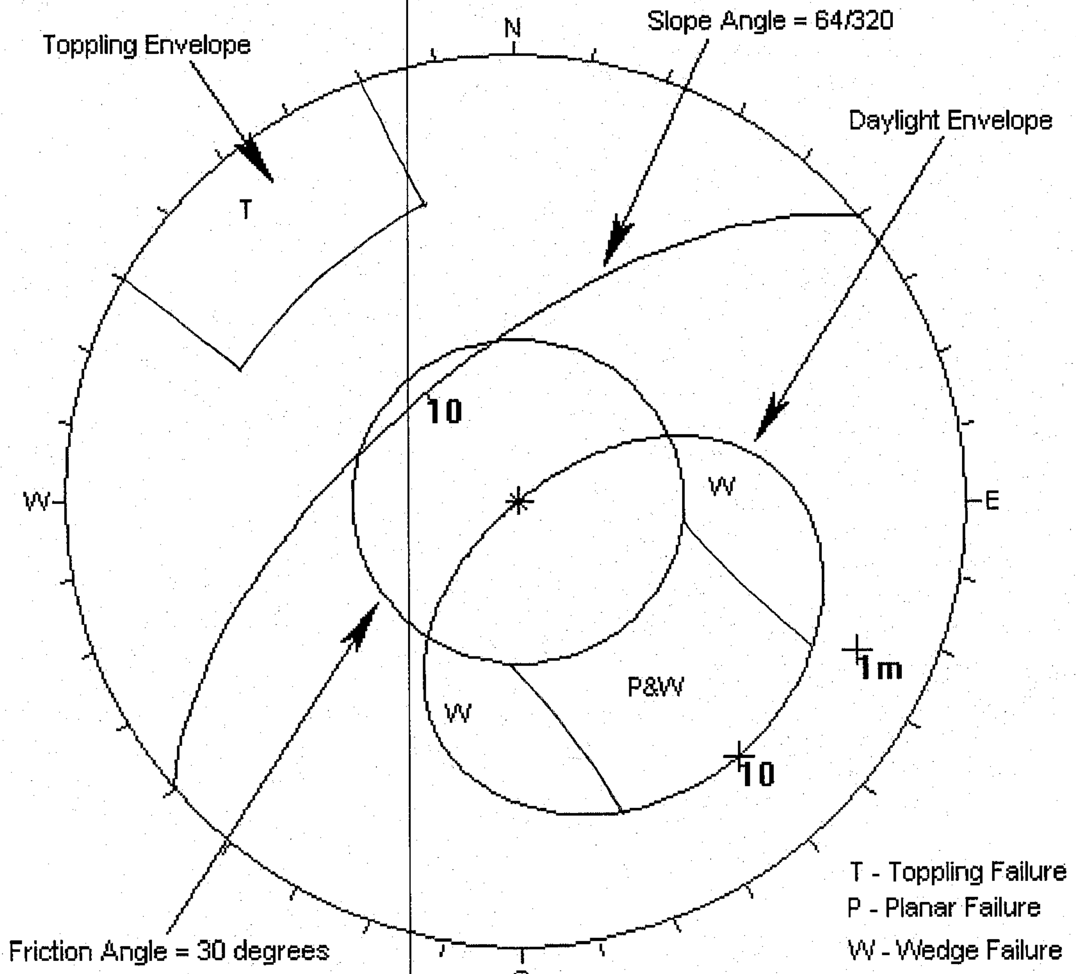
Subject Feature No. 12SW-A/C76 (Along Strips S1,S3, & S32) MAJOR PLANES PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 10



Toppling Envelope
Slope Angle = 64/320
Daylight Envelope
N
T
10
W
E
W
P&W
W
10
S
Friction Angle = 30 degrees
T - Toppling Failure
P - Planar Failure
W - Wedge Failure
◇ Poles
Equal Area
Lower Hemisphere
4 Poles
4 Entries

FEATURE NO. 12SW-A/C180 (Along Strip S13)

Subject Feature No. 12SW-A/C180 (Along Strip S13) POLE & CONTOUR PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 26


Toppling Envelope
N
Slope Angle = 64/320
Daylight Envelope
T
10
W
E
W
P&W
W
1m
10
Friction Angle = 30 degrees
S
T - Toppling Failure
P - Planar Failure
W - Wedge Failure

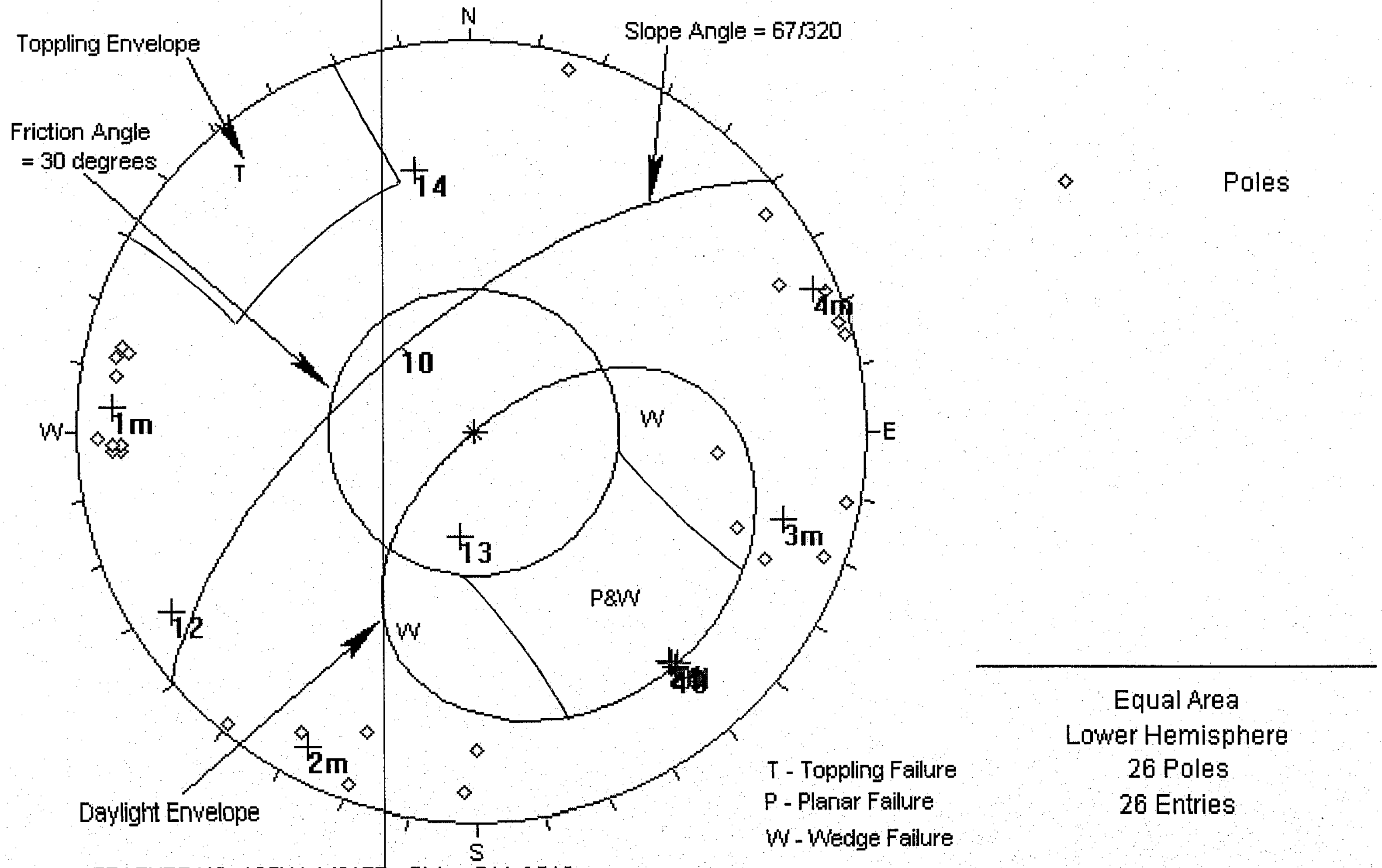
FEATURE NO. 12SW-A/C180 (Along Strip S13)

Orientations

ID		Dip / Direction
10		064 / 320
1	m	071 / 294
1	w	071 / 294

Equal Area
Lower Hemisphere
4 Poles
4 Entries

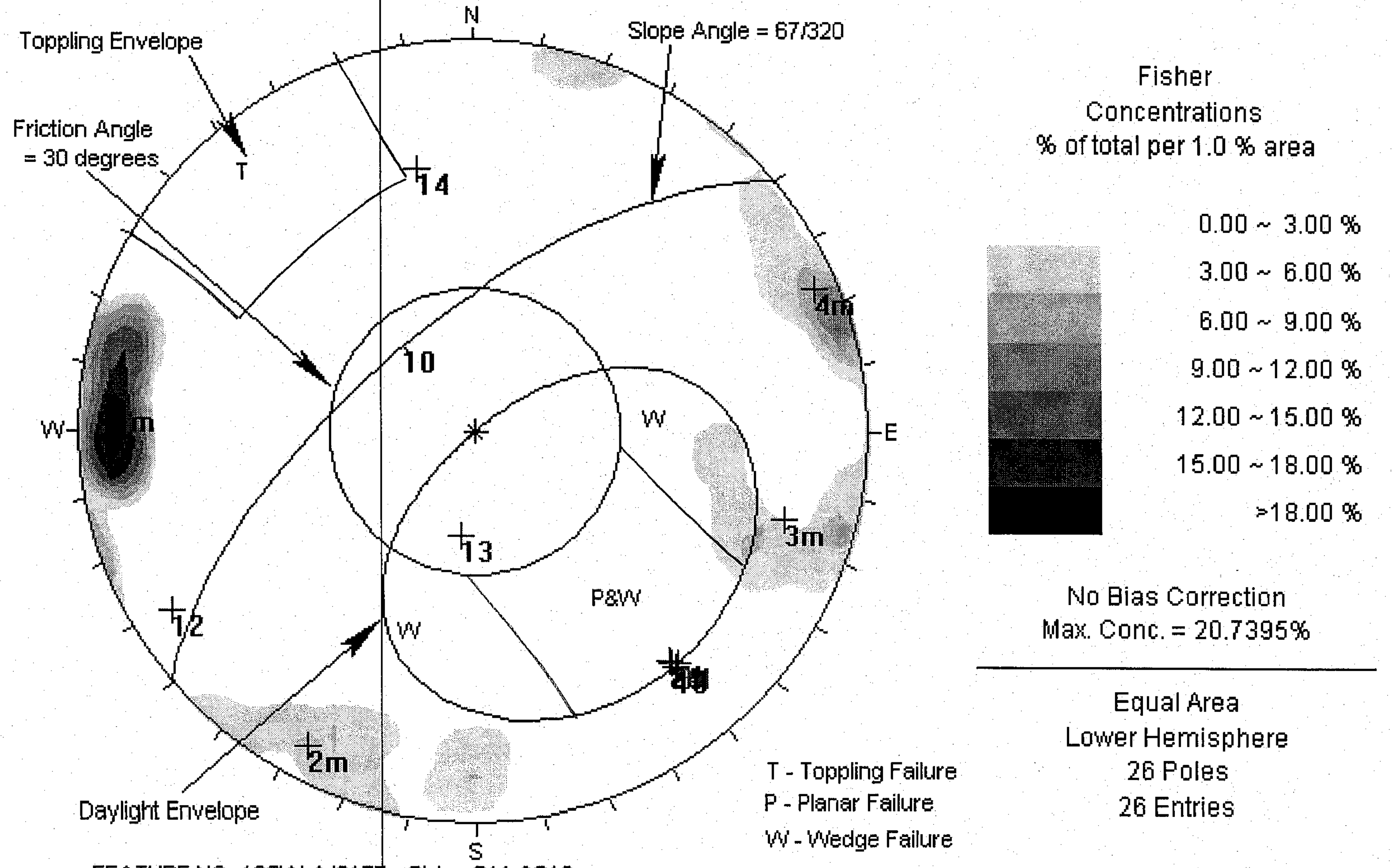
Subject Feature No. 12SW-A/C180 (Along Strip S13) MAJOR PLANES PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 27



Toppling Envelope
Slope Angle = 67/320
Friction Angle
= 30 degrees
N
T
14
4m
10
W
1m
E
W
13
3m
P&W
1/2
4b
W
2m
Daylight Envelope
S
Poles
Equal Area
Lower Hemisphere
26 Poles
26 Entries
T - Toppling Failure
P - Planar Failure
W - Wedge Failure

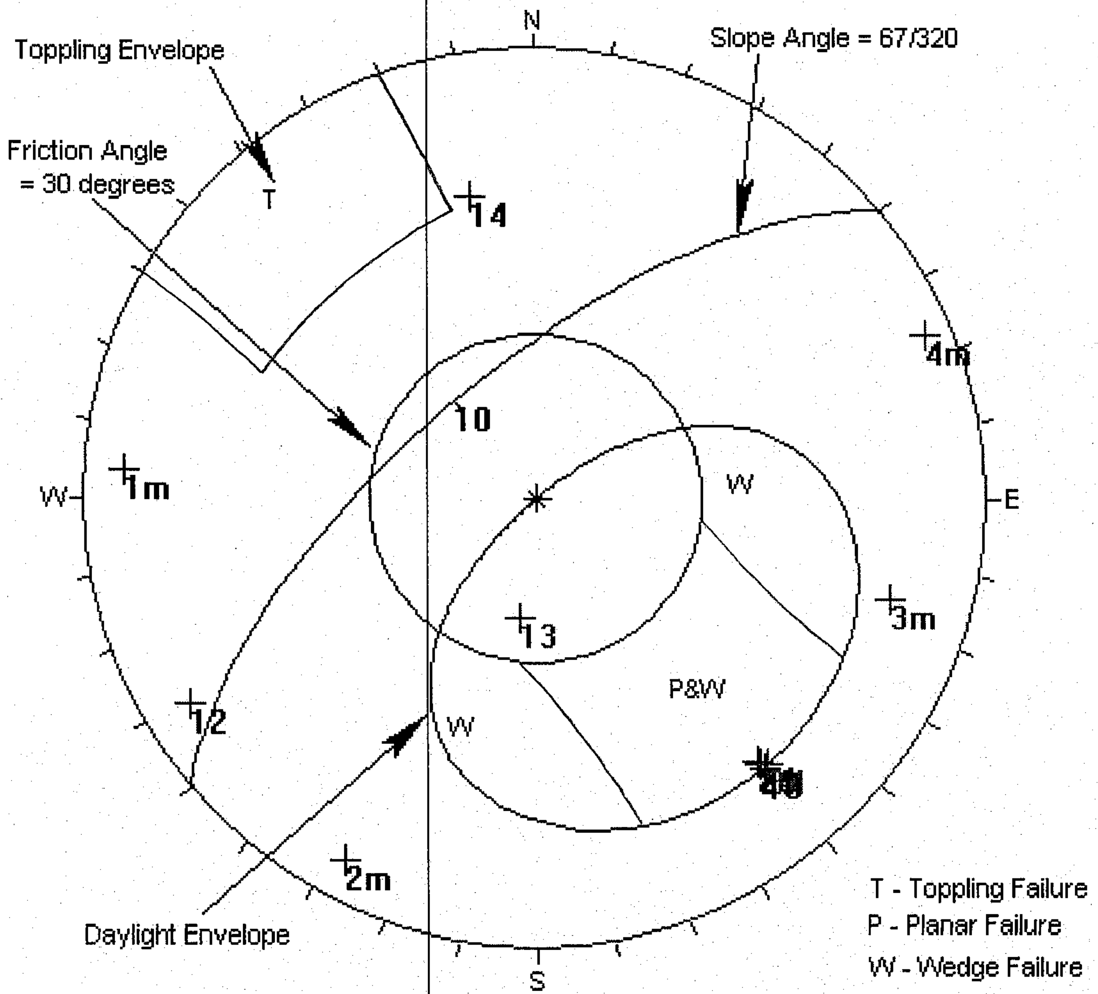
FEATURE NO. 12SW-A/C177 - Strips S11 &S12

Subject Feature No. 12SW-A/C177 (Along Strips S11 & S12) POLE PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 28



FEATURE NO. 12SW-A/C177 - Strips S11 &S12

Subject Feature No. 12SW-A/C177 (Along Strips S11 & S12) CONTOUR PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 29


Toppling Envelope
Friction Angle
= 30 degrees
Slope Angle = 67/320
N
E
S
W
T
14
4m
10
1m
W
P&W
3m
13
12
W
40
2m
Daylight Envelope
T - Toppling Failure
P - Planar Failure
W - Wedge Failure

FEATURE NO. 12SW-A/C177 - Strips S11 &S12

Orientations

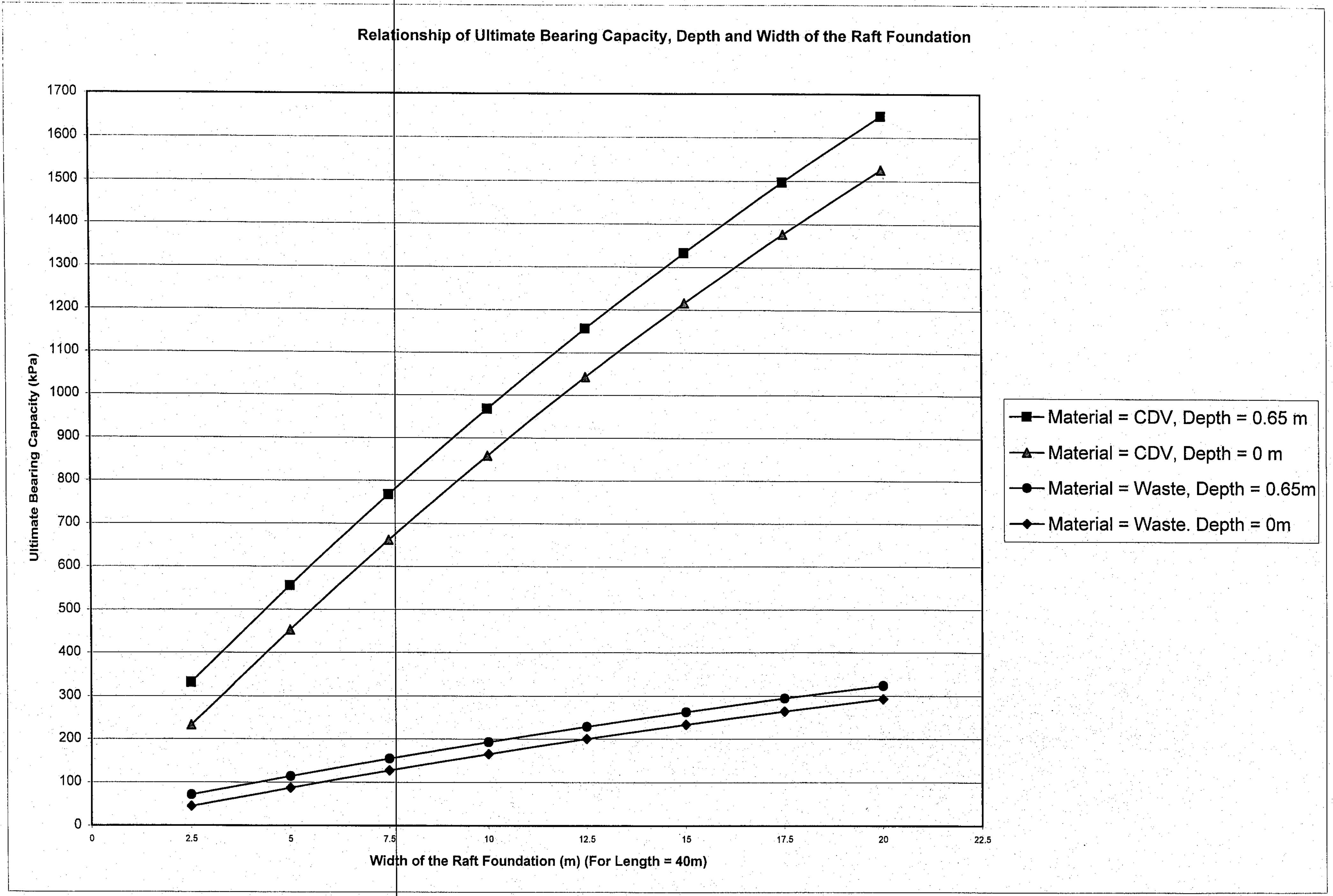
ID		Dip / Direction
12		078 / 59
13		022 / 8
14		058 / 168
23		066 / 320
24		065 / 320
34		067 / 319
10		067 / 320
1	m	080 / 94
1	w	080 / 94
2	m	080 / 28
2	w	080 / 28

More... (See text)

Equal Area
Lower Hemisphere
26 Poles
26 Entries

Subject Feature No. 12SW-A/C177 (Along Strips S11 & S12) MAJOR PLANES PLOT	Prepared Smo	Checked JH	Binnie
Project Agreement No. FD 01-052, Tseung Kwan O Landfill Stage II/III Afteruse Development	Date Aug-02	Scale N/A	Figure No. 30

APPENDIX F
Bearing Capacity and Settlement Calculations



Relationship of Ultimate Bearing Capacity, Depth and Width of the Raft Foundation

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 2.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 2.50 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 25.61 kPa

Total normal force, N = q*B'*L'
2560.60 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 100.00 m^2
K_i = F_d/(N+c_{ground}*A'/tan(ϕ_{ground})) = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.94

Bearing Capacity Factors, Nq = exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2 = 7.24
Nc = (Nq-1)/tan(ϕ_{ground}) = 16.06
Ng = 2*(Nq+1)*tan(ϕ_{ground}) = 6.40

Shape Factors, sq = 1+tan(ϕ_{ground})*B'/L' = 1.02
sc = 1+Nq/Nc*B'/L' = 1.03
sg = 1-0.4*B'/L' = 0.98

Inclination Factors, iq = (1-K_i)^m_i = 1.00
ic = iq-(1-iq)/(Nc*tan(ϕ_{ground})) = 1.00
ig = (1-K_i)^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = tq-(1-tq)/(Nc*tan(ϕ_{ground})) = 1.00
tg = (1-ω*tan(ϕ_{ground}))^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = exp(-2*β*tan(ϕ_{ground})) = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 8.008643 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 70.81 kPa

Factor of safety on bearing = 2.8

Conclusion, q(ult) > q OK

Prepared by: LWY
Checked by: LTC

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2^*e_b)$ = 5.00 m
Effective length, L' = $(L-2^*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 27.50 kPa

Total normal force, N = $q^*B'^*L'$
5500.55 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = $c_{ground}{}^*Nc^*sc^*ic^*tc^*gc + 0.5^*\gamma'^*B'^*Ng^*sg^*ig^*tg^*gg + q'^*Nq^*sq^*iq^*tq^*gq$

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'^*L' = 200.00 m^2
K_i = $F_d/(N+c_{ground}{}^*A'/\tan(\phi_{ground}))$ = 0.00
m_i = $(2+B'/L')/(1+B'/L')$ = 1.89

Bearing Capacity Factors, Nq = $\exp(\pi^*\tan(\phi_{ground}))^*\tan(\pi/4+\phi_{ground}/2)$^2 = 7.24
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 16.06
Ng = $2^*(Nq+1)^*\tan(\phi_{ground})$ = 6.40

Shape Factors, sq = $1+\tan(\phi_{ground})^*B'/L'$ = 1.05
sc = $1+Nq/Nc^*B'/L'$ = 1.06
sg = $1-0.4^*B'/L'$ = 0.95

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc^*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc^*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega^*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2^*\beta^*\tan(\phi_{ground}))$ = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'^*d^*\cos\beta$
= 8.008643 kN/m

Ultimate Bearing Capacity, q(ult) = $c_{ground}{}^*Nc^*sc^*ic^*tc^*gc + 0.5^*\gamma'^*B'^*Ng^*sg^*ig^*tg^*gg + q'^*Nq^*sq^*iq^*tq^*gq$
= 113.80 kPa

Factor of safety on bearing = 4.1

Conclusion, q(ult) > q OK

Prepared by: LWY
Checked by: LTC

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation,	B	=	7.5	m	
Length of foundation,	L	=	40	m	
Angle of foundation slab tilt,	ω	=	0	deg.	Not > 45°
Depth in front of the foundation,	d	=	0.65	m	
Slope angle,	β	=	18.6	deg.	
Surcharge,	p	=	10	kPa	
Unit weight of water,	γ_w	=	10	kN/m^3	
Unit weight of concrete,	γ_{conc}	=	24	kN/m^3	

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force,	F_d	=	0.0 kN		
Eccentricity,	e_b	=	0.00 m		
	e_l	=	0.00 m		
Effective width,	B'	=	(B-2*e_b)	=	7.50 m
Effective length,	L'	=	(L-2*e_l)	=	40.00 m
Pressure on the raft foundation		=	30.00 kPa		
Therefore, bearing pressure,	q	=	28.20 kPa		
Total normal force,	N	=	q*B'*L' 8459.71 kN		

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity,	q(ult)	=	c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq		Geoguide Figure A1 & A2
Effective area of foundation base,	A'	=	B'*L'	=	300.00 m^2
	K_i	=	F_d/(N+c_{ground}*A'/tan(ϕ_{ground}))	=	0.00
	m_i	=	(2+B'/L')/(1+B'/L')	=	1.84
Bearing Capacity Factors,	Nq	=	exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2	=	7.24
	Nc	=	(Nq-1)/tan(ϕ_{ground})	=	16.06
	Ng	=	2*(Nq+1)*tan(ϕ_{ground})	=	6.40
Shape Factors,	sq	=	1+tan(ϕ_{ground})*B'/L'	=	1.07
	sc	=	1+Nq/Nc*B'/L'	=	1.08
	sg	=	1-0.4*B'/L'	=	0.93
Inclination Factors,	iq	=	(1-K_i)^m_i	=	1.00
	ic	=	iq-(1-iq)/(Nc*tan(ϕ_{ground}))	=	1.00
	ig	=	(1-K_i)^(m_i+1)	=	1.00
Tilt Factors,	tq	=	tg	=	1.00
	tc	=	tq-(1-tq)/(Nc*tan(ϕ_{ground}))	=	1.00
	tg	=	(1-ω*tan(ϕ_{ground}))^2	=	1.00
Ground Slope Factors,	gq	=	(1-tanβ)^2	=	0.44
	gc	=	exp(-2*β*tan(ϕ_{ground}))	=	0.78
	gg	=	gq	=	0.44
Effective Unit Weight of soil,	γ'	=	13 kN/m^3		
Overburden Pressure on Founding Level	q'	=	γ'*d*cosβ		
		=	8.008643 kN/m		
Ultimate Bearing Capacity,	q(ult)	=	c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq		
		=	154.50 kPa		
Factor of safety on bearing		=	5.5		
Conclusion,	q(ult)	>	q OK		

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 10 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 10.00 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 28.56 kPa

Total normal force, N = q*B'*L'
11424.22 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 400.00 m^2
K_i = F_d/(N+c_{ground}*A'/tan(ϕ_{ground})) = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.80

Bearing Capacity Factors, Nq = exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2 = 7.24
Nc = (Nq-1)/tan(ϕ_{ground}) = 16.06
Ng = 2*(Nq+1)*tan(ϕ_{ground}) = 6.40

Shape Factors, sq = 1+tan(ϕ_{ground})*B'/L' = 1.10
sc = 1+Nq/Nc*B'/L' = 1.11
sg = 1-0.4*B'/L' = 0.90

Inclination Factors, iq = (1-K_i)^m_i = 1.00
ic = iq-(1-iq)/(Nc*tan(ϕ_{ground})) = 1.00
ig = (1-K_i)^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = tq-(1-tq)/(Nc*tan(ϕ_{ground})) = 1.00
tg = (1-ω*tan(ϕ_{ground}))^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = exp(-2*β*tan(ϕ_{ground})) = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 8.008643 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 192.91 kPa

Factor of safety on bearing = 6.8

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 12.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 12.50 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 28.78 kPa

Total normal force, N = q*B'*L'
14390.97 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 500.00 m^2
K_i = F_d/(N+c_{ground}*A'/tan(ϕ_{ground})) = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.76

Bearing Capacity Factors, Nq = exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2 = 7.24
Nc = (Nq-1)/tan(ϕ_{ground}) = 16.06
Ng = 2*(Nq+1)*tan(ϕ_{ground}) = 6.40

Shape Factors, sq = 1+tan(ϕ_{ground})*B'/L' = 1.12
sc = 1+Nq/Nc*B'/L' = 1.14
sg = 1-0.4*B'/L' = 0.88

Inclination Factors, iq = (1-K_i)^m_i = 1.00
ic = iq-(1-iq)/(Nc*tan(ϕ_{ground})) = 1.00
ig = (1-K_i)^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = tq-(1-tq)/(Nc*tan(ϕ_{ground})) = 1.00
tg = (1-ω*tan(ϕ_{ground}))^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = exp(-2*β*tan(ϕ_{ground})) = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 8.008643 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 229.03 kPa

Factor of safety on bearing = 8.0

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 15 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 15.00 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 28.93 kPa

Total normal force, N = q*B'*L'
17358.88 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 600.00 m^2
K_i = F_d/(N+c_{ground}*A'/tan(ϕ_{ground})) = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.73

Bearing Capacity Factors, Nq = exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2 = 7.24
Nc = (Nq-1)/tan(ϕ_{ground}) = 16.06
Ng = 2*(Nq+1)*tan(ϕ_{ground}) = 6.40

Shape Factors, sq = 1+tan(ϕ_{ground})*B'/L' = 1.15
sc = 1+Nq/Nc*B'/L' = 1.17
sg = 1-0.4*B'/L' = 0.85

Inclination Factors, iq = (1-K_i)^m_i = 1.00
ic = iq-(1-iq)/(Nc*tan(ϕ_{ground})) = 1.00
ig = (1-K_i)^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = tq-(1-tq)/(Nc*tan(ϕ_{ground})) = 1.00
tg = (1-ω*tan(ϕ_{ground}))^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = exp(-2*β*tan(ϕ_{ground})) = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 8.008643 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 262.86 kPa

Factor of safety on bearing = 9.1

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 17.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 17.50 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 29.04 kPa

Total normal force, N = q*B'*L'
20327.45 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 700.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.70

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 7.24
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 16.06
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 6.40

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.17
sc = 1+Nq/Nc*B'/L' = 1.20
sg = 1-0.4*B'/L' = 0.83

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'*d*\cos\beta$
= 8.008643 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 294.40 kPa

Factor of safety on bearing = 10.1

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 20 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 20.00 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 29.12 kPa

Total normal force, N = $q*B'*L'$
23296.45 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, $q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$

Geoguide
Figure A1 & A2

Effective area of foundation base, $A' = B'*L'$ = 800.00 m^2
$K_i = F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
$m_i = (2+B'/L')/(1+B'/L')$ = 1.67

Bearing Capacity Factors, $Nq = \exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)\text{^}2$ = 7.24
$Nc = (Nq-1)/\tan(\phi_{ground})$ = 16.06
$Ng = 2*(Nq+1)*\tan(\phi_{ground})$ = 6.40

Shape Factors, $sq = 1+\tan(\phi_{ground})*B'/L'$ = 1.19
$sc = 1+Nq/Nc*B'/L'$ = 1.23
$sg = 1-0.4*B'/L'$ = 0.80

Inclination Factors, $iq = (1-K_i)\text{^}m_i$ = 1.00
$ic = iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
$ig = (1-K_i)\text{^}(m_i+1)$ = 1.00

Tilt Factors, $tq = tg$ = 1.00
$tc = tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
$tg = (1-\omega*\tan(\phi_{ground}))\text{^}2$ = 1.00

Ground Slope Factors, $gq = (1-\tan\beta)\text{^}2$ = 0.44
$gc = \exp(-2*\beta*\tan(\phi_{ground}))$ = 0.78
$gg = gq$ = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level $q' = \gamma'*d*\cos\beta$
= 8.008643 kN/m

Ultimate Bearing Capacity, $q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$
= 323.65 kPa

Factor of safety on bearing = 11.1

Conclusion, $q(ult) > q$ OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 2.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 2.50 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 17.13 kPa

Total normal force, N = q*B'*L'
1712.92 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 100.00 m^2
K_i = F_d/(N+c_{ground}*A'/tan(ϕ_{ground})) = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.94

Bearing Capacity Factors, Nq = exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2 = 7.24
Nc = (Nq-1)/tan(ϕ_{ground}) = 16.06
Ng = 2*(Nq+1)*tan(ϕ_{ground}) = 6.40

Shape Factors, sq = 1+tan(ϕ_{ground})*B'/L' = 1.02
sc = 1+Nq/Nc*B'/L' = 1.03
sg = 1-0.4*B'/L' = 0.98

Inclination Factors, iq = (1-K_i)^m_i = 1.00
ic = iq-(1-iq)/(Nc*tan(ϕ_{ground})) = 1.00
ig = (1-K_i)^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = tq-(1-tq)/(Nc*tan(ϕ_{ground})) = 1.00
tg = (1-ω*tan(ϕ_{ground}))^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = exp(-2*β*tan(ϕ_{ground})) = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 44.66 kPa

Factor of safety on bearing = 2.6

Conclusion, q(ult) > q OK

Prepared by: LWY
Checked by: LTC

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 5.00 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 21.48 kPa

Total normal force, N = q*B'*L'
4295.07 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 200.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.89

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 7.24
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 16.06
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 6.40

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.05
sc = 1+Nq/Nc*B'/L' = 1.06
sg = 1-0.4*B'/L' = 0.95

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'*d*\cos\beta$
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$
= 87.03 kPa

Factor of safety on bearing = 4.1

Conclusion, q(ult) > q OK

Prepared by: LWY
Checked by: LTC

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 7.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 7.50 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 23.46 kPa

Total normal force, N = q*B'*L'
7037.85 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 300.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.84

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 7.24
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 16.06
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 6.40

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.07
sc = 1+Nq/Nc*B'/L' = 1.08
sg = 1-0.4*B'/L' = 0.93

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 127.12 kPa

Factor of safety on bearing = 5.4

Conclusion, q(ult) > q OK

Prepared by: LWY
Checked by: LTC

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	φ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation,	B	=	10	m	
Length of foundation,	L	=	40	m	
Angle of foundation slab tilt,	ω	=	0	deg.	Not > 45°
Depth in front of the foundation,	d	=	0	m	
Slope angle,	β	=	18.6	deg.	
Surcharge,	p	=	10	kPa	
Unit weight of water,	γ_w	=	10	kN/m^3	
Unit weight of concrete,	γ_{conc}	=	24	kN/m^3	

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	φ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force,	F_d	=	0.0 kN		
Eccentricity,	e_b	=	0.00 m		
	e_l	=	0.00 m		
Effective width,	B'	=	$(B-2*e_b)$	=	10.00 m
Effective length,	L'	=	$(L-2*e_l)$	=	40.00 m
Pressure on the raft foundation		=	30.00 kPa		
Therefore, bearing pressure,	q	=	24.60 kPa		
Total normal force,	N	=	q*B'*L' 9838.28 kN		

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity,	q(ult)	=	$c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$			Geoguide Figure A1 & A2
Effective area of foundation base,	A'	=	B'*L'	=	$400.00\ m^2$	
	K_i	=	$F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$	=	0.00	
	m_i	=	(2+B'/L')/(1+B'/L')	=	1.80	
Bearing Capacity Factors,	Nq	=	$\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2	=	7.24	
	Nc	=	$(Nq-1)/\tan(\phi_{ground})$	=	16.06	
	Ng	=	$2*(Nq+1)*\tan(\phi_{ground})$	=	6.40	
Shape Factors,	sq	=	$1+\tan(\phi_{ground})*B'/L'$	=	1.10	
	sc	=	1+Nq/Nc*B'/L'	=	1.11	
	sg	=	1-0.4*B'/L'	=	0.90	
Inclination Factors,	iq	=	$(1-K_i)$^m_i	=	1.00	
	ic	=	$iq-(1-iq)/(Nc*\tan(\phi_{ground}))$	=	1.00	
	ig	=	$(1-K_i)$^(m_i+1)	=	1.00	
Tilt Factors,	tq	=	tg	=	1.00	
	tc	=	$tq-(1-tq)/(Nc*\tan(\phi_{ground}))$	=	1.00	
	tg	=	$(1-\omega*\tan(\phi_{ground}))$^2	=	1.00	
Ground Slope Factors,	gq	=	(1-tanβ)^2	=	0.44	
	gc	=	$\exp(-2*\beta*\tan(\phi_{ground}))$	=	0.78	
	gg	=	gq	=	0.44	
Effective Unit Weight of soil,	γ'	=	13 kN/m^3			
Overburden Pressure on Founding Level	q'	=	γ'*d*cosβ			
		=	0 kN/m			
Ultimate Bearing Capacity,	q(ult)	=	$c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$			
		=	164.91 kPa			

Factor of safety on bearing = 6.7

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 12.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 12.50 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 25.33 kPa

Total normal force, N = q*B'*L'
12665.92 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 500.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.76

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 7.24
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 16.06
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 6.40

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.12
sc = 1+Nq/Nc*B'/L' = 1.14
sg = 1-0.4*B'/L' = 0.88

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'*d*\cos\beta$
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$
= 200.41 kPa

Factor of safety on bearing = 7.9

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 15 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 15.00 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 25.85 kPa

Total normal force, N = q*B'*L'
15508.55 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$

Geoguide Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 600.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.73

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 7.24
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 16.06
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 6.40

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.15
sc = 1+Nq/Nc*B'/L' = 1.17
sg = 1-0.4*B'/L' = 0.85

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'*d*\cos\beta$
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$
= 233.62 kPa

Factor of safety on bearing = 9.0

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation, B = 17.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 17.50 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 26.23 kPa

Total normal force, N = q*B'*L'
18360.31 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq — Geoguide Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 700.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.70

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 7.24
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 16.06
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 6.40

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.17
sc = 1+Nq/Nc*B'/L' = 1.20
sg = 1-0.4*B'/L' = 0.83

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.78
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 13 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 264.54 kPa

Factor of safety on bearing = 10.1

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0	25	13

Width of foundation,	B	=	20	m	
Length of foundation,	L	=	40	m	
Angle of foundation slab tilt,	ω	=	0	deg.	Not > 45°
Depth in front of the foundation,	d	=	0	m	
Slope angle,	β	=	18.6	deg.	
Surcharge,	p	=	10	kPa	
Unit weight of water,	γ_w	=	10	kN/m^3	
Unit weight of concrete,	γ_{conc}	=	24	kN/m^3	

2) Check bearing capacity failure

Partial material factor,	γ_m	=	1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Waste beneath the foundation	0.0	21.2	13

Lateral Force,	F_d	=	0.0 kN			
Eccentricity,	e_b	=	0.00 m			
	e_l	=	0.00 m			
Effective width,	B'	=	$(B-2*e_b)$	=	20.00 m	
Effective length,	L'	=	$(L-2*e_l)$	=	40.00 m	
Pressure on the raft foundation		=	30.00 kPa			
Therefore, bearing pressure,	q	=	26.52 kPa			
Total normal force,	N	=	q*B'*L' 21218.05 kN			

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity,	q(ult)	=	$c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$			Geoguide Figure A1 & A2
Effective area of foundation base,	A'	=	B'*L'	=	800.00 m^2	
	K_i	=	$F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$	=	0.00	
	m_i	=	(2+B'/L')/(1+B'/L')	=	1.67	
Bearing Capacity Factors,	Nq	=	$\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2	=	7.24	
	Nc	=	$(Nq-1)/\tan(\phi_{ground})$	=	16.06	
	Ng	=	$2*(Nq+1)*\tan(\phi_{ground})$	=	6.40	
Shape Factors,	sq	=	$1+\tan(\phi_{ground})*B'/L'$	=	1.19	
	sc	=	1+Nq/Nc*B'/L'	=	1.23	
	sg	=	1-0.4*B'/L'	=	0.80	
Inclination Factors,	iq	=	$(1-K_i)$^m_i	=	1.00	
	ic	=	$iq-(1-iq)/(Nc*\tan(\phi_{ground}))$	=	1.00	
	ig	=	$(1-K_i)$^(m_i+1)	=	1.00	
Tilt Factors,	tq	=	tg	=	1.00	
	tc	=	$tq-(1-tq)/(Nc*\tan(\phi_{ground}))$	=	1.00	
	tg	=	$(1-\omega*\tan(\phi_{ground}))$^2	=	1.00	
Ground Slope Factors,	gq	=	$(1-\tan\beta)$^2	=	0.44	
	gc	=	$\exp(-2*\beta*\tan(\phi_{ground}))$	=	0.78	
	gg	=	gq	=	0.44	
Effective Unit Weight of soil,	γ'	=	13 kN/m^3			
Overburden Pressure on Founding Level	q'	=	$\gamma'*d*\cos\beta$			
		=	0 kN/m			
Ultimate Bearing Capacity,	q(ult)	=	$c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$			
		=	293.17 kPa			
Factor of safety on bearing		=	11.1			
Conclusion,	q(ult)	>	q OK			

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation,	B	=	2.5	m	
Length of foundation,	L	=	40	m	
Angle of foundation slab tilt,	ω	=	0	deg.	Not > 45°
Depth in front of the foundation,	d	=	0.65	m	
Slope angle,	β	=	18.6	deg.	
Surcharge,	p	=	10	kPa	
Unit weight of water,	γ_w	=	10	kN/m^3	
Unit weight of concrete,	γ_{conc}	=	24	kN/m^3	

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force,	F_d	=	0.0 kN		
Eccentricity,	e_b	=	0.00 m		
	e_l	=	0.00 m		
Effective width,	B'	=	(B-2*e_b)	=	2.50 m
Effective length,	L'	=	(L-2*e_l)	=	40.00 m
Pressure on the raft foundation		=	30.00 kPa		
Therefore, bearing pressure,	q	=	30.00 kPa		
Total normal force,	N	=	q*B'*L' 3000.00 kN		

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity,	q(ult)	=	c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq			Geoguide Figure A1 & A2
Effective area of foundation base,	A'	=	B'*L'	=	100.00 m^2	
	K_i	=	F_d/(N+c_{ground}*A'/tan(ϕ_{ground}))	=	0.00	
	m_i	=	(2+B'/L')/(1+B'/L')	=	1.94	
Bearing Capacity Factors,	Nq	=	exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2	=	18.96	
	Nc	=	(Nq-1)/tan(ϕ_{ground})	=	30.78	
	Ng	=	2*(Nq+1)*tan(ϕ_{ground})	=	23.30	
Shape Factors,	sq	=	1+tan(ϕ_{ground})*B'/L'	=	1.04	
	sc	=	1+Nq/Nc*B'/L'	=	1.04	
	sg	=	1-0.4*B'/L'	=	0.98	
Inclination Factors,	iq	=	(1-K_i)^m_i	=	1.00	
	ic	=	iq-(1-iq)/(Nc*tan(ϕ_{ground}))	=	1.00	
	ig	=	(1-K_i)^(m_i+1)	=	1.00	
Tilt Factors,	tq	=	tg	=	1.00	
	tc	=	tq-(1-tq)/(Nc*tan(ϕ_{ground}))	=	1.00	
	tg	=	(1-ω*tan(ϕ_{ground}))^2	=	1.00	
Ground Slope Factors,	gq	=	(1-tanβ)^2	=	0.44	
	gc	=	exp(-2*β*tan(ϕ_{ground}))	=	0.68	
	gg	=	gq	=	0.44	
Effective Unit Weight of soil,	γ'	=	18.6 kN/m^3			
Overburden Pressure on Founding Level	q'	=	γ'*d*cosβ			
		=	11.45852 kN/m			
Ultimate Bearing Capacity,	q(ult)	=	c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq			
		=	331.57 kPa			
Factor of safety on bearing		=	11.1			
Conclusion,	q(ult)	>	q OK			

Prepared by: LWY
Checked by: LTC

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 5.00 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = q*B'*L'
6000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 200.00 m^2
K_i = F_d/(N+c_{ground}*A'/tan(ϕ_{ground})) = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.89

Bearing Capacity Factors, Nq = exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2 = 18.96
Nc = (Nq-1)/tan(ϕ_{ground}) = 30.78
Ng = 2*(Nq+1)*tan(ϕ_{ground}) = 23.30

Shape Factors, sq = 1+tan(ϕ_{ground})*B'/L' = 1.07
sc = 1+Nq/Nc*B'/L' = 1.08
sg = 1-0.4*B'/L' = 0.95

Inclination Factors, iq = (1-K_i)^m_i = 1.00
ic = iq-(1-iq)/(Nc*tan(ϕ_{ground})) = 1.00
ig = (1-K_i)^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = tq-(1-tq)/(Nc*tan(ϕ_{ground})) = 1.00
tg = (1-ω*tan(ϕ_{ground}))^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = exp(-2*β*tan(ϕ_{ground})) = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 11.45852 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 555.59 kPa

Factor of safety on bearing = 18.5

Conclusion, q(ult) > q OK

Agreement No. FD 01-052
Geotechnical Review and Site Investigation Works
For Tseung Kwan O Landfill Stage II/III Afteruse Development

Raft Foundation

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 7.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2^*e_b)$ = 7.50 m
Effective length, L' = $(L-2^*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = $q^*B'^*L'$
9000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = $c_{ground}{}^*Nc^*sc^*ic^*tc^*gc + 0.5^*\gamma'^*B'^*Ng^*sg^*ig^*tg^*gg + q'^*Nq^*sq^*iq^*tq^*gq$

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'^*L' = 300.00 m^2
K_i = $F_d/(N+c_{ground}{}^*A'/\tan(\phi_{ground}))$ = 0.00
m_i = $(2+B'/L')/(1+B'/L')$ = 1.84

Bearing Capacity Factors, Nq = $\exp(\pi^*\tan(\phi_{ground}))^*\tan(\pi/4+\phi_{ground}/2)$^2 = 18.96
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 30.78
Ng = $2^*(Nq+1)^*\tan(\phi_{ground})$ = 23.30

Shape Factors, sq = $1+\tan(\phi_{ground})^*B'/L'$ = 1.11
sc = $1+Nq/Nc^*B'/L'$ = 1.12
sg = $1-0.4^*B'/L'$ = 0.93

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc^*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc^*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega^*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2^*\beta^*\tan(\phi_{ground}))$ = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'^*d^*\cos\beta$
= 11.45852 kN/m

Ultimate Bearing Capacity, q(ult) = $c_{ground}{}^*Nc^*sc^*ic^*tc^*gc + 0.5^*\gamma'^*B'^*Ng^*sg^*ig^*tg^*gg + q'^*Nq^*sq^*iq^*tq^*gq$
= 767.68 kPa

Factor of safety on bearing = 25.6

Conclusion, q(ult) > q OK

Prepared by: LWY
Checked by: LTC

11/12/02

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 10 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 10.00 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = q*B'*L'
12000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 400.00 m^2
K_i = F_d/(N+c_{ground}*A'/tan(ϕ_{ground})) = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.80

Bearing Capacity Factors, Nq = exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2 = 18.96
Nc = (Nq-1)/tan(ϕ_{ground}) = 30.78
Ng = 2*(Nq+1)*tan(ϕ_{ground}) = 23.30

Shape Factors, sq = 1+tan(ϕ_{ground})*B'/L' = 1.15
sc = 1+Nq/Nc*B'/L' = 1.15
sg = 1-0.4*B'/L' = 0.90

Inclination Factors, iq = (1-K_i)^m_i = 1.00
ic = iq-(1-iq)/(Nc*tan(ϕ_{ground})) = 1.00
ig = (1-K_i)^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = tq-(1-tq)/(Nc*tan(ϕ_{ground})) = 1.00
tg = (1-ω*tan(ϕ_{ground}))^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = exp(-2*β*tan(ϕ_{ground})) = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 11.45852 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 967.86 kPa

Factor of safety on bearing = 32.3

Conclusion, q(ult) > q OK

Prepared by: LWY
Checked by: LTC

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 12.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 12.50 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = q*B'*L'
15000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 500.00 m^2
K_i = F_d/(N+c_{ground}*A'/tan(ϕ_{ground})) = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.76

Bearing Capacity Factors, Nq = exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2 = 18.96
Nc = (Nq-1)/tan(ϕ_{ground}) = 30.78
Ng = 2*(Nq+1)*tan(ϕ_{ground}) = 23.30

Shape Factors, sq = 1+tan(ϕ_{ground})*B'/L' = 1.18
sc = 1+Nq/Nc*B'/L' = 1.19
sg = 1-0.4*B'/L' = 0.88

Inclination Factors, iq = (1-K_i)^m_i = 1.00
ic = iq-(1-iq)/(Nc*tan(ϕ_{ground})) = 1.00
ig = (1-K_i)^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = tq-(1-tq)/(Nc*tan(ϕ_{ground})) = 1.00
tg = (1-ω*tan(ϕ_{ground}))^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = exp(-2*β*tan(ϕ_{ground})) = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 11.45852 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 1156.11 kPa

Factor of safety on bearing = 38.5

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation,	B	=	15	m	
Length of foundation,	L	=	40	m	
Angle of foundation slab tilt,	ω	=	0	deg.	Not > 45°
Depth in front of the foundation,	d	=	0.65	m	
Slope angle,	β	=	18.6	deg.	
Surcharge,	p	=	10	kPa	
Unit weight of water,	γ_w	=	10	kN/m^3	
Unit weight of concrete,	γ_{conc}	=	24	kN/m^3	

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m

e_l = 0.00 m

Effective width,	B'	=	(B-2*e_b)	=	15.00 m
Effective length,	L'	=	(L-2*e_l)	=	40.00 m

Pressure on the raft foundation = 30.00 kPa

Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = q*B'*L'
18000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq — Geoguide Figure A1 & A2

Effective area of foundation base,	A'	=	B'*L'	=	600.00 m^2
	K_i	=	F_d/(N+c_{ground}*A'/tan(ϕ_{ground}))	=	0.00
	m_i	=	(2+B'/L')/(1+B'/L')	=	1.73
Bearing Capacity Factors,	Nq	=	exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2	=	18.96
	Nc	=	(Nq-1)/tan(ϕ_{ground})	=	30.78
	Ng	=	2*(Nq+1)*tan(ϕ_{ground})	=	23.30
Shape Factors,	sq	=	1+tan(ϕ_{ground})*B'/L'	=	1.22
	sc	=	1+Nq/Nc*B'/L'	=	1.23
	sg	=	1-0.4*B'/L'	=	0.85
Inclination Factors,	iq	=	(1-K_i)^m_i	=	1.00
	ic	=	iq-(1-iq)/(Nc*tan(ϕ_{ground}))	=	1.00
	ig	=	(1-K_i)^(m_i+1)	=	1.00
Tilt Factors,	tq	=	tg	=	1.00
	tc	=	tq-(1-tq)/(Nc*tan(ϕ_{ground}))	=	1.00
	tg	=	(1-ω*tan(ϕ_{ground}))^2	=	1.00
Ground Slope Factors,	gq	=	(1-tanβ)^2	=	0.44
	gc	=	exp(-2*β*tan(ϕ_{ground}))	=	0.68
	gg	=	gq	=	0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3

Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 11.45852 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 1332.44 kPa

Factor of safety on bearing = 44.4

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation,	B	=	17.5	m	
Length of foundation,	L	=	40	m	
Angle of foundation slab tilt,	ω	=	0	deg.	Not > 45°
Depth in front of the foundation,	d	=	0.65	m	
Slope angle,	β	=	18.6	deg.	
Surcharge,	p	=	10	kPa	
Unit weight of water,	γ_w	=	10	kN/m^3	
Unit weight of concrete,	γ_{conc}	=	24	kN/m^3	

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force,	F_d	=	0.0 kN			
Eccentricity,	e_b	=	0.00 m			
	e_l	=	0.00 m			
Effective width,	B'	=	$(B-2*e_b)$	=	17.50 m	
Effective length,	L'	=	$(L-2*e_l)$	=	40.00 m	
Pressure on the raft foundation		=	30.00 kPa			
Therefore, bearing pressure,	q	=	30.00 kPa			
Total normal force,	N	=	q*B'*L' 21000.00 kN			

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity,	q(ult)	=	c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq			Geoguide Figure A1 & A2
Effective area of foundation base,	A'	=	B'*L'	=	700.00 m^2	
	K_i	=	$F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$	=	0.00	
	m_i	=	(2+B'/L')/(1+B'/L')	=	1.70	
Bearing Capacity Factors,	Nq	=	$\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2	=	18.96	
	Nc	=	$(Nq-1)/\tan(\phi_{ground})$	=	30.78	
	Ng	=	$2*(Nq+1)*\tan(\phi_{ground})$	=	23.30	
Shape Factors,	sq	=	$1+\tan(\phi_{ground})*B'/L'$	=	1.26	
	sc	=	1+Nq/Nc*B'/L'	=	1.27	
	sg	=	1-0.4*B'/L'	=	0.83	
Inclination Factors,	iq	=	$(1-K_i)$^m_i	=	1.00	
	ic	=	$iq-(1-iq)/(Nc*\tan(\phi_{ground}))$	=	1.00	
	ig	=	$(1-K_i)$^(m_i+1)	=	1.00	
Tilt Factors,	tq	=	tg	=	1.00	
	tc	=	$tq-(1-tq)/(Nc*\tan(\phi_{ground}))$	=	1.00	
	tg	=	$(1-\omega*\tan(\phi_{ground}))$^2	=	1.00	
Ground Slope Factors,	gq	=	(1-tanβ)^2	=	0.44	
	gc	=	$\exp(-2*\beta*\tan(\phi_{ground}))$	=	0.68	
	gg	=	gq	=	0.44	
Effective Unit Weight of soil,	γ'	=	18.6 kN/m^3			
Overburden Pressure on Founding Level	q'	=	γ'*d*cosβ			
		=	11.45852 kN/m			
Ultimate Bearing Capacity,	q(ult)	=	c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq			
		=	1496.86 kPa			

Factor of safety on bearing = 49.9

Conclusion, q(ult) > q OK

Prepared by: LWY
Checked by: LTC

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 20 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0.65 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 20.00 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = q*B'*L'
24000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 800.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.67

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 18.96
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 30.78
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 23.30

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.29
sc = 1+Nq/Nc*B'/L' = 1.31
sg = 1-0.4*B'/L' = 0.80

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'*d*\cos\beta$
= 11.45852 kN/m

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$
= 1649.35 kPa

Factor of safety on bearing = 55.0

Conclusion, q(ult) > q OK

Prepared by: LWY
Checked by: LTC

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 2.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 2.50 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = $q*B'*L'$
3000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$ Geoguide Figure A1 & A2

Effective area of foundation base, A' = $B'*L'$ = 100.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = $(2+B'/L')/(1+B'/L')$ = 1.94

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 18.96
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 30.78
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 23.30

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.04
sc = $1+Nq/Nc*B'/L'$ = 1.04
sg = $1-0.4*B'/L'$ = 0.98

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'*d*\cos\beta$
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$
= 232.45 kPa

Factor of safety on bearing = 7.7

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 5.00 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = q*B'*L'
6000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 200.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.89

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 18.96
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 30.78
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 23.30

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.07
sc = 1+Nq/Nc*B'/L' = 1.08
sg = 1-0.4*B'/L' = 0.95

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'*d*\cos\beta$
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 452.97 kPa

Factor of safety on bearing = 15.1

Conclusion, q(ult) > q OK

Raft Foundation

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 7.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 7.50 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = $q*B'*L'$
9000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = $B'*L'$ = 300.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = $(2+B'/L')/(1+B'/L')$ = 1.84

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)^\wedge 2$ = 18.96
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 30.78
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 23.30

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.11
sc = $1+Nq/Nc*B'/L'$ = 1.12
sg = $1-0.4*B'/L'$ = 0.93

Inclination Factors, iq = $(1-K_i)^\wedge m_i$ = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)^\wedge(m_i+1)$ = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))^\wedge 2$ = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)^\wedge 2$ = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'*d*\cos\beta$
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$
= 661.58 kPa

Factor of safety on bearing = 22.1

Conclusion, q(ult) > q OK

Prepared by: LWY
Checked by: LTC

11/12/02

Raft Foundation

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 10 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 10.00 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = $q*B'*L'$
12000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, $q(ult)$ = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$ — Geoguide Figure A1 & A2

Effective area of foundation base, A' = $B'*L'$ = 400.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = $(2+B'/L')/(1+B'/L')$ = 1.80

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)\text{^}2$ = 18.96
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 30.78
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 23.30

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.15
sc = $1+Nq/Nc*B'/L'$ = 1.15
sg = $1-0.4*B'/L'$ = 0.90

Inclination Factors, iq = $(1-K_i)\text{^}m_i$ = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)\text{^}(m_i+1)$ = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))\text{^}2$ = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)\text{^}2$ = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'*d*\cos\beta$
= 0 kN/m

Ultimate Bearing Capacity, $q(ult)$ = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$
= 858.27 kPa

Factor of safety on bearing = 28.6

Conclusion, $q(ult) > q$ OK

Prepared by: LWY
Checked by: LTC

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 12.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 12.50 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = q*B'*L'
15000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 500.00 m^2
K_i = F_d/(N+c_{ground}*A'/tan(ϕ_{ground})) = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.76

Bearing Capacity Factors, Nq = exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2 = 18.96
Nc = (Nq-1)/tan(ϕ_{ground}) = 30.78
Ng = 2*(Nq+1)*tan(ϕ_{ground}) = 23.30

Shape Factors, sq = 1+tan(ϕ_{ground})*B'/L' = 1.18
sc = 1+Nq/Nc*B'/L' = 1.19
sg = 1-0.4*B'/L' = 0.88

Inclination Factors, iq = (1-K_i)^m_i = 1.00
ic = iq-(1-iq)/(Nc*tan(ϕ_{ground})) = 1.00
ig = (1-K_i)^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = tq-(1-tq)/(Nc*tan(ϕ_{ground})) = 1.00
tg = (1-ω*tan(ϕ_{ground}))^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = exp(-2*β*tan(ϕ_{ground})) = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 1043.03 kPa

Factor of safety on bearing = 34.8

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 15 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = (B-2*e_b) = 15.00 m
Effective length, L' = (L-2*e_l) = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = q*B'*L'
18000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 600.00 m^2
K_i = F_d/(N+c_{ground}*A'/tan(ϕ_{ground})) = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.73

Bearing Capacity Factors, Nq = exp(π*tan(ϕ_{ground}))*tan(π/4+ϕ_{ground}/2)^2 = 18.96
Nc = (Nq-1)/tan(ϕ_{ground}) = 30.78
Ng = 2*(Nq+1)*tan(ϕ_{ground}) = 23.30

Shape Factors, sq = 1+tan(ϕ_{ground})*B'/L' = 1.22
sc = 1+Nq/Nc*B'/L' = 1.23
sg = 1-0.4*B'/L' = 0.85

Inclination Factors, iq = (1-K_i)^m_i = 1.00
ic = iq-(1-iq)/(Nc*tan(ϕ_{ground})) = 1.00
ig = (1-K_i)^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = tq-(1-tq)/(Nc*tan(ϕ_{ground})) = 1.00
tg = (1-ω*tan(ϕ_{ground}))^2 = 1.00

Ground Slope Factors, gq = (1-tanβ)^2 = 0.44
gc = exp(-2*β*tan(ϕ_{ground})) = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 1215.88 kPa

Factor of safety on bearing = 40.5

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 17.5 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 17.50 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = q*B'*L'
21000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = B'*L' = 700.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = (2+B'/L')/(1+B'/L') = 1.70

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 18.96
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 30.78
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 23.30

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.26
sc = 1+Nq/Nc*B'/L' = 1.27
sg = 1-0.4*B'/L' = 0.83

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = γ'*d*cosβ
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = c_{ground}*Nc*sc*ic*tc*gc + 0.5*γ'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq
= 1376.80 kPa

Factor of safety on bearing = 45.9

Conclusion, q(ult) > q OK

I. DESIGN PARAMETERS

1) Parameters

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0	35	18.6

Width of foundation, B = 20 m
Length of foundation, L = 40 m
Angle of foundation slab tilt, ω = 0 deg. Not > 45°
Depth in front of the foundation, d = 0 m
Slope angle, β = 18.6 deg.
Surcharge, p = 10 kPa

Unit weight of water, γ_w = 10 kN/m^3
Unit weight of concrete, γ_{conc} = 24 kN/m^3

2) Check bearing capacity failure

Partial material factor, γ_m = 1.2

Factored material properties:

	c' (kPa)	ϕ' (deg.)	γ' (kN/m^3)
Ground soil beneath the foundation	0.0	30.3	18.6

Lateral Force, F_d = 0.0 kN

Eccentricity, e_b = 0.00 m
e_l = 0.00 m

Effective width, B' = $(B-2*e_b)$ = 20.00 m
Effective length, L' = $(L-2*e_l)$ = 40.00 m

Pressure on the raft foundation = 30.00 kPa
Therefore, bearing pressure, q = 30.00 kPa

Total normal force, N = $q*B'*L'$
24000.00 kN

Determine Ultimate Bearing Capacity, q(ult)

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$

Geoguide
Figure A1 & A2

Effective area of foundation base, A' = $B'*L'$ = 800.00 m^2
K_i = $F_d/(N+c_{ground}*A'/\tan(\phi_{ground}))$ = 0.00
m_i = $(2+B'/L')/(1+B'/L')$ = 1.67

Bearing Capacity Factors, Nq = $\exp(\pi*\tan(\phi_{ground}))*\tan(\pi/4+\phi_{ground}/2)$^2 = 18.96
Nc = $(Nq-1)/\tan(\phi_{ground})$ = 30.78
Ng = $2*(Nq+1)*\tan(\phi_{ground})$ = 23.30

Shape Factors, sq = $1+\tan(\phi_{ground})*B'/L'$ = 1.29
sc = $1+Nq/Nc*B'/L'$ = 1.31
sg = $1-0.4*B'/L'$ = 0.80

Inclination Factors, iq = $(1-K_i)$^m_i = 1.00
ic = $iq-(1-iq)/(Nc*\tan(\phi_{ground}))$ = 1.00
ig = $(1-K_i)$^(m_i+1) = 1.00

Tilt Factors, tq = tg = 1.00
tc = $tq-(1-tq)/(Nc*\tan(\phi_{ground}))$ = 1.00
tg = $(1-\omega*\tan(\phi_{ground}))$^2 = 1.00

Ground Slope Factors, gq = $(1-\tan\beta)$^2 = 0.44
gc = $\exp(-2*\beta*\tan(\phi_{ground}))$ = 0.68
gg = gq = 0.44

Effective Unit Weight of soil, γ' = 18.6 kN/m^3
Overburden Pressure on Founding Level q' = $\gamma'*d*\cos\beta$
= 0 kN/m

Ultimate Bearing Capacity, q(ult) = $c_{ground}*Nc*sc*ic*tc*gc + 0.5*\gamma'*B'*Ng*sg*ig*tg*gg + q'*Nq*sq*iq*tq*gq$
= 1525.81 kPa

Factor of safety on bearing = 50.9

Conclusion, q(ult) > q OK

Project : Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development

Subject : Calculation of Settlement of Platform

Settlement of Waste

To estimate the settlement of waste due to building loading, the following equation is adopted:

$$\Delta H = paH_w$$

where ΔH is the settlement
H_w is the thickness of compressible waste
p is the applied loading (kPa) at foundation level
a is a coefficient relating to primary settlement

Settlement of Soil

To estimate the settlement of soil due to building loading, the following equation is adopted:

$$\Delta H = m_v pH\alpha$$

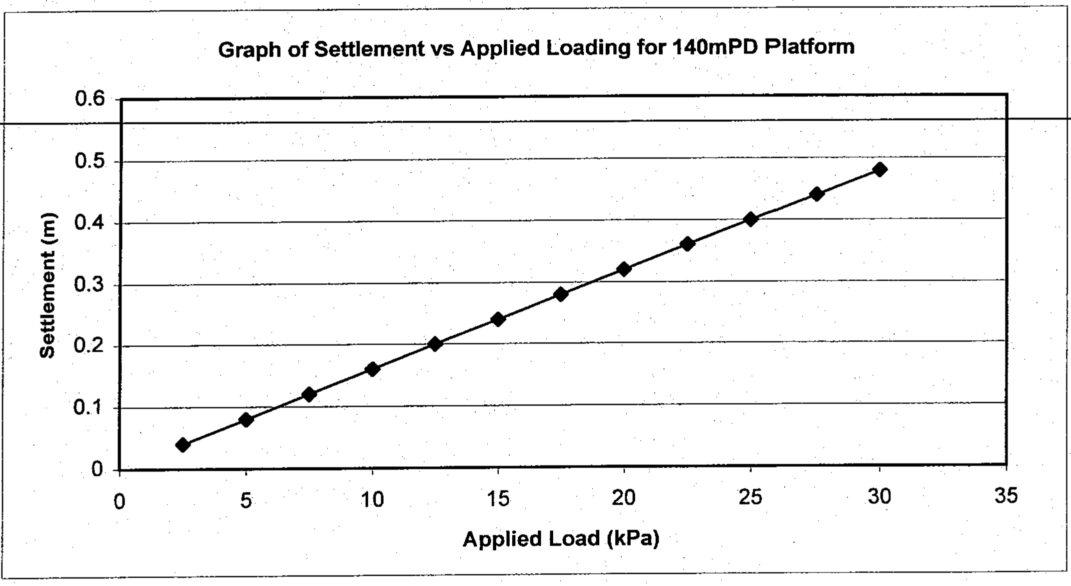
where ΔH is the settlement
H is the thickness of soil layer
p is the applied loading (kPa) at foundation level
m_v is coefficient of volume compressibility
α is load factor

140mPD Platform

Since CDV/HDV underlies waste, only settlement due to waste is considered.

For settlement due to waste
H_w = 40 m
a = 0.0004 kPa^{-1} (Adopted from Report STG1/STE/SUB/001/Issue 2)

p (kPa)	ΔH (m) Waste
2.5	0.04
5	0.08
7.5	0.12
10	0.16
12.5	0.2
15	0.24
17.5	0.28
20	0.32
22.5	0.36
25	0.4
27.5	0.44
30	0.48



Prepared By: LWY Date :2/17/03
Checked by : LTC Date :2/17/03

Project : Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development

Subject : Calculation of Settlement of Platform

40mPD Platform

Since there are layers of marine mud and alluvium under waste, settlement due to both waste, the marine mud and alluvium are considered

For settlement due to waste

H_w = 40 m

a = 0.0004 kPa^{-1}

For settlement due to marine mud

H_m = 4.5 m

m_v = 0.00035 m^2/kN (Adopted from Report STG1/STE/SUB/001/Issue 2)

$\alpha = \frac{10 \times 40}{(10+H_w \times 2)(40+H_w \times 2)}$ (For raft footing having a dimension of 10m x 40m)

= 0.04938

$\alpha = \frac{20 \times 40}{(20+H_w \times 2)(40+H_w \times 2)}$ (For raft footing having a dimension of 20m x 40m)

= 0.06667

$\alpha = \frac{30 \times 40}{(30+H_w \times 2)(40+H_w \times 2)}$ (For raft footing having a dimension of 30m x 40m)

= 0.09091

For settlement due to alluvium

H_a = 3 m

m_v = 0.00087 m^2/kN (Adopted from Report STG1/STE/SUB/001/Issue 2)

$\alpha = \frac{10 \times 40}{[10+(H_w + H_m) \times 2][(40+(H_w + H_m) \times 2]}$ (For raft footing having a dimension of 10m x 40m)

= 0.03132

$\alpha = \frac{20 \times 40}{[20+(H_w + H_m) \times 2][(40+(H_w + H_m) \times 2]}$ (For raft footing having a dimension of 20m x 40m)

= 0.05689

$\alpha = \frac{30 \times 40}{[30+(H_w + H_m) \times 2][(40+(H_w + H_m) \times 2]}$ (For raft footing having a dimension of 30m x 40m)

= 0.07817

Prepared By: LWY Date :2/17/03
Checked by : LTC Date :2/17/03

Black & Veatch Hong Kong Limited
Engineers and Scientists

Project : Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development

Subject : Calculation of Settlement of Platform

(For raft footing having a dimension of 10m x 40m)

Δσ' (kPa)	ΔH (m) Waste	ΔH (m) Marine Mud	ΔH (m) Alluvium	ΔH (m) Total
2.5	0.04000	0.00019	0.00020	0.04040
5	0.08000	0.00039	0.00041	0.08080
7.5	0.12000	0.00058	0.00061	0.12120
10	0.16000	0.00078	0.00082	0.16160
12.5	0.20000	0.00097	0.00102	0.20199
15	0.24000	0.00117	0.00123	0.24239
17.5	0.28000	0.00136	0.00143	0.28279
20	0.32000	0.00156	0.00163	0.32319
22.5	0.36000	0.00175	0.00184	0.36359
25	0.40000	0.00194	0.00204	0.40399
27.5	0.44000	0.00214	0.00225	0.44439
30	0.48000	0.00233	0.00245	0.48479

(For raft footing having a dimension of 20m x 40m)

Δσ' (kPa)	ΔH (m) Waste	ΔH (m) Marine Mud	ΔH (m) Alluvium	ΔH (m) Total
2.5	0.04000	0.00026	0.00037	0.04063
5	0.08000	0.00053	0.00074	0.08127
7.5	0.12000	0.00079	0.00111	0.12190
10	0.16000	0.00105	0.00148	0.16253
12.5	0.20000	0.00131	0.00186	0.20317
15	0.24000	0.00158	0.00223	0.24380
17.5	0.28000	0.00184	0.00260	0.28444
20	0.32000	0.00210	0.00297	0.32507
22.5	0.36000	0.00236	0.00334	0.36570
25	0.40000	0.00263	0.00371	0.40634
27.5	0.44000	0.00289	0.00408	0.44697
30	0.48000	0.00315	0.00445	0.48760

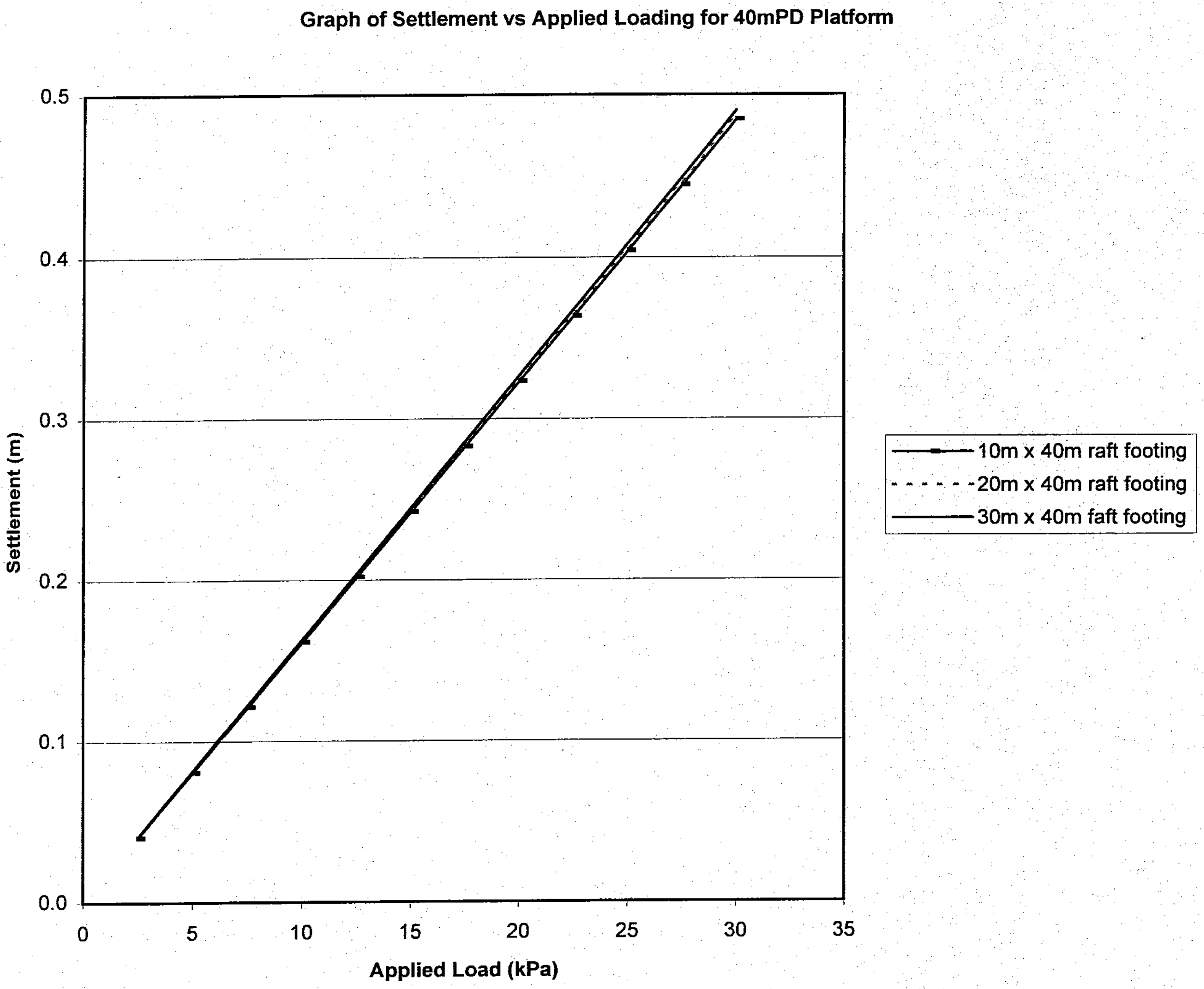
(For raft footing having a dimension of 30m x 40m)

Δσ' (kPa)	ΔH (m) Waste	ΔH (m) Marine Mud	ΔH (m) Alluvium	ΔH (m) Total
2.5	0.04000	0.00036	0.00051	0.04087
5	0.08000	0.00072	0.00102	0.08174
7.5	0.12000	0.00107	0.00153	0.12260
10	0.16000	0.00143	0.00204	0.16347
12.5	0.20000	0.00179	0.00255	0.20434
15	0.24000	0.00215	0.00306	0.24521
17.5	0.28000	0.00251	0.00357	0.28608
20	0.32000	0.00286	0.00408	0.32694
22.5	0.36000	0.00322	0.00459	0.36781
25	0.40000	0.00358	0.00510	0.40868
27.5	0.44000	0.00394	0.00561	0.44955
30	0.48000	0.00430	0.00612	0.49042

Prepared By: LWY　　Date :2/17/03
Checked by : LTC　　Date :2/17/03

Project : Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development

Subject : Calculation of Settlement of Platform



Prepared By: LWY
Checked by : LTC

Date :2/17/03
Date :2/17/03

APPENDIX G
SUMMARY OF COST ESTIMATE

Item	Description	Quantity	Unit	Rate	$
	EARTHWORK				
	Filling				
	Deposition and compaction of Grade 200 rock fill :-				
1	In general filling areas including slopes	12500	m^3	$240.00	$3,000,000.00
	GEOTECHNICAL WORKS				
	Slope Inspection				
2	Inspection scaffolding	0	m^2	$35.00	$0.00
3	Preliminary stripping to impermeable surface on slope	0	m^2	$60.00	$0.00
	Removal of Impermeable Slope Surface				
4	Removal of impermeable surface of artificial hard material, chunam, thickness not exceeding 75mm, without reinforcing mesh	0	m^2	$90.00	$0.00
5	Extra over for item for item 3 for each additional 25mm thickness or part thereof in excess of 75mm	0	m^2	$25.00	$0.00
6	Removal of impermeable surface of artificial hard material, shotcrete, thickness not exceeding 75mm, without reinforcing mesh.	0	m^2	$90.00	$0.00
7	Removal of impermeable surface of artificial hard material, shotcrete, thickness not exceeding 75mm, with reinforcing mesh.	0	m^2	$110.00	$0.00
8	Extra over for item for item 6 for each additional 25mm thickness or part thereof in excess of 75mm	0	m^2	$30.00	$0.00

Item	Description	Quantity	Unit	Rate	$
	Rock Scaling, Removing of Boulders, Sealing and Infilling Rock Joints, and Mesh Protection				
9	Rock scaling	0	m^2	$50.00	$0.00
10	Removing of boulders	20	m^3	$470.00	$9,400.00
11	Mesh protection as Standard Drawing C 2205A	0	m^2	$100.00	$0.00
12	Sealing rock joints with 1:3 cement mortar	0	m^3	$805.00	$0.00
13	Infilling rock joint:				
14	with no-fines concrete	0	m^3	$805.00	$0.00
15	with Grade 20/20 concrete	5	m^3	$800.00	$4,000.00
16	with soil-cement fill	0	m^3	$300.00	$0.00
	Relief Drains				
17	Relief drains 200 mm wide as Standard Drawing C 2404B	0	m	$95.00	$0.00
	Raking Drains				
18	Establishment of equipment for raking drain	3	item	$5,000.00	$15,000.00
19	Moving equipment	27	nr	$200.00	$5,400.00
20	Drilling drain hole, upwards at an angle of 0° - 45° to the horizontal, length not exceeding 25m, minimum diameter 80mm	27	m	$170.00	$4,590.00
21	Raking drains, upwards at an angle of 0° - 45° to the horizontal as Standard Drawing 2403A, length not exceeding 25m, Type 3	27	m	$200.00	$5,400.00

Item	Description		Quantity	Unit	Rate	$
	Rock Dowels					
	Rock dowels as Standard Drawing C 2202A, X mm diameter, Y metre in length:					
	X mm	Y m				
22	25	4	0	nr	$1,085.00	$0.00
23	32	4	20	nr	$1,200.00	$24,000.00
24	32	5	0	nr	$1,420.00	$0.00
25	32	6	0	nr	$2,085.00	$0.00
	Rock Bolts					
26	Establishment of equipment for rock bolts		0	item	$4,910.00	$0.00
27	Moving equipment for rock bolts		0	nr	$380.00	$0.00
28	Rock bolts as Standard Drawing C 2201, working load 80kN, 1m free length		0	nr	$1,580.00	$0.00
	Surface Protection					
	Grade 20 sprayed concrete with A252 welded mesh to BS 4461:					
29	100 mm thick		300	m^2	$310.00	$93,000.00
	Soil Nails					
30	Establishment of equipment for soil nails and pull-out tests		6	item	$15,000.00	$90,000.00
31	Moving equipment for soil nails and pull-out tests		846	nr	$350.00	$296,100.00

Item	Description	Quantity	Unit	Rate	$
	Soil nails as Standard Drawings C2106/1F, C2106/2C and C2106/3D 25 mm diameter, in hole of 100 mm diameter, of length:				
32	4 m	0	nr	$1,072.40	$0.00
33	6 m	0	nr	$1,600.00	$0.00
34	7 m	0	nr	$1,865.00	$0.00
35	8 m	201	nr	$2,240.00	$450,240.00
36	9 m	0	nr	$2,520.00	$0.00
37	10 m	320	nr	$2,800.00	$896,000.00
38	11 m	0	nr	$2,930.00	$0.00
39	12 m	0	nr	$3,200.00	$0.00
40	13 m	0	nr	$3,575.00	$0.00
	Soil nails as Standard Drawings C2106/1F, C2106/2C and C2106/3D 32 mm diameter, in hole of 100 mm diameter, of length:				
41	5 m	0	nr	$1,530.00	$0.00
42	6 m	0	nr	$1,680.00	$0.00
43	7 m	0	nr	$2,255.00	$0.00
44	8 m	0	nr	$2,335.00	$0.00
45	10 m	325	nr	$2,765.00	$898,625.00
46	12 m	0	nr	$3,260.00	$0.00

CORRESPONDENCE

801218

Environmental Protection Department
Hong Kong SAR Government

FACSIMILE TRANSMISSION LEADER PAGE

'04 JAN -2 11:37

From : Philip LEE

Our Ref. : EP184/06/B/10-01 (VIII)
Our Telephone No: 2872 1817
Our Fax No. : 2591 6662

Date/~~Time~~ Fax Sent : 2.1.2004

To : Mr. Tony Chen
Company: Black & Veatch Hong Kong Ltd
Your Fax No. : 2601 3988

This message consists of 1+13 page(s) (including this leader page)

Please notify Philip Lee on Tel. No. 2872 1817 if message received is incomplete.

RECEIVED BY FAX			
ACTION REQUIRED BY	LTC		
FILE			
REPLY	BY	DATE	
TO SEE			

Message:

Agreement No. FD 01-02
Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development
Draft Final Geotechnical Assessment Report (Draft B)

Responses to Comments

Please find attached EPD's memo to GEO dd. 23.12.2003 and GEO's "no further comments" memo ref GCME 2/B 15/8 of 30.12.2003.

2. Please arrange to finalize the report by incorporating GEO's current and previous comments and responses to comments. In particular, please include the notes of meeting on 27.8.2003 in the final report as per GEO's request. The notes of meeting on 27.8.03 and the related correspondences with GEO are attached for your easy reference.

3. Please arrange to prepare 6 copies of the Final Report and submit them to us. In addition, please also provide the electronic files of the drawings in the report for our record as discussed this morning.

Encl.
Regards,

Philip Lee
EPD

→ S(FD)3 31/12

by fax

MEMO

From CGE/ME, GEO, CED
Ref. in GCME 2/B15/8
Tel. No. 2762 5233
Fax. No. 2714 0245
Date 30 December, 2003

To DEP
(Attn.: Mr. Philip LEE CC 31/12/03
Your Ref. ( ) in EP 184/06/B/10-1(VIII)
dated 23.12.2003 Fax. No. 2591 6662
Total Pages 1

Geotechnical Review and Site Investigation Works For Tseung Kwan O Landfill Stage II/III Afteruses Development

Draft Final Geotechnical Assessment Report (Draft B)

Responses to Comments

I refer to your above memo enclosing the responses to comments for the captioned report.

2. The responses to comments are noted. I have no further geotechnical comment.

(J. C. L. LAU)
for Chief Geotechnical Engineer/Mainland East
Geotechnical Engineering Office
Civil Engineering Department

JCLL/TMFL
T 31.12

MEMO

From : Director of Environmental Protection	**To:** CGE/ME, GEO, CED
Ref : ( ) in EP 184/06/B/10-1 (VIII)	(Attn.: Mr. J.C.L. LAU)
Tel : 2872 1817	**Your Ref :** ( ) in GCME 2/B15/8
Fax : 2591 6662	**Dated :** 10.11.2003 **Fax. No.:** 2714 0245
Date : 23 December 2003	**Total pages :** 1 + 4

Geotechnical Review and Site Investigation Works
For Tseung Kwan O Landfill Stage II/III
Afteruses Development
Draft Final Geotechnical Assessment Report (Draft B)

Responses to Comments

I refer to your above memo enclosing some comments on the consultant's responses to comments.

2. We have forwarded your comments to the consultants for review and the responses to your comments in your above memo are:

Para. 3: Noted. We shall seek further comment from GEO should the option of slope upgrading be adopted in future.

Para. 4: The proposed boulder stabilization work has been discussed in section 5.1.2 of the report in the previous submission to GEO in May and the design of the dentition of concrete was also shown in drawing no. BV/TKO/382311/002 of the report (relevant pages are extracted from the report and attached for your easy reference).
The consultant also confirmed that the design of dentition of concrete to the boulder is in accordance with common practice in Hong Kong (please refer to the attached copy of standard drawing no. HD/STD/G/GS-19 for example).

Para. 5 The stability of the slopes affecting or affected by the proposed after-use facility at +40m PD platform has been assessed in previous submissions, as discussed in Section 3 of the current report.

Para. 6: Noted. The notes of meeting will be included in the final report for completeness and be submitted to GEO for record.

3. I trust that the above responses have addressed your comments. I should be grateful if you would issue a "no further comment" memo to us so that we can instruct the consultant to wrap up the project and issue the final report.

4. Your early reply as soon as possible is highly appreciated. Please contact me if you have any further questions.

(Philip Lee)
Environmental Protection Officer
for Director of Environmental Protection

~~P(FO)~~ f.i.

by fax

11/11

S(FO)

MEMO

From	CGE/ME, GEO, CED	To	DEP
Ref.	in GCME 2/B15/8	(Attn.:	Mr. Lawrence S. H. Cheung
Tel. No.	2762 5233	Your Ref.	( ) in EP 184/06/B/10-01
Fax. No.	2714 0245	dated	7.10.2003 Fax. No. 2591 6662
Date	10 November, 2003	Total Pages	1

E(FD) 7

12/1

Geotechnical Review and Site Investigation Works
For Tseung Kwan O Landfill Stage II/III
Afteruses Development
Draft Final Geotechnical Assessment Report (Draft B)

Responses to Comments

I refer to your above memo enclosing the responses to comments for the captioned report.

2. I have no geotechnical objection in principle to the adoption of the no-build zone option subject to conditions as agreed previously at our meeting on 27.8.2003.

3. In view of the adoption of the no-build zone option as the preferred landslide risk mitigation scheme for the proposed afteruses development, I would not comment on item 2(a) of the Response to Comments further at this time. However, should the option of slope upgrading be used in future, you are advised to seek further comment from this office.

4. Please submit details of the proposed boulder stabilization works as shown on drawing No. BV/TKO/382311/003 to GEO for comment prior to commencement of the works.

5. Please clarify if the +40mPD platform would also be used for afteruses facilities and if any structures will be erected, please also clarify if the stability of the slopes affecting or be affected by the facility has been assessed in the previous submission. If not, it should be submitted to GEO for comment.

6. Please include notes of meeting on 27.8.2003 in the final report for completeness and submit the report to GEO for record in due course.

(J. C. L. LAU)
for Chief Geotechnical Engineer/Mainland East
Geotechnical Engineering Office
Civil Engineering Department

JCLL/TMFL

14

MEMO

From	Director of Environmental Protection	*To*	**CGE/ME,GEO,CED**
Ref.	*In* EP 184/06/B/10-01	*(Attn:*	Mr. Jimmy Lau
Tel. No.	2872 1803	*Your Ref.*	*In* GCME 2/B15/8
Fax. No.	2591 6662	*Dated*	25.6.2003 *Fax No.* 2877 0594
Date	7 October 2003	*Total Pages*	13

Geotechnical Review and Site Investigation Works For Tseung Kwan O Landfill Stage II/III Afteruses Development

Draft Final Geotechnical Assessment Report (Draft B)

I refer to the above quoted memo and the subsequent meeting on 27.8.03 with your colleagues (Mr. KY Tang, Tony YK Ho, Vitus MC Chan, and Eric KS Fung) concerning the captioned report. Please find the attached responses to comments for your comments.

2. In addition to answer your queries in your previous memo, the Consultants proposed to add paragraph 5.4 stating that no-building zone is considered as the adopted option because it is most economic and feasible approach to safeguard the proposed Park The attached drawing no BV/TKO/382311/033 has highlighted the extent of area on the platform +140 mPD for afteruse activities. This area will be properly delineated from the "no build zone" with fencing and warning signs at suitable locations.

3. In addition, EPD will make reference of the LCSD safety procedures for inclement weather in the Tuen Mun Golf Driving Range in the future liaision with the potential users to devise some safety procedures for the use of the plateform +140 mPD.

4. You may like to note that we are currently seeking the endorsement of the Landfill Afteruse Working Group's support in the proposed usage. Should you have any query, please contact me for further clarification.

(Lawrence SH Cheung)
Senior Environmental Protection Officer
For Director of Environmental Protection

Encl.

Page 1 of 3

Letter reference: GCME 2/B15/8

Date: 25 June 2003

Item	Comment	Response
2 (a)	Stability Analyses of Cut Slopes	
	(i) Justification for geological models and design groundwater assumptions depicted in sections for stability analyses of soil slopes is required. Besides, the locations of the sections shall be given. Without the above information, it is difficult to comment on the stability analyses and the proposed slope upgrading works.	(i) As mentioned in Section 4.3.2, the geological models and groundwater levels have been adopted based on the ground investigation results, particularly the slope stripping results. The sections are cut at the stripping locations; for easy reference, the locations are shown in attached Figure C1, i.e. Location of Geological Sections for Stability Analysis.
	(ii) Justification for adoption of the minimum factors of safety given in Table 2 of Appendix A of WBTC No. 13/99 is required.	(ii) The justification for adopting the required factors of safety is given in Section 4.2.
	(iii) It is noted that the stability analysis of slope 12SW-A/C175 is missing in the report.	(iii) The analysis results for slope 12SW-A/C175 are now attached. Soil nailing is proposed to upgrade this substandard slope, as shown in attached Dwg No. BV/TKO/382311/001.
	(iv) According to our district records, some landslips have occurred at the cut slopes over the past few years (e.g. Incident Nos. 2001/06/0049 and 2003/06/0139). An assessment of whether the proposed slope upgrading works can effectively eliminate the reoccurrence of similar failures shall be given.	(iv) The two incidents occurred at slope nos. 12SW-A/C175 (Incident No. 2001/06/0049) and 12SW-A/C177 (Incident No. 2003/06/0139). Upgrading works have been proposed under this study to mitigate further failure.
		Concluding Remark: As mentioned at the end of Section 4.4.2, **no** upgrading works will be actually required to upgrade any of the substandard cut slopes as they are superseded by the proposed adjacent preventive measures against natural terrain hazards, i.e. the proposed no-build zone which is the

Letter reference: GCME 2/B15/8

Date: 25 June 2003

Item	Comment	Response
		adopted option (see attached text Section 5.4). Please note that, in the natural terrain hazard assessment, the cut slopes were taken into account already (i.e. the height of the cut slope was considered), in accordance with GEO SPR 1/2002. The report has nevertheless included the stability analyses for the cut slopes for completeness.
2 (b)	Natural Terrain Hazard Study (NTHS) (i) Please remind the consultant to include the revised NTHS calculations for catchment no. 7 into the final report.	(i) Noted.
2 (c)	Option 1 – Earth Bund (i) It is noted that the earth bund design has considered only slope failure occurred at the natural terrain. Further calculations to demonstrate that the earth bund can accommodate the debris resulted from a combination of filures occurred at both the natural terrain and cut slopes shall be given.	(i) As mentioned in our above response to Item 2(a), the cut slopes have already been taken into account in the natural terrain hazard assessment. Therefore, the proposed earth bund will be able to contain debris from cut slope failure.
	(ii) Further design details to prevent the failure debris from flowing downstream along the area within the earth bund, in particular under heavy rainstorm conditions, shall be provided.	(ii) Any debris due to natural terrain hazards or cut slope failure will be able to be contained within the earth bund.
2 (d)	Option – No-build zone (i) I have no in-principle geotechnical objection to the no-build zone option proposed in the report subject to the following: • The no-build zone must not form a part of the proposed Park.	(i) Noted. • The no-build zone will not form part of the proposed Park.

5.2.2 Open hillslope landslides and channelised debris flows

The perimeter enclosing the run-out distances due to both open hillslope landslides and channelised debris flows is marked in Drawing No. BV/TKO/382311/002. Based on the calculation results, it is recommended that a 2.5m high earth bund, located at a minimum distance of 4m from the toe of the slopes, be constructed to contain any debris flows, as also shown in Drawing No. BV/TKO/382311/002. However, parts of the existing access road which is the only access road leading to the top 140mPD platform, would be blocked by the proposed earth bund and need to be diverted.

An alternative option that does not require diversion of the access road is discussed in Section 5.3.

5.3 'No build zone' option

An alternative option that does not require diversion of the access road is to define a 'no-build zone', outside of which no development will be affected by any potential hazards, even if the total area of the development has to be reduced upon the establishment of the 'no-build-zone' within the landfill site.

Such a no-build-zone can be defined based on the calculated run-distances discussed in Section 5.2 and is shown in Drawing No. BV/TKO/382311/003, with its boundary being defined as one meter further away from the calculated run-out distance boundary. Note the following points:

- The majority of the platform at 140 mPD is located outside of the no-build-zone and can therefore be used for development, as per the conceptual design which would only require the set up of a couple of movable containers as offices.
- The entire platform at 40 mPD is located outside of the no-build-zone and can therefore be used for development. The conceptual design indicates that a steel structure for recycling facility is to be constructed on this platform.
- Some parts of the access road are located within the no-build-zone. Instead of carrying out extensive road diversion works and slope stabilization works, it is recommended to close the road on signs (e.g. bad weather) indicating a potential danger to the road.

5.4 Adopted Option

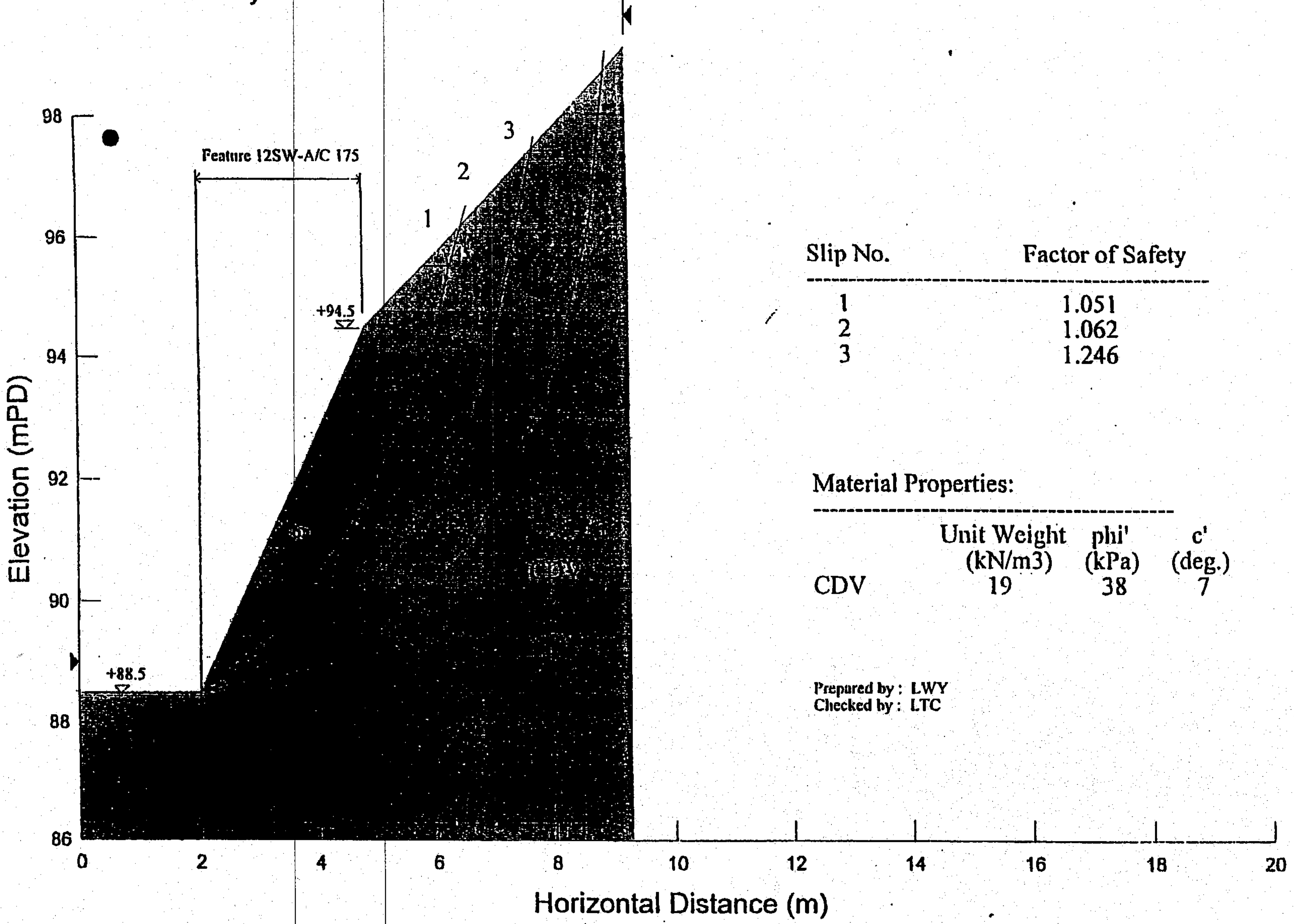
The 'no-build-zone' option, as shown in Drawing No. BV/TKO/382311/003, is considered an economic and feasible approach to safeguard the proposed Park, and is therefore the adopted option.

Letter reference: GCME 2/B15/8

Date: 25 June 2003

Item	Comment	Response
	• No access road is allowed to be located within the no-build zone. • The no-build zone must be fenced off to prevent public access. Appropriate signs should be placed to warn the public to stay away from the no-build zone. (ii) Owing to our comments given in paragraphs 2(a) and 2(c), the extent of the no-build zone shall be further justified.	• As mentioned in Section 5.3, administrative measures will be enforced to close the access road on signs (e.g. bad weather) indicating a potential danger to the road. • The areas allocated for after-use development are shown in attached Dwg No. BV/TKO/382311/003. (ii) The extent of the no-build zone does not need to be revised as explained in our above responses to Items 2(a) and 2(c).
2 (e)	Foundation design (i) The effect of differential settlement on the bearing capacity calculated shall be considered.	(i) Differential settlement will be considered in detailed design of the structures.

Geotechnical Review and Site Investigation Works for Tseung Kwan O Stage II/III Afteruse Development -Stability Assessment for Feature No. 12SW-A/C 175


Feature 12SW-A/C 175
+94.5
+88.5
1
2
3
Elevation (mPD)
98
96
94
92
90
88
86
0
2
4
6
8
10
12
14
16
18
20
Horizontal Distance (m)

Slip No.	Factor of Safety
1	1.051
2	1.062
3	1.246

Material Properties:

	Unit Weight (kN/m3)	phi' (kPa)	c' (deg.)
CDV	19	38	7

Prepared by : LWY
Checked by : LTC

Section I-I

Annex IV(1)

Operating Guidelines for Staff of TMRSC
On Tropical Cyclones

MR. Hung LCSD Area 19
Driving Range Tel: 2466 261

The Centre Manager or the shift supervisors should arrange appropriate actions to deal with various storm signal as specified below:

Typhoon signal	Actions	Remark
No.1	(i) inform the public via notices about the following:- - issuing of typhoon signal no.1. - closure of the centre once typhoon signal no.3 being issued. (ii) keep alert the change in weather condition. (iii) ensure all loose objects and equipment stored in a safe place.	
No.3	(i) inform the public via notices at the booking office and at the entrance of the centre about the following:- - issuing of typhoon no.3. - closure of the centre. (ii) arrange to lower down the LCSD supernet system and inform concern maintenance parties(EMSD) to standby. (iii) arrange disconnection or fastening of the safety net of the archery range. (iv) ensure all trees and litter bins being fixed. (v) evacuate all the users of the centre except those requiring counter services. (vi) keep alert the change in weather condition. (vii) take reasonable step to prevent the damage of properties. (viii) check the drainage to clear all blockage.	(i) booking counter remains open for - advance booking only - reallocation / refund application - user registration - public enquiry (ii) contract-out cleansing, horticultural maintenance & security services remain. (Note: if typhoon signal No.8 is lowered within 2 hrs of the end of staff duty hours, staff concerned are not required to reported on duty.)
No.8	(i) arrange the closure of the whole centre. (ii) arrange the public, all staff and centre workers to leave the centre safely. (iii) ensure power-off and the whole administrative block being locked.	(i) only the security guards left to man the centre. (ii) closure of the main gate is required.
Canceling of No.8 to No.3	(i) arrange to check and damage of properties injury, slope failure and any accident.	(i) all LCSD duty staff should return to the office as soon as possible. (within 2 hours under normal circumstances)
	(ii) prepare the typhoon damage report and report verbally to SM(OPU)2 immediately and send the written report within 24 hours. (iii) arrange to necessary repair and clearance of the damaging debris, plant debris, blockage of drainage and refuse. (iv) provide counter services only as Typhoon signal No.3 above.	(ii) all cleansing and horticulture maintenance service should be provided within 2 hours. (iii) staff serving the Pro Shop and General Restaurant should be on standby basis and to provide immediate services just after the canceling No.3 signal. (iv) all services to the public except the booking and enquiry services are still suspended.
Canceling of No.3	(i) arrange full services to the public. (ii) ensure the staff of Pro shop & General Restaurant to provide service at the same time.	(i) Centre Manager should report within 24 hours to SM(OPU)2 on any accidents, injury or arrange of facilities of the Centre caused by the tropical cyclone. (ii) Centre Manager should report within 20 hours to LM (T/L)NTW on any damaged trees after typhoon.

Annex IV(

Operational Guidelines for Staff of TMRSC on Rainstorm

The Centre Manager or the shift duty i/c should arrange appropriate actions during rainstorm as specified below:

Rainstorm Warning signal	Actions	Remark
Green	(i) check drainage as to remove any blockage materials. (ii) check the driving range to see whether the driving bays are still suitable for public use and arrange reallocation or suspend booking of affeced sessions if the driving bays are unsuitable to use. (iii) keep alert the change in weather condition.	
Amber	(i) check drainage as to remove any blockage materials. (ii) check the diving range to see whether the driving bays are still suitable for public use and arrange reallocation or suspend booking of affeced sessions if the driving bays are unsuitable to use. (iii) keep alert the change in weather condition. (iv) inform the public via notices about the following - the hoisting of "Amber" rainstorm warning signal. - Closure of the centre once "Red" rainstorm warning hoisted.	
Red	(i)&(iii) (v) arrange the closure of the centre and evaculate all users safely. (vi) keep alert on the stability of slopes. (vii) inform the public via the P.A. and the notice about the following - hoisting of "Red" rainstorm warning signal. - closure of the centre and suspension of all activities.	- users are allowed to stay indoors if they have difficulty in leaving the centre.
Black	(viii) arrange all staff to stay indoor. (ix) inform the public staying indoor via notices and the P.A about the following - hoisting of "Black" rainstorm warning signal. - closure of the centre and suspension of all activities.	- centre had been closed during "red" storm warning signal. - users are allowed to stay indoor if they have difficulty in leaving the centre. (Note: if the "Black" rainstorm signal is hoisted before the opening of the centre. all staff should stay at home or any other safe place.)
Lowering of Black	(x) check any damage of properties. injury. slope failure and any accident. (xi) report damage verbally to SM(OPU)2 immediately and then send written report within 24 hours. (xii) arrange necessary repair and clearance of debris and refuse.	- all centre duty staff should return to the office as soon as possible (within 2 hours under normal circumstances) if the condition of note(I) above occurs. - Centre Manger should report within 24 hours to SM(OPU)2 on any accidents. injuries and damages of facilities of the Centre caused by the rainstorm. - Centre Manager should report within 20 hours to LM (T/L)NTW on any damaged trees after canceling of rainstorm signal.

By fax C Post

(11)

MEMO

From Director of Environmental Protection
Ref. *in* EP 184/06/B/10-01
Tel. No. 2872 1803
Fax. No. 2591 6662
Date 29 August, 2003

To **SGE/NTE, GEO,CED**
(Attn: Mr.KY Tang / Y.K. Ho)
Your Ref. (L) *In* GCME 2/B 15/8
Dated 25.6.2003 *Fax. No.* 2714 0245
Total Pages 2

Recreational Afteruse Proposals in Tseung Kwan O (Stage II/III) Landfill
Notes of meeting on 27.8.03

Subsequent to the meeting held on 27.8.03 concerning the captioned issue, please find the attached notes of meeting for your reference.

2. To elaborate the briefing presented in the meeting, I shall prepare a set of information paper summarizing the details of the proposed recreational afteruse and EPD's undetaking for your further consideration.

(Lawrence SH Cheung)
Senior Environmental Protection Officer
For Director of Environmental Protection

Encl.

c.c. BVHKL (Attn: Mr. Tony Chen fax no. 2601 3988)

Recreational Afteruse Proposals in Tseung Kwan O (Stage II/III) Landfill
Notes of meeting on 27.8.2003 at GEO

Present:		
	Mr. KY Tang	SGE/NTE, GEO
	Mr Tong YK Ho	GE/NTE2, GEO
	Mr. Vitus MC Chan	SGE/Planning &Terrain Evaluation,GEO
	Mr. Eric KS Fung	GE/Planning & Terrain Evaluation 2,GEO
	Mr. Lawrence SH Cheung	S(FD)3/EPD
	Mr. PL Ip	E(FD)7/EPD

1. The meeting was held to discuss the proposed afteruse activites in the restored Tseung Kwan O (Stage II/III) Landfill and the geotechnical assessment recently prepared by Black & Veatch Hong Kong Limited.

2. In view of the shortage of recreational space in Tseung Kwan O Town, EPD was under pressure to open the restored landfills to the public. EPD briefed GEO on the recreational proposal from Hong Kong Air Cadet Corp (HKACC), which will include an access to the upper platform to play model aeroplane. From the current preliminary estimation, only about 4 to 8 vehicles will be involved and no structures will be installed on the platform. EPD confirmed that stringent safety measures could be imposed on the users if the application was found acceptable in principle.

3. Subsequent to a series of discussion, the following issues were agreed in principle:

   (i) The model aeroplane flying activity would be confined in the top platform +140 mPD except for the eastern corner in view of the risk of channelised debris (detailed layout plan will be provided separately);
   (ii) Regarding the potential risk at the downhill slope, users would be forbidden to walk on the slope i.e. picking up their descended aeroplane, and delegates from the restoration contractor will be deployed to assist the users;
   (iii) No structure would be installed on the platform +140 mPD; the restoration contractor would provide space somewhere within the site area for storage purposes;
   (iv) EPD would consider to complete stabilisation works to the two boulders at the uphill slope;
   (v) Regarding the potential risk of the access road, EPD would establish some safety procedures with the restoration contractor and HKACC. These procedures would include:

      * closure of the site during inclement weather;
      * some kinds of traffic management to be established for the use of the access road;
      * regular safety briefings to their cadets instructors to be established;
      * strict control on the number of vehicles to use the access road;
      * insurance on their personnel due to the risk of land slide;

   (vi) GEO advised that the golf driving range in Tuen Mun Area 19 had similar potential risk of landslide; LCSD had established some safety procedures for which EPD could make reference;

4. EPD will prepare a set of information paper summarizing the details of the proposed recreational afteruse and EPD's undertaking in the future management for GEO/CED's further consideration.

GEO_HKACC.doc

Appendix C

Previous NTHS Report 2023

Natural Terrain Hazard Study Report for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

January 2023

The Hong Kong Jockey Club
LOD Hong Kong Limited
Modern Consulting Engineers Limited

Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

Natural Terrain Hazard Study Report

Revision 0

Consultant Team:

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Tel: (852) 9383 5505

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Revision Schedule:

Rev	Date	Details	Prepared by	Reviewed by	Approved by
0	18 Jan, 2023	First Submission	H.Y.Yeung	H.S.Tsang	George Lo
1	15 Mar, 2023	Second Submission	H.Y.Yeung	H.S.Tsang	George Lo

Prepared by: ______________________
Esther, H.Y. Yeung

Reviewed by: ______________________
Calvin, H.S.Tsang

Approved by: ______________________
George Lo

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FOR INTERNAL EPD / HKJC USE ONLY

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Appendix A	Ground Investigation Records
Appendix B	Detailed Aerial Photograph Interpretations
Appendix C	Drainage Line Records
Appendix D	Debris Mobility Modelling
Appendix E	Unstable Boulders Extracted from the Boulder Survey Report
Appendix F	Boulder Fall Modelling

Abbreviations

B&V	Binnie Black & Veatch Hong Kong Limited
CDV	Completely Decomposed Volcanic
EPD	Environmental Protection Department, Hong Kong SAR Government
FOS	Factor of Safety
HAB	Home Affairs Bureau, Hong Kong SAR Government
HDV	Highly Decomposed Volcanic
ha	Hectare
HKJC	The Hong Kong Jockey Club
kPa	Kilopascal
LLDPE	Linear Low Density Polyethylene
PD	Principal Datum
PRS	Public Riding School
RDA	Riding for the Disabled Association
TKO	Tseung Kwan O
Stage II/III	Tseung Kwan O Stage II/III Landfill site

Executive Summary

A new public riding school is proposed to be constructed on Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III) by the Hong Kong Jockey Club (HKJC). A natural terrain hazard study was carried out with respect to the natural hillside located to the northeast of the proposed development site.

The natural terrain hazard assessment was carried out based on guidelines given in GEO Report No.138 2nd edition (GEO, 2016), by reviewing the topography, geomorphology, landslide susceptibility and landslide history of the NTSA. Results of the assessment showed that there is potential Open Hillslope Landslide (OHL), Debris Flow (DF) and Channelized Debris Flow (CDF) hazards from the NTSA.

Debris mobility modelling has been carried out to simulate the potential design event. The results revealed that the modelled debris will not reach the proposed facilities. Following the results from the assessment, mitigation works for the potential natural terrain hazard is considered not necessary for the proposed new public riding school. The 'No-build Zone' recommended in the previous study in 2004 was reviewed and based on the current updated landslide debris mobility modelling, no landslide debris could run beyond the lower boundary of the "No-build Zone" and therefore, as a conservative and safe approach, it is recommended to keep the "No-build Zone" for the site formation design in the later stage.

Although the results from the NTHS showed that there is no significant risk of boulder fall hazard presence within the NTSA, there are a total number of six (6) boulders with low to medium stability which were identified from the site-specific boulder survey. Having said that these 6 nos. of boulders are resting on gentle slopes ranged from 30-35°. It is not considered to have immediate danger and significant risk of boulder fall hazard. These boulders could travel further downslope in the foreseeable future if severe soil erosion occurred beneath the boulders. Among these six (6) boulders, two (2) of them are located at the "Green Belt" Zone whereas the other four (4) are located at the Clear Water Bay Country Park zone. The two (2) boulders at the "Green Belt" Zone are recommended to be removed or in-situ stabilized by rock dowels as a precautionary measures; and no mitigation for the four (4) boulders within the Clear Water Bay Country Park is proposed as they could be either caught up by the existing concrete catchwater channel at the toe of the NTSA or deposited before reaching the low density traffic access road (Group 4 facility).

1 Introduction

1.1 General

1.1.1 A public riding school is proposed to be constructed at the restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III), Tseung Kwan O, New Territories (under Government Land Allocation, GLA-TSK 500, 847019E 817245N). A natural terrain hazard study was carried out with respect to the natural hillside located to the northeast of the proposed development site. This report documented the findings of the natural terrain hazards aroused from the natural hillside and the necessary mitigation measures to be carried out.

2 Site Description

2.1 Site Location

2.1.1 The Site (the Upper Platform) which are located on a very gentle man-made fill slope (<10°) at Tseung Kwan O is defined as the area for the proposed public riding school development. The Site is overlooking by natural terrains at its north-eastern side. The natural terrain study area (NTSA) overlooking the proposed public riding school was delineated in **Figure 1, Plate 1** and **Plate 2**. According to Catchment Classification stated in GEO Report No. 138 2nd Edition (GEO, 2016), the NTSA has been divided into sixteen hillside catchments based on their topographic characteristics, for simplicity these have been labelled as OH1 to OH5, TD1 to TD8, CD1 to CD3 in this report (**Figure 1**).

2.1.2 The NTSA is a natural open hillside consist of five main drainage lines and five sub-ordinate drainage lines. The majority of the NTSA is covered with dense vegetation and is within the Clear Water Bay Country Park. The hillslope is generally facing southwest above Wan Po Road.

2.2 Initial Screening

2.2.1 An initial screening exercise has been carried out to assess whether the proposed development falls within the "In-principle Objection Criteria" or the "Alert Criteria" with respect to the concerned natural terrain according to the guideline given in GEO Report No. 138 2nd Edition. The potential hillside catchments that may affect the proposed development has been delineated based on the 1:1000 topographic map and is presented in **Figure 2**. The angular elevations projected from the hillside catchment to the location of the proposed public riding school were measured. The angular elevations of each catchment are summarised in **Table 2.1**. Graphical presentations of the angular elevation are presented in **Figure 2**.

Table 2.1 Summary of Angular Elevation for Initial Screening

Catchment Nos.	Profile Section Nos.	Corresponding Toe Facilities	Facility Group	Angular Elevation (°)
OH1	Section C1	Open space area Note 1	Group 4	32
TD1	Section C2	Open space area	Group 4	22
TD2	Section C3	Open space area	Group 4	27

TD3	Section C4	Grazing Area Note 2	Group 4	24
TD4	Section C5	Grazing Area	Group 4	24
TD5	Section C6	Paddock Note 3	Group 4	24
TD6	Section C7	Paddock	Group 4	20
CD1	Section C8	Paddock	Group 4	22
OH2	Section C9-1	Staff Resting Area	Group 1	18
	Section C9-2	Stable block	Group 3/4	22
CD2	Section C10	Stable block	Group 3/4	23
OH3	Section C11	Office/Changing Room	Group 1	24
CD3	Section C12	Paddock	Group 4	23
OH4	Section C13	Paddock	Group 4	28
TD7	Section C14	Road with low traffic density Note 4	Group 4	31
OH5	Section C15	Road with low traffic density	Group 4	30
TD8	Section C16	Road with low traffic density	Group 4	27

Remarks:
Note 1: Open Space Area refers to the general outdoor open-air space at the Upper Platform.

Note 2: Grazing Area is used for horses to get sunshine, fresh air and exercise where sufficient space shall be provided for each horse during occupation. Limited numbers of horses are expected inside the Area at each time. Therefore, in our option, Grazing Area can be considered as lightly-used open-air reactional area.

Note 3: Paddock is an open-air space fenced off for riding activities. Limited numbers of horses and riders are expected inside the Paddock for each riding session. Therefore, in our option, Paddock can be considered as lightly-used open-air reactional area.

Note 4: Traffic to the Upper Platform is restricted due to limited capacity of existing access road. All the public traffic will be stopped at the entrance area of the Site. Only emergency vehicles, small utility vehicles and shuttle buses for students are allowed to access the

Platform. Therefore, in our option, the access road within the Upper Platform can be considered as road with low traffic density.

2.2.2 The measured angular elevations of each catchment from the NTSA to the proposed public riding school are generally measured in between 20° and 32°, except section C9-1 has only 18°. Most of the hillside catchments satisfied the “Alert Criteria”. Given the proposed facilities are generally belong to Group 4, except the staff resting area and office are belong to Group 1, according to the GEO Report No. 138, Group 4 facilities normally do not require natural terrain hazard study. However, for a holistic approach, a natural terrain hazard assessment is to be carried out for the entire NTSA.

2.2.3 Apart from the Upper Platform, the proposed public riding school also consists of two proposed Platforms, namely the Middle Platform and the Lower Platform at about +40 mPD and +10 mPD respectively (**Figure 2.1**). The measured angular elevations from the natural hillsides to the Middle and Lower Platforms are below 20 degrees, i.e. not satisfy the “Alert Criteria” and therefore, natural terrain hazard study is not required for these two Platforms.

2.2.4 Moreover, in view of the Middle Platform, given there is an existing concrete catchwater channel (2.5m wide) located at the toe of the natural hillsides to the southeast of the Platform. If there is landslide debris originated from the natural hillsides, the debris will likely to be caught up and diverted away from the platform by the catchwater channel towards the southwest downslope direction.

3 Desk Study

3.1 Topography

3.1.1 The general topography of the NTSA was reviewed based on the latest 1:1000 scale topographical map. The maximum altitude of the NTSA is about +343 mPD and its toe is at about +126 mPD. The elevation different between the toe and the crest of the NTSA is about 217 m. A slope angle map has been generated for the NTSA based on the 1:1000 topographic map with the aid of the software ArcGIS (**Figure 3**). As shown in the slope angle map, relative gentle slopes which lies <20° are mainly located at the ridge and spurs along the boundaries of the NTSA; whilst most of the hillslopes within the NTSA lie between 25° to 35° with locally relatively steep terrain (35-50°) near the northeast top of the NTSA.

3.2 Geological Maps

3.2.1 The geology of the NTSA is shown on the Hong Kong Geological Survey (HKGS) Map Sheet 12 (Clear Water Bay), 1:20,000-scale HGM20 series, 1989 Edition I. The local geology of the NTSA is presented in **Figure 4**.

3.2.2 Solid Geology

3.2.3 The 1:20,000 scale geological map sheet 12 shows that the NTSA is underlain by four types of solid geology. Fine ash crystal Tuff of the High Island Formation (JHI) underlain along the crest of the NTSA. The upper portion of the NTSA is underlain by fine ash Tuff of the Clear Water Bay Formation (fa). The middle portion of the NTSA is comprise of Trachydacite and Rhyolite lava of the Clear Water Bay Formation (JCB). The lower portion of the NTSA is underlain by fine ash Tuff of the Clear Water Bay Formation (fa) and Trachydacite lava of the Ta Miu Wan Member of the Clear Water Bay Formation (Jmw). All these formations are belonged to the Repulse Bay Volcanic Group formed in Upper Jurassic of Mesozoic.

3.2.4 Superficial Geology

3.2.5 Majority of the NTSA does not indicate superficial deposit on the 1:20,000 scale geological map which implies the superficial deposits within the NTSA is less than 2m thick; only a tiny area of Pleistocene to Holocene Debris flow deposits (Qd) was indicated at the northern portion of Catchment No CD3.

3.2.6 Structural Geology

3.2.7 No faults or any photo-lineament has been recorded within the NTSA. However, a northwest trending inferred fault is present at about 80m away from the north of the NTSA.

3.3 GASP

3.3.1 The Geotechnical Area Studies Programme (GASP) comprised a systematic geotechnical information and assessment for land management and development planning of the Territory of Hong Kong. The findings were based on terrain classification techniques using aerial photographs, examination of geotechnical data collected from existing site investigation records and available literature and field reconnaissance. The study was based on the bedrock geology given on the 1:50,000 scale geological map produced by Allen & Stephens (1971) 'Report on the Geological Survey of Hong Kong', which has subsequently been superseded. The following are extracts from the relevant GASP report (GASP Report VII, Clear Water Bay, 2nd Edition, 1988).

3.3.2 Physical Constraints Map – This map has indicated the majority of the NTSA is covered by zones of general instability associated with predominantly insitu terrain. A small portion of area traversed along the top to the bottom of Catchment No. CD3 has been classified as zones of colluvium which are subject to overland flow and periodic inundation; and evidence of unusual groundwater regime. Toe of Catchment Nos. CD3 and OH4, and the crest of Catchment No. CD3 are recorded as slopes on insitu terrain which are generally steeper than 30°.

3.3.3 Engineering Geology Map – This map indicates that the majority of the NTSA is covered by mainly banded acid lavas and some welded Tuffs with general instability, whilst the upper portion of Catchment No. CD3 is underlain by acid lavas. A small portion of Catchment No. CD3 is covered by colluvium.

3.3.4 Geotechnical Land Use Map – This map indicates that the majority of the NTSA is designated as Class IV, which has extreme geotechnical limitations and has very high engineering cost for development. Toe of Catchment Nos. CD3 and OH4, and the crest of Catchment No. CD3 are classified as Class III, which has high geotechnical limitations and has high engineering cost for development. Part of Catchment No. CD3 is recorded as Class II, which has moderate geotechnical limitations and has normal engineering cost for development.

3.4 Enhanced Natural Terrain Hazard Landslide Inventory

3.4.1 In 1995, the GEO compiled the Natural Terrain Landslide Inventory (NTLI) from an interpretation of high-altitude (8,000ft and above) aerial photographs dated from 1945 to 1994 (King, 1999). In 2007, the GEO produced an Enhanced Natural Terrain

Landslide Inventory (ENTLI) using low-altitude (8,000ft and below) aerial photographs to update the NTLI.

3.4.2 In accordance with GEO Report No. 138 2nd Edition (GEO, 2016), landslides are classed as either “Relict” or “Recent”, depending on their appearance in aerial photographs. “Relict” landslides are defined as those where the main scarp is well-defined but vegetation has re-established on the scar on the earliest set of available aerial photographs. “Recent” landslides are defined as having occurred within the timespan of the aerial photograph coverage. These are typically identified as having a light tone on the aerial photographs and are bare of vegetation.

3.4.3 Three ENTLI records have been recorded within the NTSA and one ENTLI has been registered at the boundary of the NTSA (**Figure 5.1**). Three relict landslide scars (12SWA0004E, 12SWA0005E and 12SWA0220E) are marked at the crest of Catchment No. CD3. ENTLI No. 12SWA0341E is recorded at the NTSA boundary at upper portion of Catchment No. CD3.

3.4.4 Four ENTLI records are indicated in the close vicinity of the NTSA. Three ENTLIs, namely 12SWA0006E, 12SWA0007E and 12SWA0339E were located approximately 9m to 37m to the east of the upper portion of Catchment No. CD3, whilst another ENTLI No. 12SWA0273E is located 21m to the south of the middle portion of Catchment No. TD8 (Figure 5.1).

3.4.5 Two relict (12SWA0198E and 12SWA0199E) and one recent (12SWA0378E) ENTLI records are registered below the NTSA (**Figure 5.1).**

3.4.6 In addition, ten relict ENTLI records are registered adjacent to Catchment No. OH1 (**Figure 5.2**); twenty-one ENTLI records (18 relict and 3 recent landslides) are recorded in the catchment adjacent to Catchment No. TD8 (**Figure 5.3**). Among these ENTLI records, 20 of them were formed as man-made fill slopes afterwards.

3.4.7 The ENTLI recorded within and in the vicinity of the NTSA were summarised below in **Table 3.1.**

Table 3.1 Summary of Natural Terrain Landslide Events Recorded in ENTLI

ENTLI No.	Location	Recent / Relict	ENTLI Relict Landslide Class	Year of Photo	Landslide Type	Source Gradient (°)	Width (m)	Source Length (m)	Head Elevation (mPD)
12SWA0004E	At crest of Catchment No.	Relict	Rounded Scarp	1963	R	31	14	21.5	302

ENTLI No.	Location	Recent / Relict	ENTLI Relict Landslide Class	Year of Photo	Landslide Type	Source Gradient (°)	Width (m)	Source Length (m)	Head Elevation (mPD)
	CD3		(50% certain)						
12SWA0005E	At crest of Catchment No. CD3	Relict	Sharp Scarp (80% certain)	1963	R	42	12	11	314
12SWA0220E	At crest of Catchment No. CD3	Relict	Depression related to drainage line (10% certain)	1963	R	34	12	10	306
12SWA0341E	At the NTSA boundary at upper portion of Catchment No. CD3	Relict	Rounded Scarp (50% certain)	1963	R	49.5	11	11.5	294
12SWA0006E	9m to the east of the upper portion of Catchment No. CD3	Relict	Rounded Scarp (50% certain)	1963	R	45.5	12	7.5	303
12SWA0007E	24m to the east of the upper portion of Catchment No. CD3	Relict	Rounded Scarp (50% certain)	1963	R	38	13.5	9.5	305
12SWA0339E	37m to the east of the upper portion of Catchment No. CD3	Relict	Rounded Scarp (50% certain)	1963	R	40.5	11	9.5	287
12SWA0273E	21m to the south of the middle portion of Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	49	12	7.5	207
12SWA0198E	52m below Catchment No. TD4	Relict	Sharp Scarp (80% certain)	1963	R	-	7	13	-
12SWA0378E	102m below Catchment No. OH1	Recent	-	1975	Open Hillslope Landslide	-	5	8	-
12SWA0199E	165m below Catchment No. OH2	Relict	Depression related to drainage line (10% certain)	1963	R	-	7	14	-
12SWA0195E	178m adjacent to Catchment No. OH1	Relict	Depression related to drainage line (10% certain)	1963	R	-	7	9	-

ENTLI No.	Location	Recent / Relict	ENTLI Relict Landslide Class	Year of Photo	Landslide Type	Source Gradient (°)	Width (m)	Source Length (m)	Head Elevation (mPD)
12SWA0196E	190m adjacent to Catchment No. OH1	Relict	Broad depression (10% certain)	1963	R	-	16	7	-
12SWA0197E	215m adjacent to Catchment No. OH1	Relict	Broad depression (10% certain)	1963	R	-	8	10	-
12SWA0272E	229m adjacent to Catchment No. OH1	Relict	Broad depression (10% certain)	1963	R	-	8	7	-
12SWA0017E	261m adjacent to Catchment No. OH1	Relict	Depression related to drainage line (10% certain)	1963	R	-	9	10.5	-
12SWA0018E	298m adjacent to Catchment No. OH1	Relict	Rounded Scarp (50% certain)	1963	R	-	14	13.5	-
12SWA0194E	307m adjacent to Catchment No. OH1	Relict	Rounded Scarp (50% certain)	1963	R	-	9	11.5	-
12SWA0019E	314m adjacent to Catchment No. OH1	Relict	Rounded Scarp (50% certain)	1963	R	-	10	10	-
12SWA0021E	343m adjacent to Catchment No. OH1	Relict	Rounded Scarp (50% certain)	1963	R	-	9.5	11.5	-
12SWA0020E	344m adjacent to Catchment No. OH1	Relict	Rounded Scarp (50% certain)	1963	R	-	6	10.5	-
12SWA0068E	188m adjacent to Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	50	14	20	195
12SWA0069E	238m adjacent to Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	32.5	15	15	196
12SWA0184E	272m adjacent to Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	39	12	13.5	195
12SWA0187E	259m adjacent to Catchment No. TD8	Relict	Broad depression (10% certain)	1963	R	-	28	13	-

ENTLI No.	Location	Recent / Relict	ENTLI Relict Landslide Class	Year of Photo	Landslide Type	Source Gradient (°)	Width (m)	Source Length (m)	Head Elevation (mPD)
12SWA0188E	262m adjacent to Catchment No. TD8	Relict	Broad depression (10% certain)	1963	R	-	18	11.5	-
12SWA0183E	408m adjacent to Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	42	10	12	186
12SWA0186E	311m adjacent to Catchment No. TD8	Relict	Sharp Scarp (80% certain)	1963	R	-	8	8.5	-
12SWA0185E	302m adjacent to Catchment No. TD8	Relict	Rounded Scarp (50% certain)	1963	R	-	14.5	11	-
12SWA0182E	399m adjacent to Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	45.5	9	7.5	121
12SWA0330E	436m adjacent to Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	37	8.5	10	141
12SWA0329E	418m adjacent to Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	43	8	8	116
12SWA0181E	457m adjacent to Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	47	9	11	137
12SWA0376E	415m adjacent to Catchment No. TD8	Recent	-	1973	Open Hillslope Landslide	-	4	6	-
12SWA0328E	378m adjacent to Catchment No. TD8	Relict	Rounded Scarp (50% certain)	1963	R	-	7	10.5	-
12SWA0180E	453m adjacent to Catchment No. TD8	Relict	Rounded Scarp with debris (80% certain)	1963	R	-	12	12	-
12SWA0380E	477m adjacent to Catchment No. TD8	Recent	-	1975	Channelised Debris Flow	29.5	8	12	97
12SWA0377E	534m adjacent to Catchment No. TD8	Recent	-	1973	Open Hillslope Landslide	39.5	8	6	106

ENTLI No.	Location	Recent / Relict	ENTLI Relict Landslide Class	Year of Photo	Landslide Type	Source Gradient (°)	Width (m)	Source Length (m)	Head Elevation (mPD)
12SWA0015E	634m adjacent to Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	34	15	21.5	141
12SWA0179E	647m adjacent to Catchment No. TD8	Relict	Depression related to drainage line (10% certain)	1963	R	38.5	18	16.5	136
12SWA0178E	647m adjacent to Catchment No. TD8	Relict	Rounded Scarp (50% certain)	1963	R	43.5	14	15.5	122
12SWA0016E	668m adjacent to Catchment No. TD8	Relict	Sharp Scarp (80% certain)	1963	R	29.5	15	19	114

3.5 Historical Landslide Catchment (HLC) Inventory

3.5.1 Historical Landslide Catchments (HLCs) have been defined by GEO based on the results of the ENTLI. No HLC is recorded within the NTSA and in the vicinity of the NTSA.

3.6 Hillside Pockets

3.6.1 Hillside pockets are form of natural hillside catchment which have been affected by human disturbance to varying degree (e.g. construction of roads or building platforms). GEO has compiled an inventory of Hillside Pockets for the whole Hong Kong (GEO Report No. 138, Second Edition).

3.6.2 Under the Hillside Pockets Inventory, there is no registered Hillside Pockets within or in the vicinity of the NTSA.

3.7 Reported Landslide Incidents

3.7.1 No landslide incidents recorded within the NTSA. Five incidents recorded below the NTSA (**Figure 5.2**). Details of the incident records are summarised below in **Table 3.2**.

Table 3.2 Summary of Reported Landslide Incidents

Incident No.	Location	Occurrence Slope No.	Failure Type	Failure Volume (m3)

NT82/226	220m below Catchment No. OH3	12SW-A/F72	Soil cut	<50
NT82/233	424m below Catchment No. OH2	12SW-A/F68	Retaining wall	<5
NT82/232	374m below Catchment No. TD2	12SW-A/F69	Retaining wall	<5
NT82/225	403m below Catchment No. TD2	12SW-A/F69	Soil cut	0
NT82/224	408m below Catchment No. TD2	12SW-A/F69	Soil cut	<50

3.8 Boulder Field Inventory

3.8.1 The Boulder Field Inventory is a boulder study of the whole territory of Hong Kong including a series of study reports and 1:20,000 maps. The study was based on the use of the 1963 low altitude aerial photographs.

3.8.2 Four main attributes (Percentage Area Covered, Boulder Type, Boulder Size and Boulder Shape) and additional attributes are defined for the boulder study. Multiple Attribute Mapping was adopted to define areas of land having a relatively uniform pattern of boulder deposits and the results were mapped on 1:20,000 topographic maps of Hong Kong.

3.8.3 The Boulder Field Inventory was compiled by MGSL. The inventory contains referenced polygons encompassing individual boulder fields. According to the inventory, the NTSA is located within polygon nos. S12_44, S12_53, S12_54, S12_55, S12_263, S12_272, S12_273 and S12_C. The distribution of each polygon is present in **Figure 6**. The data represent each boulder number are summarised below in **Table 3.3**.

Table 3.3 Summary of Boulder Field Inventory

Polygon No.	Boulder Type	% of area covered by boulders	% of boulder <1m	% of boulder 1-2m	% of boulder 2-5m	% of boulder >5m	Boulder Shape
S12_44	corestone or tor	<10%	20	20	40	20	angular
S12_48	colluvial boulder field	10-20%	50	30	20	0	angular
S12_49	colluvial boulder field	10-20%	0	0	100	0	angular
S12_53	cliff or rock	20-50%	10	30	60	0	angular

Polygon No.	Boulder Type	% of area covered by boulders	% of boulder <1m	% of boulder 1-2m	% of boulder 2-5m	% of boulder >5m	Boulder Shape
	outcrop						
S12_54	cliff or rock outcrop	20-50%	10	20	40	30	angular
S12_55	corestone or tor	<10%	0	20	80	0	angular
S12_58	corestone or tor	<10%	100	0	0	0	angular
S12_248	land surface obscured by vegetation						
S12_263	cliff or rock outcrop	>75%	0	0	0	100	angular
S12_264	colluvial boulder field	<10%	0	100	0	0	angular
S12_269	colluvial boulder field	50-75%	20	30	10	40	angular
S12_270	colluvial boulder field	<10%	0	20	30	50	angular
S12_272	corestone or tor	20-50%	40	20	20	20	angular
S12_273	corestone or tor	<10%	30	40	30	0	angular
S12_C	land surface obscured by cloud						

3.9 Previous Ground Investigation

3.9.1 Previous ground investigations include 6 boreholes, 5 trial pits and 14 slope strippings were carried out within the NTSA. The locations of these previous ground investigation stations are present in **Figure 7**, corresponding logs are given in **Appendix A**.

3.9.2 The boreholes located within the NTSA including 12880/BH17, 12880/BH18, 21370/NM7, 21370/NM8, 36093/DH6 and 36093/DH7, which are located at the toe of the NTSA. These six boreholes revealed 0.72m to 12.65m thick of saprolite layer overlying moderately to slightly decomposed Tuff or Trachydacite Lava. Five trial pits, namely 36093/TP6, 36093/TP7, 36093/TP7A, 36093/TP8 and 36093/TP12 are located at the lower portion of the NTSA. These five trail pits revealed 0.22m to 1.1m thick of colluvium layer overlying 0.85m to 2.35m thick of saprolitic soil derived from Tuff or Trachydacite Lava. Fourteen slope strippings at the toe of the NTSA also revealed the cut slope surfaces are predominately in-situ materials with locally 0.6m to 3.9m colluvium exposed on the upper portions the cut slopes.

3.10 Existing Facilities

3.10.1 No existing facility is located within the NTSA.

3.11 Registered Man-made Slopes

3.11.1 Eight man-made slopes are recorded within or in the close vicinity of the NTSA. Features formed along the toe of the NTSA, namely 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188. In addition, four man-made features are registered below the NTSA, namely 12SW-A/C227, 12SW-A/F72, 12SW-A/F73 and 12SW-A/F74. The locations of the man-made features are provided in

Figure 8. The details of the registered man-made slopes are summarised below in **Table 3.5**. Neither Stage 2 nor Stage 3 Study has been carried out for these registered man-made slopes.

Table 3.5 Summary of the Registered Man-made Slopes

Feature No.	Location	Registered Date (dd/mm/ yy)	Average Angle (degree)	S2/S3 Study	Slope Upgrading Works	Checking Status/ Checking Certificate No.
12SW-A/C188	Along the toe of Catchment No. OH1	07/01/1998	45	Nil	Nil	Nil
12SW-A/C187	Along the toe of Catchment Nos. OH1 & TD1	07/01/1998	40	Nil	Nil	Nil
12SW-A/C186	Along the toe of Catchment Nos. TD1 & TD2 & TD3	07/01/1998	40	Nil	Nil	Nil
12SW-A/C185	Along the toe of Catchment No. TD3, TD4 & TD5	07/01/1998	45	Nil	Nil	Nil

Feature No.	**Location**	**Registered Date (dd/mm/ yy)**	**Average Angle (degree)**	**S2/S3 Study**	**Slope Upgrading Works**	**Checking Status/ Checking Certificate No.**
12SW-A/C184	Along the toe of Catchment Nos. TD5, TD6, CD1, OH2 & CD2	07/01/1998	70	Nil	Nil	Nil
12SW-A/C183	Along the toe of Catchment Nos. CD2, OH3 & CD3	07/01/1998	55	Nil	Nil	Nil
12SW-A/C182	Along the toe of Catchment Nos. CD3, OH4 & TD7	07/01/1998	50	Nil	Nil	Nil
12SW-A/C178	Along the toe of Catchment Nos. TD7, OH5 & TD8	07/01/1998	50	Nil	Nil	Nil
12SW-A/C227	Immediately below NTSA	14/02/2003	25	Nil	Nil	Nil
12SW-A/F73	Immediately below NTSA	07/01/1998	25	Nil	Nil	Nil
12SW-A/F74	Immediately below NTSA	07/01/1998	20	Nil	Nil	Nil
12SW-A/F72	200m below NTSA	07/01/1998	25	Nil	Nil	Nil

3.12 Previous Study

3.12.1 As part of a feasibility study for this project, a natural terrain hazard assessment was carried out by Binnie Black & Veatch Hong Kong Limited (B&V) in 2004. According to the report, a “No-build Zone” was devised based on the calculated debris runout distances using the conservative design event. The “No-build Zone” was defined as one meter further away from the calculated debris runout distance boundary, outside of which no development will be affected by any potential natural terrain hazards. The lower boundary of the “no-build zone” was shown in **Figure D1**.

4 Aerial Photograph Interpretation

4.1 General

4.1.1 In order to study the landslide history, geomorphology and engineering geology of the NTSA and its adjacent area, an aerial photograph interpretation (API) has been carried out using a total of 120 relevant aerial photographs taken between 1924 and 2021. Site development and geomorphology obtained from API are summarised below and list of aerial photographs being examined is provided in **Appendix B**.

4.2 Landslides

4.2.1 Natural Terrain Landslide History.

4.2.2 The landslide history for the NTSA was obtained from a series of aerial photographs between 1924 and 2021.

4.2.3 Landslides have been classified as “relict” and “recent”, in accordance with GEO Report No. 138 2nd Edition (GEO, 2016). “Relict” landslides are defined as the landslides first observed on the earliest set of available aerial photographs where vegetation has re-established and the scarp is not well defined due to degradation. While “recent” landslides are defined as the landslides first observed on the earliest set of aerial photographs where vegetation has not re-established. The volumes of the landslides are assessed base on the observation from API and calculation using the formula 1/6πD.W.L, which assumes that the failure was “spoon-shaped”.

4.2.4 Based on the findings from API, 4 relict landslide scars (RL1 to RL4) have been identified within the NTSA. No recent landslide scars can be identified within the NTSA. In addition, 35 relict and 4 recent landslide scars can be determined in the study region of the NTSA. Among all, RL5 to RL9, RL22 to RL24 are considered to have similar geological and geomorphological setting with the NTSA. A relevant landslide inventory for the NTSA has been developed based on API are summarised in **Table 4.1** below.

Table 4.1 Landslide Inventory for the NTSA Based on API Findings

Landslide Reference No.	ENTLI No.	Location	Recent / Relict	Year of Photo	Landslide Type	Estimated Width (m)	Estimated Source Length (m)	Estimated Source Volume (m^3)
RL1	12SWA0004E	At crest of Catchment No. CD3	Relict	1963	Relict	12	11	35

Landslide Reference No.	ENTLI No.	Location	Recent / Relict	Year of Photo	Landslide Type	Estimated Width (m)	Estimated Source Length (m)	Estimated Source Volume (m³)
RL2	12SWA0220E	At crest of Catchment No. CD3	Relict	1963	Relict	10	9	24
RL3	12SWA0005E	At crest of Catchment No. CD3	Relict	1963	Relict	7	11.5	29
RL4	-	At crest of Catchment No. CD3	Relict	1963	Relict	6	8	18
RL5	12SWA0341E	At the NTSA boundary at upper portion of Catchment No. CD3	Relict	1963	Relict	7.5	7	11
RL6	12SWA0006E	9m to the east of the upper portion of Catchment No. CD3	Relict	1963	Relict	8	7	12
RL7	12SWA0007E	24m to the east of the upper portion of Catchment No. CD3	Relict	1963	Relict	9	8	19
RL8	12SWA0339E	37m to the east of the upper portion of Catchment No. CD3	Relict	1963	Relict	11	13	37
RL9	12SWA0273E	21m to the south of the middle portion of Catchment No. TD8	Relict	1963	Relict	12	9.5	30
RL22	12SWA0068E	188m adjacent to Catchment No. TD8	Relict	1963	Relict	14	10	37
RL23	12SWA0069E	238m adjacent to Catchment No. TD8	Relict	1963	Relict	13	11	37
RL24	12SWA0184E	272m adjacent to Catchment No. TD8	Relict	1963	Relict	15	10	39
RC1	12SWA0376E	415m adjacent to Catchment No. TD8	Recent	1973	OHL	8.5	9	20
RC2	12SWA0377E	535m adjacent to Catchment No. T8	Recent	1973	OHL	10	9.5	25

Landslide Reference No.	ENTLI No.	Location	Recent / Relict	Year of Photo	Landslide Type	Estimated Width (m)	Estimated Source Length (m)	Estimated Source Volume (m³)
RC3	12SWA0378E	102m below Catchment No. OH1	Recent	1975	OHL	5	8	10
RC4	12SWA0380E	477m adjacent to Catchment No. TD8	Recent	1975	CDF	6	16	40

4.2.5 A break of slope and an incisive concave depression is observed near the head of ephemeral sub-ordinate drainage line DL4.2, possibly instability (RL1) had taken place. The estimated landslide volume of RL1 is about 35m^3. This location was possibly the ENTLI record no. 12SWA0004E. Another three concave depressions (RL2 to RL4) are discerned adjacent to RL1 which located at the crest of Catchment No. CD3. RL3 and RL4 are appeared as a spoon-shaped depression with distinct landslide trails whilst RL2 is a relatively subtle depression when compare with the other three landslides. RL3 and RL4 has an estimated failure volume of 29m^3 and 18m^3 respectively, whilst RL2 is about 24m^3. RL2 and RL3 are possibly the locations of ENTLI record Nos. 12SWA0220E and 12SWA0005E respectively. RL4 does not recorded in the ENTLI.

4.2.6 Four broad and shallow concave depressions are observed adjacent to the upper portion of Catchment No. CD3, possibly four landslide incidents (RL5, RL6, RL7 and RL8) were occurred. RL5 is located at the NTSA boundary, whilst another three depressions (RL6, RL7 and RL8) are apparent approximately 9m to 37m to the east of the upper portion of Catchment No. CD3. These four landslide scarps are unobvious observed which indicate probably have been degraded for a long period of time. The estimated failure source volume of these four landslides is about 11m^3 to 37m^3. They are possibly registered as ENTLI Nos. 12SWA0341E, 12SWA0006E, 12SWA0007E and 12SWA0339E.

4.2.7 A distinct break of slope and depression is discerned on the bank of an ephemeral drainage line located outside the NTSA, which located approximately 20m to the south of the middle portion of Catchment No. TD8, probably a landslide event (RL9) was happened previously. RL9 has a failure volume of about 30m^3 which is possibly the location of ENTLI No. 12SWA0273E.

4.2.8 Relict landslide scars, RL22, RL23 and RL24 located at about 200m to the south of TD8, are considered to have similar geological and geomorphological setting with the NTSA and their estimated failure volumes range from 37m^3 to 39m^3. All these landslide events are regarded as relict landslides.

4.2.9 In aerial photos of year 1973, two high reflectance concave depressions are discerned approximately 415m and 535m adjacent to Catchment No. TD8, bare soil without any vegetation is observed, probably recent landslides (RC1 and RC2) occurred recently. RC1 is located on a topographic depression whilst RC2 located on the bank of a drainage line, both of them appears as shallow depressions. The estimated failure volumes of RC1 and RC2 are about 20m³ and 25m³ respectively. These two locations are registered as ENTLI Nos. 12SWA0376E (RC1) and 12SWA0377E (RC2).

4.2.10 In aerial photos of year 1975, a very shallow depression is evident on an open hillslope at about 102m below Catchment No. OH1. It is highly reflective bare soil surface without any vegetation, possibly recent landslide RC3. The failure area is relatively small and therefore the estimated source volume is only about 10m³. This is probably the location of ENTLI No. 12SWA0378E. Another elongated depression is apparent along a drainage line which located approximately 477m adjacent to Catchment No. TD8. It is highly reflective, bare soil is observed, probably a channelized debris flow (RC4) was occurred very recently due to no vegetation is present. The source area is narrow but long in shaped, and it is relatively incisive when compares to RC3. RC4 has an estimated source failure volume of 40m³. This recent landslide event is registered as ENTLI No. 12SWA0380E.

4.3 Geomorphological Conditions

4.3.1 The geomorphological map of the NTSA was developed based on API and cross-checked with field mapping. Details of the geomorphological features, including the morphology based on the system of Savigear (1965) and the regolith types based on the regolith guideline (TGN 22) are presented in **Figure 9.1** for a regional view and **Figure 9.2 to Figure 9.4** for a close-up view and described below:

4.3.2 Morphology

4.3.3 Morphologically, the NTSA appears as a generally slightly concave, fan-shaped southwest facing hillsides emerging from a northwest trending ridge. The eastern and western boundary of the NTSA is bounded by sub-rounded spurs.

4.3.4 A relatively sharp convex change of slope is discerned immediately below the ridgeline which bounded the upper boundary of the NTSA. The convex change of slope is discerned at about +142mPD at Catchment No. OH1 and then extend up to +234mPD at Catchment No. CD3. Another distinct convex change of slope is apparent at approximately +228mPD which located along the upper portion of Catchment Nos. TD7, OH5 and TD8. These convex changes of slope demarcate the upper and middle slope terrain. The upper slope terrain comprises of gentle slope with gradient less than 20° whilst the transportation middle slope terrain comprises of relatively steeper slope with gradient lies in between 25° to 35°.

4.3.5 Regolith Types and Distribution

4.3.6 The smooth surface of the NTSA indicates the NTSA is probably covered by in-situ materials without significant mass wasting process, possibly a thin layer veneer (< 2m thick) of hillslope colluvium blanket the majority of the hillsides within the NTSA. Valley colluvium is confined along the drainage lines. Some boulder fields were deposited at the upper and middle portion of Catchment Nos. CD3, and also dispersed in the middle portion of Catchment Nos. OH4, TD7, OH5 and TD8. Many sub-angular to sub-rounded boulders were scattered across the NTSA.

4.3.7 Rock Outcrops

4.3.8 Minor intermittent rock outcrops are discerned at the crest of the NTSA which located at upper portion of Catchment Nos. CD3, OH5 and TD8.

4.3.9 Drainage Lines

4.3.10 No perennial drainage line can be discerned within the NTSA.

4.3.11 Ten linear hollows, possibly ephemeral drainage lines DLl, DL2, DL3, DL4 and DL5 and sub-ordinate ephemeral drainage lines DL4.1, DL4.2, DL4.3, DL4.4 and DL4.5 are observed in Catchment Nos. TD1, CD1, CD2, CD3, TD7 and TD8. Drainage lines DL1, DL2, DL3 and DL5 are present at the lower half portion of Catchment Nos. TD1, CD1, CD2 and TD8 respectively. DL4 contains five sub-ordinate drainage lines, namely DL4.1, DL4.2, DL4.3, DL4.4 and DL4.5. Main drainage line DL4 flows from the top of Catchment No. CD3 towards the bottom of Catchment No. CD3; sub-ordinates drainage line DL4.1 is discerned approximately 20m away from the top of Catchment No. CD3, whilst DL4.2, DL4.3 and DL4.4 are apparent at the upper, middle and lower portion of Catchment No. CD3 respectively. DL4.5 is located along Catchment No. TD7. These five southwest trending drainage lines are running towards the toe of the NTSA. Sub-ordinate drainage lines DL4.1, DL4.2, DL4.3 and DL4.4 are generally west trending and flowing towards DL4 which finally converge towards the toe of the NTSA. Sub-ordinates DL4.5 is apparent as an individual southwest trending drainage line flowing towards the toe of the NTSA. However, DL4.5 was converging towards DL4 below the NTSA. DL1 and DL5 appeared to be subtle depression, whilst DL2 and DL3 is relatively incisive, DL4 is the most distinctive. This probably indicates more water concentrate along DL4 and therefore the erosion of DL4 is more active than the other four drainage lines. Some boulders, probably colluvial boulders are concentrated along the middle section of DL4.

4.3.12 Topographic Depressions

4.3.13 Seven linear hollows were observed in Catchment Nos. TD2, TD3, TD4, TD5, TD6 and OH3. They are part of the head of ephemeral drainage lines or sub-drainage lines which located below the NTSA. Since they appeared as broad and subtle depressions, this indicate no water concentration and therefore the erosion activities are limited. These seven hollows within Catchment Nos. TD2, TD3, TD4, TD5, TD6 and OH3 can be degraded as minor topographic depressions, DP1 to DP7 in the engineering geomorphological map (**Figure 9.2**).

4.3.14 Erosion and sign of distress

4.3.15 No observable sign of erosion and sign of distress can be discerned within the NTSA.

4.3.16 Anthropogenic Features

4.3.17 No significant anthropogenic features are identified within the NTSA. Minor formation of footpaths, graves were evident within the NTSA since 1963.

4.3.18 In 1989, three highly reflective white spot features are discerned at the lower portion of Catchment Nos. TD5, OH2 and OH3. Bare soil is observed. The locations within Catchment Nos. OH2 and OH3 are possibly the Borehole locations of BH17 and BH18 under GIU No. 12800. The bare soil existed in Catchment No. TD5 appeared as rounded bare soil surface and thus likely created by anthropogenic activities, possibly inspection pits for the boreholes.

4.3.19 In between year 1990 to 1992, a linear feature, probably catchwater is aligned along the toe of the NTSA. Eight man-made cut slopes were formed along the toe of the NTSA, probably in association with the alignment of the catchwater. They were registered as Feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188. In additional, a cut slope was formed below Catchment Nos. TD7 and OH5, probably in association with the extension of the landfill site. This man-made slope was registered as Feature No. 12SW-A/C227. The Site area is being modified and formed as a cut slope.

4.3.20 No fill bodies can be discerned within the NTSA.

5 Fieldwork

5.1 General

5.1.1 Fieldwork included detailed geological and geomorphological mapping, which was cross checked with the API and existing geological data.

5.2 Field Mapping

5.2.1 In general, the findings from field mapping were consistent with aerial photography interpretations.

5.3 Regolith Mapping and Boulders

5.3.1 **Figure 9.2** illustrates the mapped regolith types within the NTSA which generally include saprolite, hillslope colluvium, valley colluvium, landslide debris, rock outcrops.

5.3.2 Saprolitic soil covered most of the gentle slopes along the spurs and ridges along the upper portion of catchment boundaries of Catchment Nos. OH1, TD1, TD2, TD3, TD4, TD5, TD6, CD1, CD2, OH3, CD3, TD7, OH5 and TD8. Saprolite typically consists of extremely weak, orange brown, dappled red, completely decomposed Trachydacite lava (Stiff, slightly sandy SILT with some gravel) and extremely weak, pinkish brown, slightly dappled white, completely decomposed fine ash Tuff (Firm to stiff, slightly sandy SILT with some gravel) (**Plate 3**):

5.3.3 Most of the open hillslopes within the NTSA were covered by a thin veneer of matrix supported hillslope colluvium, locally associated with colluvial boulders. The colluvium generally comprises firm, brown, dappled grey, sandy SILT with some subangular fine to coarse gravel, occasional cobbles and boulders sized rock fragments **(Plate 3)**.

5.3.4 Clast supported valley colluvium, consisting of subangular cobbles and boulders with sandy silt matrix was deposited and confined within the ephemeral drainages (**Plate 4**).

5.3.5 The extent of landslide debris was estimated from field observations based on the size of the degraded landslide scars and possible lobate features observed below the scars. Most of them were either being eroded away or covered by dense vegetation. The landslide debris identified below degraded relict landslide scars (RL1 to RL9) typically comprised firm, brown, sandy Silt with gravels and some cobbles/boulders.

5.3.6 Colluvial boulders were probably derived from exhumed corestones of fine ash Tuff, Trachydacite lava and Rhyolite lava. They are generally subangular to subrounded in shape, less than 2.0m diameter scattered across the NTSA (**Plate 5**). Many of them were concentrated and inter-locked along the ephemeral drainage lines. Others were either embedded in ground or deposited on the gentle slopes. According to the detailed boulder survey (Chung Shun, 2023), 405 nos. of boulders were recorded within the NTSA. The majority of the boulders were recorded with a high stability rating. 6 nos. of boulders were considered with low to medium stability which could travel further downslope by active soil erosion beneath the boulder in the foreseeable future. Having said that these 6 nos. of boulders are resting on gentle slopes ranged from 30-35°. It is not considered to have immediate danger and significant risk of boulder fall hazard. Details of the boulder survey are given in the separate "Boulder Survey Report".

5.4 Rock Exposures

5.4.1 Minor intermittent rock outcrops of moderately decomposed fine ash Tuff (JHI) (RO1) was mapped near the crest of Catchment No. CD3. The rockmass contains closely to medium spaced discontinuities. No adverse joint sets were identified within this outcrop (**Plate 6**).

5.4.2 Another 11 minor rock outcrops were mapped across the NTSA. Rock outcrops of moderately decomposed Trachydacite Lava (Jmw) (RO2 & RO3) were mapped at the upper portion of Catchment No. TD1 and the lower portion of Catchment No. TD4. Rock outcrops of moderately decomposed fine ash Tuff (fa) (RO4 & RO5) were mapped at the middle portion of Catchment No. TD7. Rock outcrops of moderately decomposed Trachydacite & Rhyolite Lava (JCB) (RO6, RO7, RO8, RO9, RO10, RO11 and RO12) were discerned at the upper portion of Catchment Nos. CD3, TD7, OH5 and TD8. The rockmass of RO2 to RO12 are massive and without any discontinuity.

5.4.3 All the rock outcrops mapped within the NTSA were less than 2m high. Given, no adverse joint sets were identified within these rock outcrops, rock fall is considered very unlikely to pose hazardous to the proposed development.

5.5 Natural Terrain Landslides

5.5.1 During API stage, a total of 9 relict (RL1 to RL9) potential landslide scars were identified within and in the close vicinity of the NTSA. Key features from API were targeted during mapping for field verification and the dimensions of these features were revised during field mapping. In some locations, however, relict landslide scars were not clearly defined due to overgrown shrub. In these locations the dimension of the relict landslide scars were estimated using the discernible topographic depressions and break of slopes.

5.5.2 Four relict landslides (RL1, RL2, RL3 and RL4) were identified at the upper portion of Catchment No. CD3. RL1 has a rounded scarp and shallow (Plate 7). It has a failure volume of 39m³. RL2 has an imperceptible scarp and the failure depth is subtle, therefore the certainty of RL2 is relatively low (Plate 8). It has an estimated failure volume of 27m³. RL3 has a distinctive sharp scarp and the failure depth is relatively incisive which has a failure volume of 32m³ (Plate 9). Location of RL4 is not registered as ENTLI and was identified during API. It has a rounded scarp, but the depression is shallow. It is a relatively small-scale landslide which failure volume is only 13m³ (**Plate 10**).

5.5.3 Another four relict landslides (RL5, RL6, RL7 and RL8) were discerned at the upper portion of the adjacent catchment of Catchment No. CD3. These four relict landslide events have distinctive rounded scarp, RL5, RL6 and RL7 are relatively incisive whilst RL8 is shallow (**Plate 11 to 14**). The estimated failure source volume of RL5, RL6, RL7 and RL8 are 27m³, 20m³, 11m³ and 36m³ respectively.

5.5.4 The slope instabilities of RL1 to RL8 are located on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and middle slope. This failure probably part of the hillside retreat process.

5.5.5 One relict landslide (RL9) is apparent near the head of a drainage line within the incising terrain which located adjacent to Catchment No. TD8. The slope instability could relate to retrogressive stream head erosion process. The failure volume of RL9 is 14m³ (**Plate 15**).

5.6 Drainage Line Characteristics

5.6.1 Ephemeral drainage line DL1 is a relatively short, small and subtle drainage line. It is located along Catchment No. TD1. It was dry during field mapping. The width and depth of DL1 is generally less than 2.7 m and 0.3-0.5 m respectively. The channelization ratios (CRs) of the drainage line are between 5 and 9. The drainage line is inclined at only at about 18-23°. The drainage line is covered by matrix supported hillslope colluvium. DL1 has a relatively broad channelization ratio and absent of clast supported valley colluvium suggested that even if slope failure occurred, the hazard is more likely to be debris flow.

5.6.2 Ephemeral drainage line DL2 is a relatively longer drainage line compared to DL1. It is located at the middle and lower portion of Catchment No. CD1 and was also dry during field mapping. The width and depth of DL2 is generally less than 3.7m and 0.9m respectively. The channelization ratios (CRs) of the drainage line are range in between 2.5 to 4.4, the upper most section of DL2 has a CR of 7.4. The inclination of the steam bed of DL2 lies in between 15 to 35°, locally up to 40°. Clast supported valley colluvium consisting of subangular cobbles and boulders with sandy silt matrix was accumulated along the drainage line.

5.6.3 Ephemeral drainage line DL3 has similar length as DL2. It is located at the middle and lower portion of Catchment No. CD2. It was dry during field mapping. The width and depth of DL3 is generally less than 5.2m and 0.7m respectively. The channelization ratios (CRs) of the drainage line range in between 4.8 to 6.6, the middle section of DL3 is broad and subtle which has a CR of 8.7. The inclination of the steam bed of DL3 lies in between 15 to 35°. Clast supported valley colluvium consisting of subangular cobbles and boulders with sandy silt matrix was accumulated along the drainage line.

5.6.4 Ephemeral drainage line DL4 and its sub-ordinate drainage lines DL4.1, DL4.2, DL4.3 and DL4.4 are located within Catchment No. CD3. DL4 is the longest drainage line within the NTSA. The lower half section (below +214 mPD) of DL4 was in wet condition during field mapping; the upper half section (above +214 mPD) of DL4, and the entire DL4.1, DL4.2 DL4.3 and DL4.4 were in dry condition during the field mapping. The width of DL4 is generally 2.5m to 9.2m, with depth ranging from 0.4m to 1.5m. In general, the channelization ratio (CR) of the drainage line is less than 6.6 and the channel gradients are general range of 15° to 45°, locally up to 50°, suggesting that the likelihood of channelized debris flow (CDP) is high. It was noted during fielding mapping that entrainable materials comprising a thin layer (< 0.5 m) of clast supported bouldery colluvium with sandy silt matrix were present along the drainage beds. Occasional boulders were deposited on the drainage bed, up to 2.0m diameter. Moderately decomposed fine ash Tuff was mapped at the drainage channel beds at about +157 mPD and +191 mPD; moderately decomposed Trachydacite and Rhyolite lava was discerned at the channel bed at approximately +230 mPD. Channelised debris flow is a potential hazard within Catchment No. CD3. The outlet of this natural stream course discharges into the existing concrete catchwater channel (1.5m wide and 1.1m depth) along the toe of the NTSA and therefore part of the debris may retain in the catchwater.

5.6.5 Ephemeral sub-ordinate drainage line DL4.5 within Catchment No. TD7 is not recorded as a hydro-line feature marked on 1:1000 LIC map, however, during the API stage, DL4.5 was identified as an ephemeral sub-ordinate drainage line of main stream DL4 which adjoining DL4 at approximately 80m below the NTSA. Since TKO Landfill site was in use, the adjoining point of DL4.5 to main stream DL4 was being filled up and therefore DL4.5 is no longer connected to the main stream DL4. According to field mapping, it was dry, the width and depth of DL1 is generally less than 8.3 m and 1.6 m respectively. The lower section of DL4.5 (below +176 mPD) has CR range in between 4.6 to 6.6, the CRs of the upper section (above +176 mPD) lie between 7.2 to 9.5 which imply the valley is relatively broad and subtle. The debris would likely converge and confine by topography but with low drainage concentration, therefore the potential hazard is likely to be debris flow.

5.6.6 Ephemeral drainage line DL5 is recorded as a hydro-line feature marked on 1:1000 LIC map in the lower portion of Catchment No. TD8 (below +180 mPD). According to field mapping, it was dry, the width and depth of DL5 is generally less than 8.3 m and 1.5 m respectively. The lower section of DL5 (below +164 mPD) has CRs range in between 4.0 to 7.5, the CRs of the upper section (above +164 mPD) lie in between 8.8 to 10.0 which imply the valley is relatively broad and subtle. The debris would likely converge and confine by topography but with low drainage concentration, therefore the potential hazard is likely to be debris flow.

5.6.7 Details of the drainage line mapping is given in **Appendix C** and **Plate 16**.

5.7 Topographic Depression Characteristics

5.7.1 Seven topographic depressions are identified within the NTSA from API. Topographic depression DP1, DP2, DP3, DP4 and DP5 are located along Catchment Nos. TD2, TD3, TD4, TD5 and TD6 respectively. These five topographic depressions are short, broad, shallow and subtle. They have similar channel characteristics with channel width range in between 3.8m to 4.6m and channel depth range from 0.3m to 0.5m. The CRs of DP1 to DP5 range from 9.2 to 12.7 (**Plate 17**).

5.7.2 Another two topographic depressions DP6 and DP7 lie in the lower portion of Catchment No. OH3. DP6 and DP7 are slightly longer compare with DP1 to DP5. DP6 and DP7 has channel width of 3.6m to 4.8m and channel depth of 0.4m to 0.5m. The CRs are therefore range from 9.0 to 9.6 (**Plate 17**).

5.8 Erosion and Sign of Distress

5.8.1 No sign of erosion or distress have been identified within the NTSA.

5.9 Water Seepage

5.9.1 Minor water seepage was observed at the bedrock of the channel bed at the lower half section (below +214 mPD) of drainage line DL4. No other water seepage could be observed within the NTSA.

5.10 Soil Pipes

5.10.1 No obvious soil pipe was identified within the NTSA during the field mapping.

5.11 Vegetation

5.11.1 The NTSA is well vegetated with bamboo, ferns with some shrubs and small trees.

5.12 Anthropogenic Features

5.12.1 No major anthropogenic features were found within the NTSA during field mapping. Five footpaths (FP1 to FP5) are present within the NTSA or along the boundary of the NTSA. Footpath FP1 traversed the middle portion of the NTSA from Catchment No. CD3 downwards to Catchment No. TD8. FP2 present along the upper portion from Catchment No. OH1 to Catchment No. CD3. FP3 is discerned at the lower portion of the NTSA, it traversed from Catchment No. TD6 to TD8. FP4 located along the crest of the NTSA whist FP5 apparent along the eastern boundary of the NTSA (**Plate 18**).

5.12.2 A grave is present at the upper portion of Catchment No. CD3 (**Plate 18**).

5.12.3 A concrete catchwater channel with dimension of 1.5m width and 1.1m depth were formed and aligned the toe of the NTSA (**Plate 18**).

5.12.4 No significant fill bodies can be observed within the NTSA during field mapping.

6 Engineering Geological/Geomorphological Model

6.1 General

6.1.1 Geomorphological and engineering geological models were formulated for the NTSA based on information obtained from the desk study, API, field mapping and previous GIs. An Engineering Geological Model and Geomorphological model of the NTSA were developed and presented below:

6.2 Solid Geology

6.2.1 The solid geology within the NTSA was underlain by four types of solid geology. Fine ash crystal Tuff of the High Island Formation (JHI) underlain along the crest of the NTSA. The upper portion of the NTSA is underlain by fine ash Tuff of the Clear Water Bay Formation (fa). The middle portion of the NTSA is comprise of Trachydacite and Rhyolite lava of the Clear Water Bay Formation (JCB). The lower portion of the NTSA is underlain by fine ash Tuff of the Clear Water Bay Formation (fa) and Trachydacite lava of Ta Miu Wan Member of the Clear Water Bay Formation (Jmw). All four types of geology are belonged to Repulse Bay Volcanic Group formed in Upper Jurassic of Mesozoic.

6.3 Superficial Geology

6.3.1 Superficial deposit within the NTSA is mainly a thin layer (<2.0 m) of hillslope colluvium blanketing the middle portion of the NTSA. The colluvium typically comprises firm, brown dappled grey, sandy SILT with some gravel and cobbles sized rock fragments. Clast supported valley colluvium, consisting of subangular cobbles and boulders with sandy silt matrix was deposited and confined within the ephemeral drainages.

6.4 Hillside Catchment Classification

6.4.1 Following the guideline given in GEO Report No. 138 2nd Edition (GEO, 2016), the NTHS area can be classified into three types of catchment, including Channelised Catchment, Topographic Depression Catchment and Open Hillslope Catchment, according to the type of hazard defined by the failure mechanism and mobility of debris movement. The catchment classification of the NTSA is given below:

6.4.2 Based on the LIC 1:1000 scale topographic map, the site specific aerial photograph interpretation and site mapping, the catchment classification of the NTSA is summarized in **Table 6.1** below and present graphically in **Figure 10.**

Table 6.1 Summary of Catchment Classification Assessment

Catchment No.	Catchment Type			Justification
	OH	TD	CD	
OH1	✓			1. Hillside is generally planar. 2. Absent of drainage line or distinct depression. 3. Debris path is relatively unconfined and may involve lateral spreading of debris. 4. Potential hazard will be open hillslope landslide.
OH2	✓			1. Catchment located on a spur and therefore hillslope is convex-shaped. 2. Absent of drainage line or distinct depression. 3. Debris path very likely involve lateral spreading of debris. 4. Potential hazard will be open hillslope landslide.
OH3	✓			1. Catchment located on a rounded spur and therefore hillslope is general convex-shaped. 2. Two topographic depressions appear at the lower portion of the catchment, probably head of drainage lines which located below the NTSA. 3. Debris path is relatively unconfined and may involve lateral spreading of debris, even though two topographic depressions are present, the relatively large catchment is unlikely to confine the debris flow into the short and subtle depressions. 4. Potential hazard will be open hillslope landslide.
OH4	✓			1. Hillside is generally planar. 2. Absent of drainage line or distinct depression. 3. Debris path is relatively unconfined and may involve lateral spreading of debris. 4. Potential hazard will be open hillslope landslide.
OH5	✓			1. Hillside is generally planar. 2. Absent of drainage line or distinct depression. 3. Debris path is relatively unconfined and may involve lateral spreading of debris. 4. Potential hazard will be open hillslope landslide.
TD1		✓		1. A hydro-line feature marked on 1:1000 LIC map along the catchment, but it is a relatively short, small and subtle. 2. Debris would likely converge and confine by topography but with a low drainage concentration. 3. Potential hazard will be debris flow. 4. Potential entrainment material will be relatively small as compared to the CD Catchment.
TD2		✓		1. No hydro-line feature marked on 1:1000 LIC map, but a small topographic depression is present. 2. Debris would likely converge and confine by topography but with a low drainage concentration. 3. Potential hazard will be debris flow. 4. No potential entrainment material.
TD3		✓		1. No hydro-line feature marked on 1:1000 LIC map, but a small topographic depression is present. 2. Debris would likely converge and confine by topography but with a low drainage concentration. 3. Potential hazard will be debris flow. 4. No potential entrainment material.
TD4		✓		1. No hydro-line feature marked on 1:1000 LIC map, but a small topographic depression is present. 2. Debris would likely converge and confine by topography but with a low drainage concentration. 3. Potential hazard will be debris flow. 4. No potential entrainment material.
TD5		✓		1. No hydro-line feature marked on 1:1000 LIC map, but a small topographic depression is present. 2. Debris would likely converge and confine by topography but with a low drainage concentration. 3. Potential hazard will be debris flow. 4. No potential entrainment material.

TD6		✓		1. No hydro-line feature marked on 1:1000 LIC map, but a small topographic depression is present. 2. Debris would likely converge and confine by topography but with a low drainage concentration. 3. Potential hazard will be debris flow. 4. No potential entrainment material.
TD7		✓		1. No hydro-line feature marked on 1:1000 LIC map, but a broad and subtle sub-ordinate drainage line present along the catchment. 2. Debris would likely converge and confine by topography but with a low drainage concentration. 3. Potential hazard will be debris flow. 4. Potential entrainment material will be relatively small as compared to the CD Catchment.
TD8		✓		1. A hydro-line feature marked on 1:1000 LIC map at the lower half of the catchment. 2. Debris would likely converge and confine by topography at the lower half of the catchment with a low drainage concentration. 3. Potential hazard will be debris flow. 4. Potential entrainment material will be relatively small as compared to the CD Catchment.
CD1			✓	1. A well-defined and incised drainage line leading to a single discharge point. 2. It has a relatively high drainage concentration. 3. Potential hazard will be channalised debris flow. 4. Relatively high entrainment potential.
CD2			✓	1. A well-defined and incised drainage line leading to a single discharge point. 2. It has a relatively high drainage concentration. 3. Potential hazard will be channalised debris flow. 4. Relatively high entrainment potential.
CD3			✓	1. A very well-defined and very incisive main drainage line with three incised sub-ordinate drainage lines present with the catchment leading to a single discharge point. 2. It has very high drainage concentration. 3. Potential hazard will be channalised debris flow. 4. High entrainment potential due to present of many colluvial boulders along the drainage line.

6.5 Geomorphological Model

6.5.1 To appreciate the geomorphological process within the NTSA, it is better to look at a wider picture within the Study Region. Terrain Units within the Study Region are divided into four main units developed based on the simplified land surface model (Dalrymple, et al., 1968) according to their geomorphological characteristics. The terrain units identified within the NTSA are described below and presented in Figure 11.1 for a regional view and Figure 11.2 for a close-up view of the NTSA.

6.5.2 Upper Slope Terrain Unit

6.5.3 The upper slope terrain comprises the gentle slopes along the ridges and spurs along the upper boundary of the NTSA. The slope gradient is generally less than 20 degrees. The upper slope terrain appears to be the oldest terrain unit in the NTSA. The terrain comprises predominately saprolitic soil. The predominant geomorphic processes are likely to be pedogenic process, eluviation and soil creeping. This terrain appears currently stable with no evidence of recent or relict slope instabilities identified.

6.5.4 Middle Slope Terrain Unit

6.5.5 The transportational Middle Slope Terrain Unit is present at about +126 mPD to +316 mPD at the middle and lower portion of the NTSA. This Terrain Unit is demarcated by the convex change of slope immediately below the Upper Slope Terrain Unit. General slope gradient within this terrain is 25-35°, locally 35-50°. The Terrain mainly comprises completely decomposed fins ash Tuff, trachydacite and rhyolite lava overlain by a very thin layer of hillslope colluvium (probably <2m thick). Given only four relict landslides (RL1 to RL4) were identified at the upper portion of the NTSA, they all very degraded and could be occurred for a long period of time (over 100 years). These landslides were probably part of the hillslope retreat process. Another 4 relict landslides (RL5 to RL8) were verified at the adjacent catchment of the NTSA within this terrain unit, they were also very broad and degraded. The mass wasting process within this terrain is relatively infrequent and therefore the terrain is considered to be low to moderately susceptible to landslides.

6.5.6 Incising Terrain Unit

6.5.7 The comparatively young and active Incising Terrain is characterized by the presence of ephemeral drainage channels DL1, DL2, DL3, DL4 and DL5 which formed relatively incised valley slopes by fluvial incision, retrogressive erosion and undercutting of the adjacent soil by surface water. The terrain units are largely covered with clast supported valley colluviums overlying saprolite or bedrocks at the stream beds. No relict or recent landslide can be identified within this terrain unit in the NTSA. However, a relict landslide (RL9) was identified at the adjacent catchment of the NTSA within this terrain unit. RL9 was possibly associated with drainage incision and erosion process.

6.5.8 Disturbed Terrain Unit

6.5.9 The disturbed terrain is located below the NTSA. The Site is sitting on the Disturbed Terrain Unit. This terrain unit was used as a landfill site in between year 1988 and 1994. Slope cutting and filling were performed in this terrain unit during the operation period of the landfill site.

7 Hazard Assessment

7.1 General

7.1.1 Design Event Approach is adopted to assess the natural hazard based on the five generic hazard models defined in GEO Report No. 138 2nd Edition (GEO, 2016) as follows: open hillslope landslide, channelized debris flow, deep-seated landslide, rockfall / slide and boulder fall.

7.1.2 Based on the findings from detailed desk study, GI and field mapping as well as the geological and geomorphological model established in section 6, hazard assessment with respect to the five generic hazard models are discussed below and the natural terrain hazard map is presented in **Figure 12**.

7.2 Hazard Identification

7.2.1 Open Hillslope Landslide

7.2.2 The NTSA comprises stable upper slope terrain and transportation middle slope terrain. The upper slope terrain and is considered to be of very low susceptible to landslide as the slope gradient generally less than 20° and has no evidence of failure. Mass wasting process within the terrain unit is observed to be inactive, with no signs of erosions or past instability. Therefore, open hillslope landslide is not envisaged.

7.2.3 The NTSA also contain a transportation middle slope terrain between +126 mPD and +316 mPD where slope gradient lies between 25-35°, locally 35-50°. The Terrain mainly comprises completely decomposed fins ash Tuff, trachydacite and rhyolite lava overlain by a very thin layer of hillslope colluvium (probably <2m thick). Given four relict landslides (RL1 to RL4) were identified within this terrain in the NTSA, and four relict landslides (RL5 to RL8) were verified at the adjacent catchment of the NTSA within this terrain unit. All these relict landslides were probably occurred over 100 years ago and belonged to part of the hillslope retreat process, the mass wasting process within this terrain is considered relatively infrequent and therefore the terrain is considered to be low to moderately susceptible to open hillslope landslides.

7.2.4 Channelised Debris Flow (CDF)/Debris Flow

7.2.5 No perennial natural drainage line is present within the NTSA, but three relatively incisive (channelization ratio less than 7.5) ephemeral drainage lines DL2, DL3 and DL4 and its sub-ordinates drainage lines DL4.1, DL4.2, DL4.3 and DL4.4 are present within the NTSA. Therefore, it is considered that CDF is a potential natural hazard which may occur within the NTSA.

7.2.6 After site verification, ephemeral drainage lines DL1, DL4.4 and DL5 are broad and subtle with low drainage concentration, according to the stream characteristics, ephemeral drainage lines DL1, DL4.4 and DL5 are classified as topographic depression. In addition, five topographic depressions DP1 to DP5 are present with the NTSA. Therefore, debris flow is considered could be a potential hazard within the NTSA.

7.2.7 Deep-seated Landslide

7.2.8 Deep-seated, intact sliding is not common in Hong Kong and in some cases the displaced material has not moved from the source area (slump) or where tension cracks and bulging are the sole surface expression of movement (Irfan, 1989; Ho & Evans, 1993). Based on the existing GI information and the field mapping results, neither tension cracks, surface bulging nor persistent thick layers of kaolin/weak seam within saprolite have been identified within the NTSA that could indicate the potential for deep-seated landslides. There is no clear evidence from historical records that suggests a deep-seated landslide could have occurred, or is likely to occur, within the NTSA. Therefore, the susceptibility for deep-seated landslide occurring within the NTSA is considered to be low.

7.2.9 Rock Fall

7.2.10 Twelve intermittent rock outcrops (RO1 to RO12) are present within the NTSA, but they are massive and less than 2m high. No adverse joint sets, which can attribute to unstable rock block failure within these rock mass, can be discerned on site. Therefore, Rock Fall is not considered a viable hazard within the NTSA.

7.2.11 Boulder Fall

7.2.12 Given, i) the proposed development are mostly belonged to Group 4 facilities, ii) no evidence of past boulder fall records within the NTSA, iii) no clear evidence of any known signs of potentially boulder falls from the site specific API and field mapping. According to the special considerations for dealing with boulder fall hazards as stipulated in Section 2.3.5 of GEO Report No. 138, it is considered that no significant risk of boulder fall hazards is presence with the NTSA.

7.2.13 According to the detailed boulder survey report (Chung Shun, 2023), 6 nos. of boulders (C120, C126, C127, C128, W068 and W075) with low to medium stability which could travel further downslope by active soil erosion beneath the boulder in the foreseeable future. Having said that these 6 nos. of boulders are resting on gentle slopes ranged from 30-35°. It is not considered to have immediate danger and significant risk of boulder fall hazard. Most of the boulders could probably be caught by the concrete catchwater channel along the toe of the NTSA. Nevertheless, removal of these boulders is recommended as a cost-effective precautionary measure. Details of the boulder survey are given in the separate “Boulder Survey Report”. The records of these 6 nos. boulders were extracted from the boulder survey report in **Appendix E** and the locations of these boulders are presented in **Figure 12.**

7.2.14 Hillside Pocket Type Setting

7.2.15 The NTSA does not fall into any hillside pocket boundary. No fill body was identified from the API and field mapping within the NTSA. Therefore, it is considered that the NTSA is not associated with landslide hazard with respect to the Hillside Pocket setting.

7.3 Design Event

7.3.1 According to GEO Report No. 138 2nd Edition (GEO, 2016), a design event should refer to the magnitude of the hazard type selected for mitigation and requires the understanding of the geological and geomorphological model and the consideration of historical landslide records.

7.3.2 Landslide Susceptibility

7.3.3 The landslide susceptibility of the NTSA has been reviewed to aid the derivation of the design event magnitude. This was based on the geological and geomorphological model as well as the landslide history of the NTSA. Details of the landslide susceptibility of each terrain unit are discussed in **Table 7.1** below:

Table 7.1 Summary of Hazard Types and Landslide Susceptibility

Hazard Type	Terrain Unit Present Within NTSA	Description of Hazard and the Landslide Susceptibility
OHL	Upper Slope Terrain	The terrain comprises mainly saprolitic soil. The predominant geomorphic processes are likely to be pedogenic process, eluviation and soil creeping. This terrain appears currently stable with no evidence of recent or relict slope instabilities identified and therefore considered to have very low susceptibility to open hillslope failure.
OHL/DF	Middle Slope Terrain	General slope gradient within this terrain is 20-35°, locally 35-50°. The Terrain mainly comprises completely decomposed fins ash Tuff, trachydacite

Hazard Type	Terrain Unit Present Within NTSA	Description of Hazard and the Landslide Susceptibility
		and rhyolite lava overlain by a very thin layer of hillslope colluvium (probably <2m thick). The predominant geomorphic process within this terrain unit is considered to be the mass wasting process in the form of shallow debris slides. Given four relict landslides (RL1 to RL4) were identified within this terrain in the NTSA, and four relict landslides (RL5 to RL8) were verified at the adjacent catchment of the NTSA within this terrain unit. They are all very degraded and probably occurred over 100 years ago. The mass wasting process within this terrain is relatively infrequent and therefore the terrain is considered to be low to moderately susceptible to open hillslope landslide and debris flow.
CDF	Incising Terrain	The comparatively young and active Incising Terrain is characterized by the presence of ephemeral drainage channels DL2, DL3, DL4, DL4.1, DL4.2, DL4.3 and DL4.4 which formed relatively steep channel incised valley slopes by fluvial incision, retrogressive erosion and undercutting of the adjacent soil by surface water. The terrain units are largely covered with clast supported valley colluviums overlying saprolite or bedrocks at the stream beds. No relict or recent landslide can be identified within this terrain unit within the NTSA. However, a relict landslide (RL9) was identified at the adjacent catchment of the NTSA within this terrain unit, and also a recent landslide (RC4) in year 1975 was identified within this terrain unit adjacent to the NTSA, RL9 and RC4 were possibly associated with drainage incision and erosion process. Failure may also be attributed to the undermining effect of fluvial action along the flanks of drainage line, given the adjacent catchment has similar geomorphological setting as

Hazard Type	Terrain Unit Present Within NTSA	Description of Hazard and the Landslide Susceptibility
		the NTSA, suggesting the terrain is moderately susceptible to landslides.

7.3.4 Design Event Requirement

7.3.5 According to the latest guideline given in GEO Report No. 138 2nd Edition (GEO, 2016), the design event principle is aimed at dealing with a realistic estimation of credible failure volume (e.g. Based on recent landslides as well as relict landslides with a high degree of certainty) that may be encountered during the design life of the affected facilities. A combination of desk study, API and detained field mapping should provide basis for developing a realistic geological/geomorphological model of the NTSA by defining the magnitude of the design event.

7.3.6 Based on the detailed review on the above factors, the NTSA belongs to Upper Slope Terrain and Middle Slope Terrain units. The landslide susceptibility of these terrain units is considered to be very low to moderately high.

7.3.7 The Design Event Requirement for the NTSA is summarized in **Table 7.2**.

Table 7.2 Design event Requirement for the NTSA

Hazard	**Terrain Unit**	**Landslide History**	**Design Event Requirement**
OHL	Upper Slope Terrain	No evidence of relict and recent landslide almost in the past 100 year	Not required
OHL, DF	Middle Slope Terrain	Relict landslides RL1 to RL4 located within Catchment No. CD3 (13-39m^3); Relict landslides RL5 to RL8 located adjacent to Catchment No. CD3 (11-36m^3)	40m^3

Hazard	Terrain Unit	Landslide History	Design Event Requirement
CDF	Incising Terrain	Relict landslide RL9 located adjacent to Catchment No. TD8 (14m^3); Recent landslide RC4 located below the NTSA (40m^3)	40m^3

7.3.8 Based on the assessment of the design event requirements of different terrain units within the NTSA, Adopting 40m³ as a credible design event for the Middle Slope Terrain and Incising Terrain within the NTSA is considered appropriate.

7.3.9 Debris Mobility Modelling

7.3.10 A notional landslide source volume of 40m3 is adopted as the source volume for the NTSA for the debris mobility modelling.

7.3.11 In order to estimate the run out distance for debris flow within the NTSA, dynamic debris mobility modelling has been carried out using the programme 'DAN/W'. The input parameters and results of this modelling are discussed below and presented in **Appendix D**.

7.3.12 Potential landslide events have been modelled by adopting the Voellmy Rheology Model for DF and CDF; and Friction Rheology Model for OHL. To estimate the potential entrainment volume along the debris runout path analysed, the average depth of potentially entrainable materials is assessed based on the results of the drainage line mapping and professional judgments, e.g. channel gradients, probable erosion depth according to the loose materials perched on the drainage bed and the erosional materials from channel side slopes. The average thickness of entrainable materials along the ephemeral drainage line is assessed to be from 0.1 to 0.5m. The result of the debris mobility modelling is summarized in **Table 7.3** below:

Table 7.3 Summary of Debris Mobility Modelling Results

Terrain Unit	Catchment No.	Runout Path No.	Source Volume (m^3)	Analytical Model	Final Volume	Entrainment	Travel Distance (m)	Landslide Debris Reaching the

					(m^3)	Volume (m^3)		Proposed Facilities
Middle Slope Terrain /Incising Terrain	TD3	RP1	40.24	Friction & Voellmy	40.24	-	11.58	No
	TD4	RP2	40.41	Friction & Voellmy	40.41	-	27.02	No
	TD5	RP3	40.63	Friction & Voellmy	40.63	-	53.78	No
	TD6	RP4 (Case 1)	40.55	Friction & Voellmy	40.55	-	13.92	No
		RP4 (Case 2)	40.34	Friction & Voellmy	40.34	-	35.46	No
	CD1	RP5 (Case 1)	40.84	Friction & Voellmy	40.84	-	25.16	No
		RP5 (Case 2)	40.22	Friction & Voellmy	107.11	66.89	114.16	No
	OH2	RP6 (Case 1)	40.90	Friction	40.90	-	27.63	No
		RP6 (Case 2)	40.87	Friction	40.87	-	4.75	No
	CD2	RP7 (Case 1)	40.43	Friction & Voellmy	40.43	-	5.74	No
		RP7 (Case 2)	40.50	Friction & Voellmy	143.05	102.55	117.90	No
	OH3	RP8 (Case 1)	40.65	Friction	40.65	-	2.45	No
		RP8 (Case 2)	40.26	Friction	40.26	-	46.01	No
		RP9 (Case 1)	40.27	Friction	40.27	-	75.2	No
		RP9 (Case 2)	40.18	Friction	40.18	-	34.95	No
	CD3	RP10 (Case 1)	40.58	Friction & Voellmy	106.83	66.25	95.63	No

		RP10 (Case 2)	40.14	Friction & Voellmy	43.68	-	7.07	No
		RP11 (Case 1)	40.50	Friction & Voellmy	41.00	0.5	35.35	No
		RP11 (Case 2)	40.10	Friction & Voellmy	382.83	342.73	154.81	No
		RP12 (Case 1)	40.07	Friction & Voellmy	517.11	477.04	402.06	No
		RP12 (Case 2)	40.34	Friction & Voellmy	196.99	156.65	140.64	No
		RP13 (Case 1)	40.51	Friction & Voellmy	40.51	-	104.65	No
		RP13 (Case 2)	40.81	Friction & Voellmy	96.65	55.84	67.08	No
		RP14 (Case 1)	40.88	Friction & Voellmy	41.54	-	89.85	No
		RP14 (Case 2)	40.17	Friction & Voellmy	272.87	232.70	193.52	No
	OH4	RP15	40.67	Friction	40.67	-	100.87	No
	TD7	RP16	40.28	Friction & Voellmy	321.11	280.83	129.70	No
	OH5	RP17	40.89	Friction	40.89	-	135.74	No
	TD8	RP18	40.61	Friction & Voellmy	434.97	394.36	180.95	No

7.3.13 Debris mobility analysis have been carried out for Catchment Nos. TD3, TD4, TD5, TD6, CD1, OH2, CD2, OH3, CD3, OH4, TD7, OH5 and TD8. Eighteen credible run out paths, (the steepest paths generated from ArcGIS, RP1 to RP18) have been modelled. The results indicate that the debris on different elevations along the credible run out paths RP1 to RP18 would not reach the proposed facilities of the proposed new public riding school. Volume of the Potential entrainment materials along the biggest CD catchment CD3 is estimated in the range between 7.07m^3 and 402.06m^3. Most of the modelled landslide debris would either be deposited at the shallow hillsides or retained at the concrete catchwater channel at the toe of the NTSA.

7.3.14 Results of the debris mobility analysis also showed that no landslide debris could run beyond the lower boundary of the “No-build Zone” which was defined in the previous feasibility study in 2004.

8 Hazard Mitigation Strategy

8.1 General

8.1.1 Following the review of the landslide hazards on the NTSA, debris mobility model for Catchment Nos. TD3, TD4, TD5, TD6, CD1, OH2, CD2, OH3, CD3, OH4, TD7, OH5 and TD8 have been simulated to assess whether a failure volume of 40m³ from the NTSA could pose hazard to the proposed new public riding school. The results revealed that the debris on all credible flow paths (RP1 to RP18) will not reach the proposed facilities. Given most of the proposed development are belonged to Group 4 facilities, therefore natural terrain hazard mitigation measures is considered not necessary.

8.1.2 Although there is no significant risk of boulder fall hazard presence within the NTSA, in view of the fact that 6 nos. of boulders with low to medium stability (without immediate and obvious danger conditions) were identified from the site-specific boulder survey. Among these 6 boulders, only four of them fall within the Clear Water Bay Country Park zone. The 2 boulders (W068 and W075) outside the Clear Water Bay Country Park are recommended to be removed or in-situ stabilized by rock dowels as a precautionary measures as they may likely travel further downslope towards the proposed development under the condition of heavily erosion underneath the boulders; and no mitigation for the 4 boulders (C120, C126, C127 and C128) within the Clear Water Bay Country Park is proposed as they could be either caught up by the existing concrete catchwater channel at the toe of the NTSA or deposited before reaching the low density traffic access road (Group 4 facility) which is about 50m away from the NTSA. The justification of these 4 boulders will not reach the facilities is further supplemented by the boulder fall modelling presented in Appendix F.

9 Conclusions & Recommendations

9.1 General

9.1.1 A natural terrain hazard assessment was carried out based on guidelines given in GEO Report No.138 2nd edition (GEO, 2016), by reviewing the topography, geomorphology, landslide susceptibility and landslide history of the NTSA. Results of the assessment showed that there is potential OHL, DF, CDF and BF hazard from the NTSA.

9.1.2 Debris mobility modelling has been carried out to simulate the potential design event of $40m^3$. The results revealed that the debris will not reach the proposed facilities. Following the result from the assessment, mitigation works for the potential natural terrain hazard is considered not necessary for the proposed new public riding school.

9.1.3 The 'No-build Zone' recommended in the previous feasibility study in 2004 was reviewed. The "No-build Zone" was calculated based on the debris runout distances using the conservative design event. The "No-build Zone" was defined as one meter further away from the calculated debris runout distance boundary, outside of which no development will be affected by any potential natural terrain hazards. Based on the updated current landslide debris mobility modelling, no landslide debris could run beyond the lower boundary of the "No-build Zone" and therefore, as a conservative and safe approach, it is recommended to keep the "No-build Zone" for the site formation design in the later stage.

9.1.4 A total 6 numbers of boulders with low to medium stability (C120, C126, C127, C128, W068 and W075) are identified. Only four boulders C120. C126, C127 and C128 are within the Clear Water Bay Country Park zone.

9.1.5 Boulders Nos. W068 and W075 which are outside the Clear Water Bay Country Park are recommended to be removed or in-situ stabilized by rock dowels as a cost-effective precautionary measures as they may likely travel further downslope towards the proposed development under the condition of heavily erosion underneath the boulders.

9.1.6 No mitigation for Boulder Nos. C120, C126, C127 and C128 within the Clear Water Bay Country Park is proposed as they could be either caught up by the existing concrete catchwater channel at the toe of the NTSA or deposited before reaching the low density traffic access road (Group 4 facility) which is about 50m away from the NTSA.

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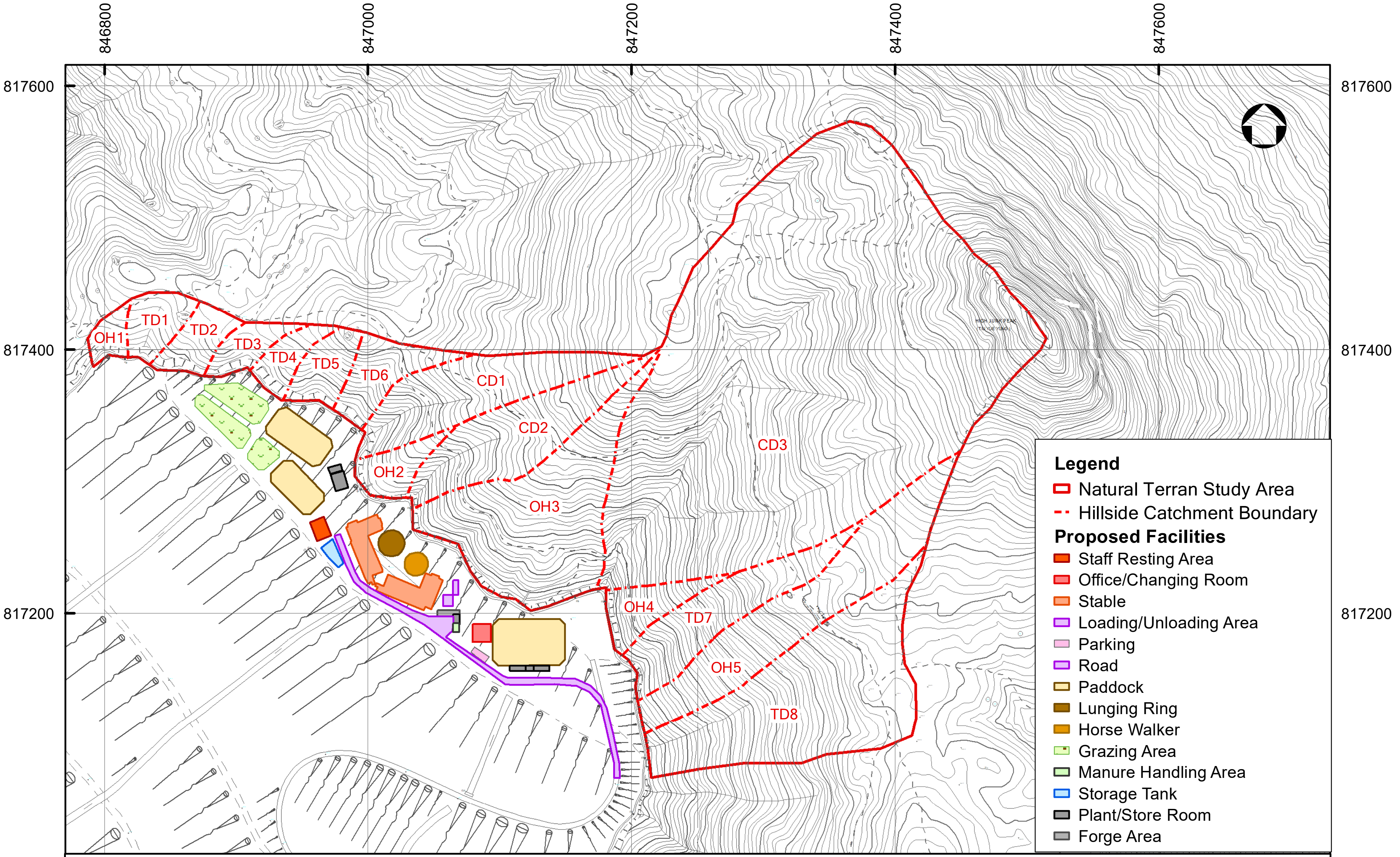

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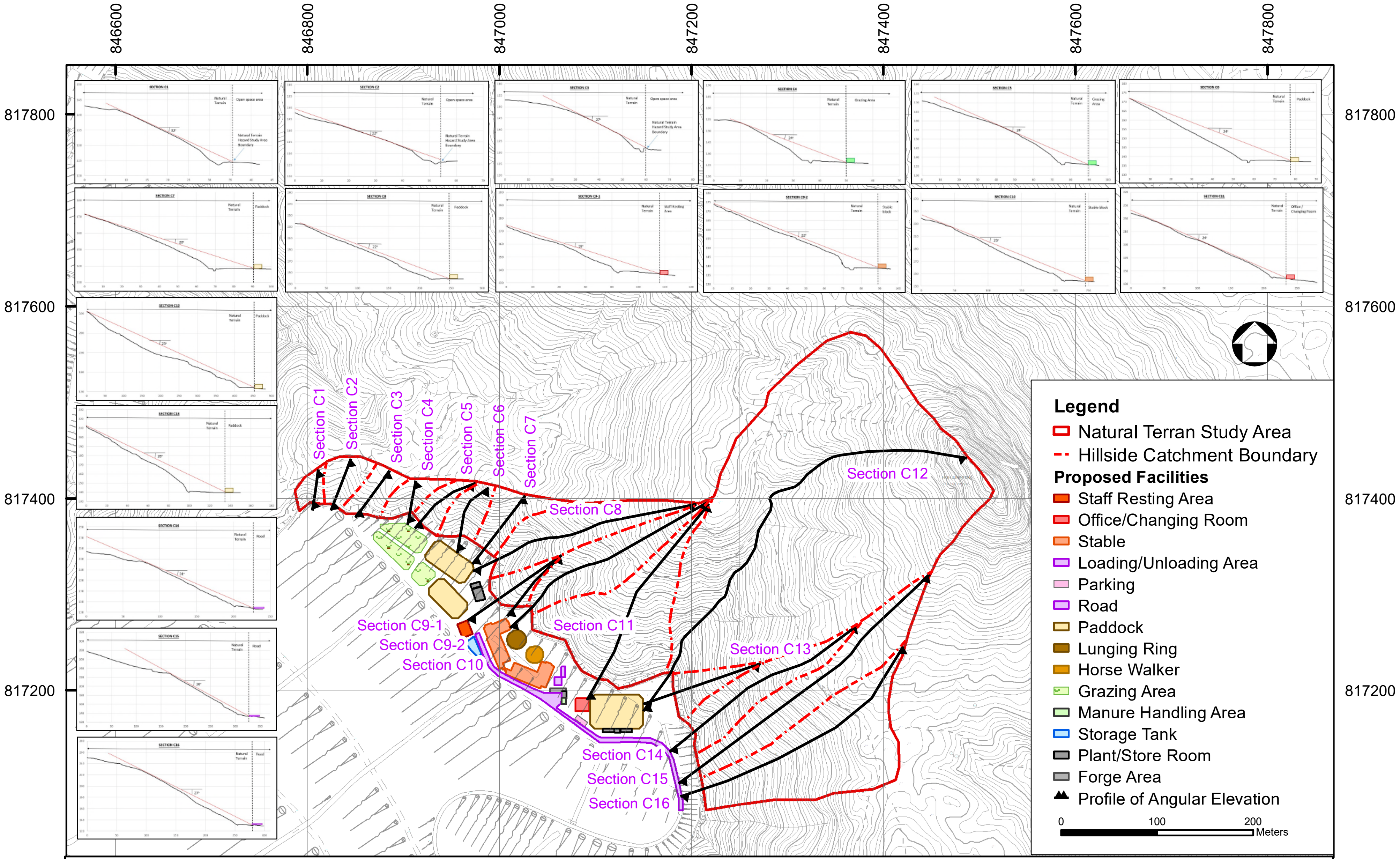
Forge Area

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Location Plan of NTSA	**SCALE:** 1 :4000	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 1**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Horse Walker
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Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
Profile of Angular Elevation
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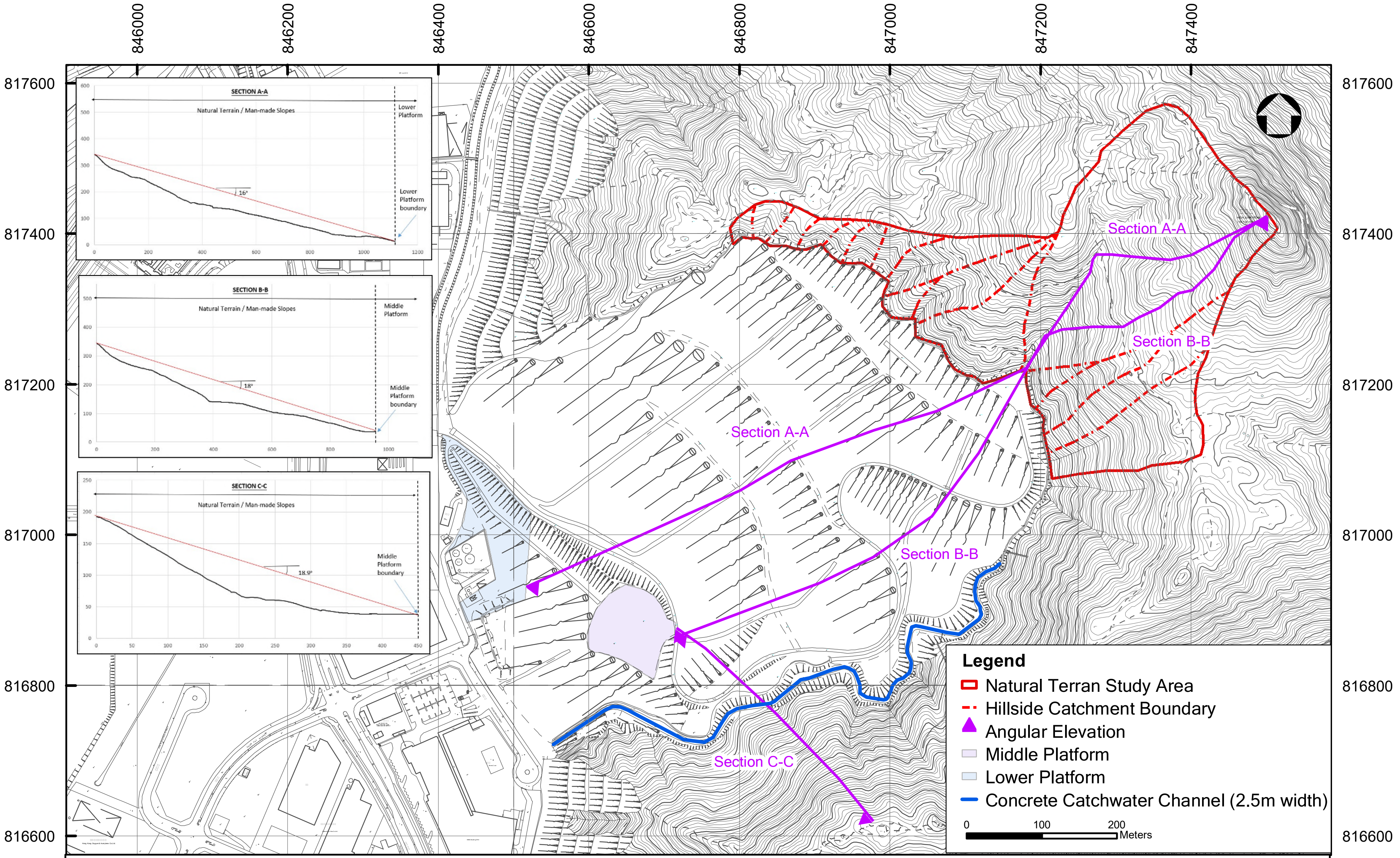
PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Angular Elevation	**SCALE:** 1 :5500	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 2**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18°
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Legend
Natural Terran Study Area
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Angular Elevation
Middle Platform
Lower Platform
Concrete Catchwater Channel (2.5m width)
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PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Landfill Site (TKOL II/III) in Tseung Kwan O

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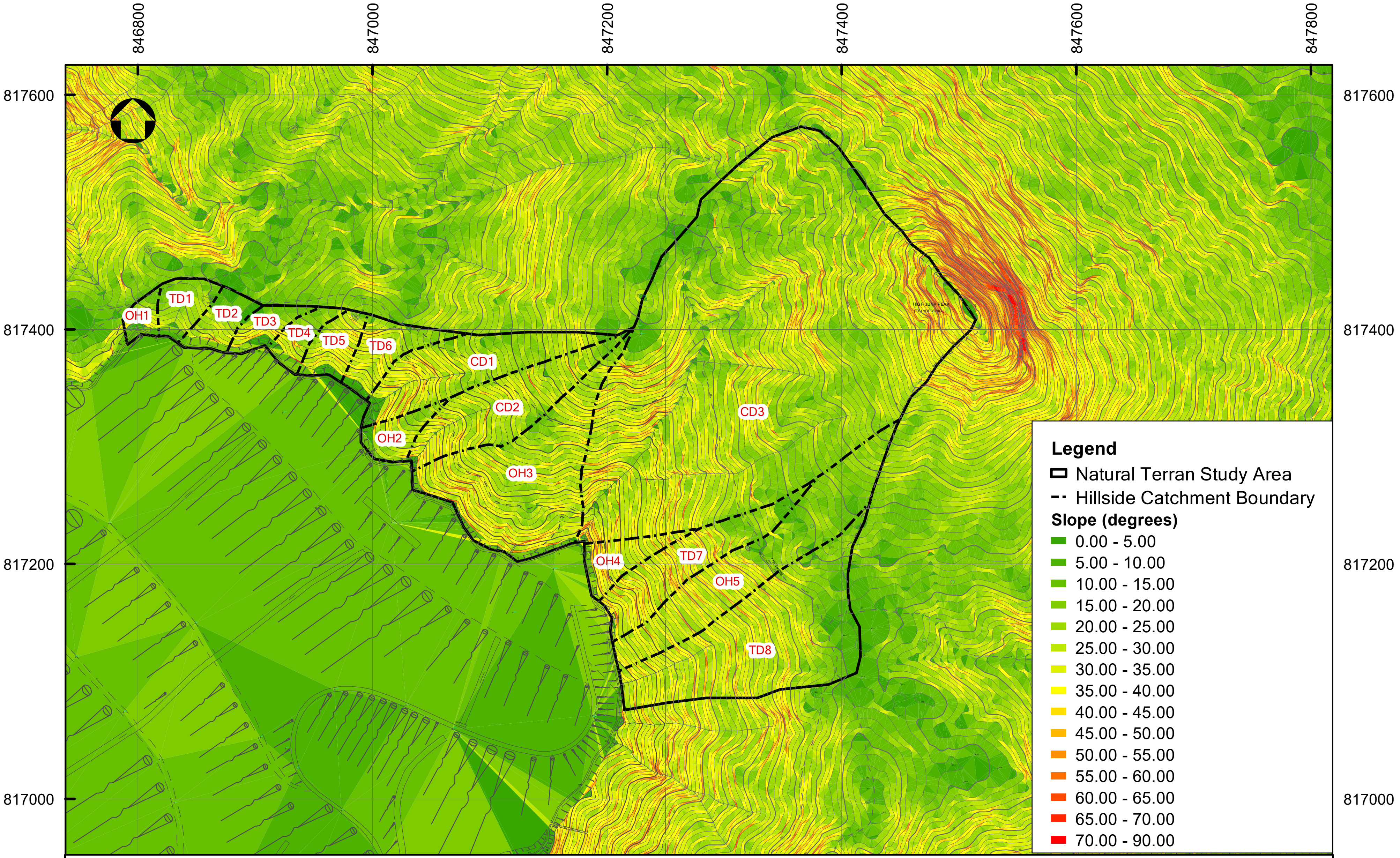
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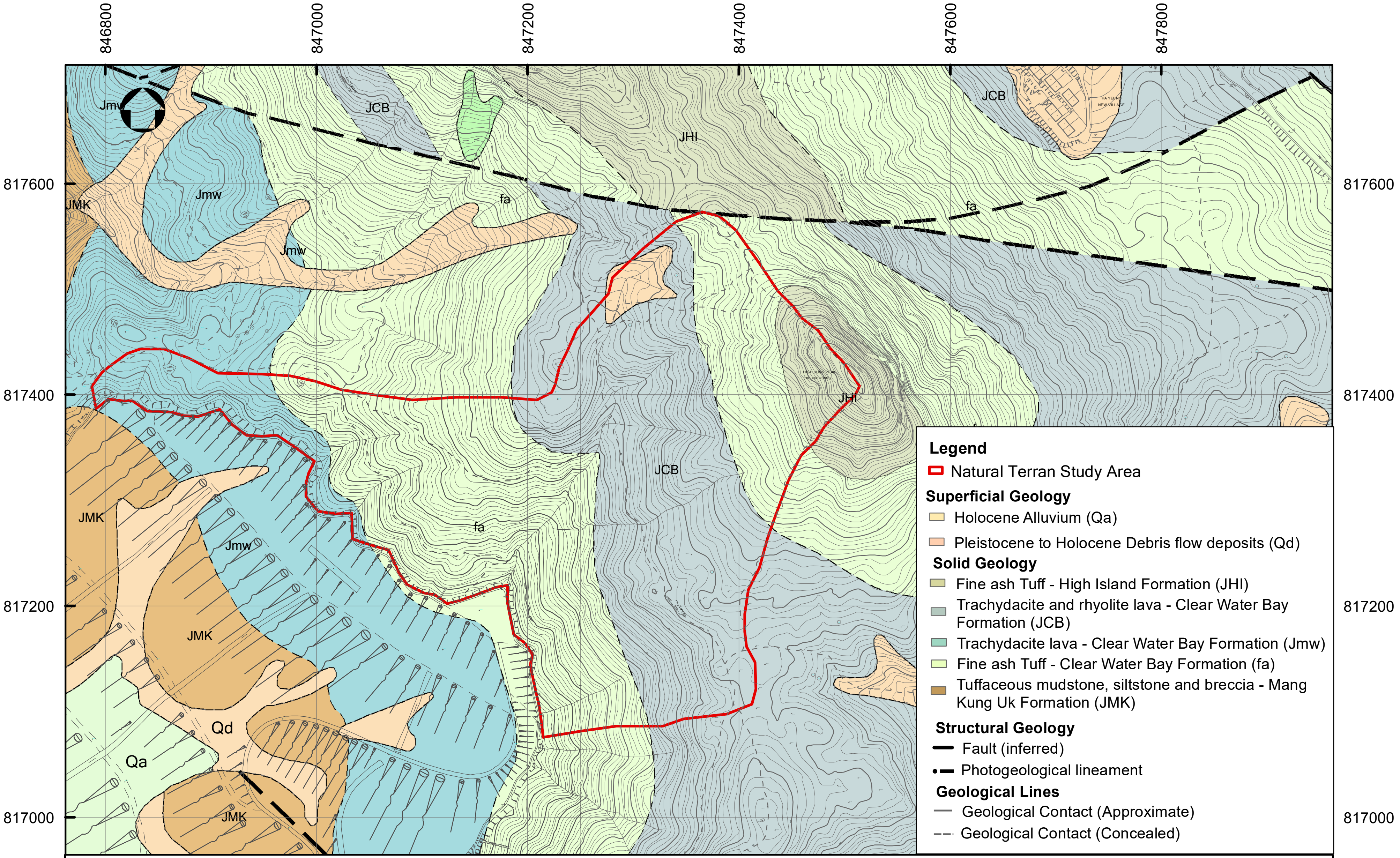
Legend
▭ Natural Terran Study Area
-- Hillside Catchment Boundary
Slope (degrees)
0.00 - 5.00
5.00 - 10.00
10.00 - 15.00
15.00 - 20.00
20.00 - 25.00
25.00 - 30.00
30.00 - 35.00
35.00 - 40.00
40.00 - 45.00
45.00 - 50.00
50.00 - 55.00
55.00 - 60.00
60.00 - 65.00
65.00 - 70.00
70.00 - 90.00

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Slope Angle Map	**SCALE:** 1 :4500	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 3**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847000
847200
847400
847600
847800
817600
817400
817200
817000
Jmw
JCB
JHI
JCB
JMK
Jmw
Jmw
fa
fa
JHI
JCB
JMK
Jmw
fa
JMK
Qd
Qa
JMK
Legend
🟥 Natural Terran Study Area
Superficial Geology
Holocene Alluvium (Qa)
Pleistocene to Holocene Debris flow deposits (Qd)
Solid Geology
Fine ash Tuff - High Island Formation (JHI)
Trachydacite and rhyolite lava - Clear Water Bay Formation (JCB)
Trachydacite lava - Clear Water Bay Formation (Jmw)
Fine ash Tuff - Clear Water Bay Formation (fa)
Tuffaceous mudstone, siltstone and breccia - Mang Kung Uk Formation (JMK)
Structural Geology
Fault (inferred)
Photogeological lineament
Geological Lines
Geological Contact (Approximate)
Geological Contact (Concealed)

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

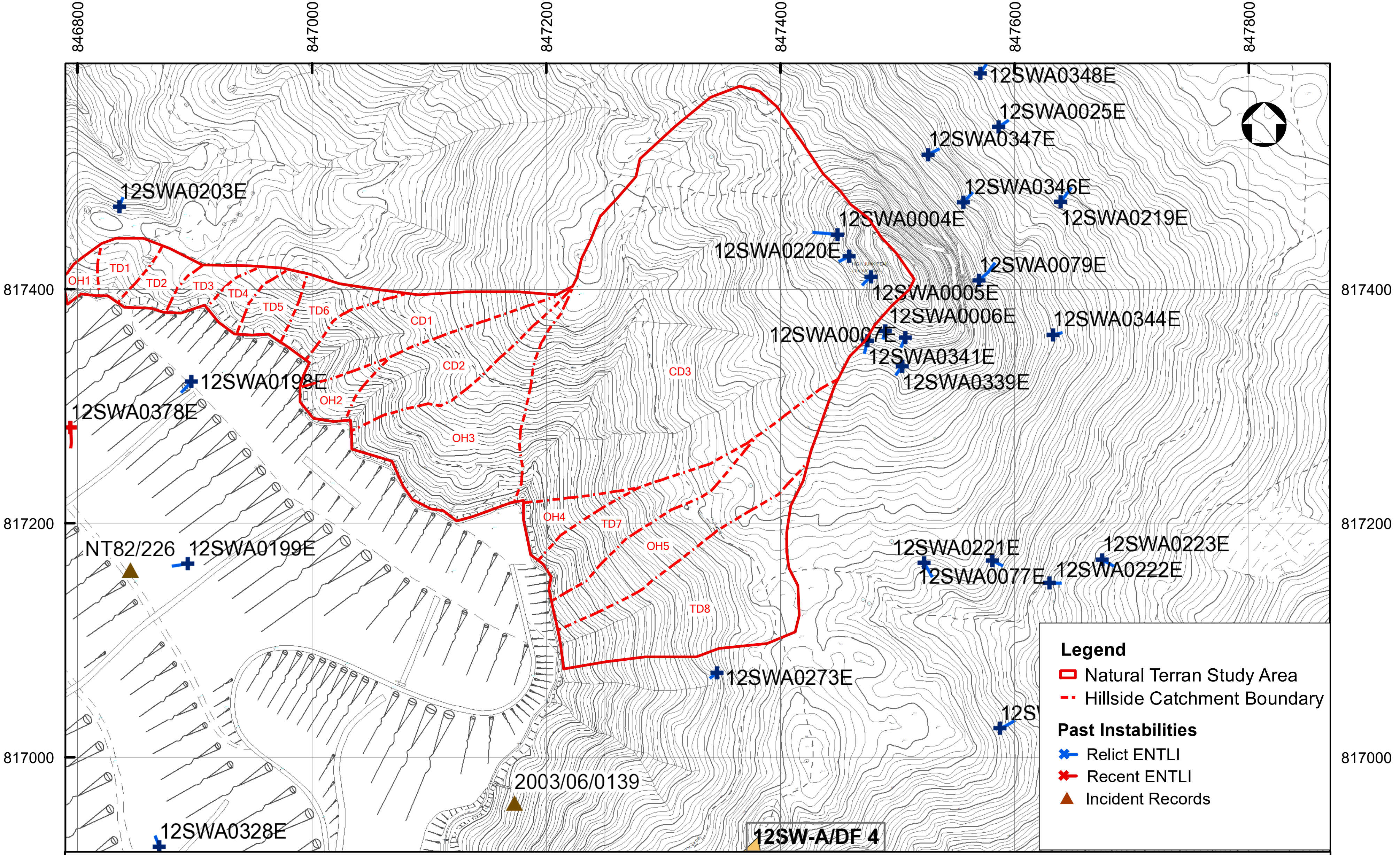
TITLE: Geological Map

SCALE: 1 :5000

Modern Consulting Engineers Limited

In association with CALVINT GEO-SERVICES LIMITED

FIGURE NO : FIGURE 4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847600
847800
817400
817200
817000
12SWA0348E
12SWA0025E
12SWA0347E
12SWA0346E
12SWA0219E
12SWA0203E
12SWA0004E
12SWA0220E
12SWA0079E
12SWA0005E
12SWA0006E
12SWA0344E
12SWA0007E
12SWA0341E
12SWA0339E
12SWA0198E
12SWA0378E
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
CD3
OH2
OH3
OH4
TD7
OH5
TD8
NT82/226
12SWA0199E
12SWA0221E
12SWA0077E
12SWA0223E
12SWA0222E
12SWA0273E
12S
2003/06/0139
12SWA0328E
12SW-A/DF 4
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Past Instabilities
Relict ENTLI
Recent ENTLI
Incident Records

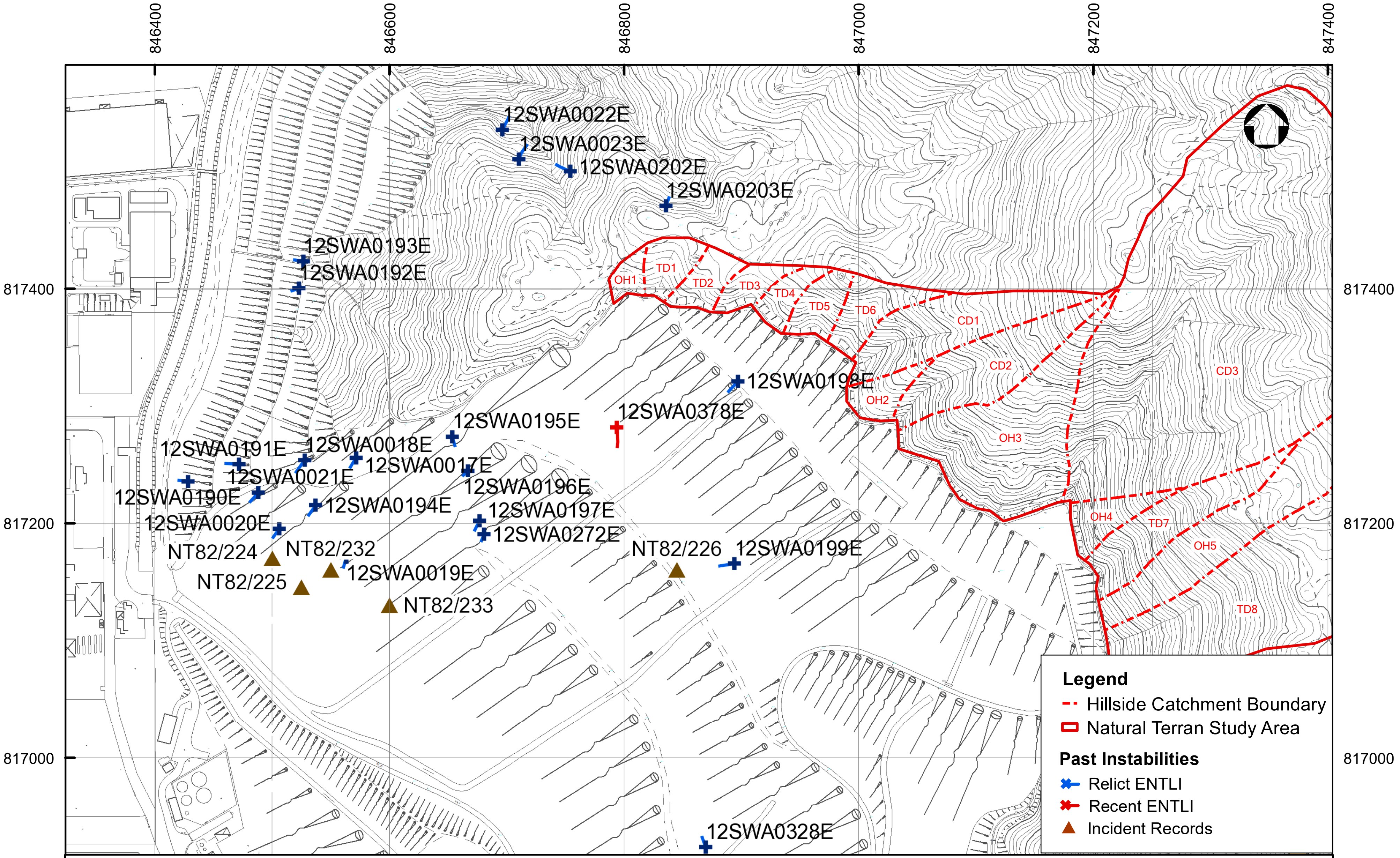
PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Recorded Past Instabilities (Natural Terrain Study Area)

SCALE:
1 :4500

Modern Consulting Engineers Limited
In association with

FIGURE NO :
FIGURE 5.1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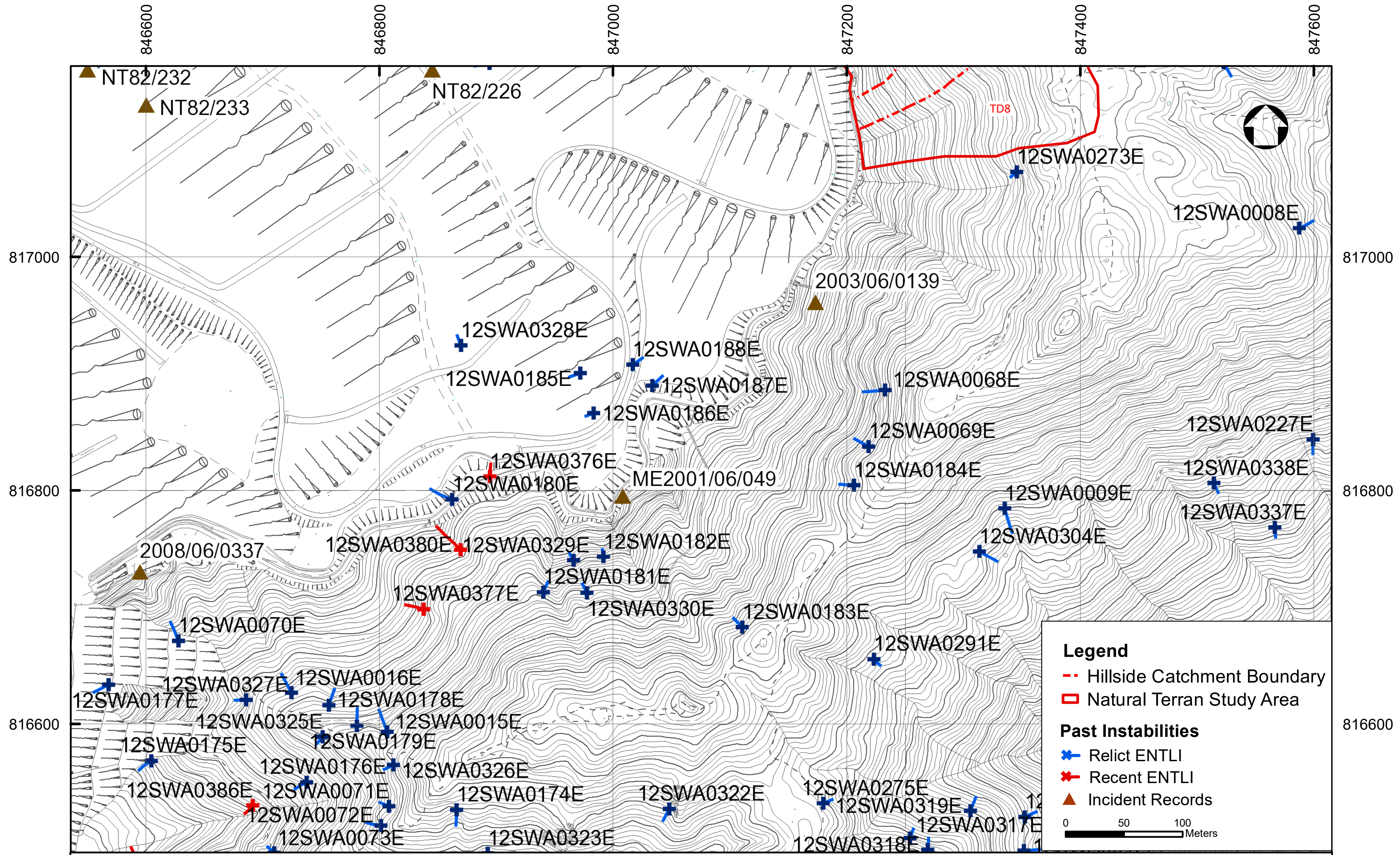
846600
846800
847000
847200
847400
817400
817200
817000
12SWA0022E
12SWA0023E
12SWA0202E
12SWA0203E
12SWA0193E
12SWA0192E
TD1
TD2
TD3
TD4
TD5
TD6
OH1
CD1
CD2
CD3
OH2
OH3
OH4
OH5
TD7
TD8
12SWA0198E
12SWA0378E
12SWA0195E
12SWA0191E
12SWA0018E
12SWA0017E
12SWA0021E
12SWA0196E
12SWA0190E
12SWA0194E
12SWA0197E
12SWA0020E
12SWA0272E
NT82/224
NT82/232
NT82/226
12SWA0199E
12SWA0019E
NT82/225
NT82/233
12SWA0328E
Legend
Hillside Catchment Boundary
Natural Terran Study Area
Past Instabilities
Relict ENTLI
Recent ENTLI
Incident Records

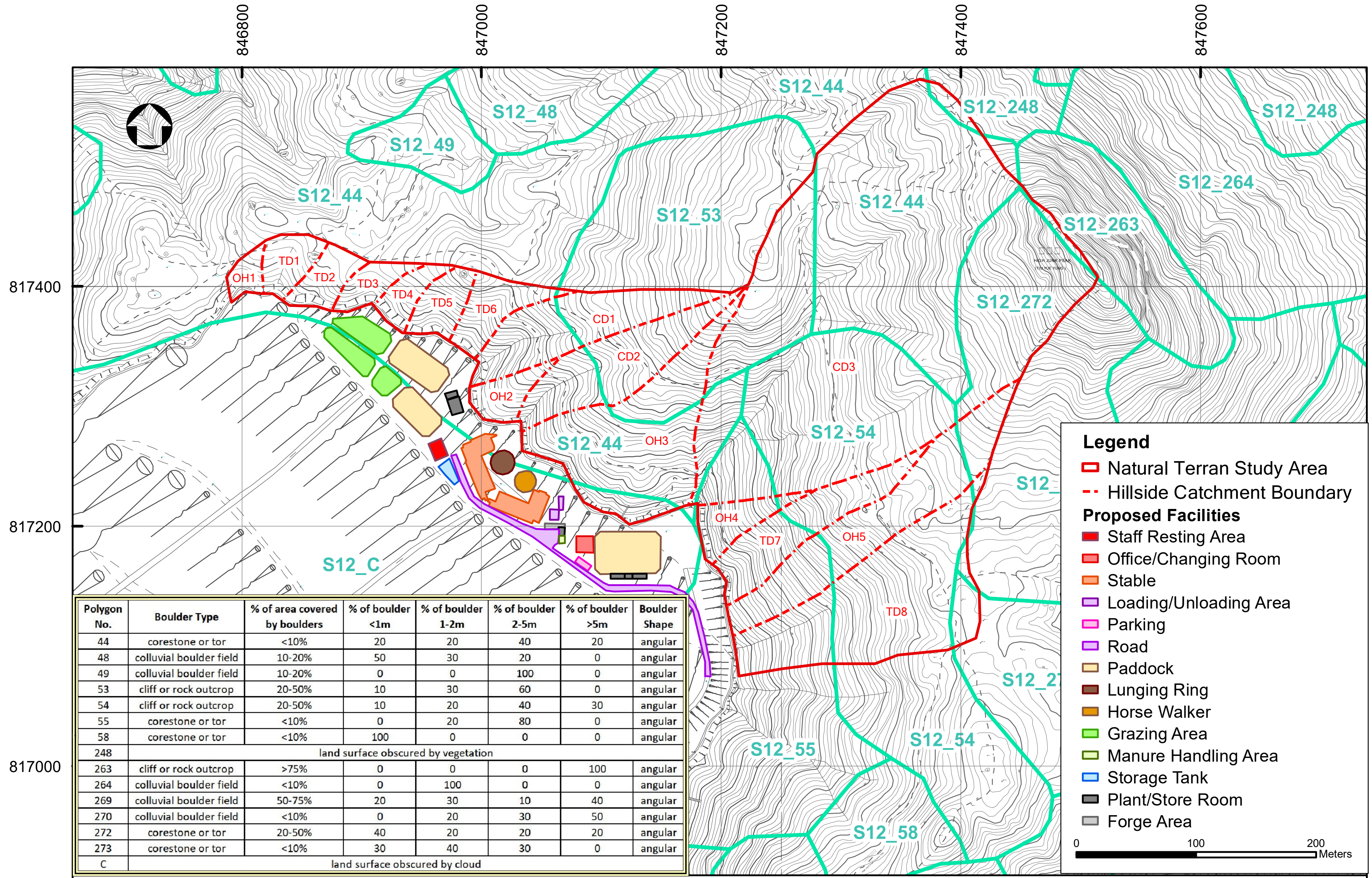
PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Recorded Past Instabilities (Below Study Area - Northern Portion)	SCALE: 1 :4500	Modern Consulting Engineers Limited In association with CALVINT GEO-SERVICES LIMITED	FIGURE NO : FIGURE 5.2


846600
846800
847000
847200
847400
847600
817000
816800
816600
NT82/232
NT82/233
NT82/226
TD8
12SWA0273E
12SWA0008E
2003/06/0139
12SWA0328E
12SWA0188E
12SWA0185E
12SWA0187E
12SWA0068E
12SWA0186E
12SWA0069E
12SWA0227E
12SWA0376E
12SWA0180E
ME2001/06/049
12SWA0184E
12SWA0338E
12SWA0009E
12SWA0337E
2008/06/0337
12SWA0380E
12SWA0329E
12SWA0182E
12SWA0304E
12SWA0181E
12SWA0377E
12SWA0330E
12SWA0183E
12SWA0070E
12SWA0291E
12SWA0327E
12SWA0016E
12SWA0177E
12SWA0178E
12SWA0325E
12SWA0015E
12SWA0175E
12SWA0179E
12SWA0176E
12SWA0326E
12SWA0386E
12SWA0071E
12SWA0174E
12SWA0322E
12SWA0275E
12SWA0319E
12SWA0072E
12SWA0317E
12SWA0073E
12SWA0323E
12SWA0318E
Legend
Hillside Catchment Boundary
Natural Terran Study Area
Past Instabilities
Relict ENTLI
Recent ENTLI
Incident Records
0
50
100
Meters

PROJECT: **Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)**

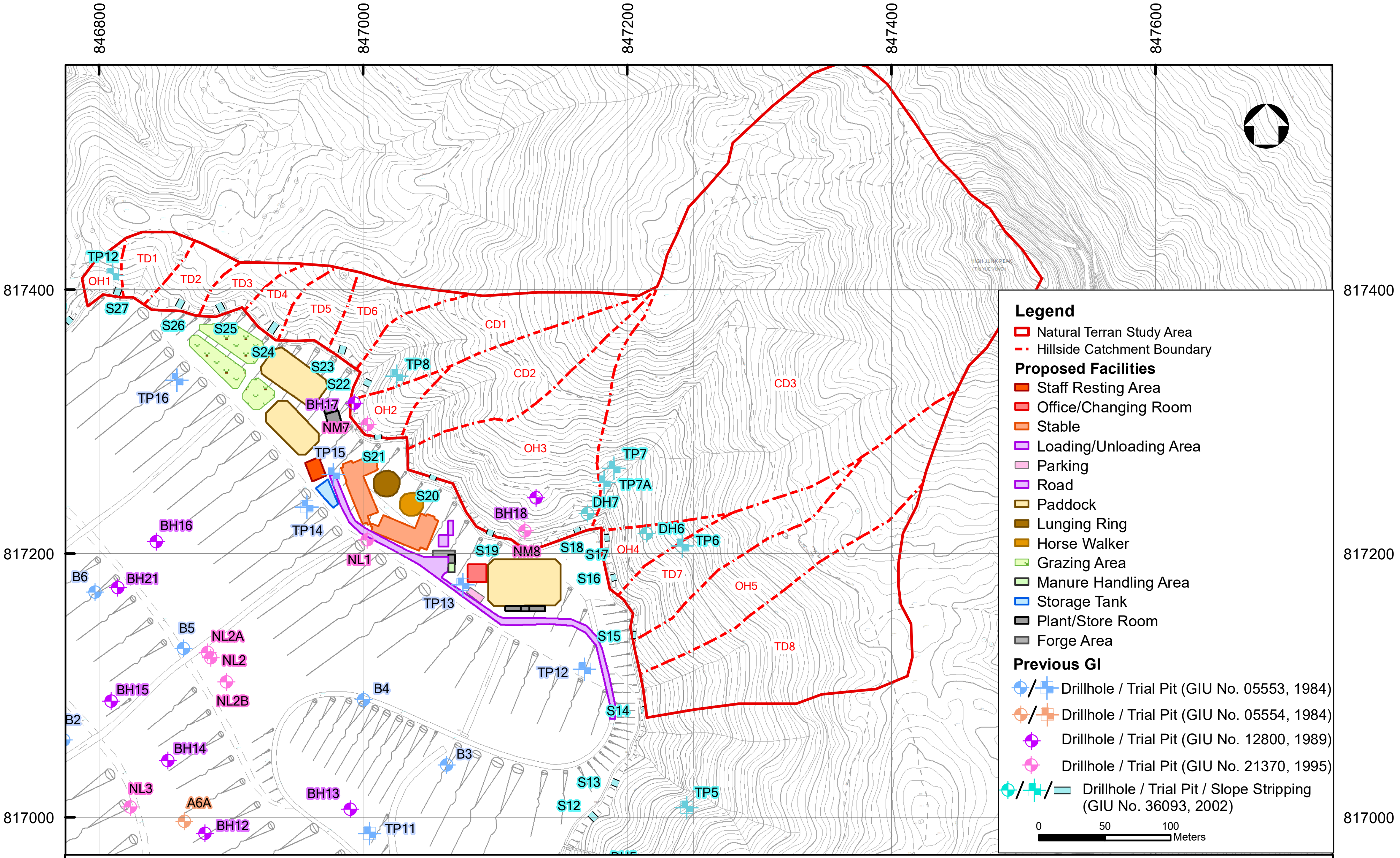
TITLE: **Recorded Past Instabilities (Below Study Area - Southern Portion)**	**SCALE:** **1 :4500**	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 5.3**


846800
847000
847200
847400
847600
817400
817200
817000
S12_44
S12_48
S12_49
S12_248
S12_53
S12_264
S12_263
S12_272
S12_54
S12_55
S12_58
S12_C
TD1
TD2
TD3
TD4
TD5
TD6
TD7
TD8
OH1
OH2
OH3
OH4
OH5
CD1
CD2
CD3
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
0
100
200
Meters

Polygon No.	Boulder Type	% of area covered by boulders	% of boulder <1m	% of boulder 1-2m	% of boulder 2-5m	% of boulder >5m	Boulder Shape
44	corestone or tor	<10%	20	20	40	20	angular
48	colluvial boulder field	10-20%	50	30	20	0	angular
49	colluvial boulder field	10-20%	0	0	100	0	angular
53	cliff or rock outcrop	20-50%	10	30	60	0	angular
54	cliff or rock outcrop	20-50%	10	20	40	30	angular
55	corestone or tor	<10%	0	20	80	0	angular
58	corestone or tor	<10%	100	0	0	0	angular
248	land surface obscured by vegetation						
263	cliff or rock outcrop	>75%	0	0	0	100	angular
264	colluvial boulder field	<10%	0	100	0	0	angular
269	colluvial boulder field	50-75%	20	30	10	40	angular
270	colluvial boulder field	<10%	0	20	30	50	angular
272	corestone or tor	20-50%	40	20	20	20	angular
273	corestone or tor	<10%	30	40	30	0	angular
C	land surface obscured by cloud						

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Boulder Inventory	**SCALE:** 1 :4500	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 6**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847000
847200
847400
847600
817400
817200
817000
TD1
TD2
TD3
TD4
TD5
TD6
TD7
TD8
OH1
OH2
OH3
OH4
OH5
CD1
CD2
CD3
TP12
S27
S26
S25
S24
S23
S22
BH17
NM7
TP16
TP15
S21
TP8
TP14
S20
BH16
BH18
NL1
S19
NM8
S18
S17
S16
TP7
TP7A
DH7
DH6
TP6
B6
BH21
TP13
B5
NL2A
NL2
NL2B
S15
TP12
BH15
B4
B2
S14
BH14
B3
S13
S12
TP5
NL3
A6A
BH13
BH12
TP11
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
Previous GI
Drillhole / Trial Pit (GIU No. 05553, 1984)
Drillhole / Trial Pit (GIU No. 05554, 1984)
Drillhole / Trial Pit (GIU No. 12800, 1989)
Drillhole / Trial Pit (GIU No. 21370, 1995)
Drillhole / Trial Pit / Slope Stripping (GIU No. 36093, 2002)
0
50
100
Meters

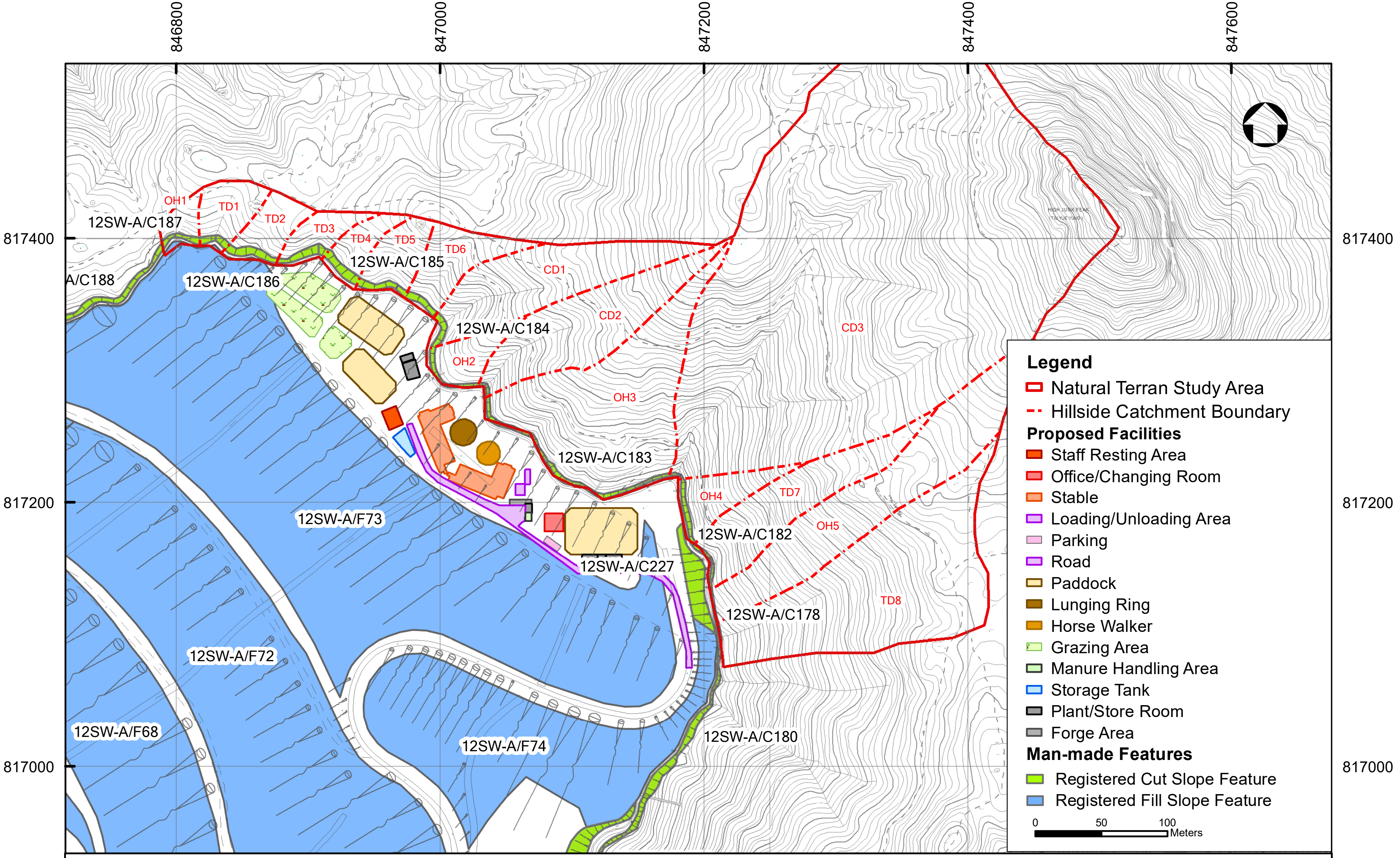
PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Location Plan of Ground Investigations (Natural Terrain Study Area)

SCALE:
1 :4000

Modern Consulting Engineers Limited
In association with
CALVINT GEO-SERVICES LIMITED

FIGURE NO :
FIGURE 7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847200
847400
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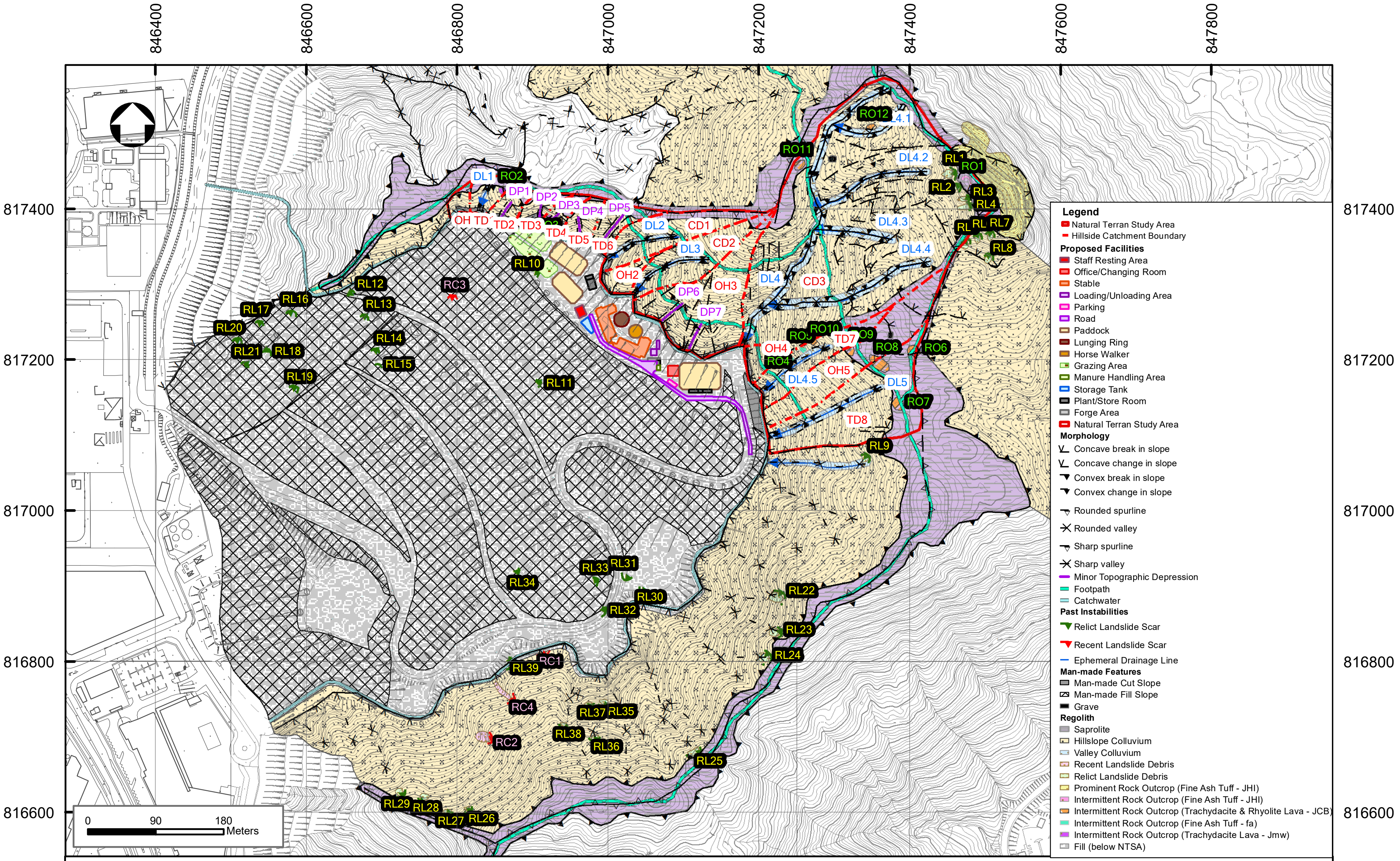
817400
817200
817000
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
CD3
OH2
OH3
OH4
TD7
OH5
TD8
12SW-A/C187
A/C188
12SW-A/C186
12SW-A/C185
12SW-A/C184
12SW-A/C183
12SW-A/C182
12SW-A/C227
12SW-A/C178
12SW-A/C180
12SW-A/F73
12SW-A/F72
12SW-A/F68
12SW-A/F74
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
Man-made Features
Registered Cut Slope Feature
Registered Fill Slope Feature
0
50
100
Meters

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Registered Man-made Features (Natural Terrain Study Area)	**SCALE:** 1 :4000	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 8**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846600
846800
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847600
847800
817400
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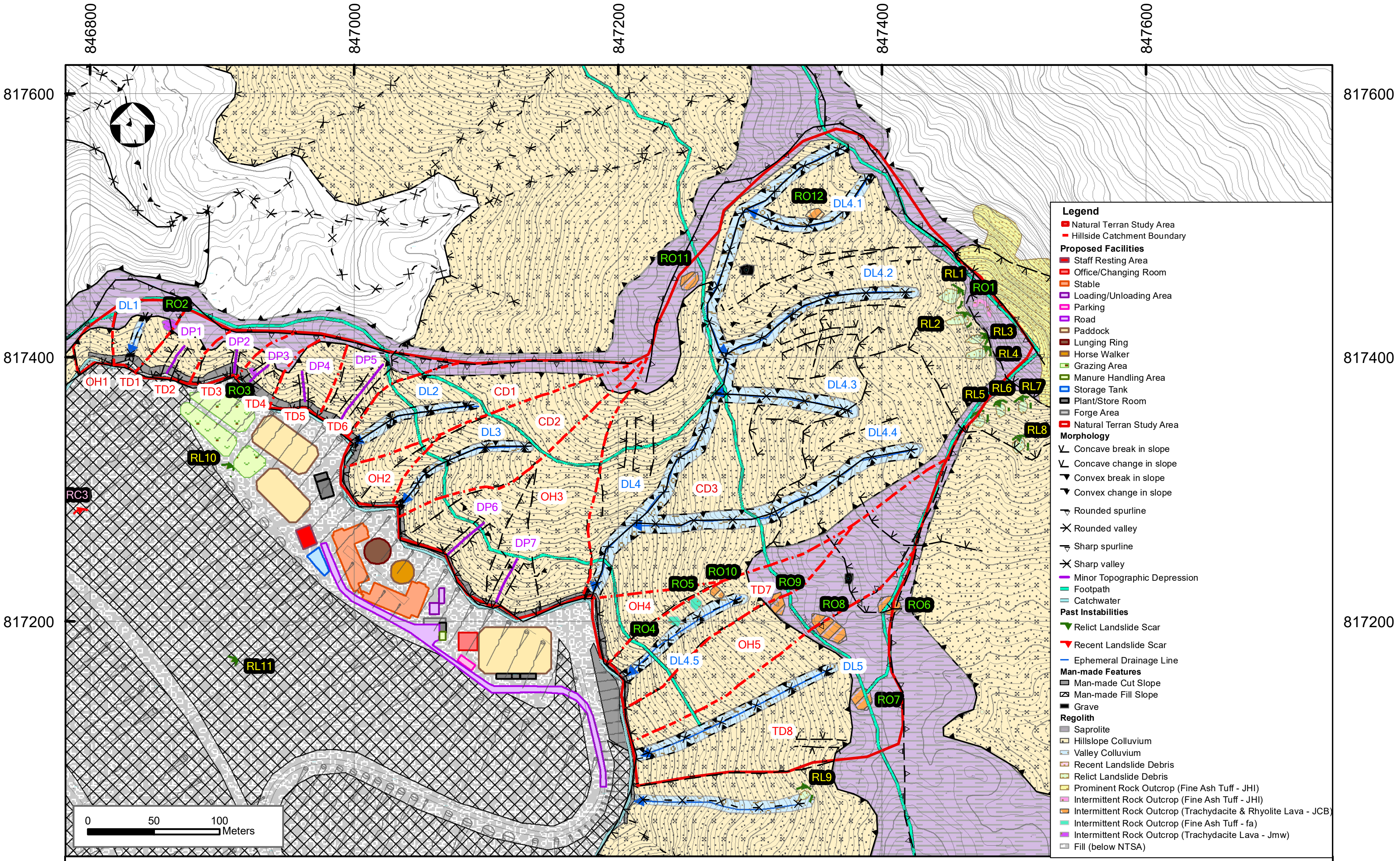
817000
816800
816600
DL1
RO2
DP1
DP2
DP3
DP4
DP5
OH
TD
TD2
TD3
TD4
TD5
TD6
DL2
CD1
DL3
CD2
OH2
OH3
DP6
DP7
DL4
CD3
RC3
RL10
RL11
RL12
RL13
RL14
RL15
RL16
RL17
RL18
RL19
RL20
RL21
RO12
L4.1
RO11
DL4.2
RL1
RO1
RL2
RL3
RL4
RL
RL
RL7
RL8
DL4.3
DL4.4
RO10
TD7
O9
RO8
RO6
OH4
RO4
OH5
DL4.5
DL5
RO7
TD8
RL9
RL22
RL23
RL24
RL25
RL26
RL27
RL28
RL29
RL30
RL31
RL32
RL33
RL34
RL35
RL36
RL37
RL38
RL39
RC1
RC2
RC4
0
90
180
Meters
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
Natural Terran Study Area
Morphology
Concave break in slope
Concave change in slope
Convex break in slope
Convex change in slope
Rounded spurline
Rounded valley
Sharp spurline
Sharp valley
Minor Topographic Depression
Footpath
Catchwater
Past Instabilities
Relict Landslide Scar
Recent Landslide Scar
Ephemeral Drainage Line
Man-made Features
Man-made Cut Slope
Man-made Fill Slope
Grave
Regolith
Saprolite
Hillslope Colluvium
Valley Colluvium
Recent Landslide Debris
Relict Landslide Debris
Prominent Rock Outcrop (Fine Ash Tuff - JHI)
Intermittent Rock Outcrop (Fine Ash Tuff - JHI)
Intermittent Rock Outcrop (Trachydacite & Rhyolite Lava - JCB)
Intermittent Rock Outcrop (Fine Ash Tuff - fa)
Intermittent Rock Outcrop (Trachydacite Lava - Jmw)
Fill (below NTSA)

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Engineering Geomorphological Map (Regional View)	**SCALE:** 1 :7000	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 9.1**


846800
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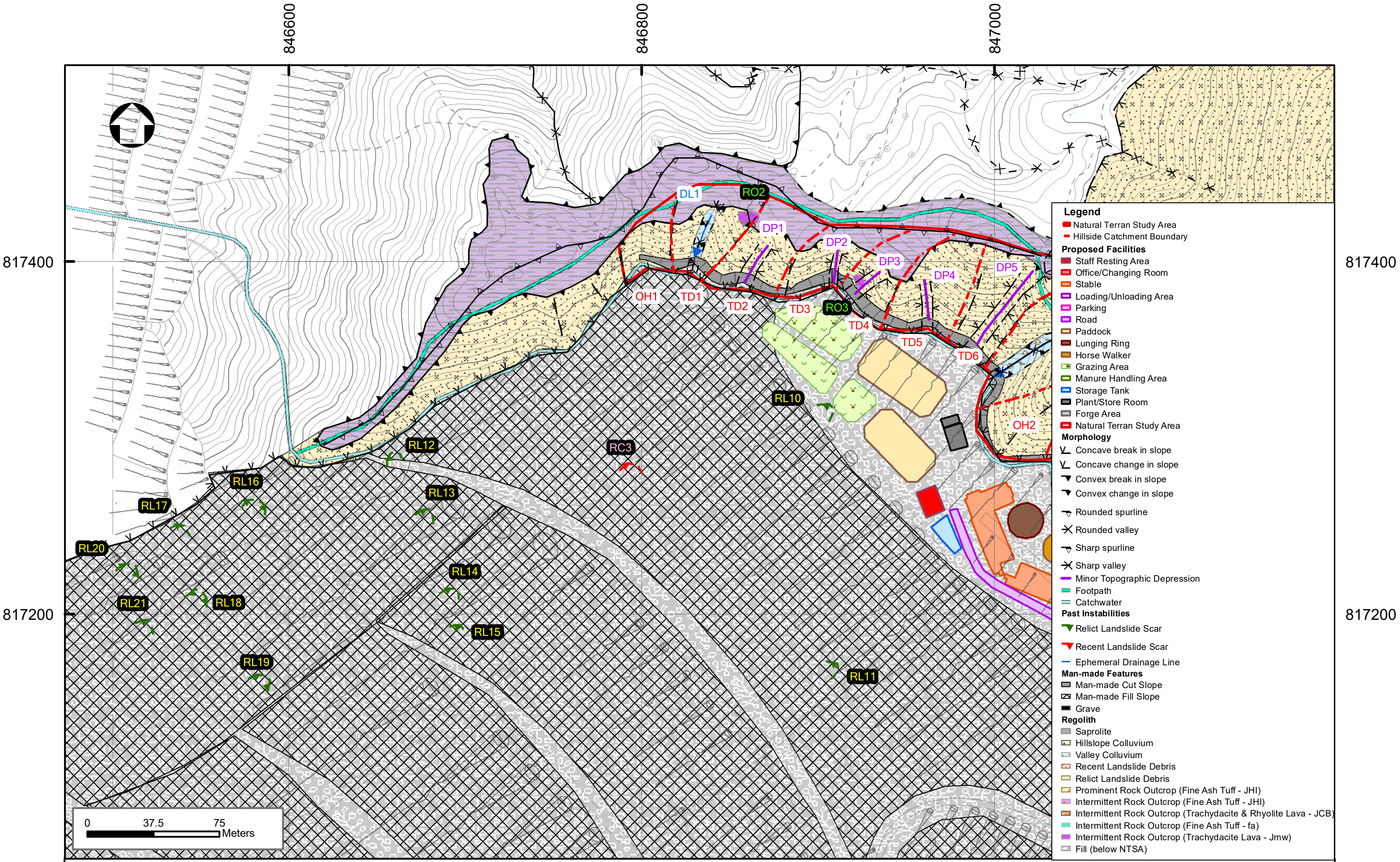
847200
847400
847600
817600
817400
817200
817600
817400
817200
DL1
RO2
DP1
DP2
DP3
DP4
DP5
OH1
TD1
TD2
TD3
RO3
TD4
TD5
TD6
RL10
RC3
DL2
CD1
CD2
DL3
OH2
OH3
DP6
DP7
RL11
RO11
RO12
DL4.1
DL4.2
DL4.3
DL4.4
DL4
CD3
RL1
RO1
RL2
RL3
RL4
RL5
RL6
RL7
RL8
RO10
RO5
TD7
RO9
RO8
RO6
OH4
RO4
OH5
DL4.5
DL5
RO7
TD8
RL9
0
50
100
Meters
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
Natural Terran Study Area
Morphology
Concave break in slope
Concave change in slope
Convex break in slope
Convex change in slope
Rounded spurline
Rounded valley
Sharp spurline
Sharp valley
Minor Topographic Depression
Footpath
Catchwater
Past Instabilities
Relict Landslide Scar
Recent Landslide Scar
Ephemeral Drainage Line
Man-made Features
Man-made Cut Slope
Man-made Fill Slope
Grave
Regolith
Saprolite
Hillslope Colluvium
Valley Colluvium
Recent Landslide Debris
Relict Landslide Debris
Prominent Rock Outcrop (Fine Ash Tuff - JHI)
Intermittent Rock Outcrop (Fine Ash Tuff - JHI)
Intermittent Rock Outcrop (Trachydacite & Rhyolite Lava - JCB)
Intermittent Rock Outcrop (Fine Ash Tuff - fa)
Intermittent Rock Outcrop (Trachydacite Lava - Jmw)
Fill (below NTSA)

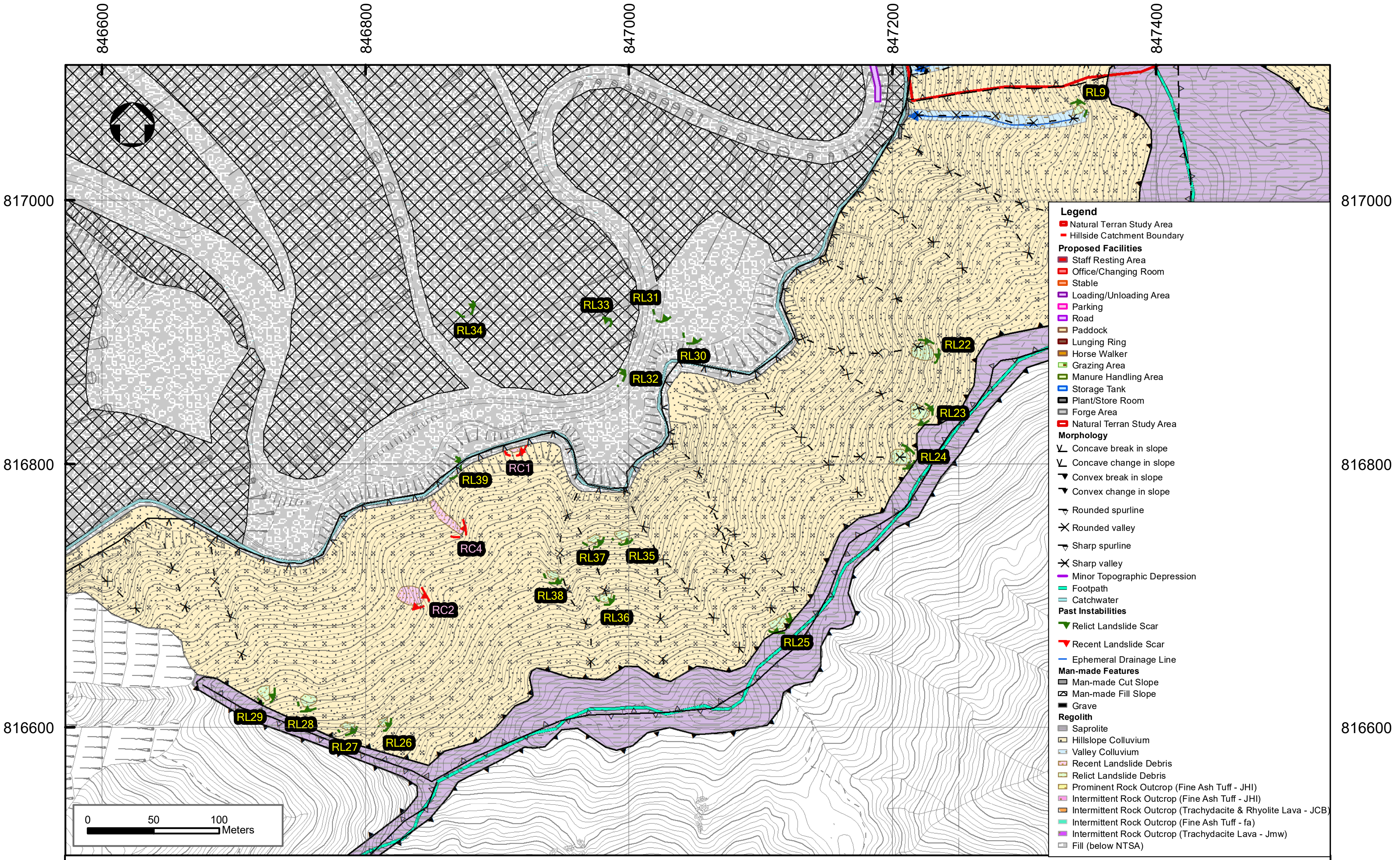
PROJECT: **Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)**

TITLE: **Engineering Geomorphological Map (Natural Terrain Study Area)**	**SCALE:** **1 :4000**	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 9.2**


846600
846800
847000
817400
817400
817200
817200
DL1
RO2
DP1
DP2
DP3
DP4
DP5
OH1
TD1
TD2
TD3
RO3
TD4
TD5
TD6
OH2
RL10
RL11
RL12
RL13
RL14
RL15
RL16
RL17
RL18
RL19
RL20
RL21
RC3
0
37.5
75
Meters
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
Natural Terran Study Area
Morphology
Concave break in slope
Concave change in slope
Convex break in slope
Convex change in slope
Rounded spurline
Rounded valley
Sharp spurline
Sharp valley
Minor Topographic Depression
Footpath
Catchwater
Past Instabilities
Relict Landslide Scar
Recent Landslide Scar
Ephemeral Drainage Line
Man-made Features
Man-made Cut Slope
Man-made Fill Slope
Grave
Regolith
Saprolite
Hillslope Colluvium
Valley Colluvium
Recent Landslide Debris
Relict Landslide Debris
Prominent Rock Outcrop (Fine Ash Tuff - JHI)
Intermittent Rock Outcrop (Fine Ash Tuff - JHI)
Intermittent Rock Outcrop (Trachydacite & Rhyolite Lava - JCB)
Intermittent Rock Outcrop (Fine Ash Tuff - fa)
Intermittent Rock Outcrop (Trachydacite Lava - Jmw)
Fill (below NTSA)

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Engineering Geomorphological Map (Below Study Area - Northern Portion)	**SCALE:** 1 :4000	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 9.3**


846600
846800
847000
847200
847400
817000
816800
816600
RL9
RL22
RL23
RL24
RL25
RL26
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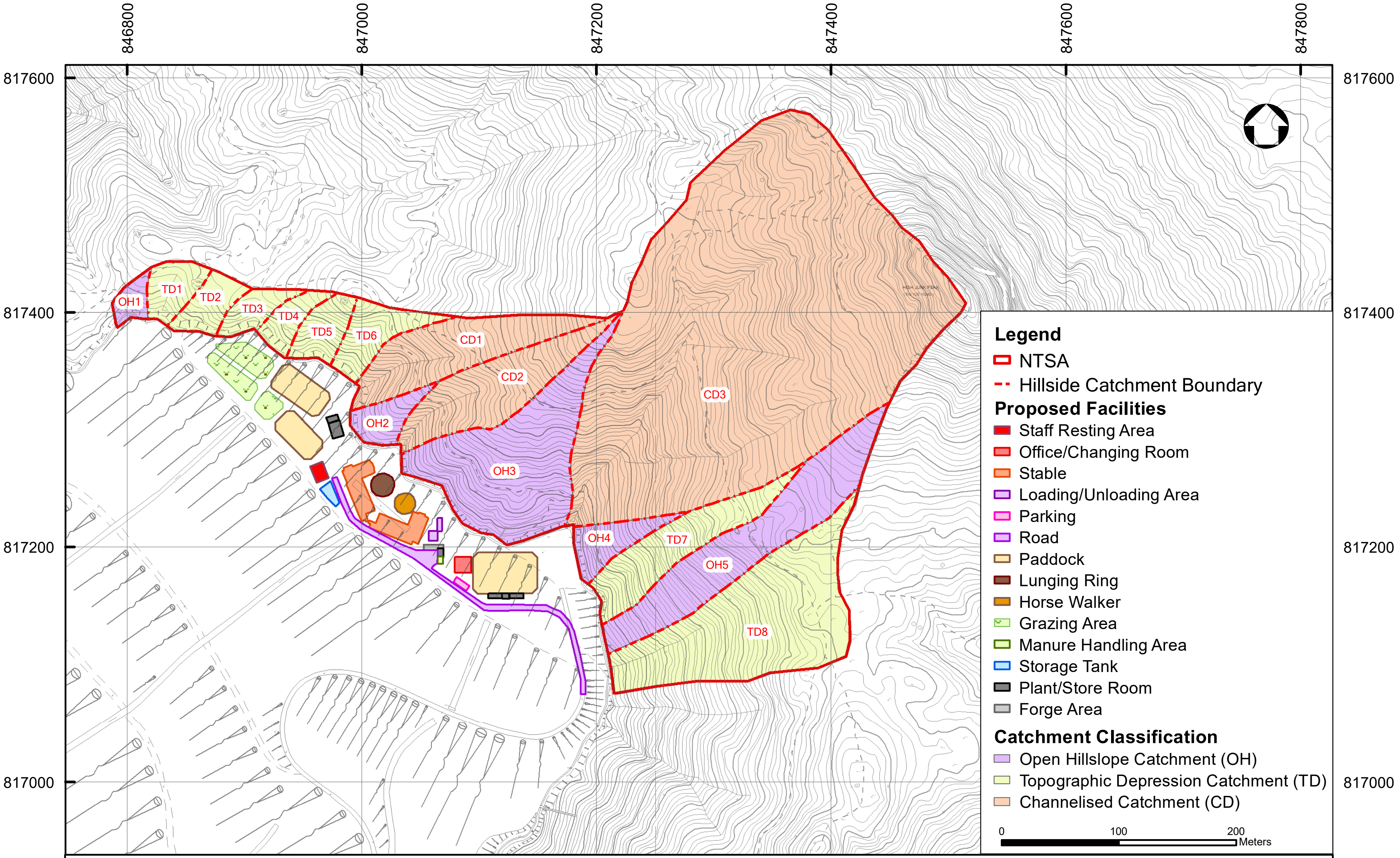
RL28
RL29
RL30
RL31
RL32
RL33
RL34
RL35
RL36
RL37
RL38
RL39
RC1
RC2
RC4
0
50
100
Meters
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
Natural Terran Study Area
Morphology
Concave break in slope
Concave change in slope
Convex break in slope
Convex change in slope
Rounded spurline
Rounded valley
Sharp spurline
Sharp valley
Minor Topographic Depression
Footpath
Catchwater
Past Instabilities
Relict Landslide Scar
Recent Landslide Scar
Ephemeral Drainage Line
Man-made Features
Man-made Cut Slope
Man-made Fill Slope
Grave
Regolith
Saprolite
Hillslope Colluvium
Valley Colluvium
Recent Landslide Debris
Relict Landslide Debris
Prominent Rock Outcrop (Fine Ash Tuff - JHI)
Intermittent Rock Outcrop (Fine Ash Tuff - JHI)
Intermittent Rock Outcrop (Trachydacite & Rhyolite Lava - JCB)
Intermittent Rock Outcrop (Fine Ash Tuff - fa)
Intermittent Rock Outcrop (Trachydacite Lava - Jmw)
Fill (below NTSA)

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE:	Engineering Geomorphological Map (Below Study Area - Southern Portion)	**SCALE:** 1 :4000	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 9.4**


846800
847000
847200
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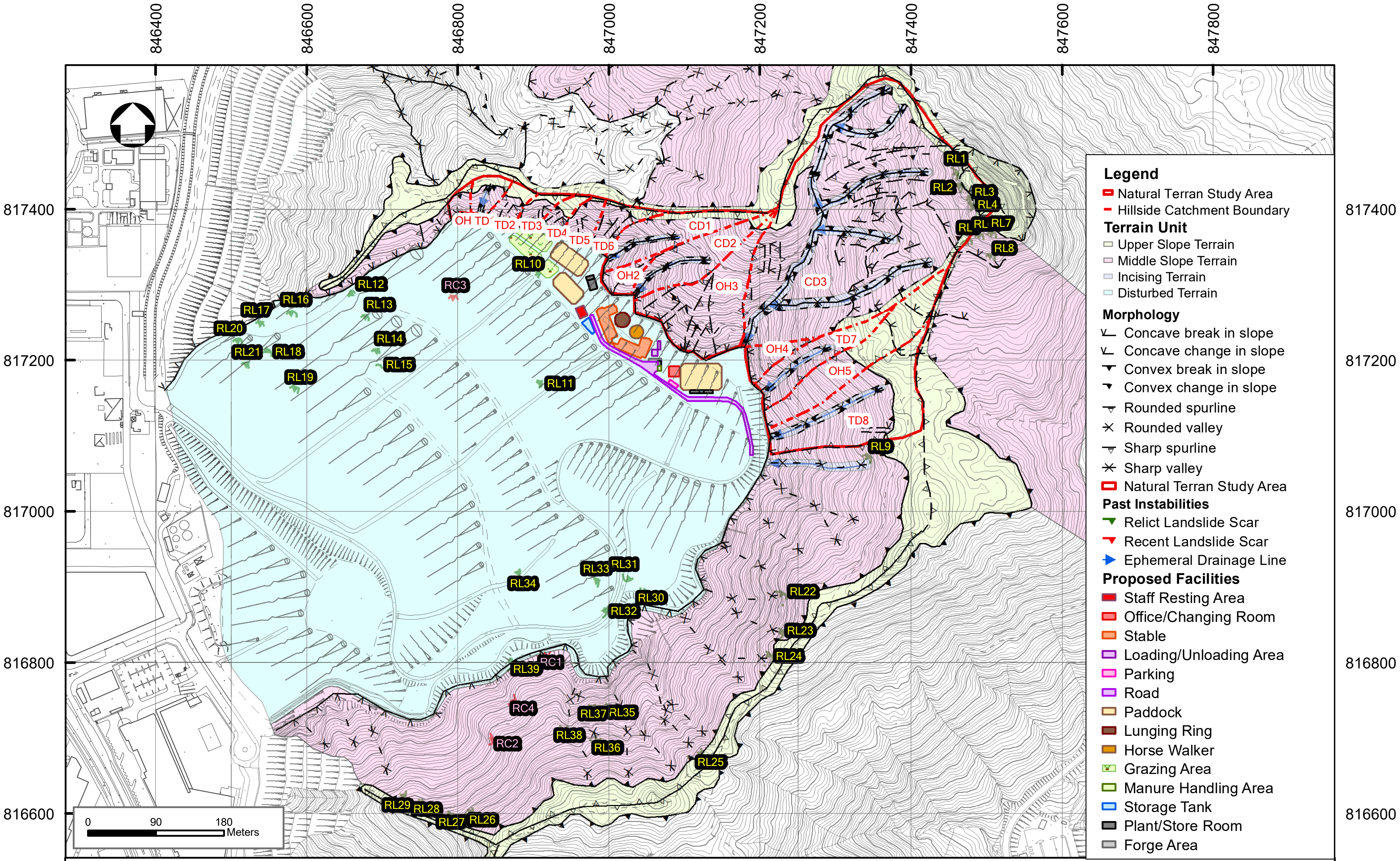
847600
847800
817600
817400
817200
817000
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
CD3
OH2
OH3
OH4
TD7
OH5
TD8
Legend
NTSA
Hillside Catchment Boundary
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
Catchment Classification
Open Hillslope Catchment (OH)
Topographic Depression Catchment (TD)
Channelised Catchment (CD)
0
100
200
Meters

PROJECT: **Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)**

TITLE: **Catchment Classification Map**	**SCALE:** **1 :4500**	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 10**


846400
846600
846800
847000
847200
847400
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847800
817400
817200
817000
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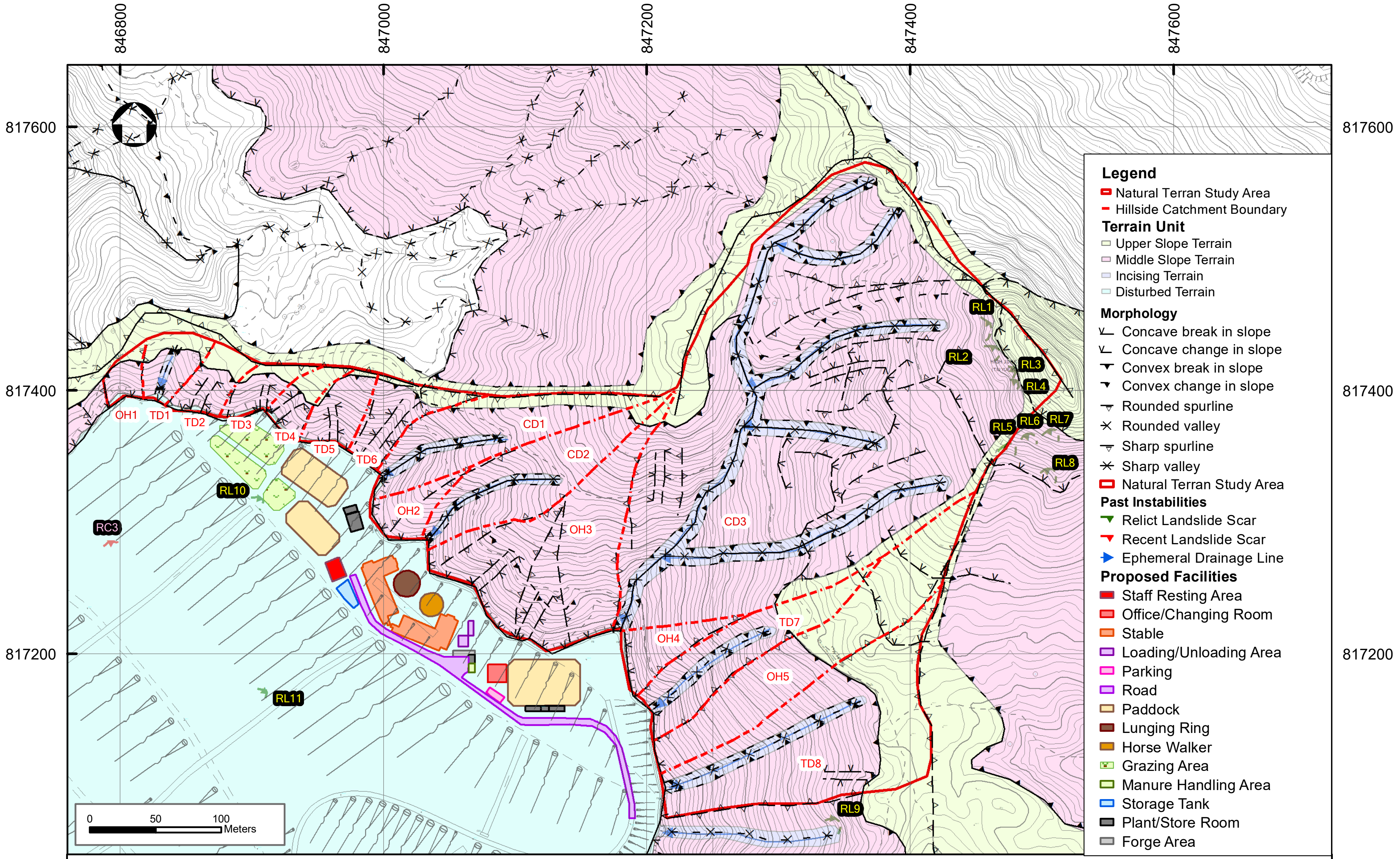
816600
OH TD
TD2
TD3
TD4
TD5
TD6
CD1
CD2
CD3
OH2
OH3
OH4
OH5
TD7
TD8
RL1
RL2
RL3
RL4
RL
RL
RL7
RL8
RL9
RL10
RL11
RL12
RL13
RL14
RL15
RL16
RL17
RL18
RL19
RL20
RL21
RL22
RL23
RL24
RL25
RL26
RL27
RL28
RL29
RL30
RL31
RL32
RL33
RL34
RL35
RL36
RL37
RL38
RL39
RC1
RC2
RC3
RC4
0
90
180
Meters
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Terrain Unit
Upper Slope Terrain
Middle Slope Terrain
Incising Terrain
Disturbed Terrain
Morphology
Concave break in slope
Concave change in slope
Convex break in slope
Convex change in slope
Rounded spurline
Rounded valley
Sharp spurline
Sharp valley
Natural Terran Study Area
Past Instabilities
Relict Landslide Scar
Recent Landslide Scar
Ephemeral Drainage Line
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Terrain Unit Map (Regional View)	**SCALE:** 1 :7000	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 11.1**


846800
847000
847200
847400
847600
817600
817400
817200
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Terrain Unit
Upper Slope Terrain
Middle Slope Terrain
Incising Terrain
Disturbed Terrain
Morphology
Concave break in slope
Concave change in slope
Convex break in slope
Convex change in slope
Rounded spurline
Rounded valley
Sharp spurline
Sharp valley
Natural Terran Study Area
Past Instabilities
Relict Landslide Scar
Recent Landslide Scar
Ephemeral Drainage Line
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
RL1
RL2
RL3
RL4
RL5
RL6
RL7
RL8
RL10
RC3
RL11
OH4
TD7
OH5
TD8
RL9
0
50
100
Meters

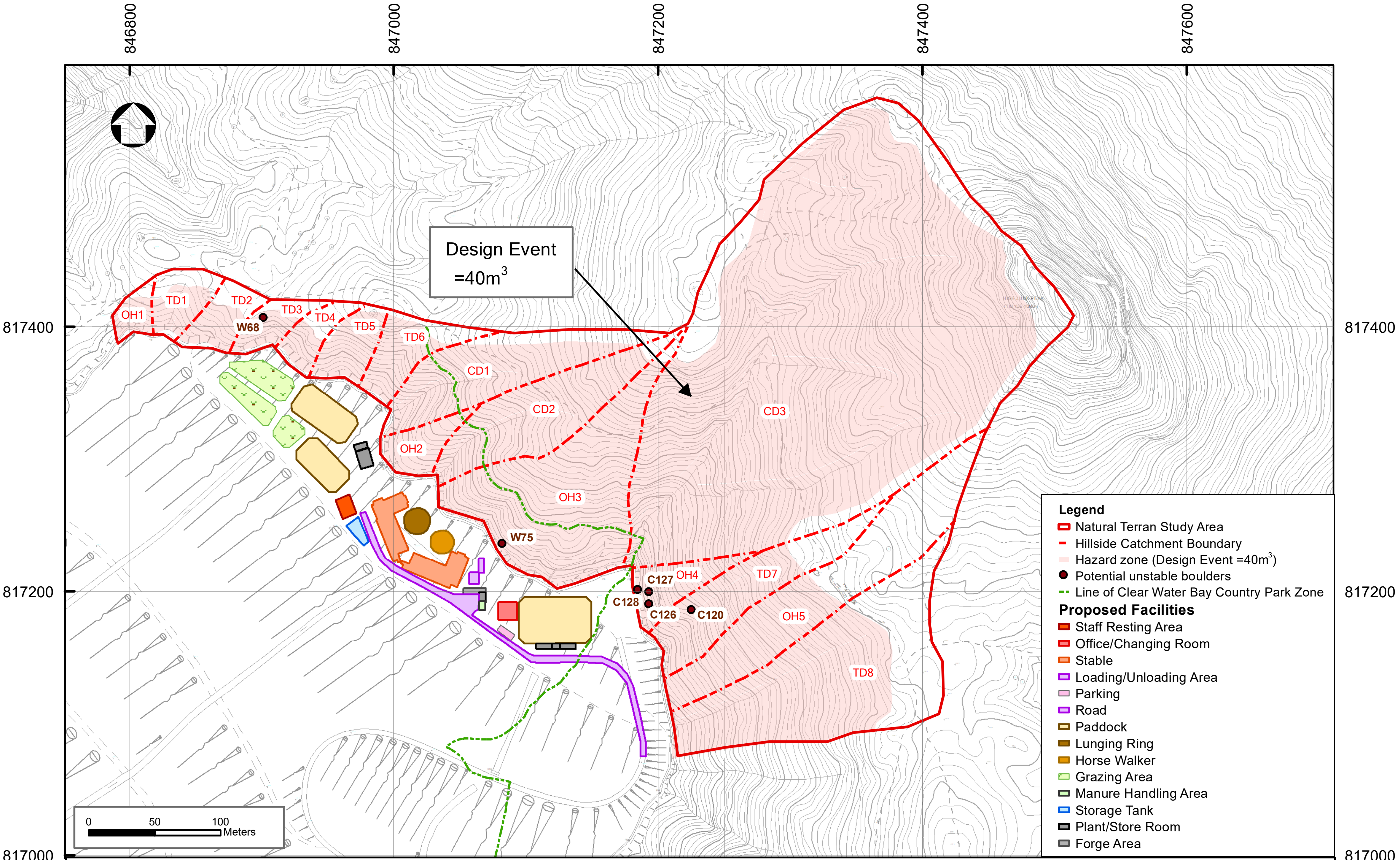
PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Terrain Unit Map (Natural Terrain Study Area)

SCALE:
1 :7000

Modern Consulting Engineers Limited
In association with
CALVINT GEO-SERVICES LIMITED

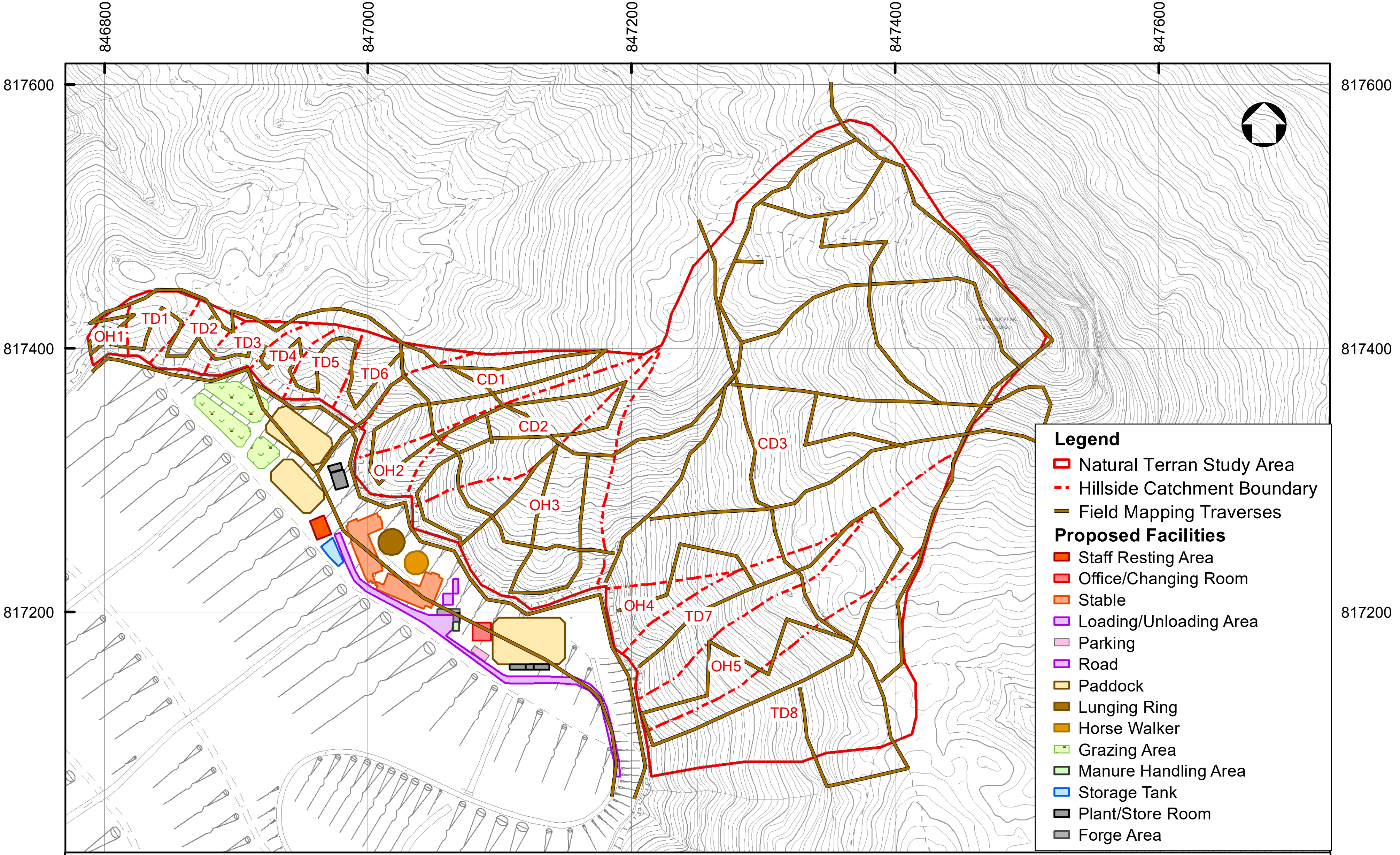
FIGURE NO :
FIGURE 11.2



846800
847000
847200
847400
847600
817400
817200
817000
Design Event
=40m³
OH1
TD1
TD2
W68
TD3
TD4
TD5
TD6
CD1
CD2
CD3
OH2
OH3
W75
OH4
C127
C128
C126
C120
TD7
OH5
TD8
0
50
100
Meters
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Hazard zone (Design Event =40m³)
Potential unstable boulders
Line of Clear Water Bay Country Park Zone
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Natural Terrain Hazard Map	**SCALE:** 1 :4000	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE 12**


846800
847000
847200
847400
847600
817600
817400
817200
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
OH4
TD7
OH5
TD8
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Field Mapping Traverses
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Field Mapping Traverses

SCALE:
1 :4000

Modern Consulting Engineers Limited
In association with
CALVINT GEO-SERVICES LIMITED

FIGURE NO :
FIGURE 13

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Plate 13 Relict landslide scar RL7 (ENTLI No. 12SWA0007E) located at the Crest of the Catchment Adjacent to Catchment No. CD3

Plate 14 Relict landslide scar RL8 (ENTLI No. 12SWA0339E) located at the Crest of the Catchment Adjacent to Catchment No. CD3

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Plate 16 General View of the Ephemeral Drainage Lines within NTSA

Plate 17 General View of Topographic Depressions within NTSA

Plate 18 Anthropogenic Features within and below the NTSA

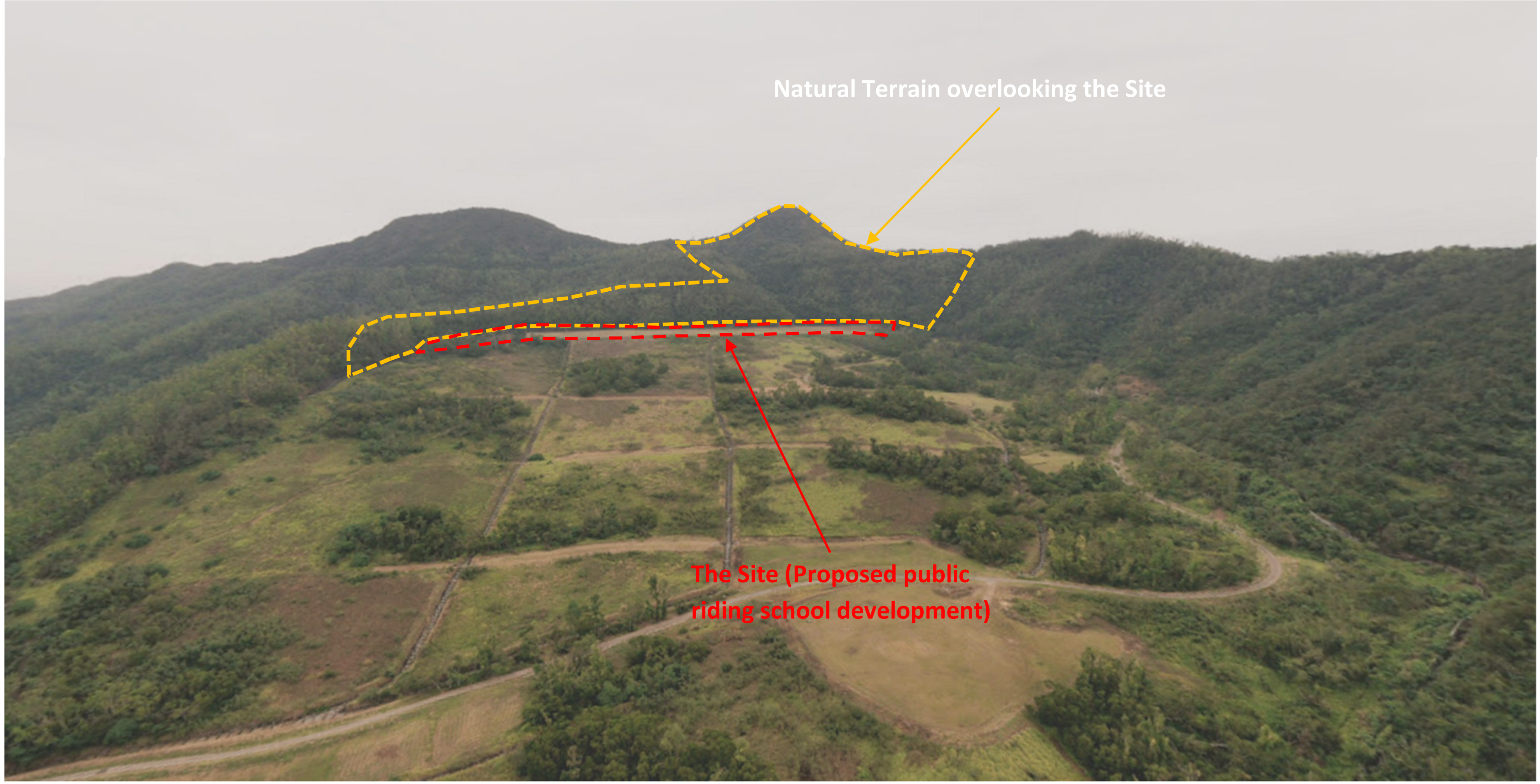

Natural Terrain overlooking the Site
The Site (Proposed public riding school development)

Plate 1 General View of the Natural Terrain Hazard Study Area (NTSA) overlooking the Site

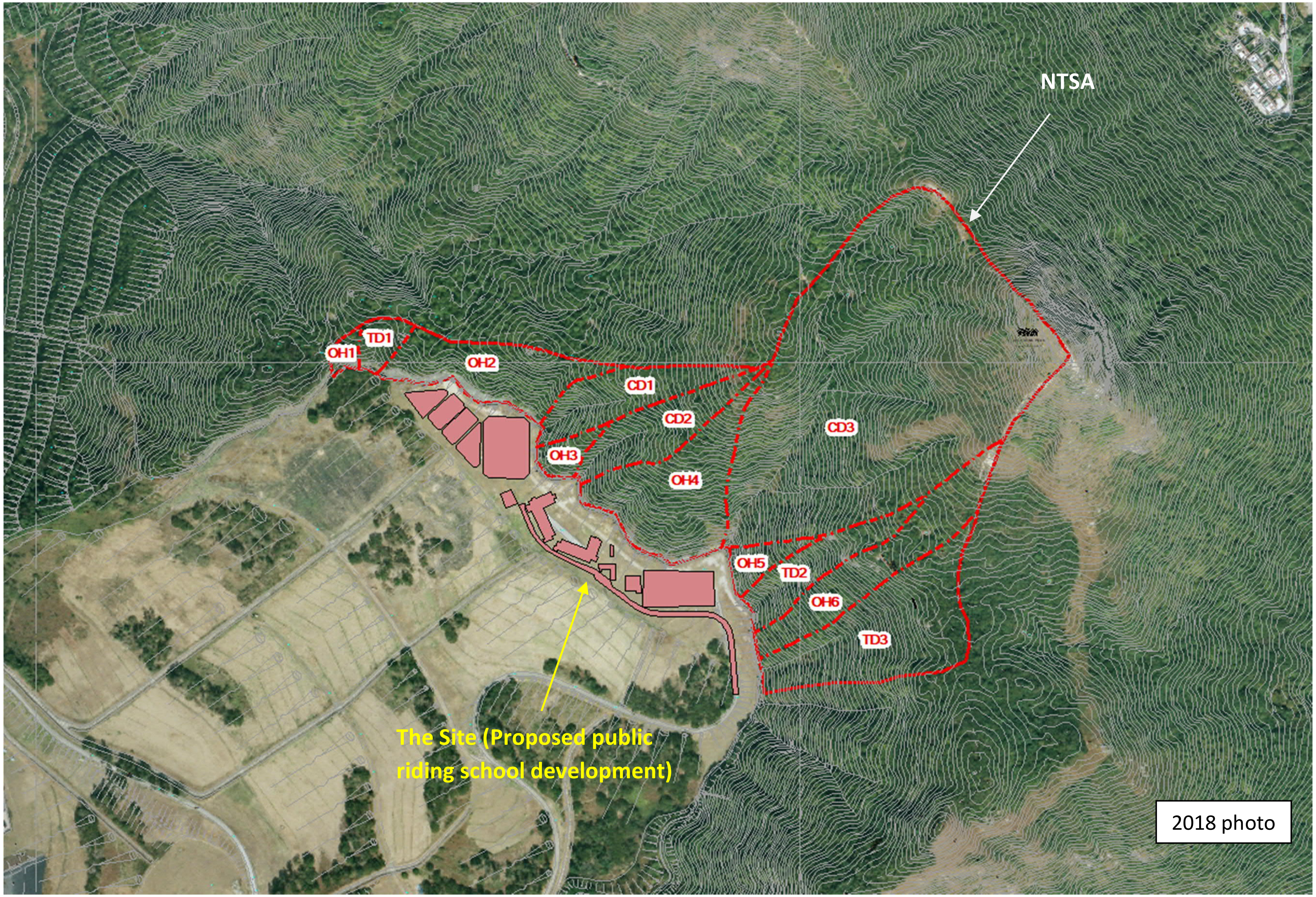
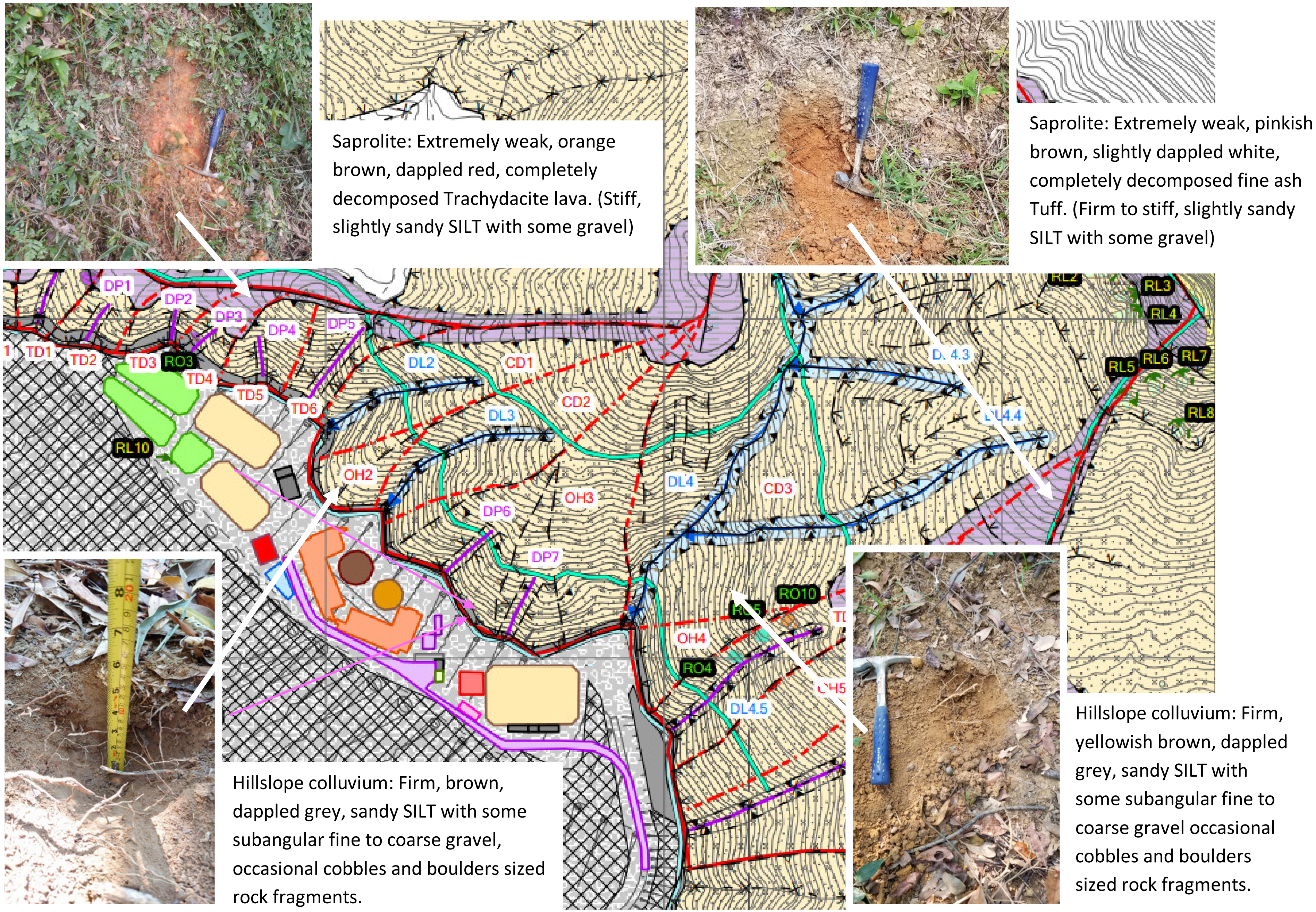

NTSA
TD1
OH1
OH2
CD1
CD2
CD3
OH3
OH4
OH5
TD2
OH6
TD3
The Site (Proposed public riding school development)
2018 photo

Plate 2 Aerial view of the NTSA and the Site


DP1
DP2
DP3
DP4
DP5
DP6
DP7
TD1
TD2
TD3
TD4
TD5
TD6
RO3
RL10
DL2
CD1
CD2
DL3
OH2
OH3
DL4
CD3
DL 4.3
DL4.4
RL2
RL3
RL4
RL5
RL6
RL7
RL8
RO10
OH4
RO4
OH5
DL4.5

Saprolite: Extremely weak, orange brown, dappled red, completely decomposed Trachydacite lava. (Stiff, slightly sandy SILT with some gravel)

Saprolite: Extremely weak, pinkish brown, slightly dappled white, completely decomposed fine ash Tuff. (Firm to stiff, slightly sandy SILT with some gravel)

Hillslope colluvium: Firm, brown, dappled grey, sandy SILT with some subangular fine to coarse gravel, occasional cobbles and boulders sized rock fragments.

Hillslope colluvium: Firm, yellowish brown, dappled grey, sandy SILT with some subangular fine to coarse gravel occasional cobbles and boulders sized rock fragments.

Plate 3 Saprolitic soil and Hillslope Colluvium within the NTSA

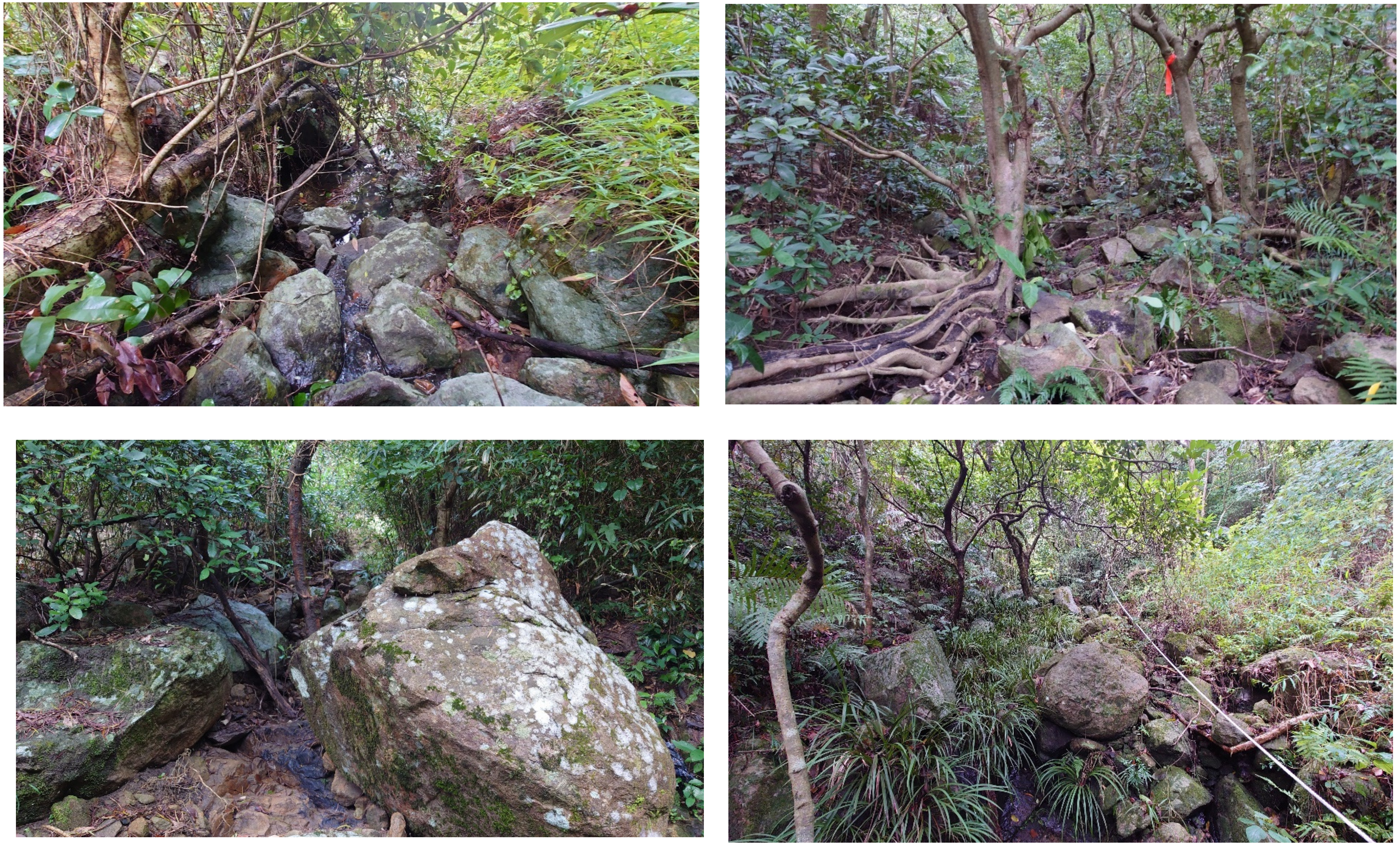


Plate 4 Valley Colluvium along the ephemeral drainage lines within the NTSA

Plate 5 Boulders Scattered across the NTSA

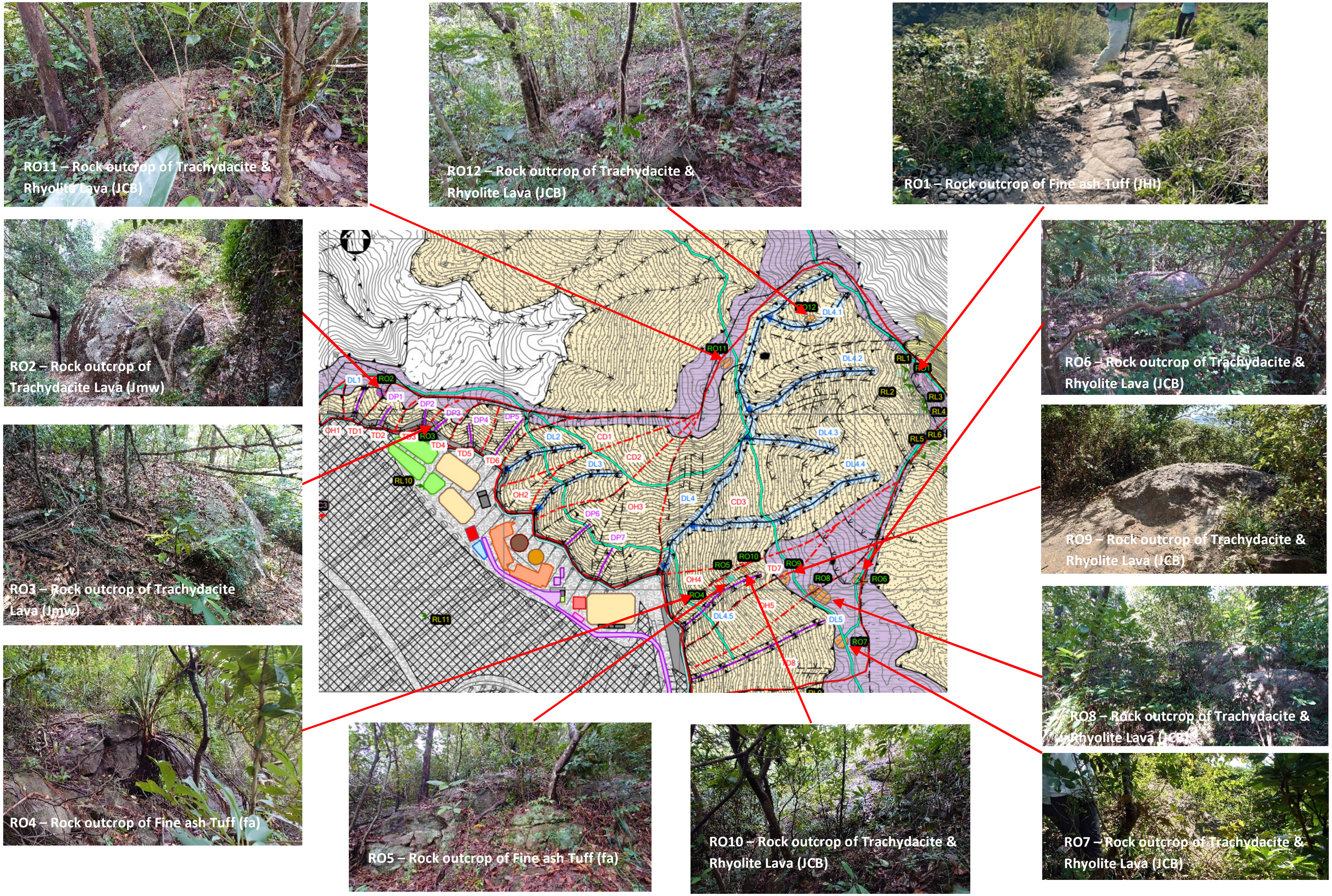
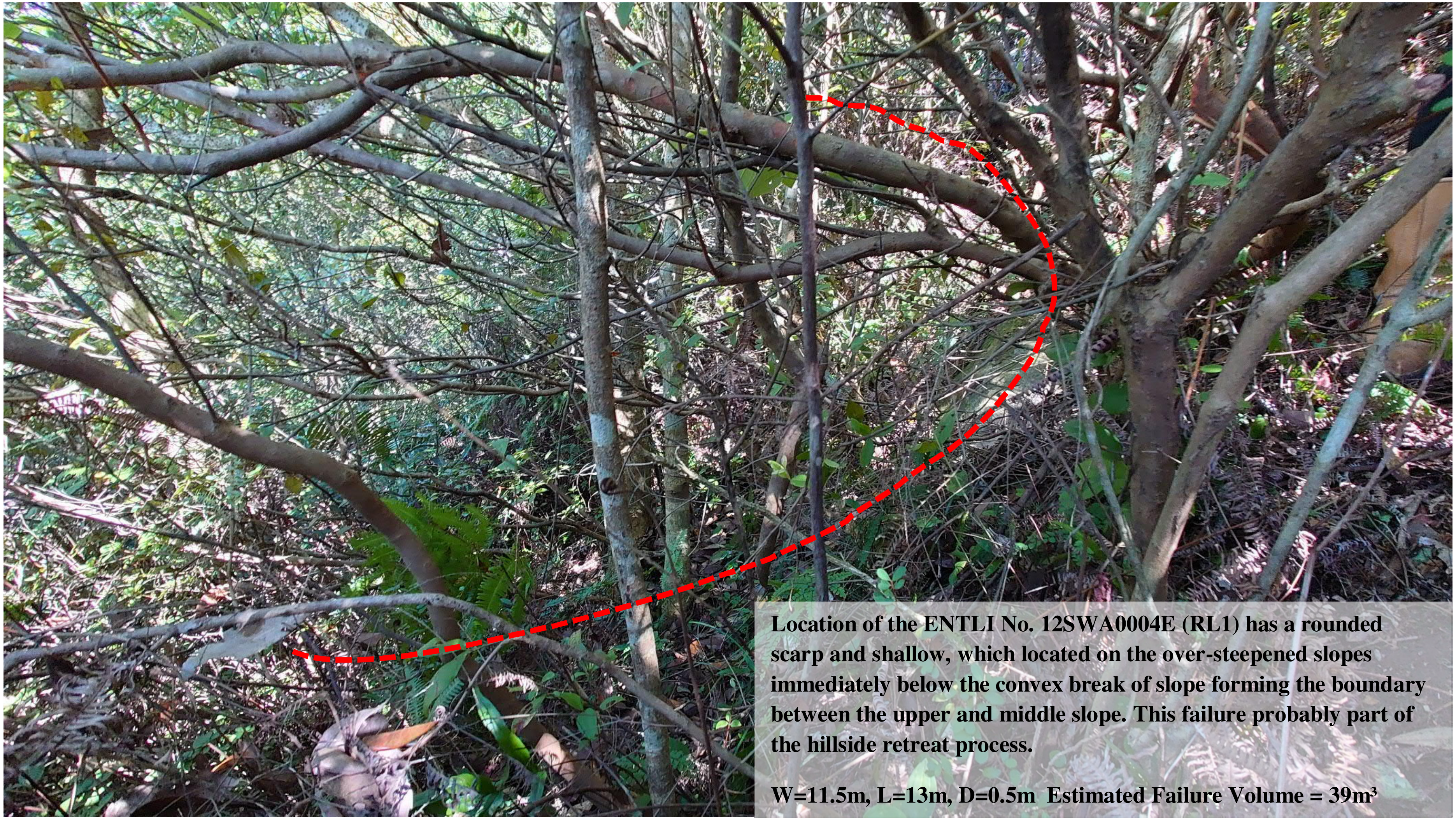

RO11 – Rock outcrop of Trachydacite & Rhyolite Lava (JCB)
RO12 – Rock outcrop of Trachydacite & Rhyolite Lava (JCB)
RO1 – Rock outcrop of Fine ash Tuff (JHI)
RO2 – Rock outcrop of Trachydacite Lava (Jmw)
RO6 – Rock outcrop of Trachydacite & Rhyolite Lava (JCB)
RO3 – Rock outcrop of Trachydacite Lava (Jmw)
RO9 – Rock outcrop of Trachydacite & Rhyolite Lava (JCB)
RO8 – Rock outcrop of Trachydacite & Rhyolite Lava (JCB)
RO4 – Rock outcrop of Fine ash Tuff (fa)
RO5 – Rock outcrop of Fine ash Tuff (fa)
RO10 – Rock outcrop of Trachydacite & Rhyolite Lava (JCB)
RO7 – Rock outcrop of Trachydacite & Rhyolite Lava (JCB)
RO12
DL4.1
RO11
DL4.2
RL1
RO1
RL2
RL3
RL4
RL5
RL6
DL1
RO2
DP1
DP2
DP3
DP4
DP5
OH1
TD1
TD2
TD3
RO3
TD4
TD5
TD6
DL2
CD1
CD2
DL3
DL4.3
DL4.4
RL10
OH2
OH3
DL4
CD3
C3
DP6
DP7
RO5
RO10
RO9
TD7
RO8
RO6
OH4
RO4
OH5
DL4.5
DL5
RO7
RL11

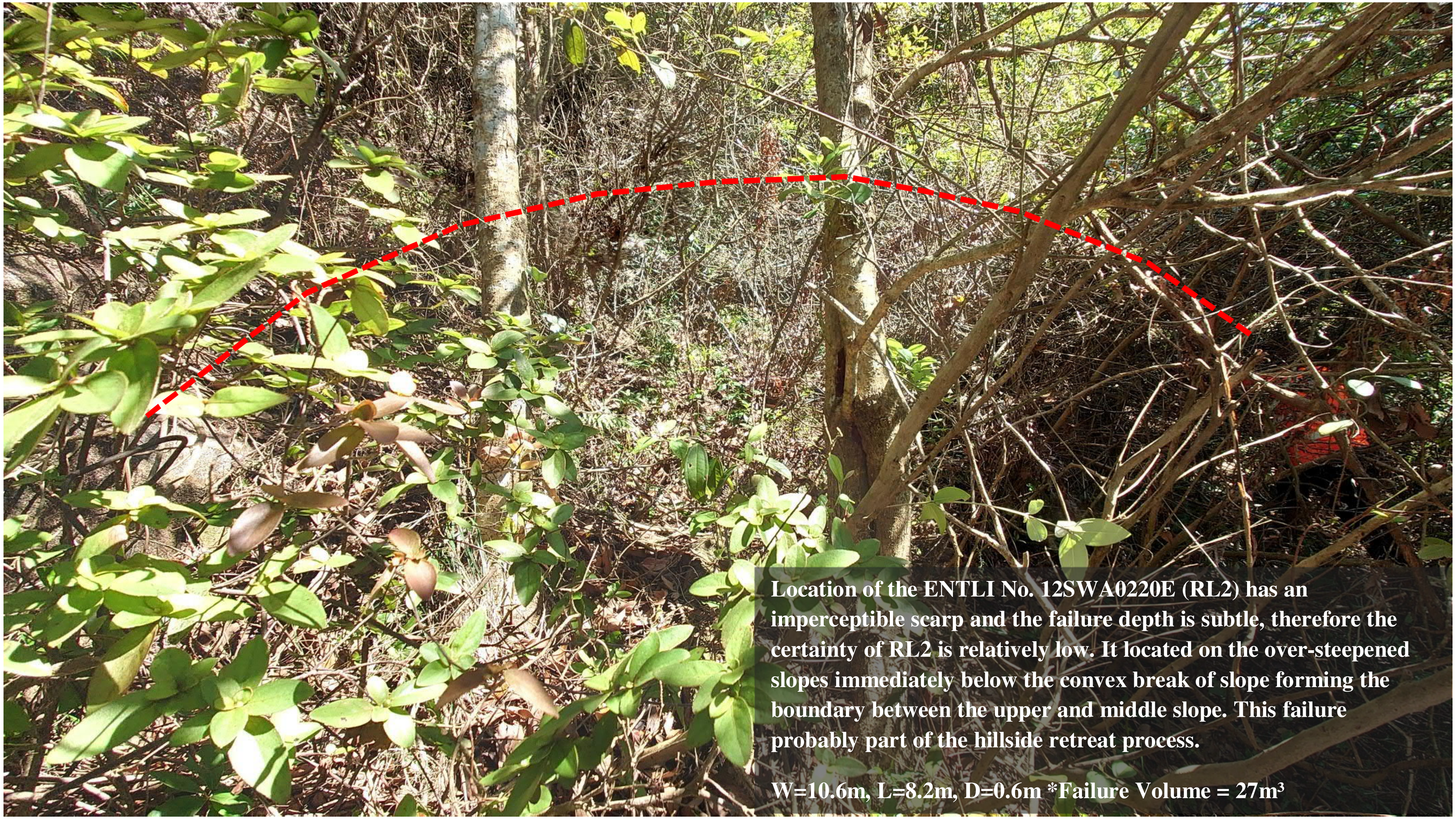
Plate 6 Rock Outcrops Discerned within the NTSA



Location of the ENTLI No. 12SWA0004E (RL1) has a rounded scarp and shallow, which located on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and middle slope. This failure probably part of the hillside retreat process.

W=11.5m, L=13m, D=0.5m Estimated Failure Volume = 39m³

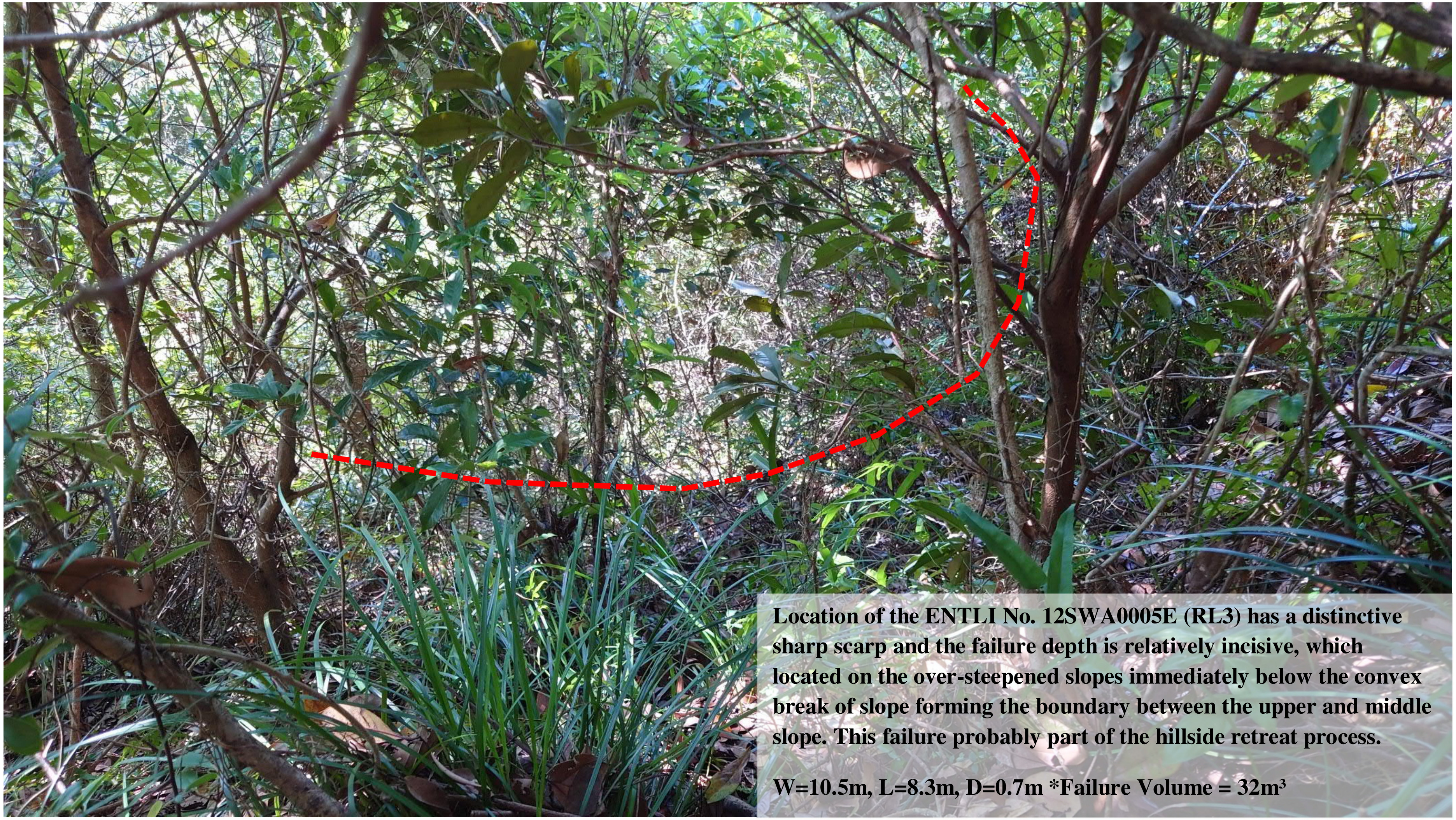
Plate 7 Relict landslide scar RL1 (ENTLI No. 12SWA0004E) located at the Crest of Catchment No. CD3



Location of the ENTLI No. 12SWA0220E (RL2) has an imperceptible scarp and the failure depth is subtle, therefore the certainty of RL2 is relatively low. It located on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and middle slope. This failure probably part of the hillside retreat process.

W=10.6m, L=8.2m, D=0.6m *Failure Volume = 27m³

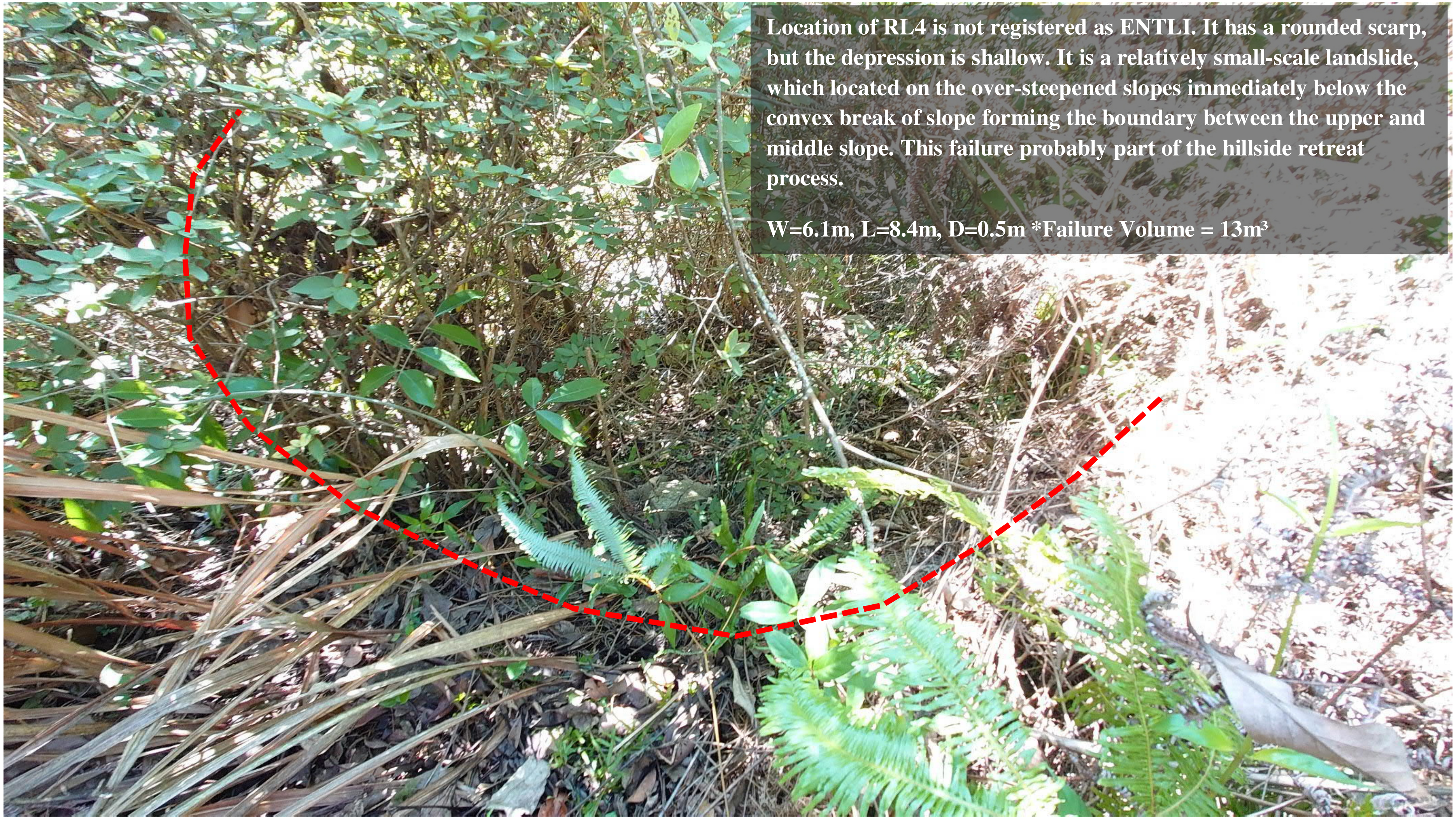
Plate 8 Relict landslide scar RL2 (ENTLI No. 12SWA0220E) located at the Crest of Catchment No. CD3



Location of the ENTLI No. 12SWA0005E (RL3) has a distinctive sharp scarp and the failure depth is relatively incisive, which located on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and middle slope. This failure probably part of the hillside retreat process.

W=10.5m, L=8.3m, D=0.7m *Failure Volume = 32m³

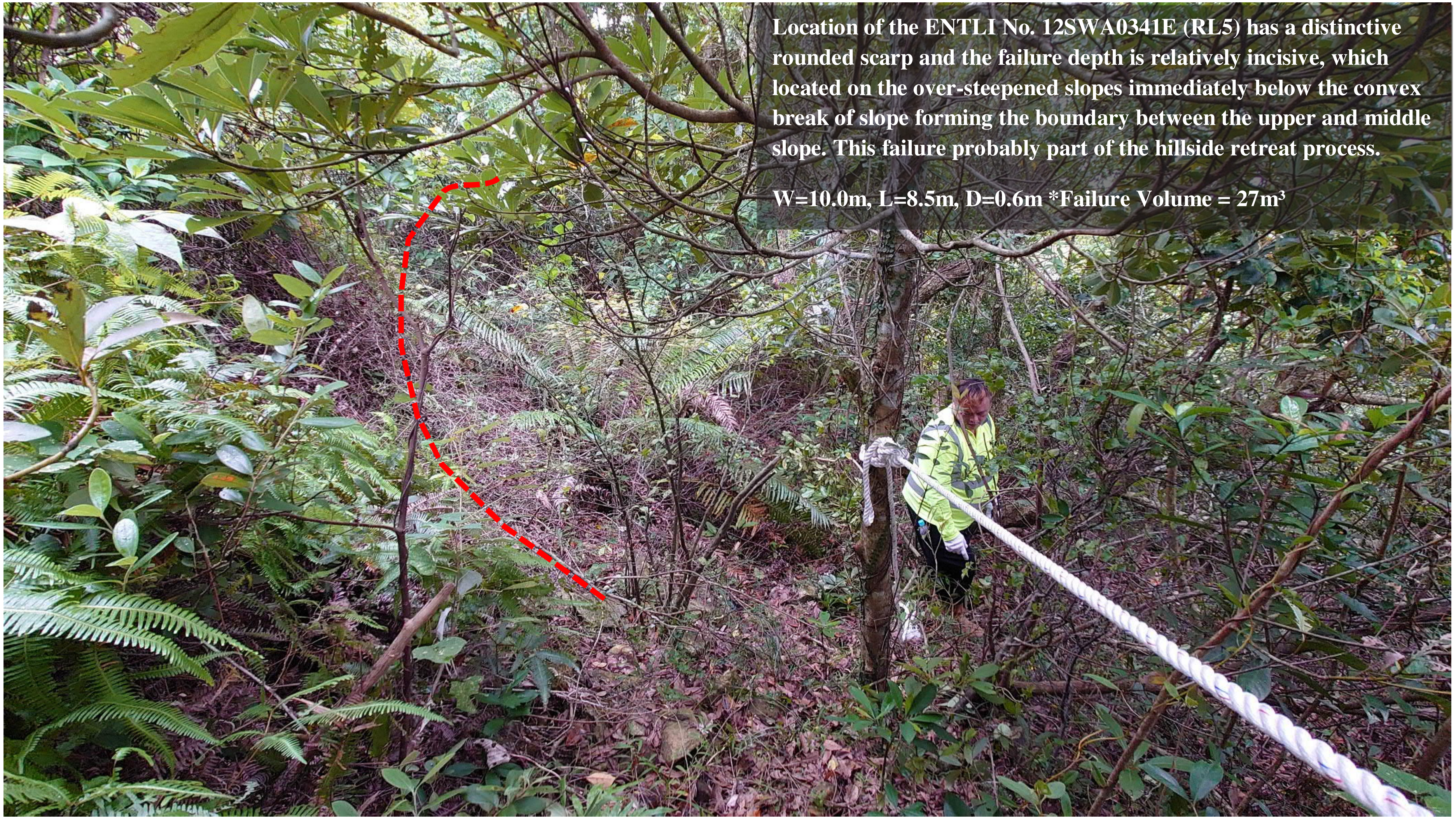
Plate 9 Relict landslide scar RL3 (ENTLI No. 12SWA0005E) located at the Crest of Catchment No. CD3



Location of RL4 is not registered as ENTLI. It has a rounded scarp, but the depression is shallow. It is a relatively small-scale landslide, which located on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and middle slope. This failure probably part of the hillside retreat process.

W=6.1m, L=8.4m, D=0.5m *Failure Volume = 13m³

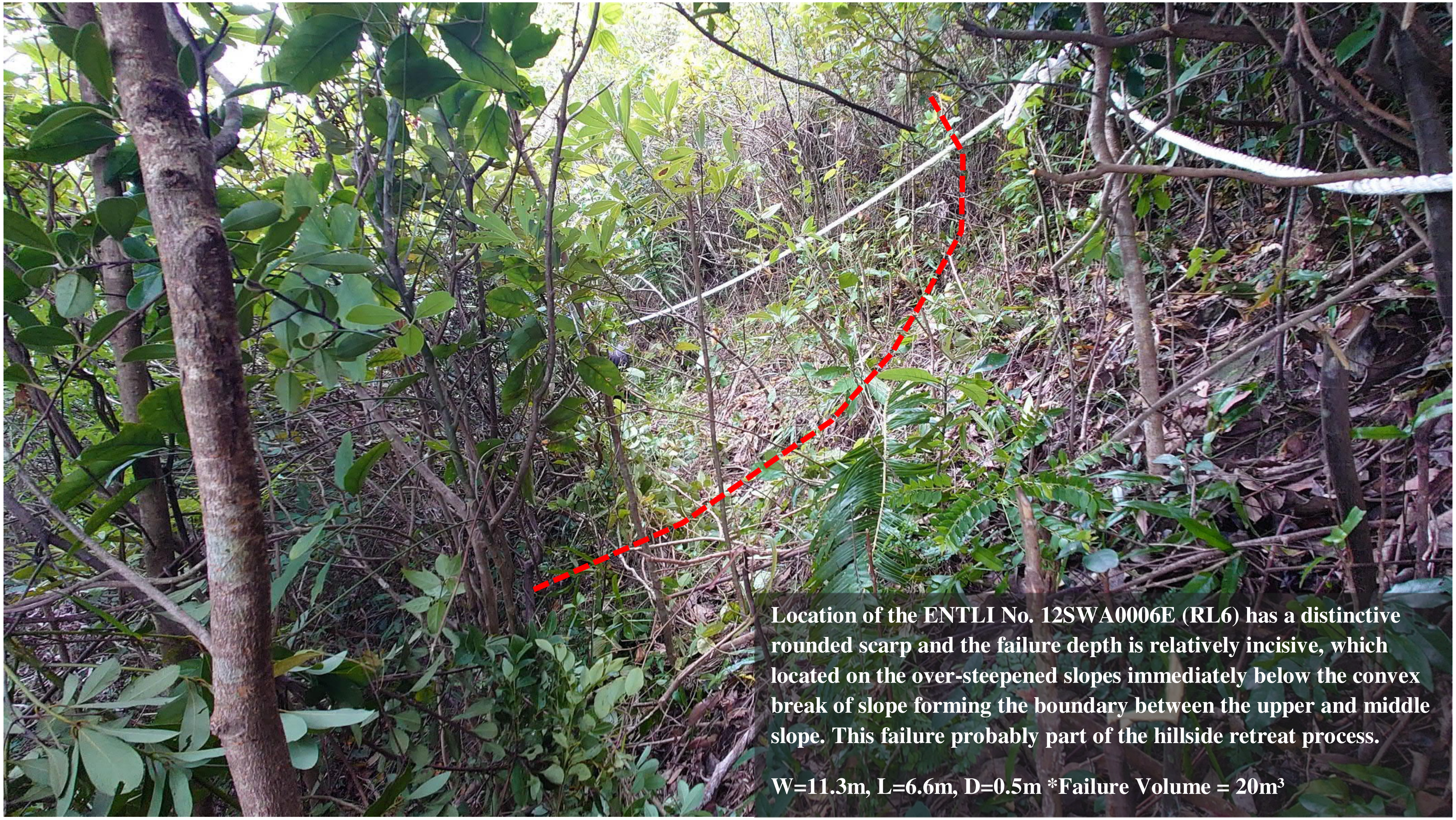
Plate 10 Relict landslide scar RL4 (Not Registered as ENTLI) located at the Crest of Catchment No. CD3



Location of the ENTLI No. 12SWA0341E (RL5) has a distinctive rounded scarp and the failure depth is relatively incisive, which located on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and middle slope. This failure probably part of the hillside retreat process.

W=10.0m, L=8.5m, D=0.6m *Failure Volume = $27m^3$

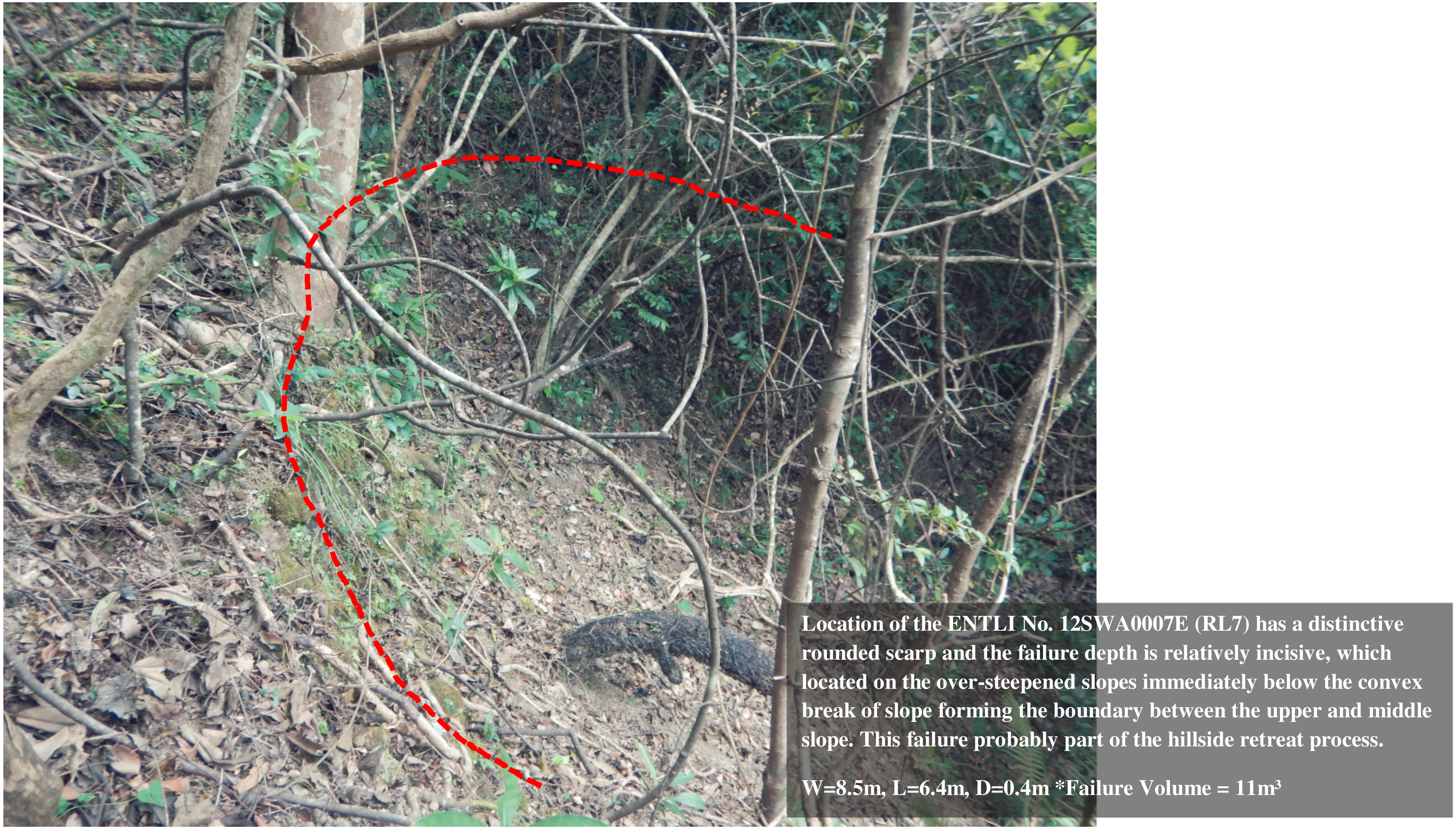
Plate 11 Relict landslide scar RL5 (ENTLI No. 12SWA0341E) located at the Crest of the Catchment Adjacent to Catchment No. CD3



Location of the ENTLI No. 12SWA0006E (RL6) has a distinctive rounded scarp and the failure depth is relatively incisive, which located on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and middle slope. This failure probably part of the hillside retreat process.

W=11.3m, L=6.6m, D=0.5m *Failure Volume = 20m³

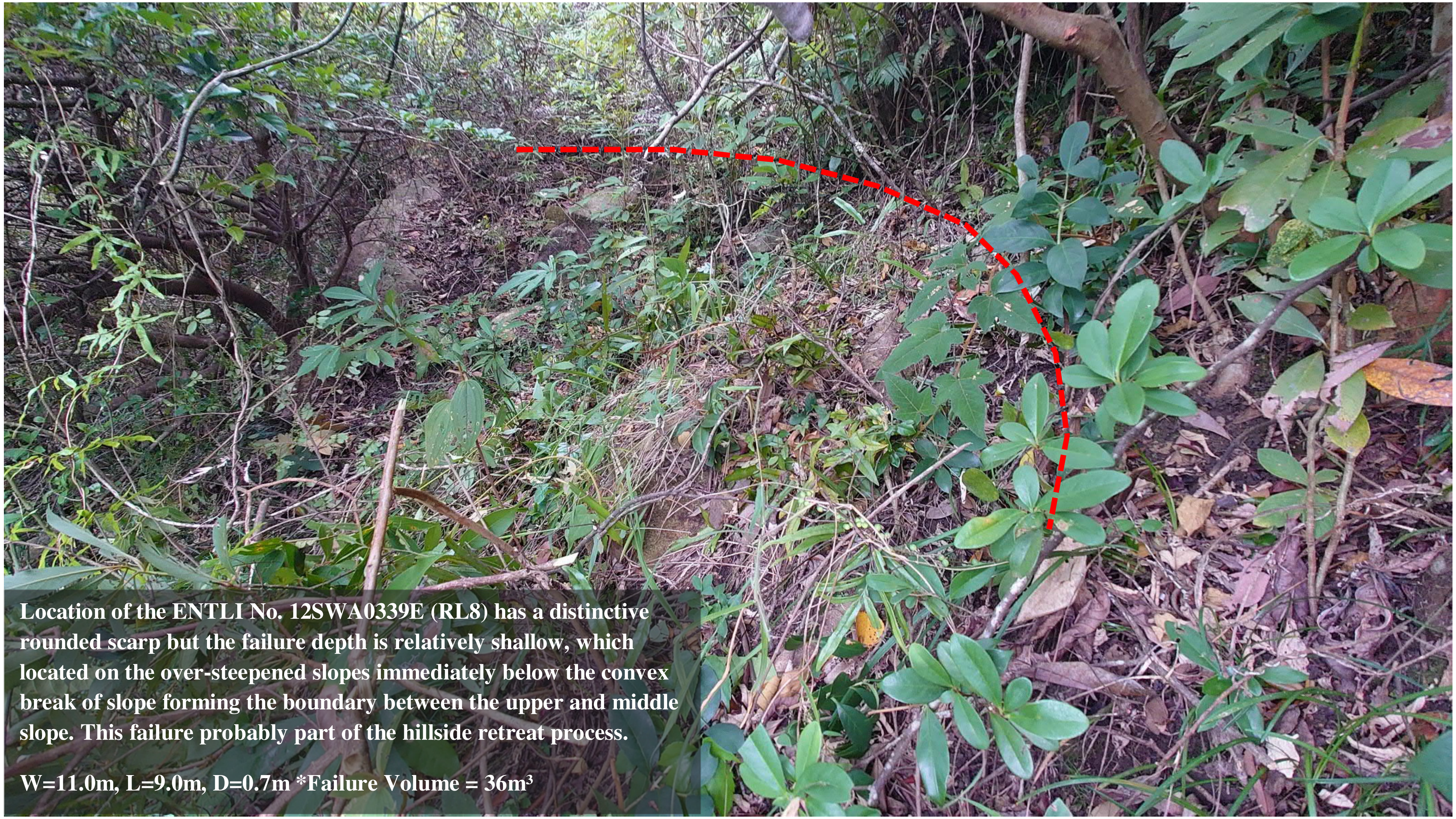
Plate 12 Relict landslide scar RL6 (ENTLI No. 12SWA0006E) located at the Crest of the Catchment Adjacent to Catchment No. CD3



Location of the ENTLI No. 12SWA0007E (RL7) has a distinctive rounded scarp and the failure depth is relatively incisive, which located on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and middle slope. This failure probably part of the hillside retreat process.

W=8.5m, L=6.4m, D=0.4m *Failure Volume = 11m^3

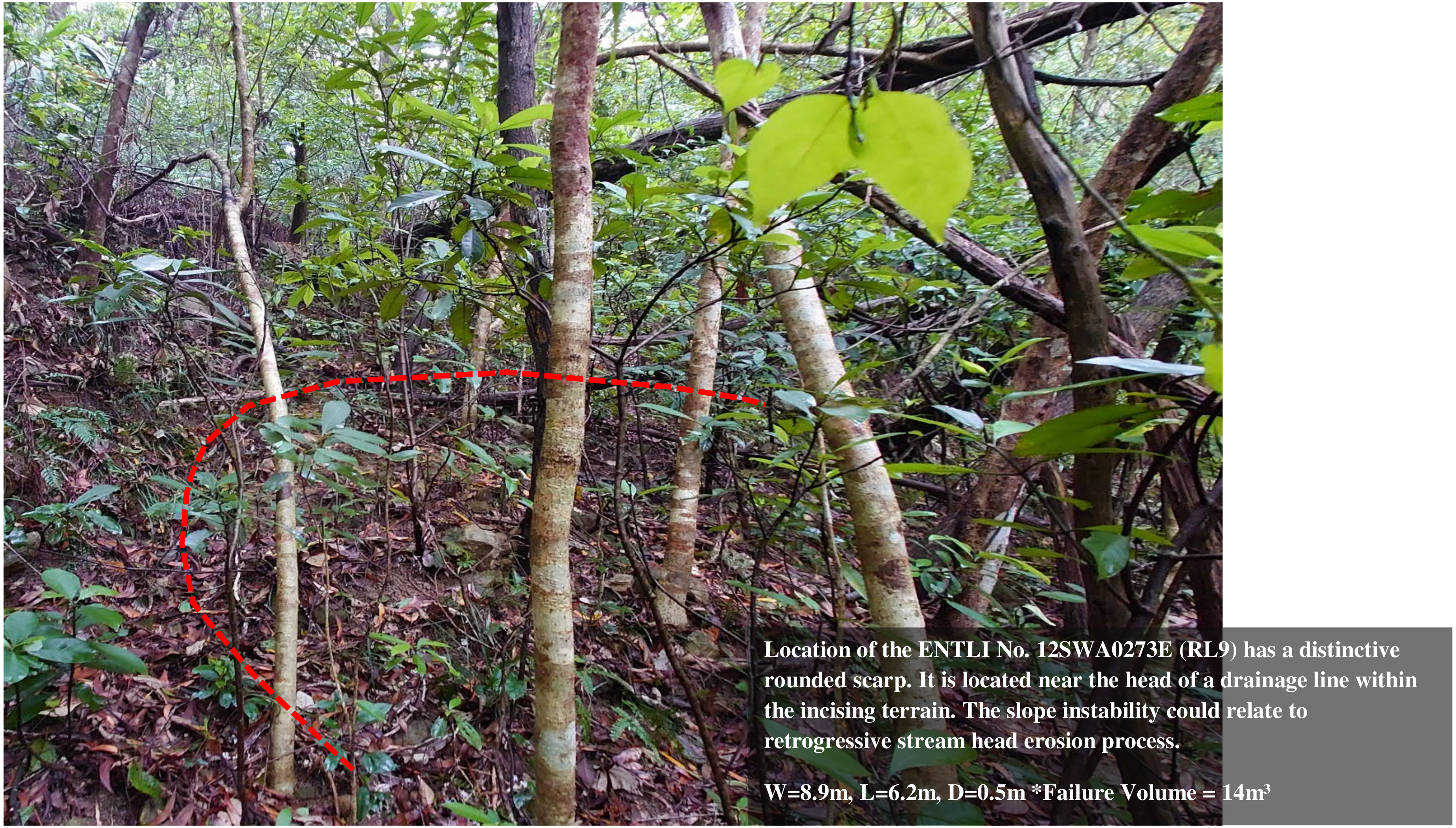
Plate 13 Relict landslide scar RL7 (ENTLI No. 12SWA0007E) located at the Crest of the Catchment Adjacent to Catchment No. CD3



Location of the ENTLI No. 12SWA0339E (RL8) has a distinctive rounded scarp but the failure depth is relatively shallow, which located on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and middle slope. This failure probably part of the hillside retreat process.

W=11.0m, L=9.0m, D=0.7m *Failure Volume = 36m^3

Plate 14 Relict landslide scar RL8 (ENTLI No. 12SWA0339E) located at the Crest of the Catchment Adjacent to Catchment No. CD3



Location of the ENTLI No. 12SWA0273E (RL9) has a distinctive rounded scarp. It is located near the head of a drainage line within the incising terrain. The slope instability could relate to retrogressive stream head erosion process.

W=8.9m, L=6.2m, D=0.5m *Failure Volume = 14m^3

Plate 15 Relict landslide scar RL9 (ENTLI No. 12SWA0273E) located Near Head of Drainage Line Adjacent to Catchment No. TD3

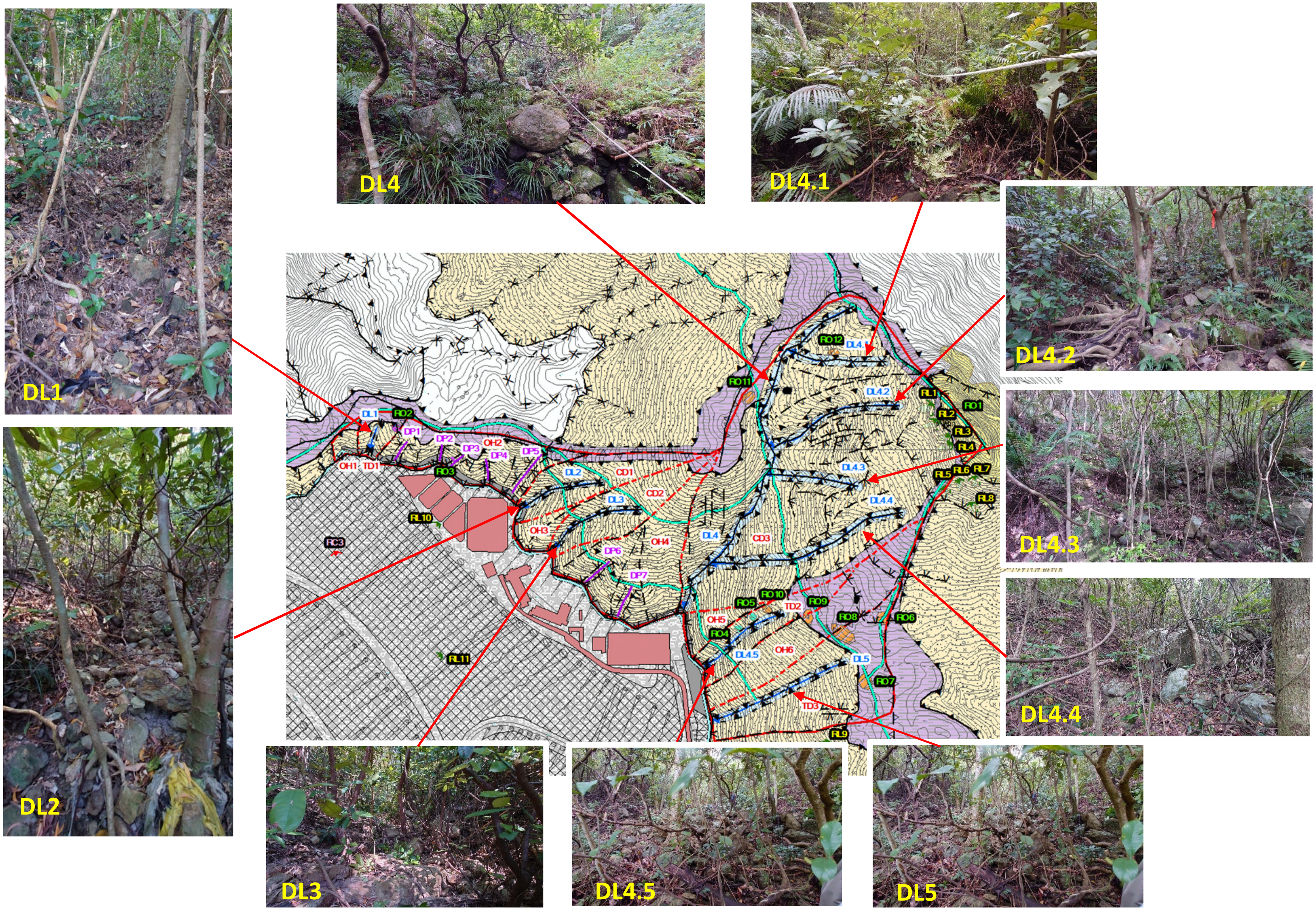

DL1
DL2
DL4
DL4.1
DL4.2
DL4.3
DL4.4
DL3
DL4.5
DL5
DL1
RO2
DP1
DP2
OH2
DP3
DP4
DP5
OH1
TD1
RO3
DL2
CD1
CD2
DL3
RL10
RC3
OH3
OH4
DL4
CD3
DP6
DP7
RO11
RO12
DL4.1
DL4.2
RL1
RL2
RO1
RL3
RL4
DL4.3
RL5
RL6
RL7
DL4.4
RL8
RO10
RO5
TD2
RO9
RO8
RO6
OH5
RO4
DL4.5
OH6
DL5
RO7
TD3
RL9
RL11

Plate 16 General View of the Ephemeral Drainage Lines within NTSA

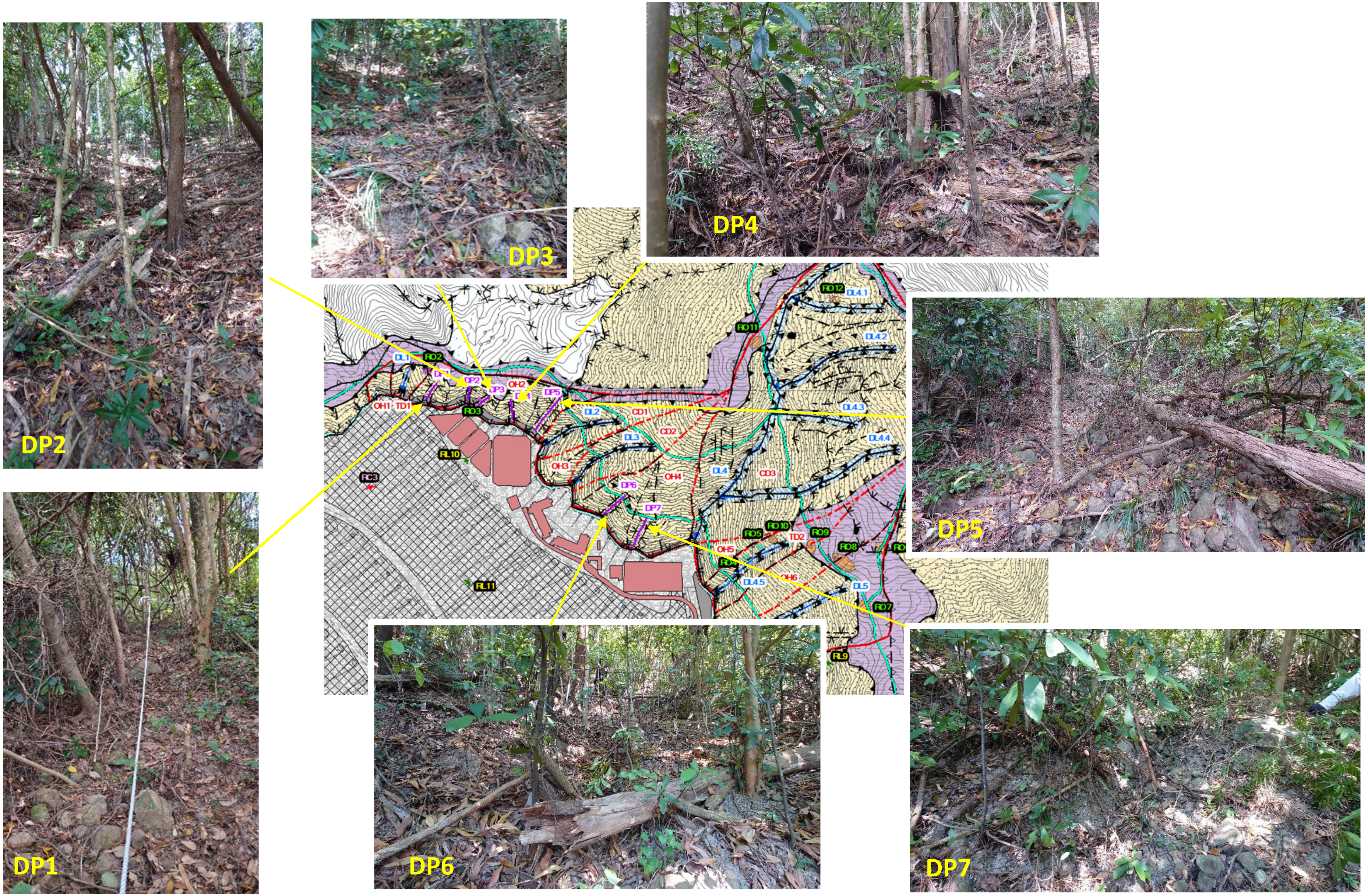

DP2
DP3
DP4
DP5
DP1
DP6
DP7
DL1
RO2
DP1
DP2
DP3
OH2
DP4
DP5
OH1
TD1
RO3
DL2
CD1
CD2
DL3
RO11
RO12
DL4.1
DL4.2
DL4.3
DL4.4
RL10
RC3
OH3
OH4
DL4
CD3
DP6
DP7
RO10
RO5
TD2
RO9
RO8
OH5
RO4
OH6
DL4.5
DL5
RO7
RL11
RL9

Plate 17 General View of Topographic Depressions within NTSA

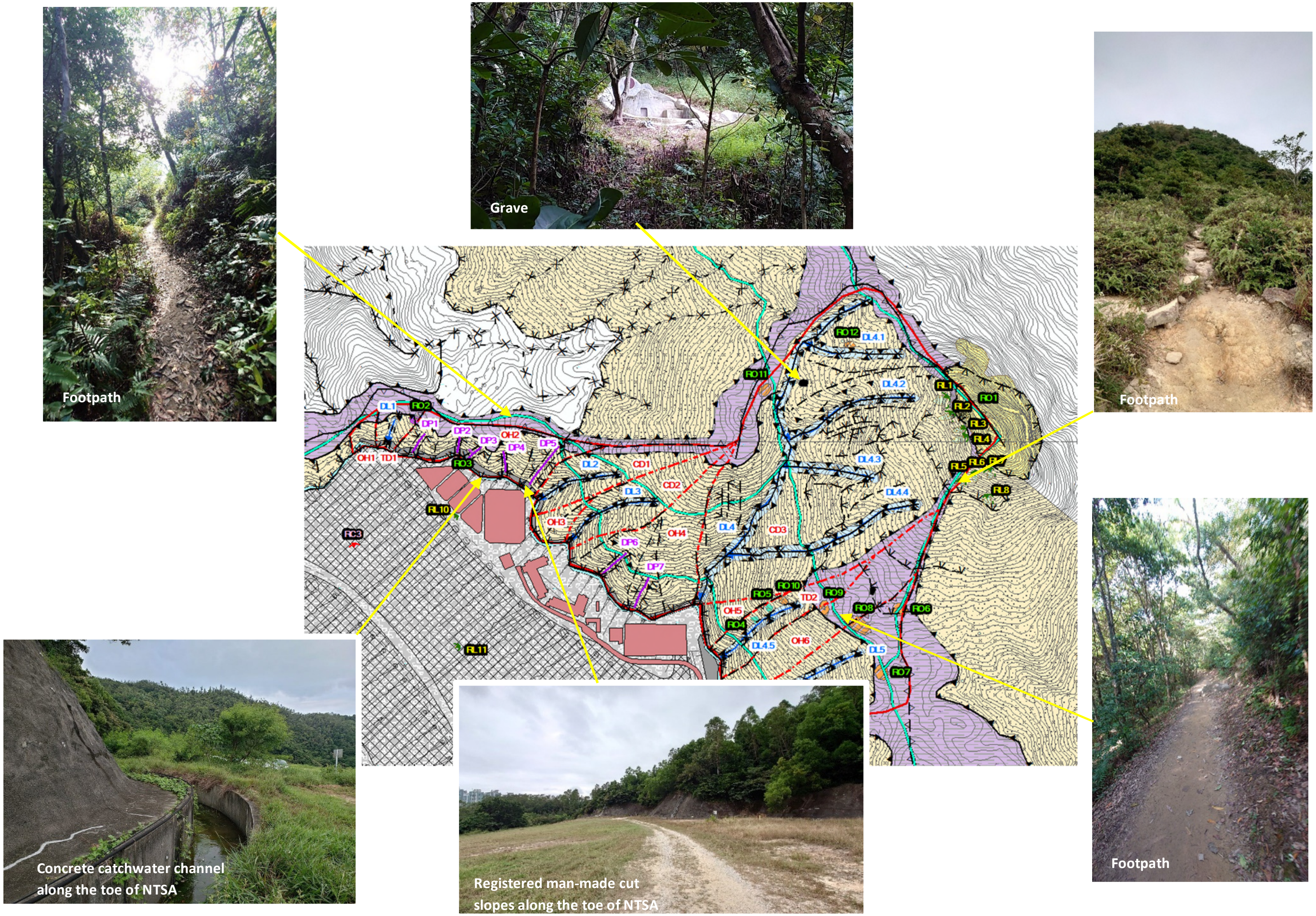

Footpath
Grave
Footpath
Footpath
Concrete catchwater channel along the toe of NTSA
Registered man-made cut slopes along the toe of NTSA
DL1
RO2
DP1
DP2
DP3
DP4
DP5
OH1
TD1
OH2
RO3
RL10
RC3
DL2
DL3
CD1
CD2
OH3
OH4
DP6
DP7
DL4
CD3
RO11
RO12
DL4.1
DL4.2
DL4.3
DL4.4
RL1
RL2
RL3
RL4
RL5
RL6
RL8
RO1
RO5
RO10
TD2
RO9
RO8
RO6
OH5
RO4
DL4.5
OH6
DL5
RO7
RL11

Plate 18 Anthropogenic Features within and below the NTSA

Appendix A

Ground Investigation Records

DRILLHOLE RECORD

W. O. PW7/2/22.99
HOLE NO. BH17
SHEET 1 of 2
DATE from 30.11.88 to 1.12.88

PROJECT	Junk Bay Landfill Stage II & III		
METHOD Rotary		CO-ORDINATES	ROCK COREBIT T6
MACHINE & No.	Diamont Boart D51	E 846993 N 817314	HOLE DIA. S 168mm
FLUSHING MEDIUM Water		ORIENTATION VERTICAL	GROUND-LEVEL 140.07 mPD

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
30/11	S 4.90 S		80							+135.17	1.00 2.00 3.00 4.00 4.90	× × ×			Soil
				97	38	0	*		T6		6.00 6.35	v v v			
				100	94	54	7				7.00 7.75	v v v	III		Moderately strong, grey fine grained moderately decomposed VOLCANIC closely spaced joints dip 5° to 60° sub-vertical joints at 5.30m to 6.45m, 8.25m to 8.90m, rock fractured between 4.90m to 6.45m
30/11		4.76m at 18:00		100	92	36	7				8.00 9.00 9.25	v v v			
1/12 1/12		8.18m at 8:00	0	100	79	41	4			+130.07	10.00	v v v			

•	Small disturbed sample	▲	Water sample
↕	Large disturbed sample	⧗	Water level
▯	SPT liner sample	↓	Standard penetration test
▮	U76 undisturbed sample	⌶	Permeability test
■	U100 undisturbed sample	▲	Piezometer tip
⊡	Mazier sample	∨	In-situ vane shear test
P/S	Piston sample		

LOGGED W.G.Lau
DATE 2.12.88
CHECKED S.P.Su
DATE 8.12.88

REMARKS
1 * : Cannot be determined
2. Installed a slotted P.V.C. pipe ∅100mm at depth 10.40m

Lam Geotechnics Limited

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- Fax: 5-8932274
- Tels: 5-8910563, 5-734365

DRILLHOLE RECORD

W. O. PW7/2/22.99
HOLE NO. BH17
SHEET 2 of 2
DATE from 30.11.88 to 1.12.88

PROJECT Junk Bay Landfill Stage II & III		
METHOD Rotary	CO-ORDINATES E 846993 N 817314	ROCK COREBIT T6
MACHINE & No. Diamont Boart D51		HOLE DIA. S 168mm
FLUSHING MEDIUM Water	ORIENTATION VERTICAL	GROUND-LEVEL 140.07 mPD

Drilling Progress	Casing depth/size	Water level/ time/ date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
1/12 1/12		9.40m at 18:00	0	100	79	41	4		T6	+129.37	10.70	v v v	III		See sheet 1 of 2
											11.00				End of investigation hole at 10.70m
											12.00				
											13.00				
											14.00				
											15.00				
											16.00				
											17.00				
											18.00				
											19.00				
											20.00				

• Small disturbed sample	▲ Water sample
↕ Large disturbed sample	⌶ Water level
▯ SPT liner sample	↓ Standard penetration test
▌ U76 undisturbed sample	⌶ Permeability test
■ U100 undisturbed sample	▲ Piezometer tip
⊡ Mazier sample	∨ In-situ vane shear test
P/S Piston sample	

LOGGED W.G.Lau
DATE 2.12.88
CHECKED S.P.Su
DATE 8.12.88

REMARKS

DRILLHOLE RECORD

W. O. PW7/2/22.99
HOLE NO. BH18
SHEET 1 of 1
DATE from 6.12.88 to 6.12.88

PROJECT	Junk Bay Landfill Stage II & III		
METHOD	Rotary	CO-ORDINATES	ROCK COREBIT T6
MACHINE & No.	Diamont Boart D51	E 847131 N 817242	HOLE DIA. S 168mm
FLUSHING MEDIUM	Water	ORIENTATION VERTICAL	GROUND-LEVEL 164.69 mPD

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
6/12	S 2.33 S		80							+162.36	1.00 2.00 2.33	× × ×			Soil
				100	55	34	>8		T6		3.00 3.33	v v v	III to II		Moderately strong to strong in part, moderately strong to moderately weak below 4.82m, grey to greyish brown fine grained moderately to slightly decomposed VOLCANIC, highly to moderately decomposed VOLCANIC below 4.82m, closely to moderately spaced joints at upper part, very closely to closely spaced joints below 4.82m, sub-vertical joints at depth 7.05m to 8.15m, dip 5° to 20° and 50° to 60°
				92	42	42	>16				3.95	v v v			
				96	64	58	7				5.00 5.30	v v v			
				96	67	14	>7				6.00 6.80	v v v			
6/12		3.50m at 18:00	80	94	38	8	*			+156.39	7.00 8.00 8.30	v v v			
											9.00 10.00				End of investigation hole at 8.30m

- • Small disturbed sample
- ↕ Large disturbed sample
- ▯ SPT liner sample
- ▮ U76 undisturbed sample
- ■ U100 undisturbed sample
- ⊡ Mazier sample
- P/S Piston sample
- ▲ Water sample
- ⌶ Water level
- ↓ Standard penetration test
- ⌶ Permeability test
- ▲ Piezometer tip
- ∨ In-situ vane shear test

LOGGED W.G.Lau
DATE 7.12.88
CHECKED S.P.Su
DATE 14.12.88

REMARKS
1 * : Cannot be determined
2. Installed a slotted P.V.C. pipe ∅100mm at depth 8.00m

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JCRIC

DRILLHOLE RECORD

CONTRACT GE/93/09		HOLE NO. **NM 7**	SHEET 1 of 4
PROJECT	Restoration of Tseung Kwan O Landfills Additional Site Investigation		
METHOD	Rotary	CO-ORDINATES E 847003.25 N 817297.78	W.O. No GE/93/09.110
MACHINE & No.	DR73		DATE from 14/11/95 to 16/11/95
FLUSHING MEDIUM	Water	ORIENTATION Vertical	GROUND LEVEL 145.85 mPD

Drilling Progress	Casing size	Water level (m) Shift start/end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples		Reduced Level	Depth (m)	Legend	Grade	Description
14/11/95	200mm dia.								0.00				V	Extremely weak, brownish grey, completely decomposed, medium grained TRACHYDACITE LAVA. (Silty fine to medium SAND with occasional subangular fine quartz gravel)
							1,2, 2,2, 3,7 N=14	1	1.15					
								● 2	1.45					
			50					3	2.25	143.60	2.25		IV	Weak, greyish brown, highly decomposed, medium grained TRACHYDACITE LAVA. (Sandy angular medium to coarse GRAVEL sized rock fragments)
			100	41	0	13.3		● 4 NMLC	2.75	143.10	2.75		IV/III	Weak to moderately strong, yellowish brown and brownish grey, highly to moderately decomposed, medium grained TRACHYDACITE LAVA. Joints very closely to closely spaced, iron-manganese stained, rough stepped and undulating, dipping at 10-20°, 30-40° and 50-60°. Generally fractured from 3.35m to 3.85m and 4.35m to 5.20m.
						NI			3.35					
									3.75					
			100	67	67	10.0			3.85					
						NI			4.35					
			93	6	0				4.50					
			100	66	12	17.5			5.20	140.65	5.20		III	Moderately strong, brownish grey, moderately decomposed, medium grained TRACHYDACITE LAVA. Joints are very closely to closely spaced, iron-manganese stained, rough stepped and undulating, dipping at 20-30°, 40-50° and 50-60°.
		5.50m at 18:00												
15/11/95		Dry at 08:00	75	23	23	NI			6.23	139.62	6.23		IV	Very weak to weak, brown and greyish brown, highly decomposed, medium grained TRACHYDACITE LAVA. (Silty fine to coarse SAND with much angular medium to coarse gravel sized rock fragments)
						NA			6.53					
						NR			6.89	138.96	6.89		V/IV	Core loss from 6.89m to 7.21m, inferred completely to highly decomposed, Trachydacite Lava.
						9.3			7.21	138.64	7.21		III/II	Moderately strong to strong, greenish grey and brownish grey, moderately to slightly decomposed, medium grained TRACHYDACITE LAVA. Joints are closely to medium, locally very closely and widely spaced, iron-manganese stained, rough planar and stepped, dipping at 10-20° and 40-50°.
	Px		100	90	77				7.50					
						0			7.64					
						>20			8.24					
									8.67					
						4.1			9.00					
			100	82	55									
									9.40	136.45	9.40		III	
						>20			9.55					
						7.5			9.95	135.85	10.00			See sheet 2 of 4 for details.

- ● SMALL DISTURBED SAMPLE
- ↕ LARGE DISTURBED SAMPLE
- ▯ SPT LINER SAMPLE
- ▨ U76 UNDISTURBED SAMPLE
- ■ U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- ▤ PISTON SAMPLE
- △ WATER SAMPLE
- ▲ PIEZOMETER TIP
- ■
- △ STANDPIPE
- □
- ↓ STANDARD PENETRATION TEST
- ⊥ PERMEABILITY TEST
- V IN-SITU VANE SHEAR TEST

LOGGED K.M.To
DATE 21/11/95
CHECKED Eric Loke
DATE 22/11/95

REMARKS
Carried out water absorption test at depth 8.50m to 13.00m and 20.50m to 25.00m.
Installed 75mm dia. uPVC tube from 0.00m to 26.50m.
Installed three piezometers at depth 11.00m, 18.50m and 30.00m.

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DRILLHOLE RECORD

CONTRACT GE/93/09

HOLE NO. NM 7

SHEET 2 of 4

PROJECT Restoration of Tseung Kwan O Landfills Additional Site Investigation

METHOD Rotary	**CO-ORDINATES** E 847003.25 N 817297.78	**W.O. No** GE/93/09.110	
MACHINE & No. DR73		**DATE from** 14/11/95 to 16/11/95	
FLUSHING MEDIUM Water	**ORIENTATION** Vertical	**GROUND LEVEL** 145.85 mPD	

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
15/11/95	Px					>20		NMLC 10.00			×	III	Moderately weak to moderately strong, brownish grey, moderately decomposed, medium grained TRACHYDACITE LAVA. Joints are very closely to closely spaced, iron-manganese stained, rough stepped and undulating, dipping at 10-20°, 30-40° and 50-60°.
			100	70	0		▲■	10.40					
			100	100	74	6.6		11.34	134.51	11.34	×	III/II	Moderately strong to strong, greenish grey and brownish grey, moderately to slightly decomposed, medium grained TRACHYDACITE LAVA. Joints are closely to medium, locally very closely spaced, iron-manganese stained, rough stepped and planar, occasionally undulating, dipping at 10-20°, 40-50° and 60-70°.
						11.5	L=21.67	11.95					
			100	98	60			12.30					
						3.9		12.82					
			100	100	100			13.30					
						0		13.59	132.26	13.59	×	II	Strong, greenish grey, spotted white, mottled and dappled dark greenish grey, slightly decomposed, medium grained TRACHYDACITE LAVA. Joints are very widely spaced, chlorite infilled, rough planar, dipping at 10-20°.
			100	100	93			14.83					
						>20		16.05	129.80	16.05	×	III	Moderately strong to strong, greenish grey, locally brownish grey, moderately decomposed, medium grained TRACHYDACITE LAVA. Joints are closely to medium, locally very closely spaced, iron manganese stained, rough planar and stepped, occasionally undulating, dipping at 10-20°, 30-40° and 50-60°, occasionally 70-80°. Weak and highly decomposed along 10° dipping joint from 17.43m to 17.45m.
						1.3		16.33					
			100	95	78			16.40					
		17.03m at 18:00				11.4		17.20					
			100	91	57			17.81					
16/11/95		Dry at 08:00				14.5		18.08					
						0	▲■	18.70	127.15	18.70	×	II	Strong, greenish grey, slightly decomposed, medium grained TRACHYDACITE LAVA. Joints are very widely spaced, chlorite infilled rough planar, dipping at 30-40°.
			100	100	100			TNW 19.31					
								20.00	125.85	20.00			

● SMALL DISTURBED SAMPLE	△ WATER SAMPLE
↕ LARGE DISTURBED SAMPLE	▲■ PIEZOMETER TIP
▯ SPT LINER SAMPLE	△□ STANDPIPE
▨ U76 UNDISTURBED SAMPLE	↓ STANDARD PENETRATION TEST
■ U100 UNDISTURBED SAMPLE	I PERMEABILITY TEST
▨ MAZIER SAMPLE	V IN-SITU VANE SHEAR TEST
▤ PISTON SAMPLE	

LOGGED K.M.To

DATE 21/11/95

CHECKED Eric Loke

DATE 22/11/95

REMARKS
See sheet 1 of 4 for details.

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	DRILLHOLE RECORD CONTRACT GE/93/09	HOLE NO. **NM 7** SHEET 3 of 4

PROJECT **Restoration of Tseung Kwan O Landfills Additional Site Investigation**		
METHOD **Rotary**	CO-ORDINATES **E 847003.25** **N 817297.78**	W.O. No **GE/93/09.110**
MACHINE & No. **DR73**		DATE from **14/11/95** to **16/11/95**
FLUSHING MEDIUM **Water**	ORIENTATION **Vertical**	GROUND LEVEL **145.85** mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
16/11/95	Px		100	100	91			TNW				II	See sheet 2 of 4 for details.
								20.87	124.98	20.87			
21			100	87	68	17.2		20.96				III/II	Moderately strong to strong, greenish grey, locally brownish grey, moderately to slightly decomposed, medium grained TRACHYDACITE LAVA. Joints are closely to medium, locally very closely spaced, iron-manganese stained, rough planar and stepped, occasionally undulating, dipping at 20-30°, 40-50° and 60-70°. Weak and highly decomposed from 21.16m to 21.20m. Moderately strong and moderately decomposed from 24.51m to 24.61m.
								21.51					
						1.5							
								21.90					
22			100	100	84								
								22.17					
						6.8							
								22.86					
23			100	99	83		L = 21.22						
24													
								24.31					
			100	96	89			24.51	121.34	24.51			
						>20		24.61	121.24	24.61		III	
						7.4		24.88	120.97	24.88		III/II	
25						0						II	Strong, greenish grey, spotted white, mottled and dappled dark greenish grey, slightly decomposed, medium grained TRACHYDACITE LAVA. Joints are widely to very widely, locally very closely to closely spaced, chlorite and calcite infilled, rough planar, dipping at 20-30°. Moderately strong and moderately decomposed from 29.21m to 29.34m.
								25.81					
26			100	100	100								
27													
								27.31					
			100	100	100								
28													
								28.71					
			100	97	93								
29													
						>20		29.21	116.64	29.21			
								29.34	116.51	29.34		III	
						1.6						II	
30							▲	30.00	115.85	30.00			

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	▲	PIEZOMETER TIP
▯	SPT LINER SAMPLE	△	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED K.M.To
DATE 21/11/95
CHECKED Eric Loke
DATE 22/11/95

REMARKS
See sheet 1 of 4 for details.

JCRIC

DRILLHOLE RECORD

CONTRACT GE/93/09	HOLE NO. **NM 7**	SHEET 4 of 4
PROJECT Restoration of Tseung Kwan O Landfills Additional Site Investigation		
METHOD Rotary	CO-ORDINATES E 847003.25 N 817297.78	W.O. No GE/93/09.110
MACHINE & No. DR73		DATE from 14/11/95 to 16/11/95
FLUSHING MEDIUM Water	ORIENTATION Vertical	GROUND LEVEL 145.85 mPD

Drilling Progress	Casing size	Water level (m) Shift start/end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
16/11/95	Px	19.35m at 18:00						TNW 30.59	115.26	30.59	× × ×	II	See sheet 3 of 4 for details.
													End of investigation hole at 30.59m.
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	▲ ■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	△ □	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	I	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED K.M.To
DATE 21/11/95
CHECKED Eric Loke
DATE 22/11/95

REMARKS
See sheet 1 of 4 for details.

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DRILLHOLE RECORD

CONTRACT GE/93/09

HOLE NO. **NM 8**

SHEET 1 of 3

PROJECT **Restoration of Tseung Kwan O Landfills Additional Site Investigation**

METHOD	Rotary	CO-ORDINATES E 847122.52 N 817217.09	W.O. No GE/93/09.110
MACHINE & No.	DR73		DATE from 23/11/95 to 27/11/95
FLUSHING MEDIUM	Water	ORIENTATION Vertical	GROUND LEVEL 152.76 mPD

Drilling Progress	Casing size	Water level (m) Shift start/end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Grade	Description
23/11/95	200mm dia.							0.00			V	Extremely weak, yellowish brown, completely decomposed, medium grained TRACHYDACITE LAVA. (Silty fine to medium SAND with occasional angular fine gravel sized rock fragments)
			100	28	28	7.1		0.60	152.16	0.60	II	
								T6131 0.88	151.88	0.88	IV/III	Weak to moderately strong, yellowish brown, light brownish grey and locally greenish grey, highly to moderately decomposed, medium grained TRACHYDACITE LAVA. Joints are very closely to closely spaced, iron-manganese stained, rough stepped, dipping at 10-20°, 30-40° and 50-60°. Strong and slightly decomposed from 0.60m to 0.88m Moderately strong and moderately decomposed from 2.50m to 3.25m and 5.26m to 5.60m. Core losses from 4.10m to 4.50m and 5.90m to 6.20m, inferred completely to highly decomposed Trachydacite Lava. Highly fractured from 0.88m to 2.00m, 2.30m to 2.50m, 3.50m to 4.10m, 5.00m to 5.90m and 6.20m to 6.40m.
						NI						
								1.60				
			100	43	20							
								NMLC 2.00				
						13.3						
								2.30				
			100	71	40	NI		2.50	150.26	2.50	III	
						13.3						
								3.25	149.51	3.25	IV/III	
						>20		3.50				
			60	0	0	NI						
								4.10	148.66	4.10	V/IV	
						NR						
								4.50	148.26	4.50	IV/III	
		3.80m at 18:00	84	30	20	>20						
								5.00				
24/11/95		4.70m at 08:00	75	30	19							
								5.26	147.50	5.26	III	
						14.7						
								5.60	147.16	5.60	IV/III	
						NI						
								5.90	146.86	5.90	V/IV	
						NR						
								6.20	146.56	6.20	IV/III	
			100	76	63	NI		6.40	146.36	6.40	III	Moderately strong, locally moderately weak, yellowish brown and light brownish grey, moderately decomposed, medium grained TRACHYDACITE LAVA. Joints are very closely to closely spaced, iron-manganese stained, rough stepped and undulating, dipping at 20-30° and 60-70°.
						12.7						
								7.10				
			100	96	86							
								7.60				
			100	91	68							
								8.37	144.39	8.37	III/II	See sheet 2 of 3 for details.
						6.9						
								9.00				
			100	92	92							
								9.97	142.76	10.00		

- ● SMALL DISTURBED SAMPLE
- ↕ LARGE DISTURBED SAMPLE
- ▯ SPT LINER SAMPLE
- ▨ U76 UNDISTURBED SAMPLE
- ■ U100 UNDISTURBED SAMPLE
- ▨ MAZIER SAMPLE
- ▤ PISTON SAMPLE
- △ WATER SAMPLE
- ▲ PIEZOMETER TIP
- ■ △ STANDPIPE
- ☐ ↓ STANDARD PENETRATION TEST
- ⌶ PERMEABILITY TEST
- V IN-SITU VANE SHEAR TEST

LOGGED K.M.To

DATE 30/11/95

CHECKED Eric Loke

DATE 01/12/95

REMARKS
Carried out water absorption test at depth 20.00m to 24.00m (Double type) and 25.00m to 29.27m (Single type).
Installed 75mm dia. uPVC tube to depth 25.77m.
Installed three piezometers at depth 15.00m, 20.77m and 28.77m.

DRILLHOLE RECORD

CONTRACT GE/93/09

HOLE NO. **NM 8**

SHEET 2 of 3

PROJECT **Restoration of Tseung Kwan O Landfills Additional Site Investigation**

METHOD	Rotary	CO-ORDINATES	E 847122.52 N 817217.09
MACHINE & No.	DR73	W.O. No	GE/93/09.110
FLUSHING MEDIUM	Water	DATE from	23/11/95 to 27/11/95
ORIENTATION	Vertical	GROUND LEVEL	152.76 mPD

Drilling Progress	Casing size	Water level (m) Shift start/end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Grade	Description
24/11/95	200mm dia.	7.65m at 18:00	100	93	53	13.3		NMLC 10.00			III/II	Moderately strong to strong, brownish grey, locally greenish grey, spotted white, mottled green, moderately to slightly decomposed, medium grained TRACHYDACITE LAVA. Joints are closely to medium, locally very closely spaced, iron-manganese stained, rough stepped, occasionally undulating, dipping at 20-30°, 40-50° and 50-60°, occasionally 70-80°. Moderately strong and moderately decomposed from 17.24m to 17.35m.
25/11/95	Px	10.00m at 08:00	100	70	0	17.0		10.57				
			100	87	63			10.90				
						9.8		11.10				
			100	100	63			12.40				
						6.5						
			100	100	90			13.95				
			100	98	52	13.5	▲■	14.58				
			100	97	87	6.7		15.54				
						15.4		16.59				
			100	83	51			16.99				
						>20		17.24	135.52	17.24	III	
						5.4		17.35	135.41	17.35	III/II	
		13.50m at 18:00				18.5		18.27				
27/11/95		15.27m at 08:00	100	100	83			18.45				
						6.6		18.81	133.95	18.81	II	Strong, greenish grey, spotted white, slightly decomposed, medium grained TRACHYDACITE LAVA. Joints are closely to medium spaced, iron-manganese stained, rough stepped and undulating, dipping at 10-20°, 40-50° and
			100	93	69			19.25				
								20.00	132.76	20.00		

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	▲■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	△□	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	⌶	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED K.M.To
DATE 30/11/95
CHECKED Eric Loke
DATE 01/12/95

REMARKS
See sheet 1 of 3 for details.

GEOTECHNICS & CONCRETE ENGINEERING (H.K.) LTD.
6 KO SHAN RD., GROUND FL., HUNG HOM, KOWLOON, HONG KONG.
TEL.: 2365 9123-6, 2333 6482 FAX NO.: 852-2765 8034

DRILLHOLE RECORD

CONTRACT GE/93/09

HOLE NO. **NM 8**

SHEET 3 of 3

PROJECT	Restoration of Tseung Kwan O Landfills Additional Site Investigation
METHOD	Rotary
MACHINE & No.	DR73
FLUSHING MEDIUM	Water
CO-ORDINATES	E 847122.52 N 817217.09
ORIENTATION	Vertical
W.O. No	GE/93/09.110
DATE from	23/11/95 to 27/11/95
GROUND LEVEL	152.76 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
27/11/95	Px		100	96	65			NMLC 20.32	132.44	20.32		II	60-70°.
						15.6	▲■					III/II	Moderately strong to strong, brownish grey and greenish grey, spotted white, moderately to slightly decomposed, medium grained TRACHYDACITE LAVA. Joints are very closely to closely, locally medium spaced, iron-manganese stained, rough stepped and planar, occasionally undulating, dipping at 10-20°, 30-40° and 50-60°, occasionally 70-80°. Weak to moderately weak and highly to moderately decomposed from 22.24m to 22.31m.
21						2.7		20.96					
								21.33					
			100	85	30	15.9		21.57					
22							L = 24.57	22.46					
						7.1							
23			100	66	57			23.10					
						14.9		23.45					
			100	100	76			23.80					
24						9.2		24.12					
25			100	95	60			25.08					
								25.97	126.79	25.97			
26			100	100	87	6.8		26.13				II	Strong, greenish grey, locally light brown, spotted white, dappled green, slightly decomposed, medium grained TRACHYDACITE LAVA. Joints are closely to medium, locally very closely spaced, iron stained, occasionally chlorite infilled, rough stepped and planar, dipping at 10-20°, 40-50°, occasionally 60-70°. Moderately strong to strong and moderately to slightly decomposed from 27.68m to 27.86m.
27						10.8	L = 11.18	27.30					
			100	95	70			27.68	125.08	27.68			
									124.90	27.86		III/II	
28						1.0		28.23				II	
			100	100	100		▲■	28.65					
29		18.50m at 18:00						29.27	123.49	29.27			
30													End of investigation hole at 29.27m.

●	SMALL DISTURBED SAMPLE	△	WATER SAMPLE
↕	LARGE DISTURBED SAMPLE	▲■	PIEZOMETER TIP
▯	SPT LINER SAMPLE	△	STANDPIPE
▨	U76 UNDISTURBED SAMPLE	▯↓	STANDARD PENETRATION TEST
■	U100 UNDISTURBED SAMPLE	⊥	PERMEABILITY TEST
▨	MAZIER SAMPLE	V	IN-SITU VANE SHEAR TEST
▤	PISTON SAMPLE		

LOGGED K.M.To

DATE 30/11/95

CHECKED Eric Loke

DATE 01/12/95

REMARKS
See sheet 1 of 3 for details.

JCRIC

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. **DH6**

SHEET 1 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT **Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation**

METHOD	**Rotary Cored**	CO-ORDINATES **E 847214.42** **N 817215.18**	Works Order No. **GE/2001/13.10**
MACHINE & No.	**DR86**		DATE from **04/06/2002** to **07/06/2002**
FLUSHING MEDIUM	**Air-Foam**	ORIENTATION **Vertical**	GROUND LEVEL **170.73** mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
04/06/2002	PX							1 ● 2 ●	170.73 169.73	0.00 0.50 1.00		VI	Firm, yellowish brown (10YR 5/8), slightly sandy SILT. (RESIDUAL SOIL)
04/06/2002 05/06/2002	PX 1.50 HX	1.20m at 18:00 Dry at 08:00	90					3 ● 4 ▨ 5 ●	168.13	1.50 2.60		V	Extremely weak, light yellowish brown (2.5Y 6/4) dappled white, completely decomposed, fine ash crystal TUFF. (Firm to stiff, sandy SILT)
			100				1,3 5,3,4,5 N=17	6 ▯ 7 ● 8 ▨ 9 ●	166.13	3.05 3.50 4.60		V	Extremely weak, pale brown (10YR 6/3) dappled yellow and white, completely decomposed, fine ash crystal TUFF. (Silty fine to coarse SAND)
							3,6 6,7,7,8 N=28	10 ▯ 11 ●	165.23	5.05 5.50		V	Extremely weak, light brownish grey (10YR 6/2), completely decomposed, fine ash crystal TUFF. (Silty fine to coarse SAND)
			100				4,6 10,13,13,15 N=51	12 ▨ 13 ● 14 ▯ 15 ●	163.23	6.60 7.05 7.50		V	Extremely weak, yellowish brown (10YR 5/8), completely decomposed, fine ash crystal TUFF. (Silty fine to coarse SAND with occasional subangular fine to medium gravel sized rock fragments)
05/06/2002	HX 8.60	5.50m at 18:00	100					16 ▨ 17 ●	162.13	8.60		V/IV	Extremely weak to very weak, grey (7.5YR 6/1) dappled brown, completely to highly decomposed, fine ash crystal TUFF. (Subangular fine to coarse GRAVEL with silty sand)
06/06/2002		Dry at 08:00 1.4	100 100	44 41	11 0	11.8 NI 20.0 NI		T2101 T2101		9.51		III/IV IV III/IV IV III/IV	Moderately weak, brownish grey spotted white, moderately to highly decomposed, fine ash crystal TUFF. Joints are closely to very closely spaced, rough undulating and rough stepped, narrow, iron and manganese oxide stained, dipping at 10° to 20°, 40° to 50° and 70° to 80°. From 8.90m to 9.08m : A subvertical joint

● SMALL DISTURBED SAMPLE	△ WATER SAMPLE
↕ LARGE DISTURBED SAMPLE	▲ PIEZOMETER TIP
▯ SPT LINER SAMPLE	△ STANDPIPE
▨ U76 UNDISTURBED SAMPLE	↓ STANDARD PENETRATION TEST
■ U100 UNDISTURBED SAMPLE	I PERMEABILITY TEST
▨ MAZIER SAMPLE	II IMPRESSION PACKER TEST
▤ PISTON SAMPLE	V IN-SITU VANE SHEAR TEST
	I PACKER TEST

LOGGED K.L. Lo

DATE 08/06/2002

CHECKED Tom Lo

DATE 10/06/2002

REMARKS

1. Standpipe was installed at 16.53m depth.

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO. **DH6**

SHEET 2 of 2

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation		
METHOD	**Rotary Cored**	CO-ORDINATES **E 847214.42** **N 817215.18**	Works Order No. **GE/2001/13.10**
MACHINE & No.	**DR86**		DATE from **04/06/2002** to **07/06/2002**
FLUSHING MEDIUM	**Air-Foam**	ORIENTATION **Vertical**	GROUND LEVEL **170.73** mPD

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade
						15.0			160.53	10.00 10.20	V V	IV
			100	66	46	NI 10.0 4.4		T2101			V V	III/IV III III/IV III
			100	84	44	4.0		T2101		11.60	V V	III/IV III
			100	74	40	11.1 NI 13.5		T2101	157.08	13.08 13.65	V V	III/IV III
06/06/2002 07/06/2002		Dry at 18:00 Dry at 08:00	100	80	48	>20 2.9 >20		T2101	155.27	14.52 15.46	V V	II III
07/06/2002		Dry at 18:00 1.57	100	90	86	11.8	Å	T2101	154.20	15.95 16.53	V V	

Description

dipping at 80° to 90°.
From 9.08m to 9.20m : Weak and highly decomposed.
From 9.44m to 9.53m : Weak and highly decomposed.
From 9.95m to 10.10m : Weak and highly decomposed.

Moderately strong, brown grey spotted white, moderately decomposed, fine ash TUFF.
Joints are closely spaced, rough undulating and rough stepped, very narrow, iron and manganese oxide stained, dipping at 20° to 30°, 40° to 50° and 70° to 80°.
From 10.55m to 11.00m : Moderately weak and moderately to highly decomposed.
From 11.50m to 12.12m : A subvertical joint dipping at 80° to 90°.
From 11.80m to 12.40m : Moderately weak and moderately to highly decomposed.
From 12.45m to 13.05m : A subvertical joint dipping at 80° to 90°.
From 13.08m to 13.65m : Moderately weak and moderately to highly decomposed.

Moderately strong, brown grey spotted white, moderately decomposed, fine ash crystal TUFF.
Joints are closely spaced, locally medium and very closely spaced, rough undulating and rough stepped, very narrow, iron and manganese oxide stained, dipping at 20° to 30°, 40° to 50° and 60° to 70°.

Moderately strong, brownish grey spotted white, moderately decomposed, coarse ash crystal TUFF.
Joints are closely spaced, locally medium and very closely spaced, rough undulating and rough stepped, very narrow, iron and manganese oxide stained, dipping at 20° to 30°, 40° to 50° and 60° to 70°.
From 15.46m to 15.68m : Strong and slightly decomposed.
From 16.43m to 16.53m : A subvertical joint dipping at 80° to 90°.
Hole completed at 16.53m.

● SMALL DISTURBED SAMPLE	△ WATER SAMPLE
↕ LARGE DISTURBED SAMPLE	PIEZOMETER TIP
▯ SPT LINER SAMPLE	Å STANDPIPE
U76 UNDISTURBED SAMPLE	↓ STANDARD PENETRATION TEST
■ U100 UNDISTURBED SAMPLE	PERMEABILITY TEST
▨ MAZIER SAMPLE	IMPRESSION PACKER TEST
▤ PISTON SAMPLE	V IN-SITU VANE SHEAR TEST
	PACKER TEST

LOGGED	K.L. Lo Lo
DATE	08/06/2002
CHECKED	Tom Lo
DATE	10/06/2002

REMARKS

GEOTECHNICS & CONCRETE ENGG. (H.K.) LTD.
GROUND INVESTIGATION DEPARTMENT

HOLE NO.	DH7
SHEET	1 of 1

DRILLHOLE RECORD

CONTRACT NO. GE/2001/13

PROJECT **Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation**

METHOD	**Rotary Cored**	CO-ORDINATES **E 847169.93** **N 817230.31**	Works Order No. **GE/2001/13.10**
MACHINE & No.	**DR86**		DATE from **30/05/2002** to **31/05/2002**
FLUSHING MEDIUM	**Air-Foam**	ORIENTATION **Vertical**	GROUND LEVEL **153.18 mPD**

Drilling Progress	Casing size	Water level (m) & Time	Total core Recovery %	Solid core Recovery %	R.Q.D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Grade
30/05/2002	HX							INSPECTION PIT	153.18	0.00	
								1 ●	152.68	0.50	V
								2 ●	152.18	1.00	IV/V
	HX 1.22	0.80m at 18:00	100	50	23	~~NI~~ 12.3		3 ● T2IO1	151.96	1.22	III
30/05/2002 31/05/2002		Dry at 08:00	95	83	68			T2IO1		1.96	
		5-8	100	86	86	3.7		T2IO1		3.26	II/III
			100	100	100	1.0		T2IO1		4.09	
			100	99	89	6.1		T2IO1		5.56	
31/05/2002		Dry at 18:00					△		146.16	7.02	

Description

Dark greyish brown (10YR 4/2) dappled yellowish brown and locally white, slightly silty fine to coarse SAND with much angular to subangular fine to coarse gravel sized rock fragments and occasional rootlets. (FILL)

Extremely weak, yellowish brown (10YR 5/8) mottled white, locally dappled dark brown, completely decomposed, fine ash TUFF. (Silty fine to coarse SAND with some subangular fine to medium gravel sized quartz fragments)

Very weak to weak, grey (7.5YR 6/1) dappled brown, highly to completely decomposed, fine ash TUFF. (Angular to subangular fine to coarse GRAVEL with some cobble sized rock fragments)

Strong to moderately strong, greenish grey spotted white and dappled yellowish brown and dark brown, slightly to moderately decomposed, fine ash TUFF.
Joints are closely to medium spaced, locally widely and very closely spaced, smooth planar and smooth undulating, extremely narrow to very narrow, iron and manganese oxide stained, dipping at 5° to 15°, 20° to 30°, 55° to 65° and 70° to 80°.
From 1.22m to 1.27m : Moderately weak and moderately decomposed.
From 1.27m to 3.74m : Moderately strong and moderately decomposed.
From 3.26m to 3.59m : An 80° to 90° joint.

Hole completed at 7.02m.

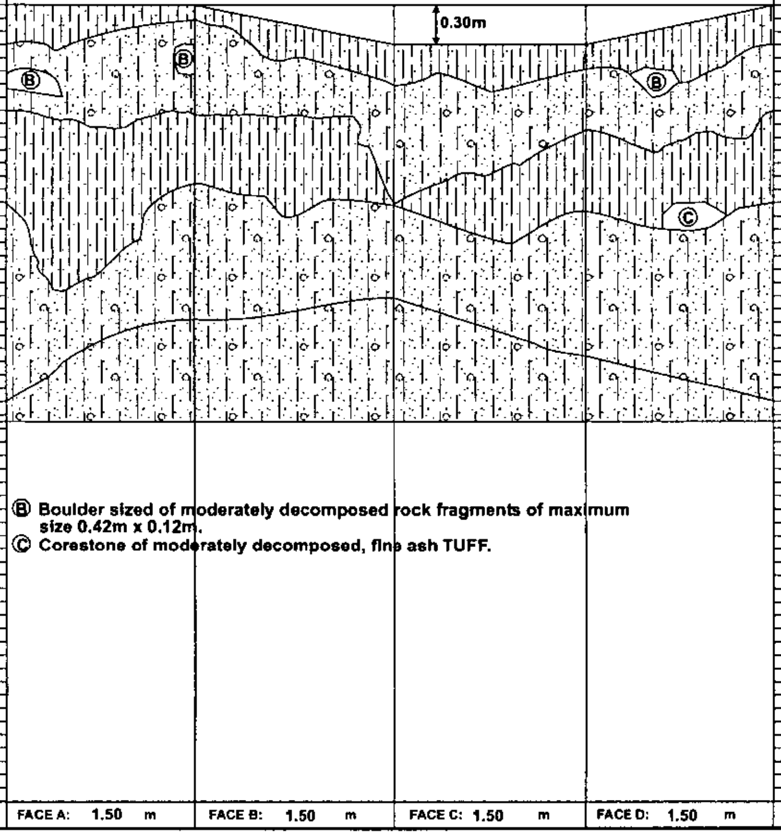
●	SMALL DISTURBED SAMPLE
↕	LARGE DISTURBED SAMPLE
▯	SPT LINER SAMPLE
▨	U76 UNDISTURBED SAMPLE
■	U100 UNDISTURBED SAMPLE
▨	MAZIER SAMPLE
▤	PISTON SAMPLE
△	WATER SAMPLE
▲	PIEZOMETER TIP
△	STANDPIPE
↓	STANDARD PENETRATION TEST
I	PERMEABILITY TEST
II	IMPRESSION PACKER TEST
V	IN-SITU VANE SHEAR TEST
I	PACKER TEST

LOGGED	K.L. Lo
DATE	01/06/2002
CHECKED	Tom Lo
DATE	03/06/2002

REMARKS
1. Standpipe was installed at 7.02m depth.

Samples & Test	Depth (m)
1 ↕	0.5
3 | 2 ↕	1.0
4 ↕	1.5
6 | 5 ↕	2.0
7 ↕	2.5
9 | 8 ↕	3.0

Sketch



Ⓑ Boulder sized of moderately decomposed rock fragments of maximum size 0.42m x 0.12m.
Ⓒ Corestone of moderately decomposed, fine ash TUFF.

FACE A: 1.50 m	FACE B: 1.50 m	FACE C: 1.50 m	FACE D: 1.50 m

Depth (m)	Legend	Description	Grade
0.30		Soft, dry, very dark greyish brown (10YR 3/2), sandy SILT with some subangular fine to coarse gravel and occasional boulder sized rock fragments and with some rootlets. (COLLUVIUM)	
0.80		Loose, moist, yellowish brown (10YR 5/4) mottled light yellowish brown and white, very silty fine to coarse SAND with some subangular fine to coarse gravel and occasional boulder sized rock fragments and with occasional rootlets. (COLLUVIUM)	
		Stiff, moist, yellowish brown (10YR 5/6) mottled pink and light yellowish brown, sandy SILT with occasional subangular fine gravel sized rock fragments and with some subrounded to rounded pocket of completely decomposed fine ash tuff of maximum size 0.50m x 0.40m. (RESIDUAL SOIL)	VI
		Extremely weak, yellowish brown (10YR 5/6) mottled pink and white, completely decomposed, fine ash TUFF. (Silty fine to coarse SAND with occasional fine gravel sized rock fragments)	V
3.15		Extremely weak to very weak, light grey (5Y 7/2) mottled yellowish brown and pink, completely to highly decomposed, fine ash TUFF. (Silty fine to coarse SAND with some angular fine gravel sized rock fragments)	V/IV

Trial pit terminated at maximum depth 3.15m.

Notes:
1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m, 2.00m, 2.50m and 3.00m depths.
2. Undisturbed vertical samples (U100) were taken at 1.00m, 2.00m and 3.00m (0% recovery) depths.

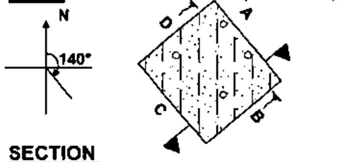
SYMBOLS

↕	Small Disturbed Sample
↕	Large Disturbed Sample
|	Undisturbed Vertical Sample
▬	Undisturbed Horizontal Sample
■	Block Sample
⊔	Insitu Density Test
▲	Water Sample
↓	Water Seepage

REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
Timber shoring over full height
Stability
Stable
Depth at pit centre
3.00m
Others
Nil

PLAN (not to scale)



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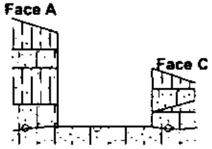


Contract No. :	GE/2001/13
Works Order No. :	GE/2001/13.10
Co-ordinates :	E 847241.54 N 817206.07
Ground Level :	182.69 mPD
Logged by :	K.L. Lo
Date logged :	13/06/2002
Checked by :	Tom Lo
Date Checked :	14/06/2002

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

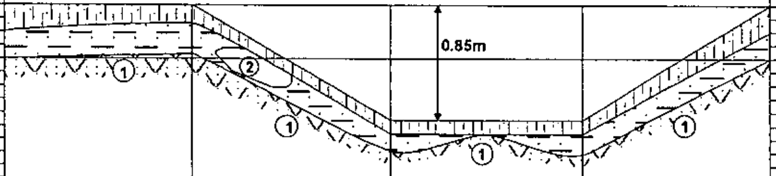
Sheet 1	of 1		
Date excavated	10/06/2002	to	12/06/2002
Date Reinstated	05/07/2002	to	05/07/2002

TRIAL PIT NO.
TP6

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Sketch	Depth (m)	Legend	Description	Grade
1			0.20		Firm, dry, dark grey (2.5Y 4/1), sandy SILT with some subangular fine to coarse gravel and occasional cobble sized rock fragments and some rootlets. (COLLUVIUM)	
			0.40		Stiff, moist, light brown (10YR 5/3) spotted white, slightly sandy CLAY with much subangular fine to coarse gravel and occasional cobble and boulder of maximum size 400mm sized rock fragments and with occasional rootlets. (COLLUVIUM)	
					Trial pit terminated at 0.40m depth.	

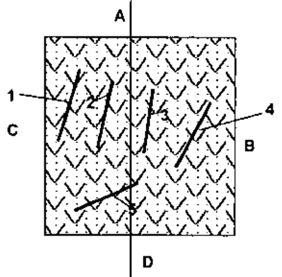
Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0



① Moderately strong, light brownish grey mottled yellowish brown and black, moderately decomposed lapilli bearing, fine ash TUFF.

② Boulder sized moderately decomposed tuff.

Top View



Joint number	Dip Direction/ Dip Angle
1	248°/076°
2	248°/078°
3	250°/080°
4	302°/068°
5	295°/076°

FACE A: 1.50 m

FACE B: 1.50 m

FACE C: 1.50 m

FACE D: 1.50 m

Note:
1. Large disturbed sample was taken at 0.30m depth.

SYMBOLS

↕	Small Disturbed Sample
↕	Large Disturbed Sample
┃	Undisturbed Vertical Sample
▬	Undisturbed Horizontal Sample
■	Block Sample
∪	Insitu Density Test
▲	Water Sample
↓	Water Seepage

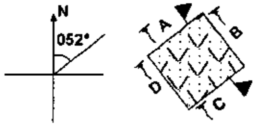
REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
No shoring

Stability
Stable

Depth at pit centre
0.40m
Others
Nil

PLAN (not to scale)



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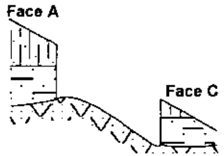


Contract No. :		GE/2001/13
Works Order No.	:	GE/2001/13.10
Co-ordinates	:	E 847182.48 N 817253.88
Ground Level	:	164.99 mPD
Logged by	:	K.L. Lo
Date logged	:	07/06/2002
Checked by	:	Tom Lo
Date Checked	:	08/06/2002

PROJECT

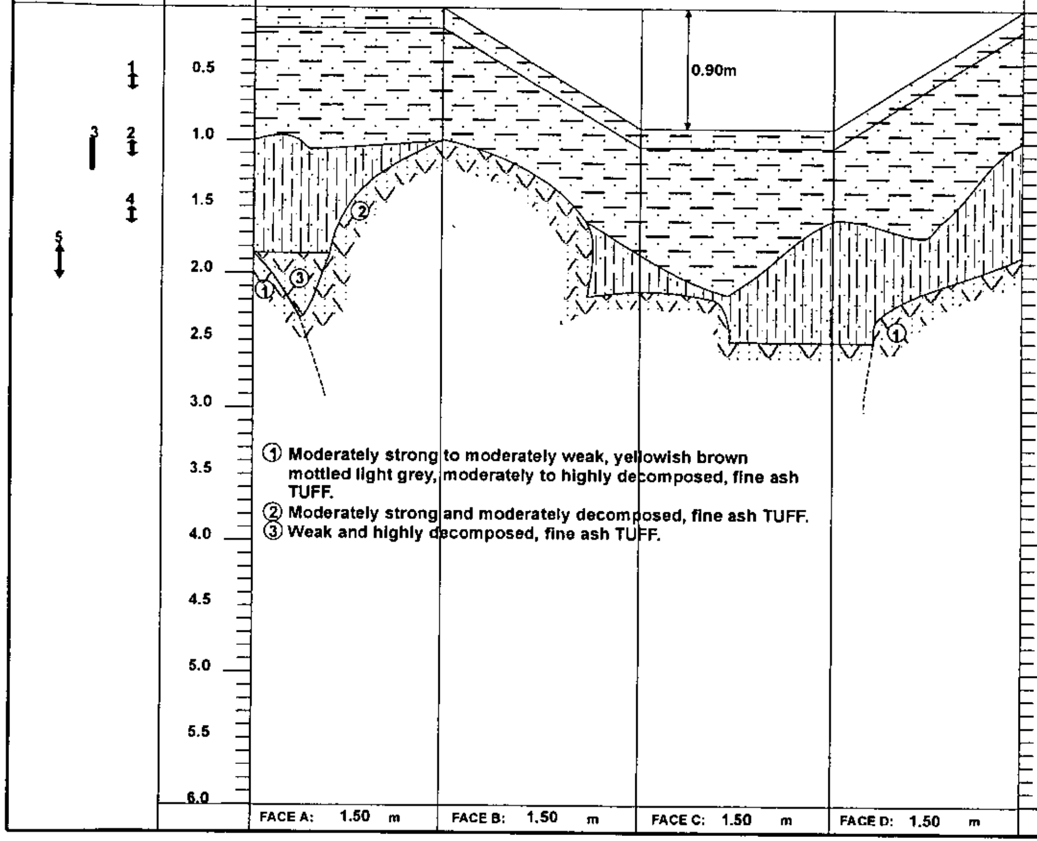
Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet 1	of 1		
Date excavated	06/06/2002	to	06/06/2002
Date Reinstated	03/07/2002	to	03/07/2002

TRIAL PIT NO.
TP7

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Sketch



① Moderately strong to moderately weak, yellowish brown mottled light grey, moderately to highly decomposed, fine ash TUFF.
② Moderately strong and moderately decomposed, fine ash TUFF.
③ Weak and highly decomposed, fine ash TUFF.

Depth (m)	Legend	Description	Grade
0.15		Firm, dry, dark grey (2.5Y 4/1), slightly sandy CLAY with some subangular fine to coarse gravel and occasional cobble sized rock fragments and with some rootlets. (COLLUVIUM)	
1.00		Firm, moist, light brown (10YR 5/3) spotted white, slightly sandy CLAY with much subangular fine to coarse gravel and cobble sized rock fragments and with occasional rootlets. (COLLUVIUM)	
1.85		Weak to very weak, yellowish brown (10YR 5/4) mottled light grey, highly to completely decomposed, fine ash TUFF. (Stiff, sandy SILT with much subangular fine to coarse gravel sized rock fragments)	IV/V
		Trial pit terminated at 1.85m depth.	

Notes:
1. Small disturbed samples were taken at 0.50m, 1.00m and 1.50m depths.
2. Undisturbed vertical sample (U100) samples were taken at 1.00m depth.
3. Large disturbed sample was taken at 1.80m depths.

SYMBOLS

↕	Small Disturbed Sample
↕	Large Disturbed Sample
┃	Undisturbed Vertical Sample
▬	Undisturbed Horizontal Sample
■	Block Sample
⊔	Insitu Density Test
▲	Water Sample
↓	Water Seepage

REMARKS

Ground Water
No Groundwater

Plant Used
Hand dug

Shoring
Timber shoring over full height

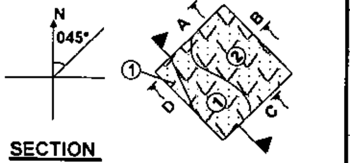
Stability
Stable

Depth at pit centre
1.30m

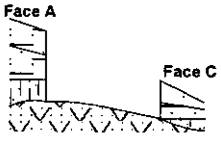
Others
Nil

PLAN

(not to scale)



SECTION



Contract No. :	GE/2001/13
Works Order No. :	GE/2001/13.10
Co-ordinates :	E 847189.84 N 817265.01
Ground Level :	166.88 mPD
Logged by :	K.L. Lo Lo
Date logged :	11/06/2002
Checked by :	Tom Lo
Date Checked :	12/06/2002

PROJECT

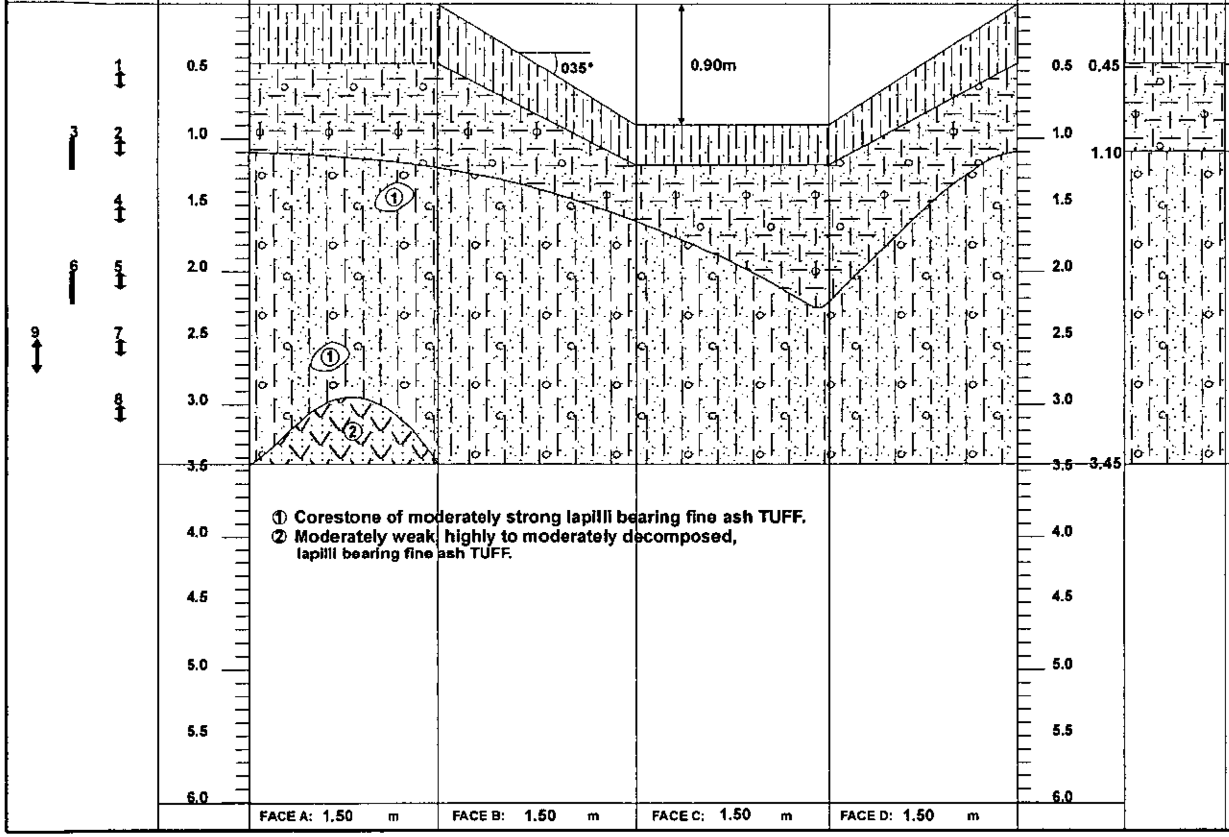
Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet	1	of	1
Date excavated	10/06/2002	to	10/06/2002
Date Reinstated	03/07/2002	to	03/07/2002

TRIAL PIT NO.
TP7A

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)	Sketch	Depth (m)	Legend	Description	Grade



① Corestone of moderately strong lapilli bearing fine ash TUFF.
② Moderately weak, highly to moderately decomposed, lapilli bearing fine ash TUFF.

FACE A: 1.50 m FACE B: 1.50 m FACE C: 1.50 m FACE D: 1.50 m

Depth (m)	Description	Grade
0.45	Stiff, dry, dark grey (2.5Y 4/1) sandy SILT with some subangular fine to coarse gravel and occasional cobble sized rock fragment and some rootlets. (COLLUVIUM)	
1.10	Firm, moist, dark greyish brown (10YR 4/2) sandy SILT/CLAY with some subangular fine to coarse gravel and cobble sized rock fragments and some rootlets. (COLLUVIUM)	
3.45	Weak to extremely weak, dry, olive grey (5Y 5/2) mottled yellowish brown and brown, highly to completely decomposed, lapilli bearing fine ash TUFF. (Silty fine to medium SAND with occasional subangular fine gravel and occasional boulder of maximum size 300mm sized rock fragment.	IV/V

Trial pit terminated at 3.45m depth.

Notes:
1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m, 2.00m, 2.50m and 3.00m depths.
2. Undisturbed vertical samples (U100) were taken at 1.00m and 2.00m depths.
3. Large disturbed samples was taken at 3.00m depth.

SYMBOLS

↕	Small Disturbed Sample
↕	Large Disturbed Sample
┃	Undisturbed Vertical Sample
▬	Undisturbed Horizontal Sample
■	Block Sample
⊔	Insitu Density Test
▲	Water Sample
⊥	Water Seepage

REMARKS

Ground Water
No Groundwater

Plant Used
Hand dug

Shoring
Timber shoring over full height

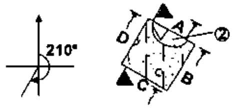
Stability
Stable

Depth at pit centre
3.00m

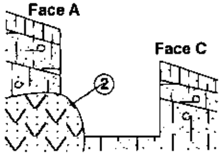
Others
Nil

PLAN

(not to scale)



SECTION



Contract No. :	GE/2001/13	
Works Order No.	: GE/2001/13.10	
Co-ordinates	:	
E 847025.18	N 817334.69	
Ground Level	: 155.42	mPD
Logged by	: K.L. Lo	
Date logged	: 06/06/2002	
Checked by	: Tom Lo	
Date Checked	: 07/06/2002	

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

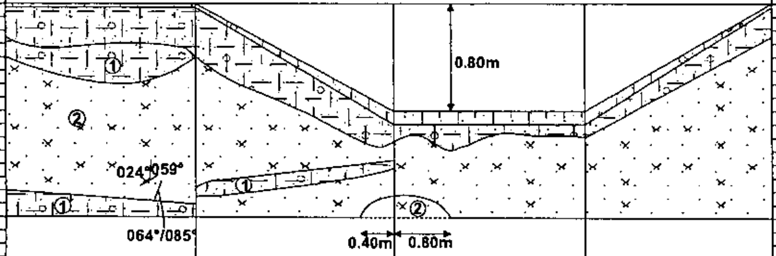
Sheet 1	of	1	
Date excavated	03/06/2002	to	05/06/2002
Date Reinstated	04/07/2002	to	04/07/2002

TRIAL PIT NO.
TP8

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

Samples & Test	Depth (m)
↨ 1	0.5
↨ 2	1.0

Sketch



① Extremely weak to very weak, moist, yellow brown (10YR 5/8), completely to highly decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND with some subangular fine to coarse gravel and cobble sized rock fragments)
② Moderately weak, yellowish brown dappled white and streaked black, moderately to highly decomposed, TRACHYDACITE LAVA.

FACE A:	FACE B:	FACE C:	FACE D:
1.50 m	1.50 m	1.50 m	1.50 m

Depth (m)	Legend	Description	Grade
0.03		Loose, dry, dark grey (2.5Y 4/1), silty fine to coarse SAND with occasional fine to medium gravel sized rock fragments and some rootlets. (TOP SOIL)	
0.25		Loose, dry, dark brownish grey (2.5Y 3/2) dappled white and red, silty fine to coarse SAND with some subrounded to subangular fine to coarse gravel sized rock fragments, occasional cobble sized rock fragments. (COLLUVIUM)	IV
		Weak to moderately weak, dry, yellowish brown dappled white, red and black, highly decomposed, highly fractured, TRACHYDACITE LAVA.	
1.60		Trial pit terminated at 1.60m.	

Note:
1. Small disturbed samples were taken at 0.50m and 1.00m depths.

SYMBOLS

↨	Small Disturbed Sample
↨	Large Disturbed Sample
|	Undisturbed Vertical Sample
—	Undisturbed Horizontal Sample
■	Block Sample
U	Insitu Density Test
▲	Water Sample
↓	Water Seepage

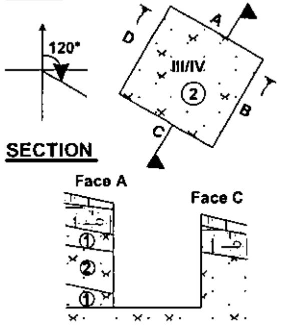
REMARKS

Ground Water
No Groundwater
Plant Used
Hand dug
Shoring
No shoring

Stability
Stable

Depth at pit centre
1.20m
Others
Nil

PLAN (not to scale)



Contract No. :	GE/2001/13
Works Order No. :	GE/2001/13.10
Co-ordinates :	E 846809.76 ✓ N 817411.30 ✓
Ground Level :	135.44 ✓ mPD
Logged by :	K.L. Lo Lo
Date logged :	07/06/2002
Checked by :	Tom Lo
Date Checked :	08/06/2002

PROJECT

Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Sheet 1	of 1		
Date excavated	04/06/2002	to	06/06/2002
Date Reinstated	02/07/2002	to	02/07/2002

TRIAL PIT NO.
TP12

GEOTECHNICS & CONCRETE ENGG.
(HONG KONG) LIMITED
GROUND INVESTIGATION DEPARTMENT

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT

SLOPE STRIPPING LOG

Stripping No.:	S14
Sheet	1 of 1
Slope No.:	NIL

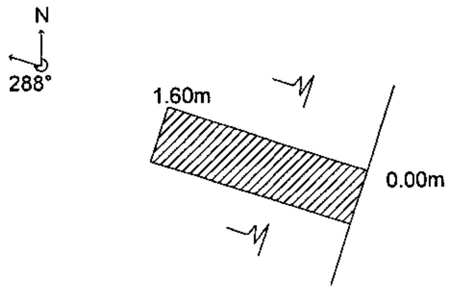
Contract No.: GE/2001/13	Datum (toe) Co-ordinates: E 847211.04 N 817081.50 Level 129.91 mPD	Datum (crest) Co-ordinates: E 847211.87 N 817081.29 Level 131.35 mPD	Works Order No.: GE/2001/13.10
Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation			Excavated by: T.O. Yuen Supervised by: T.M. Chow
Date Started / Excavation : 27/06/2002	Date Completed : 04/07/2002		Date Reinstated :

Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities	
							Dip/ Dip Direction	Nature & Infilling
	0	131.35						
	0.80	130.63	64°	Stiff, dry, brownish grey (10YR 6/2) dappled yellowish brown, sandy SILT with some subangular fine to coarse gravel and cobble sized rock fragments and occasional rootlets. (COLLUVIUM)				
	1.60	129.91		Moderately strong, brown dappled grey, moderately decomposed, lapilli bearing, fine ash TUFF. (Massive)		III		
				End of stripping at 1.60m.				

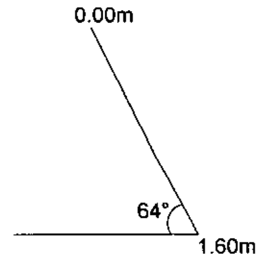
Remarks: 1. 70mm shotcrete surface.

Symbol for Sample / Test:
- ↕ Small disturbed sample
- ↕ Large disturbed sample
- ■ Block sample
- ⊔ Insitu-density test
- m Moisture content test
- ▲ Water sample
- ↓ Seepage
- [ ] Photograph

Sketch Plan:



Sketch Section:



Logged by : K.L. Lo | Date Logged : 05/07/2002 | Checked by : Tom Lo | Date Checked : 06/07/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT

SLOPE STRIPPING LOG

Stripping No.: S15

Sheet 1 of 1

Slope No.: NIL

Contract No.: GE/2001/13

Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Datum (toe) Co-ordinates:	E 847204.42 N 817138.20 Level 142.69 mPD
Datum (crest) Co-ordinates:	E 847206.27 N 817138.03 Level 145.26 mPD

Works Order No.: GE/2001/13.10

Excavated by: T.O. Yuen

Supervised by: T.M. Chow

Date Started / Excavation : 13/06/2002

Date Completed : 24/06/2002

Date Reinstated :

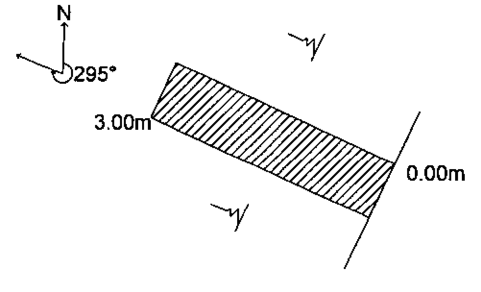
Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities	
							Dip/ Dip Direction	Nature & Infilling
	0	145.26						
	1.90	143.63	59°	Very weak, dry, light yellowish brown (2.5Y 6/4) dappled white and dark brown, highly to completely decomposed, TRACHYDACITE LAVA. (Stiff, sandy SILT with much angular to subangular fine to coarse gravel and some cobble sized rock fragments)		IV/V		
	3.00	142.69		Extremely weak, dry, yellowish brown (10YR 5/8) dappled white and light grey, completely decomposed, TRACHYDACITE LAVA. (Stiff, sandy SILT with some angular to subangular fine to coarse gravel and occasional cobble sized rock fragments)		V		
				End of stripping at 3.00m.				

Remarks: 1. 100mm chunam surface.

Symbol for Sample / Test:

- ↕ Small disturbed sample
- ↕ Large disturbed sample
- ■ Block sample
- ⊔ Insitu-density test
- m Moisture content test
- ▲ Water sample
- ↓ Seepage
- [ ] Photograph

Sketch Plan:



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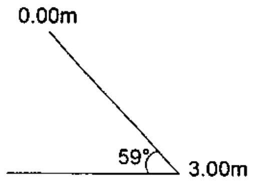


Logged by : K.L. Lo

Date Logged : 25/06/2002

Checked by : Tom Lo

Date Checked : 26/06/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT
SLOPE STRIPPING LOG

Stripping No.:	S16
Sheet	1 of 1
Slope No.:	NIL

Contract No.: GE/2001/13 Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation	Datum (toe) Co-ordinates: E 847188.07 N 817181.19 Level 141.77 mPD	Datum (crest) Co-ordinates: E 847191.33 N 817181.97 Level 148.44 mPD	Works Order No.: GE/2001/13.10 Excavated by: T.O. Yuen Supervised by: T.M. Chow
Date Started / Excavation : 13/06/2002	Date Completed : 24/06/2002		Date Reinstated :

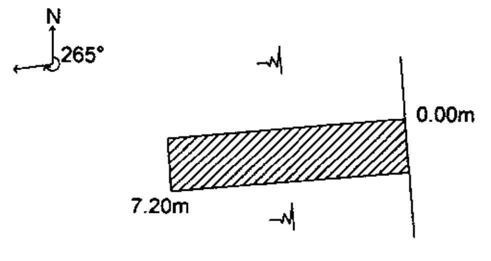
Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities Dip/ Dip Direction	Discontinuities Nature & Infilling
	0	148.44						
	3.90	145.66	60°	Firm, dry, brownish grey (10YR 6/2), sandy SILT with some angular to subangular fine to coarse gravel and cobble sized rock fragments. (COLLUVIUM)				
	5.00	143.91	77°	Very weak, dry, light yellowish brown (2.5Y 6/4) dappled white, highly to completely decomposed, TUFF. (Stiff, sandy SILT with much angular to subangular fine to coarse gravel and some cobble sized rock fragments)		IV/V		
	6.90	142.06		Extremely weak, dry, yellowish brown (10YR 5/8) dappled light grey and white, completely decomposed, TUFF. (Silty fine to coarse SAND with occasional angular fine gravel sized quartz fragments)		V		
	7.20	141.77		Very weak, dry, light yellowish brown (2.5Y 6/4) dappled white, highly to completely decomposed, TUFF. (Silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized rock fragments) End of stripping at 7.20m.		IV/V		

Remarks: 1. 40mm chunam surface.

Symbol for Sample / Test:

- ↕ Small disturbed sample
- ↕ Large disturbed sample
- ■ Block sample
- Ʊ Insitu-density test
- m Moisture content test
- ▲ Water sample
- ↓ Seepage
- [ ] Photograph

Sketch Plan:



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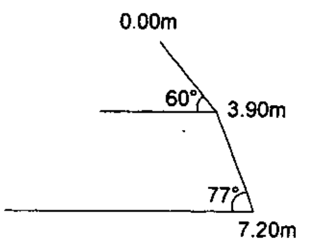


Logged by : K.L. Lo	Date Logged : 25/06/2002	Checked by : Tom Lo	Date Checked : 26/06/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT

SLOPE STRIPPING LOG

Stripping No.: S17
Sheet 1 of 1
Slope No.: NIL

Contract No.: GE/2001/13

Project:
Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

Datum (toe) Co-ordinates:
E 847183.09
N 817211.83
Level 141.98 mPD

Datum (crest) Co-ordinates:
E 817186.31
N 817212.15
Level 147.22 mPD

Works Order No.: GE/2001/13.10
Excavated by: T.O. Yuen
Supervised by: T.M. Chow

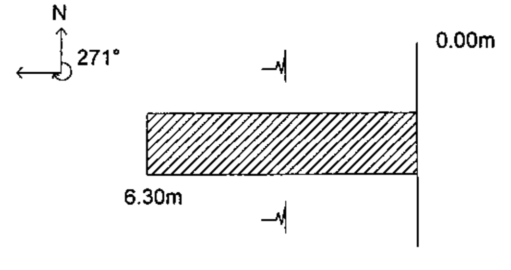
Date Started / Excavation : 13/06/2002
Date Completed : 24/06/2002
Date Reinstated :

Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities	
							Dip/ Dip Direction	Nature & Infilling
	0	147.22						
				Loose, dry, brown (7.5YR 5/4), slightly sandy SILT with much angular to subangular fine to coarse gravel and some cobble sized rock fragment. (COLLUVIUM)				
	2.00	145.56	56°	Moderately strong, light grey dappled dark brown, moderately decomposed, TRACHYDACITE LAVA. Joints are closely to medium spaced, smooth planar and rough planar, iron and manganese oxide stained, dipping at 70° to 80°. From 3.00m to 3.20m : An 80° to 90° joint. From 3.70m to 4.00m : An 80° to 90° joint. From 3.80m to 3.90m : An 80° to 90° joint.		III	068°/86° 074°/82° 176°/88° 068°/80° 065°/79° 017°/69° 066°/75°	
	6.30	141.98		End of stripping at 6.30m.				

Remarks: 1. 50mm chunam surface.

Symbol for Sample / Test:
- ↕ Small disturbed sample
- ⇕ Large disturbed sample
- ■ Block sample
- ⊔ Insitu-density test
- m Moisture content test
- ▲ Water sample
- ↓ Seepage
- [ ] Photograph

Sketch Plan:



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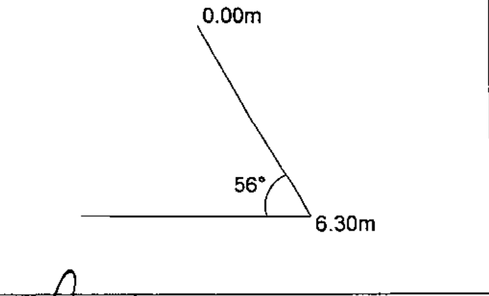


Logged by : K.L. Lo
Date Logged : 25/06/2002
Checked by : Tom Lo
Date Checked : 26/06/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT

SLOPE STRIPPING LOG

Stripping No.:	S18
Sheet	1 of 1
Slope No.:	NIL
Works Order No.:	GE/2001/13.10
Excavated by:	T.O. Yuen
Supervised by:	T.M. Chow

Contract No.: GE/2001/13

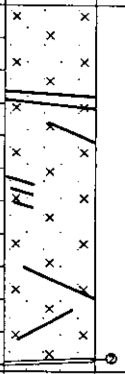
Project:
Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation

	Datum (toe)	Datum (crest)
Co-ordinates: E	847162.66	847161.74
Co-ordinates: N	817216.63	817218.94
Level	141.53 mPD	146.16 mPD

Date Started / Excavation : 14/06/2002

Date Completed : 24/06/2002

Date Reinstated :

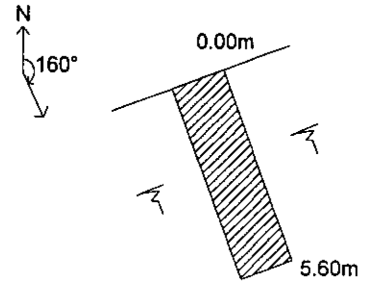
Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities Dip/ Dip Direction	Discontinuities Nature & Infilling
	0	146.16						
	1 2 3 4 5 5.60	141.53	56°	Moderately strong, brown dappled grey, moderately decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough undulating and rough planar, extremely narrow, iron and manganese oxide stained, dipping at 35° to 45° and 65° to 75°. From 1.30m to 1.40m : An 80° to 90° joint. From 4.10m to 4.40m : An 80° to 90° joint.	 ②	III	175°/84° 194°/56° 172°/39° 356°/74° 355°/73° 356°/75° 008°/84° 135°/64°	
	6 7 8 9 10 11 12 13 14 15 16			End of stripping at 5.60m. Chunam is wet. ① Seepage at 4.10m. ② PVC pipe of diameter 30mm.				

Remarks: 1. 30mm chunam surface.

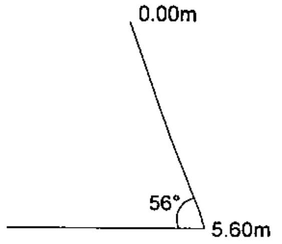
Symbol for Sample / Test:

↕	Small disturbed sample
⇕	Large disturbed sample
■	Block sample
⊔	Insitu-density test
m	Moisture content test
▲	Water sample
↓	Seepage
[ ]	Photograph

Sketch Plan:



Sketch Section:



Logged by : K.L. Lo

Date Logged : 25/06/2002

Checked by : Tom Lo

Date Checked : 26/06/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT

SLOPE STRIPPING LOG

Stripping No.:	S19
Sheet	1 of 1
Slope No.:	NIL

Contract No.: GE/2001/13	Datum (toe) Co-ordinates:	Datum (crest) Co-ordinates:
Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation	E 847095.71 N 817214.28 Level 140.83 mPD	E 847096.79 N 817217.11 Level 144.51 mPD

Works Order No.: GE/2001/13.10

Excavated by: T.O. Yuen

Supervised by: T.M. Chow

Date Started / Excavation : 14/06/2002

Date Completed : 24/06/2002

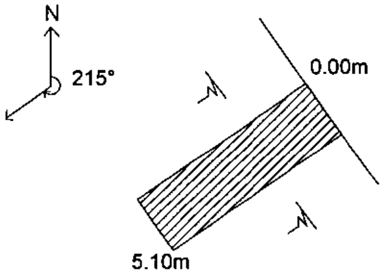
Date Reinstated :

Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities: Dip/ Dip Direction	Discontinuities: Nature & Infilling
	0	144.51						
	2.00	143.07	46°	Extremely weak to very weak, dry, brown (7.5YR 5/4) dappled grey and white, completely to highly decomposed, TRACHYDACITE LAVA. (Silty fine SAND with some angular to subangular fine to medium gravel sized rock fragments)		V/IV		
	3.20	142.21		Moderately weak, light grey dappled dark brown, moderately to highly decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough planar, iron and manganese oxide stained, dipping at 84°. From 2.20m to 2.50m : An 80° to 90° joint.		III/IV	226°/84°	
	3.80	141.78		Very weak, dry, brown (7.5YR 5/4) dappled grey and white, highly to completely decomposed, TRACHYDACITE LAVA. (Very silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized rock fragments)		IV/V		
	5.10	140.83		Moderately weak, light grey dappled light yellowish brown, moderately to highly decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough planar, iron and manganese oxide stained, dipping at 65° to 75°. From 3.90m to 4.00m : An 80° to 90° joint. End of stripping at 5.10m.		III/IV	076°/83° 140°/68° 250°/78°	

Remarks: 1. 40mm chunam surface.

Symbol for Sample / Test:
- ↕ Small disturbed sample
- ⇕ Large disturbed sample
- ■ Block sample
- Ս Insitu-density test
- m Moisture content test
- ▲ Water sample
- ⬇ Seepage
- [ ] Photograph

Sketch Plan:



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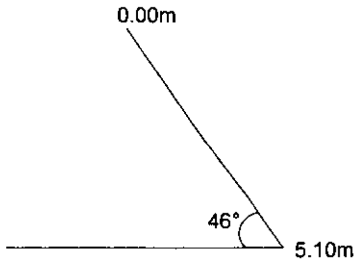


Logged by : K.L. Lo

Date Logged : 25/06/2002

Checked by : Tom Lo

Date Checked : 26/06/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT
SLOPE STRIPPING LOG

Stripping No.:	S20
Sheet	1 of 1
Slope No.:	NIL
Contract No.:	GE/2001/13
Project:	Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation
Datum (toe) Co-ordinates:	E 847052.67 N 817256.30 Level 140.08 mPD
Datum (crest) Co-ordinates:	E 847053.31 N 817258.87 Level 146.16 mPD
Works Order No.:	GE/2001/13.10
Excavated by:	T.O. Yuen
Supervised by:	T.M. Chow
Date Started / Excavation :	14/06/2002
Date Completed :	24/06/2002
Date Reinstated :	

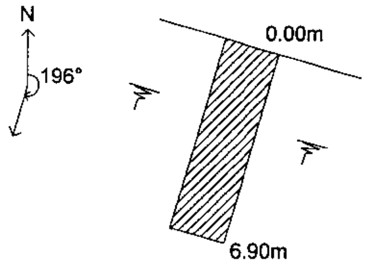
Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities Dip/ Dip Direction	Discontinuities Nature & Infilling
	0	146.16						
	1.70	144.80	53°	Firm, dry, dark brown (7.5YR 3/2), slightly sandy SILT with some angular to subangular fine to coarse gravel and occasional cobble sized rock fragments. (COLLUVIUM) ①				
	1.90	144.64		Weak to moderately weak, light grey dappled brown and yellowish brown, highly to moderately decomposed, TRACHYDACITE LAVA. (MASSIVE)		IV/III		
	2.20	144.37						
	3.70	143.00		Very weak, dry, yellowish brown (10YR 5/8) dappled white and grey, highly to completely decomposed, TRACHYDACITE LAVA. (Stiff, slightly sandy SILT)		IV/V		
			66°	Moderately strong, light grey dappled dark brown, moderately decomposed, TRACHYDACITE LAVA. Joints are closely to medium spaced, rough planar, iron oxide stained, dipping at 70° to 80°.	②	III	043°/82° 144°/76° 153°/78°	
	6.90	140.08		From 6.50m to 6.90m : Weak to moderately weak and highly to moderately decomposed.		IV/III		
				End of stripping at 6.90m. ① root of diameter 12mm. ② PVC weephole of diameter 50mm.				

Remarks: 1. 50mm chunam surface from 0.00m to 4.10m.
2. 150mm chunam surface with iron mesh from 4.10m to 6.90m.

Symbol for Sample / Test:

↕	Small disturbed sample
↕	Large disturbed sample
■	Block sample
⊔	Insitu-density test
m	Moisture content test
▲	Water sample
↓	Seepage
[ ]	Photograph

Sketch Plan:



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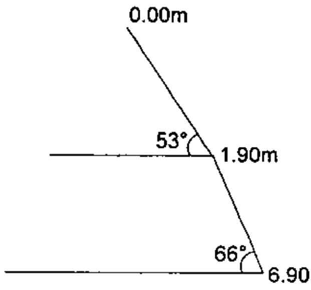


Logged by :	K.L. Lo
Date Logged :	25/06/2002
Checked by :	Tom Lo
Date Checked :	26/06/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT
SLOPE STRIPPING LOG

Stripping No.: S21

Sheet 1 of 1

Slope No.: NIL

Contract No.: GE/2001/13	Datum (toe) Co-ordinates: E 847011.28 N 817286.79 Level 139.49 mPD	Datum (crest) Co-ordinates: E 847010.96 N 817289.65 Level 144.18 mPD	Works Order No.: GE/2001/13.10 Excavated by: T.O. Yuen Supervised by: T.M. Chow
Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation			

Date Started / Excavation : 14/06/2002

Date Completed : 24/06/2002

Date Reinstated :

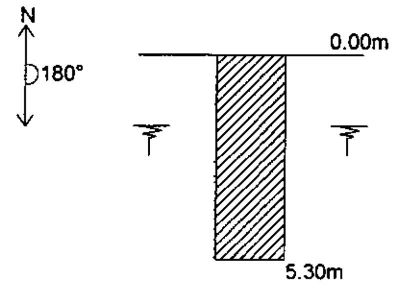
Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities	
							Dip/ Dip Direction	Nature & Infilling
	0	144.18						
	1.10	143.21	62°	Weak, brown dappled white, highly decomposed, TRACHYDACITE LAVA. Joints are very closely spaced, rough planar, extremely narrow to very narrow, iron oxide stained, dipping at 30° to 40°.		IV	190°/38° 191°/38° 190°/37° 190°/35°	
	2.50	141.97		Moderately strong, brown dappled white and grey, moderately decomposed, TRACHYDACITE LAVA. Joints are very closely to closely spaced, smooth planar, extremely narrow, iron and manganese oxide stained, dipping at 70°. From 2.10m to 2.50m : Weak and highly decomposed.		III IV	253°/70° 256°/70° 255°/70° 256°/70°	
	5.30	139.49		Weak, brown dappled dark brown and light grey, highly decomposed, TRACHYDACITE LAVA. (MASSIVE) From 2.50m to 3.80m : Weak to very weak, highly to completely decomposed trachydacite lava. (Stiff, sandy silt)		IV/V IV		
				End of stripping at 5.30m.				

Remarks: 1. 50mm chunam surface with iron mesh.

Symbol for Sample / Test:

- ↕ Small disturbed sample
- ⇕ Large disturbed sample
- ■ Block sample
- ⊔ Insitu-density test
- m Moisture content test
- ▲ Water sample
- ↓ Seepage
- [ ] Photograph

Sketch Plan:



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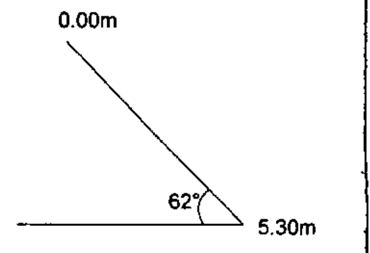


Logged by : K.L. Lo

Date Logged : 25/06/2002

Checked by : Tom Lo

Date Checked : 26/06/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT
SLOPE STRIPPING LOG

Stripping No.:	S22
Sheet	1 of 1
Slope No.:	NIL

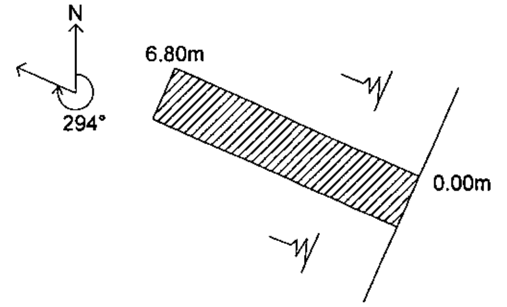
Contract No.: GE/2001/13	Datum (toe) Co-ordinates: E 847001.31 N 817330.13 Level 138.83 mPD	Datum (crest) Co-ordinates: E 847004.89 N 817328.54 Level 143.80 mPD	Works Order No.: GE/2001/13.10
Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation			Excavated by: T.O. Yuen Supervised by: T.M. Chow
Date Started / Excavation : 19/06/2002	Date Completed : 24/06/2002	Date Reinstated :	

Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities Dip/ Dip Direction	Discontinuities Nature & Infilling
	0	143.80						
1 ↨ 2 ↨ 3 ↨ 4 ↨ 5 ↨ 6 ↨ 7 ↨ 8 ↨	4.00	140.87	47°	Extremely weak, dry, light yellowish brown (2.5Y 6/4) dappled white and dark brown, completely decomposed, TRACHYDACITE LAVA. (Stiff, sandy SILT with some angular to subangular fine to coarse gravel sized rock and quartz fragments) From 0.50m to 0.70m : Extremely weak to very weak and completely to highly decomposed. From 1.80m to 1.90m : Extremely weak to very weak and completely to highly decomposed. From 2.20m to 2.40m : Extremely weak to very weak and completely to highly decomposed. From 2.80m to 3.00m : Extremely weak to very weak and completely to highly decomposed.		V V/IV V V/IV V/IV V V/IV V		
9 ↨ 10 ↨ 11 ↨ 12 ↨	6.80	138.83		Extremely weak, dry, yellowish brown (10YR 5/8) dappled light grey and light yellow, completely decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND with occasional angular to subangular fine to coarse gravel sized rock fragments) From 4.90m to 5.20m : Extremely weak to very weak and completely to highly decomposed. From 5.40m to 5.60m : Very weak and highly to completely decomposed.	V/IV	V IV/V V		
				End of stripping at 6.80m. Note: 1. Small disturbed samples were taken from 0.00m to 6.00m for interval 0.50m.				

Remarks: 1. 50mm chunam surface with iron mesh.

Symbol for Sample / Test:
- ↨ Small disturbed sample
- ↨ Large disturbed sample
- ■ Block sample
- Insitu-density test
- m Moisture content test
- ▲ Water sample
- ↓ Seepage
- [ ] Photograph

Sketch Plan:



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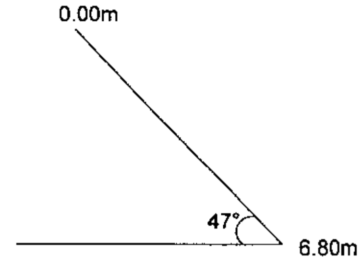


Logged by : K.L. Lo	Date Logged : 25/06/2002	Checked by : Tom Lo	Date Checked : 26/06/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT
SLOPE STRIPPING LOG

Stripping No.: S23	Sheet 1 of 1	Slope No.: NIL	
Contract No.: GE/2001/13	Datum (toe) Co-ordinates: E 846983.30 N 817351.63 Level 138.32 mPD	Datum (crest) Co-ordinates: E 846984.81 N 817356.87 Level 143.71 mPD	Works Order No.: GE/2001/13.10
Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation			Excavated by: T.O. Yuen Supervised by: T.M. Chow
Date Started / Excavation : 24/06/2002	Date Completed : 04/07/2002	Date Reinstated :	

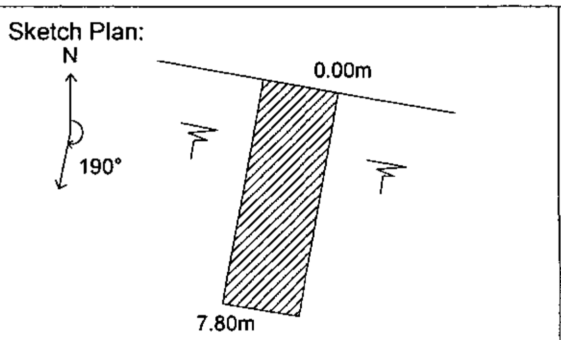
Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities Dip/ Dip Direction	Discontinuities Nature & Infilling
	0	143.71						
1 ↕ 2 ↕ 3 ↕ 4 ↕	2.40	142.04		Extremely weak to very weak, dry, light grey (7.5YR 7/1) dappled white and yellowish brown and occasional dark grey, completely to highly decomposed TRACHYDACITE LAVA. (Very stiff, sandy SILT with some angular to subangular fine to coarse gravel and occasional cobble sized rock fragments) From 1.60m to 1.70m : Weak and highly decomposed.	①	V/IV		
5 ↕	2.90	141.69		Weak to moderately weak, light grey dappled brown, highly to moderately decomposed, TRACHYDACITE LAVA. (Massive)	×	IV/III		
6 ↕ 7 ↕ 8 ↕	4.50	140.58	44°	Very weak, dry, yellowish brown (10YR 5/8) dappled light grey and dark brown, highly to completely decomposed, TRACHYDACITE LAVA. (Very stiff, sandy SILT with some angular fine to coarse gravel and occasional cobble sized rock fragments)		IV/V		
9 ↕ 10 ↕	5.20	140.09		Weak to moderately weak, light grey dappled brrown, highly to moderately decomposed, TRACHYDACITE LAVA. (Massive)	× ×	IV/III		
11 ↕	6.00	139.53		Extremely weak, dry, brown (7.5YR 5/4) mottled light grey dappled yellow, completely decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND)		V		
12 ↕ 13 ↕ 14 ↕	7.80	138.32		Moderately weak, light yellowish brown mottled brown and light grey, moderately to highly decomposed, TRACHYDACITE LAVA. Joints are medium spaced, rough planar, extremely narrow, iron oxide stained, dipping at 70° to 80° and 80° to 90°.	× × × × × × × ×	III/IV	220°/83° 195°/70° 220°/75°	
				End of stripping at 7.80m. ① Highly decomposed TRACHYDACITE LAVA. (Core Stone) Note: 1. Small disturbed samples were taken from 0.00m to 7.00m for interval 0.50m.				

Remarks: 1. 150mm shotcrete with iron mesh from 0.00m to 6.00m.

Symbol for Sample / Test:

↕	Small disturbed sample
⇕	Large disturbed sample
■	Block sample
⊔	Insitu-density test
m	Moisture content test
▲	Water sample
↓	Seepage
[ ]	Photograph

Sketch Plan:



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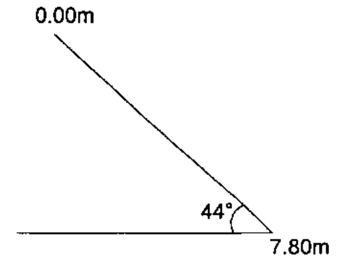


Logged by : K.L. Lo	Date Logged : 05/07/2002	Checked by : Tom Lo	Date Checked : 06/07/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD. **GROUND INVESTIGATION DEPARTMENT**		Stripping No.: S24
		Sheet 1 of 1
SLOPE STRIPPING LOG		Slope No.: NIL
Contract No.: GE/2001/13	Datum (toe) Co-ordinates: E 846929.67 N 817367.78 Level 137.70 mPD	Datum (crest) Co-ordinates: E 846933.79 N 817373.89 Level 146.27 mPD
Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation		Works Order No.: GE/2001/13.10 Excavated by: T.O. Yuen Supervised by: T.M. Chow
Date Started / Excavation : 25/06/2002	Date Completed : 04/07/2002	Date Reinstated :

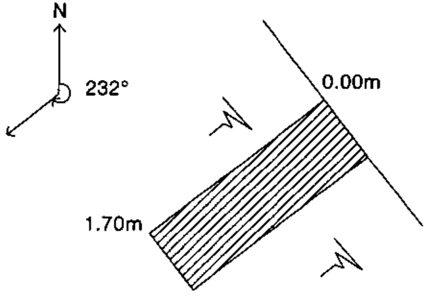
Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities Dip/ Dip Direction	Discontinuities Nature & Infilling
	0	146.27						
1 ↕ 2 ↕ 3 ↕ 4 ↕ 5 ↕	2.90	144.14	47°	Firm, moist, yellowish brown (10YR 5/8) dappled greyish brown and mottled white, sandy SILT with much angular to subangular fine to coarse gravel and some cobble sized rock fragments. (COLLUVIUM)				
6 ↕ 7 ↕ 8 ↕ 9 ↕ 10 ↕ 11 ↕	5.80	142.02		Extremely weak, dry, yellowish brown (10YR 5/8) mottled white, completely decomposed, fine ash TUFF. (Very stiff, sandy SILT with occasional subangular fine gravel sized quartz fragments)		V		
12 ↕ 13 ↕	6.70	141.36		Extremely weak, dry, yellowish brown (10YR 5/8) mottled light grey and dappled dark brown, completely decomposed fine ash TUFF. (Stiff, slightly sandy SILT)		V		
14 ↕	7.40	140.85		Very weak, dry, light yellowish brown (2.5Y 6/4) mottled white, highly to completely decomposed, fine ash TUFF. (Silty fine to medium SAND with some angular fine to coarse gravel sized rock fragments)		IV/V		
15 ↕ 16 ↕	8.20	140.26		Extremely weak, yellowish brown (10YR 5/8) mottled light grey, completely decomposed, fine ash TUFF. (Stiff, sandy SILT with some subangular fine to medium gravel sized quartz and rock fragments)		V		
17 ↕ 18 ↕	9.20	139.53		Very weak, yellowish brown (10YR 5/8) mottled white, highly to completely decomposed, fine ash TUFF. (Slightly silty fine to medium SAND) From 8.25m to 8.50m : Weak, yellowish brown dappled dark brown and mottled light grey, highly decomposed. From 8.60m to 8.85m : Weak to moderately weak, light grey dappled dark brown, highly to moderately decomposed.		IV/V IV/III IV/V		
19 ↕	9.70	139.16		Moderately weak, dark brown dappled light yellowish brown and light grey, moderately to highly decomposed, fine ash TUFF.		III/IV		
20 ↕ 21 ↕ 22 ↕ 23 ↕	11.70	137.70		Very weak, dry, yellowish brown (10YR 5/8) dappled dark brown and mottled light grey, highly to completely decomposed, fine ash TUFF. (Silty fine to coarse SAND with some angular to subangular fine to medium gravel sized rock fragments) From 10.50m to 10.65m : Moderately strong, light grey spotted black and mottled pink moderately decomposed fine ash TUFF. (CORESTONE)		IV/V III IV/V		
				End of stripping at 11.70m. Note: 1. Small disturbed samples were taken from 0.00m to 11.50m at interval 0.50m.				

Remarks: 50mm shotcrete with iron mesh.

Symbol for Sample / Test:

- ↕ Small disturbed sample
- ↕ Large disturbed sample
- ■ Block sample
- ⊔ Insitu-density test
- m Moisture content test
- ▲ Water sample
- ↓ Seepage
- [ ] Photograph

Sketch Plan:



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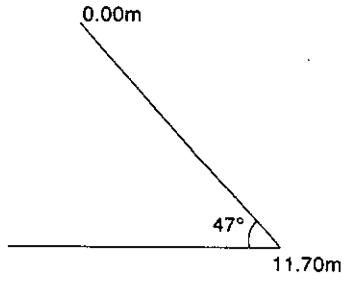


Logged by : K.L. Lo Lo | Date Logged : 05/07/2002 | Checked by : Tom Lo | Date Checked : 06/07/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT

SLOPE STRIPPING LOG

Stripping No.:	S25
Sheet	1 of 1
Slope No.:	NIL
Works Order No.:	GE/2001/13.10
Excavated by:	T.O. Yuen
Supervised by:	T.M. Chow

Contract No.: GE/2001/13	Datum (toe) Co-ordinates: E 846892.96 N 817383.80 Level 136.90 mPD	Datum (crest) Co-ordinates: E 846890.46 N 817389.25 Level 144.18 mPD
Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation		
Date Started / Excavation : 25/06/2002	Date Completed : 04/07/2002	Date Reinstated :

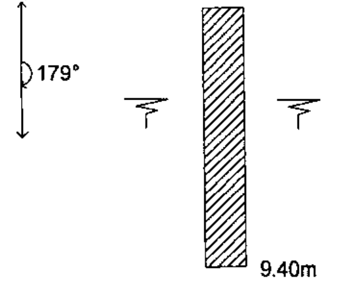
Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities Dip/ Dip Direction	Discontinuities Nature & Infilling
	0	144.18						
1 ↕ 2 ↕	1.30	143.17		Very stiff, dry, brown (7.5YR 5/4) dappled light yellow and white, sandy SILT with some subangular to subrounded fine to coarse gravel sized rock fragments and rootlets. (COLLUVIUM)	①			
3 ↕ 4 ↕ 5 ↕ 6 ↕ 7 ↕ 8 ↕	4.60	140.61		Extremely weak, dry, yellowish brown (10YR 5/8) dappled white, completely decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND)		V		
9 ↕	4.90	140.38	51°	Extremely weak to very weak, moist, reddish brown (5YR 5/4), completely to highly decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND with some subangular fine to coarse gravel sized rock fragments)		V/IV		
10 ↕ 11 ↕	6.00	139.53		Extremely weak, dry, yellowish brown (10YR 5/8), completely decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND)		V		
12 ↕ 13 ↕	6.60	139.06		Extremely weak to very weak, dry, brown (7.5YR 5/4) dappled white and yellow, completely to highly decomposed, fine grained GRANITE. (Silty fine to coarse SAND with some subangualr fine to coarse gravel sized rock fragments)		V/IV		
14 ↕ 15 ↕ 16 ↕ 17 ↕ 18 ↕	9.40	136.90		Stiff, moist, brown (7.5YR 5/4) dappled red, white and light yellow, sandy SILT with some subangular fine to coarse gravel and cobble sized rock fragments. (FILL)				
				End of stripping at 9.40m. ① Root of 5mm diameter Note : 1. Small disturbed samples were taken from 0.00m to 9.00m at interval 0.50m.				

Remarks: 1. From 0.00m to 6.10m : 80mm thickness of concrete surface. 2. From 6.10m to 8.00m : 450mm thickness of concrete surface. 3. From 8.00m to 9.40m : 80mm thickness of concrete surface. 4. From 0.60m to 5.60m : Concrete surface with wire mesh.

Symbol for Sample / Test:

↕	Small disturbed sample
↕	Large disturbed sample
■	Block sample
⊔	Insitu-density test
m	Moisture content test
▲	Water sample
↓	Seepage
[ ]	Photograph

Sketch Plan:



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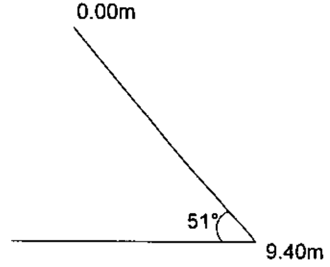


Logged by : K.L. Lo	Date Logged : 05/07/2002	Checked by : Tom Lo	Date Checked : 06/07/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD.
GROUND INVESTIGATION DEPARTMENT

SLOPE STRIPPING LOG

Stripping No.:	S26
Sheet	1 of 1
Slope No.:	NIL

Contract No.: GE/2001/13	Datum (toe) Co-ordinates:	Datum (crest) Co-ordinates:	Works Order No.: GE/2001/13.10
Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation	E 846860.02 N 817386.98 Level 132.47 mPD	E 846862.56 N 817391.84 Level 138.86 mPD	Excavated by: T.O. Yuen Supervised by: T.M. Chow
Date Started / Excavation : 26/06/2002	Date Completed : 04/07/2002	Date Reinstated :	

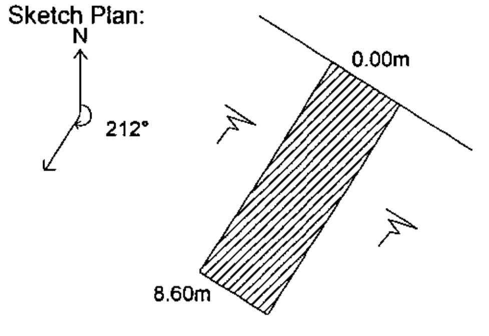
Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities Dip/ Dip Direction	Discontinuities Nature & Infilling
	0	138.86						
	0.60	138.41		Very stiff, dry, brown (10YR 4/3) dappled yellow and white, sandy SILT with some subrounded fine to coarse gravel and occasional cobble sized rock fragments. (COLLUVIUM)				
	3.00	136.63		Extremely weak, moist, light yellowish brown (10YR 6/4) dappled red and white completely decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND)		V		
	3.40	136.33		Extremely weak to very weak, moist, light yellowish brown (10YR 6/4) dappled red and white, completely to highly decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND with some subangular fine to coarse gravel sized rock fragments)		V/IV		
	4.60	135.44	48°	Weak, brown dappled black, highly decomposed, TRACHYDACITE LAVA. Joints are extremely narrow, iron and manganese oxide stained.		IV	257°/74°	
	8.60	132.47		Extremely weak to very weak, dry, yellowish brown (10YR 5/6) dappled white and grey and mottled pink, completely to highly decomposed, TRACHYDACITE LAVA. (Silty fine to coarse SAND with some angular fine to coarse gravel sized rock fragments)		V/IV		
				End of stripping at 8.60m.				

Remarks: 70mm shotcrete surface.

Symbol for Sample / Test:

↕	Small disturbed sample
↕	Large disturbed sample
■	Block sample
⊔	Insitu-density test
m	Moisture content test
▲	Water sample
↓	Seepage
[ ]	Photograph

Sketch Plan:



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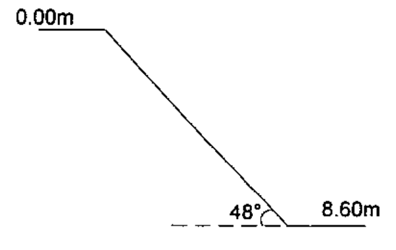
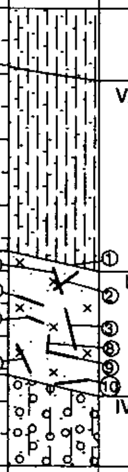


Logged by : K.L. Lo	Date Logged : 05/07/2002	Checked by : Tom Lo	Date Checked : 06/07/2002

GEOTECHNICS & CONCRETE ENGG.(HK) LTD. **GROUND INVESTIGATION DEPARTMENT**		Stripping No.: S27
		Sheet 1 of 1
SLOPE STRIPPING LOG		Slope No.: NIL
Contract No.: GE/2001/13	Datum (toe) Co-ordinates: E 846813.08 N 817396.12 Level 125.94 mPD	Datum (crest) Co-ordinates: E 846814.66 N 817400.43 Level 131.37 mPD
Project: Agreement No. FD 01-052 Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfill Stage II/III Afteruse Development Ground Investigation		Works Order No.: GE/2001/13.10 Excavated by: T.O. Yuen Supervised by: T.M. Chow
Date Started / Excavation : 26/06/2002	Date Completed : 04/07/2002	Date Reinstated :



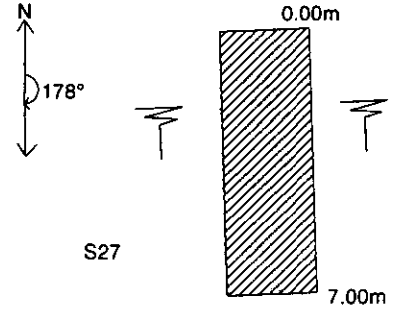
Sample or test	Distance from Datum (m)	Reduced Level (mPD)	Slope Angle	Description and Sample Data	Legend	Grade	Discontinuities Dip/ Dip Direction	Discontinuities Nature & Infilling
	0	131.37						
	0.80	130.75		Firm, dry, yellowish brown (10YR 5/8), sandy SILT with some angular to subangular cobble sized rock fragments. (COLLUVIUM)				
	3.70	128.50	51°	Extremely weak to weak, dry, light grey (10Y 7/2) dappled brown, completely to highly decomposed, TRACHYDACITE LAVA. (Very stiff, slightly sandy SILT with some angular to subangular fine to coarse gravel and occasional cobble sized rock fragments)		V/IV		
	5.60	127.02		Weak, dry, light grey dappled yellowish brown and grey, highly decomposed, TRACHYDACITE LAVA. Joints are closely spaced, rough planar and rough undulating, extremely narrow, iron and manganese oxide stained, sandy silt (<2mm) infilled.		IV	①075°/80° ②030°/60° ③108°/79° ④315°/86° ⑤038°/79° ⑥035°/72°	iron and manganese oxide iron and manganese oxide iron and manganese oxide iron and manganese oxide iron and manganese oxide iron and manganese oxide
	7.00	125.94		Weak to extremely weak, dry, light grey (10Y 7/2) dappled yellowish brown, highly to completely decomposed, TRACHYDACITE LAVA. (Slightly sandy, silty angular fine to coarse GRAVEL and some cobble sized rock fragments)		IV/V	⑦248°/70° ⑧304°/60° ⑨060°/82° ⑩227°/68°	iron and manganese oxide iron and manganese oxide iron and manganese oxide iron and manganese oxide
				End of stripping at 7.00m.				

Remarks: Slope was covered by an average 65mm thick shotcrete with iron mesh at the base.

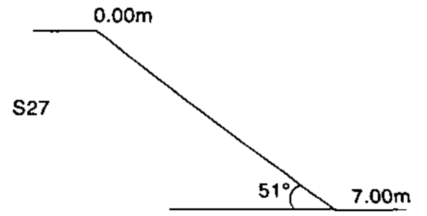
Symbol for Sample / Test:

- ↕ Small disturbed sample
- ⇕ Large disturbed sample
- ■ Block sample
- ⊔ Insitu-density test
- m Moisture content test
- ▲ Water sample
- ↓ Seepage
- [ ] Photograph

Sketch Plan:



Sketch Section:



Logged by : K.L. Lo	Date Logged : 05/07/2002	Checked by : Tom Lo	Date Checked : 06/07/2002

Appendix B

Detailed Aerial Photograph Interpretations

B.1 DETAILED AERIAL PHOTOGRAPH INTERPRETATION

The following report comprises the detailed observations made from the examination of aerial photographs taken between 1924 and 2021. A list of aerial photographs examined in this study is presented in Table B1. The interpretations on geomorphology and man-made features are shown in Figure B1 to B21.

YEAR	**OBSERVATIONS**
1924 (Figure B1)	High altitude and poor resolution stereo pairs. The NTSA appears as southwest facing natural hillsides emerging from a northwest trending ridgeline below High Junk Peak. Due to the poor resolution of aerial photographs, the entire NTSA and the Site (proposed public riding school development area) appears as high reflectance, no detail observation can be examined.
1945 (Figure B2)	High altitude and fair resolution stereo pairs. The eastern and western boundary of the NTSA is bounded by indistinct rounded spurs. Several linear hollows, possibly ephemeral drainage lines DL1, DL2, DL3, DL4 and DL5 and their sub-ordinate drainage lines can be discerned within the NTSA. No perennial drainage line can be discerned within the NTSA. The area below the NTSA and the Site is extensively cultivated.
1956	Low altitude and fair resolution stereo pairs. No substantial change to the NTSA since 1945.
1963 (Figure B3, B4 & B5)	Low altitude and high resolution stereo pairs. The smooth surface of the NTSA indicates the NTSA is probably covered by in-situ materials without significant mass wasting process, possibly a thin layer veneer (< 2m thick) of hillslope colluvium blanket the majority of the hillsides within the NTSA. Valley colluvium is confined along the drainage lines. Small portion of intermittent rock outcrops can be discerned at the crest of the NTSA which located along the ridgeline at upper portion of Catchment Nos. CD3, OH5 and TD8. Rock cliff is present at the hillside behind the crest of the NTSA which facing northeast. Ephemeral drainage lines: Ten linear hollows, possibly ephemeral drainage lines DLl, DL2, DL3, DL4 and DL5 and sub-ordinate ephemeral drainage lines DL4.1, DL4.2, DL4.3,

YEAR **OBSERVATIONS**

DL4.4 and DL4.5 are observed in Catchment Nos. TD1, CD1, CD2, CD3, TD7 and TD8. Drainage lines DL1, DL2, DL3 and DL5 are present at the lower half portion of Catchment Nos. TD1, CD1, CD2 and TD8 respectively. DL4 contains five sub-ordinate drainage lines, namely DL4.1, DL4.2, DL4.3, DL4.4 and DL4.5. Main drainage line DL4 flows from the top of Catchment No. CD3 towards the bottom of Catchment No. CD3; sub-ordinates drainage line DL4.1 is discerned approximately 20m away from the top of Catchment No. CD3, whilst DL4.2, DL4.3 and DL4.4 are apparent at the upper, middle and lower portion of Catchment No. CD3 respectively. DL4.5 is located along Catchment No. TD7. These five southwest trending drainage lines are running towards the toe of the NTSA. Sub-ordinate drainage lines DL4.1, DL4.2, DL4.3 and DL4.4 are generally west trending and flowing towards DL4 which finally converge towards the toe of the NTSA. Sub-ordinates DL4.5 is apparent as an individual southwest trending drainage line flowing towards the toe of the NTSA. However, DL4.5 was converging towards DL4 below the NTSA. DL1 and DL5 appeared to be subtle depression, whilst DL2 and DL3 is relatively incisive, DL4 is the most distinctive. This probably indicates more water concentrate along DL4 and therefore the erosion of DL4 is more active than the other four drainage lines. Some boulders, probably colluvial boulders are concentrated along DL4.

Topographic depressions:

Seven linear hollows were observed in Catchment Nos. TD2, TD3, TD4, TD5, TD6 and OH3. They are part of the head of ephemeral drainage lines or sub-drainage lines which located below the NTSA. Since they appeared as broad and subtle depressions, this indicate no significant water concentration and therefore the erosion activities are relatively small. These seven hollows within Catchment Nos. TD2, TD3, TD4, TD5, TD6 and OH3 can be regarded as minor topographic depressions.

Relict landslide scars within NTSA:

A break of slope and a concave depression is observed near the head of ephemeral sub-ordinate drainage line DL4.2, possibly instability (RL1) had taken place. The estimated landslide volume of RL1 is about $35m^3$. This location was possibly the ENTLI record no. 12SWA0004E. Another three concave depressions (RL2 to RL4) are discerned adjacent to RL1 which located at the crest of Catchment No. CD3. RL3 and RL4 are appeared as a spoon-shaped depression with distinct landslide trails whilst RL2 is a relatively subtle depression when compare with the other three landslides. RL3 and RL4 has an estimated failure volume of $29m^3$ and $18m^3$ respectively, whilst RL2 is about $24m^3$. However, RL2 may not be regarded as genuine landslide scar, further verification on site is required. RL2 and RL3 are possibly the locations of ENTLI record Nos. 12SWA0220E and 12SWA0005E respectively. RL4 does not recorded in the ENTLI.

Relict landslide scars to the east of NTSA:

Four broad and shallow concave depressions are observed adjacent to the upper portion of Catchment No. CD3, possibly four landslide incidents (RL5, RL6, RL7 and RL8) were occurred. RL5 is located at the NTSA boundary,

YEAR **OBSERVATIONS**

whilst another three depressions (RL6, RL7 and RL8) are apparent approximately 9m to 37m to the east of the upper portion of Catchment No. CD3. These four landslide scarps are very degraded which indicate probably were occurred for a long period of time. The estimated failure source volume of these four landslides is about 11m^3 to 37m^3. They are possibly registered as ENTLI Nos. 12SWA0341E, 12SWA0006E, 12SWA0007E and 12SWA0339E.

A distinct break of slope and depression is discerned on the bank of an ephemeral drainage line located outside the NTSA, which located approximately 20m to the south of the middle portion of Catchment No. TD8, probably represent a relict landslide scar, RL9. RL9 has a failure volume of about 30m^3 which is possibly the location of ENTLI No. 12SWA0273E.

Relict landslide scars below the NTSA:
Two concave depressions were apparent below the NTSA, probably two landslide events (RL10 and RL11) were occurred previously. RL10 is located approximately 52m below Catchment No. TD4 whilst RL11 is discerned 165m below Catchment No. OH2. RL10 apparent as a sharp break of slope, therefore the landslide scarp was distinct which indicated it has a relatively higher certainly and this relict landslide possibly happened in a more recently period of time. The depression of RL10 is relatively shallow and small in size, the failure volume estimated to be 16m^3. RL11 is observed at the head of a sub-ordinate drainage line. Its landslide source area appears more incisive than RL10. The estimated failure volume of RL11 is about 39m^3. RL10 and RL11 are possibly the locations of ENTLI Nos. 12SWA0198E and 12SWA0199E respectively.

Landslide scars adjacent to the Catchment OH1:
Ten concave depressions are evident in the adjacent catchment of Catchment No. OH1, which located approximately 170 to 345m to the west of the NTSA. They are probably relict landslides scars (RL12 to RL21). RL12 to RL15 are located on the bank of a drainage line which located outside the NTSA. They are hardly observed since broad and shallow depressions without obvious break of slope, therefore possibly have been degraded for a long period of time and the certainty of these landslide features are relatively low. The estimated failure volume is relatively small, about 10 m^3 to 30m^3. RL12 to RL15 are recorded as ENTLI Nos. 12SWA0195E, 12SWA0196E, 12SWA0197E and 12SWA0272E respectively. RL16 to RL21 are discerned on an open hillslope. They apparent as rounded scarps with very distinct linear-shaped landslide trails, therefore these six landslide features have a relatively higher certainty. Their failure source areas are relatively bigger and more incisive than RL12 to RL15, therefore RL16 to RL21 has a larger failure volume range between 30m^3 to 60m^3. The locations of RL16 to RL21 are registered as ENTLI Nos. 12SWA0017E, 12SWA0018E, 12SWA0194E, 12SWA0019E, 12SWA0021E and 12SWA0020E respectively.

Landslide scars adjacent to the Catchment TD8:
Eighteen concave depressions are apparent on the adjacent catchment of

YEAR **OBSERVATIONS**

Catchment No. TD8, which located approximately 190 to 670m to the south of the NTSA. They are probably relict landslides scars (RL22 to RL39). RL22 to RL29 are discerned immediately below the ridgeline. Their depression sizes are relatively broad, but most of them are located at the head of drainage lines, the suspected landslide scars are mostly rounded which is hardly to distinguish whether the depressions are related to the shape of the drainage lines or landslide failures, therefore the certainties are not too high. Geomorphologically, since these eight landslides were occurred on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and lower landforms. These failures may be possibly part of the hillside retreat process. The estimated failure volumes of RL22 to RL29 are range in between 37m^3 to 57m^3. RL22 to RL29 are registered as ENTLI Nos. 12SWA0068E, 12SWA0069E, 12SWA0184E, 12SWA0183E, 12SWA0015E, 12SWA0179E, 12SWA0178E and 12SWA0016E respectively. Another ten landslides are evident in the lower portion of the catchment, namely RL30 to RL39. They have a smaller scale of depressions when compares to RL22 to RL29. Most of them are located on the bank of drainage lines or open hillslope which also apparent as sharper scars, therefore the certainty of RL30 to RL39 are relatively higher. The failure volumes of RL30 to RL39 are about 24m^3 to 38m^3. Locations of RL30 to RL39 are probably the location of ENTLI Nos. 12SWA0187E, 12SWA0188E, 12SWA0186E, 12SWA0185E, 12SWA0328E, 12SWA0182E, 12SWA0330E, 12SWA0329E, 12SWA0181E and 12SWA0180E respectively.

RL1 to RL39 are discerned in dark grey tone, therefore they may have been happened long period ago. Among these relict landslide scars, RL22, RL23 and RL24 are considered to have similar geological and geomorphological setting with the NTSA and their estimated failure volumes range from 37m^3 to 39m^3. All these landslide events are regarded as relict landslides. No recent landslide is present within or in the close vicinity of the NTSA.

A spot of high reflectance feature was existed at the upper portion of Catchment No. OH5, possibly grave.

Four high reflectance linear features were traversed within the NTSA, probably footpaths (FP1 to FP4). FP1 were present along the middle portion of Catchment No. CD3 downwards to the upper portion of Catchment Nos. TD7, OH5 and TD8. FP2 were discerned from the top of Catchment No. OH1 which run along the ridgeline across Catchment Nos. TD1, TD2, TD3, TD4, TD5, TD6, CD1, CD2, OH3 and finally CD3 adjoining FP1. FP3 was relatively less reflective, possibly lightly in use when compares to FP1 and FP2. It apparent at the top of Catchment No. TD6 then passed through Catchment Nos. CD1, OH2, CD2 and along the toe of Catchment Nos. OH3, CD3, OH4, TD7, OH5 and TD8. FP4 existed along the ridgeline which located at the crest of the NTSA.

The agricultural terraces and farmlands observed below the NTSA in year 1945 were still actively in use. Many cottages were constructed around the agricultural terraces and farmlands.

YEAR	**OBSERVATIONS**
	Morphologically, a convex change of slope is discerned immediately below the ridgeline which bounded the upper boundary of the NTSA. The convex change of slope is discerned at about +142mPD at Catchment No. OH1 and then extend up to about +234mPD at Catchment No. CD3. Another distinct convex change of slope is apparent at approximately +228mPD which located along the upper portion of Catchment Nos. TD7, OH5 and TD8. These convex changes of slope demarcate the upper and middle slope terrain. The upper slope terrain comprises of gentle slope with gradient less than 20° whilst the transportation middle slope terrain comprises of relatively steeper slope with gradient lies in between 25° to 35°.
1964	High altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1963.
1967	High altitude and high resolution stereo pairs. Most of the NTSA was obscured by cloud. No observable significant change to the visible portion of the NTSA since 1963.
1973 (Figure B6)	High altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1967. Two high reflectance concave depressions are discerned approximately 415m and 535m adjacent to Catchment No. TD8, bare soil without any vegetation is observed, probably recent landslides (RC1 and RC2) occurred recently. RC1 is located on a topographic depression whilst RC2 located on the bank of a drainage line, both of them appears as shallow depressions. The estimated failure volumes of RC1 and RC2 are about $20m^3$ and $25m^3$ respectively. These two locations are registered as ENTLI Nos. 12SWA0376E (RC1) and 12SWA0377E (RC2). A new footpath (FP5) is formed along the eastern boundary of the NTSA which traversed along the spurline from the top of Catchment No. CD3 downslope to the top of Catchment No. TD8 which adjoining FP1.
1974	Low altitude and high resolution stereo pairs. No significant changes could be observed since 1973.
1975 (Figure B7)	High altitude and high resolution stereo pairs.

YEAR	**OBSERVATIONS**
	No observable significant change to the NTSA since 1967. A very shallow depression is evident on an open hillslope at about 102m below Catchment No. OH1. It is highly reflective bare soil surface without any vegetation, possibly recent landslide RC3. The failure area is relatively small and therefore the estimated source volume is only about 10m^3. This is probably the location of ENTLI No. 12SWA0378E. An elongated depression is apparent along a drainage line which located approximately 477m adjacent to Catchment No. TD8. It is highly reflective, bare soil is observed, probably a channelized debris flow (RC4) was occurred very recently due to no vegetation is present. The source area is narrow but long in shaped, and it is relatively incisive when compares to RC3. RC4 has an estimated failure volume of 40m^3. This recent landslide event is registered as ENTLI No. 12SWA0380E.
1976	High altitude and high resolution stereo pairs. No significant changes could be observed since 1975.
1978	High altitude and high resolution stereo pairs. No significant changes could be observed since 1976.
1979	High altitude and high resolution stereo pairs. No significant changes could be observed since 1978.
1980	Low altitude and high resolution stereo pairs. No significant changes could be observed since 1979.
1981	High altitude and high resolution stereo pairs. No significant changes could be observed since 1980.
1982	High altitude and high resolution stereo pairs. No significant changes could be observed since 1981.
1983	Low altitude and high resolution stereo pairs. No significant changes could be observed since 1982.

YEAR	**OBSERVATIONS**
1984	High altitude and high resolution stereo pairs. No significant changes could be observed since 1983.
1985 (Figure B8 & B9)	Low altitude and high resolution stereo pairs. Part of the NTSA does not cover by these stereo pairs. Several tiny high reflectance features are present below Catchment Nos. TD2, OH2, OH3 and TD7. Bare soil is observed, sharp break of slopes are discerned within the bare soil features. This is possibly due to minor excavation by anthropogenic activities, the excavated soil were then dumped and pushed downslope which formed the soil trails. The boundary in between the excavated areas and the soil trails formed the convex break of slopes. These locations are possibly the trial pit locations of TP12, TP13, TP14, TP15 and TP16 under GIU No. 05553. The upper portion of Catchment Nos. TD7, OH5 and TD8 were appeared as lighter tone, bare soil is observed, possibly due to hill fire.
1986	Low altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1985.
1987	Low altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1986.
1988 (Figure B10)	Low altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1987 except some vegetation grew on the slope surface. The agricultural terraces and cottages located below the NTSA were demolished. Site formation and reclamation works were commenced below the NTSA, probably the area was begun to use as landfill site.
1989 (Figure B11)	Low altitude and high resolution stereo pairs. Three highly reflective white spot features are discerned at the lower portion of Catchment Nos. TD5, OH2 and OH3. Bare soil is observed. The locations within Catchment Nos. OH2 and OH3 are possibly the Borehole locations of BH17 and BH18 under GIU No. 12800. The bare soil existed in Catchment No. TD5 appeared as rounded bare soil surface and thus likely created by anthropogenic activities, possibly this was an inspection pit for the proposed

YEAR	**OBSERVATIONS**
	ground investigation, but no ground investigation record could be found at that location, possible the proposed GI station has been deleted. The site formation works below the NTSA was ongoing, the area was continued to serve as landfill site.
1990 (Figure B12)	High altitude and high resolution single photograph. No observable significant change to the NTSA since 1989. A linear feature, probably catchwater is aligned along the toe of the NTSA. Formation of eight man-made cut slopes were commenced along the toe of the NTSA, probably in association with the alignment of the catchwater. They were registered as Feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188. A cross-shaped features are apparent in the middle portion of Catchment No. OH3. It was located at the intersection of two footpaths, possibly a resting place or sign indicator for hikers.
1991	Low altitude and high resolution stereo pairs. Formation of feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188 were ongoing. The area below the NTSA was continued to serve as landfill site.
1992 (Figure B13)	Low altitude and high resolution stereo pairs. A small patch of high reflectance bare soil is observed at the upper portion of Catchment No. CD3, possible a grave was constructed. Formation of feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188 were completed. A cut slope was formed below Catchment Nos. TD7 and OH5, probably in association with the extension of the landfill site. This man-made slope was registered as Feature No. 12SW-A/C227. The area below the NTSA was continued to serve as landfill site.

YEAR	**OBSERVATIONS**
1993	Low altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1992 except footpath FP1 was partially widened. The area below the NTSA was continued to serve as landfill site.
1994 (Figure B14)	Low altitude and high resolution stereo pairs. Entire footpath FP1 was being widened. The landfill site located below the NTSA is apparent as being filled up and the surface was smoothened. It was probably closed and no longer in use. The Site area is filled up as a platform.
1995 (Figure B15)	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 1994. Eight man-made fill slopes were formed at the former landfill site which located below the NTSA. Man-made drainage channels are formed on the slope surfaces. They are registered as Feature Nos. 12SW-A/F67, 12SW-A/F68, 12SW-A/F69, 12SW-A/F70, 12SW-A/F72, 12SW-A/F73, 12SW-A/F74 and 12SW-A/F96.
1996 (Figure B16)	Low altitude and high resolution stereo pairs. Many linear features are apparent parallel to the contour lines in Catchment Nos. TD6, CD1, OH2, CD2, OH3 and CD3. A very thin layer of surface soil may be disturbed along these linear features by anthropogenic activities, possibly plantation.
1997 (Figure B17)	Low altitude and high resolution colour photograph. No observable significant change to the NTSA since 1996. The linear features observed in year 1996 were no longer observable.
1998	Low altitude and fair resolution colour photograph. Part of the NTSA was obscured by cloud. No observable significant change to the NTSA since 1997.
1999	Low altitude and high resolution colour stereo pairs.

YEAR	**OBSERVATIONS**
	No observable significant change to the NTSA since 1998.
2000	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 1999.
2001	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2000 except some vegetation grew on the slope surface.
2002	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2001.
2003	Low altitude and fair resolution colour stereo pairs. No observable significant change to the NTSA since 2002.
2004 (Figure B18)	Low altitude and high resolution colour stereo photo. The upper portion of Catchment Nos. CD3, TD7, OH5 and TD8 are apparent as grey tone, possibly hill fire was occurred. A linear feature is discerned at the Site area, probably it is used as model aeroplane training field.
2005	Low altitude and high resolution colour stereo photo. No observable significant change to the NTSA since 2004.
2006	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2005 except denser vegetation grew on the slope surface.
2007	Low altitude and high resolution stereo pairs. No observable significant change to the NTSA since 2006 except denser vegetation grew on the slope surface.
2008	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2007 except denser

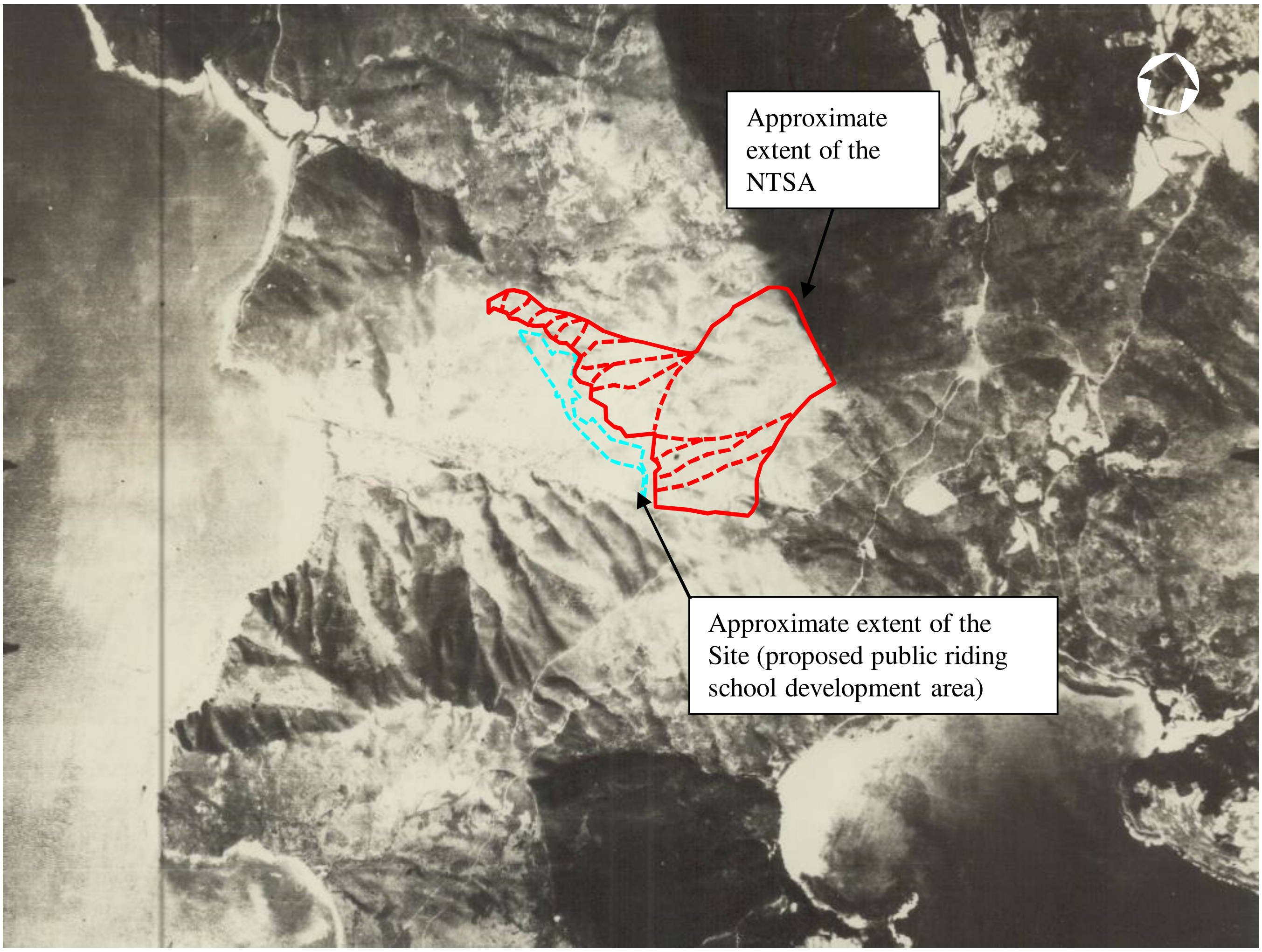
YEAR	**OBSERVATIONS**
	vegetation grew on the slope surface.
2009	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2008 except denser vegetation grew on the slope surface.
2010	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2009 except denser vegetation grew on the slope surface.
2011	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2010 except denser vegetation grew on the slope surface.
2012	Low altitude and high resolution colour stereo pairs. The stereo pairs only covered part of the NTSA. No observable significant change to the NTSA since 2011.
2013	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2012 except denser vegetation grew on the slope surface.
2014	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2013 except denser vegetation grew on the slope surface.
2015	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2014 except denser vegetation grew on the slope surface.
2016	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2015 except denser vegetation grew on the slope surface.
2017	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2016 except denser

YEAR	OBSERVATIONS
	vegetation grew on the slope surface.
2018 (Figure B19)	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2017 except vegetation clearance by anthropogenic activities at the upper portion of Catchment Nos. CD3 and OH5.
2019	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2018 except denser vegetation grew on the slope surface.
2020	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2019 except denser vegetation grew on the slope surface.
2021	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2020 except denser vegetation grew on the slope surface.

Table B1 – List of Photographs

Photo Year	Aerial Photo Reference No.	Flight Altitude (Feet)
1924	Y00031-2	12,500
1945	Y00433-4	20,000
1956	Y03253-4	-
1963	Y08354-5	3,900
1963	Y08392-3	3,900
1964	Y12906-7	12,500
1967	Y13343-4	6,250
1973	8037-8	12,500
1974	9304-5	4,000
1975	12055-6	12,500
1976	15928-9	12,500
1978	20763-4	12,500
1979	28028-9	10,000
1980	29753-5	4,000
1981	39036-7	10,000
1982	44514-5	10,000
1983	47499-501	4,000
1984	56489-90	11,000
1985	65987-8	4,000
1986	A04254-5	4,000
1987	A08668-9	4,000
1988	A12790-1	4,000
1989	A16793-4	4,000
1990	A24427-8	10,000
1991	A27706-7	4,000
1992	A32762-4	4,000
1993	A37382-3	4,000
1994	A39049-50	4,000
1995	CN10018-9	3,500
1996	A42220-1	4,000
1997	CN17110-1	4,000
1998	CN21383-4	4,000
1999	CN25165-6	4,000
2000	CN26669-70	4,000
2001	CW34867-8	4,000
2002	CW39242-3	3,000
2003	CW47869-70	4,000

Photo Year	Aerial Photo Reference No.	Flight Altitude (Feet)
2004	CW62910-1	4,000
2005	CW67596-7	4,000
2006	CS02206-8	6,000
2007	CS09051-2	6,000
2008	CS20259-60	6,000
2009	CS23448-9	6,000
2010	CS30143-4	6,000
2011	CW89762-4	3,000
2012	CW94555-6	2,000
2013	CS44655-7	6,000
2014	CS47084-6	6,000
2015	CS55027-9	6,000
2016	CS62116-7	6,000
2017	E027935-6C	6,900
2018	E046899-900C	6,900
2019	E079751-3C	6900
2020	E117651-3C	6,900
2021	E118313-5C	6,900


Approximate extent of the NTSA
Approximate extent of the Site (proposed public riding school development area)

Photograph No.: Y00032 **Date of Photograph: 1924** **Altitude: 12,500'**

Legend:

Approximate Boundary of the NTSA

- - - - Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

- The NTSA appears as southwest facing natural hillsides emerging from a northwest trending ridgeline below High Junk Peak.
- Due to the poor resolution of aerial photographs, the entire NTSA and the Site (proposed public riding school development area) appears as high reflectance, no detail observation can be examined.

Modern Consulting Engineers Limited
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CALVINT GEO-SERVICES LIMITED
THE BEST SOLUTION FOR YOU

Project:

Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

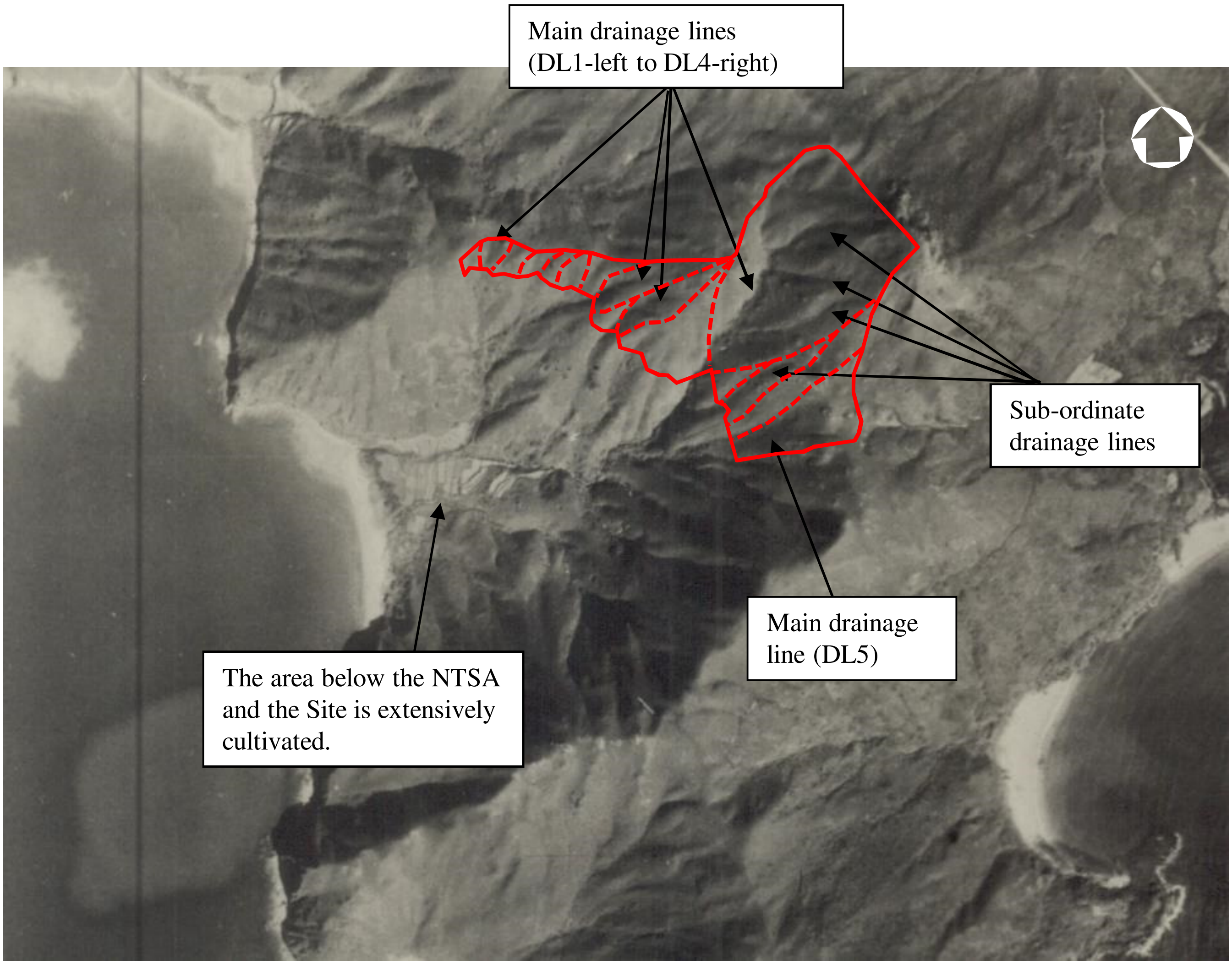
FIGURE B1

Location

Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022


Main drainage lines
(DL1-left to DL4-right)
Sub-ordinate drainage lines
Main drainage line (DL5)
The area below the NTSA and the Site is extensively cultivated.

Photograph No.: Y00433 **Date of Photograph: 11 Nov 1945** **Altitude: 20,000'**

Legend: Approximate Boundary of the NTSA ---- Catchment Boundary

- The eastern and western boundary of the NTSA is bounded by indistinct rounded spurs.
- Several linear hollows, possibly ephemeral drainage lines DL1, DL2, DL3, DL4 and DL5 and their sub-ordinate drainage lines are observed within the NTSA.
- No perennial drainage line can be discerned within the NTSA.
- The area below the NTSA and the Site is extensively cultivated.

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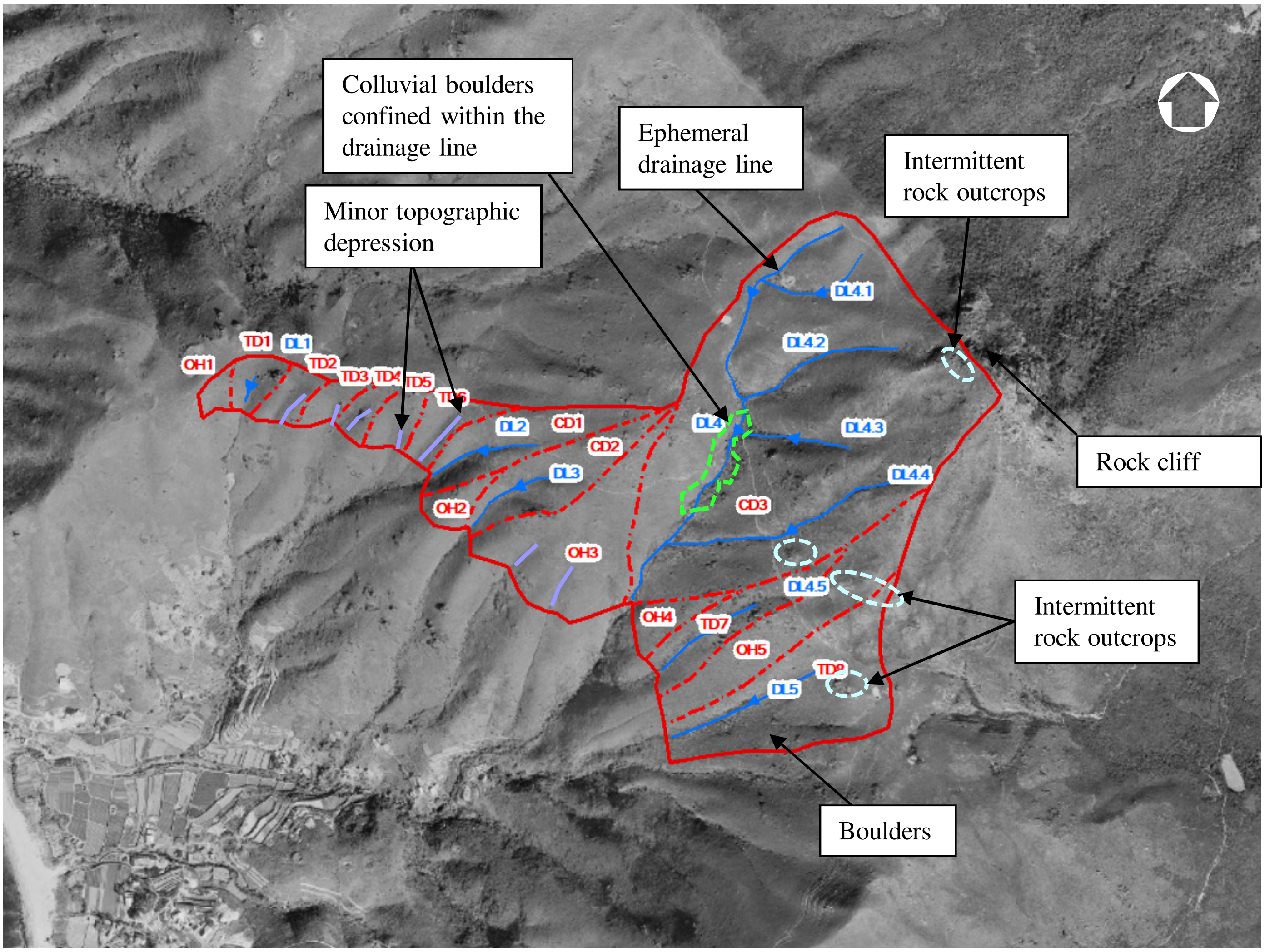
FIGURE B2

Location
Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022


Colluvial boulders confined within the drainage line
Minor topographic depression
Ephemeral drainage line
Intermittent rock outcrops
Rock cliff
Intermittent rock outcrops
Boulders
OH1
TD1
DL1
TD2
TD3
TD4
TD5
TD6
DL2
CD1
CD2
DL3
OH2
OH3
DL4
DL4.1
DL4.2
DL4.3
DL4.4
CD3
DL4.5
OH4
TD7
OH5
TD8
DL5

Photograph No.: Y08354 **Date of Photograph: 17 Feb 1963** **Altitude: 3,900'**

Legend:

⬠ Approximate Boundary of the NTSA

╌ Catchment Boundary

◯ Intermittent rock outcrop

⬭ Colluvial boulders

→ Ephemeral drainage line

— Minor topographic depression

- The smooth surface of the NTSA indicates the NTSA is probably covered by in-situ materials without significant mass wasting process, possibly a thin layer veneer (< 2m thick) of hillslope colluvium blanket the majority of the hillsides within the NTSA. Valley colluvium is confined along the drainage lines.
- Intermittent rock outcrops are discerned at the crest of the NTSA which located along the ridgeline at upper portion of Catchment Nos. CD3, OH5 and TD8. Some boulder fields were deposited at the middle portion of Catchment Nos. CD3.
- DL1 and DL5 appeared to be subtle depression, whilst DL2 and DL3 is relatively incisive, DL4 is the most distinctive. This probably indicates more water concentrate along DL4 and therefore the erosion of DL4 is more active than the other four drainage lines. Some boulders, probably colluvial boulders are concentrated along DL4.
- Morphologically, a convex change of slope is discerned immediately below the ridgeline which bounded the upper boundary of the NTSA. The convex change of slope is discerned at about +142mPD at Catchment No. OH1 and then extend up to about +234mPD at Catchment No. CD3. Another distinct convex change of slope is apparent at approximately +228mPD which located along the upper portion of Catchment Nos. TD7, OH5 and TD8. These convex changes of slope demarcate the upper and middle slope terrain. The upper slope terrain comprises of gentle slope with gradient less than 20° whilst the transportation middle slope terrain comprises of relatively steeper slope with gradient lies in between 25° to 35°.

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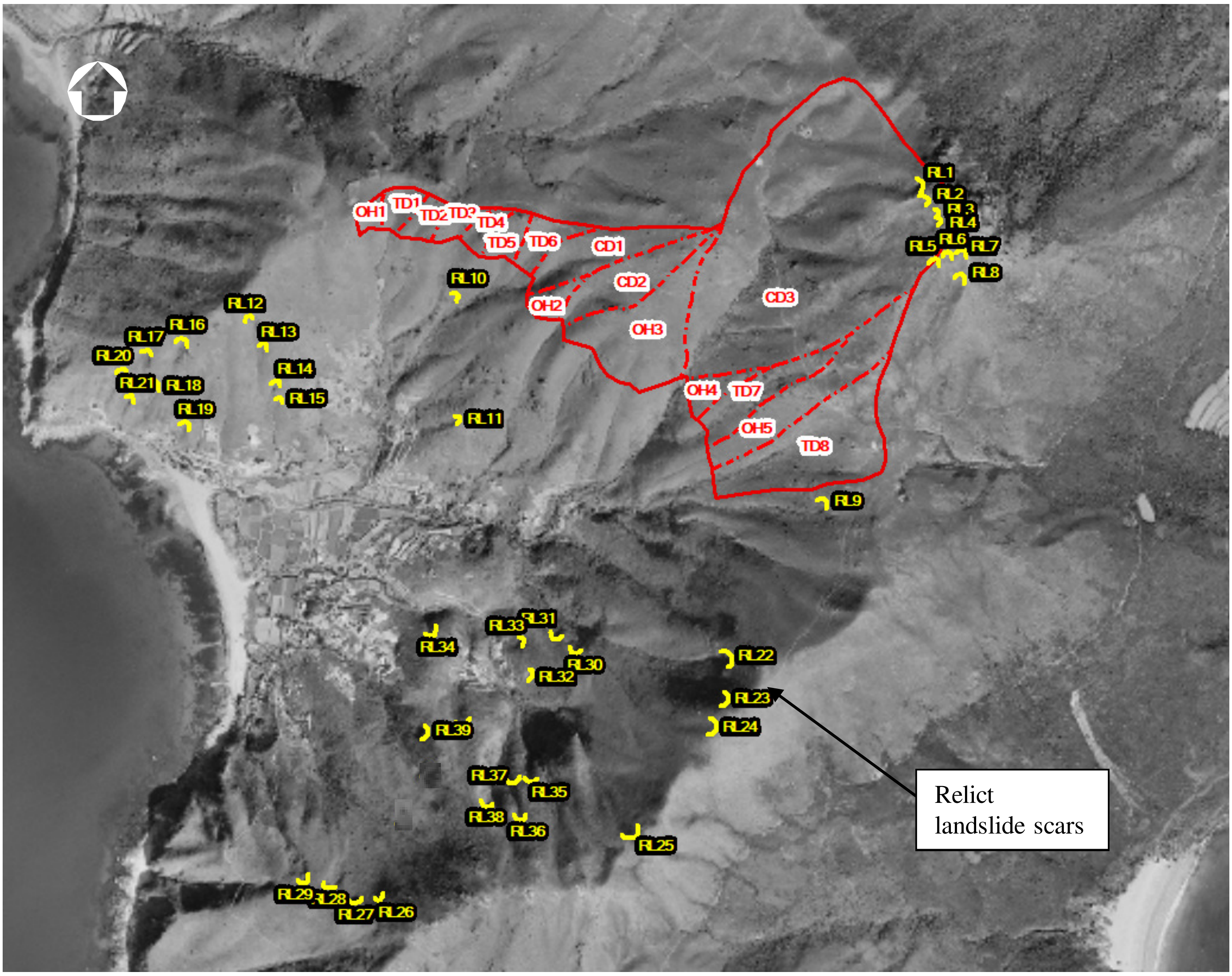
FIGURE B3

Location

Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022


OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
OH4
TD7
OH5
TD8
RL1
RL2
RL3
RL4
RL5
RL6
RL7
RL8
RL9
RL10
RL11
RL12
RL13
RL14
RL15
RL16
RL17
RL18
RL19
RL20
RL21
RL22
RL23
RL24
RL25
RL26
RL27
RL28
RL29
RL30
RL31
RL32
RL33
RL34
RL35
RL36
RL37
RL38
RL39
Relict landslide scars

Photograph No.: Y08354 **Date of Photograph: 17 Feb 1963** **Altitude: 3,900'**

Legend:

Approximate Boundary of the NTSA

--- Catchment Boundary

Relict landslide scar

- RL1 to RL39 are discerned in dark grey tone, therefore they probably occurred in a long period ago. All these landslide events are regarded as relict landslides.
- No recent landslide is discerned within or in the close vicinity of the NTSA.

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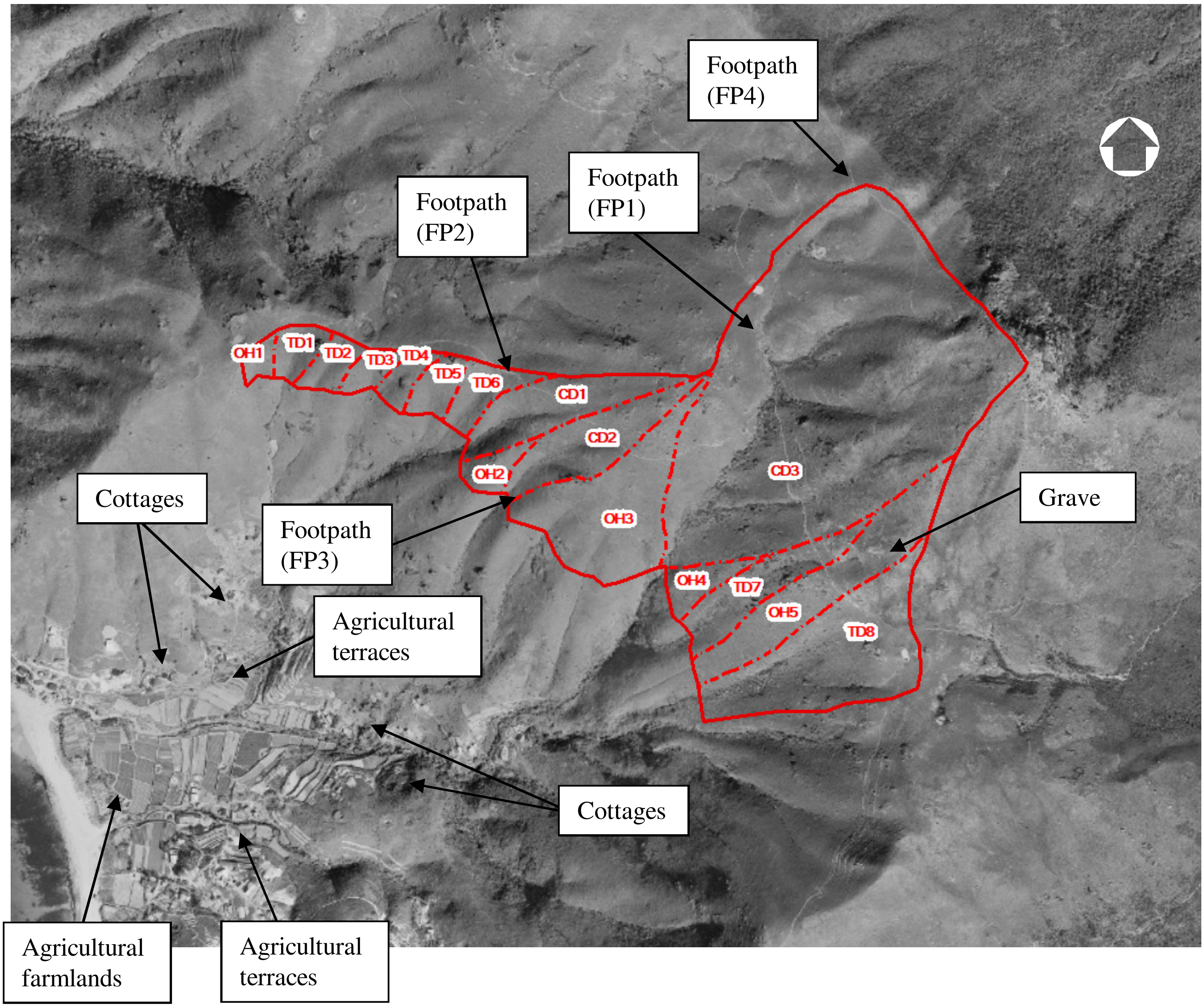
FIGURE B4

Location

Landfill Site II/III, Tseung Kwan O

Scale	Date
NTS	29 May 2022


Footpath (FP4)
Footpath (FP1)
Footpath (FP2)
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
CD3
OH3
Cottages
Footpath (FP3)
Grave
OH4
TD7
OH5
TD8
Agricultural terraces
Cottages
Agricultural farmlands
Agricultural terraces

Photograph No.: Y08354 **Date of Photograph: 17 Feb 1963** **Altitude: 3,900'**

Legend: ▭ Approximate Boundary of the NTSA - - - Catchment Boundary

- A spot of high reflectance feature was existed at the upper portion of Catchment No. OH5, possibly grave.
- Four high reflectance linear features were traversed within the NTSA, probably footpaths (FP1 to FP4). FP1 were present along the middle portion of Catchment No. CD3 downwards to the upper portion of Catchment Nos. TD7, OH5 and TD8. FP2 were discerned from the top of Catchment No. OH1 which run along the ridgeline across Catchment Nos. TD1, TD2, TD3, TD4, TD5, TD6, CD1, CD2, OH3 and finally CD3 adjoining FP1. FP3 was relatively less reflective, possibly lightly in use when compares to FP1 and FP2. It apparent at the top of Catchment No. TD6 then passed through Catchment Nos. CD1, OH2, CD2 and along the toe of Catchment Nos. OH3, CD3, OH4, TD7, OH5 and TD8. FP4 existed along the ridgeline which located at the crest of the NTSA.
- The agricultural terraces and farmlands observed below the NTSA in year 1945 were still actively in use.
- Many cottages were constructed around the agricultural terraces and farmlands.

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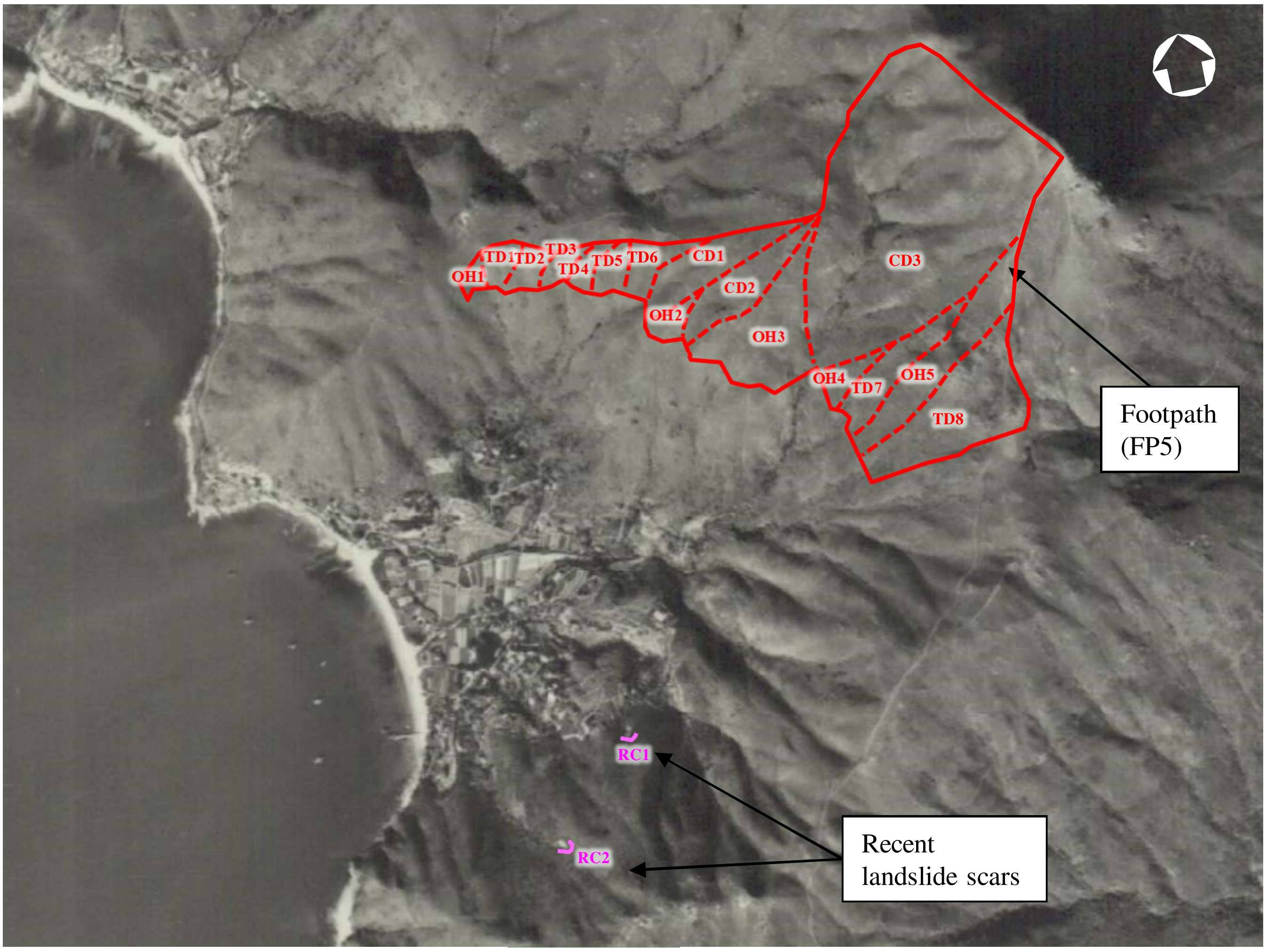
FIGURE B5

Location

Landfill Site II/III,
Tseung Kwan O

Scale	Date
NTS	29 May 2022



Photograph No.: 8038 **Date of Photograph: 20 Dec 1973** **Altitude: 12,500'**

Legend:

Approximate Boundary of the NTSA

---- Catchment Boundary

Recent landslide scar

- Two high reflectance concave depressions are discerned approximately 415m and 535m adjacent to Catchment No. TD8, bare soil without any vegetation is observed, probably recent landslides (RC1 and RC2). RC1 is located on a topographic depression whilst RC2 located on the bank of a drainage line, both of them appears as shallow depressions. The estimated failure volumes of RC1 and RC2 are about 20m³ and 25m³ respectively. These two locations are registered as ENTLI Nos. 12SWA0376E (RC1) and 12SWA0377E (RC2).
- A new footpath (FP5) is formed along the eastern boundary of the NTSA which traversed along the spurline from the top of Catchment No. CD3 downslope to the top of Catchment No. TD8 which adjoining FP1.

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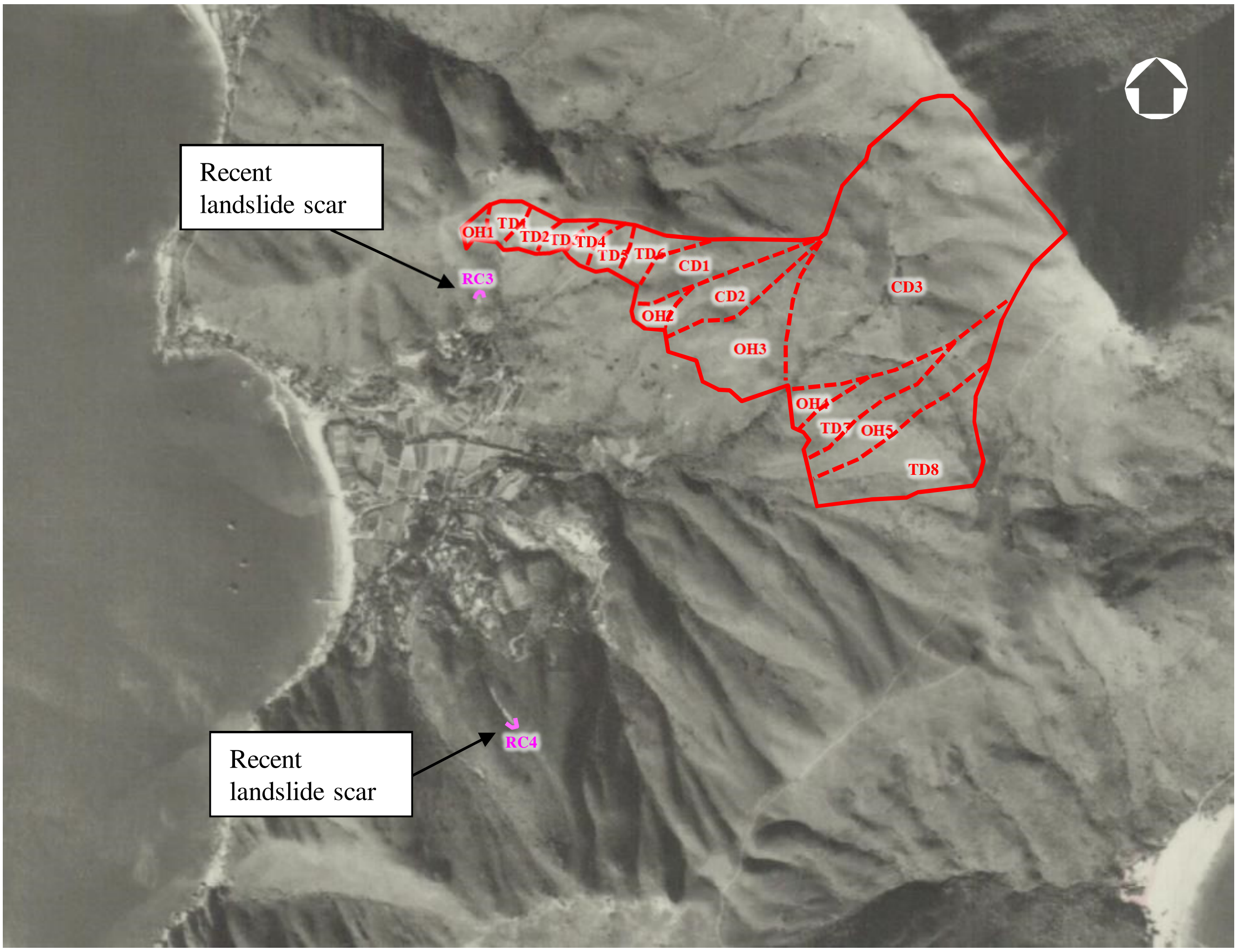
FIGURE B6

Location

Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022



Photograph No.: 12055 **Date of Photograph: 24 Dec 1975** **Altitude: 12,500'**

Legend:

	Approximate Boundary of the NTSA
----	Catchment Boundary
⌒	Recent landslide scar

- A very shallow depression is evident on an open hillslope at about 102m below Catchment No. OH1. It is highly reflective bare soil surface without any vegetation, possibly recent landslide RC3. The failure area is relatively small and therefore the estimated source volume is only about 10m³. This is probably the location of ENTLI No. 12SWA0378E.
- An elongated depression is apparent along a drainage line which located approximately 477m adjacent to Catchment No. TD8. It is highly reflective, bare soil is observed, probably a channelized debris flow (RC4) was occurred very recently due to no vegetation is present. The source area is narrow but long in shaped, and it is relatively incisive when compares to RC3. RC4 has an estimated failure source volume of 40m³. This recent landslide event is registered as ENTLI No. 12SWA0380E.

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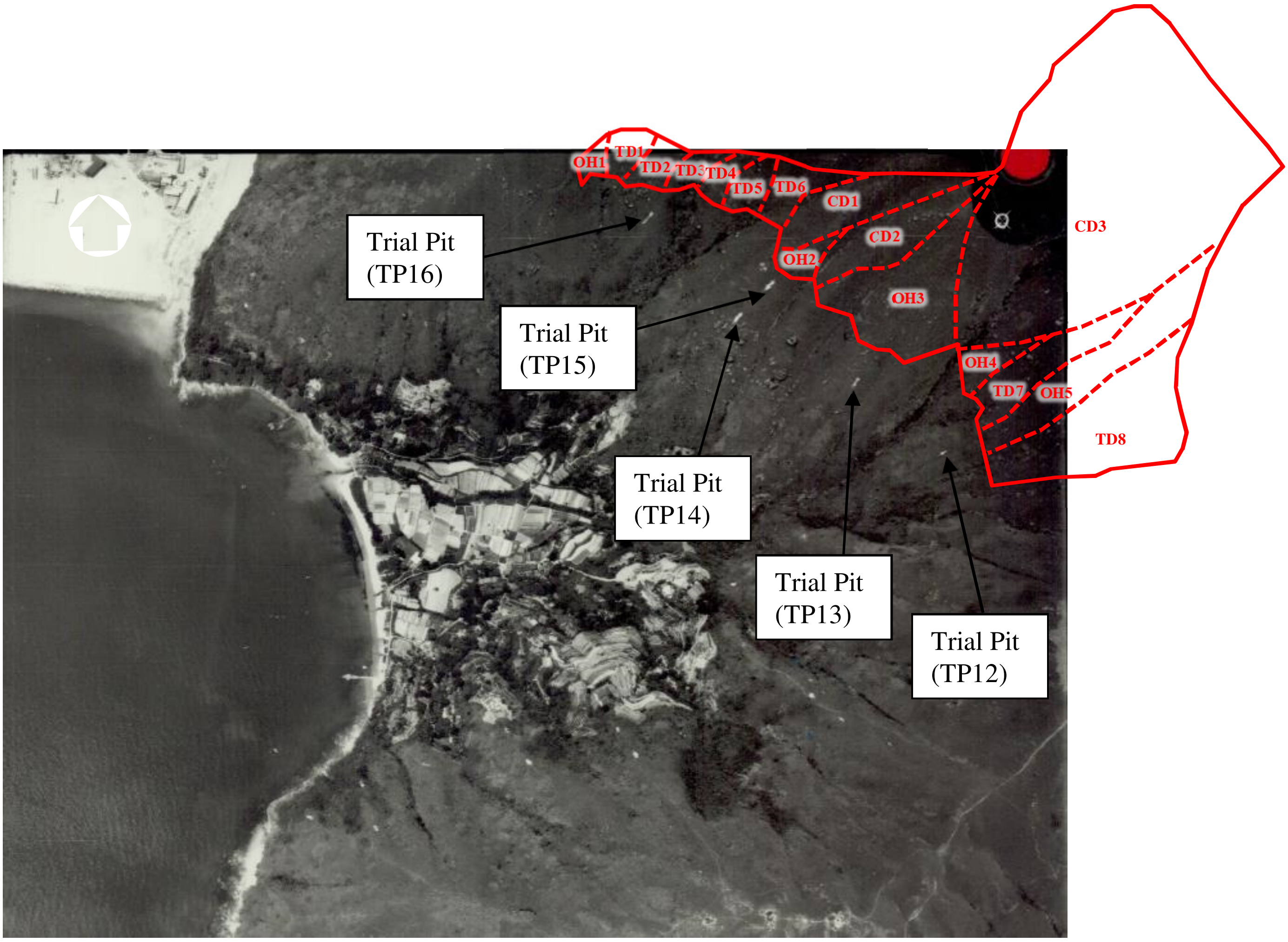
FIGURE B7

Location
Landfill Site II/III, Tseung Kwan O

Scale	Date
NTS	29 May 2022


Trial Pit (TP16)
Trial Pit (TP15)
Trial Pit (TP14)
Trial Pit (TP13)
Trial Pit (TP12)
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
OH4
TD7
OH5
TD8

Photograph No.: 65988 **Date of Photograph: 24 Apr 1985** **Altitude: 4,000'**

Legend: Approximate Boundary of the NTSA - - - - Catchment Boundary

- Several tiny high reflectance features are present below Catchment Nos. TD2, OH2, OH3 and TD7. Bare soil is observed, sharp break of slopes are discerned within the bare soil features. This is possibly due to minor excavation by anthropogenic activities, the excavated soil were then dumped and pushed downslope which formed the soil trails. The boundary in between the excavated areas and the soil trails formed the convex break of slopes. These locations are possibly the trial pit locations of TP12, TP13, TP14, TP15 and TP16 under GIU No. 05553.

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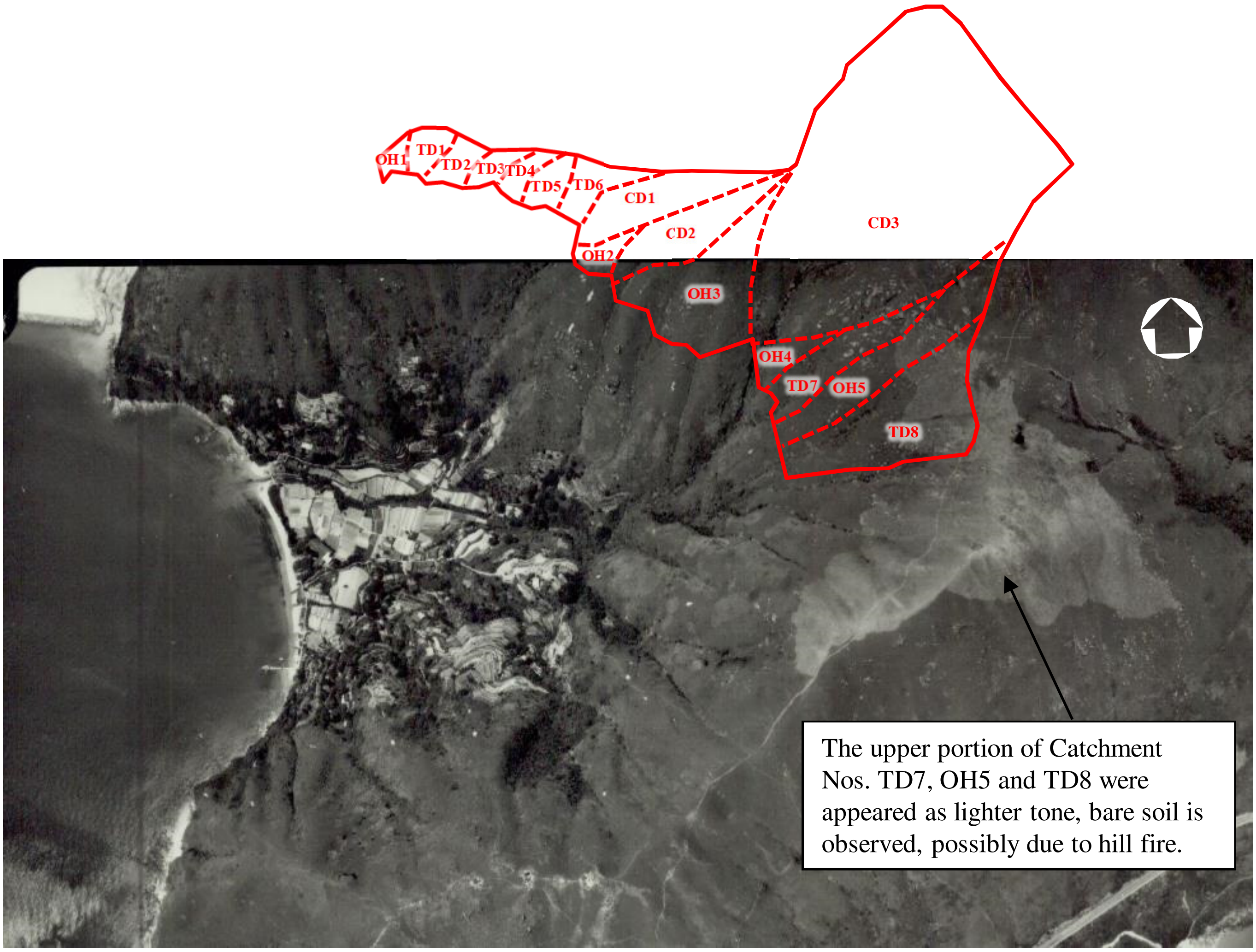
FIGURE B18

Location

Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022



The upper portion of Catchment Nos. TD7, OH5 and TD8 were appeared as lighter tone, bare soil is observed, possibly due to hill fire.

Photograph No.: 65987 **Date of Photograph: 24 Apr 1985** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

---- Catchment Boundary

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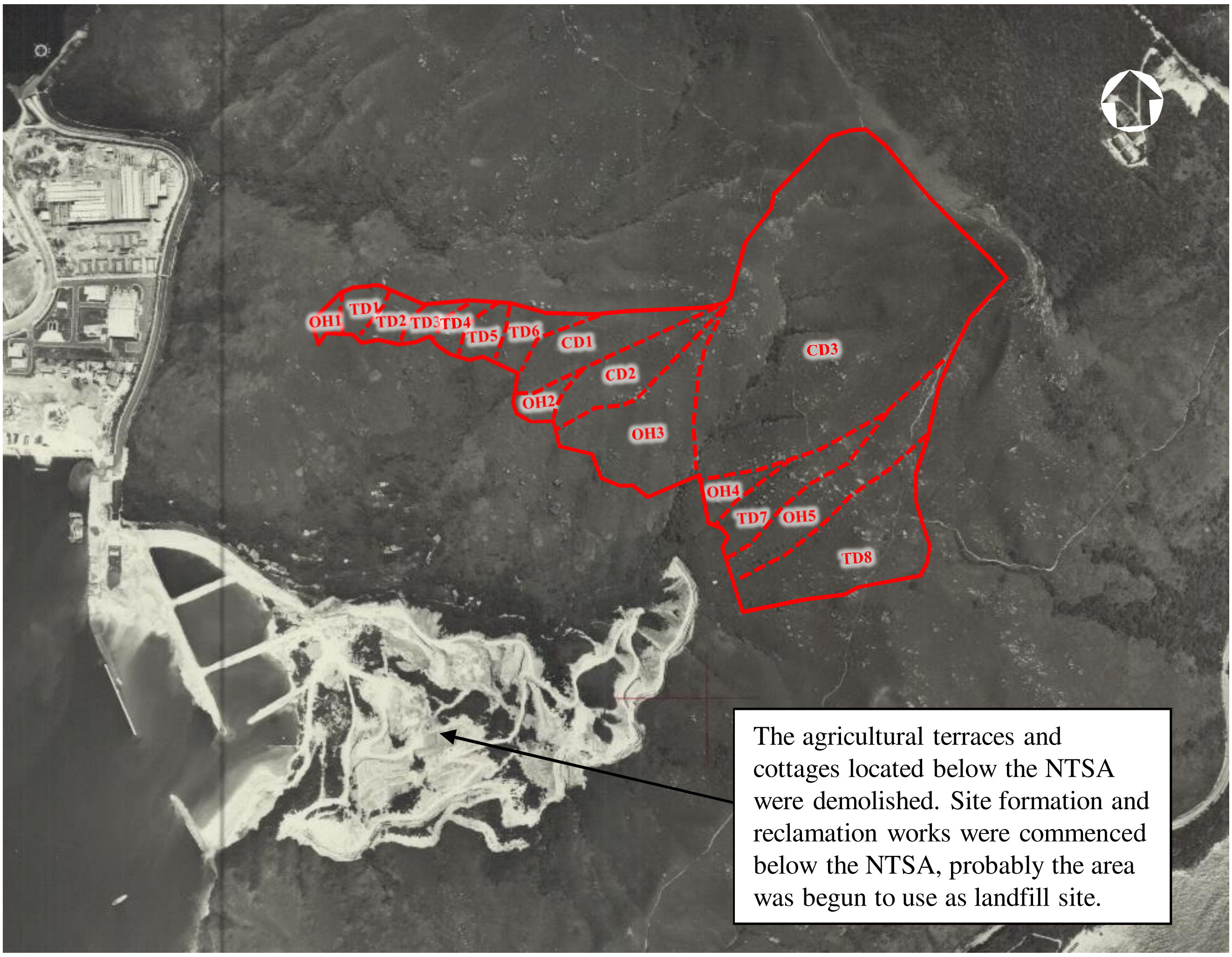
FIGURE B9

Location

Landfill Site II/III,
Tseung Kwan O

Scale NTS

Date 29 May 2022



The agricultural terraces and cottages located below the NTSA were demolished. Site formation and reclamation works were commenced below the NTSA, probably the area was begun to use as landfill site.

Photograph No.: A12791 **Date of Photograph: 2 Jun 1988** **Altitude: 4,000'**

Legend:

▭	Approximate Boundary of the NTSA
┅	Catchment Boundary

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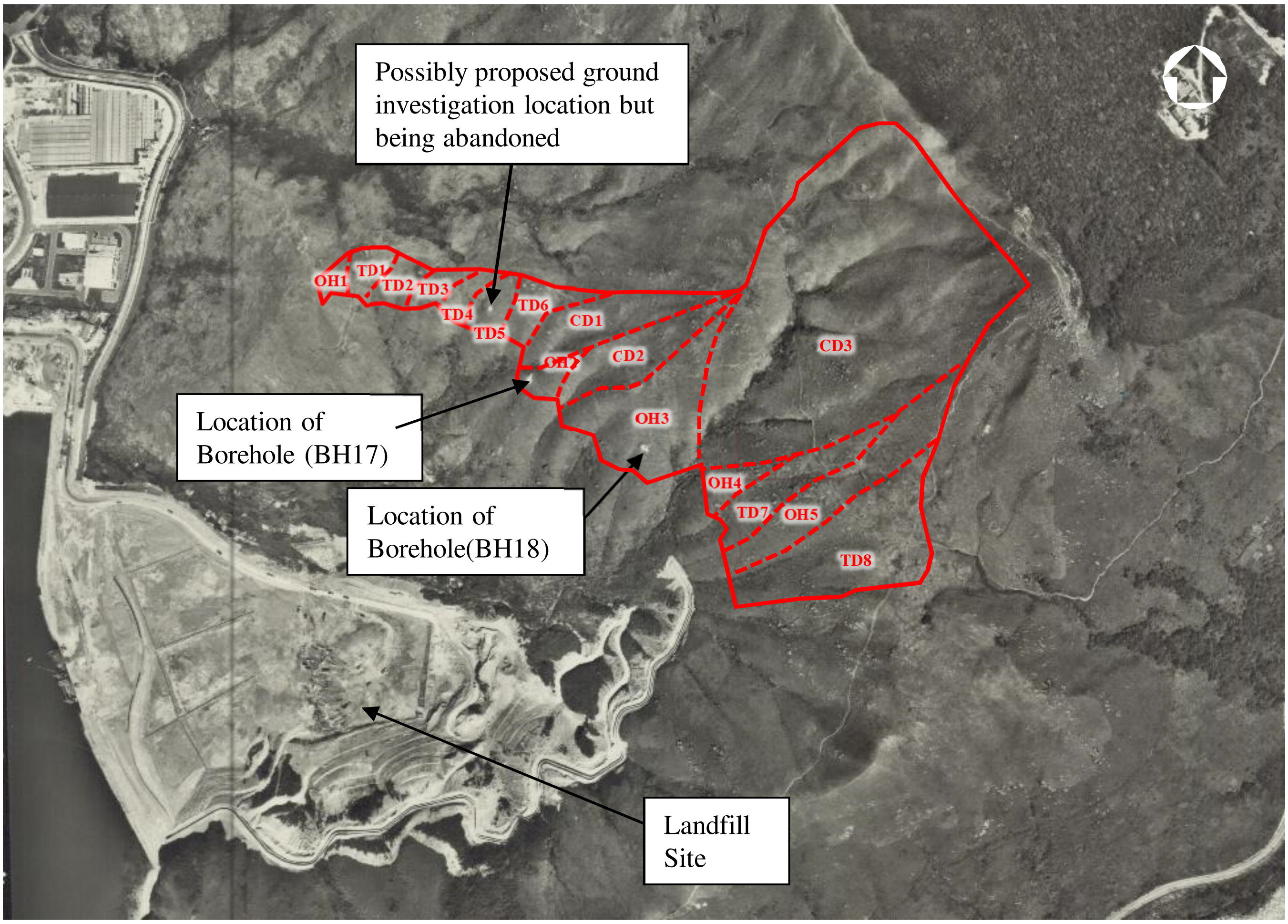
FIGURE B10

Location

Landfill Site II/III,
Tseung Kwan O

Scale NTS

Date 29 May 2022


Possibly proposed ground investigation location but being abandoned
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
OH2
CD2
CD3
OH3
Location of Borehole (BH17)
Location of Borehole(BH18)
OH4
TD7
OH5
TD8
Landfill Site

Photograph No.: A16793 **Date of Photograph: 28 Mar 1989** **Altitude: 4,000'**

Legend: Approximate Boundary of the NTSA ---- Catchment Boundary

- The locations within Catchment Nos. OH2 and OH3 are possibly the Borehole locations of BH17 and BH18 under GIU No. 12800.
- The bare soil existed in Catchment No. TD5 appeared as rounded bare soil surface and thus likely created by anthropogenic activities, possibly this was a proposed ground investigation location but being abandoned, therefore no ground investigation record could be found.
- The site formation works below the NTSA was ongoing, the area was continued to serve as landfill site.

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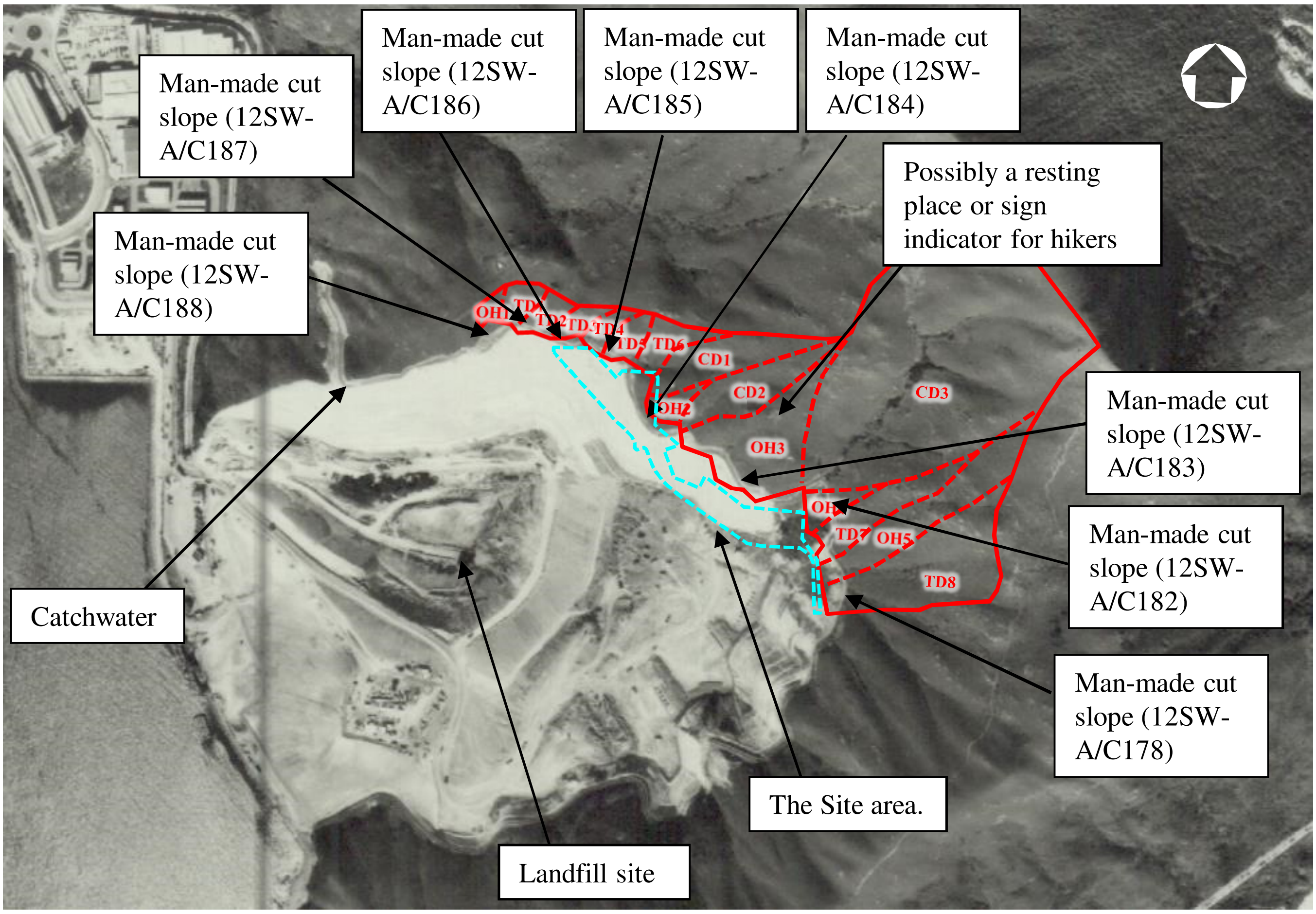
FIGURE B11

Location
Landfill Site II/III, Tseung Kwan O

Scale	Date
NTS	29 May 2022


Man-made cut slope (12SW-A/C187)
Man-made cut slope (12SW-A/C186)
Man-made cut slope (12SW-A/C185)
Man-made cut slope (12SW-A/C184)
Possibly a resting place or sign indicator for hikers
Man-made cut slope (12SW-A/C188)
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
Man-made cut slope (12SW-A/C183)
OH4
TD7
OH5
TD8
Man-made cut slope (12SW-A/C182)
Catchwater
Man-made cut slope (12SW-A/C178)
The Site area.
Landfill site

Photograph No.: A24428 **Date of Photograph: 3 Dec 1990** **Altitude: 10,000'**

Legend:

Approximate Boundary of the NTSA

Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

- A linear feature, probably catchwater is aligned along the toe of the NTSA. Formation of eight man-made cut slopes were commenced along the toe of the NTSA, probably in association with the alignment of the catchwater. They were registered as Feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188.
- A cross-shaped features are apparent in the middle portion of Catchment No. OH3. It was located at the intersection of two footpaths, possibly a resting place or sign indicator for hikers.

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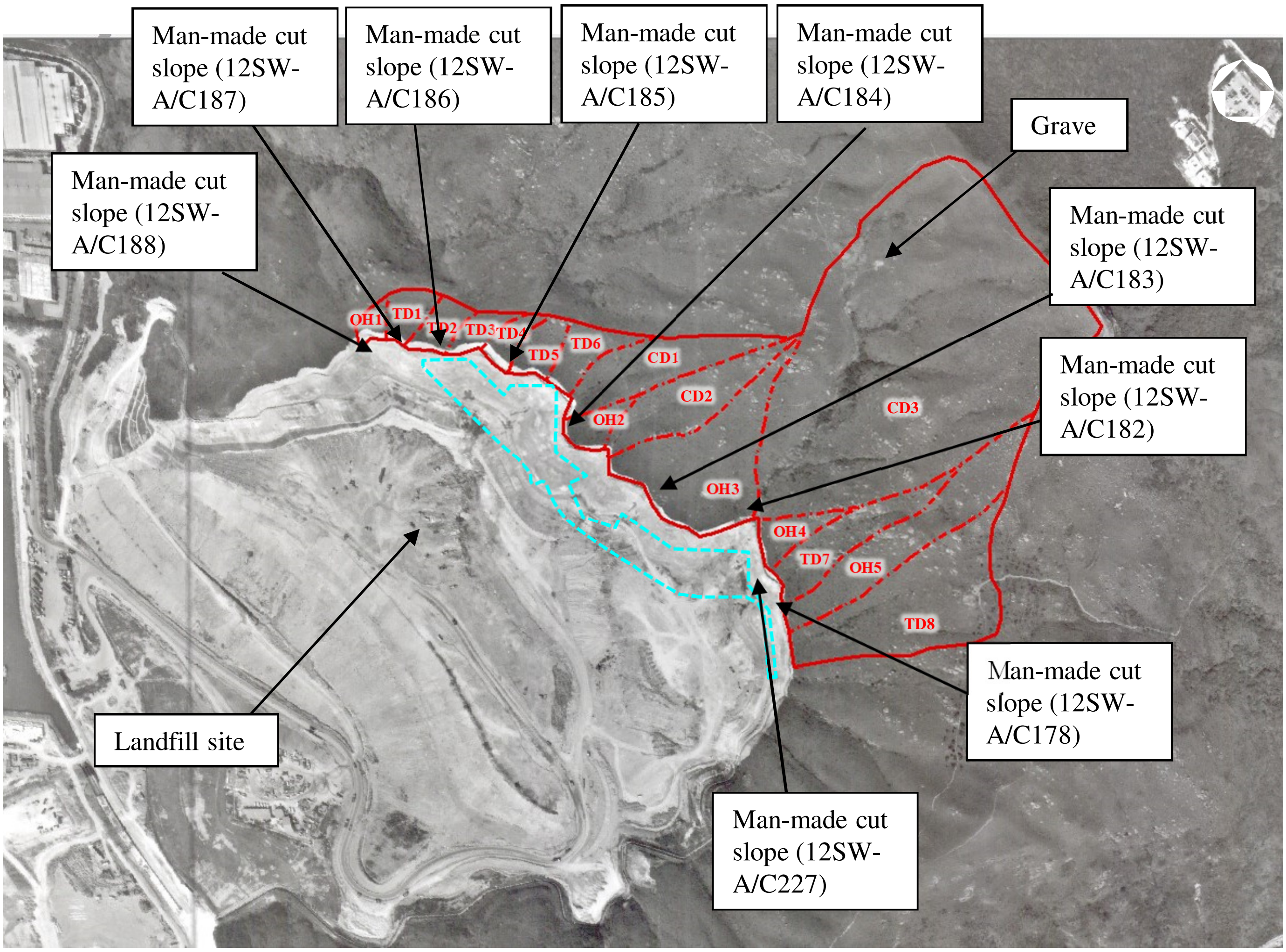
FIGURE B12

Location
Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022



Man-made cut slope (12SW-A/C187)
Man-made cut slope (12SW-A/C186)
Man-made cut slope (12SW-A/C185)
Man-made cut slope (12SW-A/C184)
Grave
Man-made cut slope (12SW-A/C188)
Man-made cut slope (12SW-A/C183)
Man-made cut slope (12SW-A/C182)
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
CD3
OH3
OH4
TD7
OH5
TD8
Landfill site
Man-made cut slope (12SW-A/C178)
Man-made cut slope (12SW-A/C227)

Photograph No.: A32763 **Date of Photograph: 20 Oct 1992** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

- - - - Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

- A small patch of high reflectance bare soil is observed at the upper portion of Catchment No. CD3, possible a grave was constructed.
- Formation of feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188 were completed.
- A cut slope was formed below Catchment Nos. TD7 and OH5, probably in association with the extension of the landfill site. This man-made slope was registered as Feature No. 12SW-A/C227.
- The area below the NTSA was continued to serve as landfill site.

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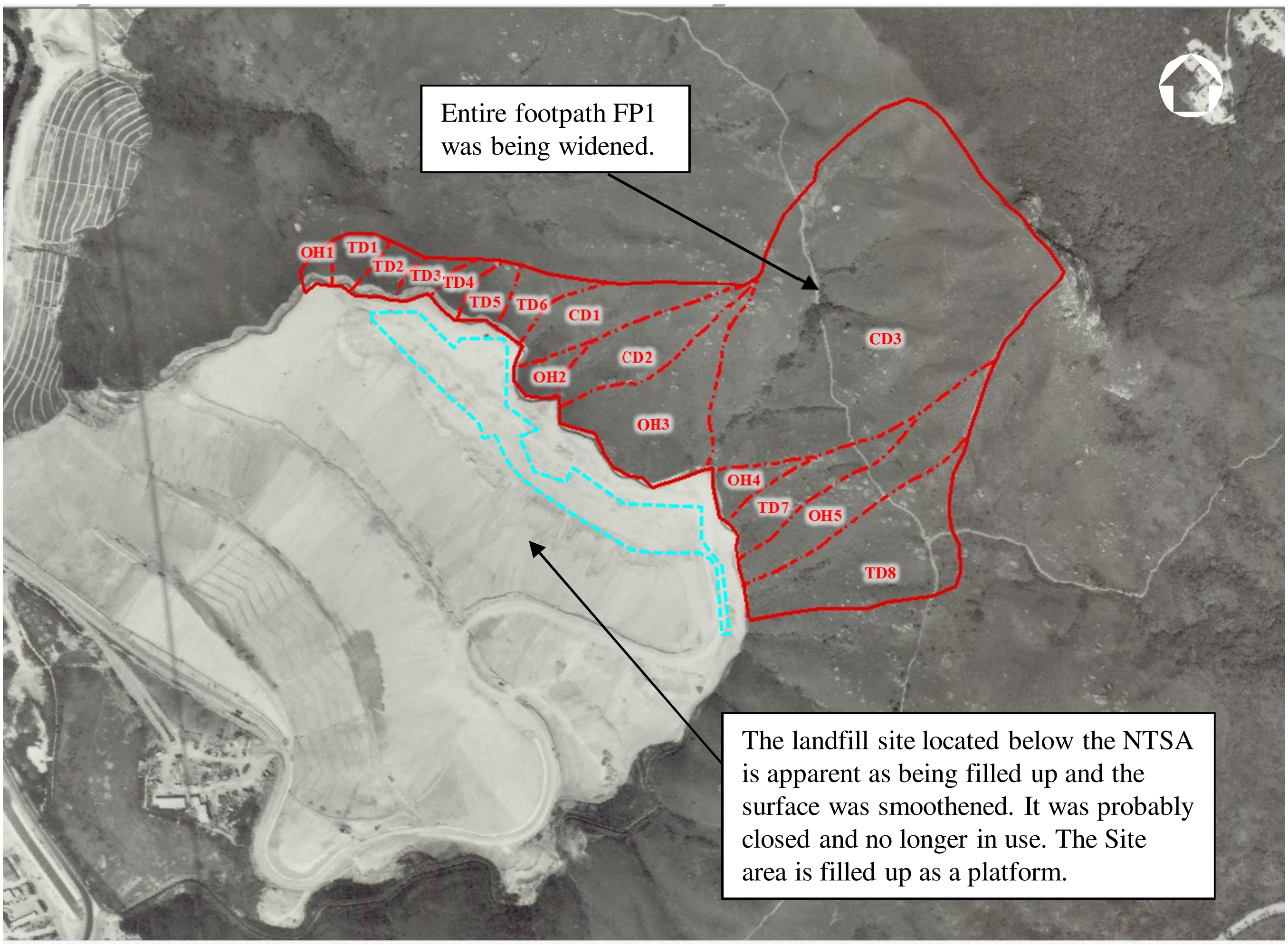
FIGURE B13

Location
Landfill Site II/III, Tseung Kwan O

Scale NTS
Date 29 May 2022



Entire footpath FP1 was being widened.

The landfill site located below the NTSA is apparent as being filled up and the surface was smoothened. It was probably closed and no longer in use. The Site area is filled up as a platform.

Photograph No.: A39049 **Date of Photograph: 17 Oct 1994** **Altitude: 4,000'**

Legend:

🟥 Approximate Boundary of the NTSA

- - - - Catchment Boundary

- - - - Approximate Boundary of the Site (Proposed public riding school development area)

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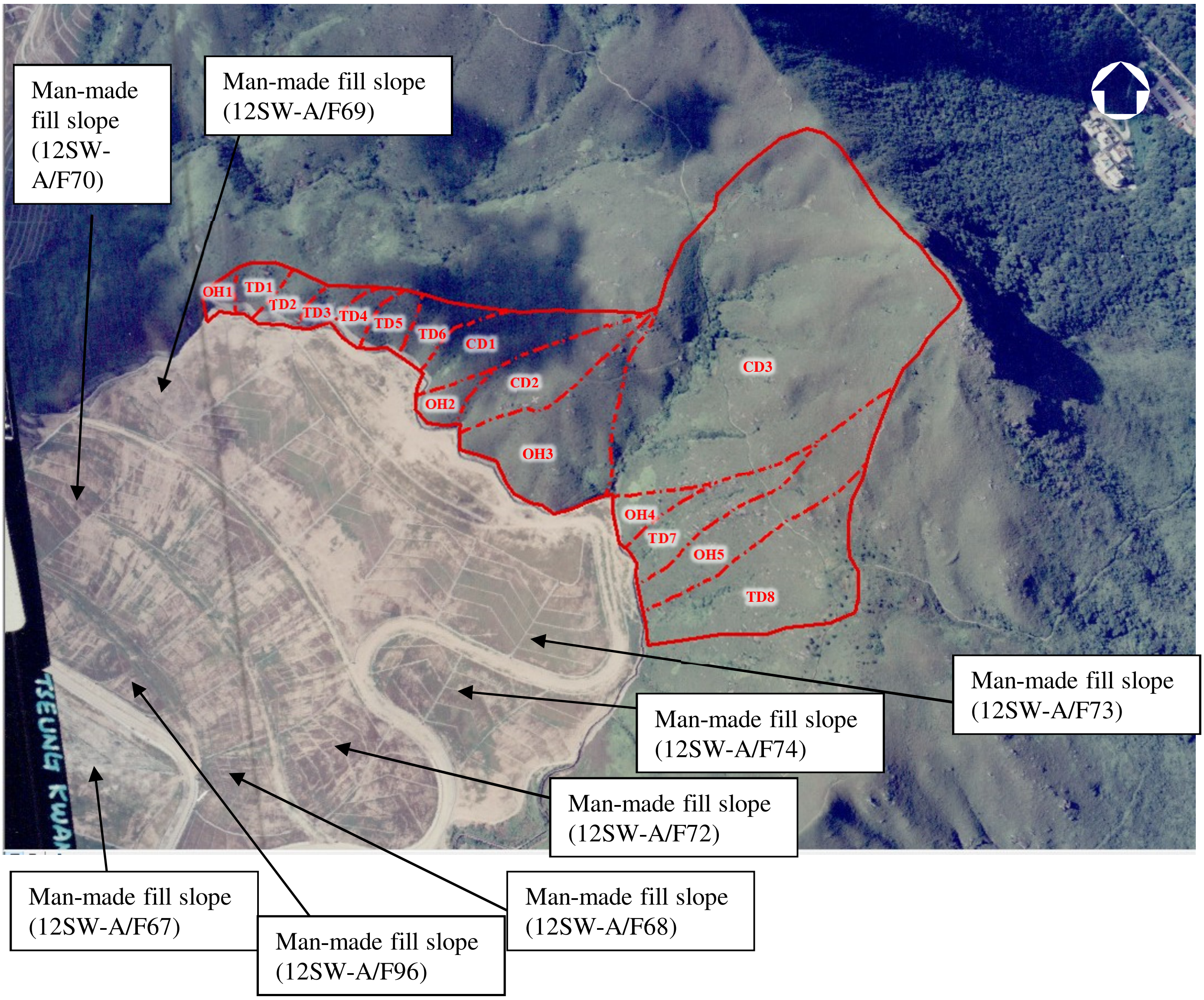
FIGURE B14

Location

Landfill Site II/III,
Tseung Kwan O

Scale NTS

Date 29 May 2022


Man-made fill slope (12SW-A/F70)
Man-made fill slope (12SW-A/F69)
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
OH4
TD7
OH5
TD8
TSEUNG KWAN
Man-made fill slope (12SW-A/F73)
Man-made fill slope (12SW-A/F74)
Man-made fill slope (12SW-A/F72)
Man-made fill slope (12SW-A/F67)
Man-made fill slope (12SW-A/F96)
Man-made fill slope (12SW-A/F68)

Photograph No.: CN10018 **Date of Photograph: 18 Jul 1995** **Altitude: 3,500'**

Legend:

Approximate Boundary of the NTSA

Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

- Eight man-made fill slopes were formed at the former landfill site which located below the NTSA. Man-made drainage channels are formed on the slope surfaces. They are registered as Feature Nos. 12SW-A/F67, 12SW-A/F68, 12SW-A/F69, 12SW-A/F70, 12SW-A/F72, 12SW-A/F73, 12SW-A/F74 and 12SW-A/F96.

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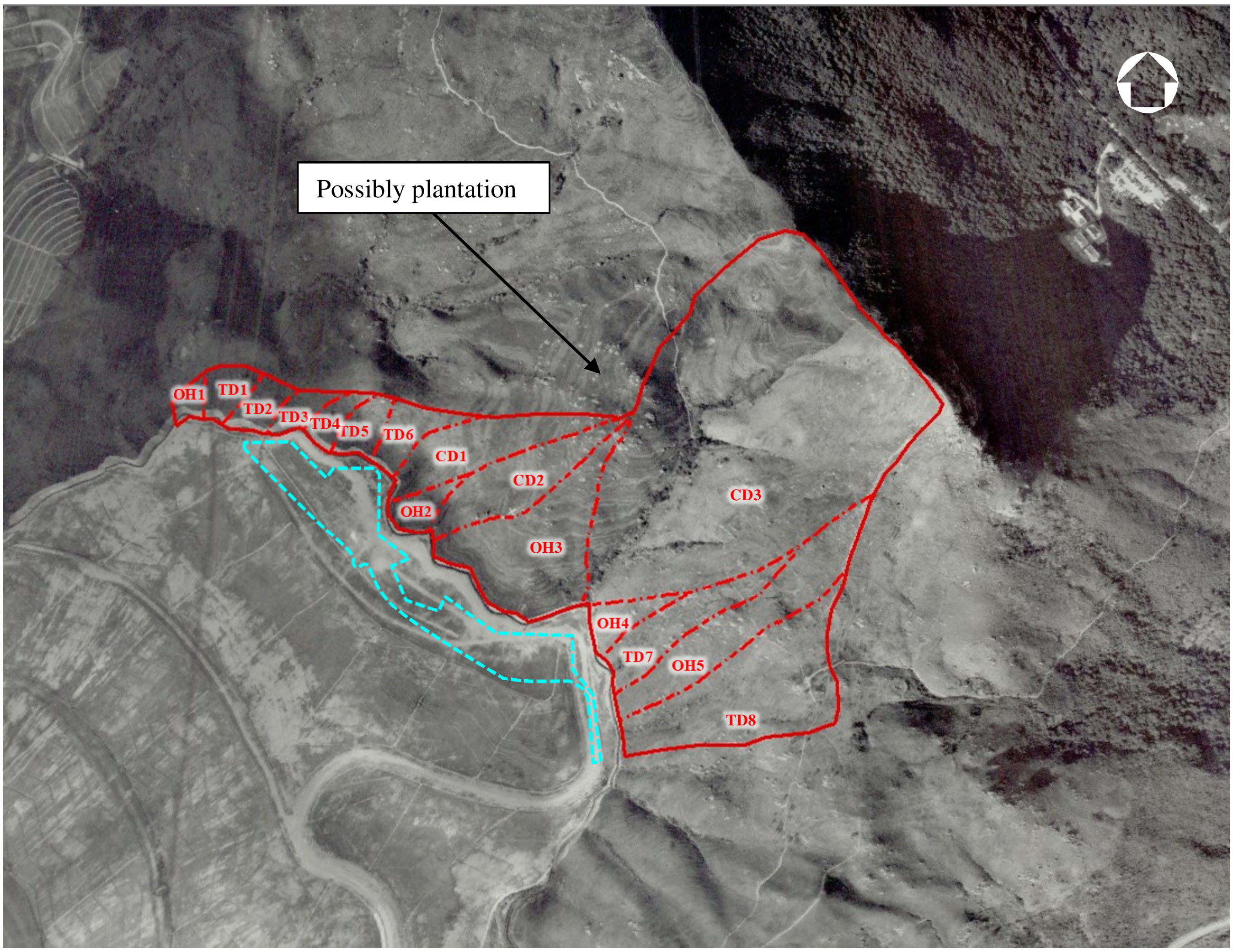
FIGURE B15

Location
Landfill Site II/III, Tseung Kwan O

Scale
NTS

Date
29 May 2022



Photograph No.: A42221 **Date of Photograph: 18 Jan 1996** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

---- Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

- Many linear features are apparent parallel to the contour lines in Catchment Nos. TD6, CD1, OH2, CD2, OH3 and CD3. A very thin layer of surface soil may be disturbed along these linear features by anthropogenic activities, possibly plantation.

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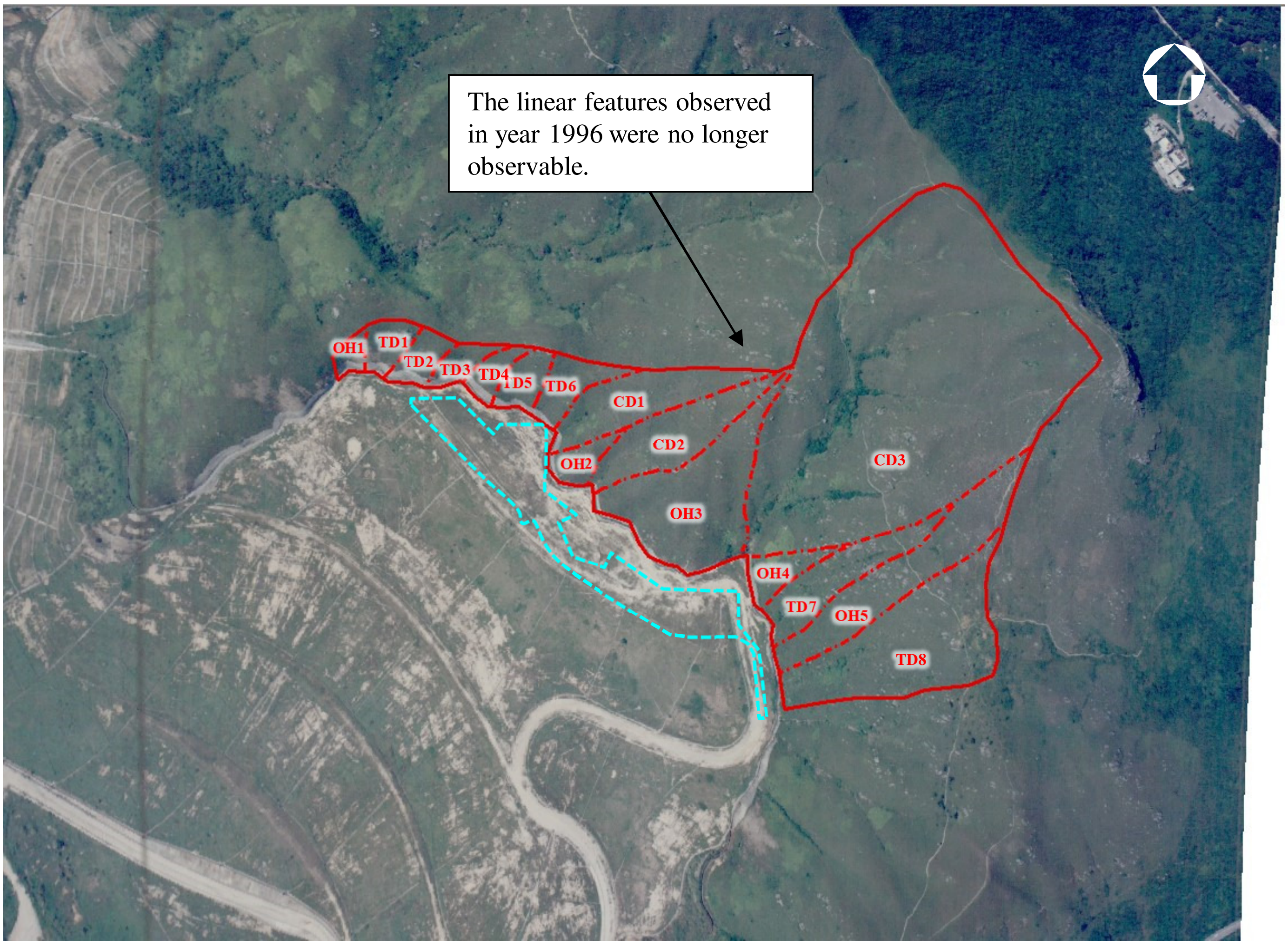
FIGURE B16

Location

Landfill Site II/III,
Tseung Kwan O

Scale
NTS

Date
29 May 2022



The linear features observed in year 1996 were no longer observable.

Photograph No.: CN17111 **Date of Photograph: 26 May 1997** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

---- Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

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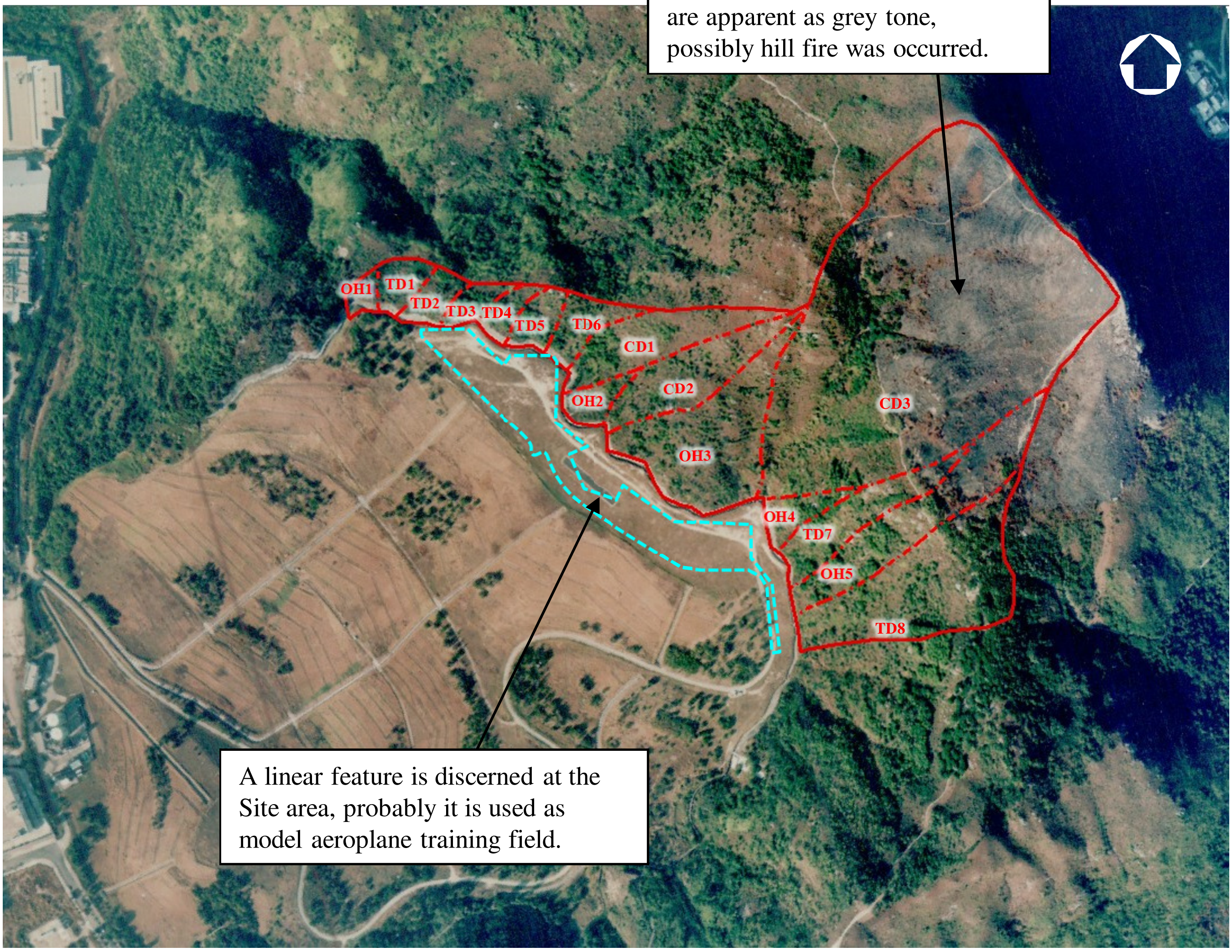
FIGURE B17

Location

Landfill Site II/III,
Tseung Kwan O

Scale	Date
NTS	29 May 2022



The upper portion of Catchment Nos. CD3, TD7, OH5 and TD8 are apparent as grey tone, possibly hill fire was occurred.

A linear feature is discerned at the Site area, probably it is used as model aeroplane training field.

Photograph No.: CW62911 **Date of Photograph: 16 Dec 2004** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

- - - - Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

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Project:

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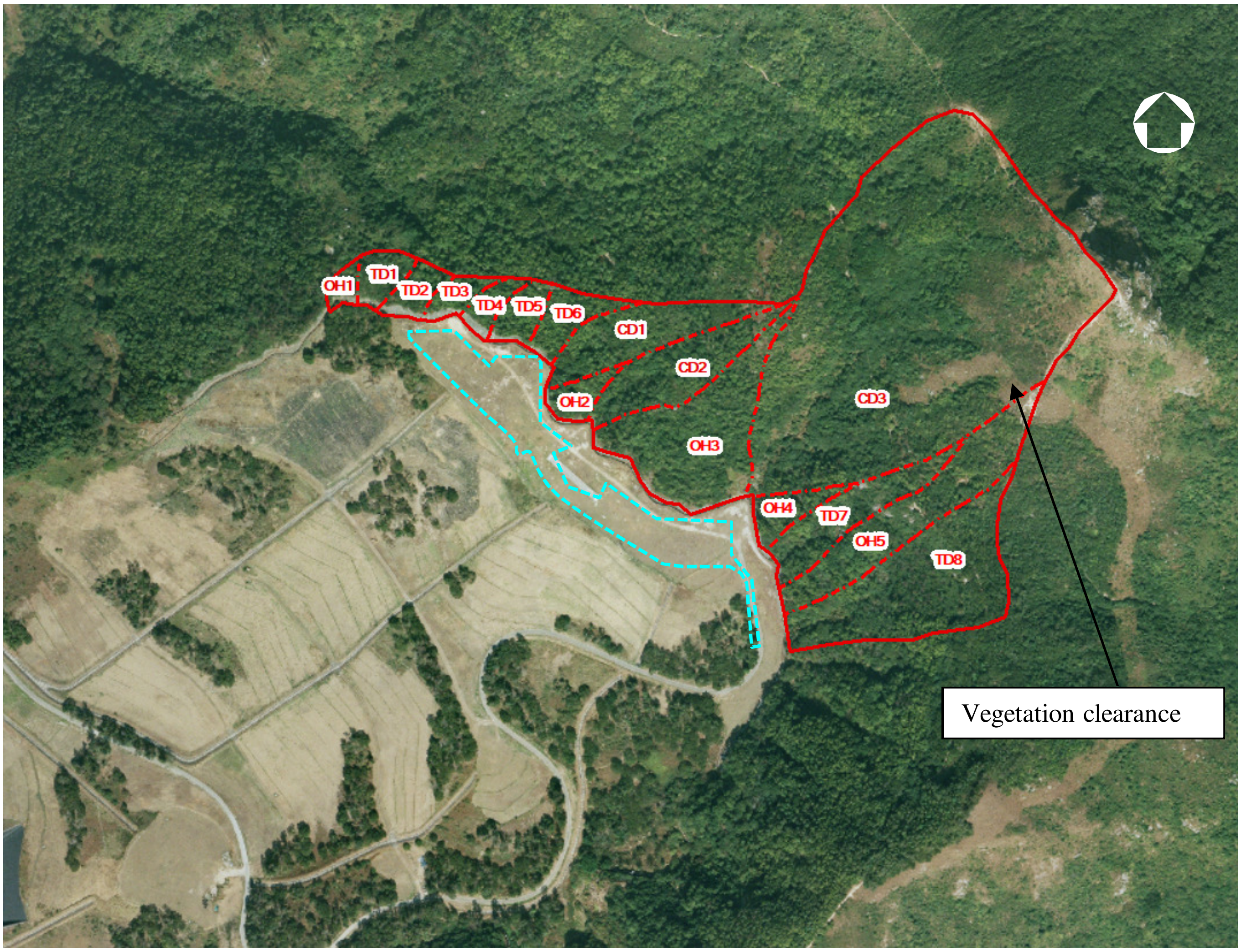
FIGURE B18

Location

Landfill Site II/III, Tseung Kwan O

Scale	Date
NTS	29 May 2022



OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
OH4
TD7
OH5
TD8
Vegetation clearance

Photograph No.: E046899C **Date of Photograph: 5 Oct 2018** **Altitude: 6,900'**

Legend:

Approximate Boundary of the NTSA

Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

- No observable significant change to the NTSA since 2010s till present except the vegetation growth or clearance.

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FIGURE B19

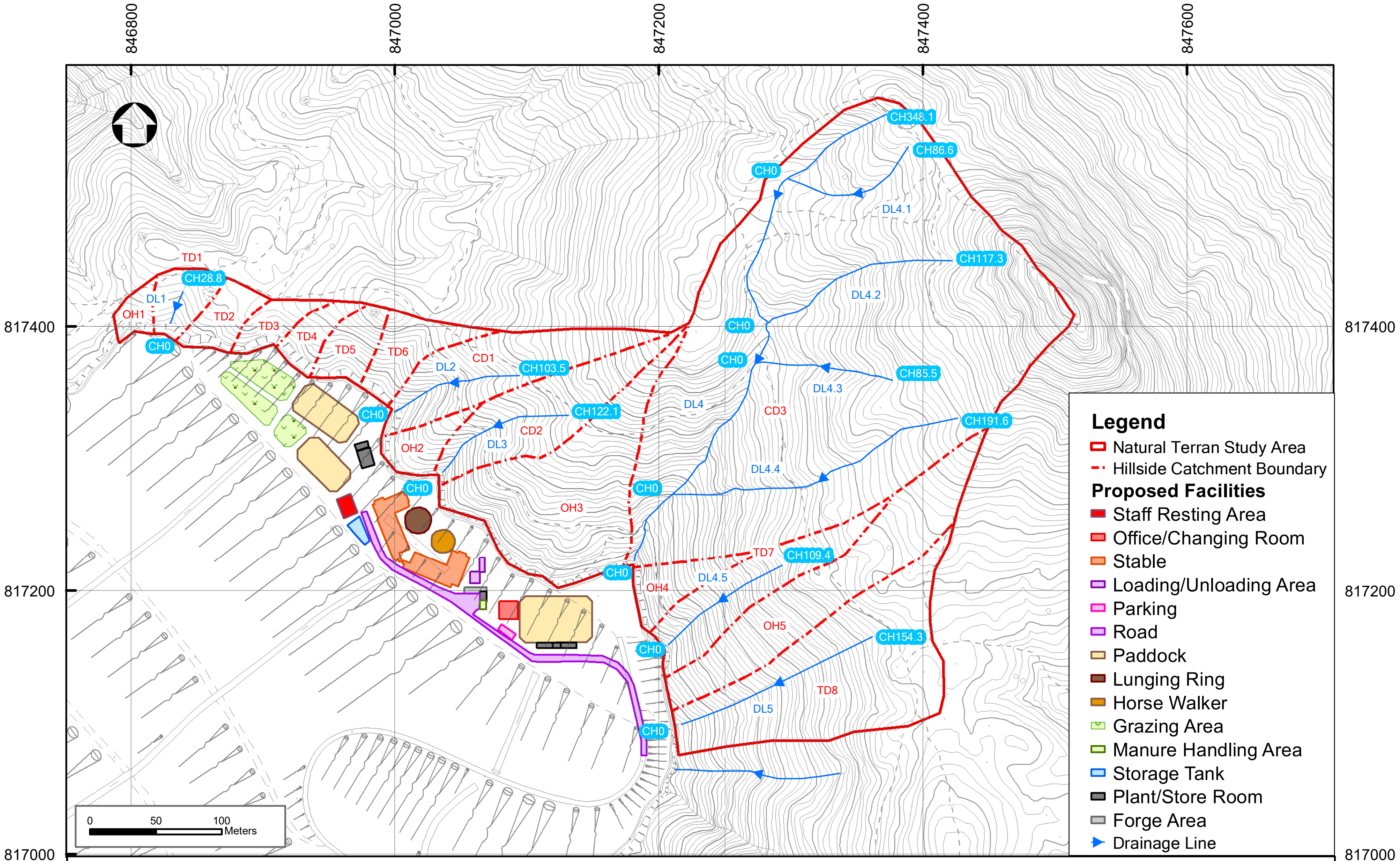
Location
Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022

Appendix C

Drainage Line Records


846800
847000
847200
847400
847600
817400
817200
817000
TD1
CH28.8
DL1
OH1
CH0
TD2
TD3
TD4
TD5
TD6
CD1
DL2
CH103.5
CH0
OH2
CD2
DL3
CH122.1
CH0
OH3
DL4
CH0
CH0
CD3
CH348.1
CH86.6
CH0
DL4.1
CH117.3
DL4.2
CH0
CH0
DL4.3
CH85.5
CH191.6
DL4.4
CH0
TD7
CH109.4
CH0
OH4
DL4.5
CH0
OH5
CH154.3
TD8
DL5
CH0
0
50
100
Meters
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
Drainage Line

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Ephemeral Drainage Lines within NTSA	**SCALE:** 1 :4000	**Modern Consulting Engineers Limited** In association with CALVINT GEO-SERVICES LIMITED	**FIGURE NO :** **FIGURE C1**

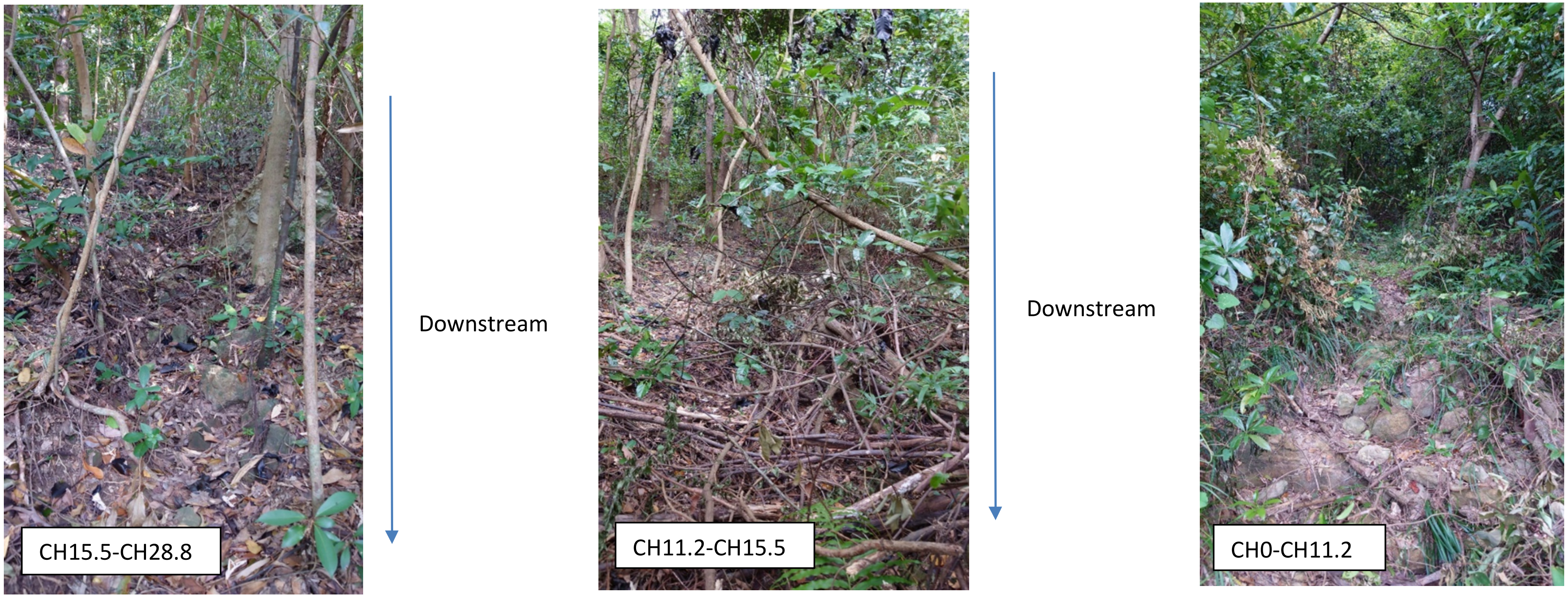
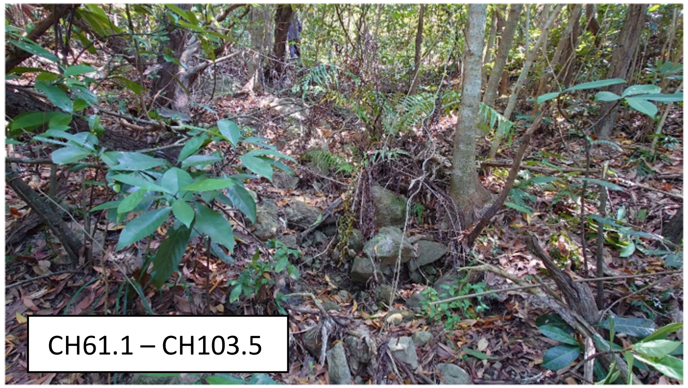
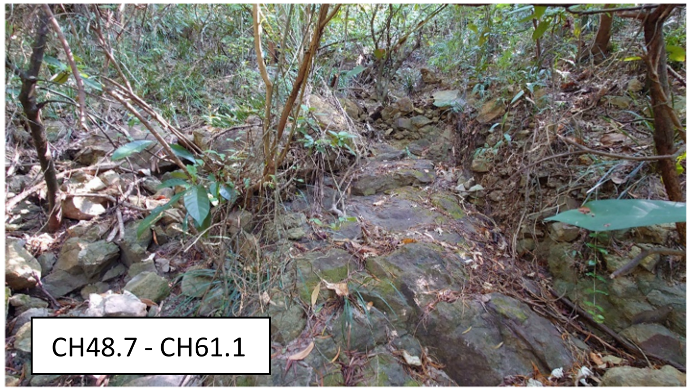
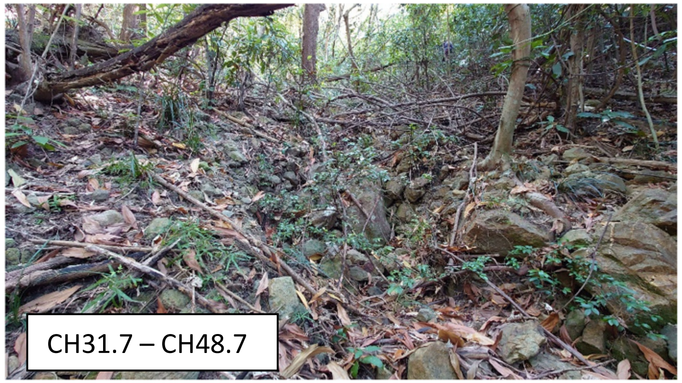

CH15.5-CH28.8
Downstream
CH11.2-CH15.5
Downstream
CH0-CH11.2

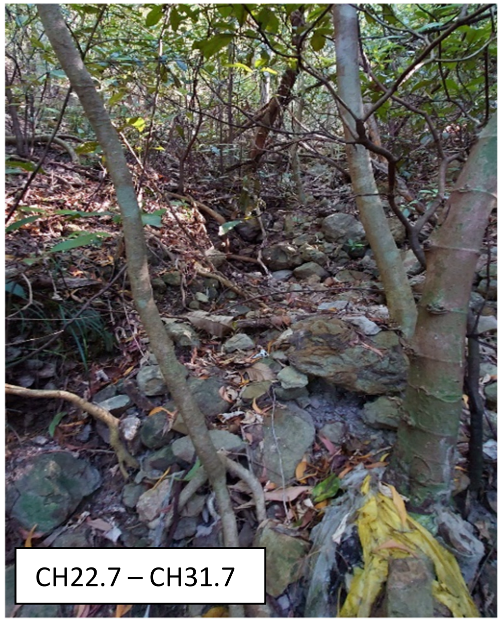
Plate C1 General View of Drainage Line DL1 in Catchment No. TD1

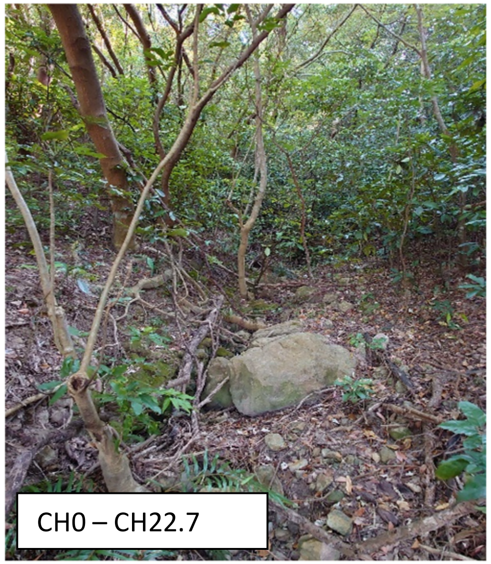

CH61.1 – CH103.5


CH48.7 - CH61.1


CH31.7 – CH48.7

Downstream


CH22.7 – CH31.7


CH0 – CH22.7

Downstream

Plate C2 General View of Drainage Line DL2 in Catchment No. CD1

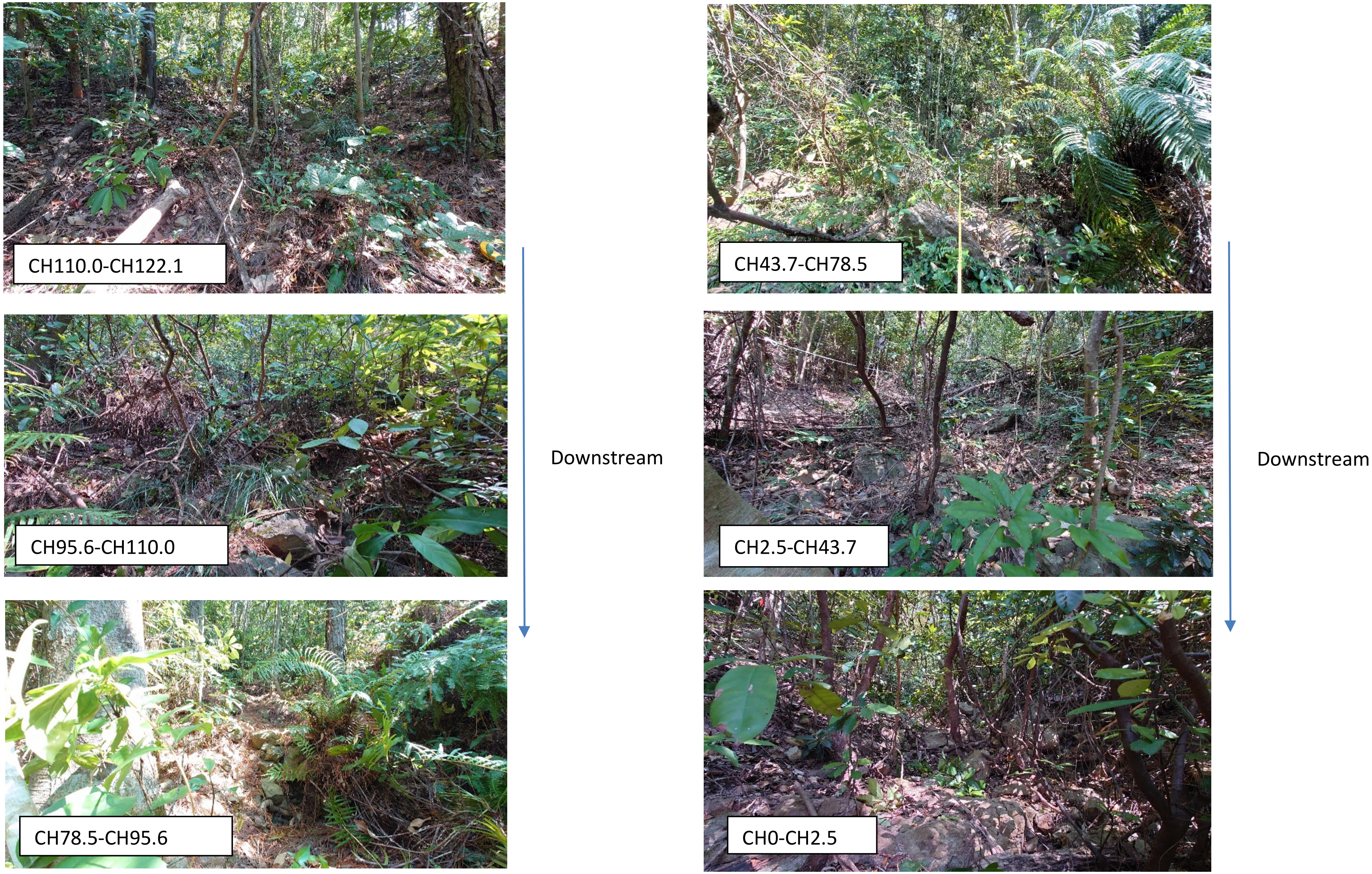

CH110.0-CH122.1
CH95.6-CH110.0
CH78.5-CH95.6
Downstream
CH43.7-CH78.5
CH2.5-CH43.7
CH0-CH2.5
Downstream

Plate C3 General View of Drainage Line DL3 in Catchment No. CD2

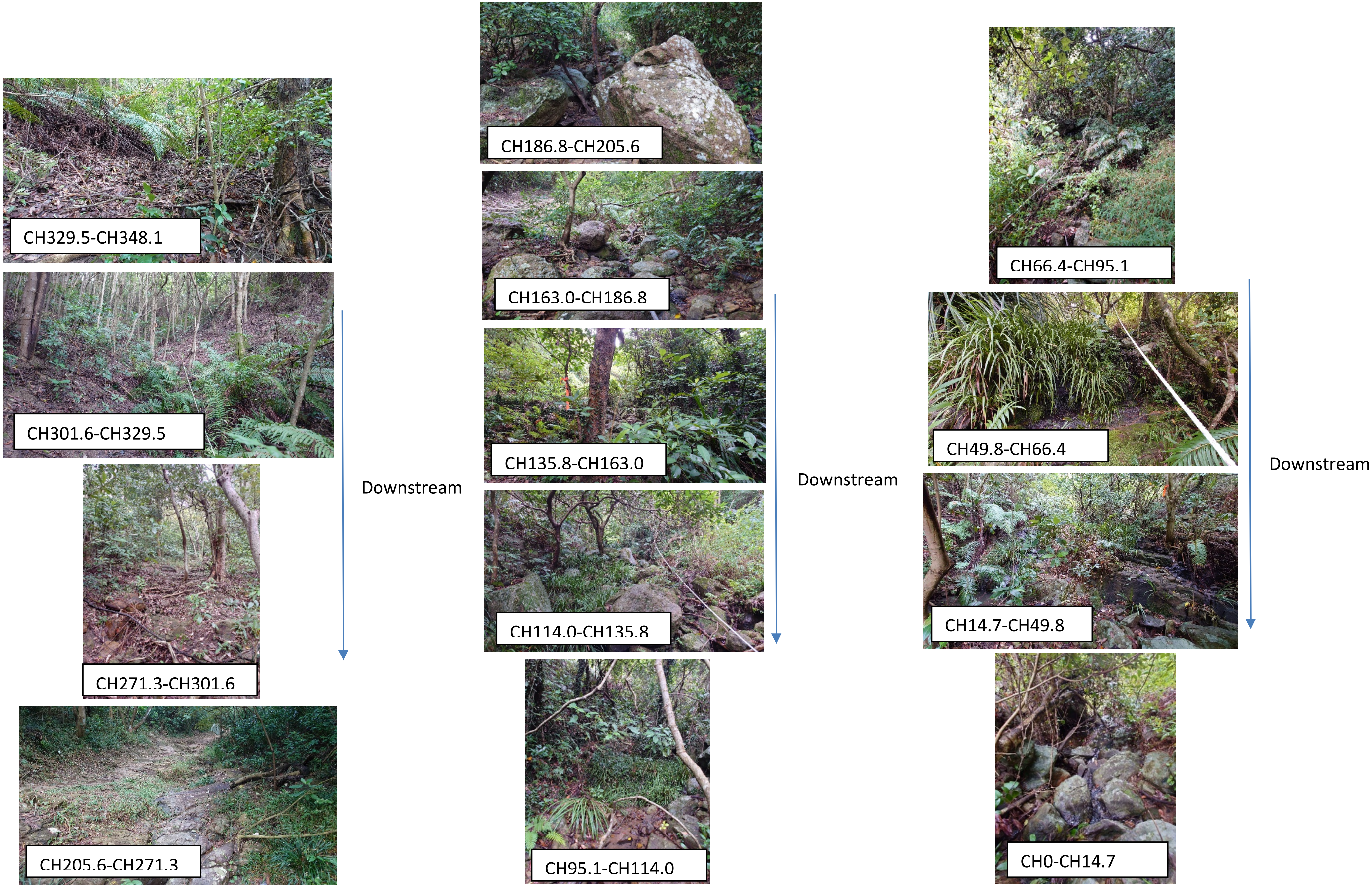

CH329.5-CH348.1
CH301.6-CH329.5
CH271.3-CH301.6
CH205.6-CH271.3
Downstream
CH186.8-CH205.6
CH163.0-CH186.8
CH135.8-CH163.0
CH114.0-CH135.8
CH95.1-CH114.0
Downstream
CH66.4-CH95.1
CH49.8-CH66.4
CH14.7-CH49.8
CH0-CH14.7
Downstream

Plate C4 General View of Drainage Line DL4 in Catchment No. CD3

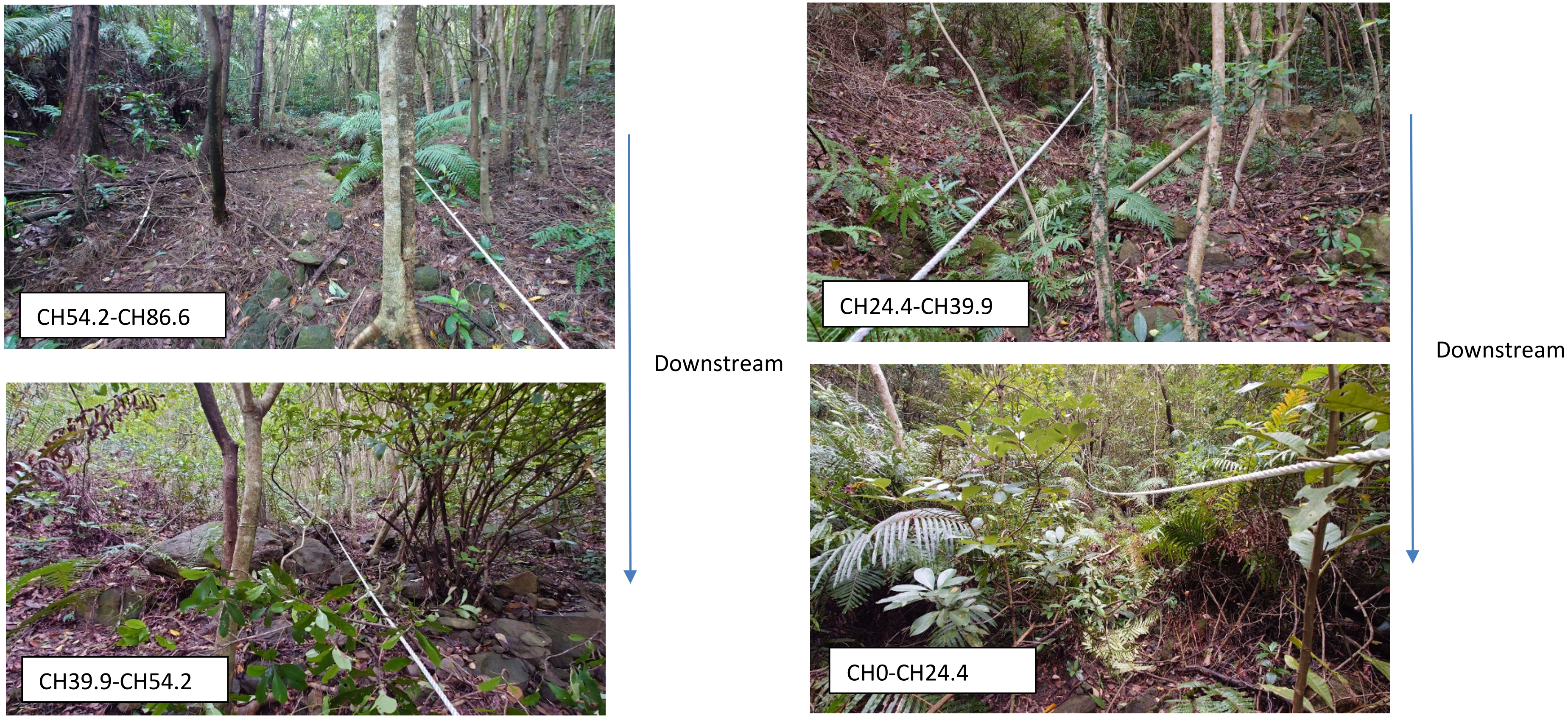

CH54.2-CH86.6
CH39.9-CH54.2
Downstream
CH24.4-CH39.9
CH0-CH24.4
Downstream

Plate C5 General View of Sub-ordinate Drainage Line DL4.1 in Catchment No. CD3

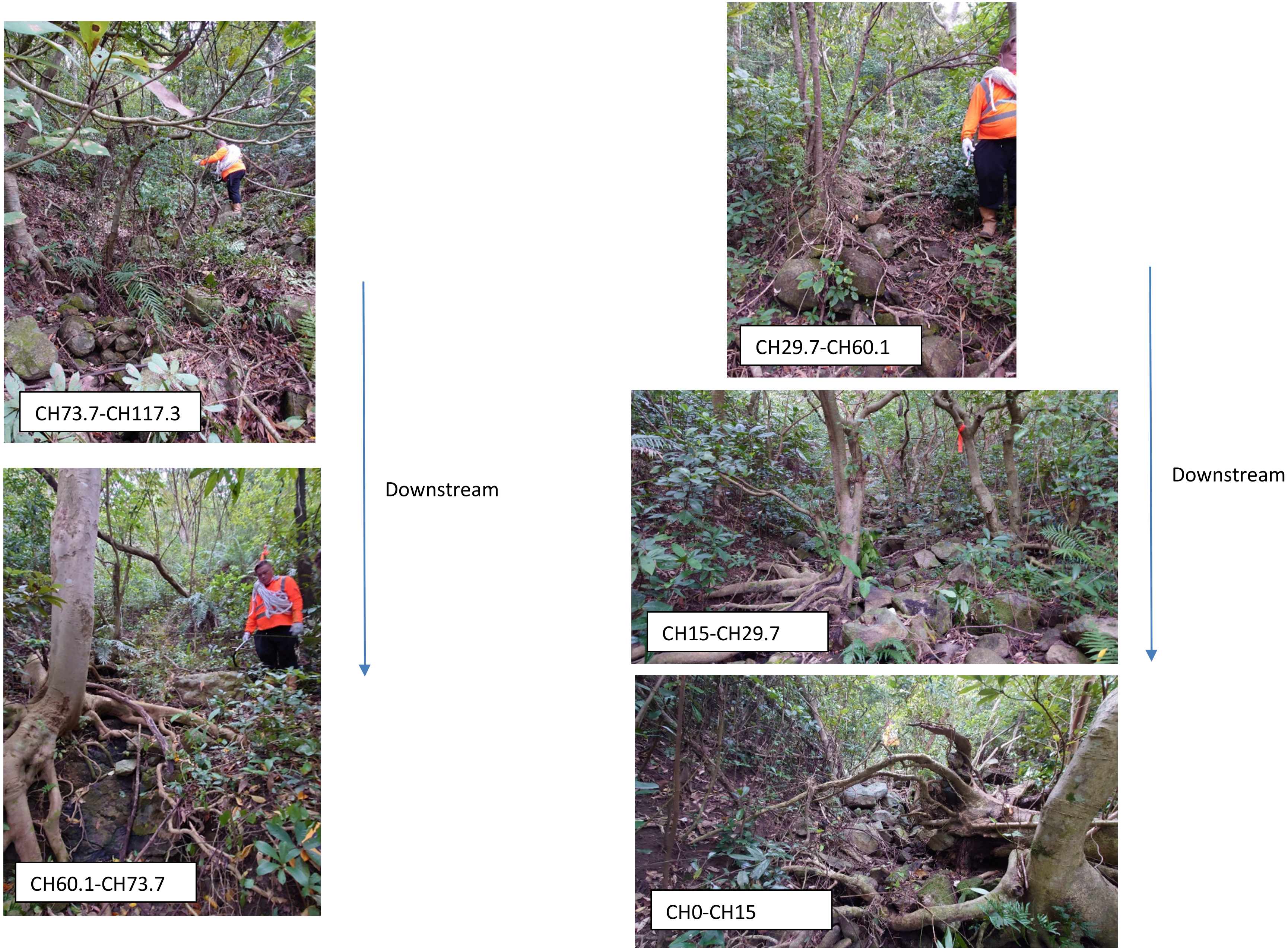

CH73.7-CH117.3
CH60.1-CH73.7
Downstream
CH29.7-CH60.1
CH15-CH29.7
CH0-CH15
Downstream

Plate C6 General View of Sub-ordinate Drainage Line DL4.2 in Catchment No. CD3

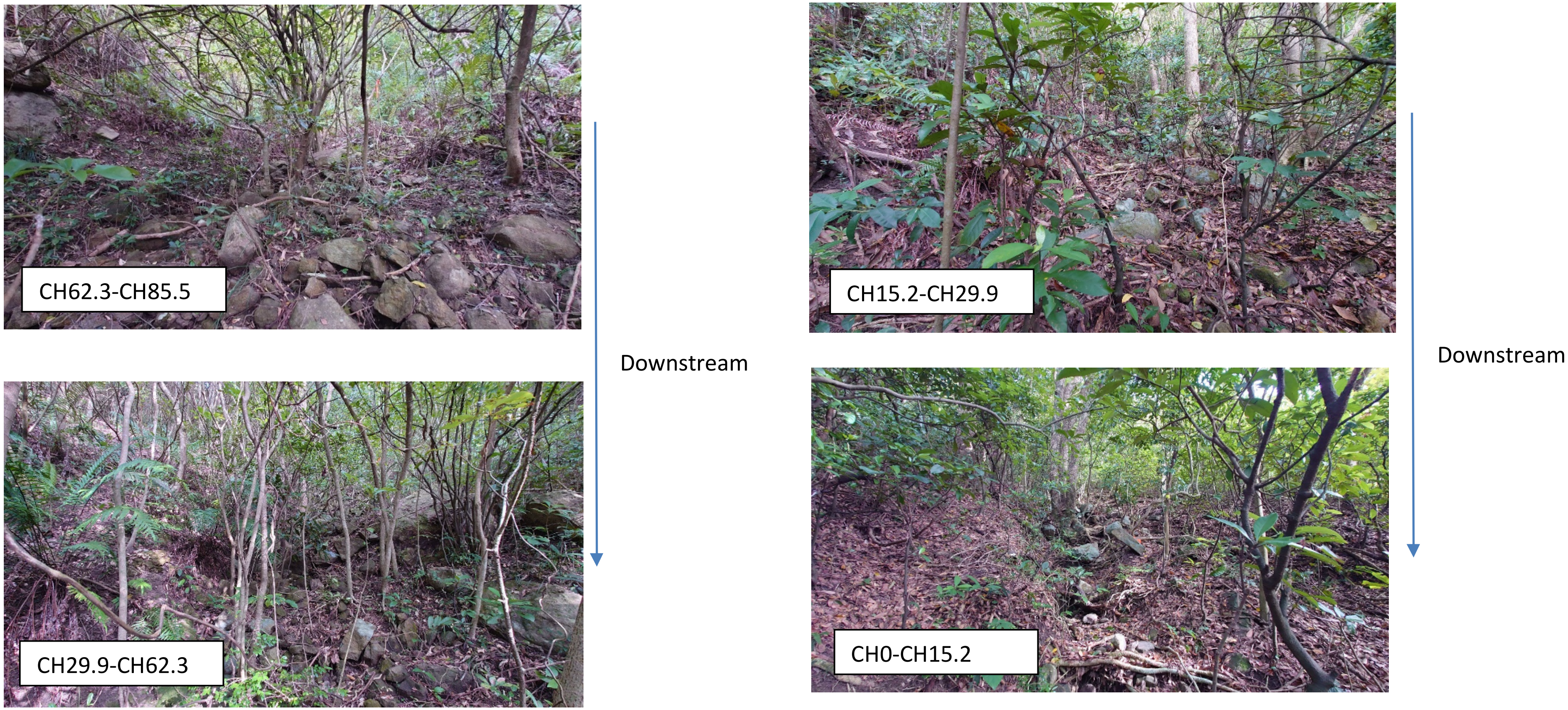
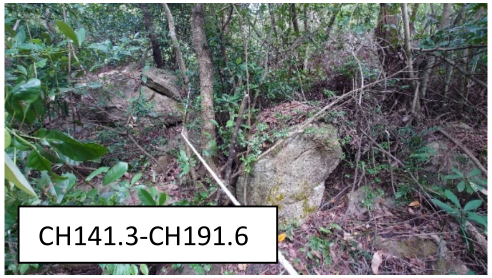
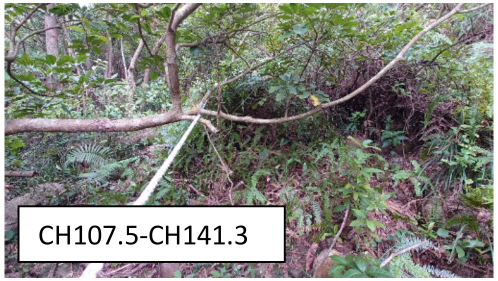

CH62.3-CH85.5
CH29.9-CH62.3
Downstream
CH15.2-CH29.9
CH0-CH15.2
Downstream

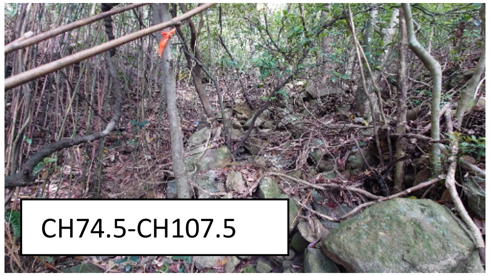
Plate C7 General View of Sub-ordinate Drainage Line DL4.3 in Catchment No. CD3



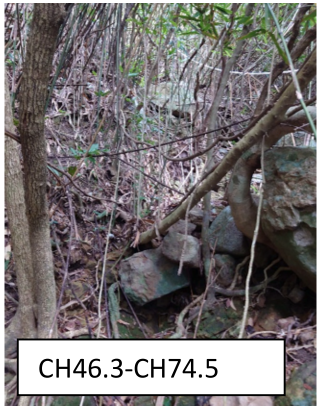
CH141.3-CH191.6



CH107.5-CH141.3

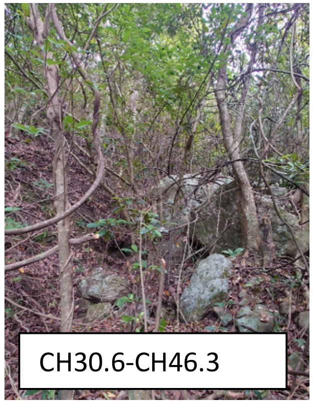


CH74.5-CH107.5

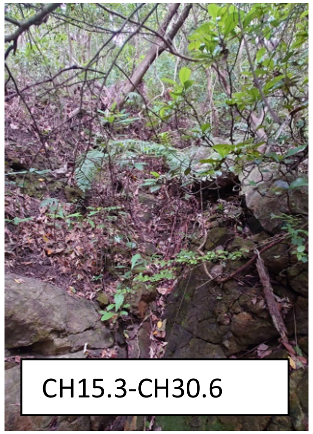


CH46.3-CH74.5

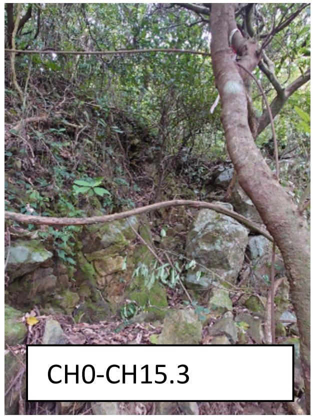
Downstream



CH30.6-CH46.3



CH15.3-CH30.6



CH0-CH15.3

Downstream

Plate C8 General View of Sub-ordinate Drainage Line DL4.4 in Catchment No. CD3

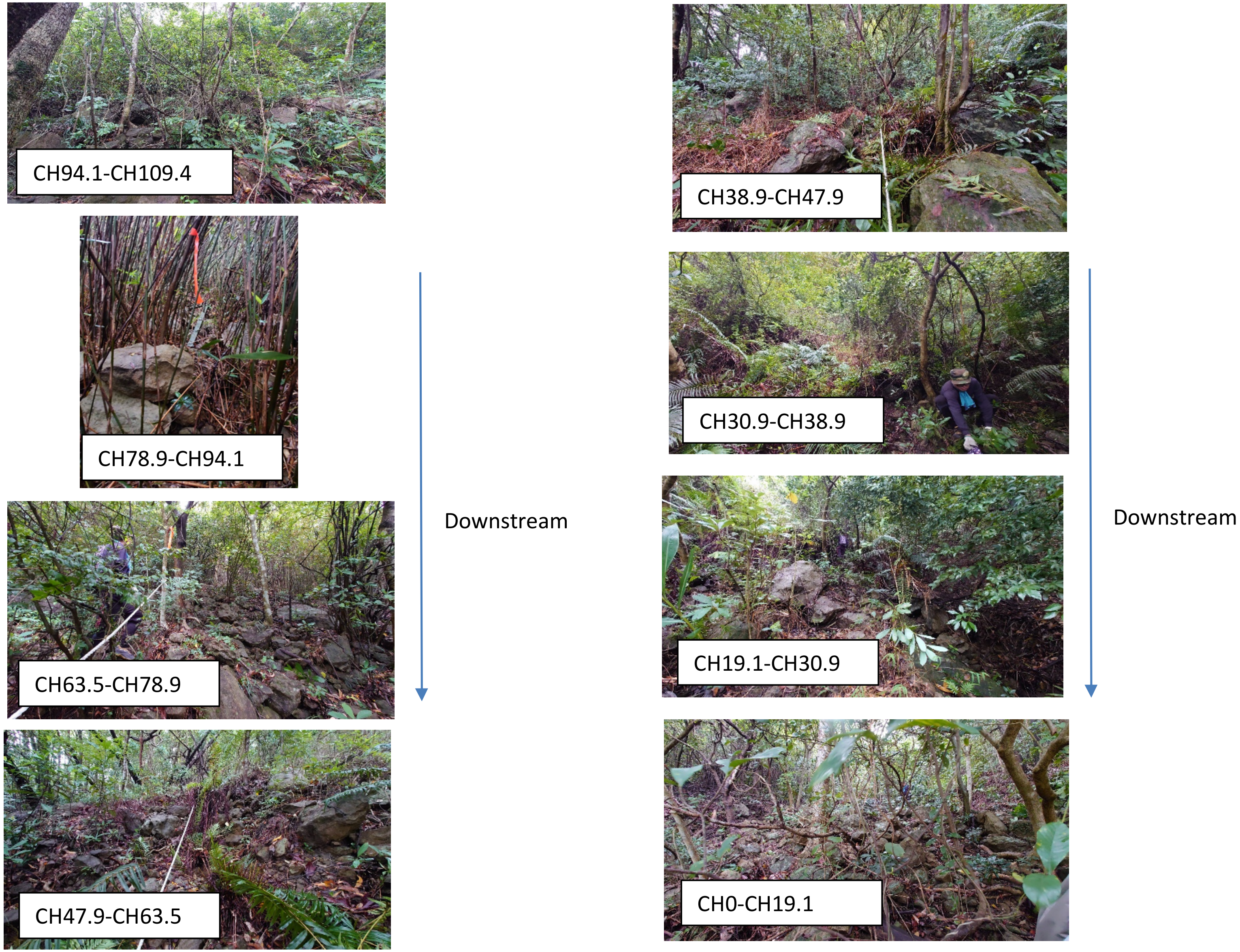

CH94.1-CH109.4
CH78.9-CH94.1
CH63.5-CH78.9
CH47.9-CH63.5
Downstream
CH38.9-CH47.9
CH30.9-CH38.9
CH19.1-CH30.9
CH0-CH19.1
Downstream

Plate 9 General View of Sub-ordinate Drainage Line DL4.5 in Catchment No. TD2

CH122.7-CH154.3

CH100.9-CH122.7

CH79.6-CH100.9

CH49.8-CH79.6

Downstream

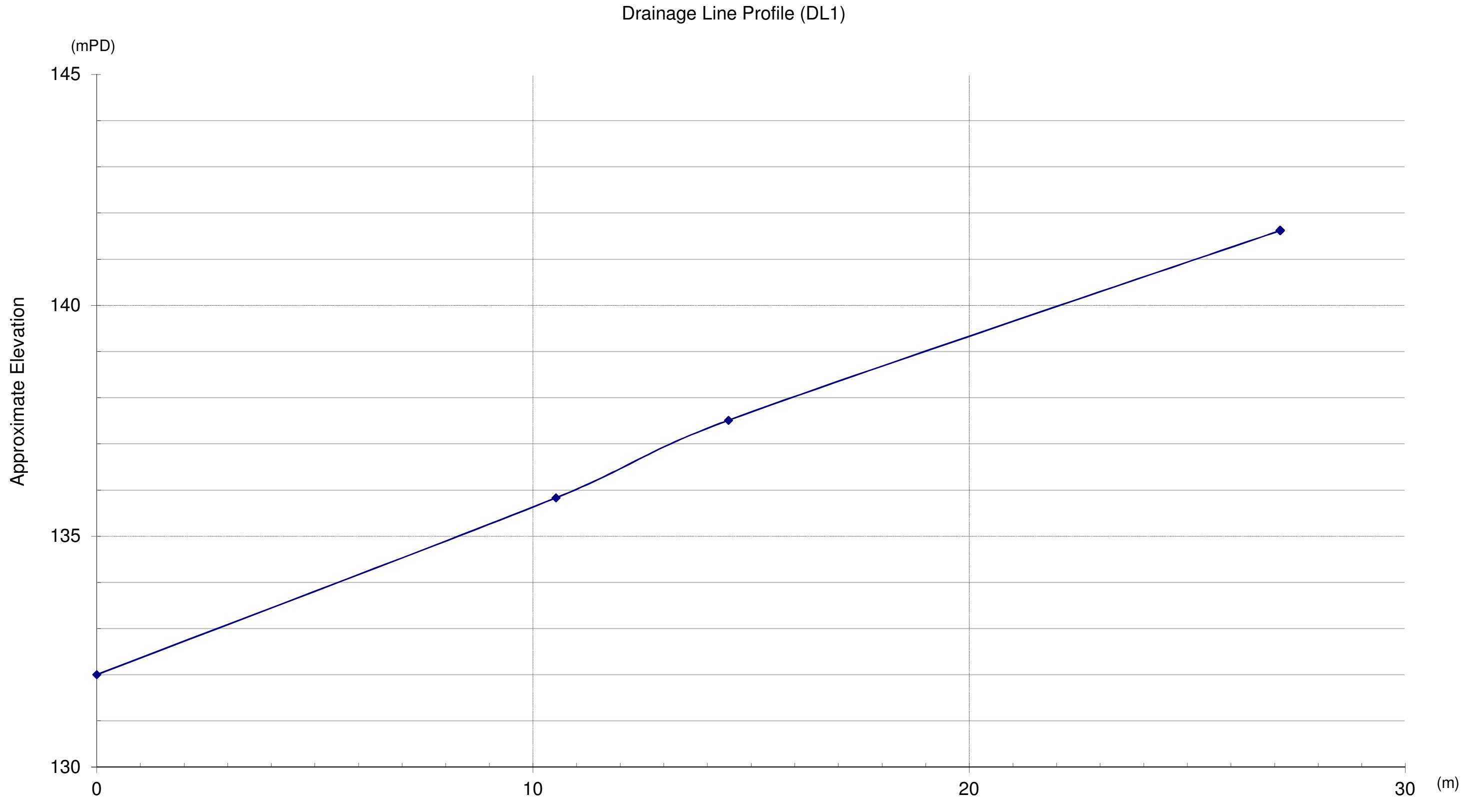
CH32.7-CH49.8

CH18.6-CH32.7

CH0-CH18.6

Downstream

Plate C10 General View of Drainage Line DL5 in Catchment No. TD3

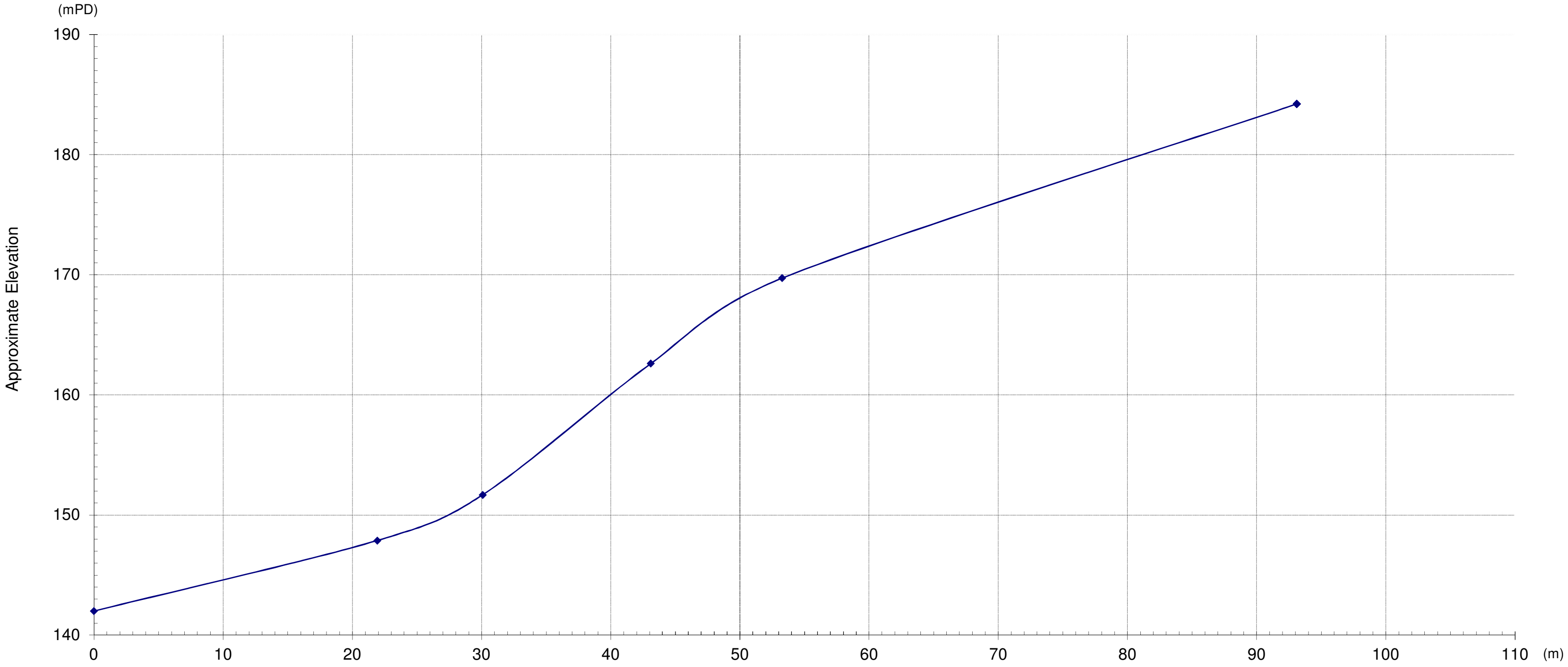


FIELD RECORD

Chainage (m)	0-11.2	11.2-15.5	15.5-28.8
Section Length (m)	11.2	4.3	13.3
Channel Width (m)	2.5	2.7	2
Channel Depth (m)	0.5	0.3	0.4
Inclination (°)	20	23	18
Side Slopes Angles (°)	15,10	10,5	10,5
Channelisation Ratio	5.0	9.0	5.0
Channel Bed Materials #	Cs,Cb	Cs	Cs,Cb
Side Slopes Materials #	Cs	Cs	Cs
Thickness of Entrainment Material (m)	0.2	0.2	0.2
Approx. Channel Shape *	H	H	H

F = Fill; Cb = Colluvial Boulders; Cs = Colluvium; CD = Completely Decomposed Rock; HD = Highly Decomposed Rock; R = Bedrock

* U = U-shaped; V = V-shaped; H= Half-rounded; R   = Rectangular-shaped



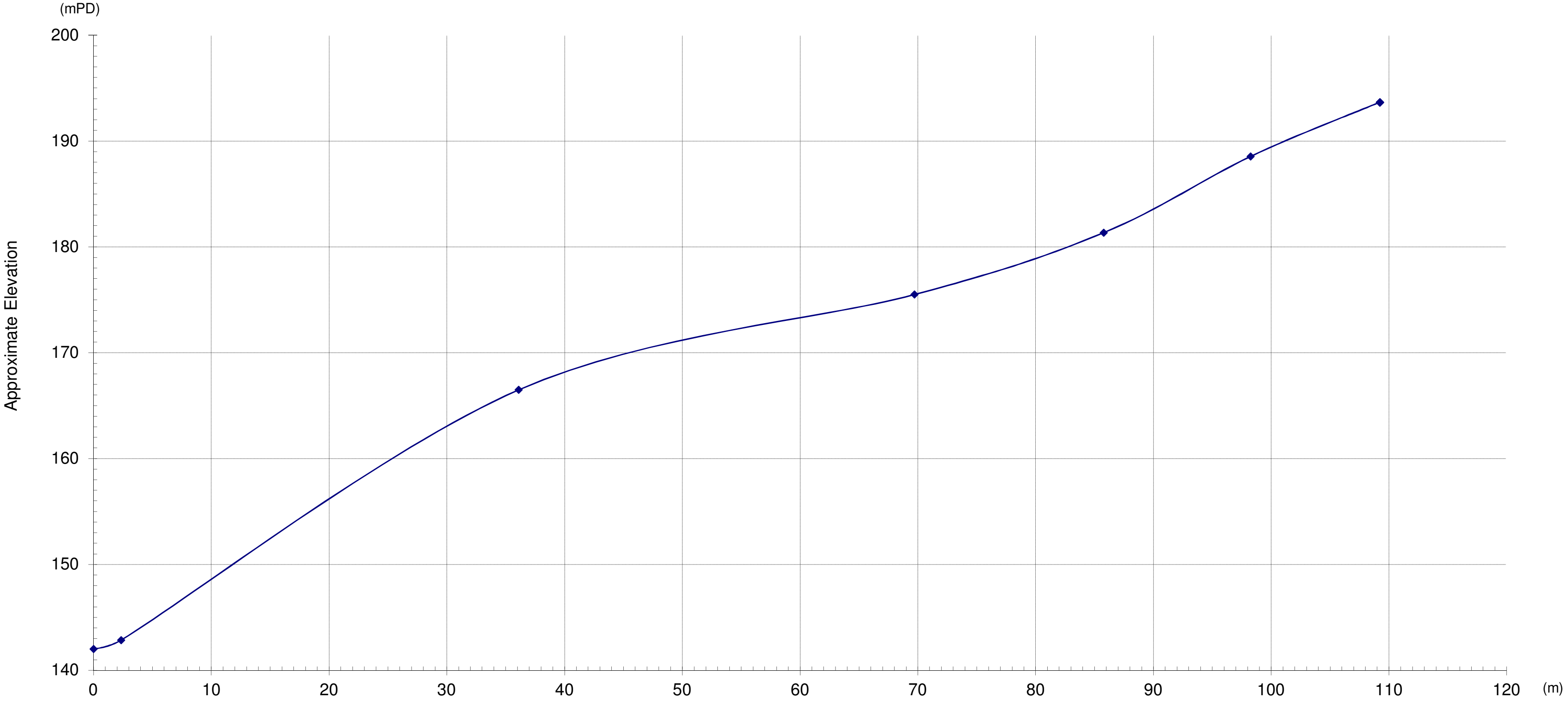
Drainage Line Profile (DL2)

FIELD RECORD

Chainage (m)	0-22.7	22.7-31.7	31.7-48.7	48.7-61.1	61.1-103.5
Section Length (m)	22.7	9	17	12.4	42.4
Channel Width (m)	2	3.3	3.2	3.5	3.7
Channel Depth (m)	0.8	0.9	0.8	0.8	0.5
Inclination (°)	15	25	40	35	20
Side Slopes Angles (°)	55,20	70,40	60,30	10,70	10,15
Channelisation Ratio	2.5	3.7	4.0	4.4	7.4
Channel Bed Materials #	Cb,Cs	Cb,Cs	Cb,Cs	Cb, R	Cb,Cs
Side Slopes Materials #	Cs	Cs	Cs	Cs	Cs
Thickness of Entrainment Material (m)	0.1	0.3	0.2	0.1	0.2
Approx. Channel Shape *	H	H	H	H	H

F = Fill; Cb = Colluvial Boulders; Cs = Colluvium; CD = Completely Decomposed Rock; HD = Highly Decomposed Rock; R = Bedrock
* U = U-shaped; V = V-shaped; H= Half-rounded; R = Rectangular-shaped

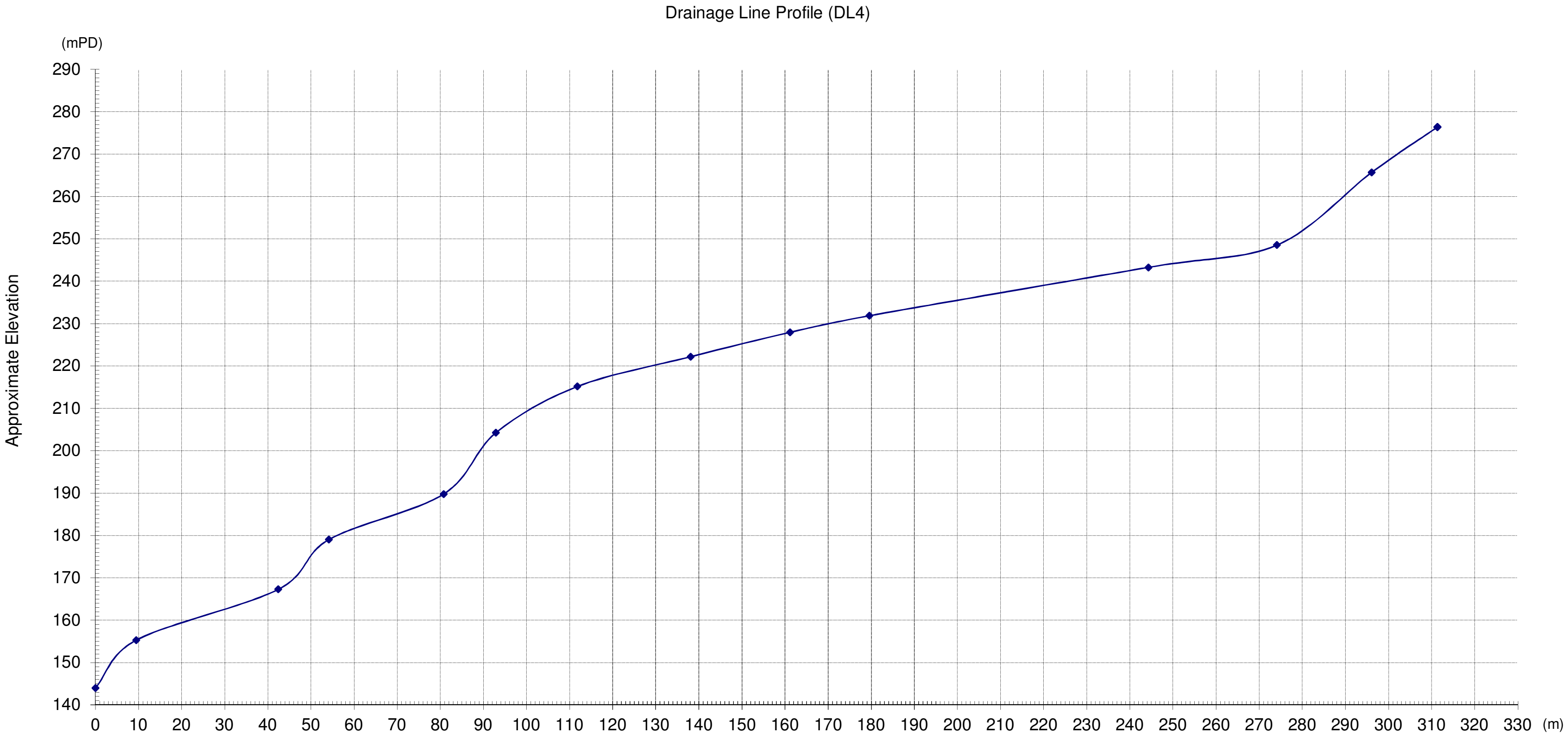
Drainage Line Profile (DL3)



FIELD RECORD

Chainage (m)	0-2.5	2.5-43.7	43.7-78.5	78.5-95.6	95.6-110.0	110.0-122.1
Section Length (m)	2.5	41.2	34.8	17.1	14.4	12.1
Channel Width (m)	3.4	4.3	5.2	2.9	2.6	3.3
Channel Depth (m)	0.7	0.7	0.6	0.6	0.5	0.5
Inclination (°)	20	35	15	20	30	25
Side Slopes Angles (°)	40,50	15,35	10,10	5,20	5,15	5,10
Channelisation Ratio	4.9	6.1	8.7	4.8	5.2	6.6
Channel Bed Materials #	Cs,Cb,R	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb
Side Slopes Materials #	Cs	Cs	Cs	Cs	Cs	Cs
Thickness of Entrainment Material (m)	0.1	0.2	0.3	0.3	0.2	0.2
Approx. Channel Shape *	H	H	H	H	H	H

F = Fill; Cb = Colluvial Boulders; Cs = Colluvium; CD = Completely Decomposed Rock; HD = Highly Decomposed Rock; R = Bedrock
* U = U-shaped; V = V-shaped; H= Half-rounded; R = Rectangular-shaped

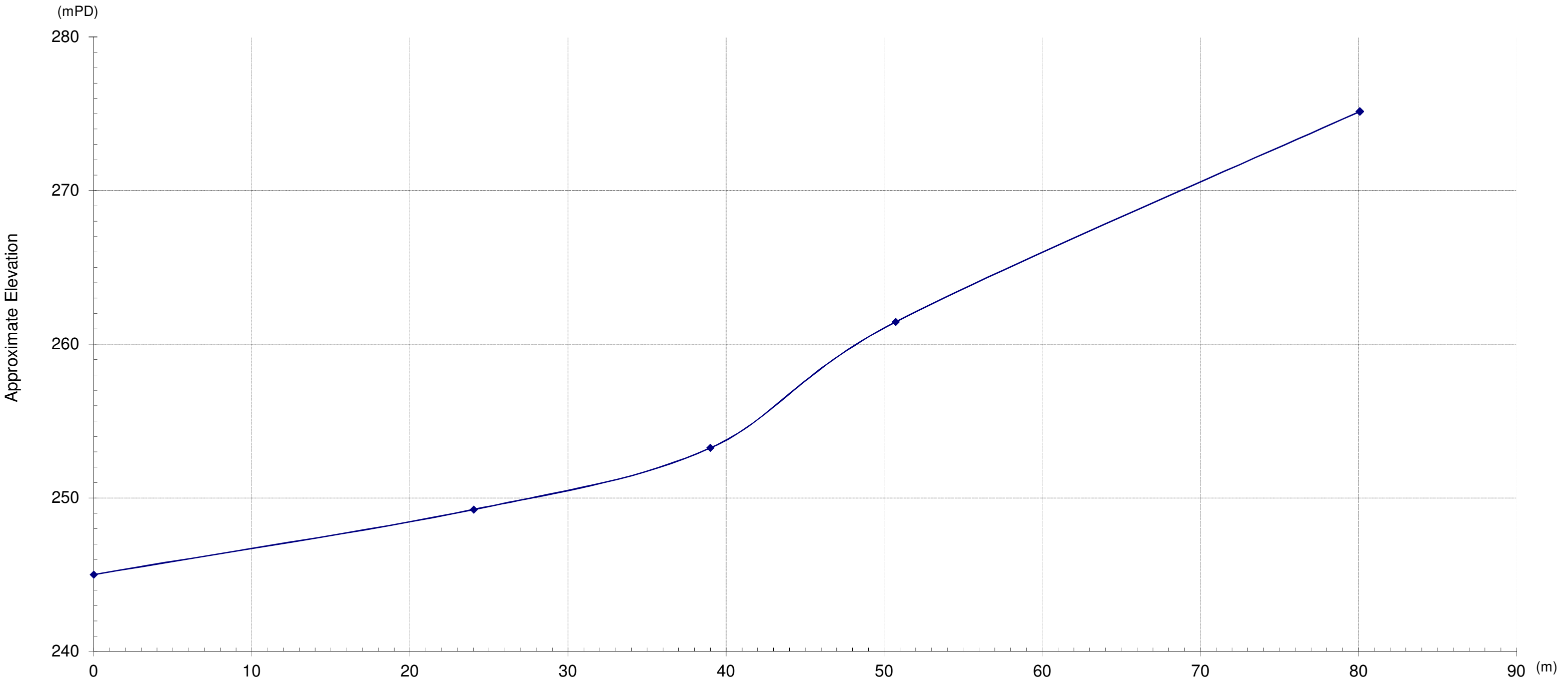


FIELD RECORD

Chainage (m)	0-14.7	14.7-49.8	49.8-66.4	66.4-95.1	95.1-114.0	114.0-135.8	135.8-163.0	163.0-186.8	186.8-205.6	205.6-271.3	271.3-301.6	301.6-329.5	329.5-348.1
Section Length (m)	14.7	35.1	16.6	28.7	18.9	21.8	27.2	23.8	18.8	65.7	30.3	27.9	18.6
Channel Width (m)	2.5	5.5	6.1	9.2	5.5	6.1	4.6	3.4	3.5	6.2	2.6	3.4	4.6
Channel Depth (m)	0.9	1.4	1.5	1.1	1.7	1.8	0.9	0.6	0.9	0.8	0.4	1.1	0.7
Inclination (°)	50	20	45	22	50	30	15	14	12	10	10	38	35
Side Slopes Angles (°)	60,60	45,20	20,15	10,5	70,30	40,35	10,15	20,20	25,15	10,25	5,5	30,45	50,10
Channelisation Ratio	2.8	3.9	4.1	8.4	3.2	3.4	5.1	5.7	3.9	7.8	6.5	3.1	6.6
Channel Bed Materials #	Cb,Cs	R,Cs	R,Cs	Cs,Cb	Cb,R	Cb,Cs	Cb,Cs	Cb,Cs	R,Cs	R,Cs	Cb,Cs	Cb,Cs	Cb,Cs
Side Slopes Materials #	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Cs
Thickness of Entrainment Material (m)	0.3	0.3	0.1	0.5	0.5	0.4	0.4	0.4	0.1	0.1	0.2	0.4	0.2
Approx. Channel Shape *	V	H	H	H	V	V	H	H	H	H	H	V	H

F = Fill; Cb = Colluvial Boulders; Cs = Colluvium; CD = Completely Decomposed Rock; HD = Highly Decomposed Rock; R = Bedrock
* U = U-shaped; V = V-shaped; H= Half-rounded; R = Rectangular-shaped

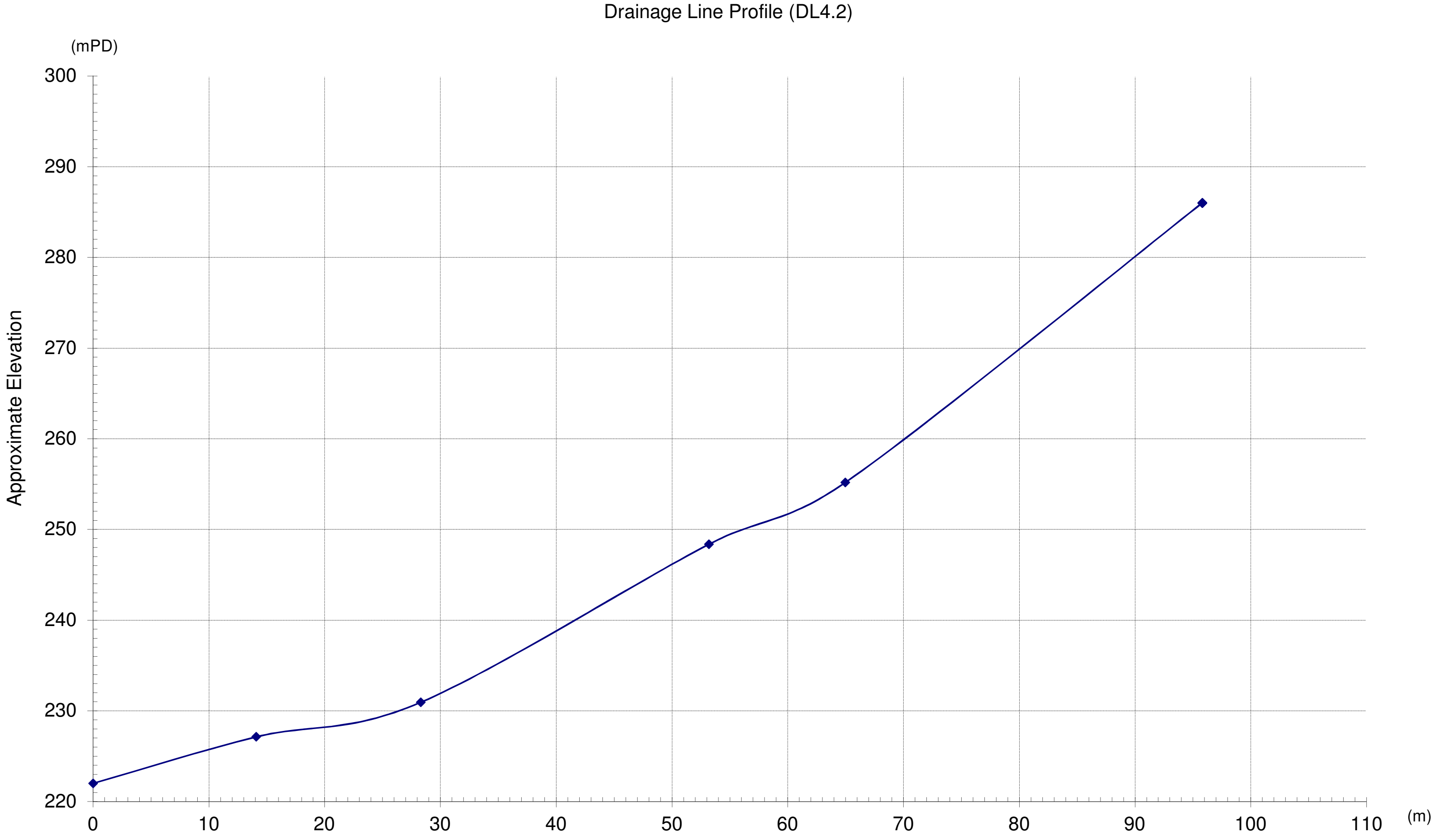
Drainage Line Profile (DL4.1)



FIELD RECORD

Chainage (m)	0-24.4	24.4-39.9	39.9-54.2	54.2-86.6
Section Length (m)	24.4	15.5	14.3	32.4
Channel Width (m)	2	2.1	4.7	3
Channel Depth (m)	0.6	0.8	1.1	0.4
Inclination (°)	10	15	35	25
Side Slopes Angles (°)	5,5	25,10	45,20	10,15
Channelisation Ratio	3.3	2.6	4.3	7.5
Channel Bed Materials #	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb
Side Slopes Materials #	Cs	Cs	Cs	Cs
Thickness of Entrainment Material (m)	0.2	0.2	0.3	0.1
Approx. Channel Shape *	H	V	H	H

F = Fill; Cb = Colluvial Boulders; Cs = Colluvium; CD = Completely Decomposed Rock; HD = Highly Decomposed Rock; R = Bedrock
* U = U-shaped; V = V-shaped; H= Half-rounded; R = Rectangular-shaped

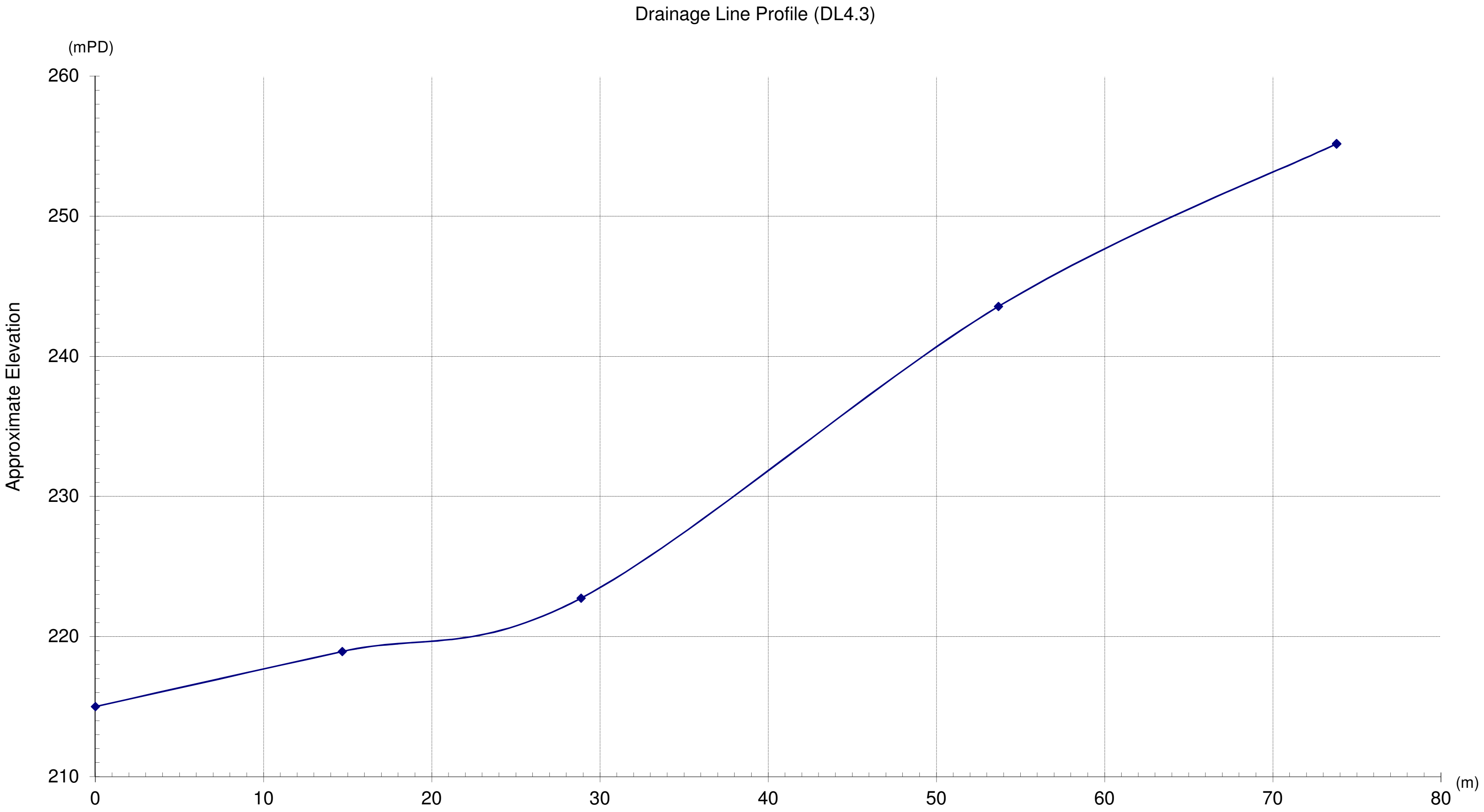


FIELD RECORD

Chainage (m)	0-15	15-29.7	29.7-60.1	60.1-73.7	73.7-117.3
Section Length (m)	15	14.7	30.4	13.6	43.6
Channel Width (m)	3.1	4.1	4.4	4.4	4.9
Channel Depth (m)	0.9	1.1	1.5	0.6	1.1
Inclination (°)	20	15	35	30	45
Side Slopes Angles (°)	20,20	10,10	40,15	15,25	55,15
Channelisation Ratio	3.4	3.7	2.9	7.3	4.5
Channel Bed Materials #	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb
Side Slopes Materials #	Cs	Cs	Cs	Cs	Cs
Thickness of Entrainment Material (m)	0.2	0.3	0.2	0.2	0.4
Approx. Channel Shape *	H	H	V	H	H

# F = Fill; Cb = Colluvial Boulders; Cs = Colluvium; CD = Completely Decomposed Rock; HD = Highly Decomposed Rock; R = Bedrock

* U = U-shaped; V = V-shaped; H= Half-rounded; R = Rectangular-shaped

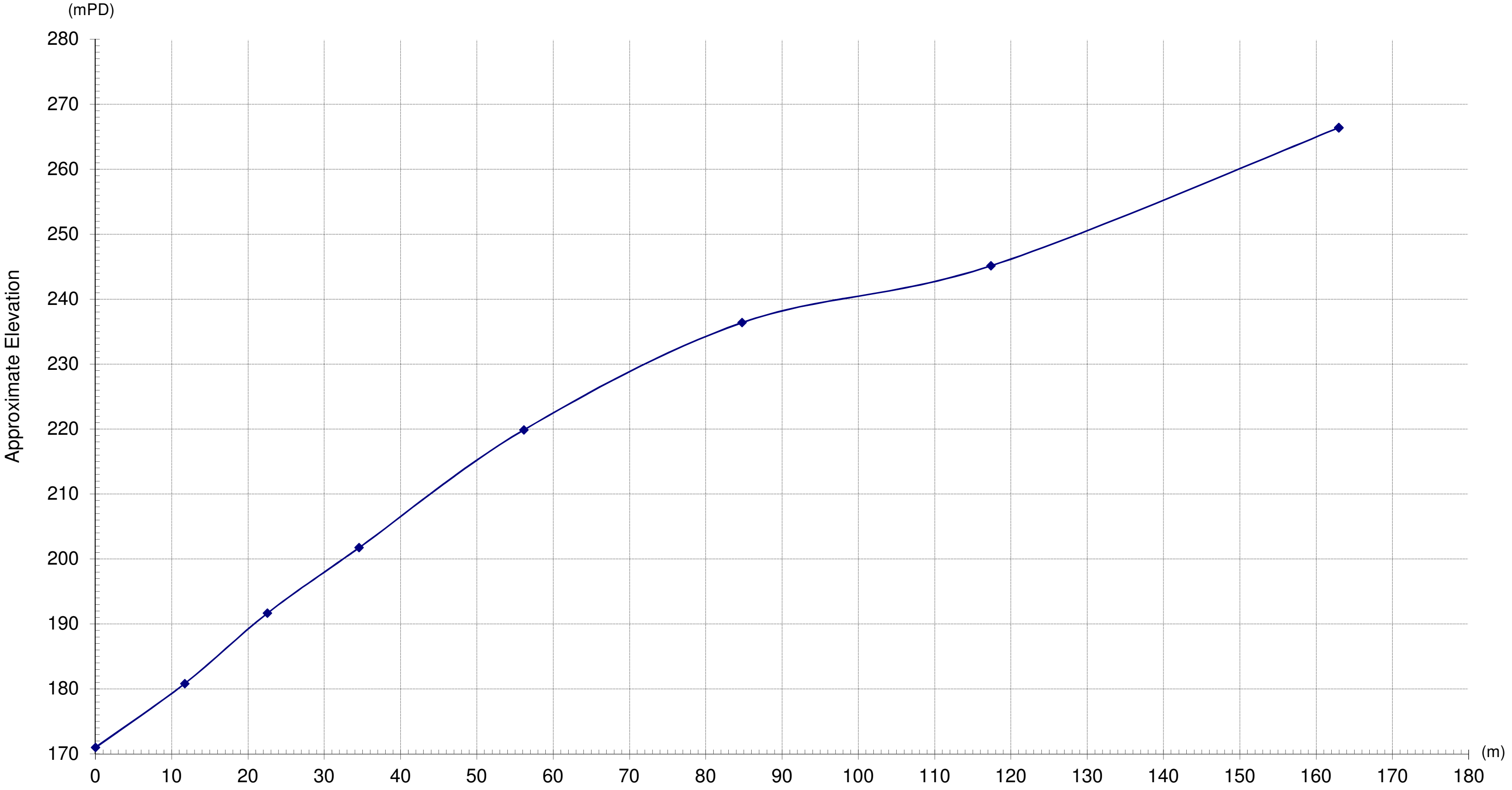


FIELD RECORD

Chainage (m)	0-15.2	15.2-29.9	29.9-62.3	62.3-85.5
Section Length (m)	15.2	14.7	32.4	23.2
Channel Width (m)	2	2.7	5	3.3
Channel Depth (m)	0.8	0.5	1.4	0.6
Inclination (°)	15	15	40	30
Side Slopes Angles (°)	80,5	20,5	60,15	30,10
Channelisation Ratio	2.5	5.4	3.6	5.5
Channel Bed Materials #	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb
Side Slopes Materials #	Cs	Cs	Cs	Cs
Thickness of Entrainment Material (m)	0.2	0.1	0.3	0.1
Approx. Channel Shape *	V	H	H	H

F = Fill; Cb = Colluvial Boulders; Cs = Colluvium; CD = Completely Decomposed Rock; HD = Highly Decomposed Rock; R = Bedrock
* U = U-shaped; V = V-shaped; H= Half-rounded; R = Rectangular-shaped

Drainage Line Profile (DL4.4)

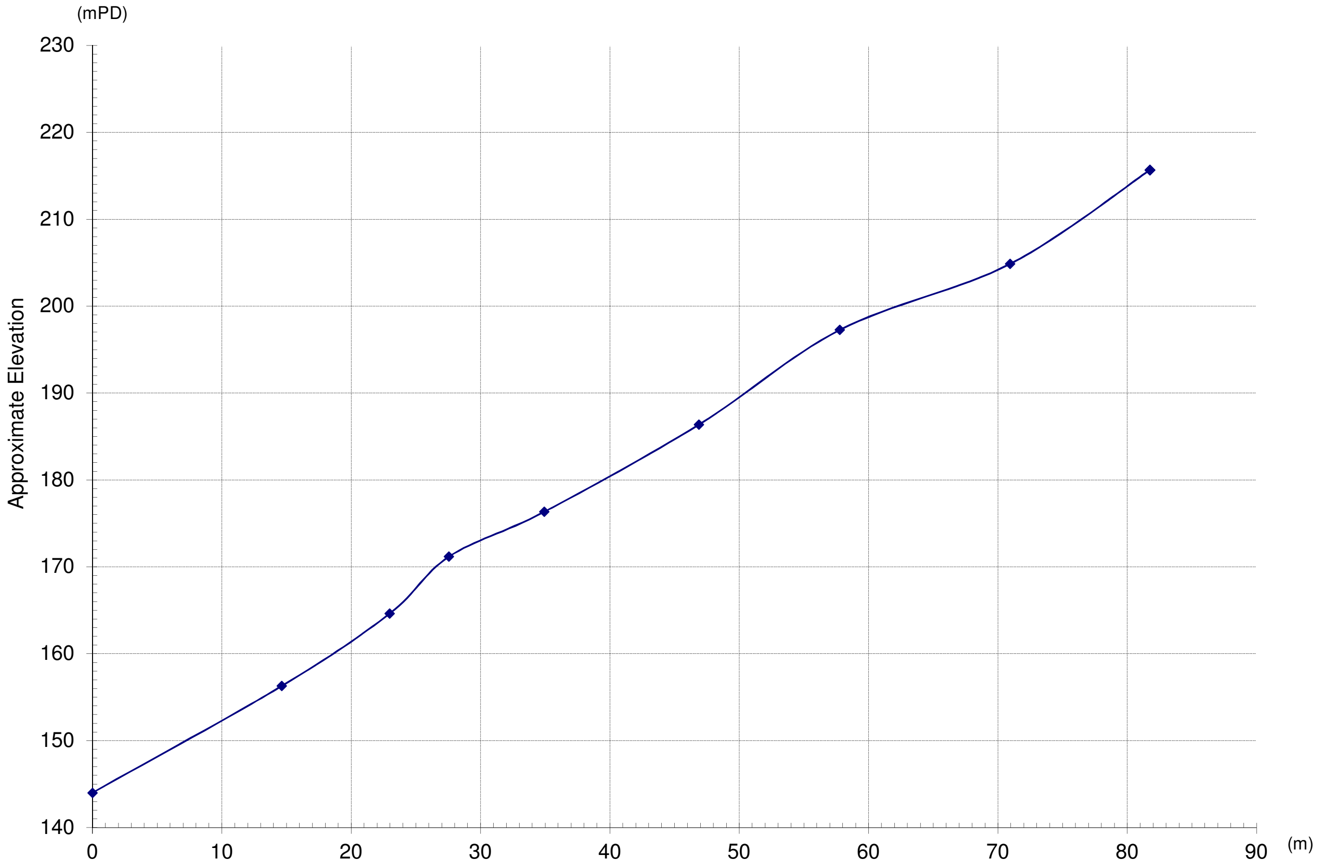


FIELD RECORD

Chainage (m)	0-15.3	15.3-30.6	30.6-46.3	46.3-74.5	74.5-107.5	107.5-141.3	141.3-191.6
Section Length (m)	15.3	15.3	15.7	28.2	33	33.8	50.3
Channel Width (m)	4.7	4.7	8.5	4.4	3.6	3.9	2.4
Channel Depth (m)	1.1	2.2	2.2	1.6	1.1	0.4	0.5
Inclination (°)	40	45	40	40	30	15	25
Side Slopes Angles (°)	85,45	75,10	75,5	75,5	30,35	5,5	5,5
Channelisation Ratio	4.3	2.1	3.9	2.8	3.3	9.8	4.8
Channel Bed Materials #	Cs,Cb,R	Cs,R	Cs,Cb	R,Cb,Cs	Cs	Cs,Cb	Cs,Cb
Side Slopes Materials #	R,Cb	R,Cs	Cs	R,Cs	Cs	Cs	Cs
Thickness of Entrainment Material (m)	0.1	0.3	0.5	0.2	0.2	0.1	0.1
Approx. Channel Shape *	H	H	H	H	H	H	H

F = Fill; Cb = Colluvial Boulders; Cs = Colluvium; CD = Completely Decomposed Rock; HD = Highly Decomposed Rock; R = Bedrock
* U = U-shaped; V = V-shaped; H= Half-rounded; R = Rectangular-shaped

Drainage Line Profile (DL4.5)



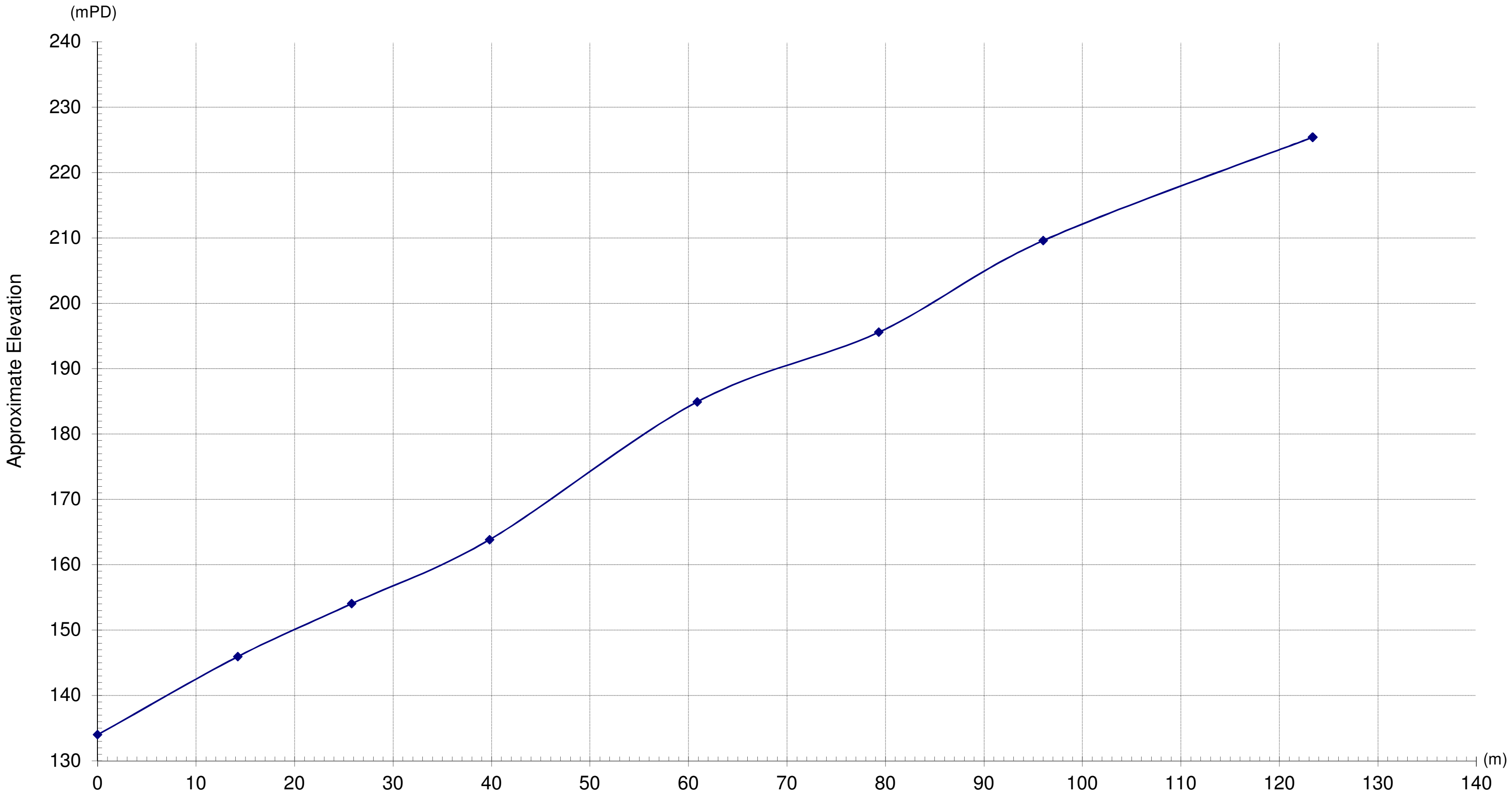
FIELD RECORD

Chainage (m)	0-19.1	19.1-30.9	30.9-38.9	38.9-47.9	47.9-63.5	63.5-78.9	78.9-94.1	94.1-109.4
Section Length (m)	19.1	11.8	8	9	15.6	15.4	15.2	15.3
Channel Width (m)	7.7	6.4	5.9	4.7	8.3	4.3	5.7	5.4
Channel Depth (m)	1.6	1.4	0.9	0.8	1	0.6	0.6	0.6
Inclination (°)	40	45	55	35	40	45	30	45
Side Slopes Angles (°)	45,50	35,45	25,40	20,35	45,30	10,25	20,20	10,15
Channelisation Ratio	4.8	4.6	6.6	5.9	8.3	7.2	9.5	9.0
Channel Bed Materials #	Cs,Cb	Cs,Cb,R	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb
Side Slopes Materials #	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Cs
Thickness of Entrainment Material (m)	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.2
Approx. Channel Shape *	H	H	H	H	H	H	H	H

F = Fill; Cb = Colluvial Boulders; Cs = Colluvium; CD = Completely Decomposed Rock; HD = Highly Decomposed Rock; R = Bedrock

* U = U-shaped; V = V-shaped; H= Half-rounded; R = Rectangular-shaped

Drainage Line Profile (DL5)



FIELD RECORD

Chainage (m)	0-18.6	18.6-32.7	32.7-49.8	49.8-79.6	79.6-100.9	100.9-122.7	122.7-154.3
Section Length (m)	18.6	14.1	17.1	29.8	21.3	21.8	31.6
Channel Width (m)	4	8.3	7.1	7.9	7.4	7	8
Channel Depth (m)	1	1.1	1.5	0.9	0.8	0.8	0.8
Inclination (°)	40	35	35	45	30	40	30
Side Slopes Angles (°)	35,20	20,10	60,15	40,15	15,10	10,20	10,15
Channelisation Ratio	4.0	7.5	4.7	8.8	9.3	8.8	10.0
Channel Bed Materials #	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb	Cs,Cb
Side Slopes Materials #	Cs	Cs	Cs	Cs	Cs	Cs	Cs
Thickness of Entrainment Material (m)	0.4	0.4	0.6	0.5	0.5	0.4	0.3
Approx. Channel Shape *	H	H	H	H	H	H	H

F = Fill; Cb = Colluvial Boulders; Cs = Colluvium; CD = Completely Decomposed Rock; HD = Highly Decomposed Rock; R = Bedrock

* U = U-shaped; V = V-shaped; H= Half-rounded; R = Rectangular-shaped

Appendix D

Debris Mobility Modelling

D1. Introduction

The debris mobility assessment for the NTSA was performed by a computer programme, DAN-W developed by O. Hungr Geotechnical Research Inc.

D2. Debris mobility analysis for the NTSA

D2.1 Credible runout paths

Based on the location of probable landslide source area, 18 steepest paths (credible debris runout paths, RP1 – RP18) are generated from the topographic map using ArcGIS (Figure D1).

D2.2 Input parameters

The initial source volume is based on the Design Event Source Volume = 40m^3. The width of the modelled landslide mass is assumed to be about 10 m by reference to the landslide data obtained from landslide records within and in the vicinity of the NTSA and also the widths of the topographic depressions and drainage lines were based on field mapping. The input parameters for the analysis are summarized below table:

Input parameters	Value	Remark & References
Rheological Model	Friction (For OHL)	GEO Report No.104, TGN 34
	Voellmy (For DF)	TGN 38
	Voellmy (For CDF)	GEO Report No.104 , TGN 29
Apparent Angle of Friction	25° (For OHL)	TGN34
	18° (For DF)	TGN38
	11° (For CDF)	GEO Report No.104, TGN 29
Turbulence Coefficient	1000m/s^2 (For DF)	TGN38
	500m/s^2 (For CDF)	GEO Report No. 104
Unit Weight of Debris	22kN/m^3	Based on DN 1/2012, assuming debris will comprise colluvium and residual soil

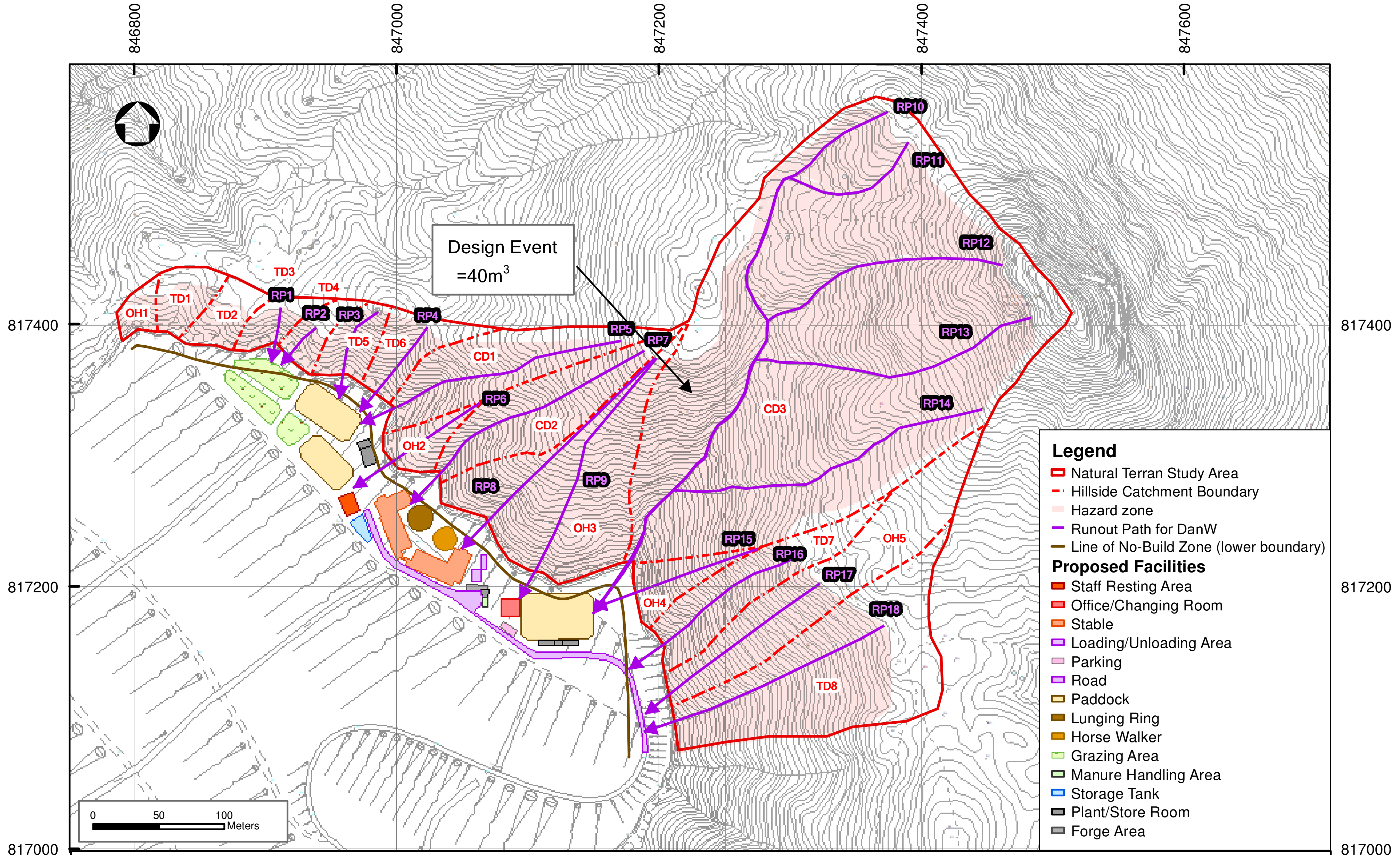
D3. Result of the analysis

Results of the analysis is shown in Figure D2 to D30 and summarized in below table:

Terrain Unit	Catchment No.	Runout Path No.	Source Volume (m^3)	Analytical Model	Final Volume (m^3)	Entrainment Volume (m^3)	Travel Distance (m)	Landslide Debris Reaching the Proposed Facilities
Middle slope	TD3	RP1	40.24	Friction & Voellmy	40.24	-	11.58	No
	TD4	RP2	40.41	Friction & Voellmy	40.41	-	27.02	No
	TD5	RP3	40.63	Friction & Voellmy	40.63	-	53.78	No
	TD6	RP4 (Case 1)	40.55	Friction & Voellmy	40.55	-	13.92	No
		RP4 (Case 2)	40.34	Friction & Voellmy	40.34	-	35.46	No
	CD1	RP5 (Case 1)	40.84	Friction & Voellmy	40.84	-	25.16	No
		RP5 (Case 2)	40.22	Friction & Voellmy	107.11	66.89	114.16	No
	OH2	RP6 (Case 1)	40.90	Friction	40.90	-	27.63	No
		RP6 (Case 2)	40.87	Friction	40.87	-	4.75	No
	CD2	RP7 (Case 1)	40.43	Friction & Voellmy	40.43	-	5.74	No
		RP7 (Case 2)	40.50	Friction & Voellmy	143.05	102.55	117.90	No
	OH3	RP8 (Case 1)	40.65	Friction	40.65	-	2.45	No
		RP8 (Case 2)	40.26	Friction	40.26	-	46.01	No
		RP9 (Case 1)	40.27	Friction	40.27	-	75.2	No
		RP9 (Case 2)	40.18	Friction	40.18	-	34.95	No
	CD3	RP10 (Case 1)	40.58	Friction & Voellmy	106.83	66.25	95.63	No

		RP10 (Case 2)	40.14	Friction & Voellmy	43.68	-	7.07	No
		RP11 (Case 1)	40.50	Friction & Voellmy	41.00	0.5	35.35	No
		RP11 (Case 2)	40.10	Friction & Voellmy	382.83	342.73	154.81	No
		RP12 (Case 1)	40.07	Friction & Voellmy	517.11	477.04	402.06	No
		RP12 (Case 2)	40.34	Friction & Voellmy	196.99	156.65	140.64	No
		RP13 (Case 1)	40.51	Friction & Voellmy	40.51	-	104.65	No
		RP13 (Case 2)	40.81	Friction & Voellmy	96.65	55.84	67.08	No
		RP14 (Case 1)	40.88	Friction & Voellmy	41.54	-	89.85	No
		RP14 (Case 2)	40.17	Friction & Voellmy	272.87	232.70	193.52	No
	OH4	RP15	40.67	Friction	40.67	-	100.87	No
	TD7	RP16	40.28	Friction & Voellmy	321.11	280.83	129.70	No
	OH5	RP17	40.89	Friction	40.89	-	135.74	No
	TD8	RP18	40.61	Friction & Voellmy	434.97	394.36	180.95	No

The result indicated that the modelled landslide debris on the all credible flow paths for all catchments would not reach the proposed facilities. Volume of the Potential entrainment materials along the biggest CD catchment CD3 is estimated in the range between 7.07m^3 and 402.06m^3. Most of the modelled landslide debris would either be deposited at the shallow hillsides or retained at the concrete catchwater channel at the toe of the NTSA.



846800
847000
847200
847400
847600
817400
817200
817000
Design Event
=40m3
RP1
RP2
RP3
RP4
RP5
RP6
RP7
RP8
RP9
RP10
RP11
RP12
RP13
RP14
RP15
RP16
RP17
RP18
OH1
OH2
OH3
OH4
OH5
TD1
TD2
TD3
TD4
TD5
TD6
TD7
TD8
CD1
CD2
CD3
0
50
100
Meters
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Hazard zone
Runout Path for DanW
Line of No-Build Zone (lower boundary)
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

TITLE: Runout Paths for Debris Mobility Analysis

SCALE:
1 :4000

Modern Consulting Engineers Limited
In association with
CALVINT GEO-SERVICES LIMITED

FIGURE NO :
FIGURE D1

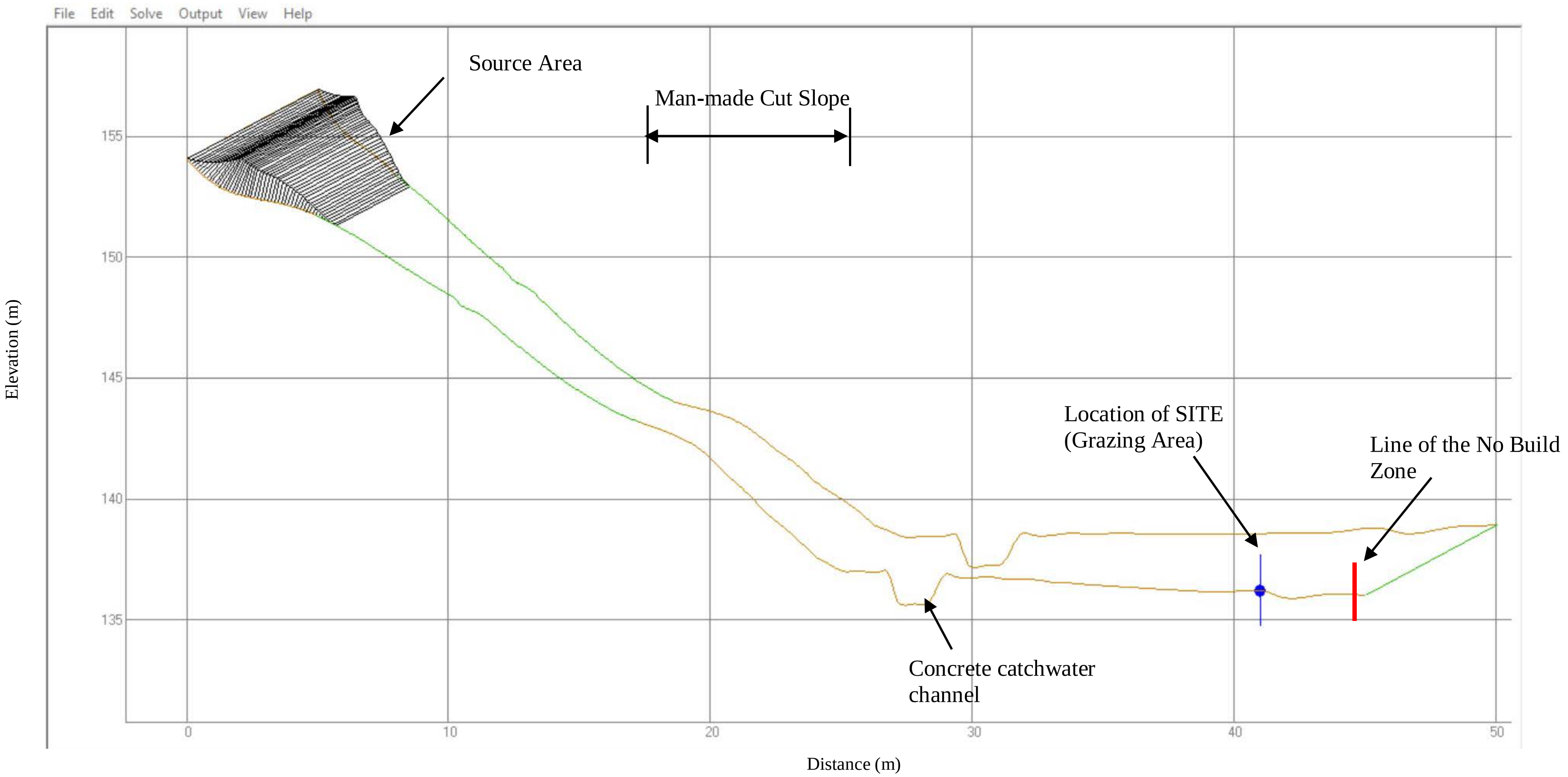
Debris Mobility Analysis for the Credible Runout Path RP1 within Catchment No. TD3

Landslide Type = DF

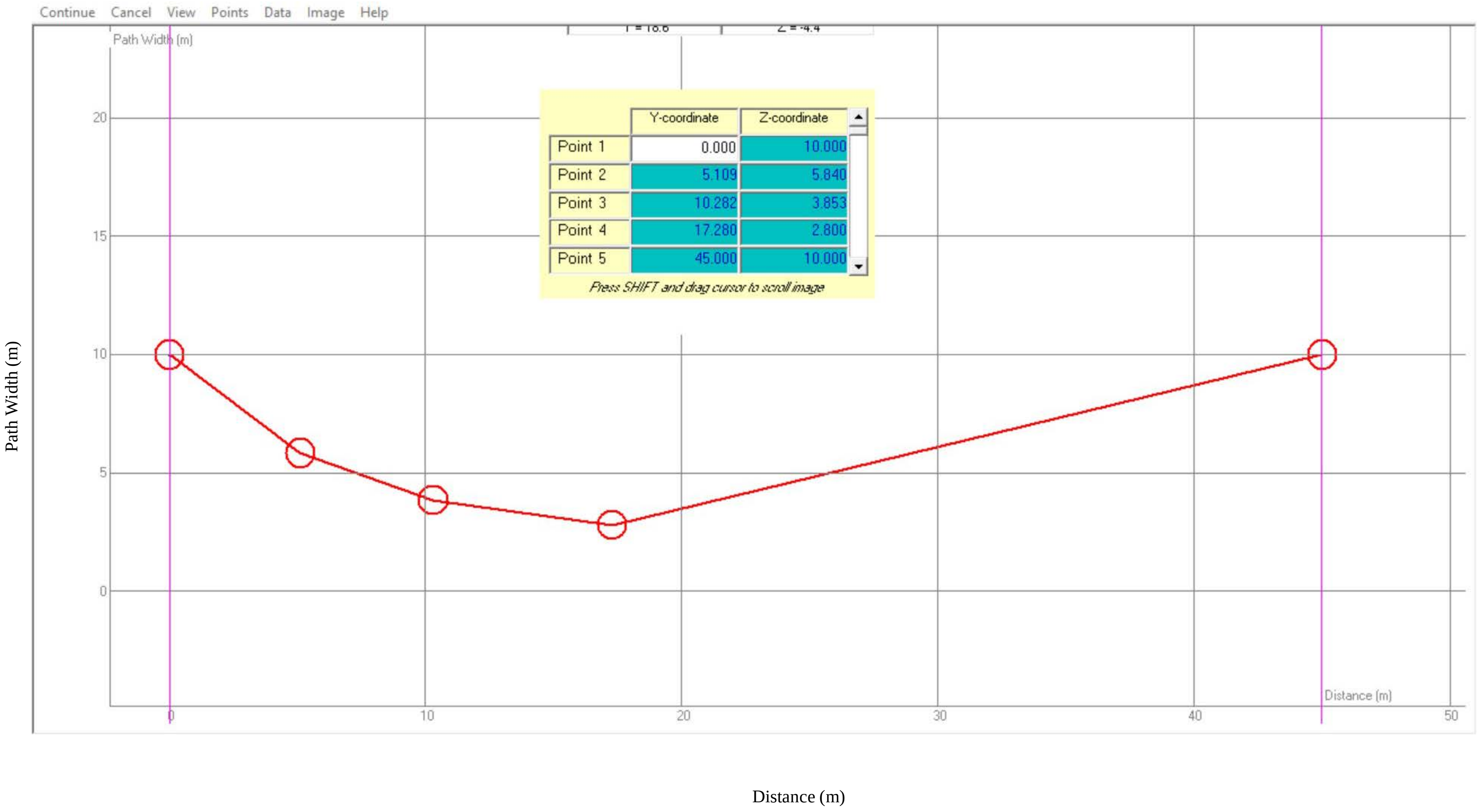
Design Source Volume = 40m^3

Figure D2

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
20
15
10
5
0
Distance (m)
0
10
20
30
40
50
Path Width (m)
Distance (m)

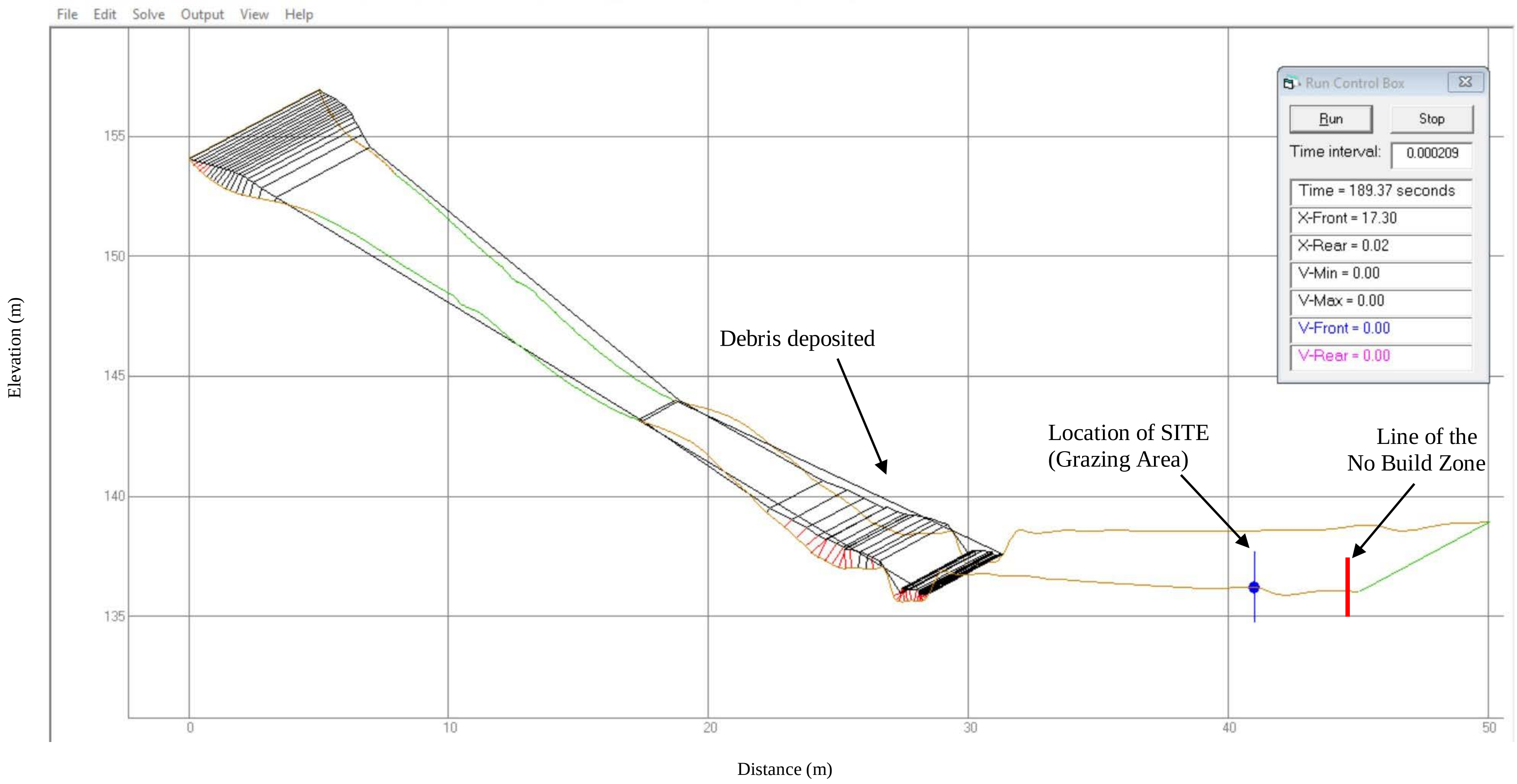
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	5.109	5.840
Point 3	10.282	3.853
Point 4	17.280	2.800
Point 5	45.000	10.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.24	40.24	11.58	No

Section Profile – (post-sliding)

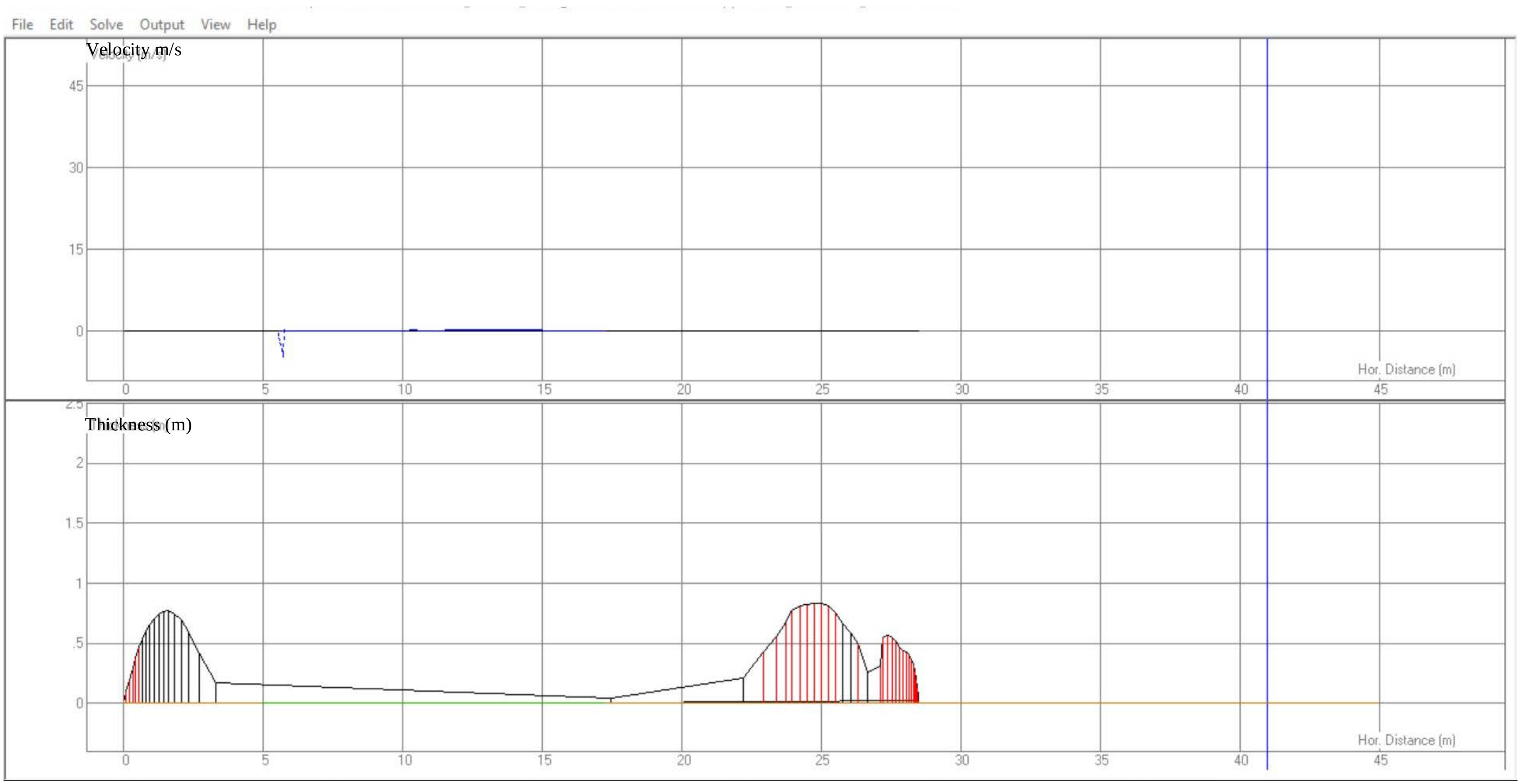

File Edit Solve Output View Help
Run Control Box
Run
Stop
Elevation (m)
155
150
145
140
135
0
10
20
30
40
50
Distance (m)

Time interval: 0.000209
Time = 189.37 seconds
X-Front = 17.30
X-Rear = 0.02
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00

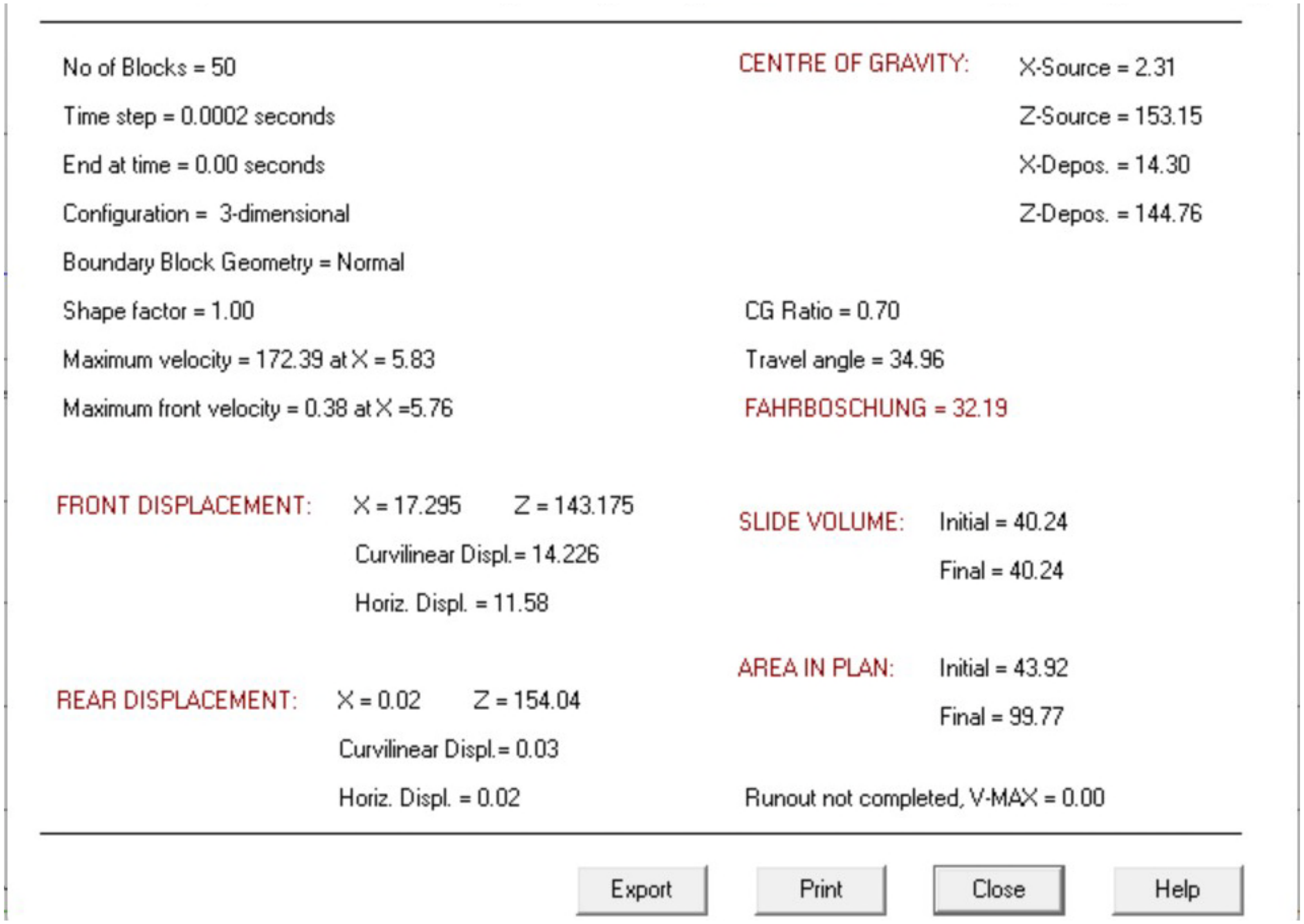
Debris deposited

Location of SITE (Grazing Area)

Line of the No Build Zone


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
5
10
15
20
25
30
35
40
45
Thickness (m)
2.5
2
1.5
1
.5
0
Hor. Distance (m)
0
5
10
15
20
25
30
35
40
45

Distance (m)



No of Blocks = 50
Time step = 0.0002 seconds
End at time = 0.00 seconds
Configuration = 3-dimensional
Boundary Block Geometry = Normal
Shape factor = 1.00
Maximum velocity = 172.39 at X = 5.83
Maximum front velocity = 0.38 at X =5.76

FRONT DISPLACEMENT: X = 17.295 Z = 143.175
Curvilinear Displ.= 14.226
Horiz. Displ. = 11.58

REAR DISPLACEMENT: X = 0.02 Z = 154.04
Curvilinear Displ.= 0.03
Horiz. Displ. = 0.02

CENTRE OF GRAVITY: X-Source = 2.31
Z-Source = 153.15
X-Depos. = 14.30
Z-Depos. = 144.76

CG Ratio = 0.70
Travel angle = 34.96
FAHRBOSCHUNG = 32.19

SLIDE VOLUME: Initial = 40.24
Final = 40.24

AREA IN PLAN: Initial = 43.92
Final = 99.77

Runout not completed, V-MAX = 0.00

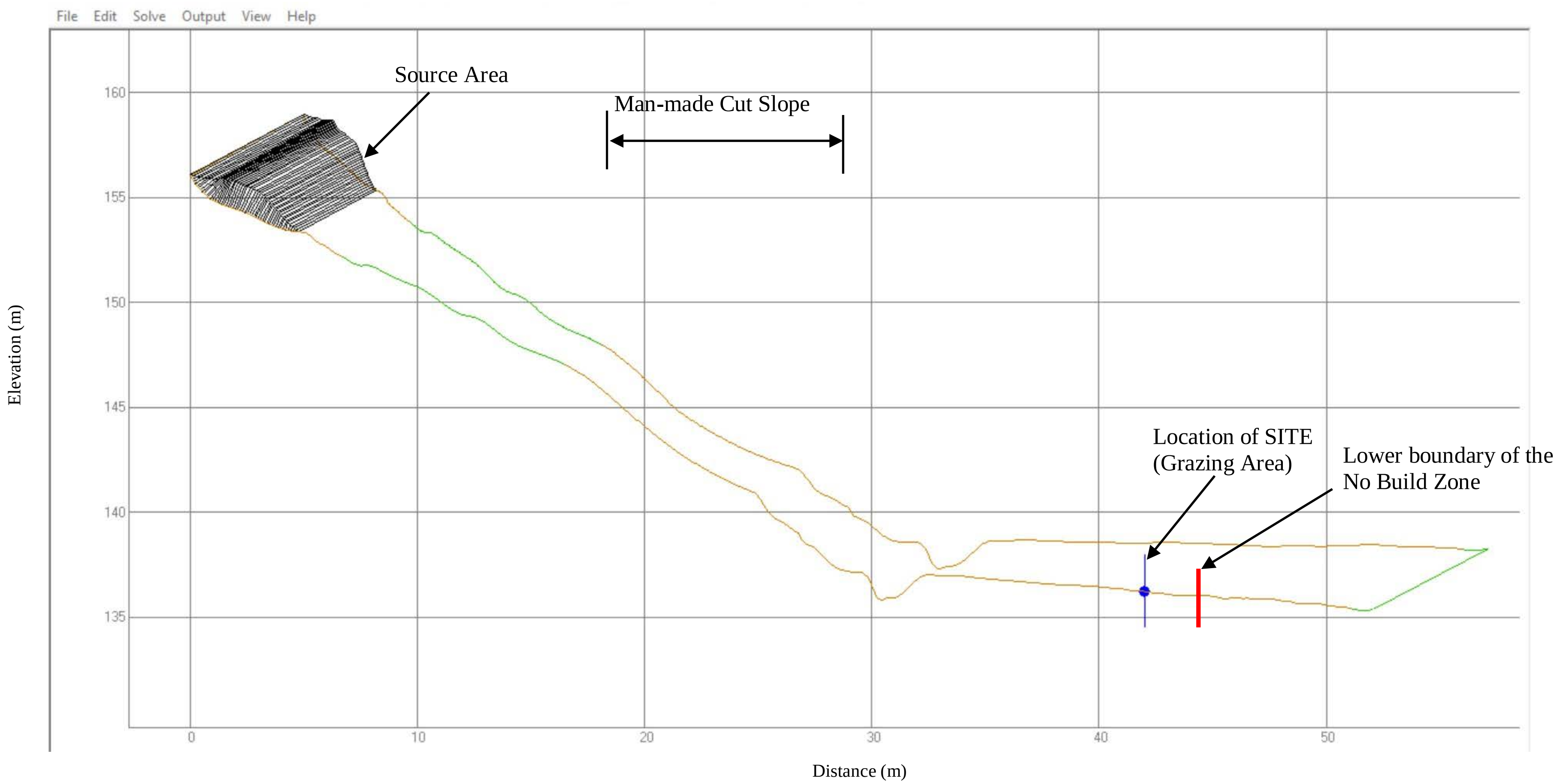
Debris Mobility Analysis for the Credible Runout Path RP2 within Catchment No. TD4

Landslide Type = DF

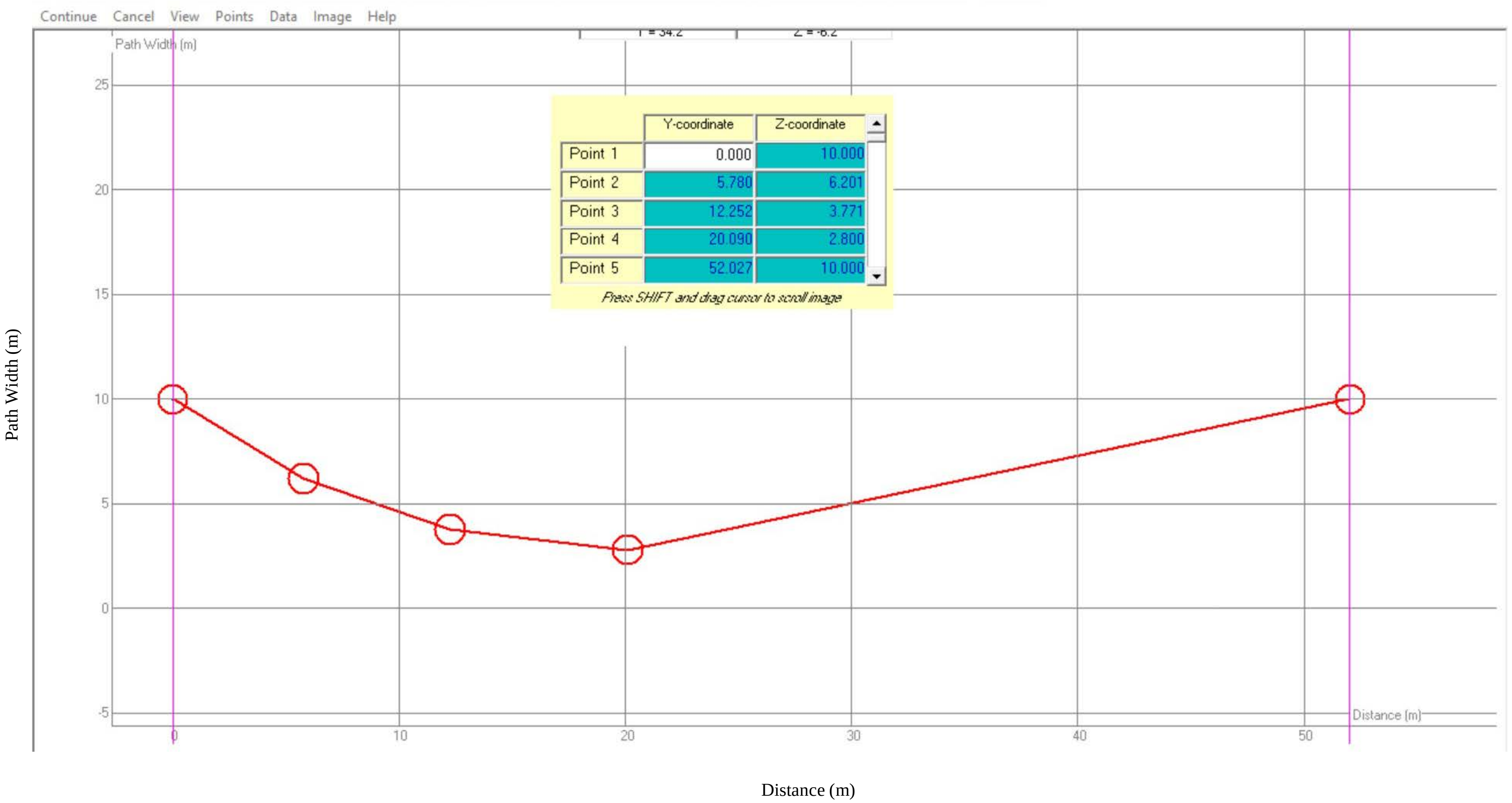
Design Source Volume = 40m^3

Figure D3

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
25
20
15
10
5
0
-5
0
10
20
30
40
50
Distance (m)
Path Width (m)
Distance (m)

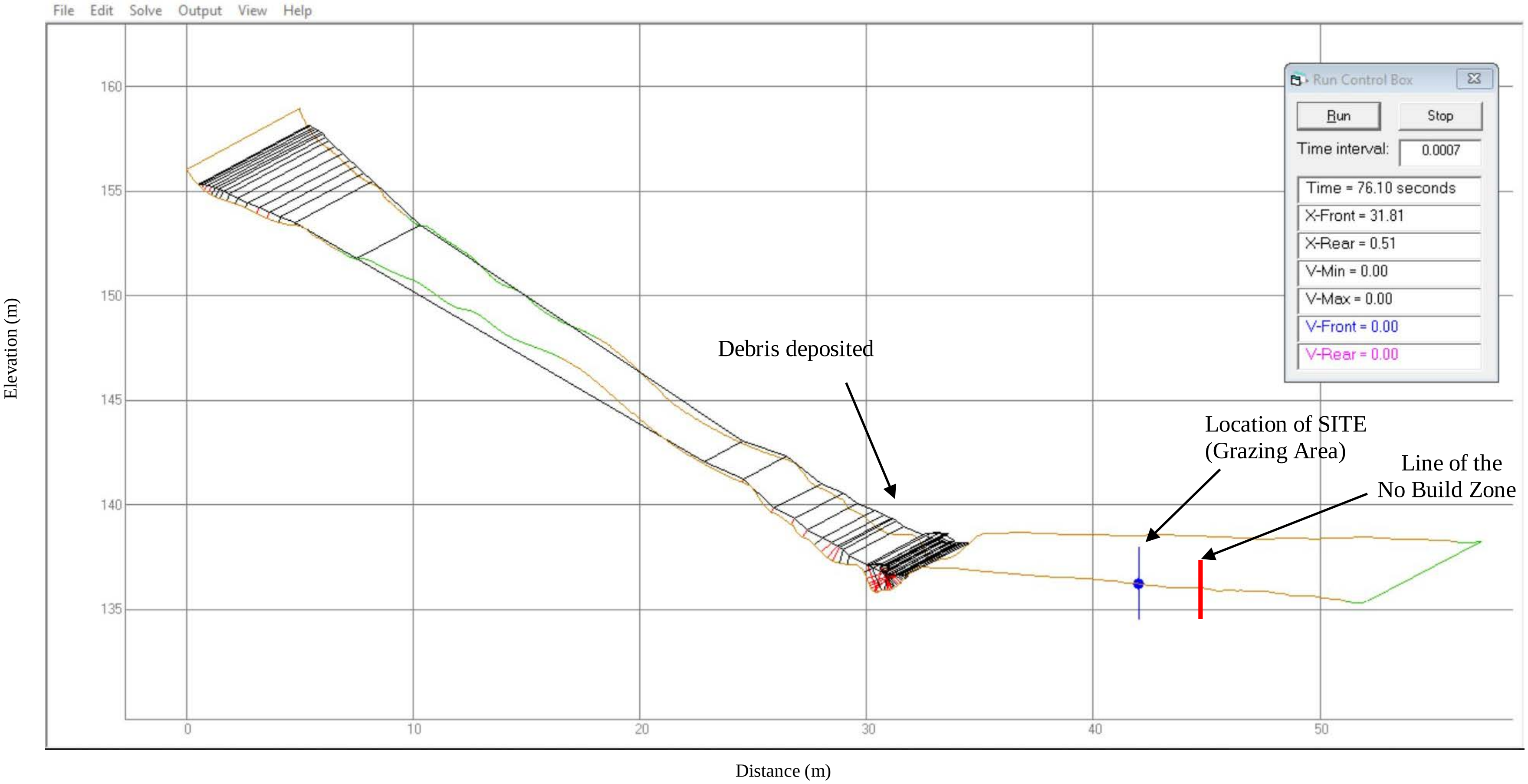
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	5.780	6.201
Point 3	12.252	3.771
Point 4	20.090	2.800
Point 5	52.027	10.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

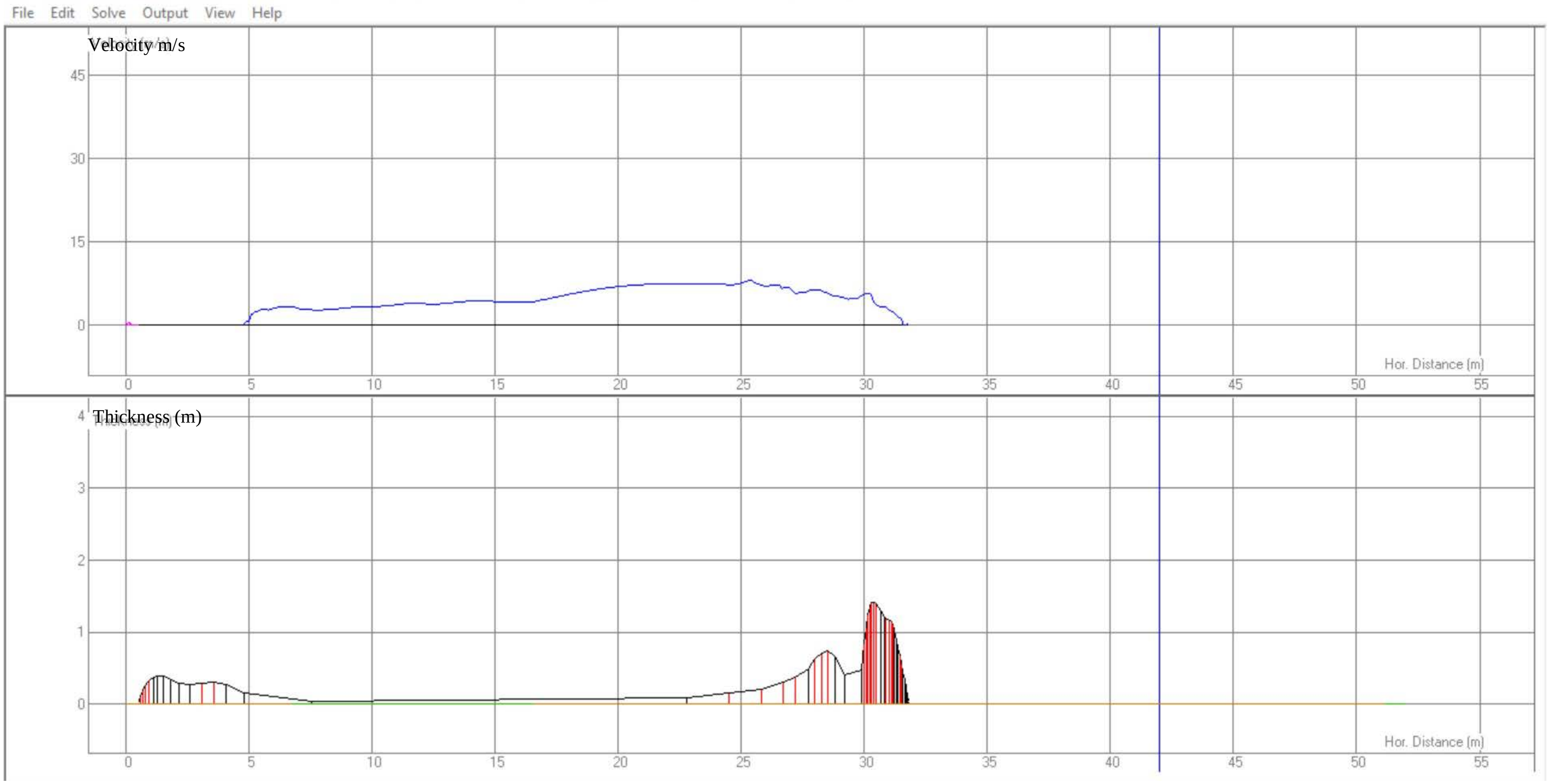
Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.41	40.41	27.02	No

Section Profile – (post-sliding)

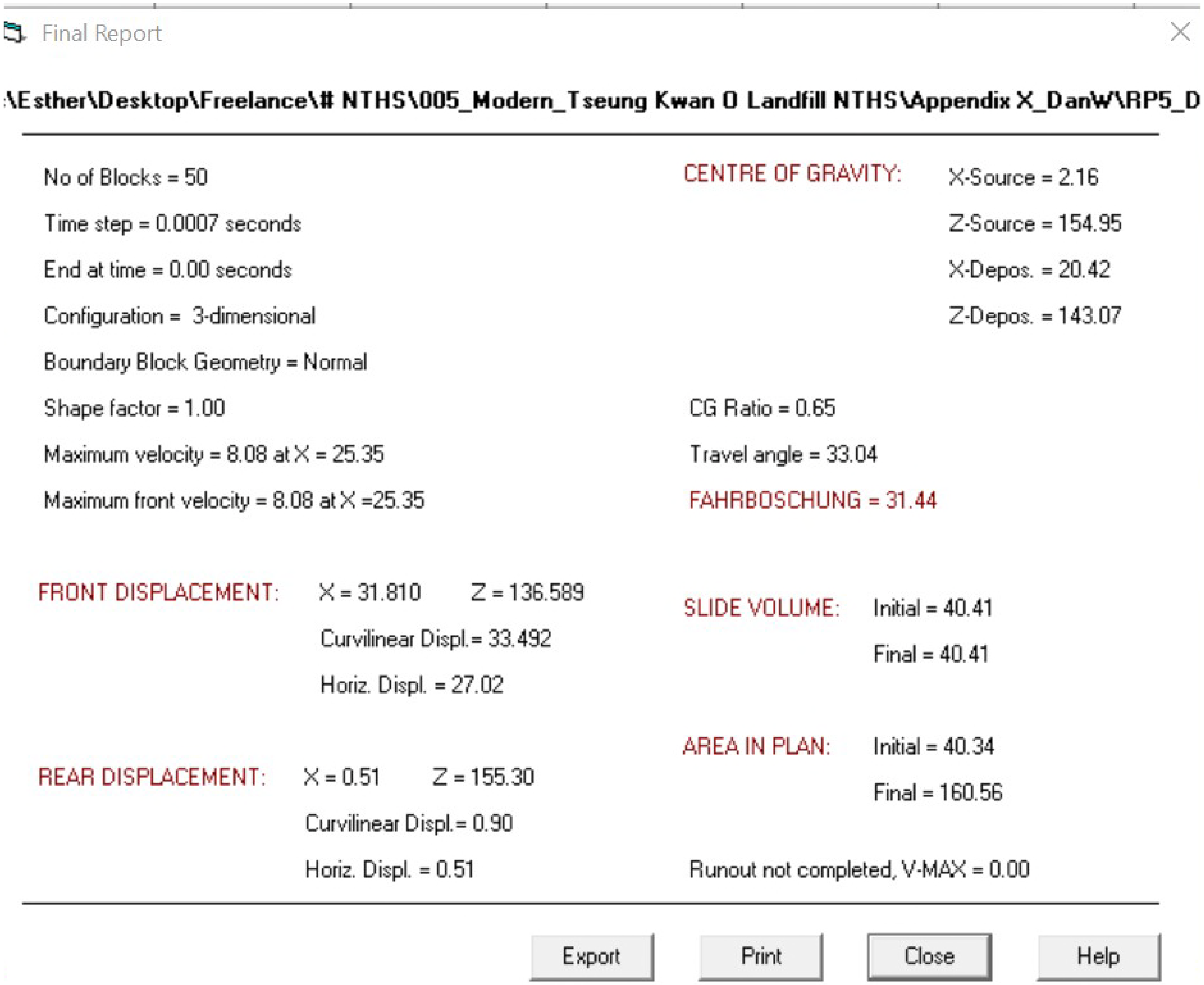

File
Edit
Solve
Output
View
Help
160
155
150
145
140
135
0
10
20
30
40
50
Elevation (m)
Distance (m)
Debris deposited
Location of SITE (Grazing Area)
Line of the No Build Zone
Run Control Box
Run
Stop

Time interval: 0.0007

```
Time = 76.10 seconds
X-Front = 31.81
X-Rear = 0.51
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00
```


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
5
10
15
20
25
30
35
40
45
50
55
Thickness (m)
4
3
2
1
0
Hor. Distance (m)
0
5
10
15
20
25
30
35
40
45
50
55

Distance (m)



\Esther\Desktop\Freelance\# NTHS\005_Modern_Tseung Kwan O Landfill NTHS\Appendix X_DanW\RP5_D

No of Blocks = 50
Time step = 0.0007 seconds
End at time = 0.00 seconds
Configuration = 3-dimensional
Boundary Block Geometry = Normal
Shape factor = 1.00
Maximum velocity = 8.08 at X = 25.35
Maximum front velocity = 8.08 at X =25.35

CENTRE OF GRAVITY:
X-Source = 2.16
Z-Source = 154.95
X-Depos. = 20.42
Z-Depos. = 143.07

CG Ratio = 0.65
Travel angle = 33.04
FAHRBOSCHUNG = 31.44

FRONT DISPLACEMENT: X = 31.810 Z = 136.589
Curvilinear Displ.= 33.492
Horiz. Displ. = 27.02

REAR DISPLACEMENT: X = 0.51 Z = 155.30
Curvilinear Displ.= 0.90
Horiz. Displ. = 0.51

SLIDE VOLUME:
Initial = 40.41
Final = 40.41

AREA IN PLAN:
Initial = 40.34
Final = 160.56

Runout not completed, V-MAX = 0.00

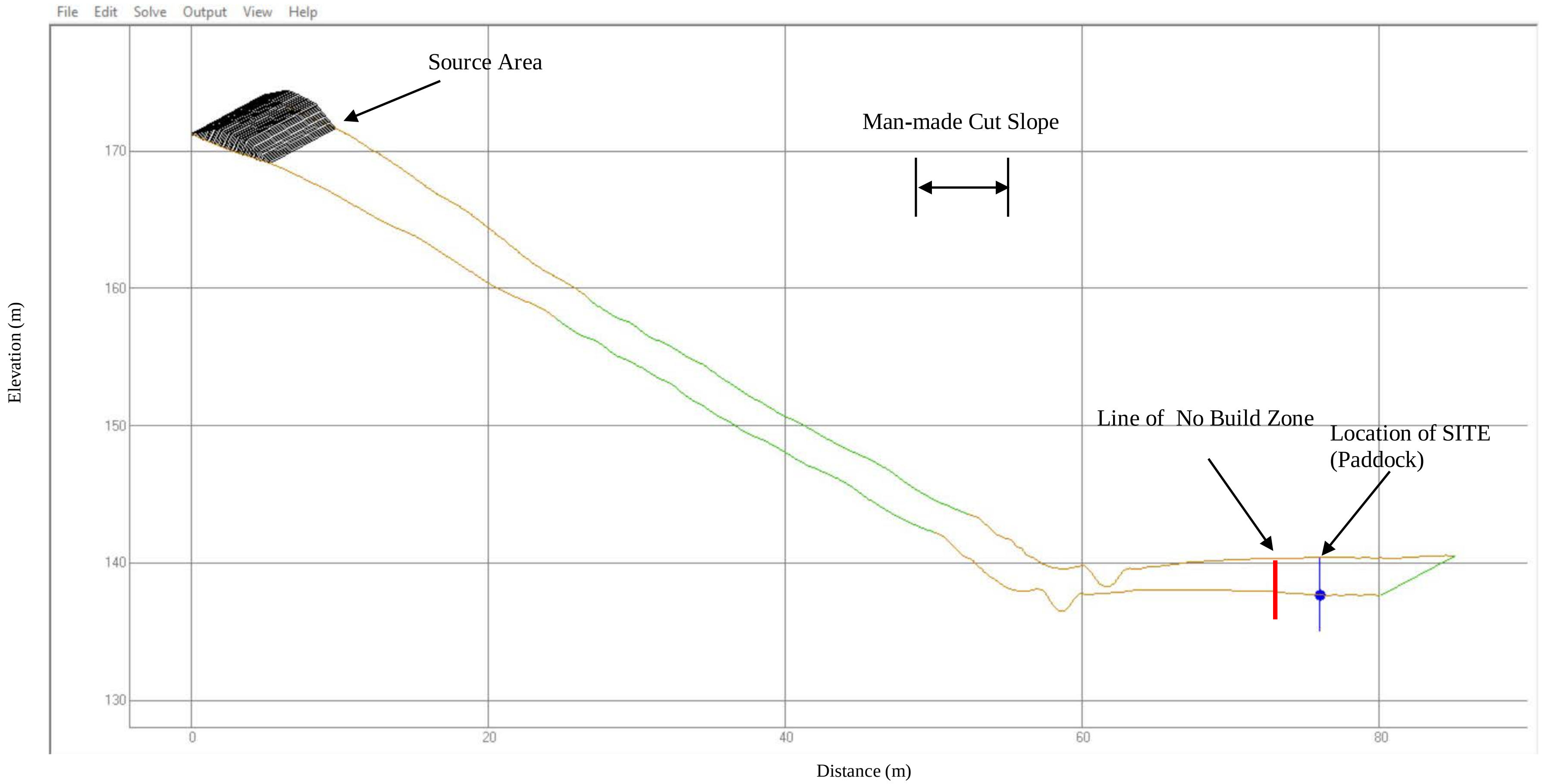
Debris Mobility Analysis for the Credible Runout Path RP3 within Catchment No. TD5

Landslide Type = DF

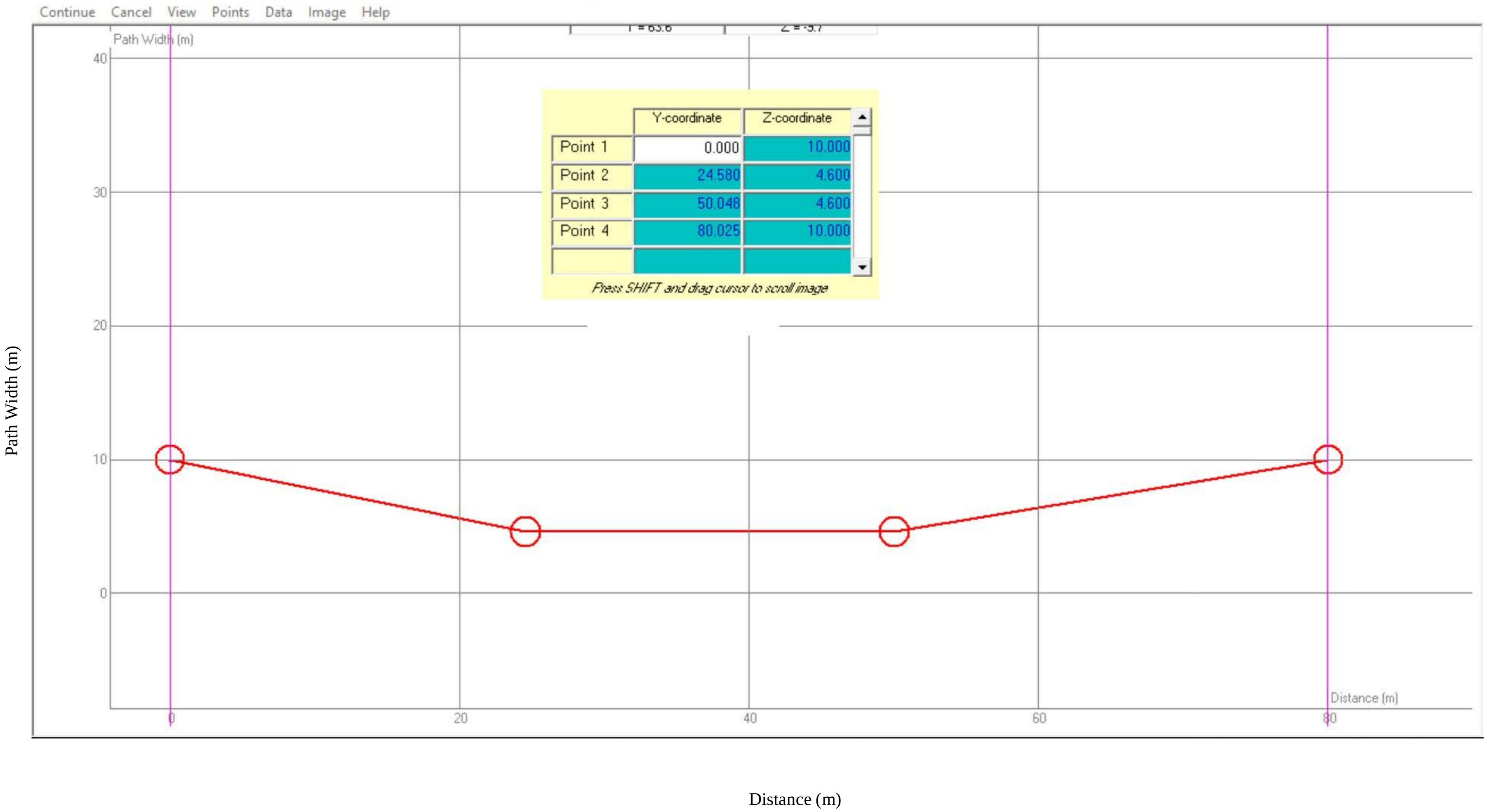
Design Source Volume = 40m^3

Figure D4

Section Profile – (pre-sliding)


File Edit Solve Output View Help
Source Area
Man-made Cut Slope
Line of No Build Zone
Location of SITE (Paddock)
170
160
150
140
130
0
20
40
60
80
Elevation (m)
Distance (m)

Width Profile

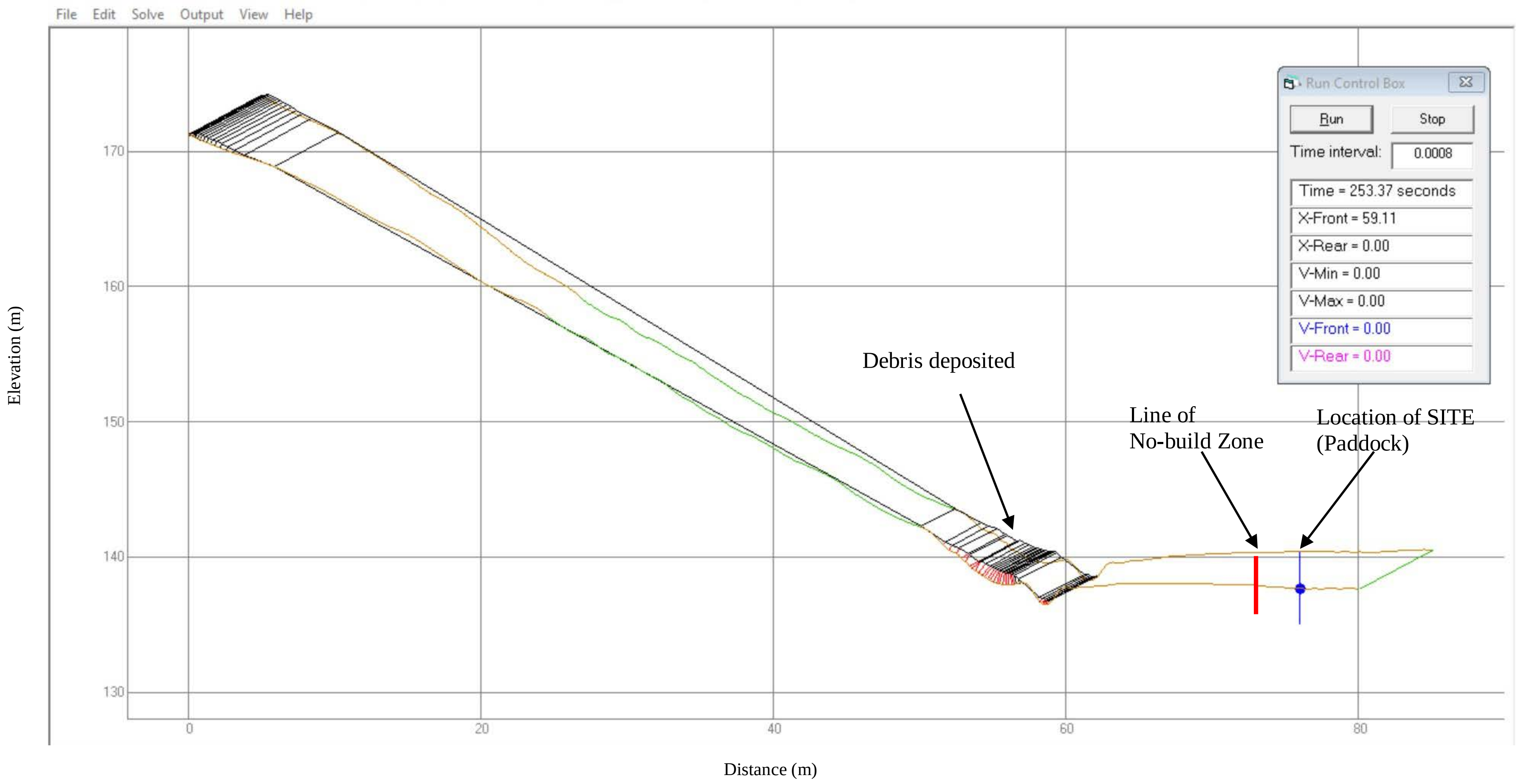

Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
40
30
20
10
0
0
20
40
60
80
Distance (m)
Press SHIFT and drag cursor to scroll image
Path Width (m)
Distance (m)

	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	24.580	4.600
Point 3	50.048	4.600
Point 4	80.025	10.000

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.63	40.63	53.78	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
170
160
150
140
130
0
20
40
60
80
Elevation (m)
Distance (m)

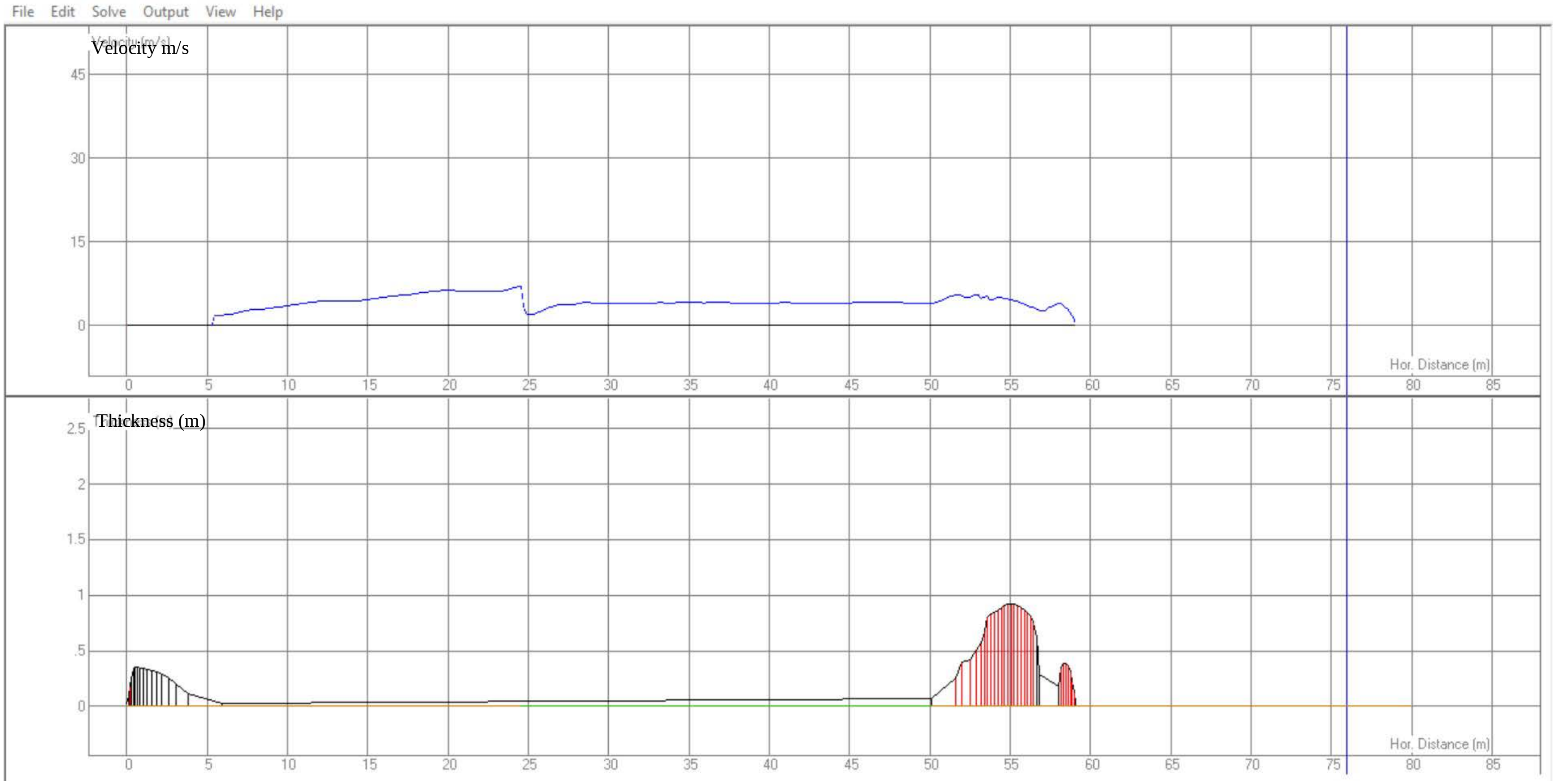
Time interval: 0.0008

Time = 253.37 seconds
X-Front = 59.11
X-Rear = 0.00
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00

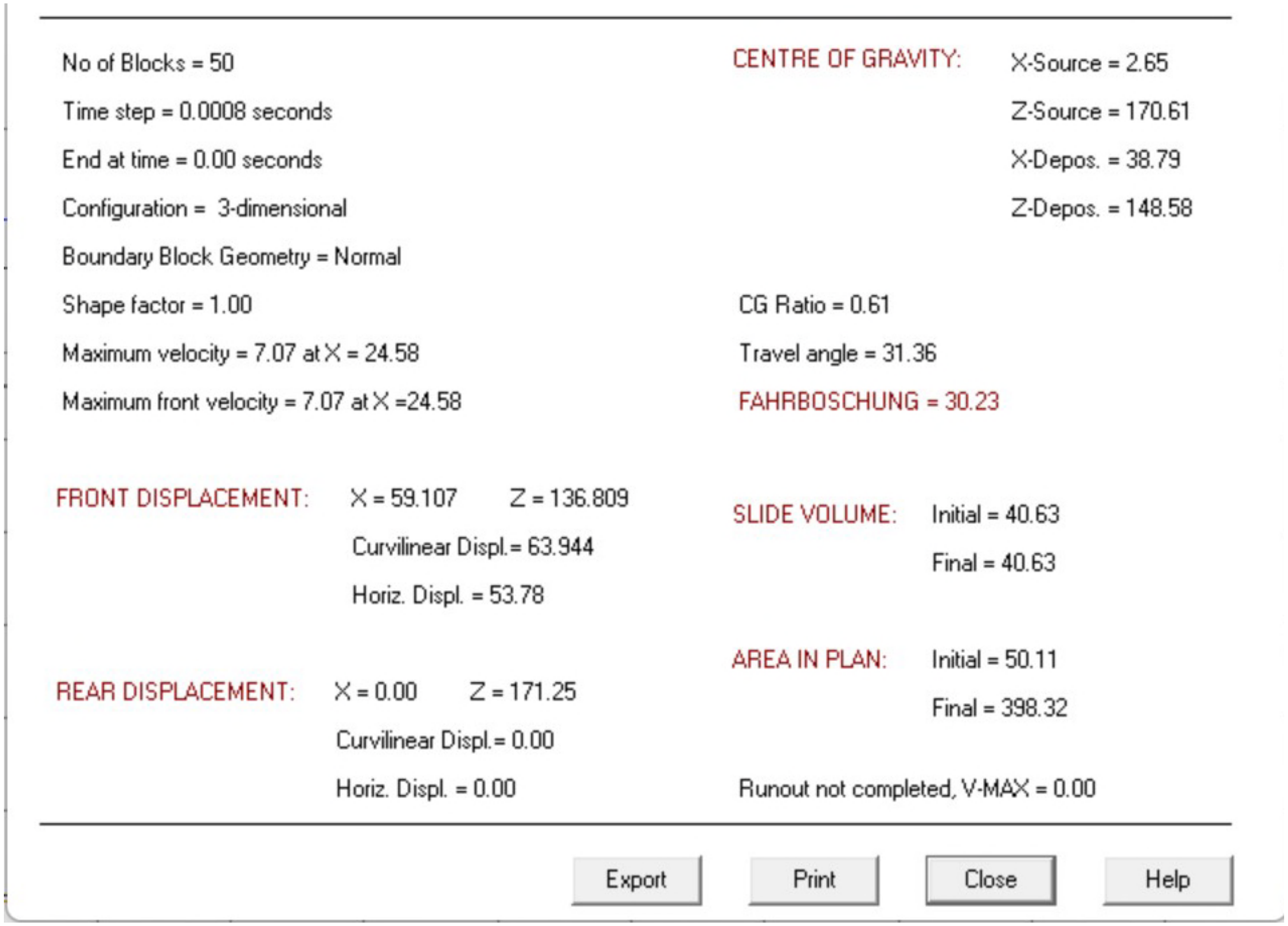
Debris deposited

Line of
No-build Zone

Location of SITE
(Paddock)


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Thickness (m)
2.5
2
1.5
1
.5
0
Hor. Distance (m)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85

Distance (m)



No of Blocks = 50
Time step = 0.0008 seconds
End at time = 0.00 seconds
Configuration = 3-dimensional
Boundary Block Geometry = Normal
Shape factor = 1.00
Maximum velocity = 7.07 at X = 24.58
Maximum front velocity = 7.07 at X =24.58

CENTRE OF GRAVITY: X-Source = 2.65
Z-Source = 170.61
X-Depos. = 38.79
Z-Depos. = 148.58

CG Ratio = 0.61
Travel angle = 31.36
FAHRBOSCHUNG = 30.23

FRONT DISPLACEMENT: X = 59.107 Z = 136.809
Curvilinear Displ.= 63.944
Horiz. Displ. = 53.78

REAR DISPLACEMENT: X = 0.00 Z = 171.25
Curvilinear Displ.= 0.00
Horiz. Displ. = 0.00

SLIDE VOLUME: Initial = 40.63
Final = 40.63

AREA IN PLAN: Initial = 50.11
Final = 398.32

Runout not completed, V-MAX = 0.00

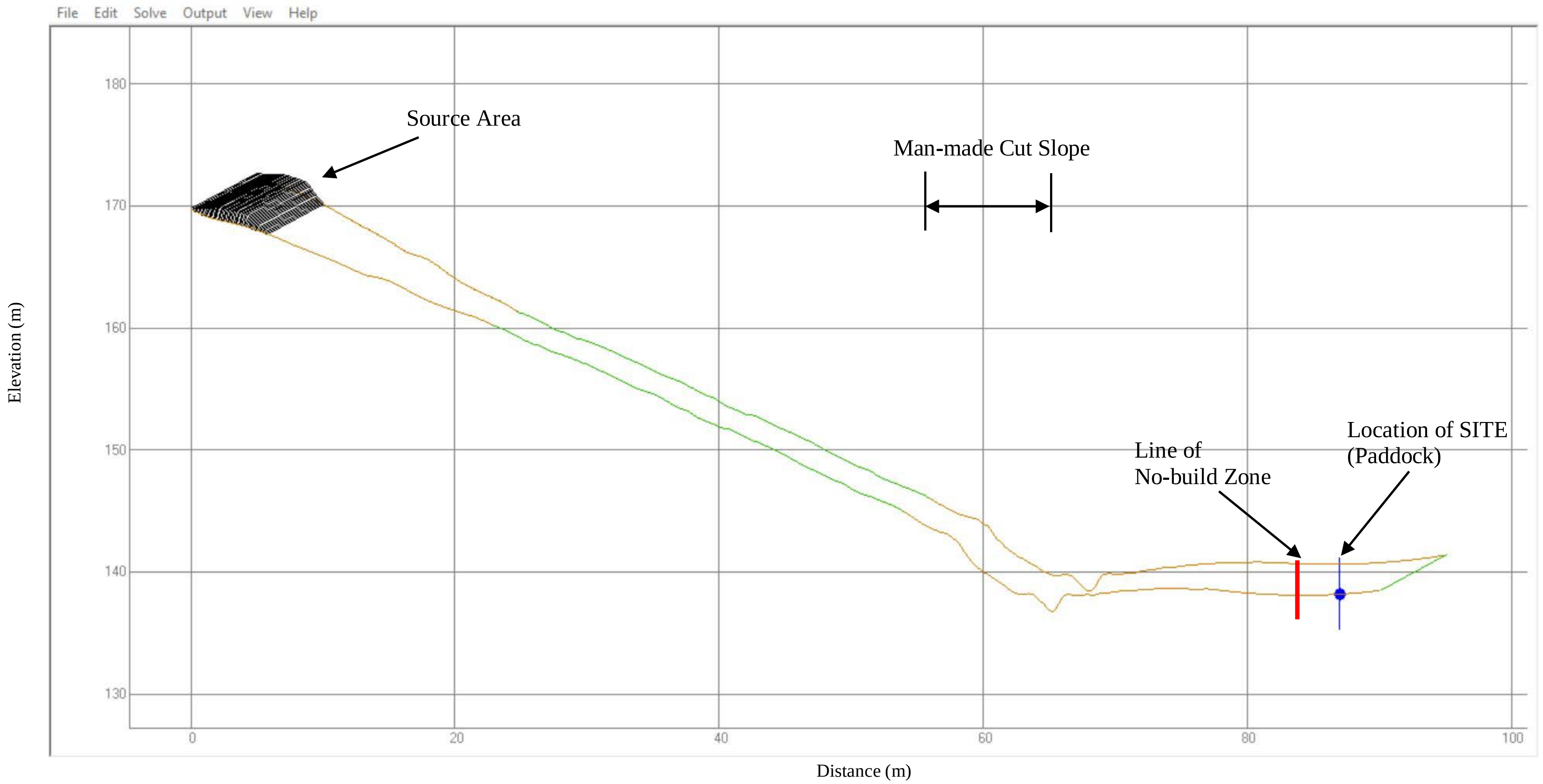
Debris Mobility Analysis for the Credible Runout Path RP4 (Case 1) within Catchment No. TD6

Landslide Type = DF

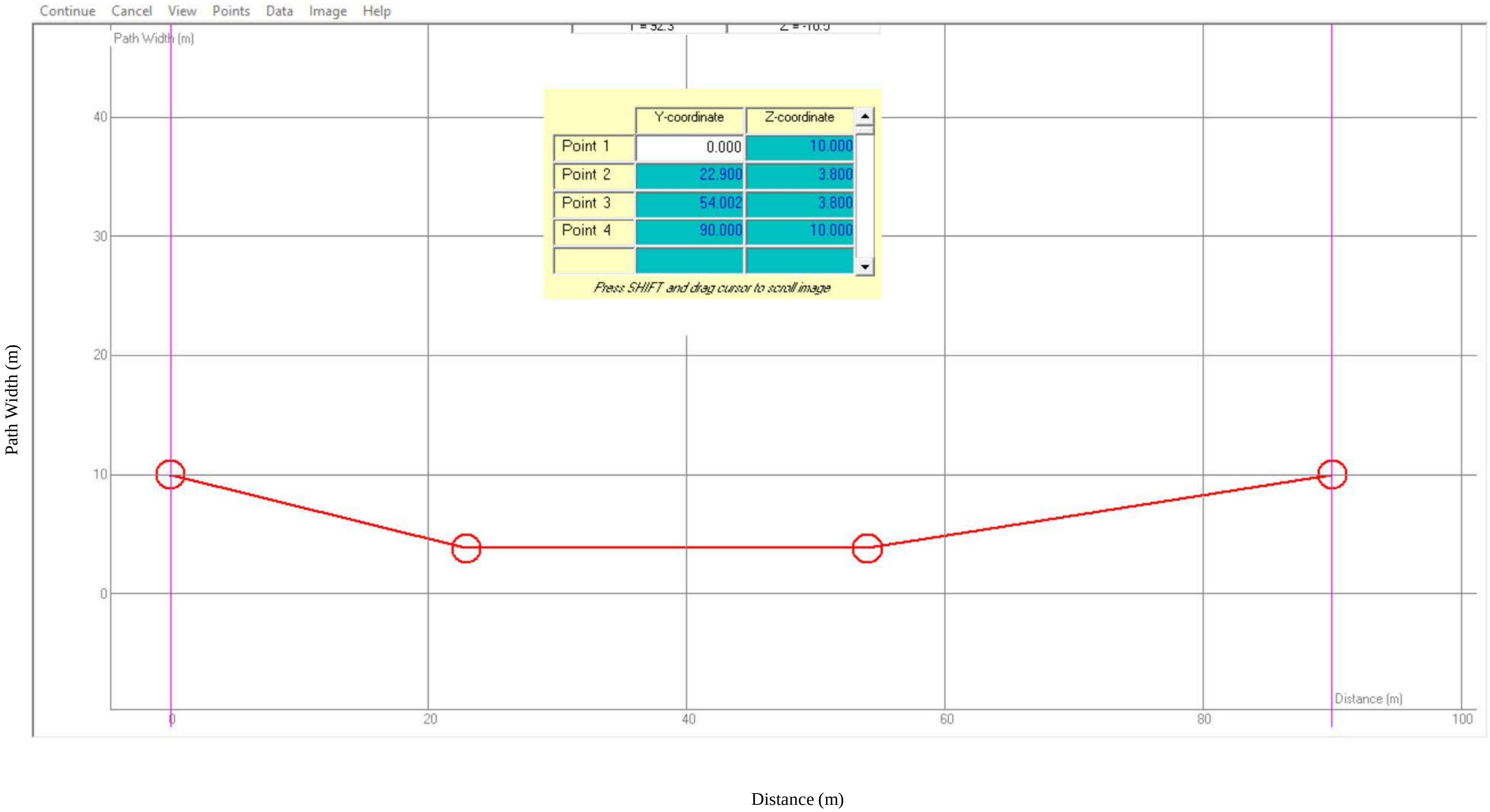
Design Source Volume = 40m^3

Figure D5

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = 52.3
Z = -10.5
Path Width (m)
40
30
20
10
0
Distance (m)
0
20
40
60
80
100
Path Width (m)
Distance (m)

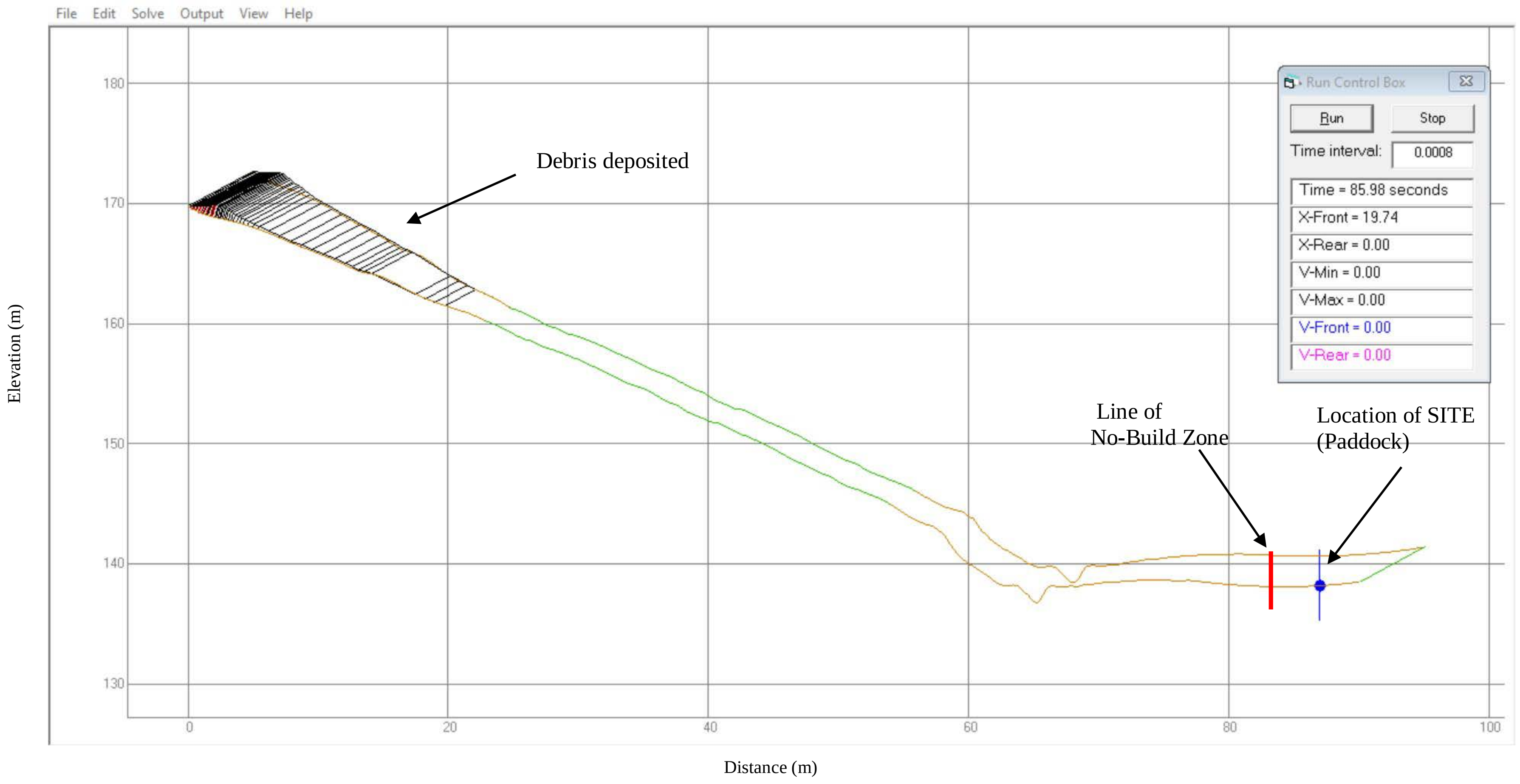
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	22.900	3.800
Point 3	54.002	3.800
Point 4	90.000	10.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.55	40.55	13.92	No

Section Profile – (post-sliding)



File Edit Solve Output View Help
Run Control Box
Run
Stop
Debris deposited
Line of No-Build Zone
Location of SITE (Paddock)
Elevation (m)
180
170
160
150
140
130
Distance (m)
0
20
40
60
80
100

Time interval: 0.0008

Time = 85.98 seconds

X-Front = 19.74

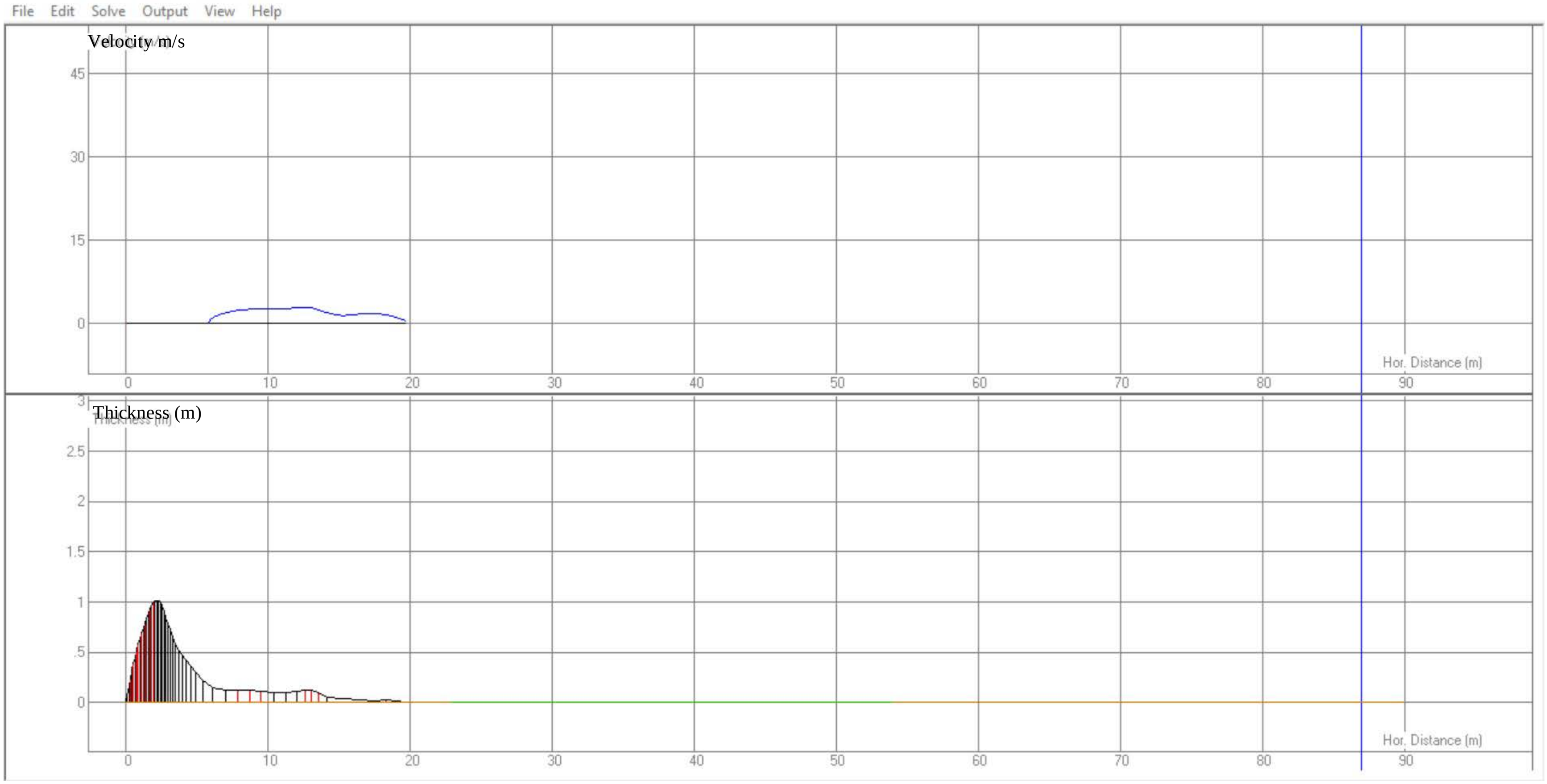
X-Rear = 0.00

V-Min = 0.00

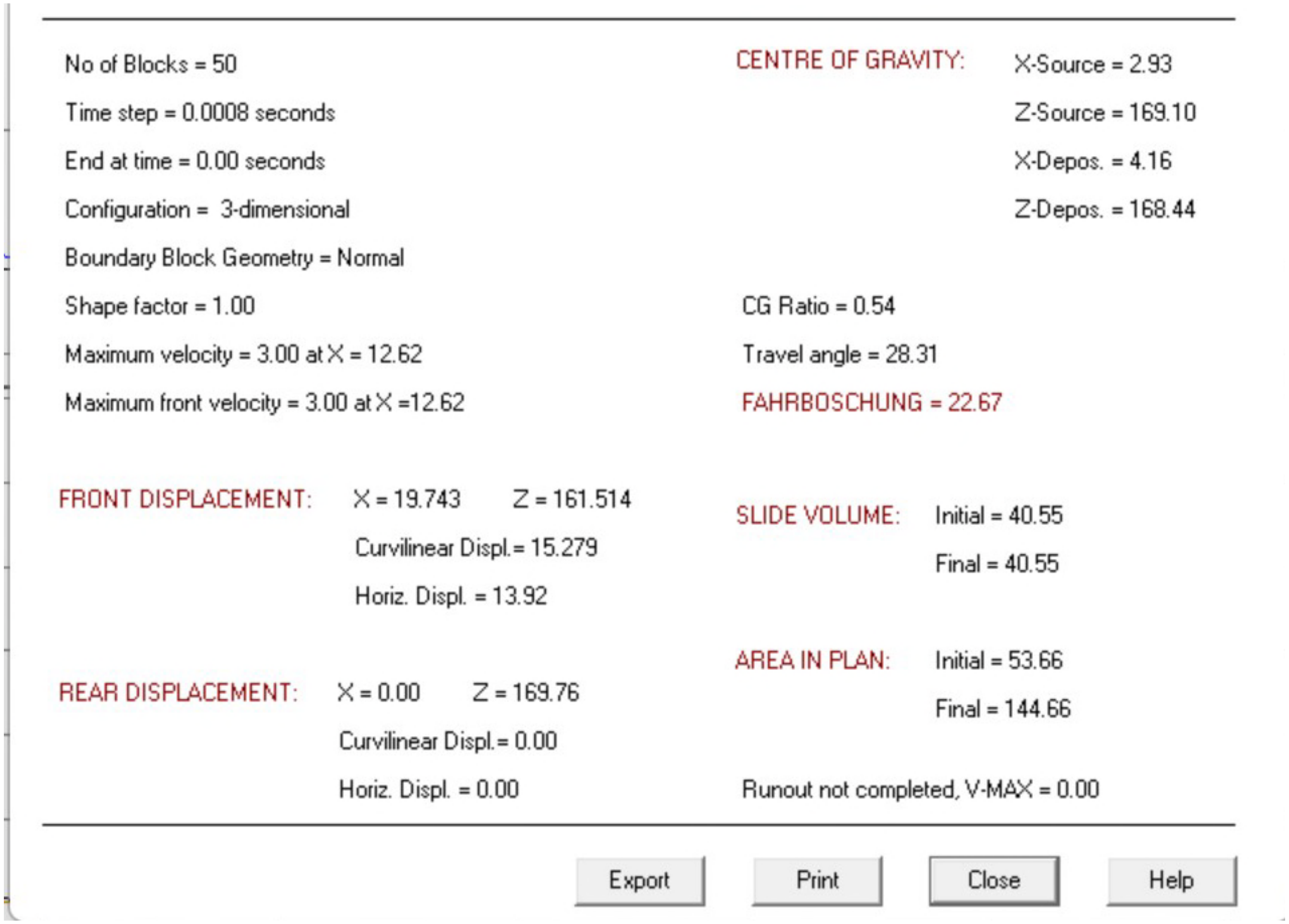
V-Max = 0.00

V-Front = 0.00

V-Rear = 0.00


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
0
10
20
30
40
50
60
70
80
90
Hor. Distance (m)
Thickness (m)
3
2.5
2
1.5
1
.5
0
0
10
20
30
40
50
60
70
80
90
Hor. Distance (m)

Distance (m)



No of Blocks = 50

Time step = 0.0008 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 3.00 at X = 12.62

Maximum front velocity = 3.00 at X =12.62

CENTRE OF GRAVITY:

X-Source = 2.93

Z-Source = 169.10

X-Depos. = 4.16

Z-Depos. = 168.44

CG Ratio = 0.54

Travel angle = 28.31

FAHRBOSCHUNG = 22.67

FRONT DISPLACEMENT: X = 19.743 Z = 161.514

Curvilinear Displ.= 15.279

Horiz. Displ. = 13.92

REAR DISPLACEMENT: X = 0.00 Z = 169.76

Curvilinear Displ.= 0.00

Horiz. Displ. = 0.00

SLIDE VOLUME: Initial = 40.55

Final = 40.55

AREA IN PLAN: Initial = 53.66

Final = 144.66

Runout not completed, V-MAX = 0.00

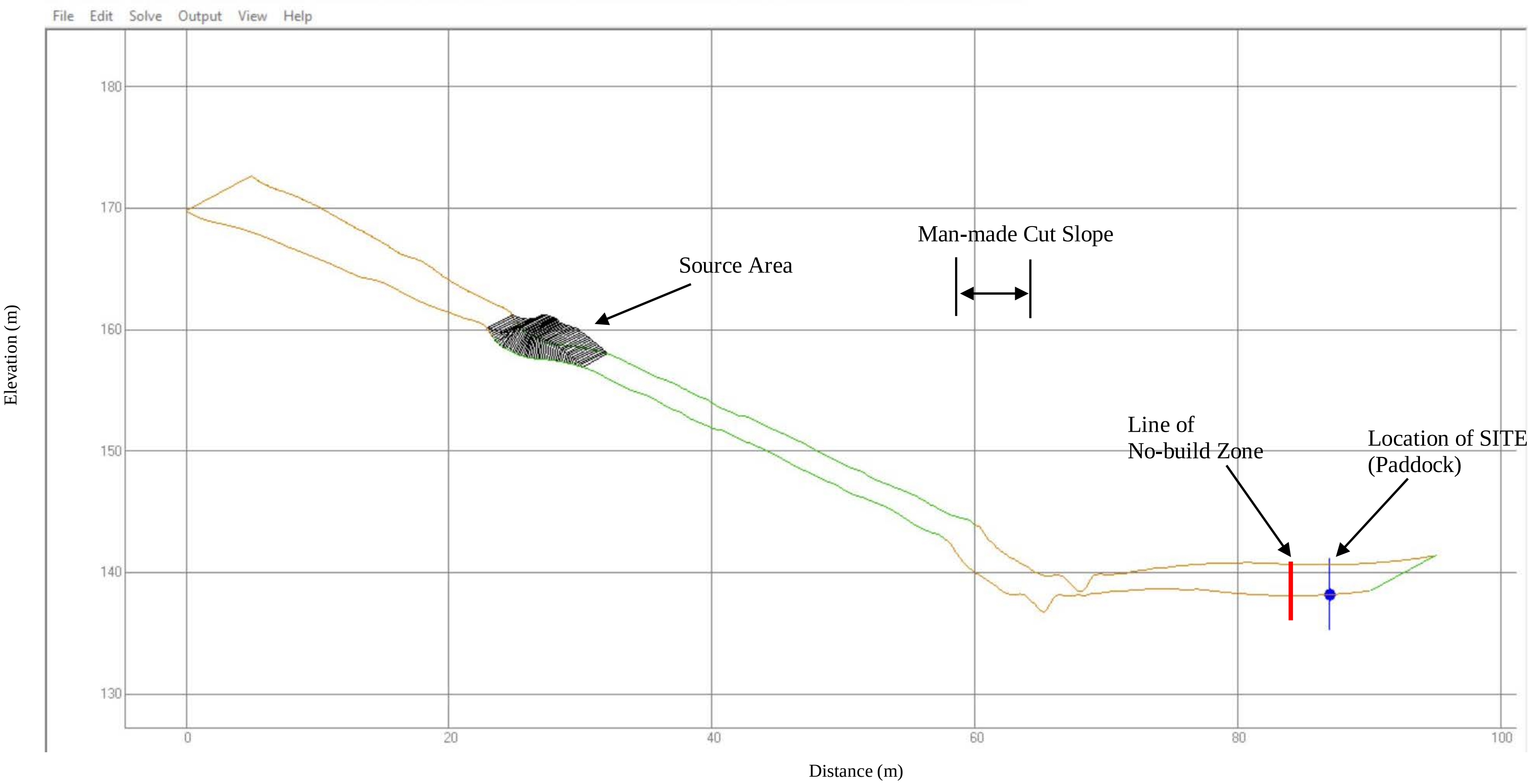
Debris Mobility Analysis for the Credible Runout Path RP4 (Case 2) within Catchment No. TD6

Landslide Type = DF

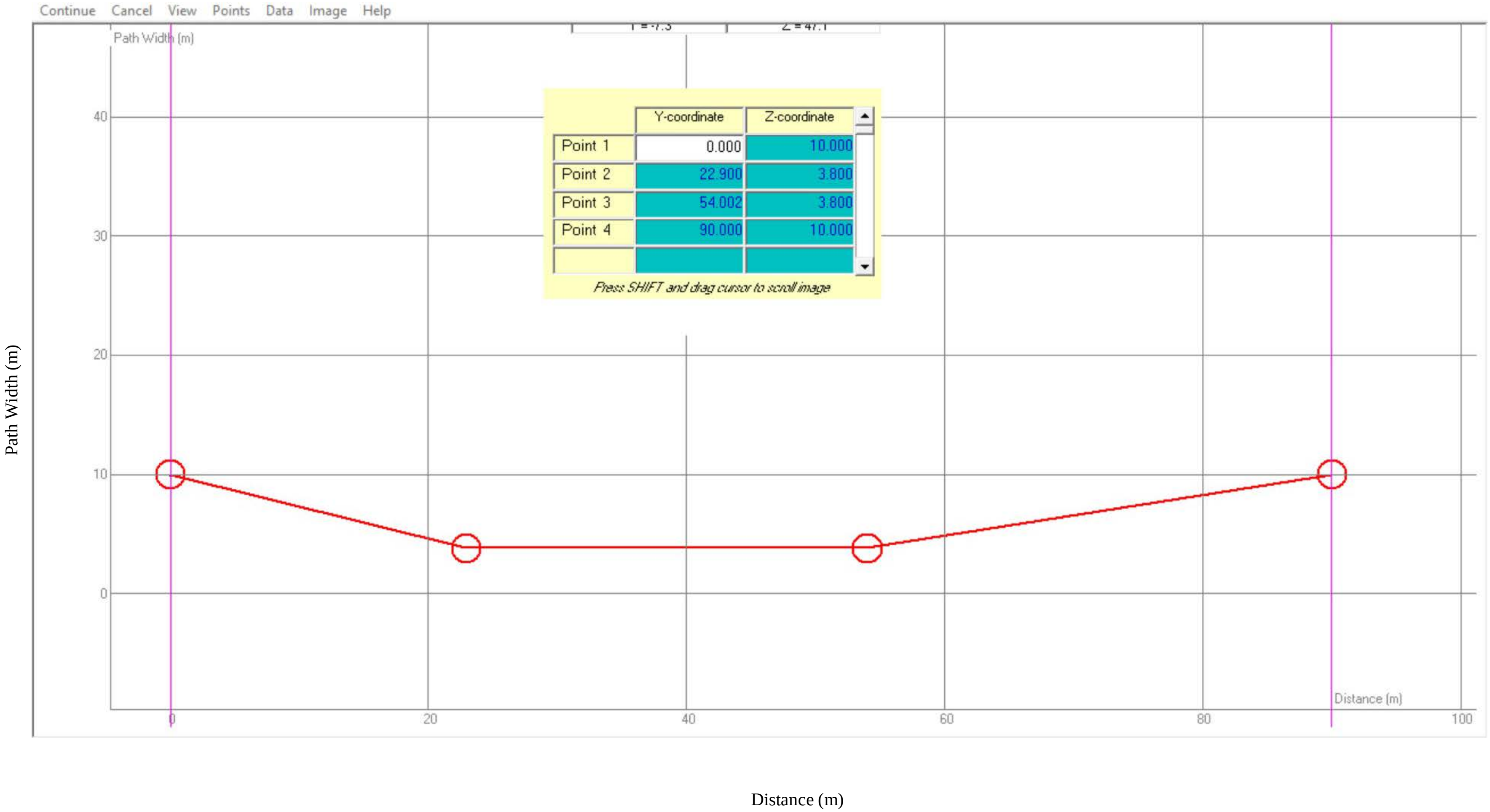
Design Source Volume = 40m^3

Figure D6

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
40
30
20
10
0
0
20
40
60
80
100
Distance (m)
Path Width (m)
Distance (m)

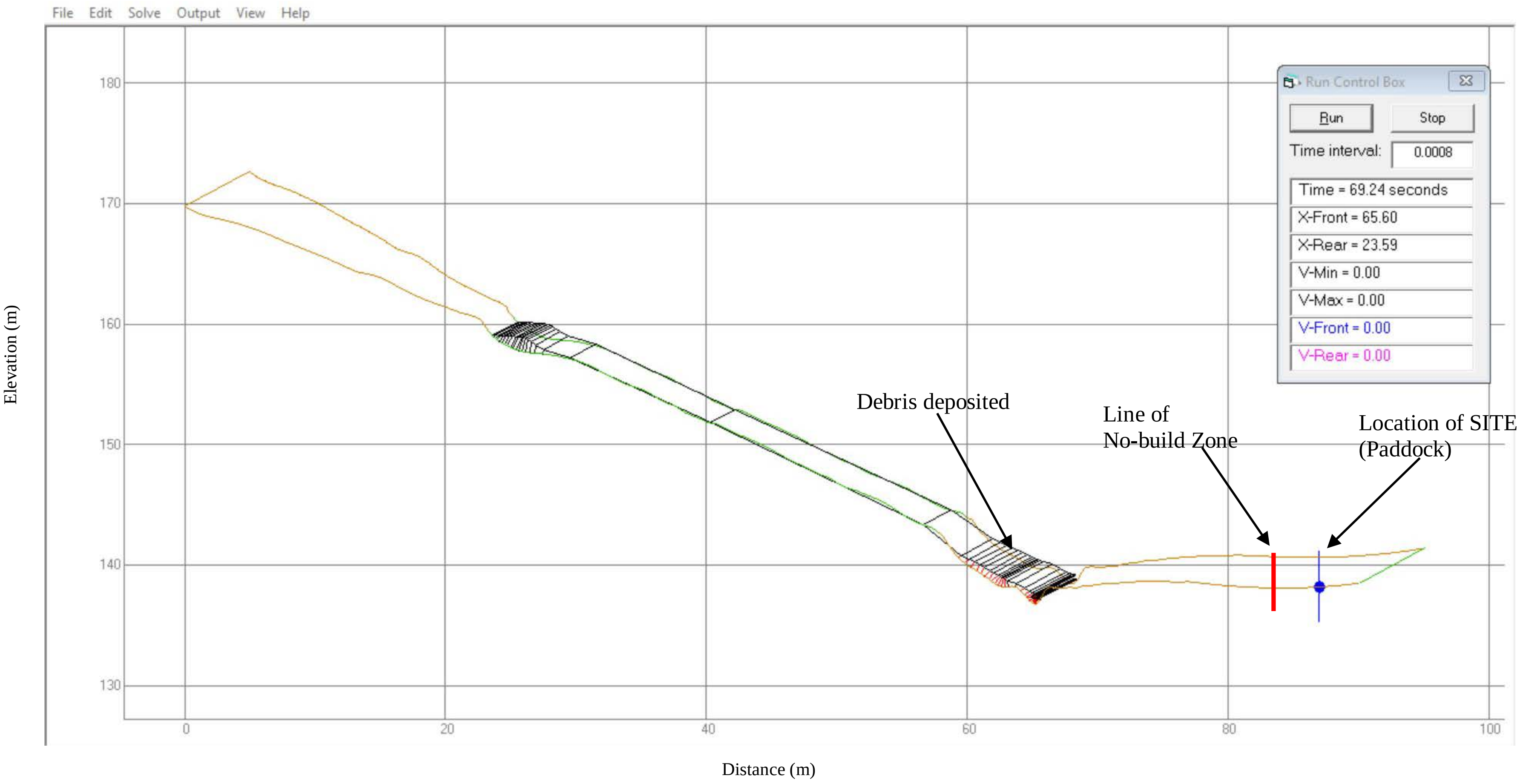
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	22.900	3.800
Point 3	54.002	3.800
Point 4	90.000	10.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.34	40.34	35.46	No

Section Profile – (post-sliding)



Time interval: 0.0008

Time = 69.24 seconds

X-Front = 65.60

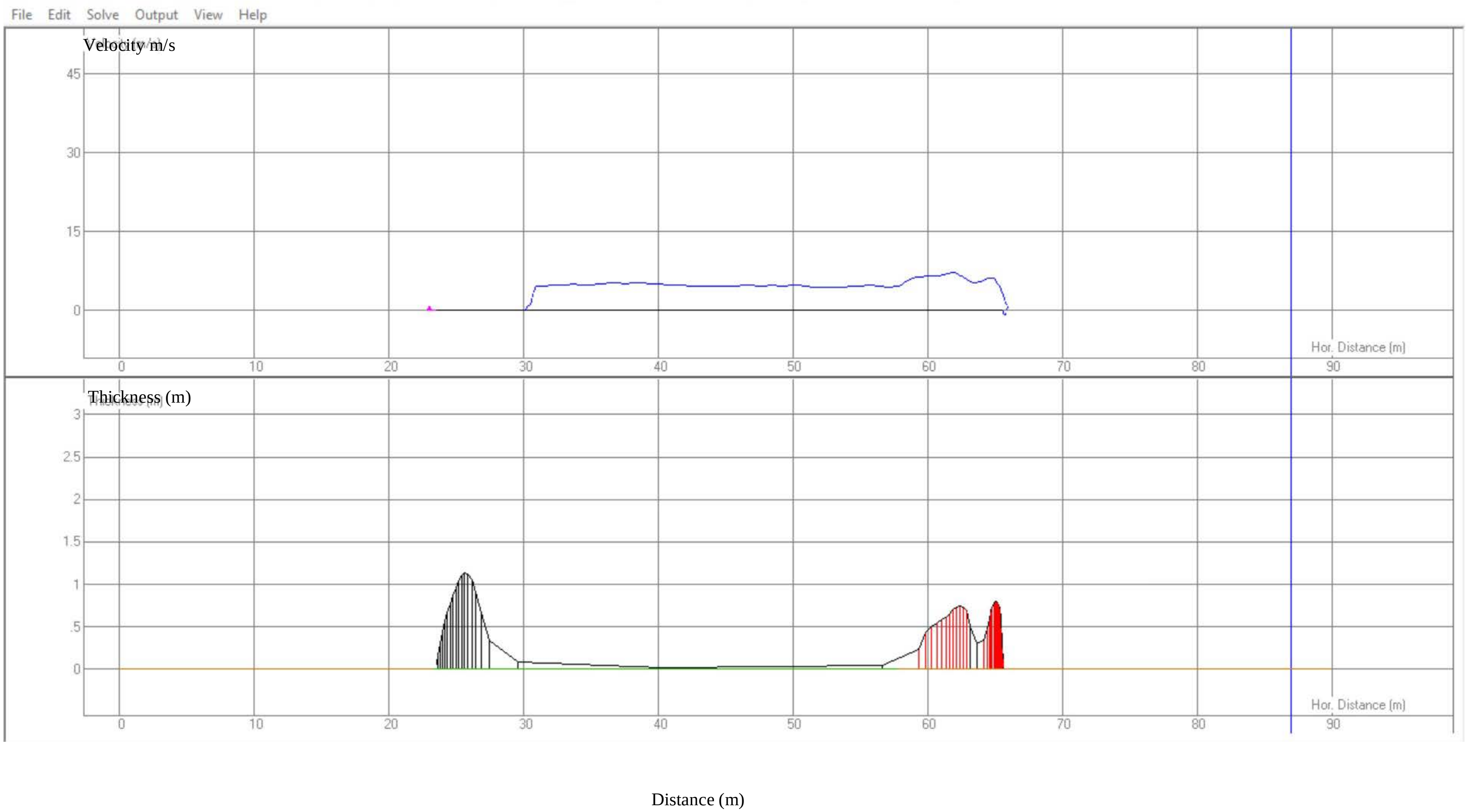
X-Rear = 23.59

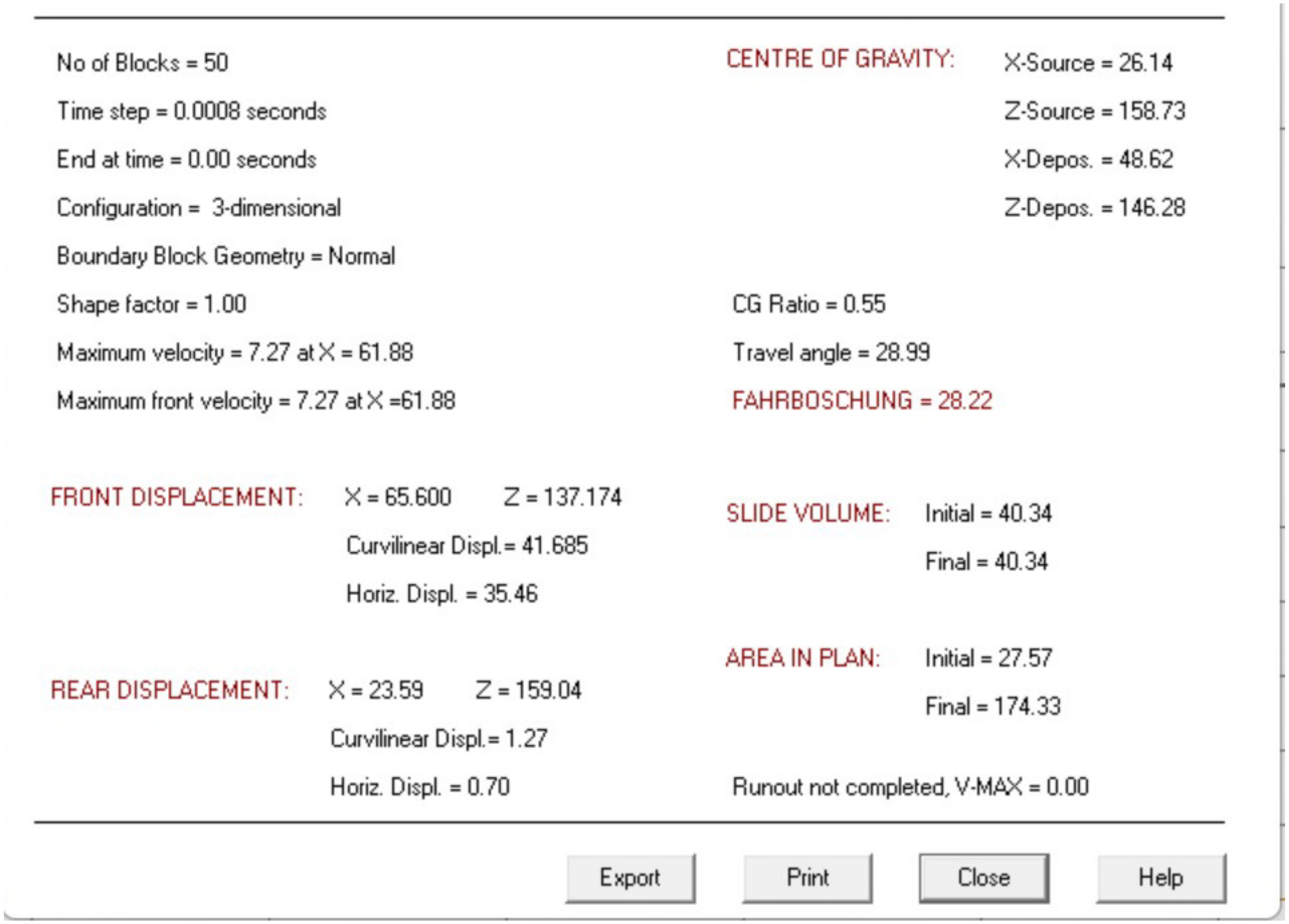
V-Min = 0.00

V-Max = 0.00

V-Front = 0.00

V-Rear = 0.00


File Edit Solve Output View Help
Velocity m/s
45
30
15
0
0
10
20
30
40
50
60
70
80
90
Hor. Distance (m)
Thickness (m)
3
2.5
2
1.5
1
.5
0
0
10
20
30
40
50
60
70
80
90
Hor. Distance (m)
Distance (m)



No of Blocks = 50

Time step = 0.0008 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 7.27 at X = 61.88

Maximum front velocity = 7.27 at X =61.88

CENTRE OF GRAVITY: X-Source = 26.14

Z-Source = 158.73

X-Depos. = 48.62

Z-Depos. = 146.28

CG Ratio = 0.55

Travel angle = 28.99

FAHRBOSCHUNG = 28.22

FRONT DISPLACEMENT: X = 65.600 Z = 137.174

Curvilinear Displ.= 41.685

Horiz. Displ. = 35.46

REAR DISPLACEMENT: X = 23.59 Z = 159.04

Curvilinear Displ.= 1.27

Horiz. Displ. = 0.70

SLIDE VOLUME: Initial = 40.34

Final = 40.34

AREA IN PLAN: Initial = 27.57

Final = 174.33

Runout not completed, V-MAX = 0.00

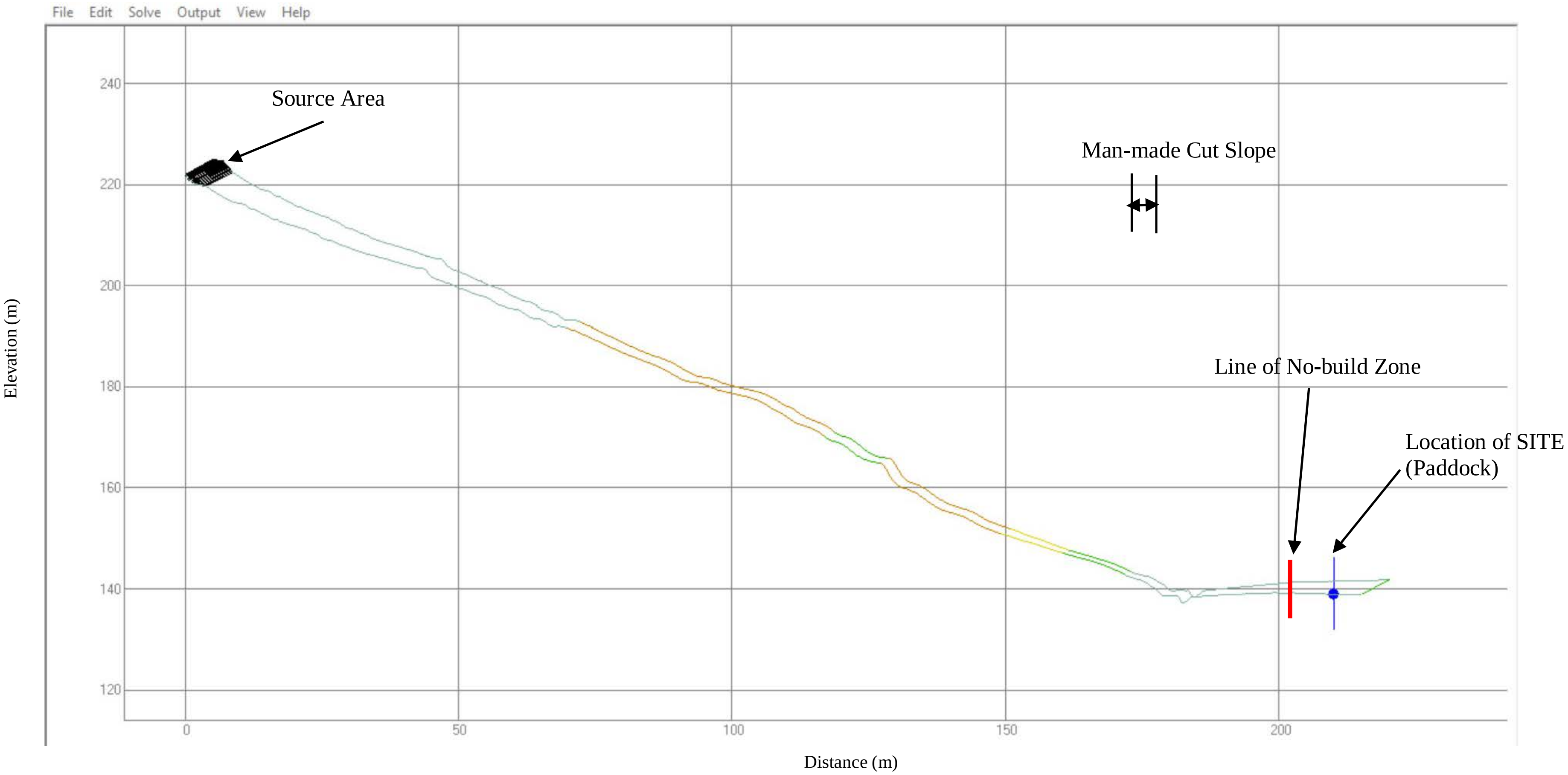
Debris Mobility Analysis for the Credible Runout Path RP5 (Case 1) within Catchment No. CD1

Landslide Type = CDF

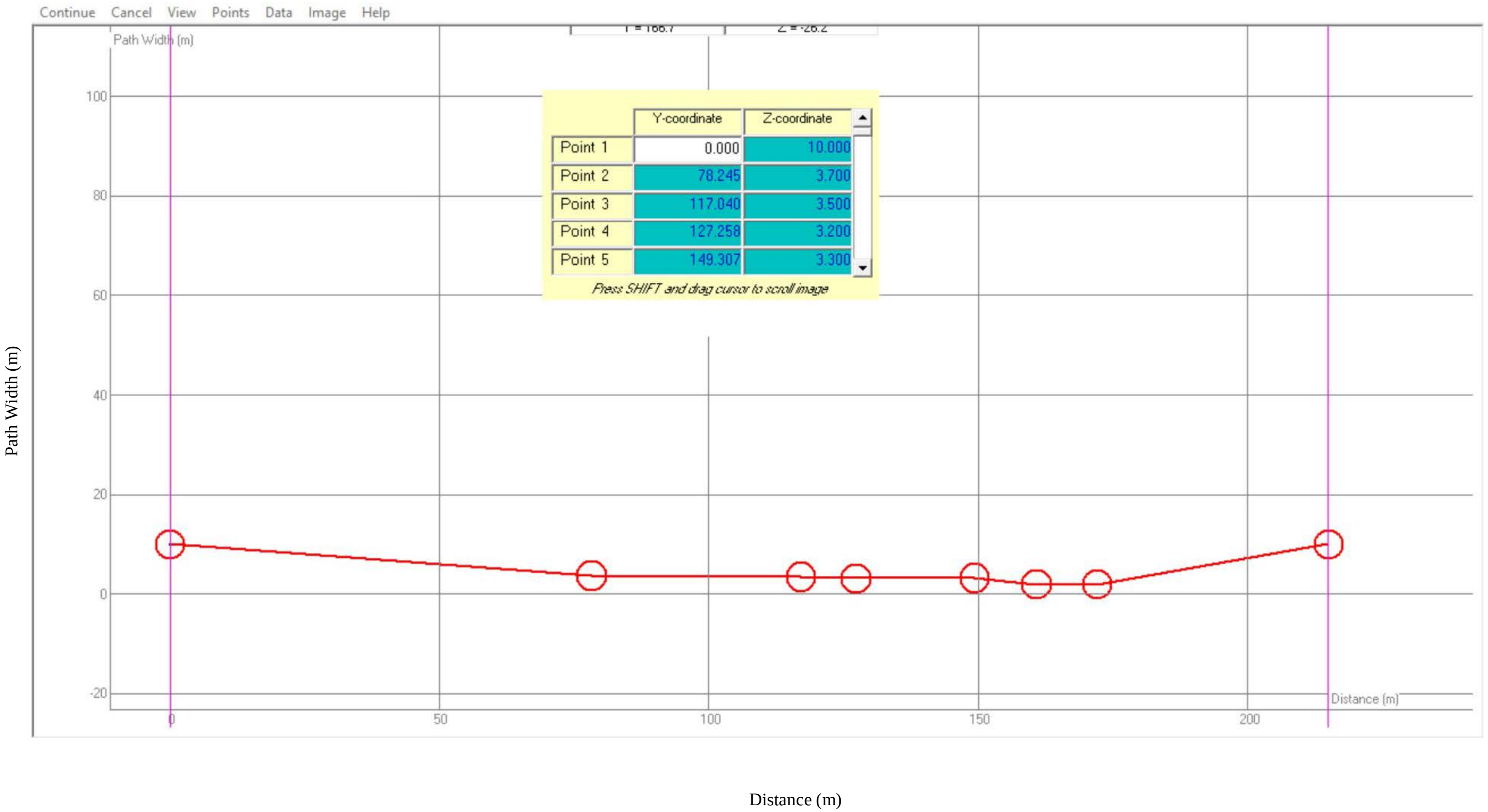
Design Source Volume = 40m^3

Figure D7

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
100
80
60
40
20
0
-20
0
50
100
150
200
Distance (m)
Path Width (m)
Distance (m)

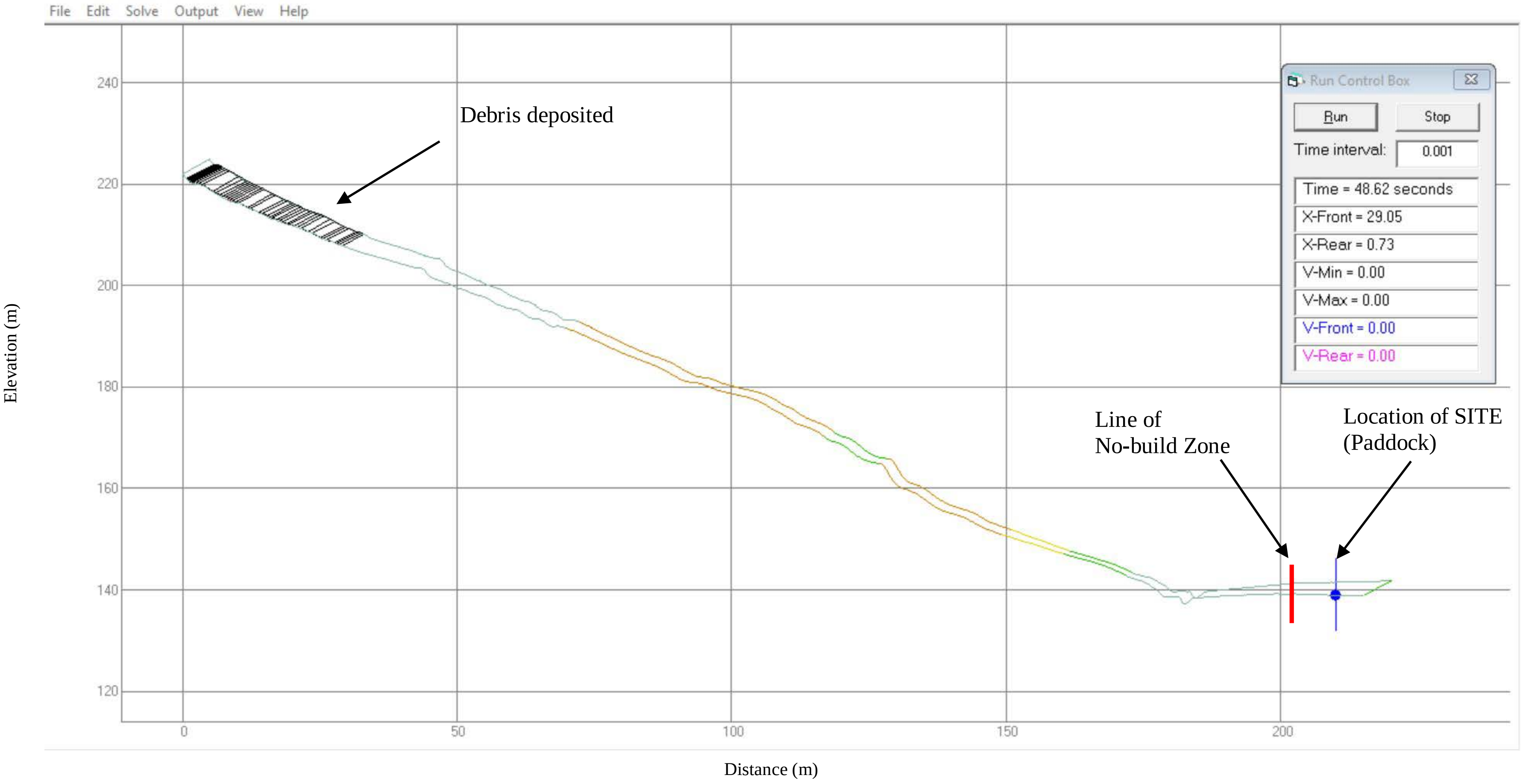
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	78.245	3.700
Point 3	117.040	3.500
Point 4	127.258	3.200
Point 5	149.307	3.300

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

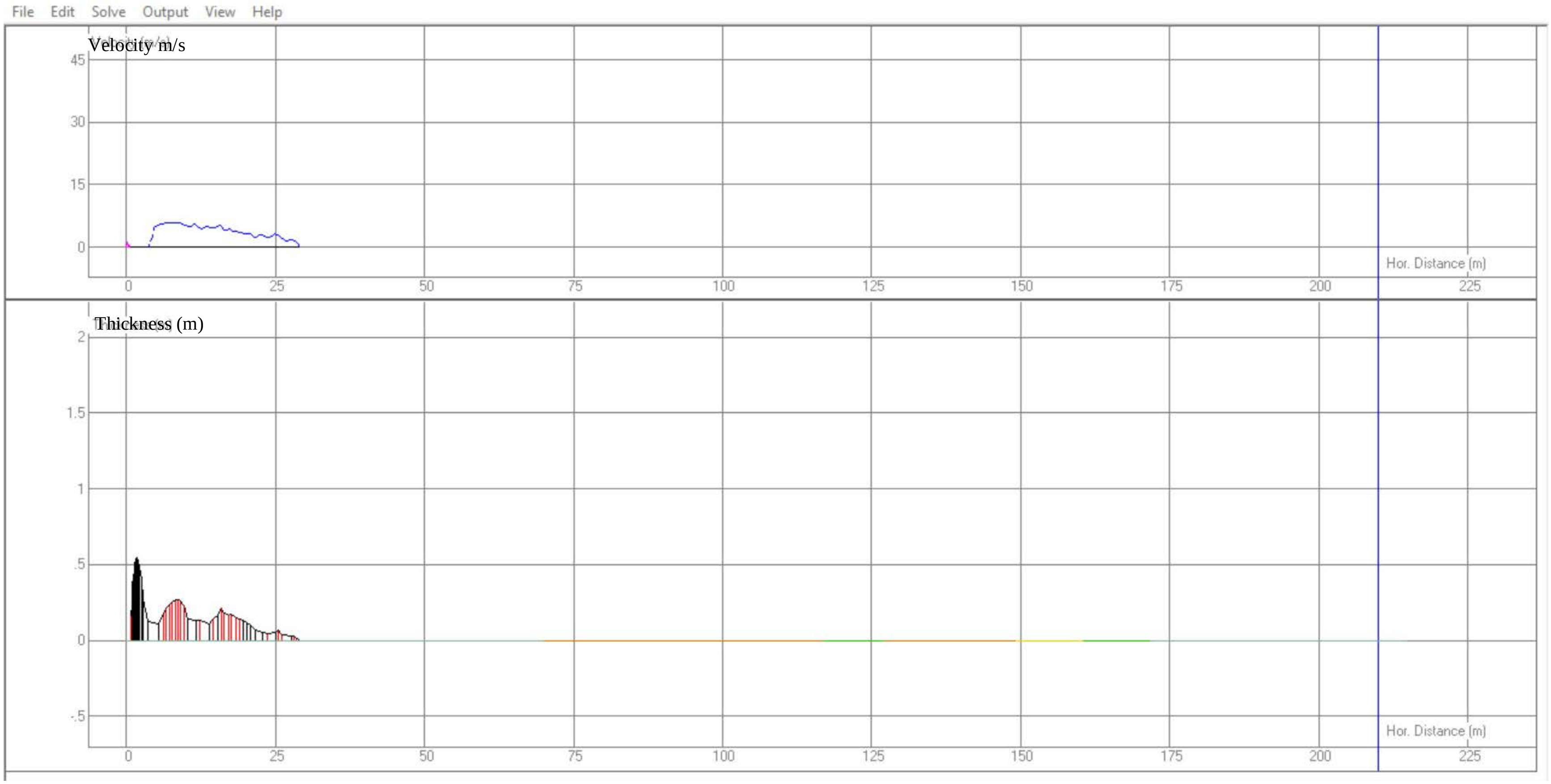
Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.84	40.84	25.16	No

Section Profile – (post-sliding)

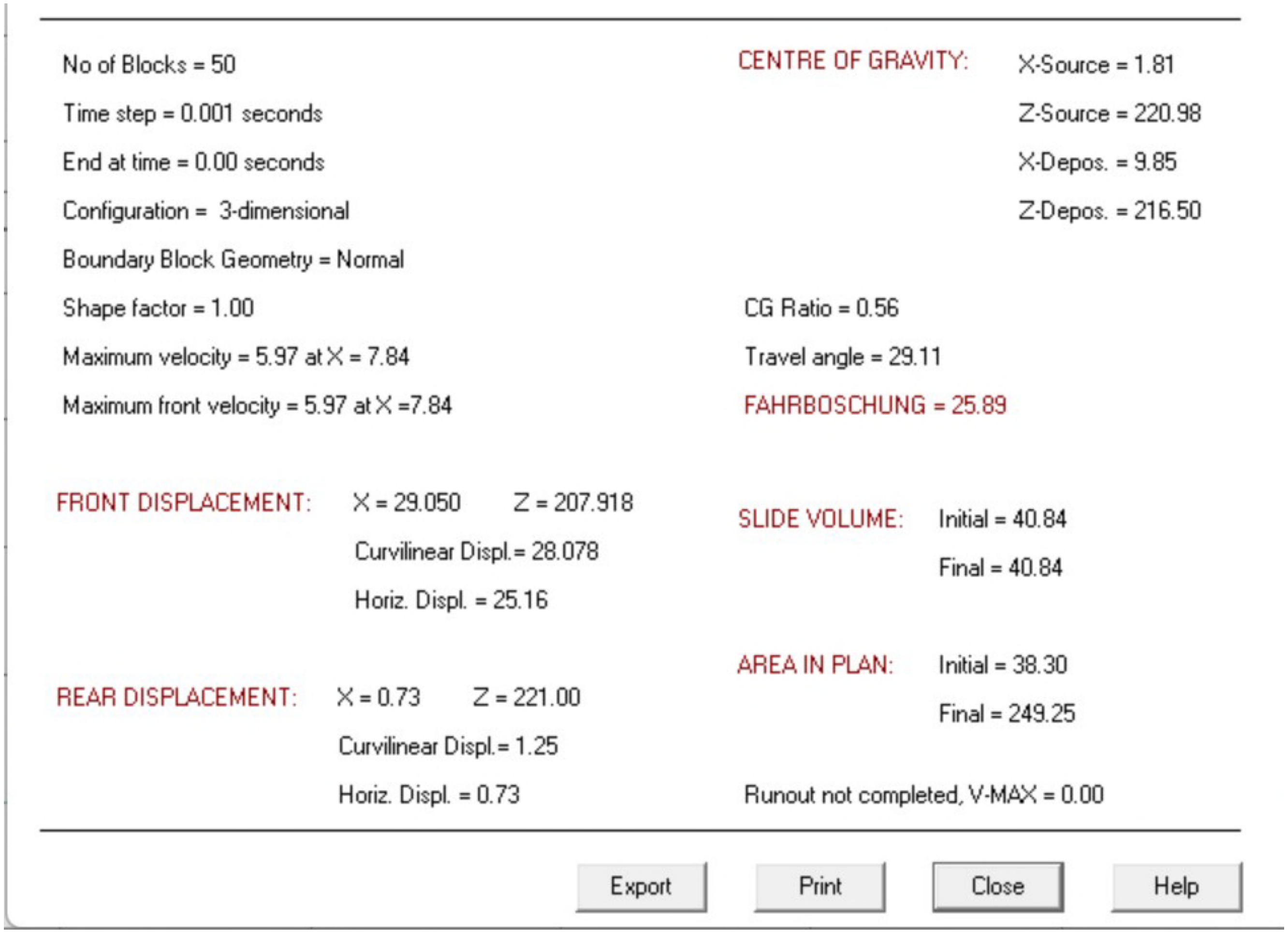


```
Time interval: 0.001
Time = 48.62 seconds
X-Front = 29.05
X-Rear = 0.73
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00
```

File Edit Solve Output View Help
Run Control Box
Run
Stop
Debris deposited
Line of No-build Zone
Location of SITE (Paddock)
Elevation (m)
240
220
200
180
160
140
120
0
50
100
150
200
Distance (m)


File Edit Solve Output View Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0 25 50 75 100 125 150 175 200 225
Thickness (m)
2
1.5
1
.5
0
-.5
Hor. Distance (m)
0 25 50 75 100 125 150 175 200 225

Distance (m)



No of Blocks = 50

Time step = 0.001 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 5.97 at X = 7.84

Maximum front velocity = 5.97 at X =7.84

FRONT DISPLACEMENT: X = 29.050 Z = 207.918

Curvilinear Displ.= 28.078

Horiz. Displ. = 25.16

REAR DISPLACEMENT: X = 0.73 Z = 221.00

Curvilinear Displ.= 1.25

Horiz. Displ. = 0.73

CENTRE OF GRAVITY: X-Source = 1.81

Z-Source = 220.98

X-Depos. = 9.85

Z-Depos. = 216.50

CG Ratio = 0.56

Travel angle = 29.11

FAHRBOSCHUNG = 25.89

SLIDE VOLUME: Initial = 40.84

Final = 40.84

AREA IN PLAN: Initial = 38.30

Final = 249.25

Runout not completed, V-MAX = 0.00

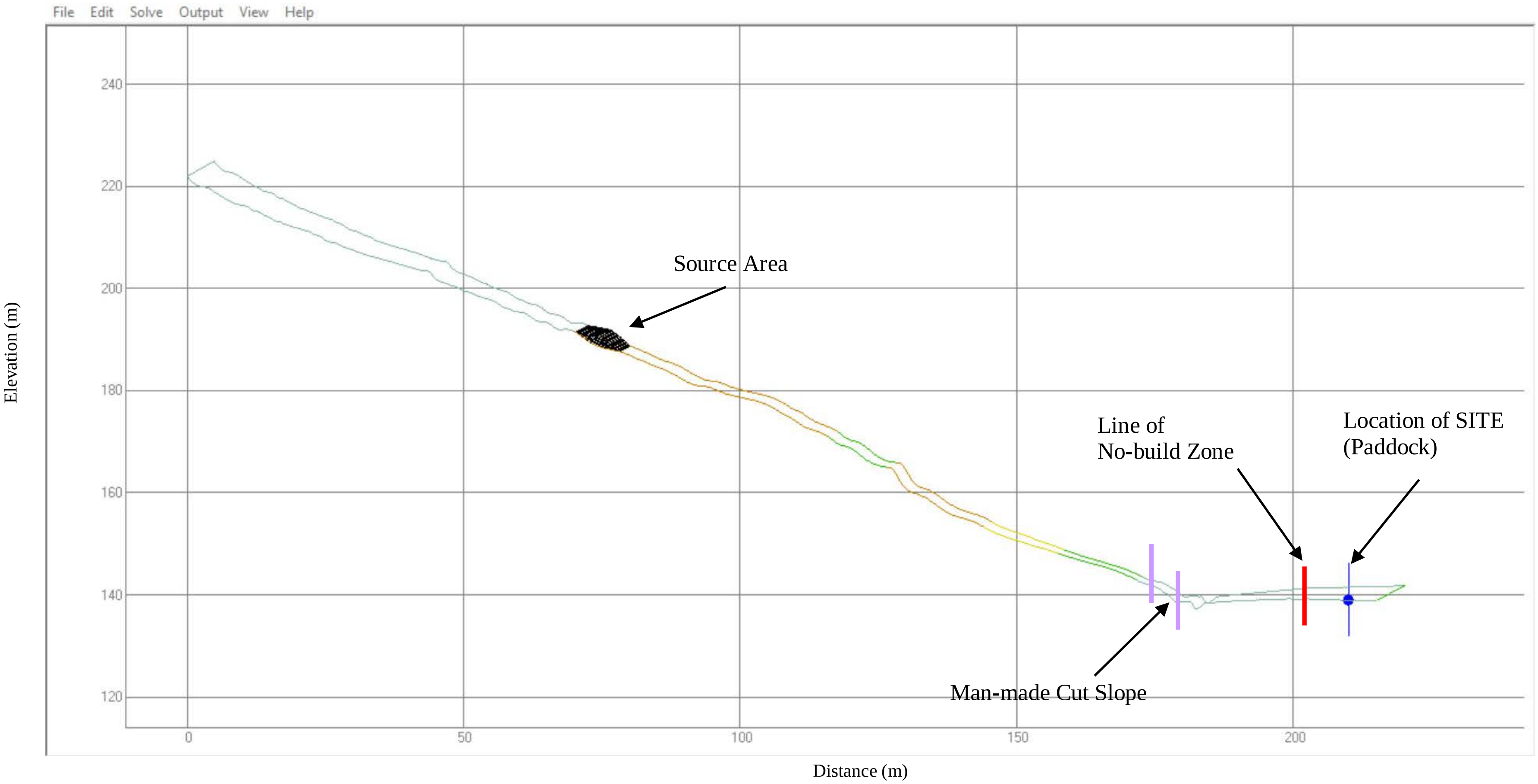
Debris Mobility Analysis for the Credible Runout Path RP5 (Case 2) within Catchment No. CD1

Landslide Type = CDF

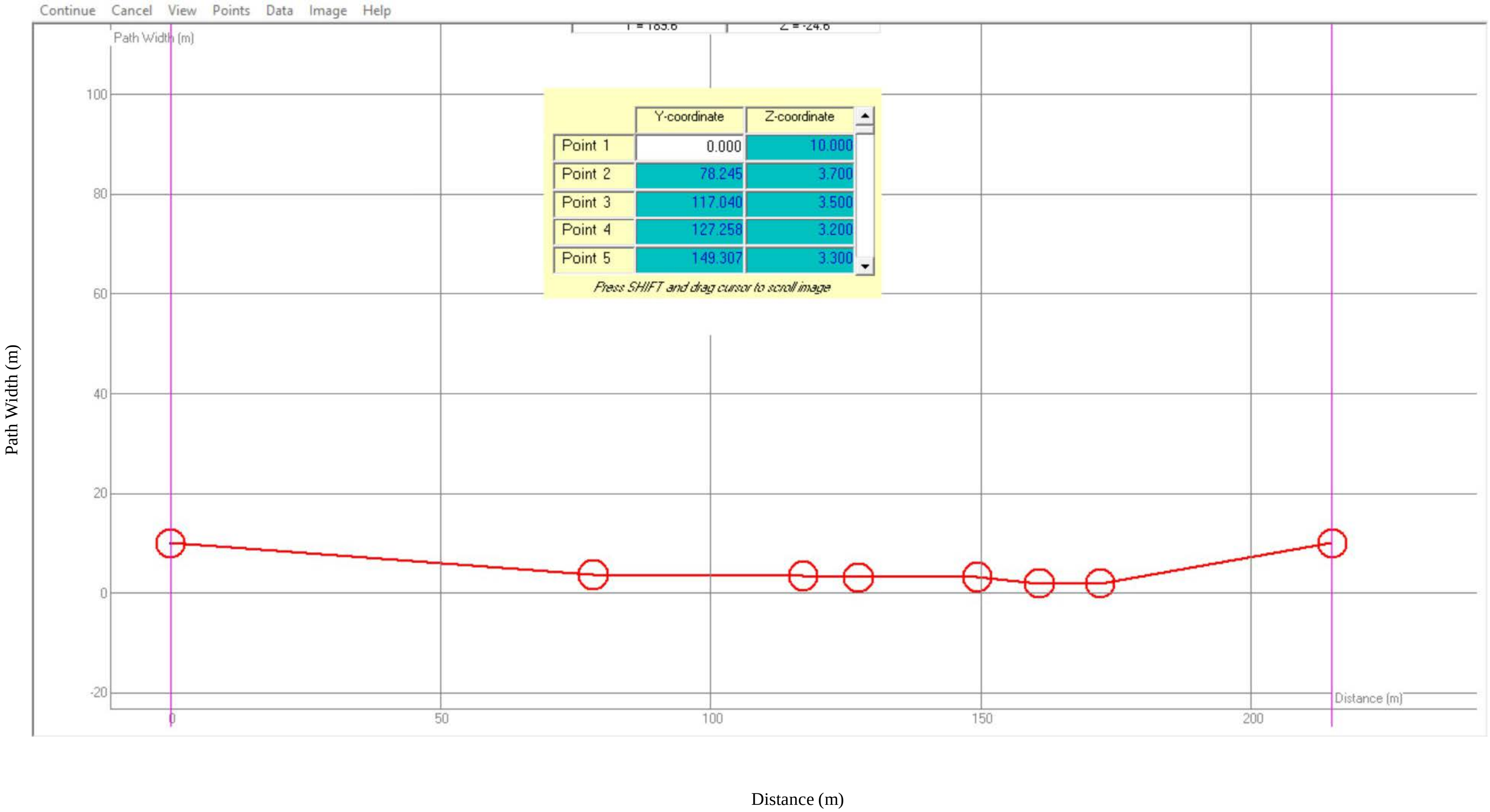
Design Source Volume = 40m^3

Figure D8

Section Profile – (pre-sliding)



Width Profile



	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	78.245	3.700
Point 3	117.040	3.500
Point 4	127.258	3.200
Point 5	149.307	3.300

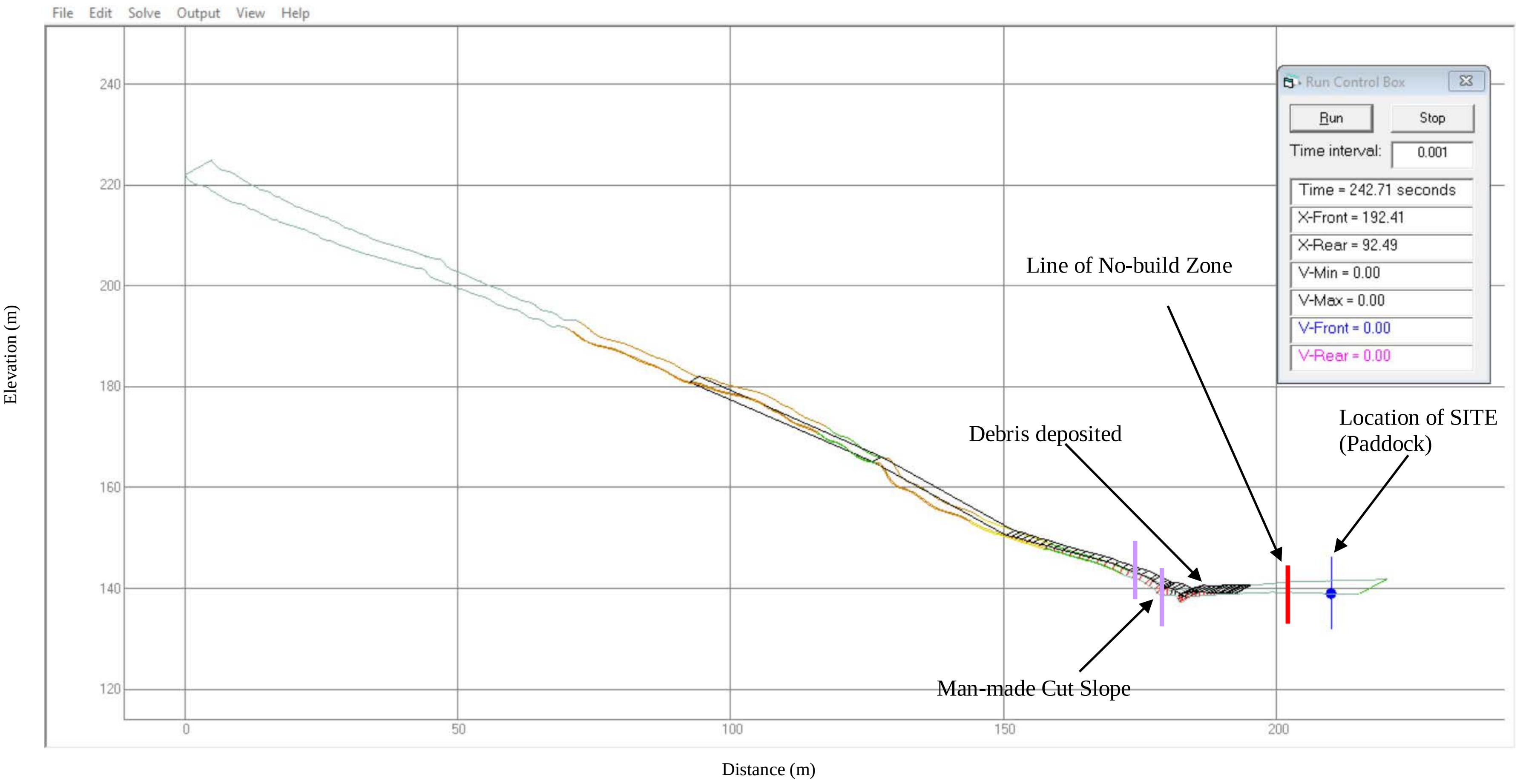
Press SHIFT and drag cursor to scroll image

Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
100
80
60
40
20
0
-20
0
50
100
150
200
Distance (m)
Path Width (m)
Distance (m)

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.22	107.11	114.16	No

Section Profile – (post-sliding)



Time interval: 0.001

Time = 242.71 seconds

X-Front = 192.41

X-Rear = 92.49

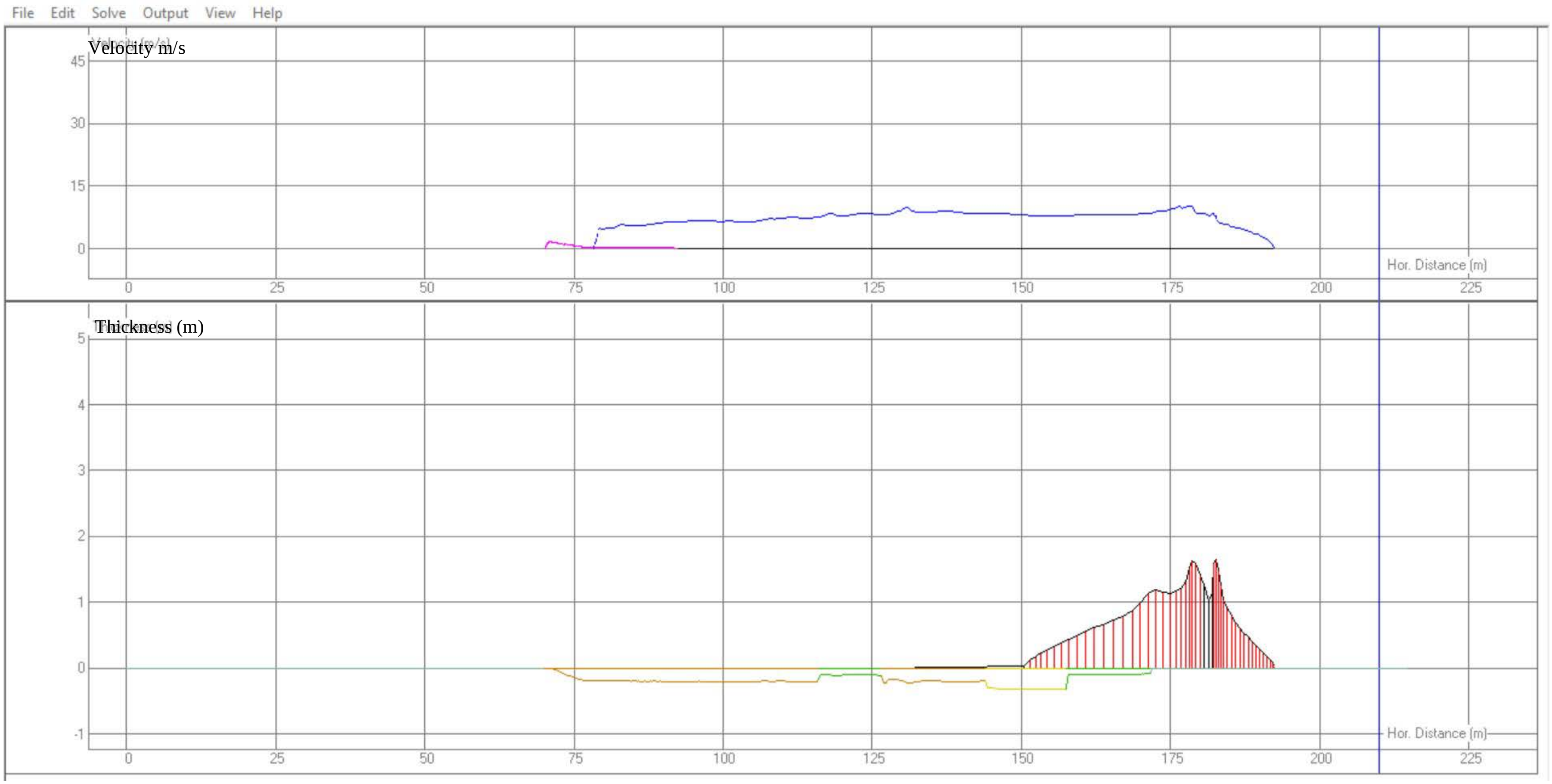
V-Min = 0.00

V-Max = 0.00

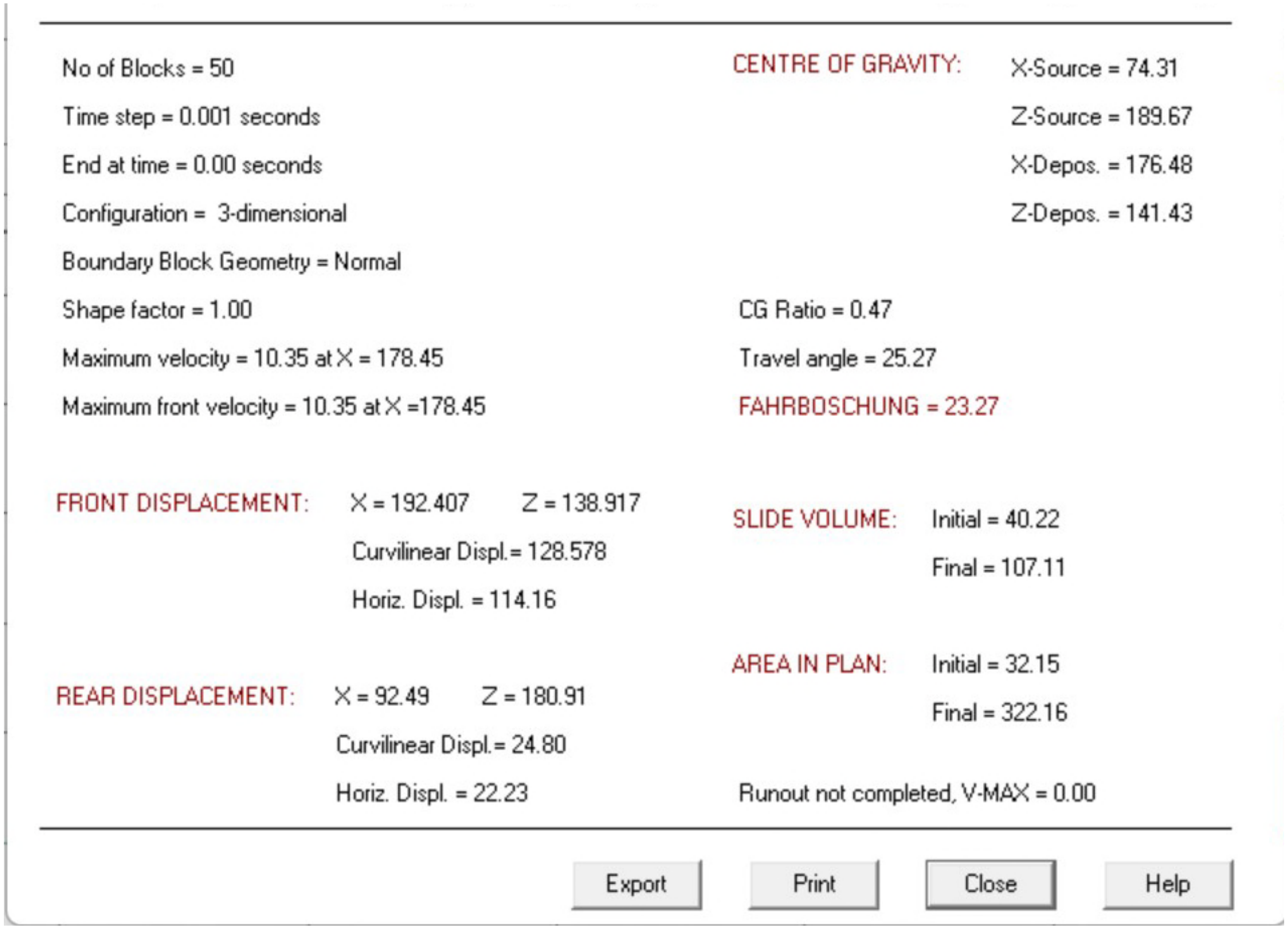
V-Front = 0.00

V-Rear = 0.00

File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Elevation (m)
240
220
200
180
160
140
120
0
50
100
150
200
Distance (m)
Line of No-build Zone
Debris deposited
Location of SITE (Paddock)
Man-made Cut Slope


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
25
50
75
100
125
150
175
200
225
Thickness (m)
5
4
3
2
1
0
-1
Hor. Distance (m)
0
25
50
75
100
125
150
175
200
225

Distance (m)



No of Blocks = 50

Time step = 0.001 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 10.35 at X = 178.45

Maximum front velocity = 10.35 at X =178.45

CENTRE OF GRAVITY:
X-Source = 74.31
Z-Source = 189.67
X-Depos. = 176.48
Z-Depos. = 141.43

CG Ratio = 0.47

Travel angle = 25.27

FAHRBOSCHUNG = 23.27

FRONT DISPLACEMENT: X = 192.407 Z = 138.917
Curvilinear Displ.= 128.578
Horiz. Displ. = 114.16

REAR DISPLACEMENT: X = 92.49 Z = 180.91
Curvilinear Displ.= 24.80
Horiz. Displ. = 22.23

SLIDE VOLUME: Initial = 40.22
Final = 107.11

AREA IN PLAN: Initial = 32.15
Final = 322.16

Runout not completed, V-MAX = 0.00

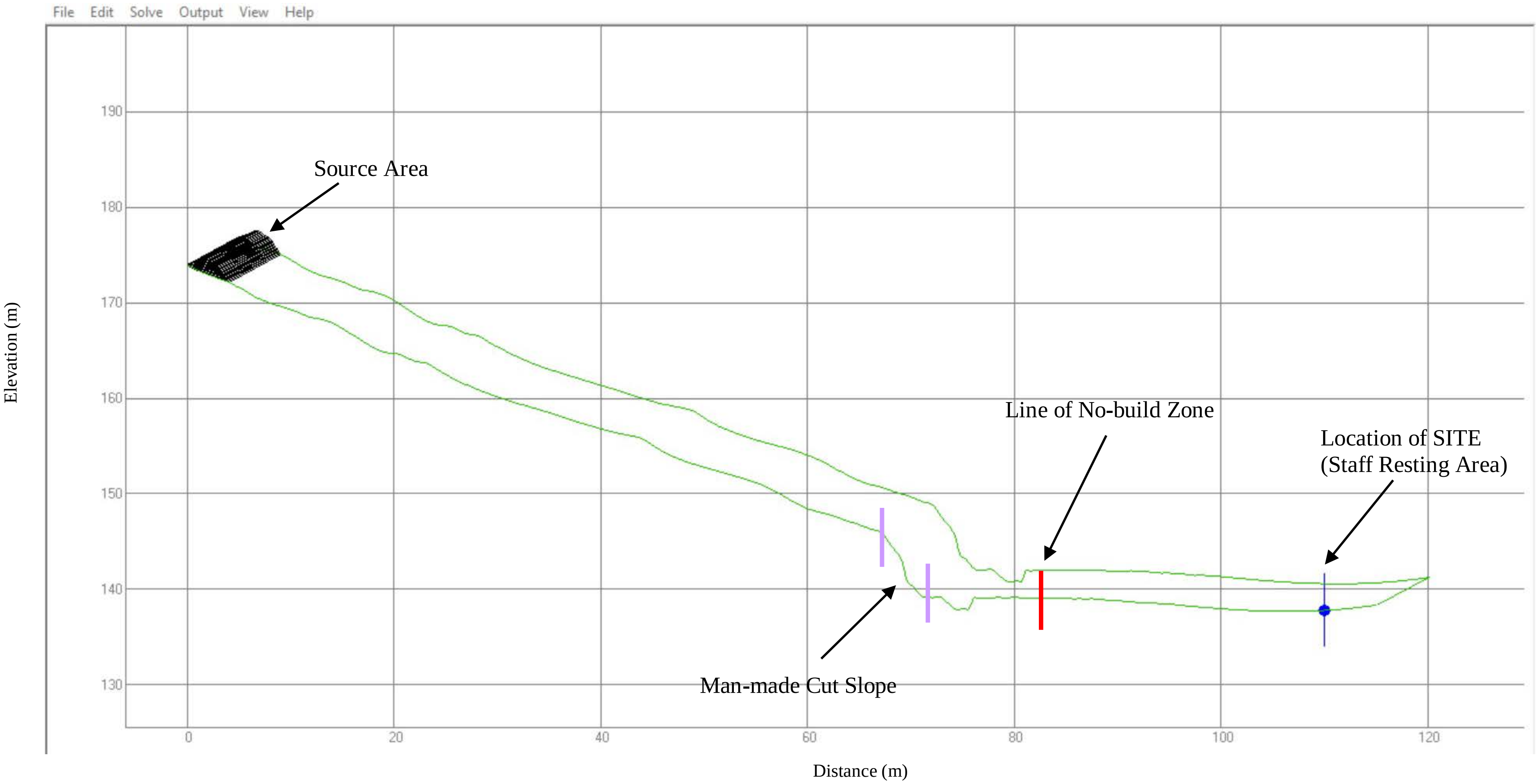
Debris Mobility Analysis for the Credible Runout Path RP6 (Case 1) within Catchment No. OH2

Landslide Type = OHL

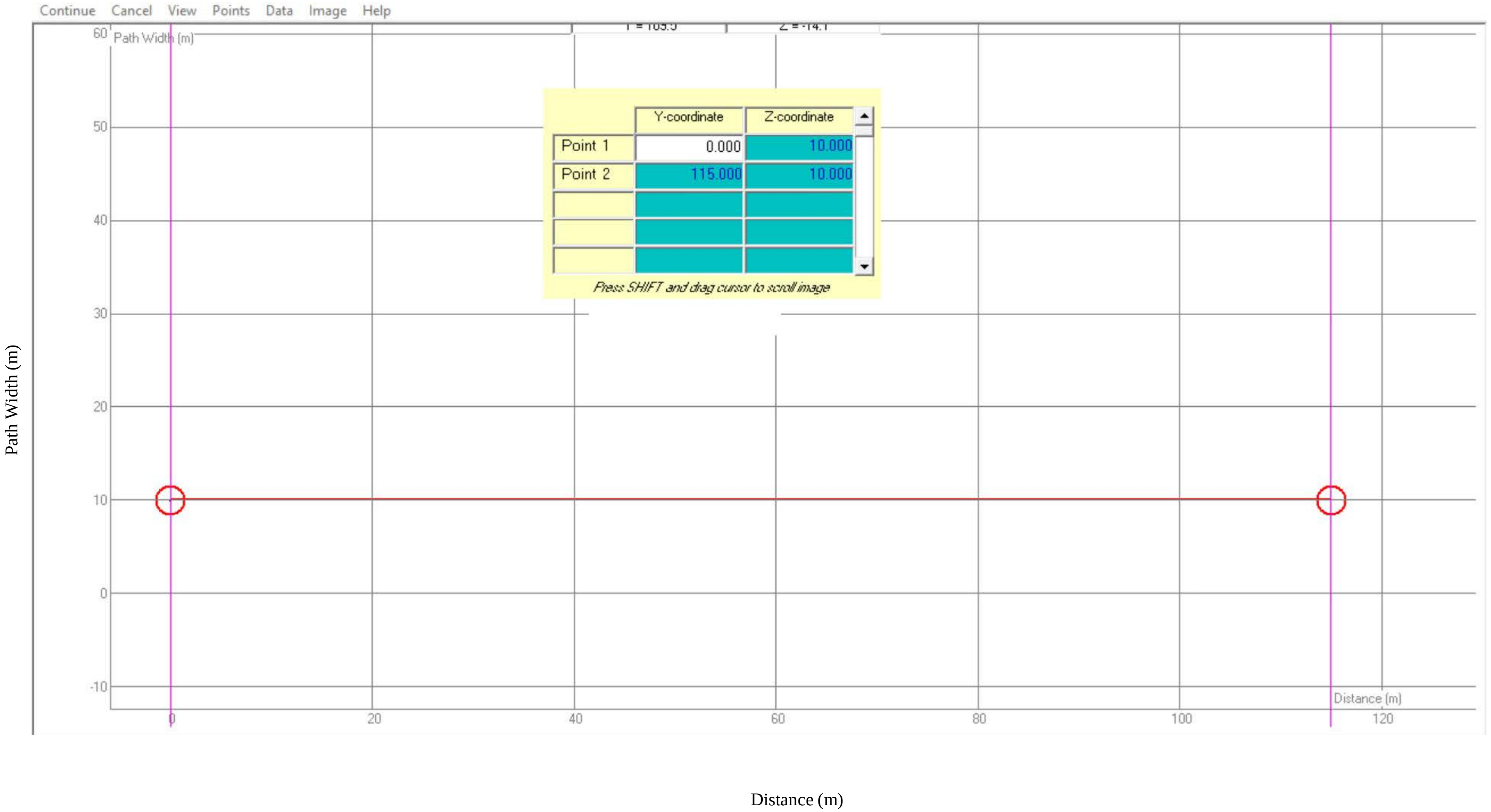
Design Source Volume = 40m^3

Figure D9

Section Profile – (pre-sliding)



Width Profile

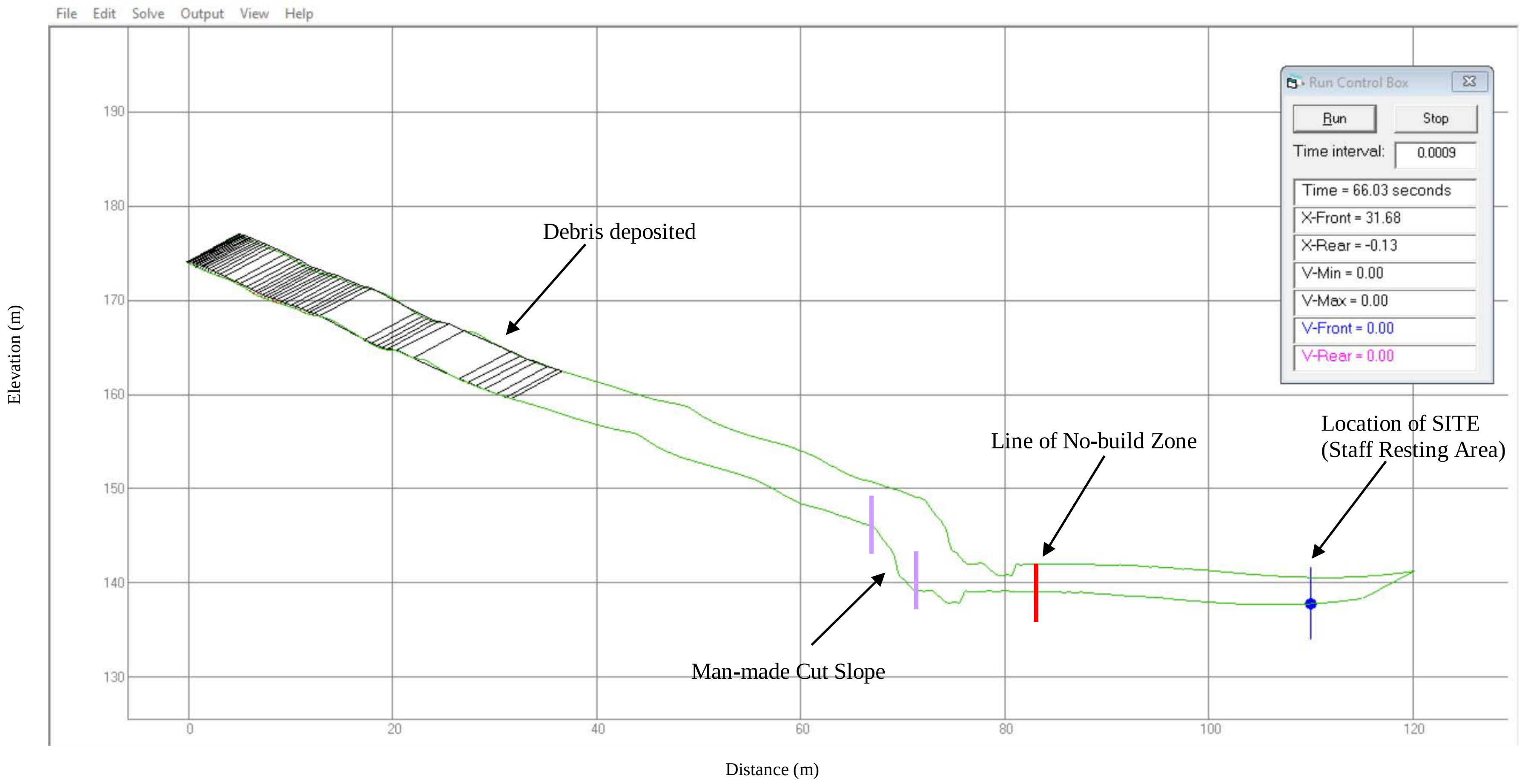

Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
60
50
40
30
20
10
0
-10
Distance (m)
0
20
40
60
80
100
120
Press SHIFT and drag cursor to scroll image
Path Width (m)
Distance (m)

	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	115.000	10.000

Result of Debris Mobility Analysis

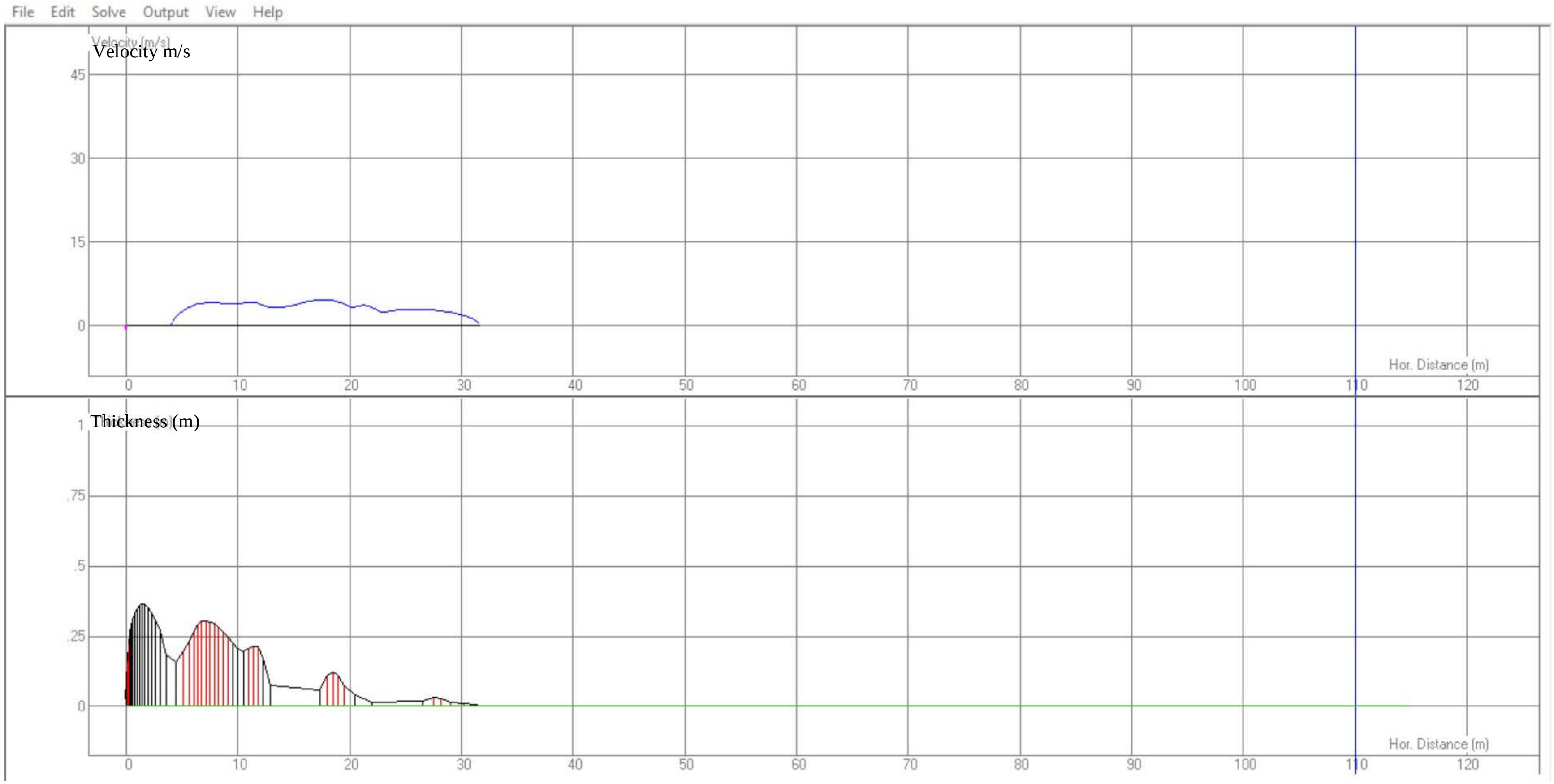
Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.90	40.90	27.63	No

Section Profile – (post-sliding)

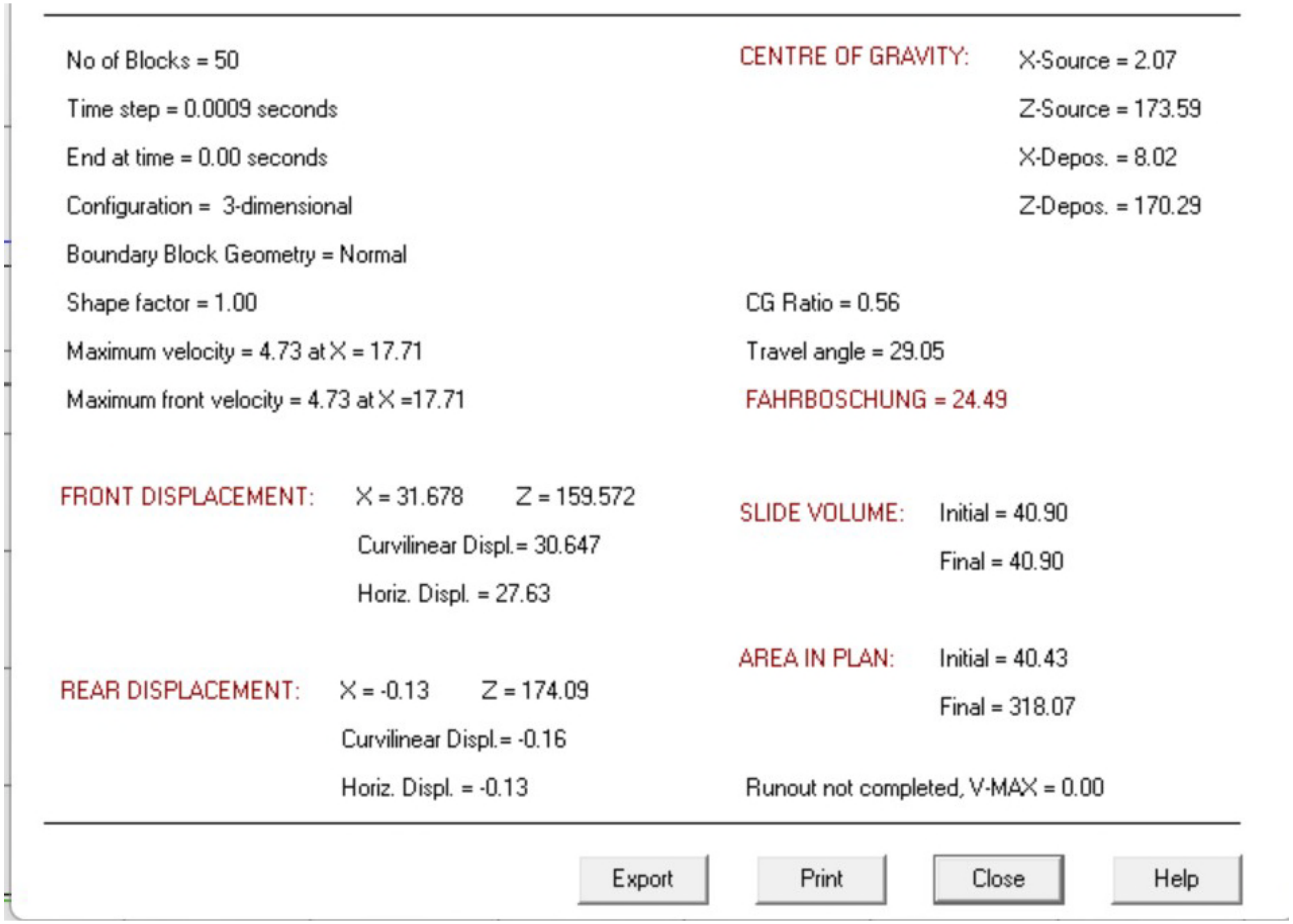

File
Edit
Solve
Output
View
Help
Elevation (m)
190
180
170
160
150
140
130
0
20
40
60
80
100
120
Distance (m)
Debris deposited
Line of No-build Zone
Location of SITE (Staff Resting Area)
Man-made Cut Slope
Run Control Box
Run
Stop

Time interval: 0.0009

Time = 66.03 seconds
X-Front = 31.68
X-Rear = -0.13
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00


File
Edit
Solve
Output
View
Help
Velocity (m/s)
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
Thickness (m)
1
.75
.5
.25
0
Hor. Distance (m)
0
10
20
30
40
50
60
70
80
90
100
110
120

Distance (m)



No of Blocks = 50

Time step = 0.0009 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 4.73 at X = 17.71

Maximum front velocity = 4.73 at X =17.71

FRONT DISPLACEMENT: X = 31.678 Z = 159.572

Curvilinear Displ.= 30.647

Horiz. Displ. = 27.63

REAR DISPLACEMENT: X = -0.13 Z = 174.09

Curvilinear Displ.= -0.16

Horiz. Displ. = -0.13

CENTRE OF GRAVITY: X-Source = 2.07

Z-Source = 173.59

X-Depos. = 8.02

Z-Depos. = 170.29

CG Ratio = 0.56

Travel angle = 29.05

FAHRBOSCHUNG = 24.49

SLIDE VOLUME: Initial = 40.90

Final = 40.90

AREA IN PLAN: Initial = 40.43

Final = 318.07

Runout not completed, V-MAX = 0.00

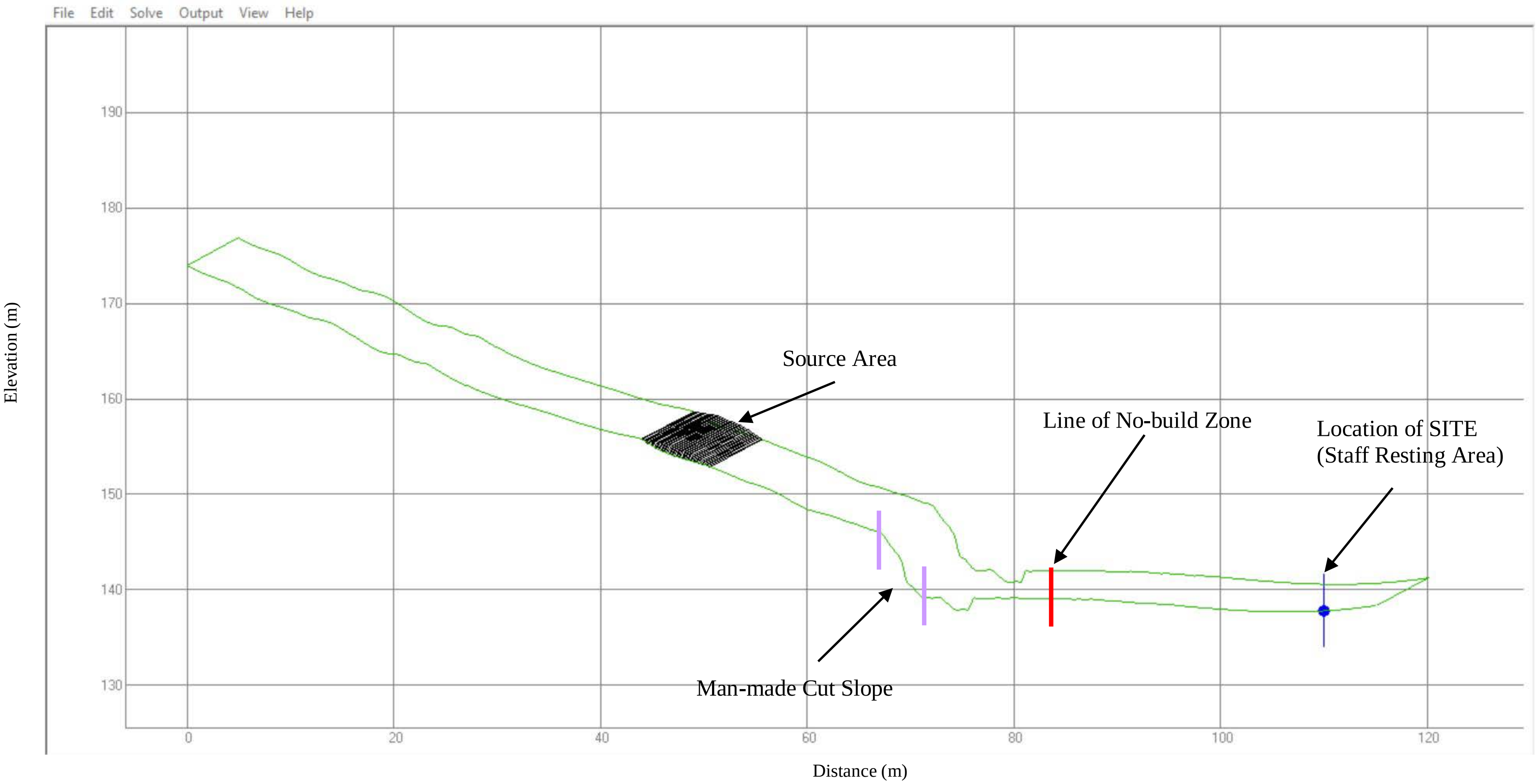
Debris Mobility Analysis for the Credible Runout Path RP6 (Case 2) within Catchment No. OH2

Landslide Type = OHL

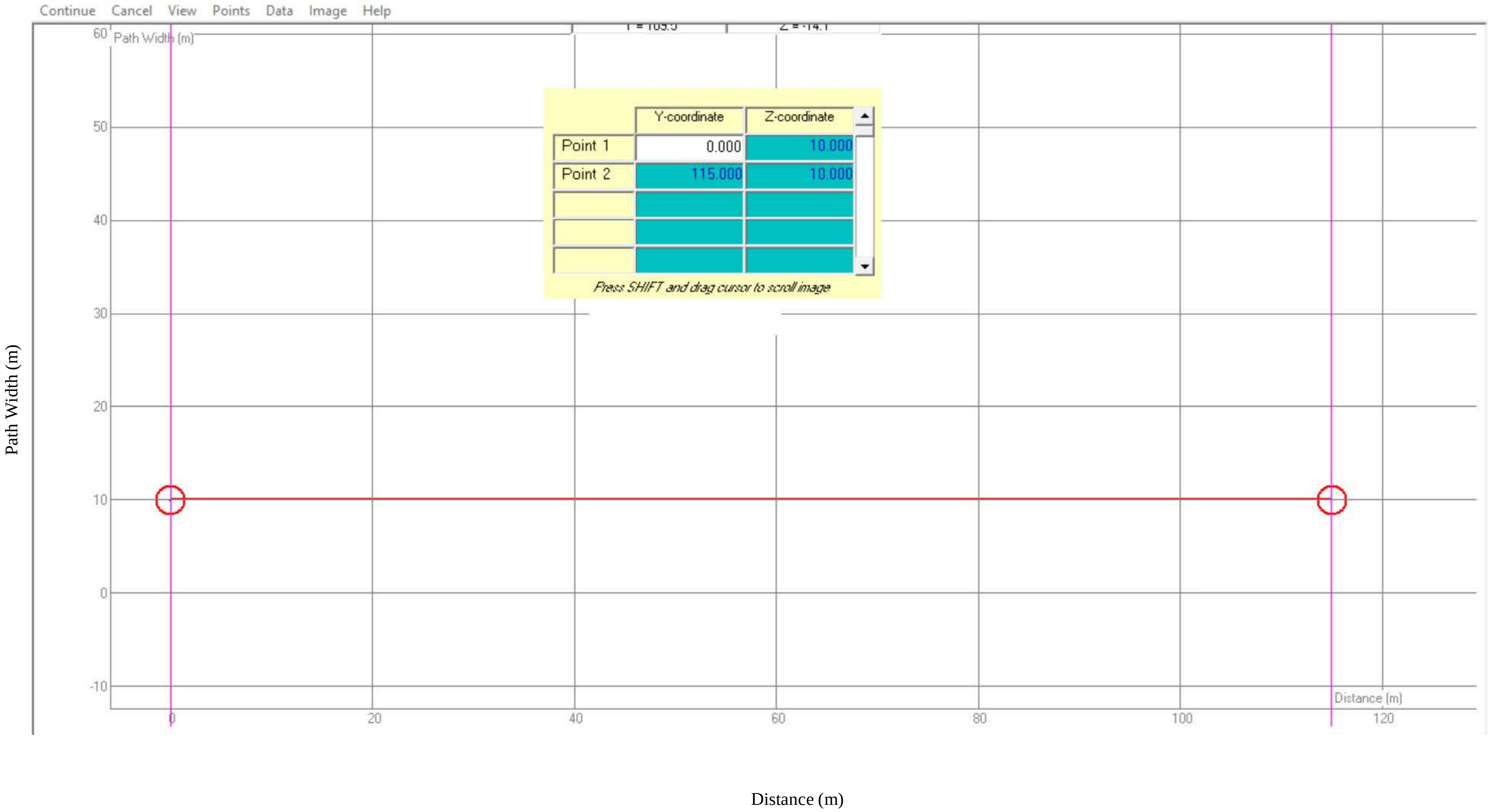
Design Source Volume = 40m^3

Figure D10

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
60
50
40
30
20
10
0
-10
Distance (m)
0
20
40
60
80
100
120
Path Width (m)
Distance (m)

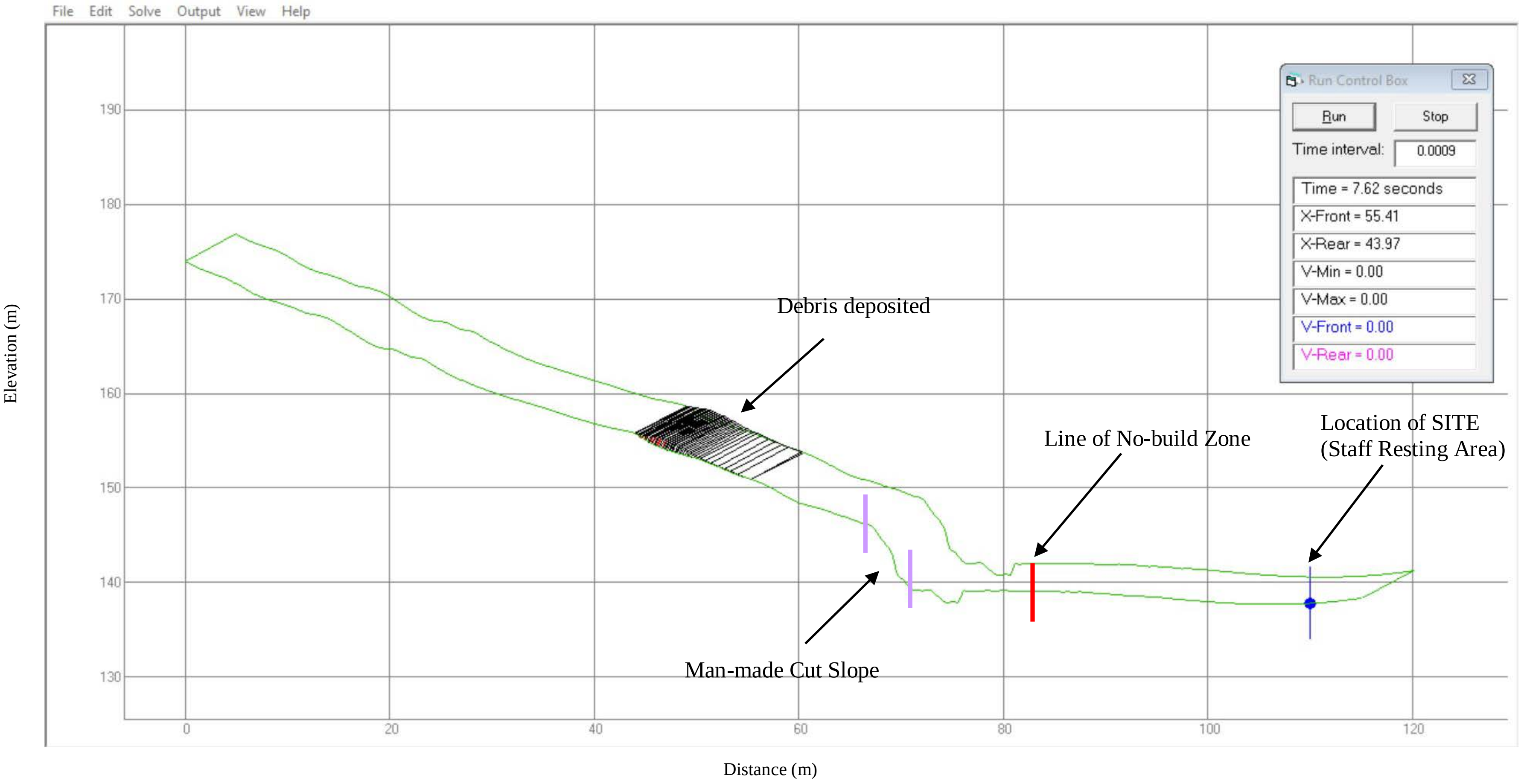
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	115.000	10.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.87	40.87	4.75	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Elevation (m)
190
180
170
160
150
140
130
Distance (m)
0
20
40
60
80
100
120
Run Control Box
Run
Stop

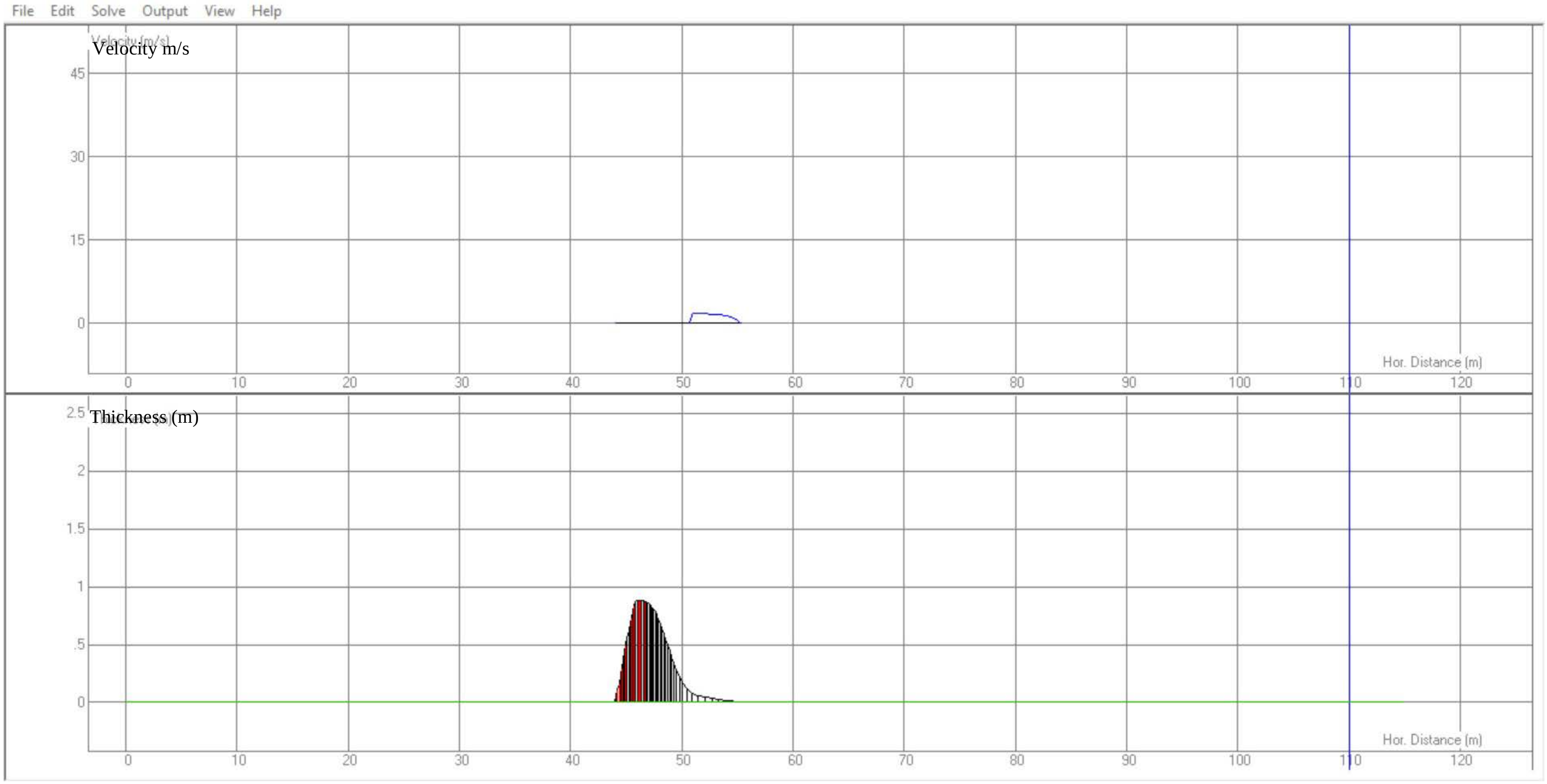
```
Time interval: 0.0009
Time = 7.62 seconds
X-Front = 55.41
X-Rear = 43.97
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00
```

Debris deposited

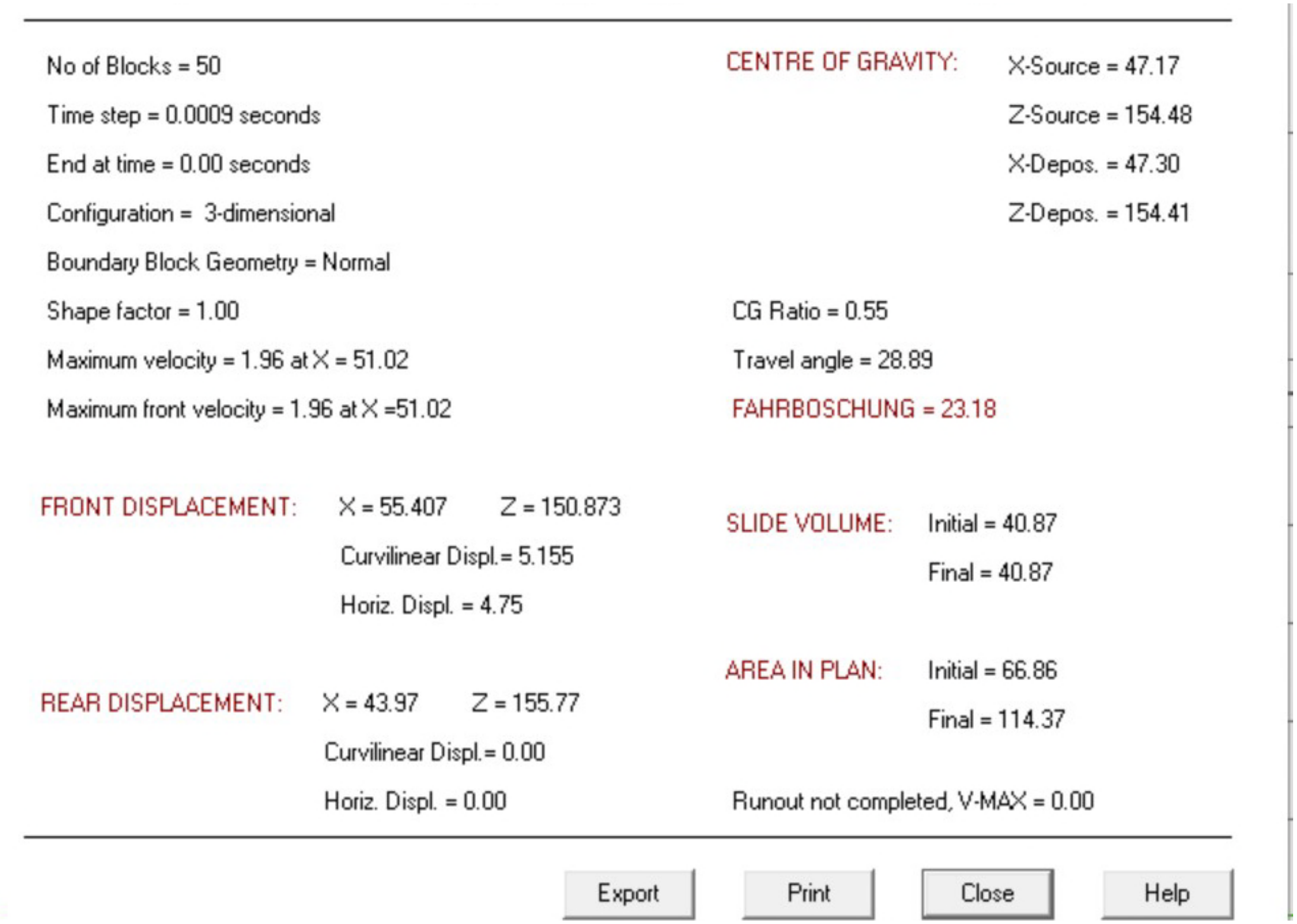
Line of No-build Zone

Location of SITE (Staff Resting Area)

Man-made Cut Slope


File Edit Solve Output View Help
Velocity (m/s)
Velocity m/s
45
30
15
0
Hor. Distance (m)
0 10 20 30 40 50 60 70 80 90 100 110 120
Thickness (m)
2.5
2
1.5
1
.5
0
Hor. Distance (m)
0 10 20 30 40 50 60 70 80 90 100 110 120

Distance (m)



```
No of Blocks = 50                                  CENTRE OF GRAVITY:   X-Source = 47.17
Time step = 0.0009 seconds                                              Z-Source = 154.48
End at time = 0.00 seconds                                              X-Depos. = 47.30
Configuration =  3-dimensional                                          Z-Depos. = 154.41
Boundary Block Geometry = Normal
Shape factor = 1.00                                 CG Ratio = 0.55
Maximum velocity = 1.96 at X = 51.02                Travel angle = 28.89
Maximum front velocity = 1.96 at X =51.02           FAHRBOSCHUNG = 23.18

FRONT DISPLACEMENT:   X = 55.407     Z = 150.873    SLIDE VOLUME:   Initial = 40.87
                      Curvilinear Displ.= 5.155                     Final = 40.87
                      Horiz. Displ. = 4.75
                                                    AREA IN PLAN:   Initial = 66.86
REAR DISPLACEMENT:   X = 43.97     Z = 155.77                       Final = 114.37
                     Curvilinear Displ.= 0.00
                     Horiz. Displ. = 0.00           Runout not completed, V-MAX = 0.00
```

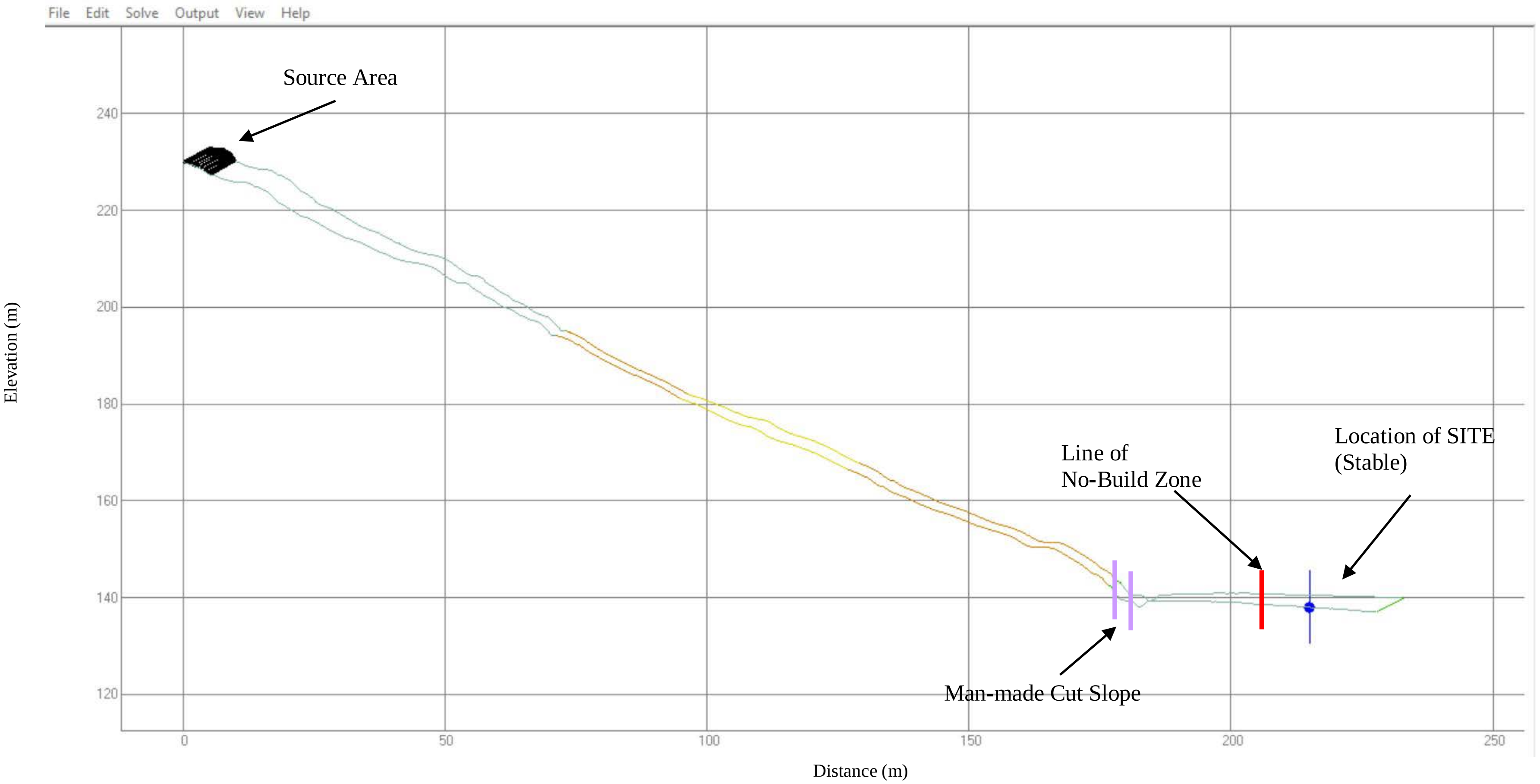
Debris Mobility Analysis for the Credible Runout Path RP7 (Case 1) within Catchment No. CD2

Landslide Type = CDF

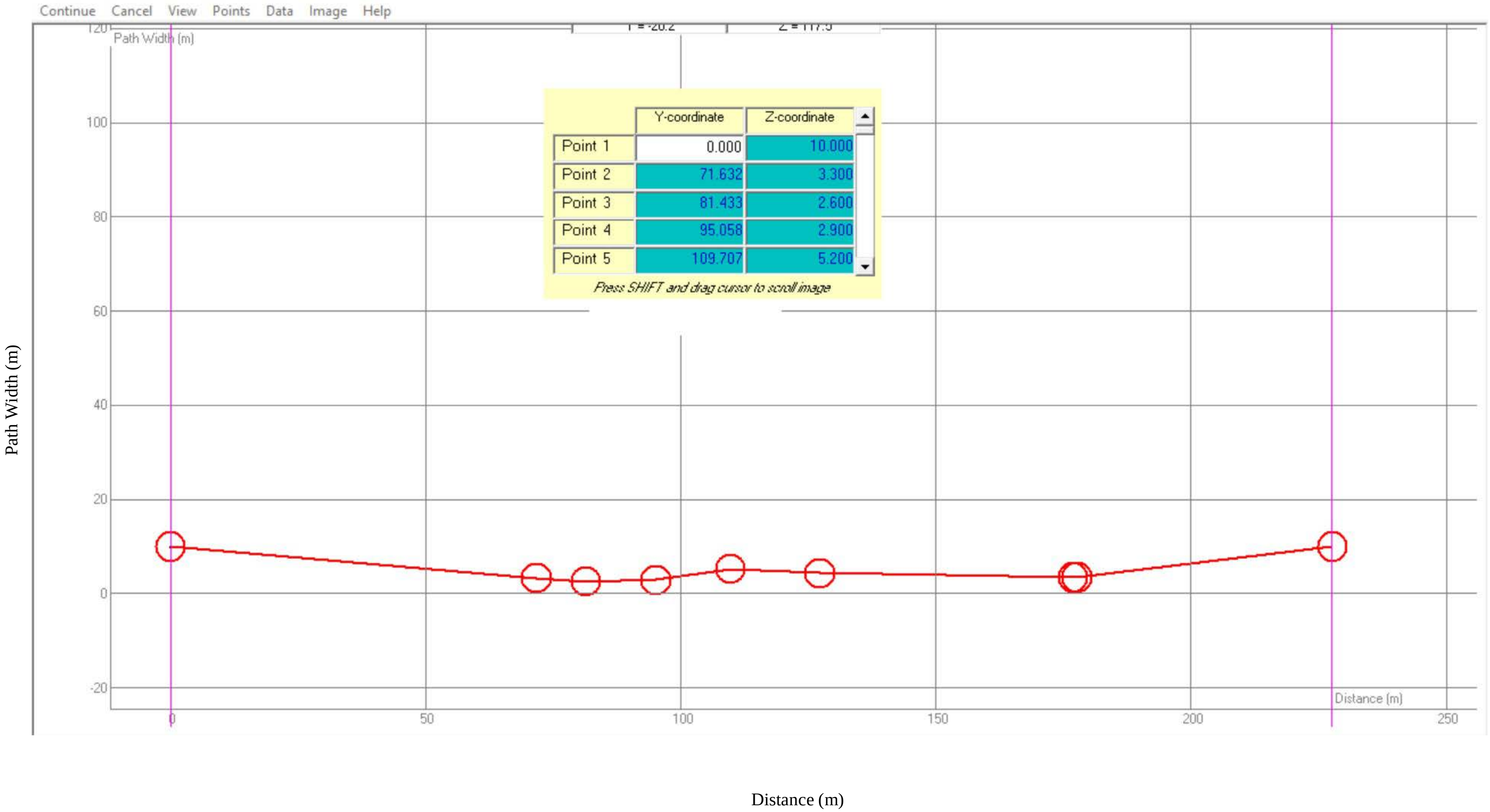
Design Source Volume = 40m^3

Figure D11

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = -20.2
Z = 117.5
Path Width (m)
120
100
80
60
40
20
0
-20
0
50
100
150
200
250
Distance (m)
Path Width (m)
Distance (m)

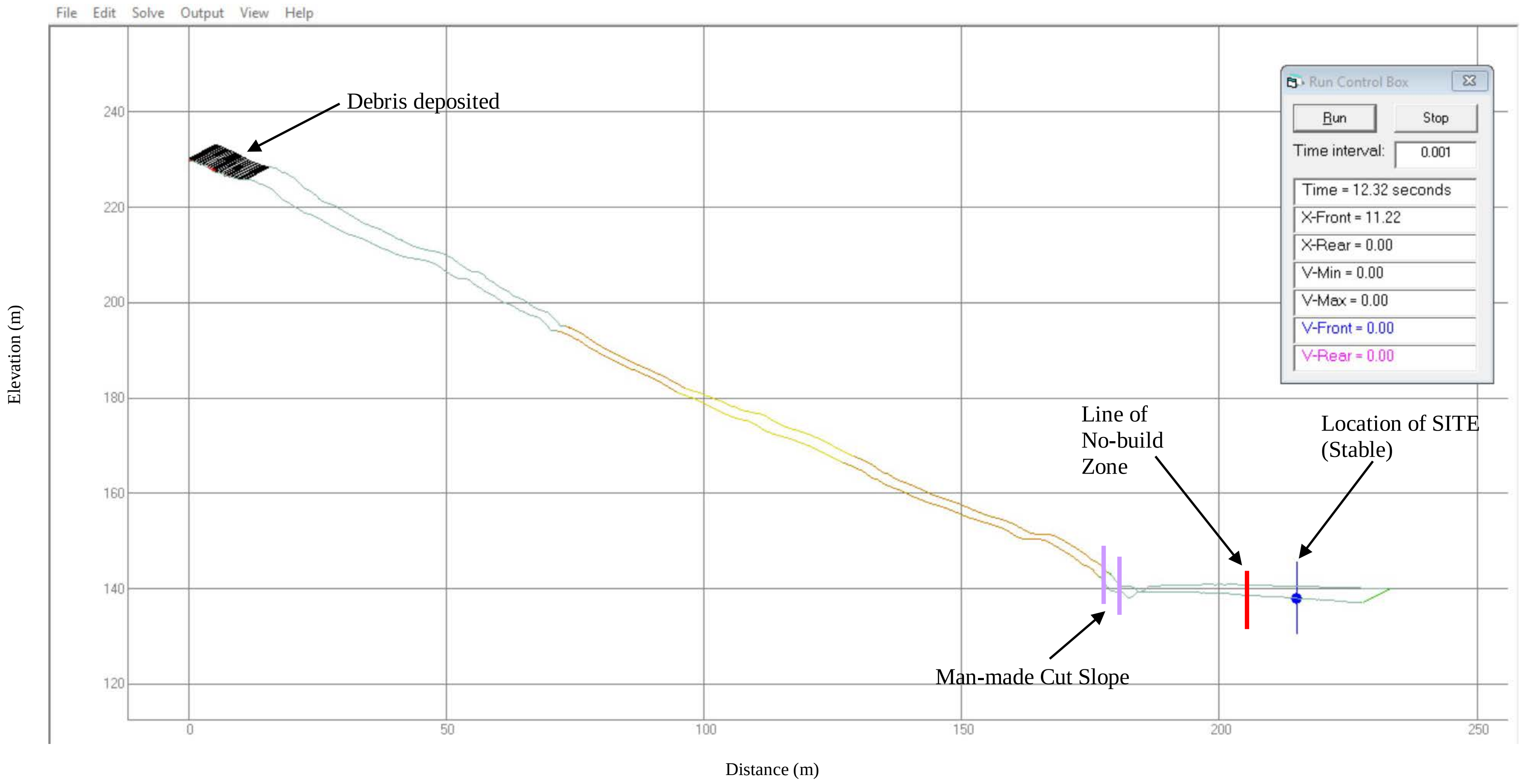
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	71.632	3.300
Point 3	81.433	2.600
Point 4	95.058	2.900
Point 5	109.707	5.200

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

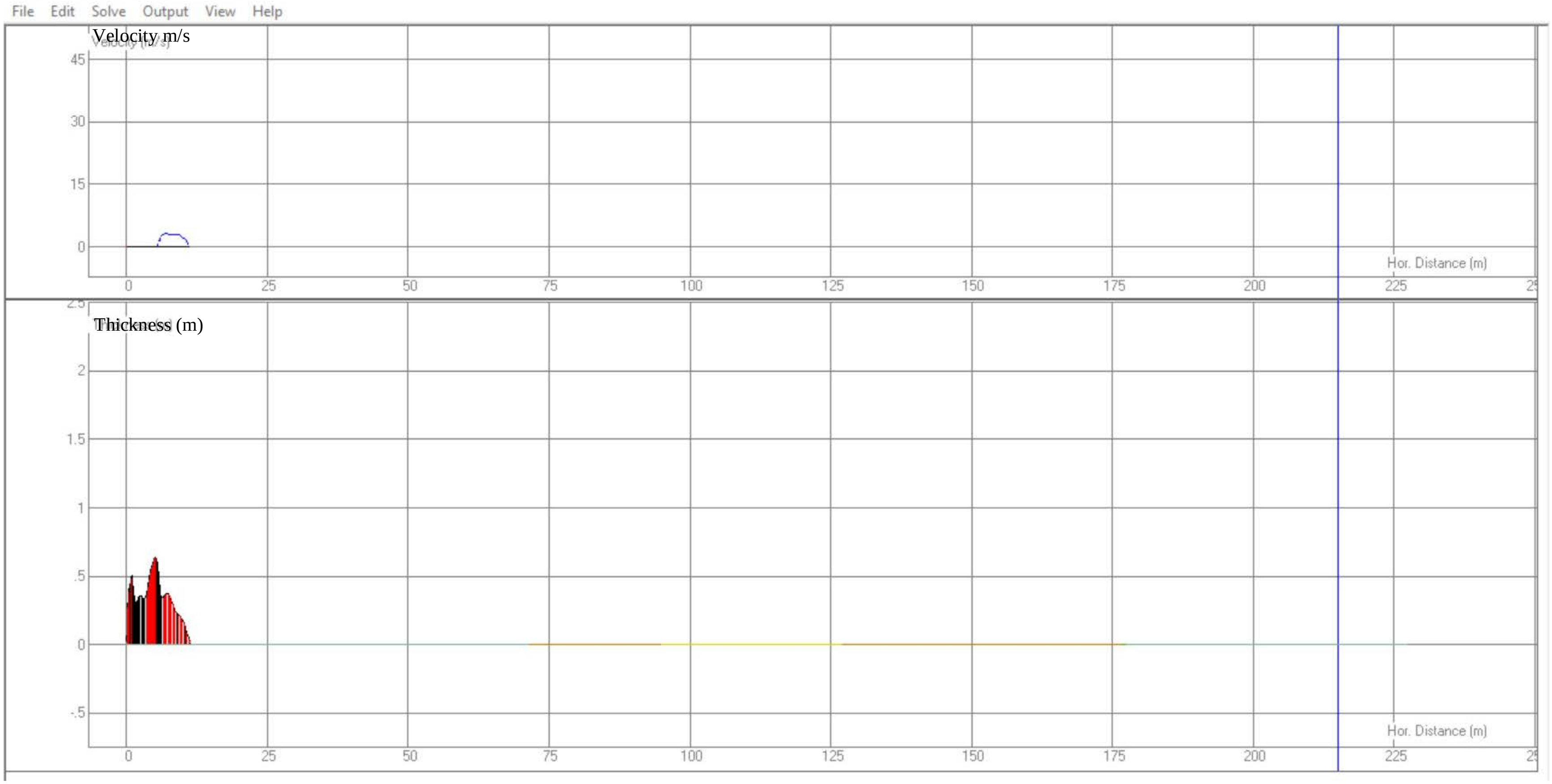
Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.43	40.43	5.74	No

Section Profile – (post-sliding)

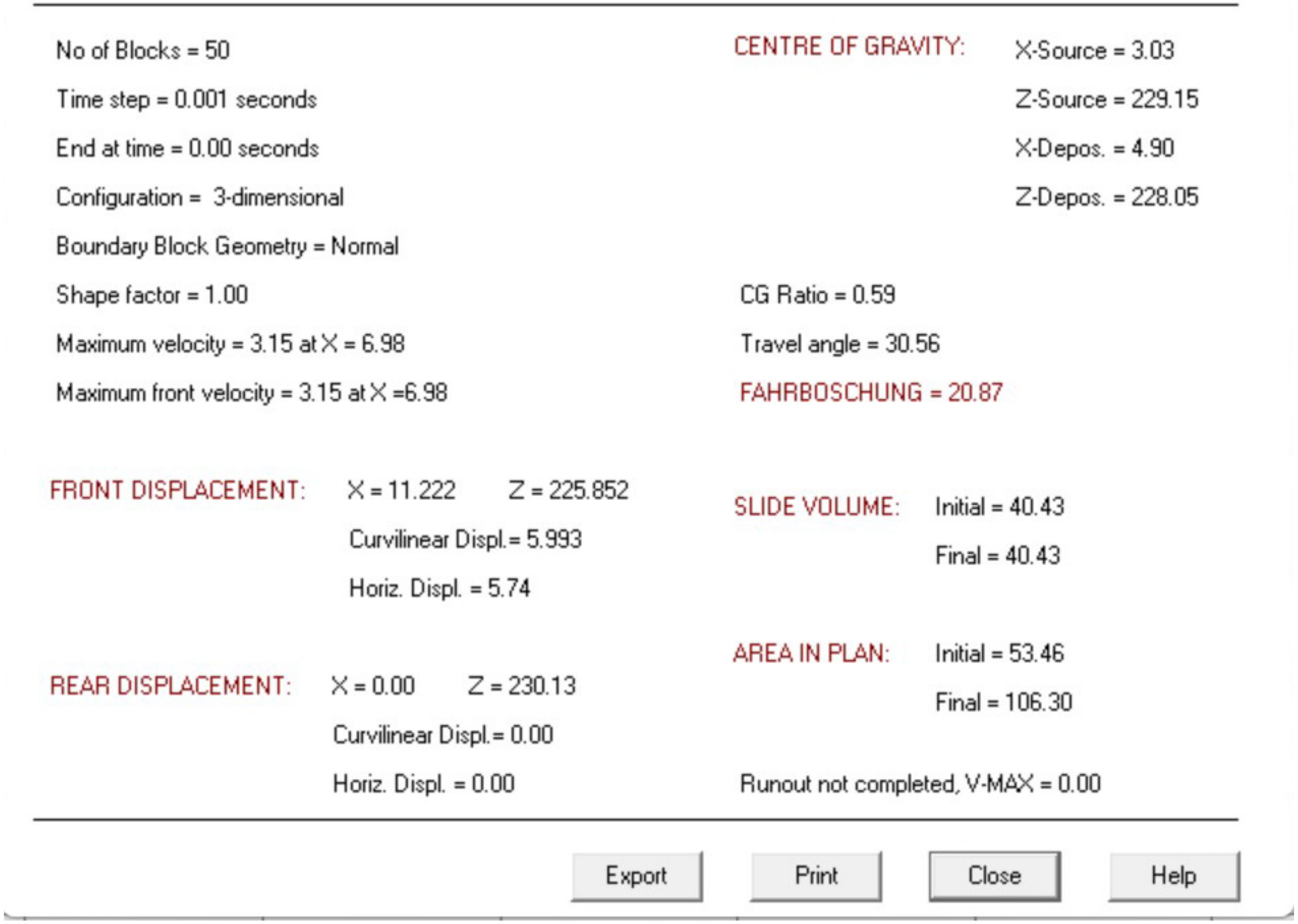


Time interval: 0.001

Time = 12.32 seconds
X-Front = 11.22
X-Rear = 0.00
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00


File Edit Solve Output View Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0 25 50 75 100 125 150 175 200 225
Thickness (m)
2.5
2
1.5
1
.5
0
-.5
Hor. Distance (m)
0 25 50 75 100 125 150 175 200 225

Distance (m)



No of Blocks = 50

Time step = 0.001 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 3.15 at X = 6.98

Maximum front velocity = 3.15 at X =6.98

CENTRE OF GRAVITY:

X-Source = 3.03

Z-Source = 229.15

X-Depos. = 4.90

Z-Depos. = 228.05

CG Ratio = 0.59

Travel angle = 30.56

FAHRBOSCHUNG = 20.87

FRONT DISPLACEMENT: X = 11.222 Z = 225.852

Curvilinear Displ.= 5.993

Horiz. Displ. = 5.74

REAR DISPLACEMENT: X = 0.00 Z = 230.13

Curvilinear Displ.= 0.00

Horiz. Displ. = 0.00

SLIDE VOLUME: Initial = 40.43

Final = 40.43

AREA IN PLAN: Initial = 53.46

Final = 106.30

Runout not completed, V-MAX = 0.00

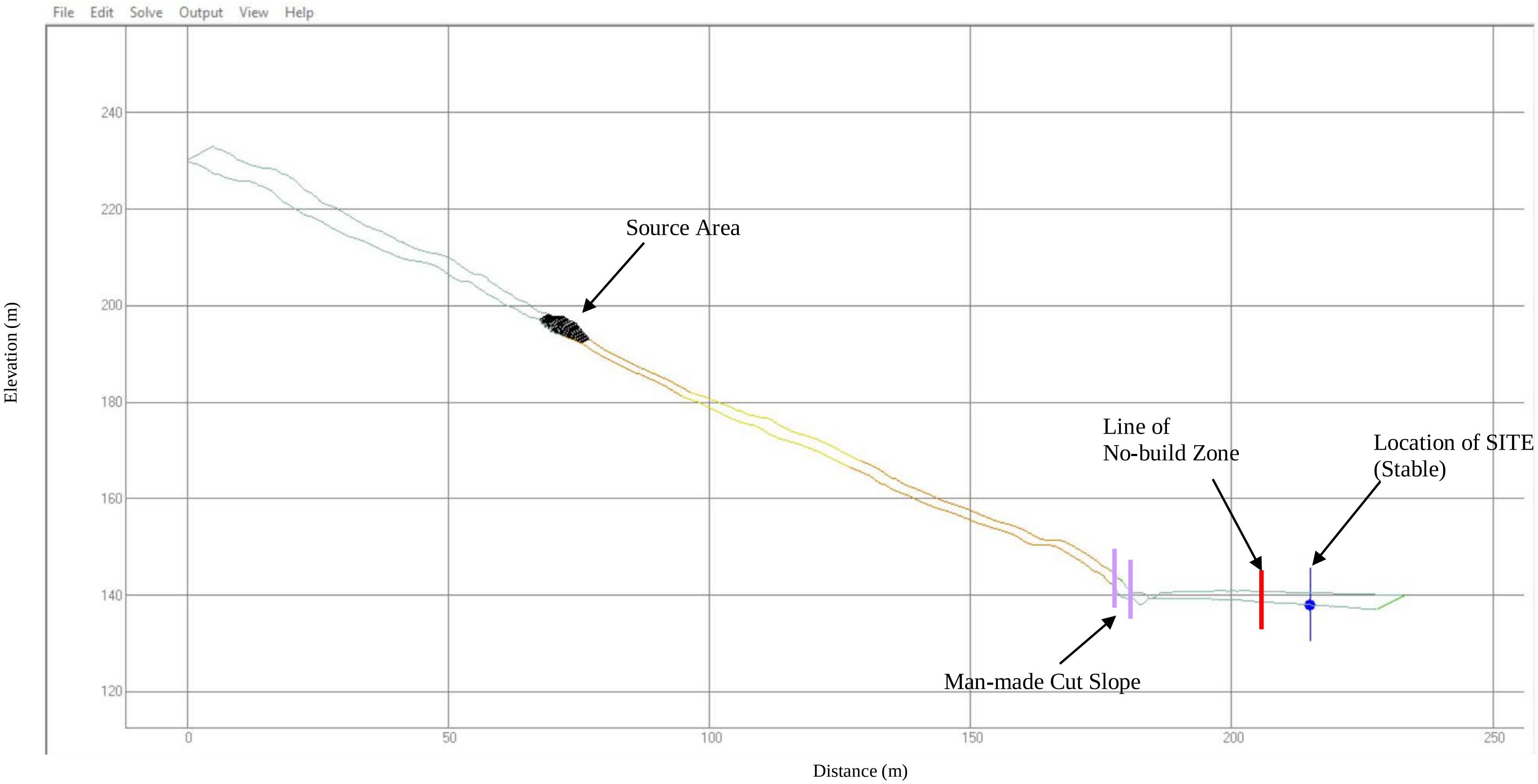
Debris Mobility Analysis for the Credible Runout Path RP7 (Case 2) within Catchment No. CD2

Landslide Type = CDF

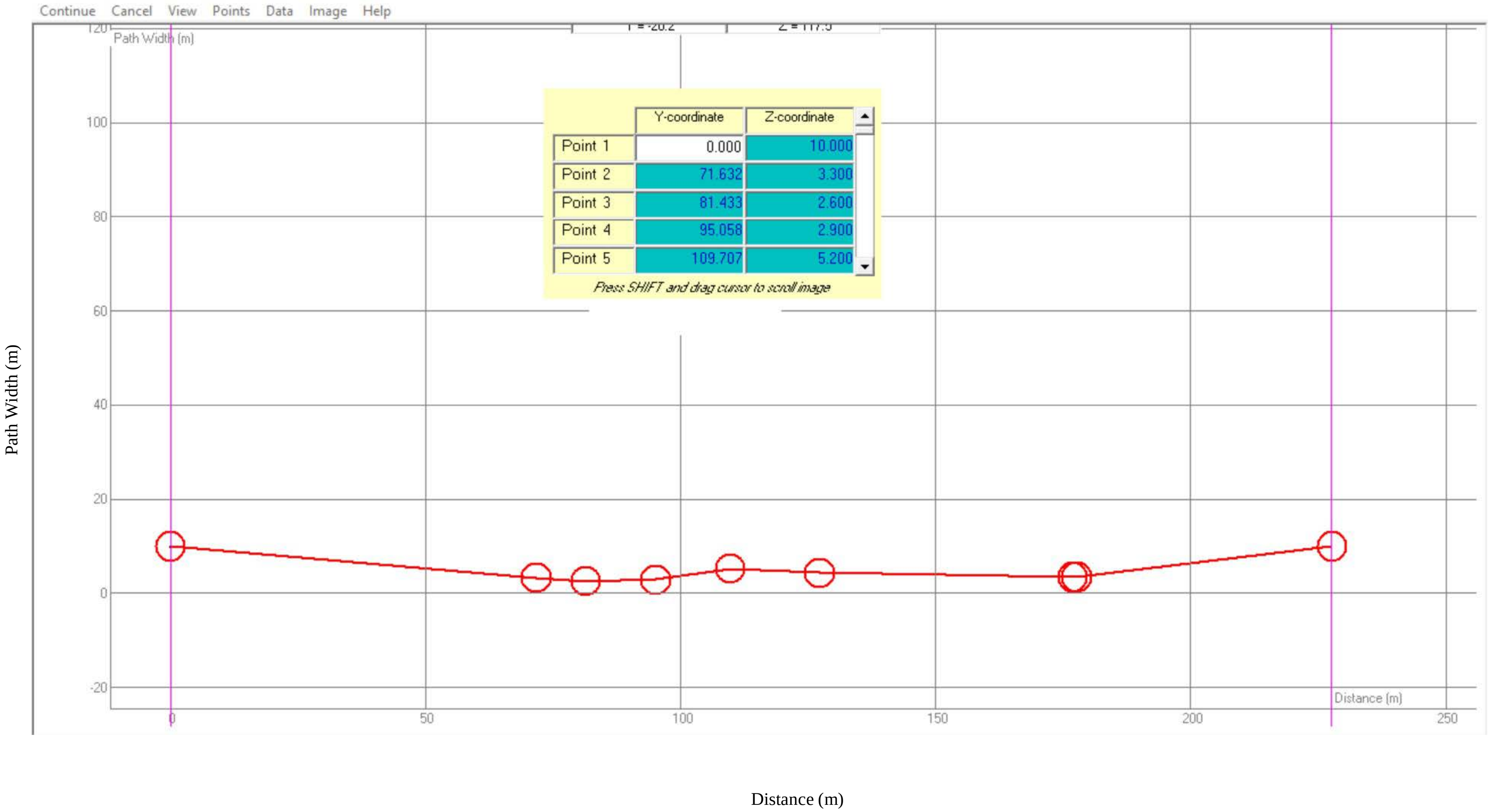
Design Source Volume = 40m^3

Figure D12

Section Profile – (pre-sliding)



Width Profile


Continue Cancel View Points Data Image Help
Y = -20.2
Z = 117.5
Path Width (m)
120
100
80
60
40
20
0
-20
0
50
100
150
200
250
Distance (m)
Path Width (m)
Distance (m)

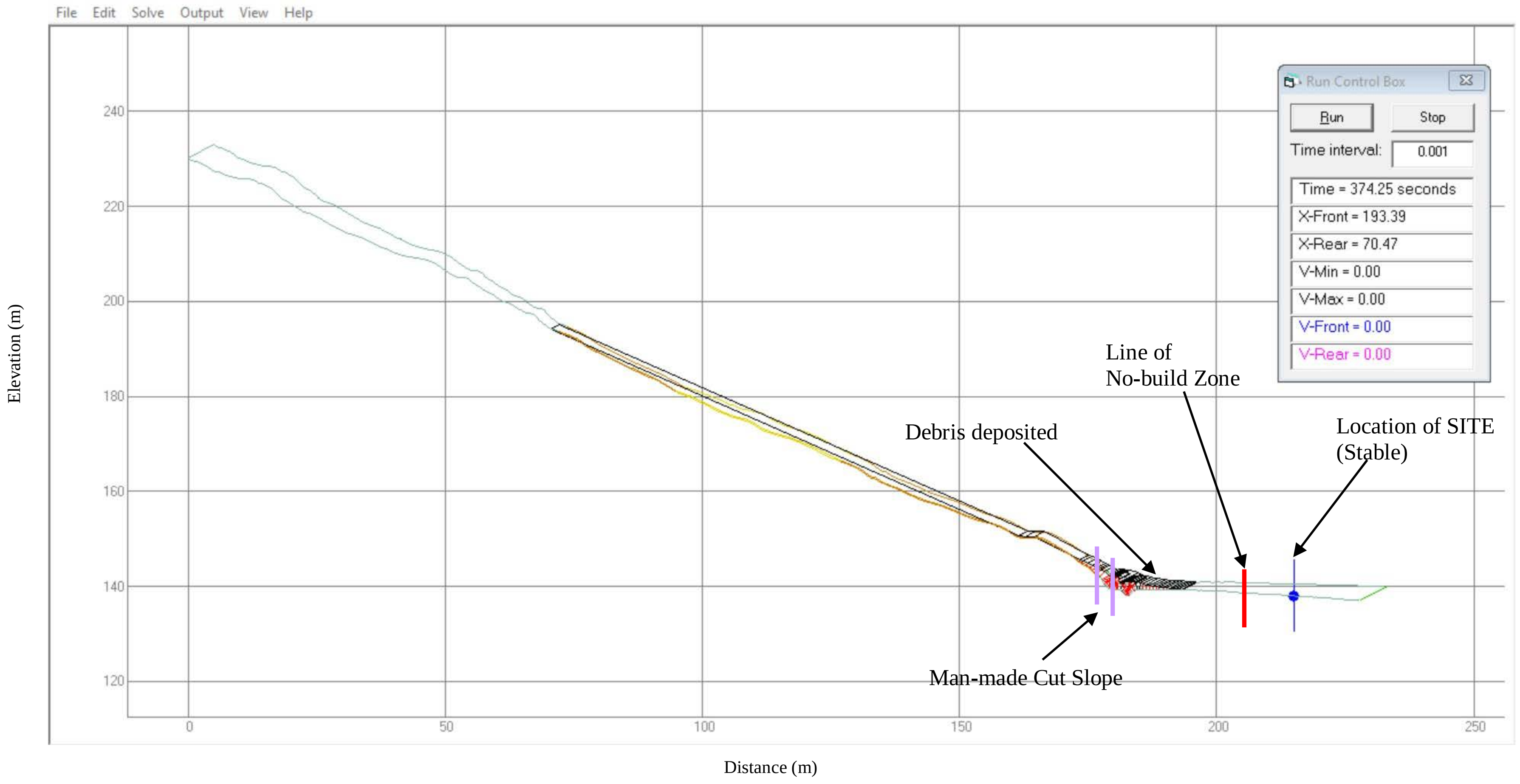
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	71.632	3.300
Point 3	81.433	2.600
Point 4	95.058	2.900
Point 5	109.707	5.200

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.50	143.05	117.90	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Elevation (m)
240
220
200
180
160
140
120
Distance (m)
0
50
100
150
200
250

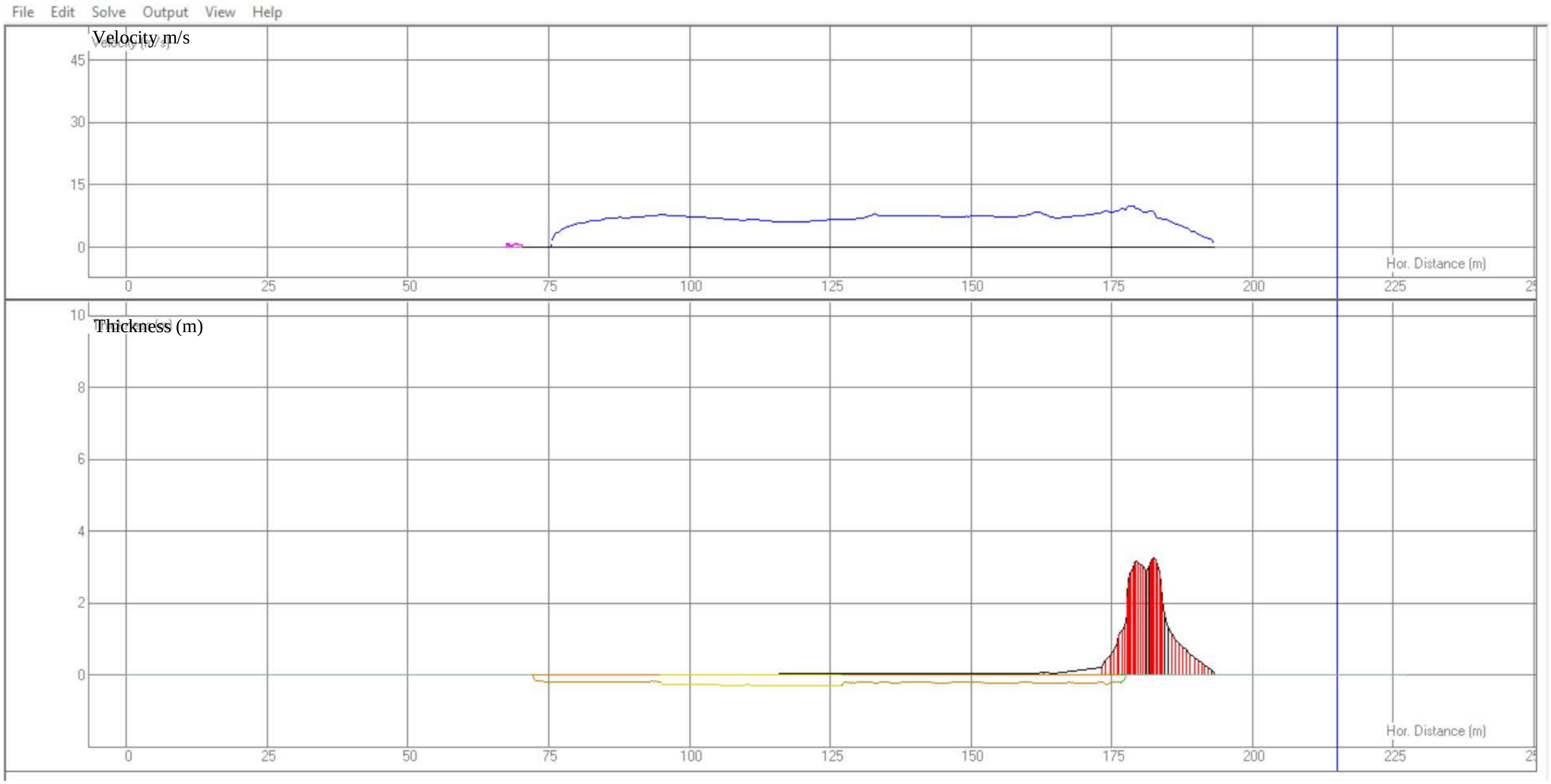
Time interval: 0.001
Time = 374.25 seconds
X-Front = 193.39
X-Rear = 70.47
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00

Line of No-build Zone

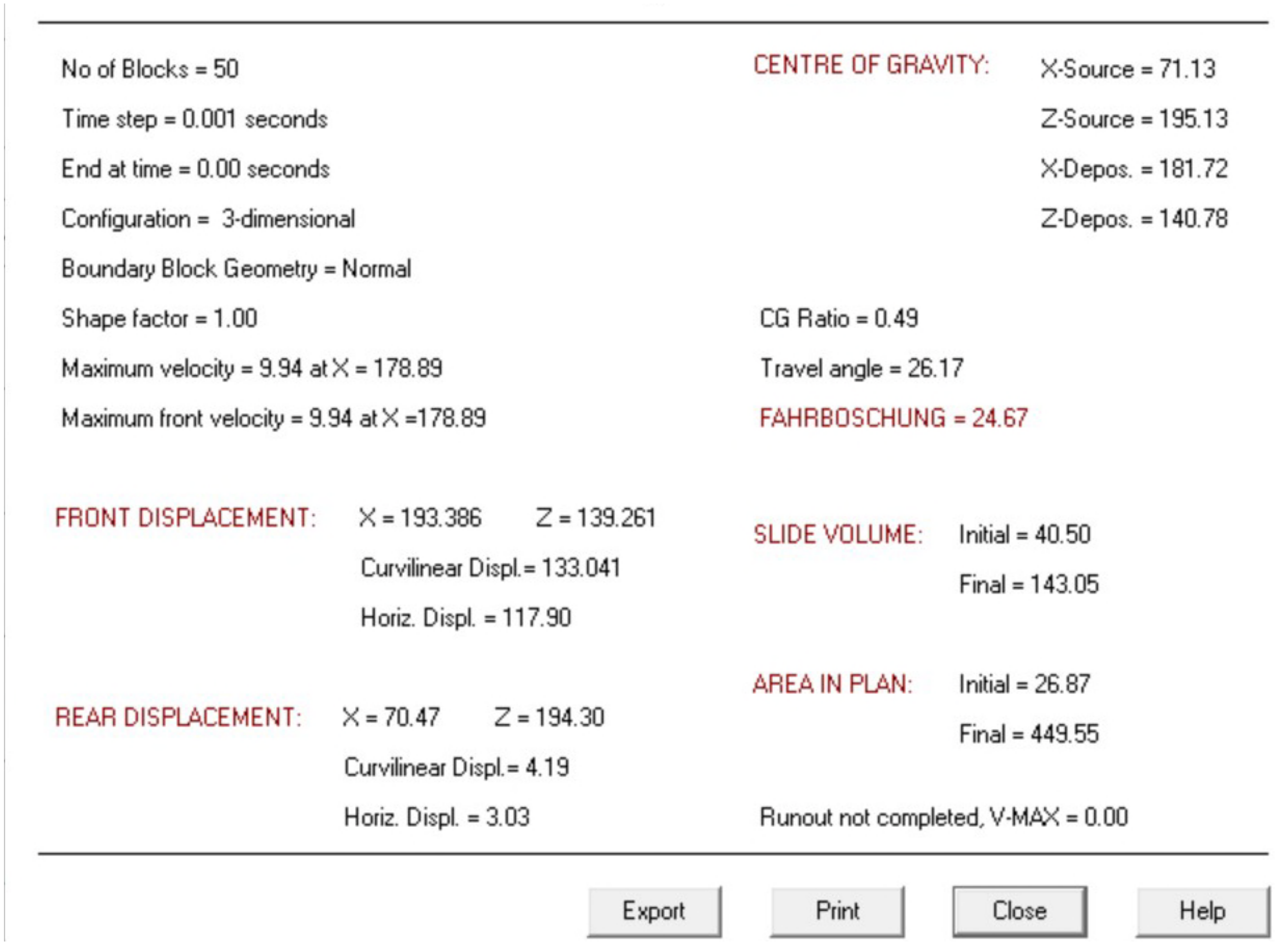
Debris deposited

Location of SITE (Stable)

Man-made Cut Slope


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
0
25
50
75
100
125
150
175
200
225
Hor. Distance (m)
10
Thickness (m)
8
6
4
2
0
0
25
50
75
100
125
150
175
200
225
Hor. Distance (m)

Distance (m)



No of Blocks = 50

Time step = 0.001 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 9.94 at X = 178.89

Maximum front velocity = 9.94 at X =178.89

CENTRE OF GRAVITY: X-Source = 71.13

Z-Source = 195.13

X-Depos. = 181.72

Z-Depos. = 140.78

CG Ratio = 0.49

Travel angle = 26.17

FAHRBOSCHUNG = 24.67

FRONT DISPLACEMENT: X = 193.386 Z = 139.261

Curvilinear Displ.= 133.041

Horiz. Displ. = 117.90

SLIDE VOLUME: Initial = 40.50

Final = 143.05

AREA IN PLAN: Initial = 26.87

Final = 449.55

REAR DISPLACEMENT: X = 70.47 Z = 194.30

Curvilinear Displ.= 4.19

Horiz. Displ. = 3.03

Runout not completed, V-MAX = 0.00

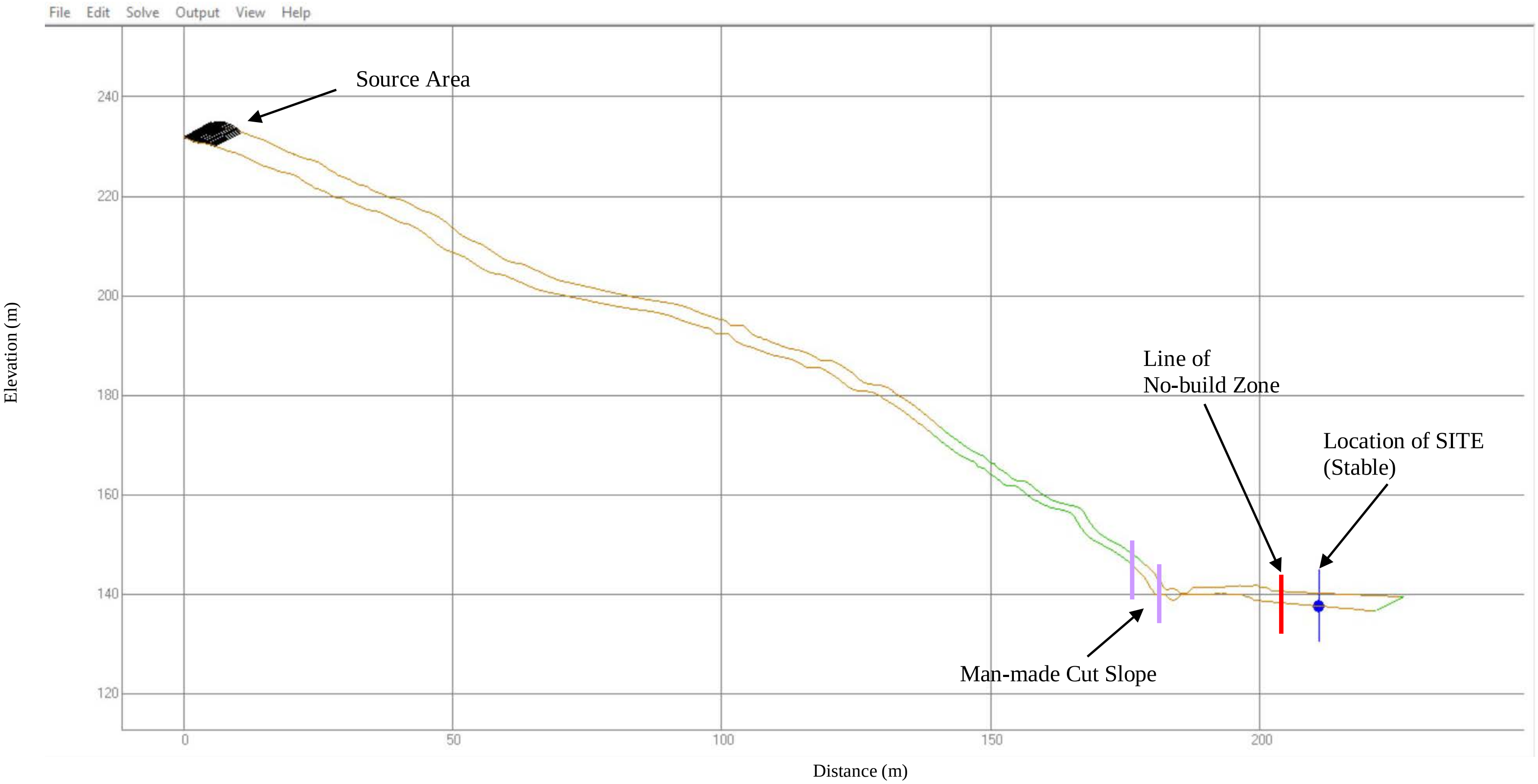
Debris Mobility Analysis for the Credible Runout Path RP8 (Case 1) within Catchment No. OH3

Landslide Type = OHL

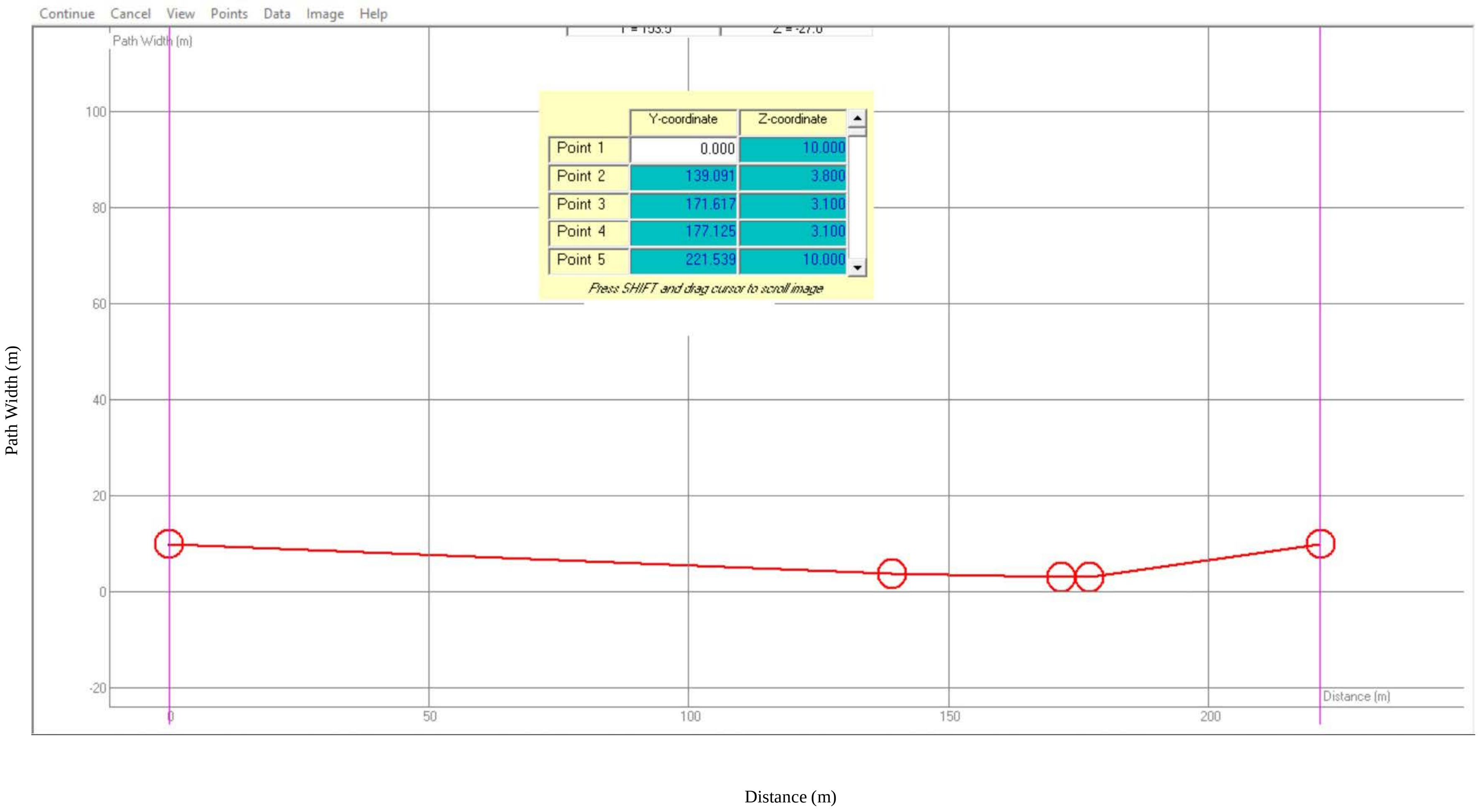
Design Source Volume = 40m^3

Figure D13

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
100
80
60
40
20
0
-20
0
50
100
150
200
Distance (m)
Path Width (m)
Distance (m)

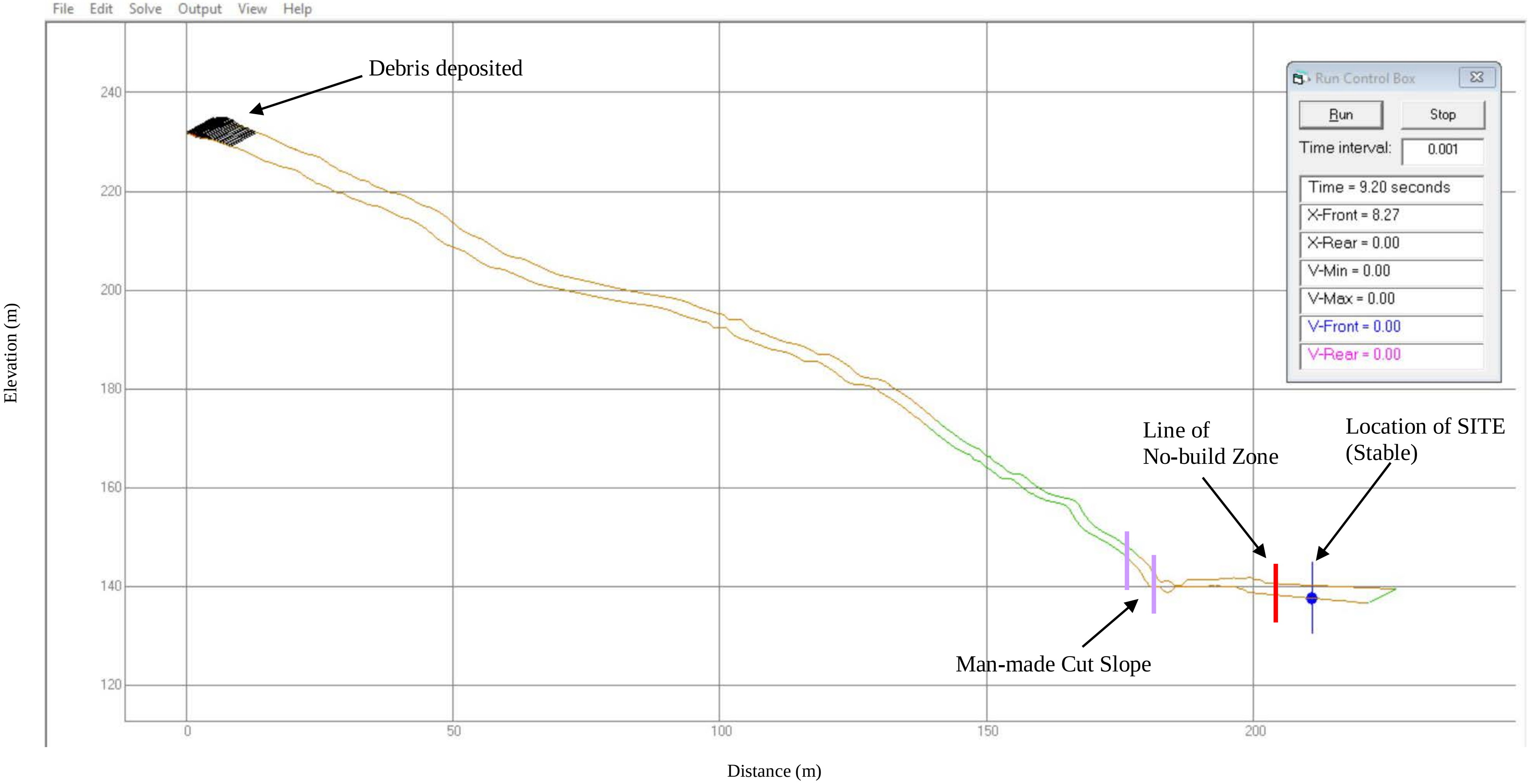
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	139.091	3.800
Point 3	171.617	3.100
Point 4	177.125	3.100
Point 5	221.539	10.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

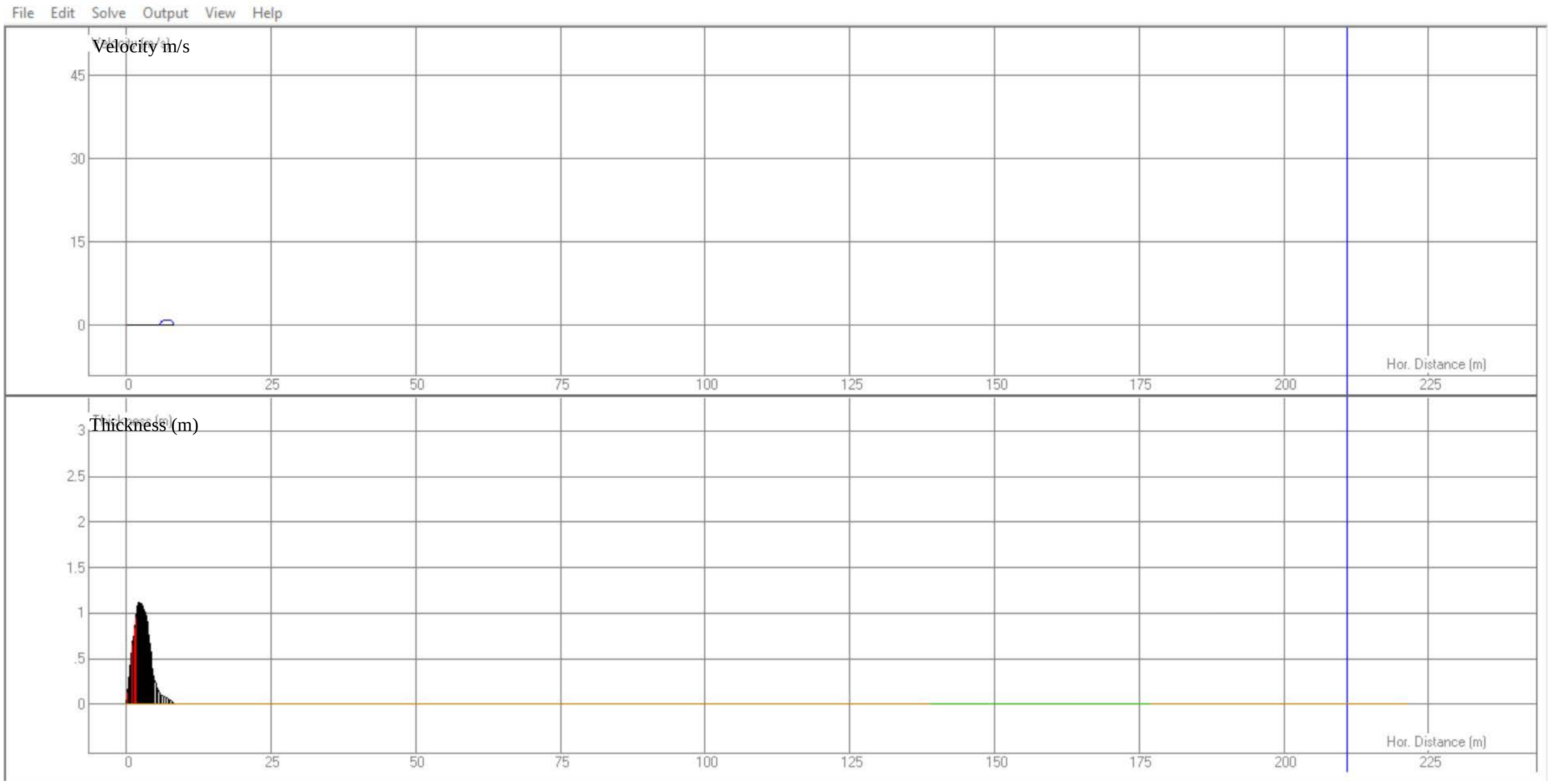
Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.65	40.65	2.45	No

Section Profile – (post-sliding)

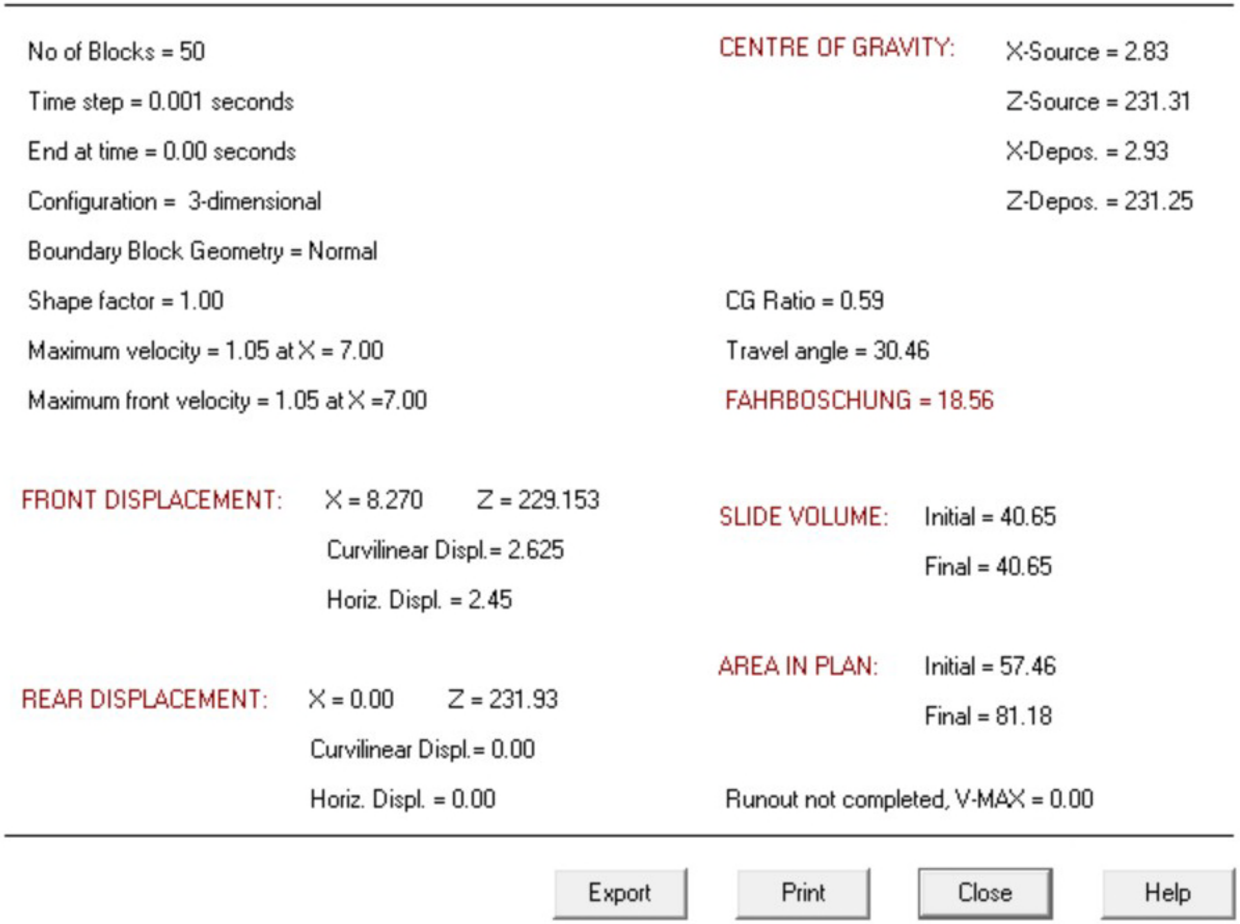


```
Time interval: 0.001
Time = 9.20 seconds
X-Front = 8.27
X-Rear = 0.00
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00
```

File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Debris deposited
Line of
No-build Zone
Location of SITE
(Stable)
Man-made Cut Slope
Elevation (m)
240
220
200
180
160
140
120
0
50
100
150
200
Distance (m)


File Edit Solve Output View Help
Velocity m/s
45
30
15
0
0 25 50 75 100 125 150 175 200 225
Hor. Distance (m)
Thickness (m)
3
2.5
2
1.5
1
.5
0
0 25 50 75 100 125 150 175 200 225
Hor. Distance (m)

Distance (m)



```
No of Blocks = 50                                   CENTRE OF GRAVITY:   X-Source = 2.83
Time step = 0.001 seconds                                                Z-Source = 231.31
End at time = 0.00 seconds                                               X-Depos. = 2.93
Configuration =  3-dimensional                                           Z-Depos. = 231.25
Boundary Block Geometry = Normal
Shape factor = 1.00                                  CG Ratio = 0.59
Maximum velocity = 1.05 at X = 7.00                  Travel angle = 30.46
Maximum front velocity = 1.05 at X =7.00             FAHRBOSCHUNG = 18.56

FRONT DISPLACEMENT:   X = 8.270     Z = 229.153
                      Curvilinear Displ.= 2.625     SLIDE VOLUME:   Initial = 40.65
                      Horiz. Displ. = 2.45                          Final = 40.65

                                                    AREA IN PLAN:   Initial = 57.46
REAR DISPLACEMENT:   X = 0.00     Z = 231.93                        Final = 81.18
                     Curvilinear Displ.= 0.00
                     Horiz. Displ. = 0.00           Runout not completed, V-MAX = 0.00
```

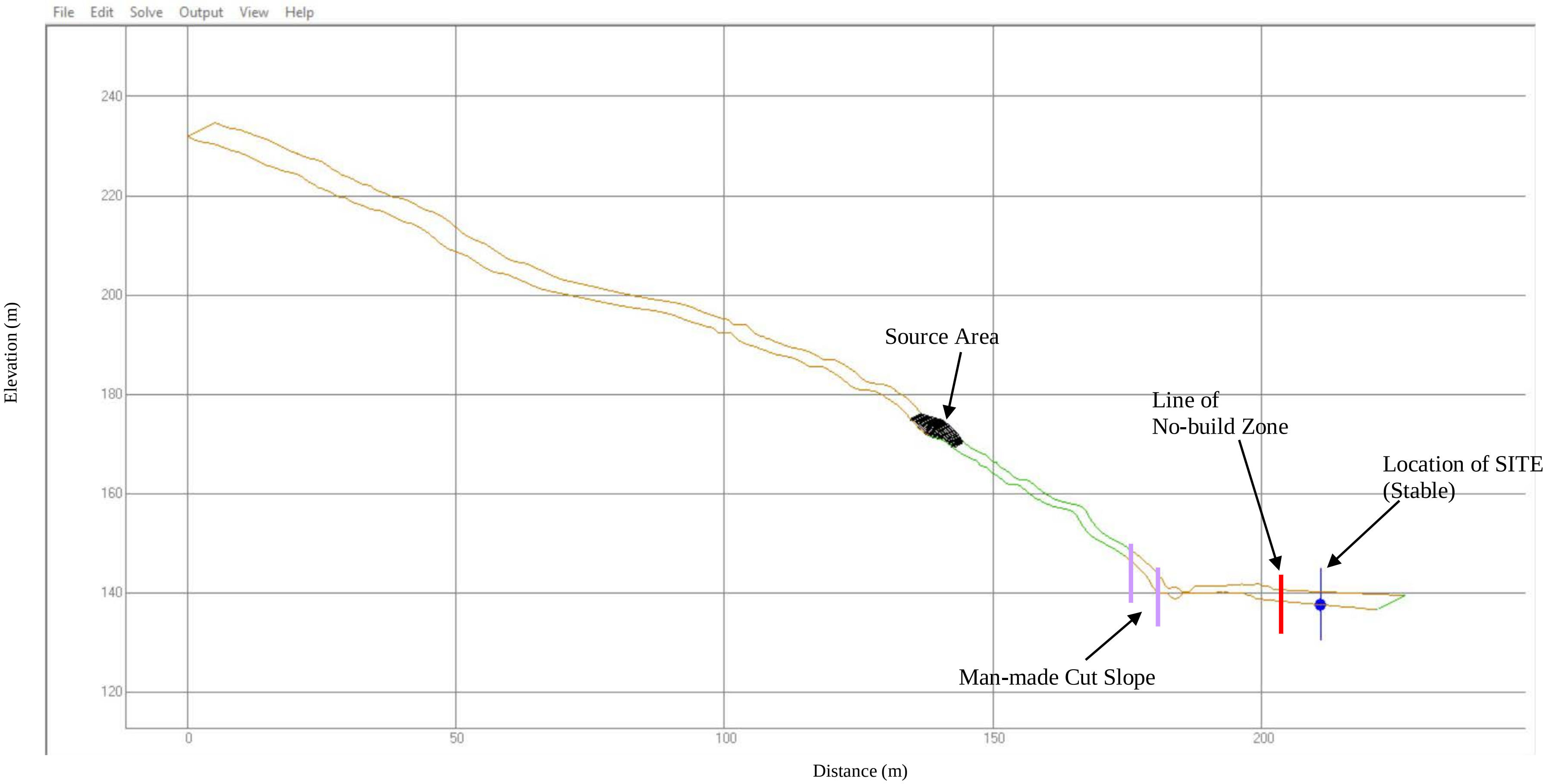
Debris Mobility Analysis for the Credible Runout Path RP8 (Case 2) within Catchment No. OH3

Landslide Type = OHL

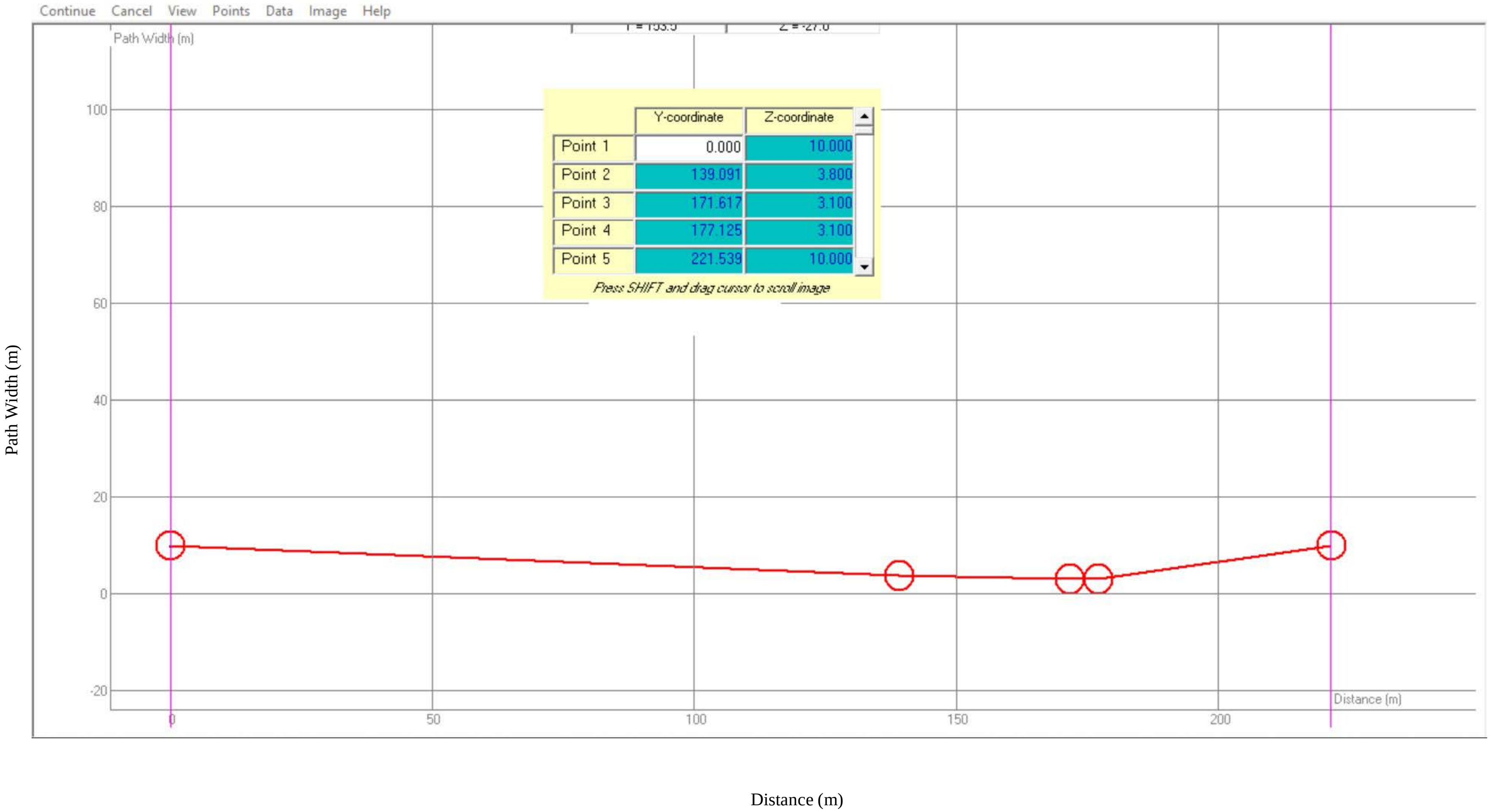
Design Source Volume = 40m^3

Figure D14

Section Profile – (pre-sliding)



Width Profile

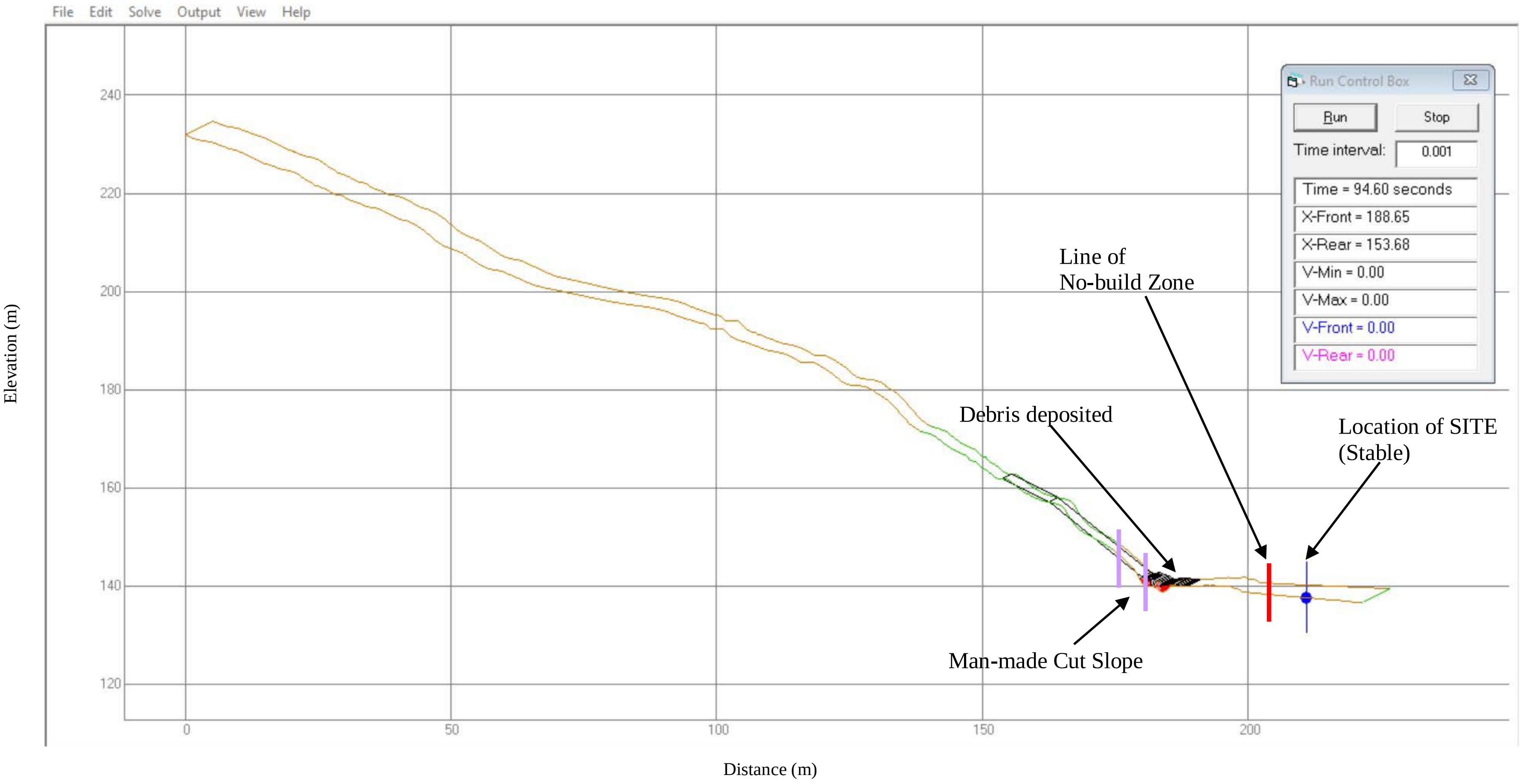

Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
100
80
60
40
20
0
-20
0
50
100
150
200
Distance (m)
Press SHIFT and drag cursor to scroll image
Path Width (m)
Distance (m)

	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	139.091	3.800
Point 3	171.617	3.100
Point 4	177.125	3.100
Point 5	221.539	10.000

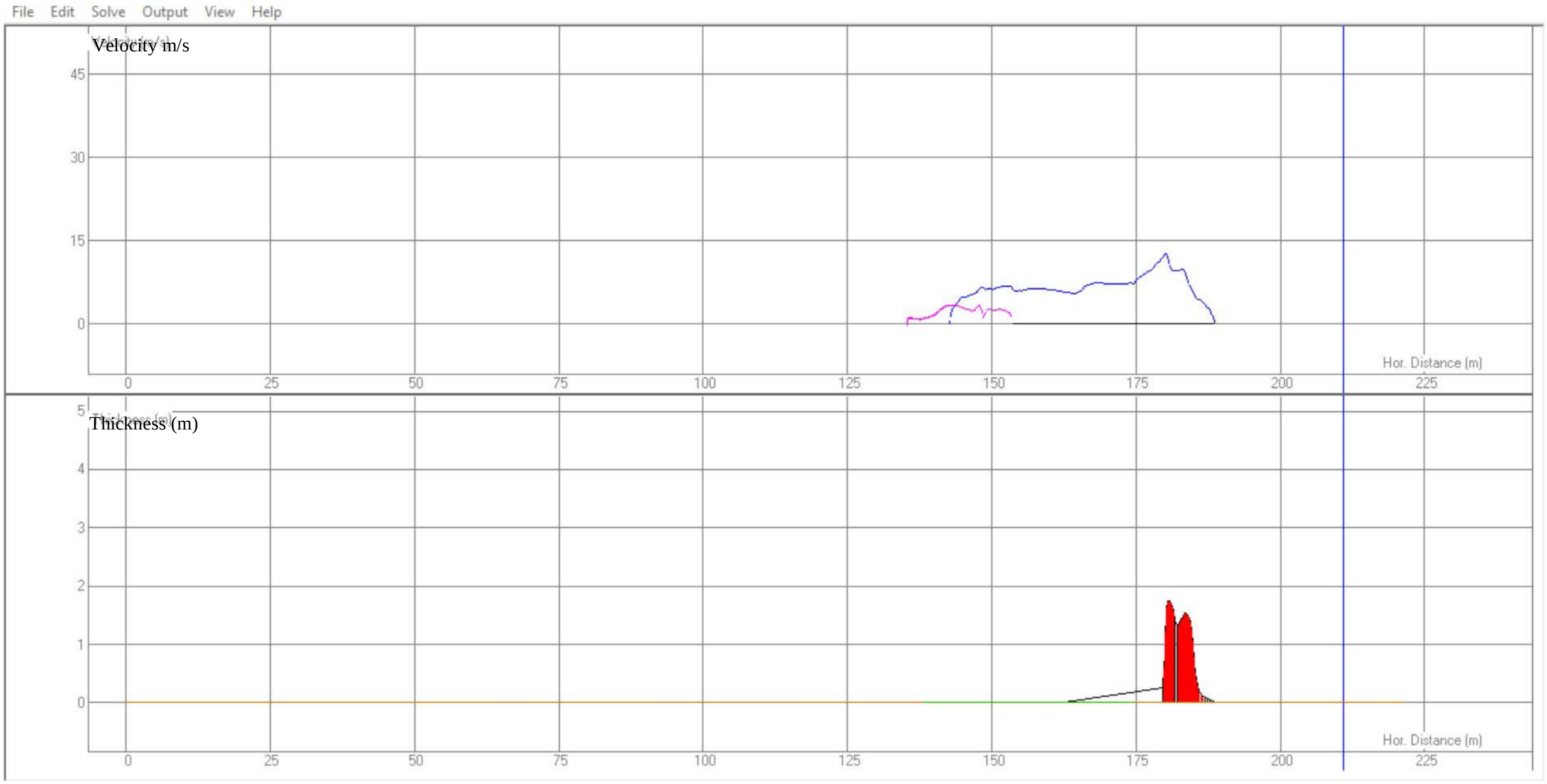
Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.26	40.26	46.01	No

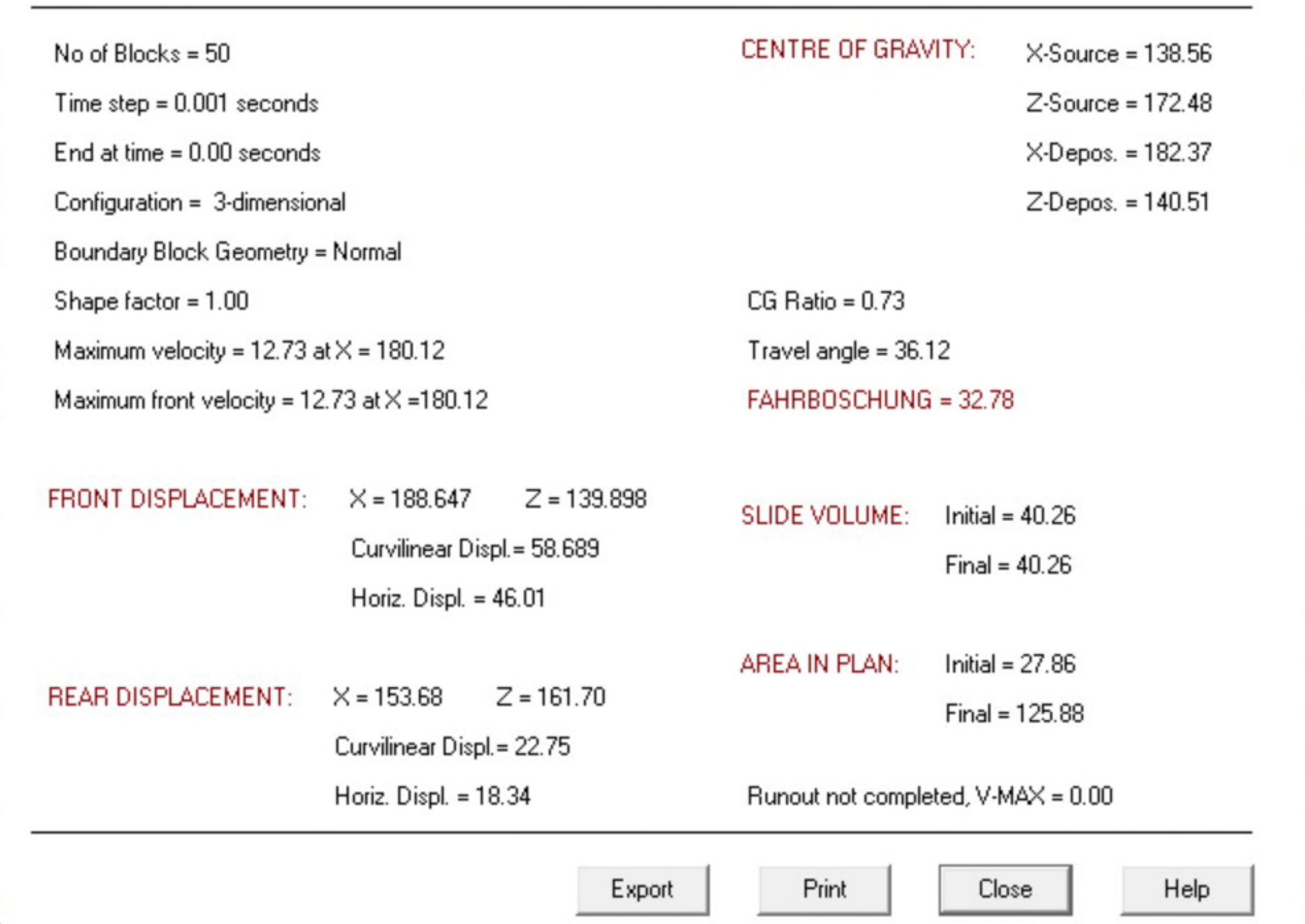
Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Elevation (m)
240
220
200
180
160
140
120
0
50
100
150
200
Distance (m)
Run Control Box
Run
Stop
Time interval:
0.001
Line of
No-build Zone
Debris deposited
Location of SITE
(Stable)
Man-made Cut Slope

```
Time = 94.60 seconds
X-Front = 188.65
X-Rear = 153.68
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00
```


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
25
50
75
100
125
150
175
200
225
Thickness (m)
5
4
3
2
1
0
Hor. Distance (m)
0
25
50
75
100
125
150
175
200
225

Distance (m)



No of Blocks = 50
Time step = 0.001 seconds
End at time = 0.00 seconds
Configuration = 3-dimensional
Boundary Block Geometry = Normal
Shape factor = 1.00
Maximum velocity = 12.73 at X = 180.12
Maximum front velocity = 12.73 at X =180.12

CENTRE OF GRAVITY: X-Source = 138.56
Z-Source = 172.48
X-Depos. = 182.37
Z-Depos. = 140.51

CG Ratio = 0.73
Travel angle = 36.12
FAHRBOSCHUNG = 32.78

FRONT DISPLACEMENT: X = 188.647 Z = 139.898
Curvilinear Displ.= 58.689
Horiz. Displ. = 46.01

REAR DISPLACEMENT: X = 153.68 Z = 161.70
Curvilinear Displ.= 22.75
Horiz. Displ. = 18.34

SLIDE VOLUME: Initial = 40.26
Final = 40.26

AREA IN PLAN: Initial = 27.86
Final = 125.88

Runout not completed, V-MAX = 0.00

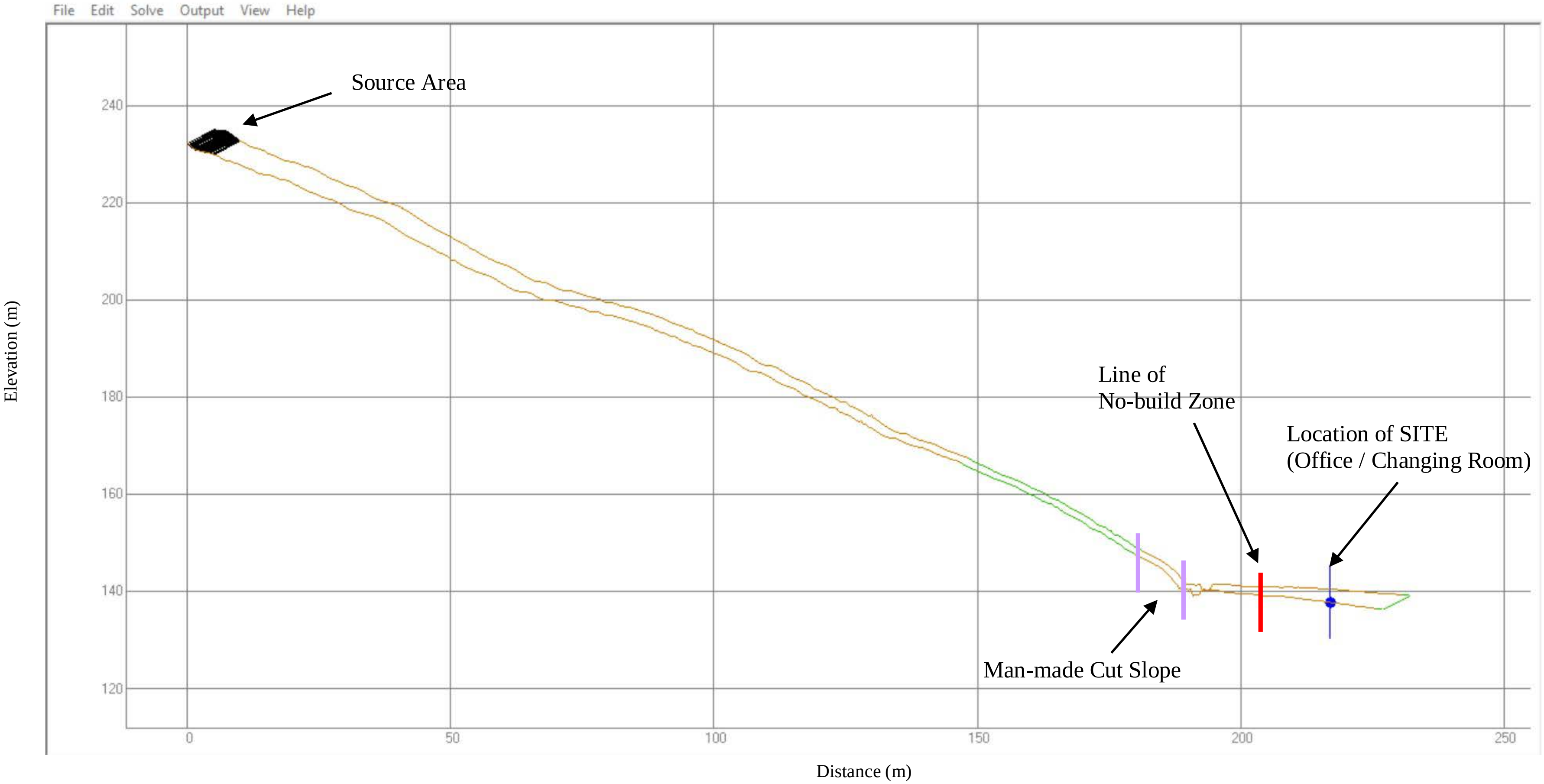
Debris Mobility Analysis for the Credible Runout Path RP9 (Case 1) within Catchment No. OH3

Landslide Type = OHL

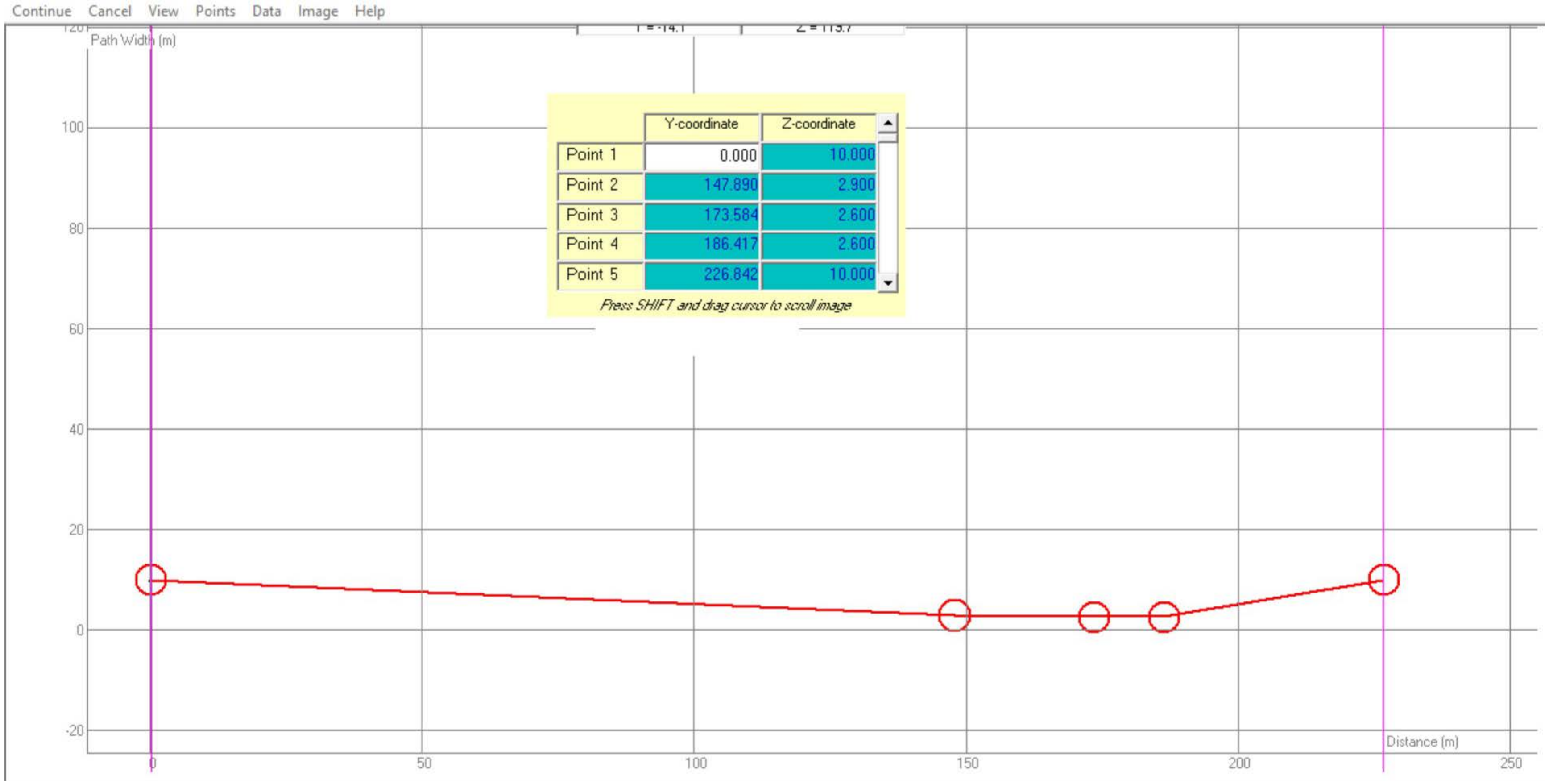
Design Source Volume = 40m^3

Figure D15

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
120
100
80
60
40
20
0
-20
0
50
100
150
200
250
Distance (m)

	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	147.890	2.900
Point 3	173.584	2.600
Point 4	186.417	2.600
Point 5	226.842	10.000

Press SHIFT and drag cursor to scroll image

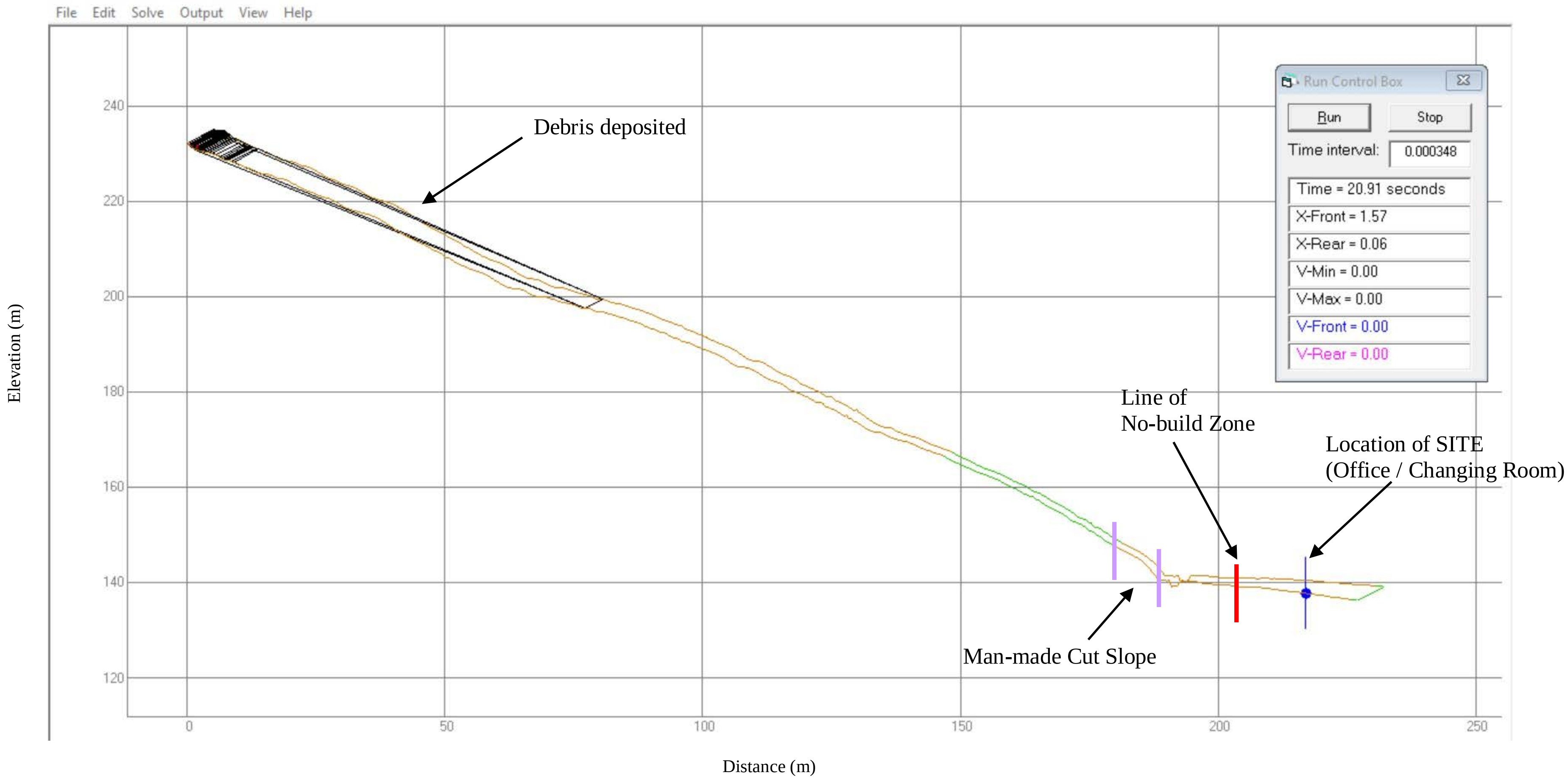
Path Width (m)

Distance (m)

Result of Debris Mobility Analysis

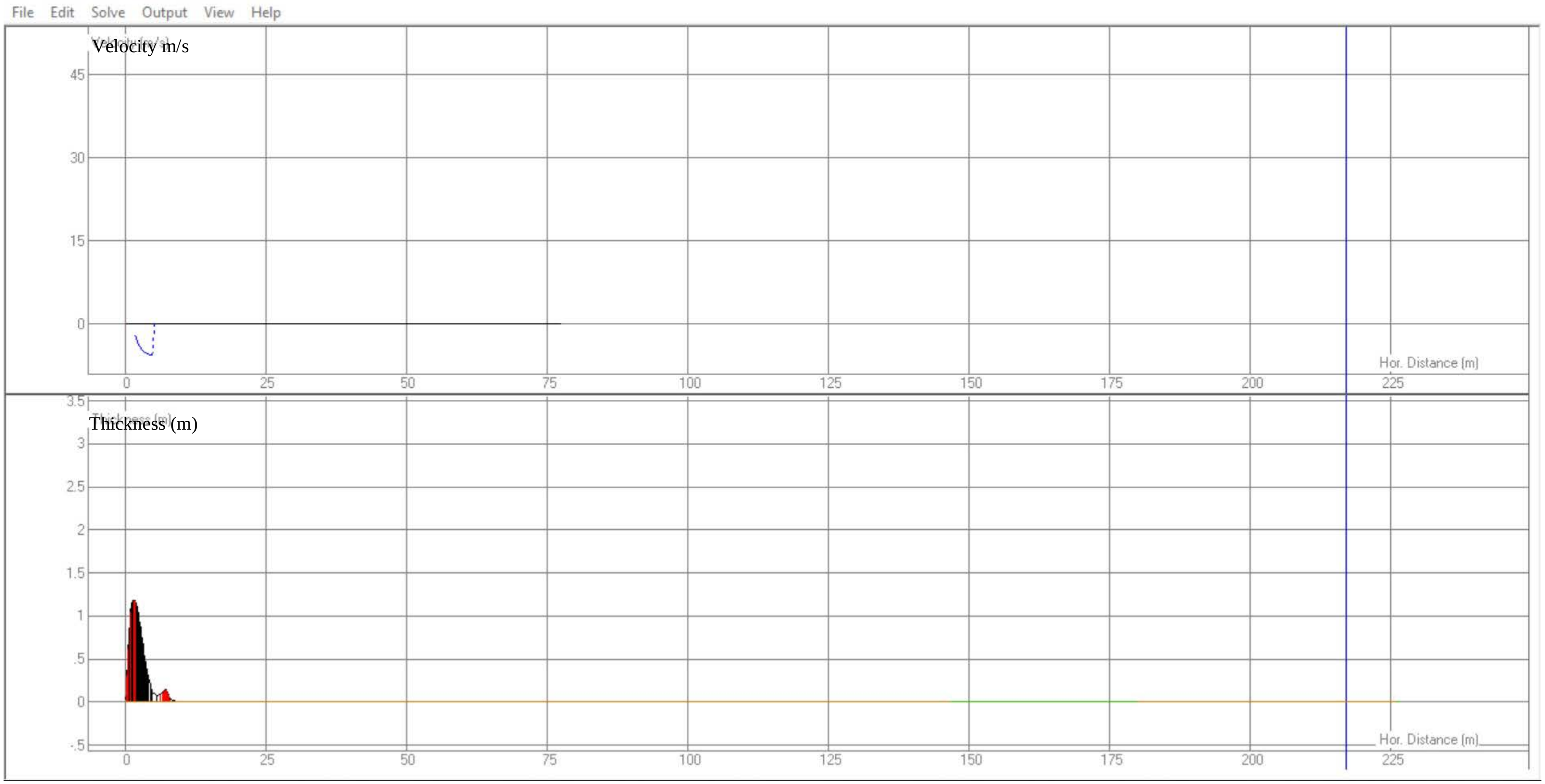
Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.27	40.27	75.2	No

Section Profile – (post-sliding)

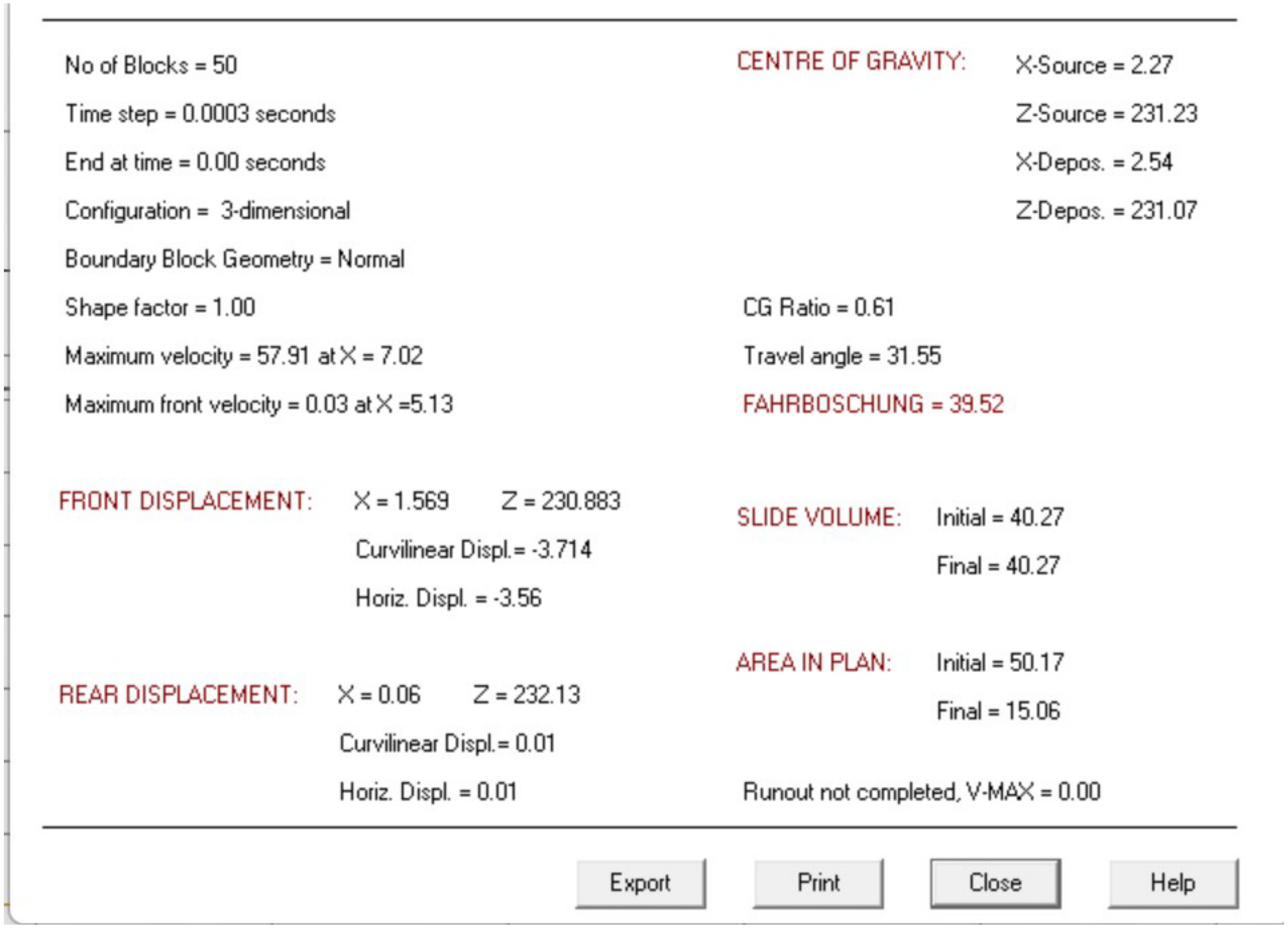


Time interval: 0.000348

```
Time = 20.91 seconds
X-Front = 1.57
X-Rear = 0.06
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00
```


File Edit Solve Output View Help
Velocity m/s
45
30
15
0
0
25
50
75
100
125
150
175
200
225
Hor. Distance (m)
Thickness (m)
3.5
3
2.5
2
1.5
1
.5
0
-.5
0
25
50
75
100
125
150
175
200
225
Hor. Distance (m)

Distance (m)



```
No of Blocks = 50                                      CENTRE OF GRAVITY:    X-Source = 2.27
Time step = 0.0003 seconds                                                   Z-Source = 231.23
End at time = 0.00 seconds                                                   X-Depos. = 2.54
Configuration =  3-dimensional                                               Z-Depos. = 231.07
Boundary Block Geometry = Normal
Shape factor = 1.00                                    CG Ratio = 0.61
Maximum velocity = 57.91  at X = 7.02                  Travel angle = 31.55
Maximum front velocity = 0.03 at X =5.13               FAHRBOSCHUNG = 39.52

FRONT DISPLACEMENT:    X = 1.569      Z = 230.883      SLIDE VOLUME:    Initial = 40.27
                       Curvilinear Displ.= -3.714
                       Horiz. Displ. = -3.56                            Final = 40.27

                                                       AREA IN PLAN:    Initial = 50.17
REAR DISPLACEMENT:    X = 0.06      Z = 232.13
                      Curvilinear Displ.= 0.01                          Final = 15.06
                      Horiz. Displ. = 0.01             Runout not completed, V-MAX = 0.00
```

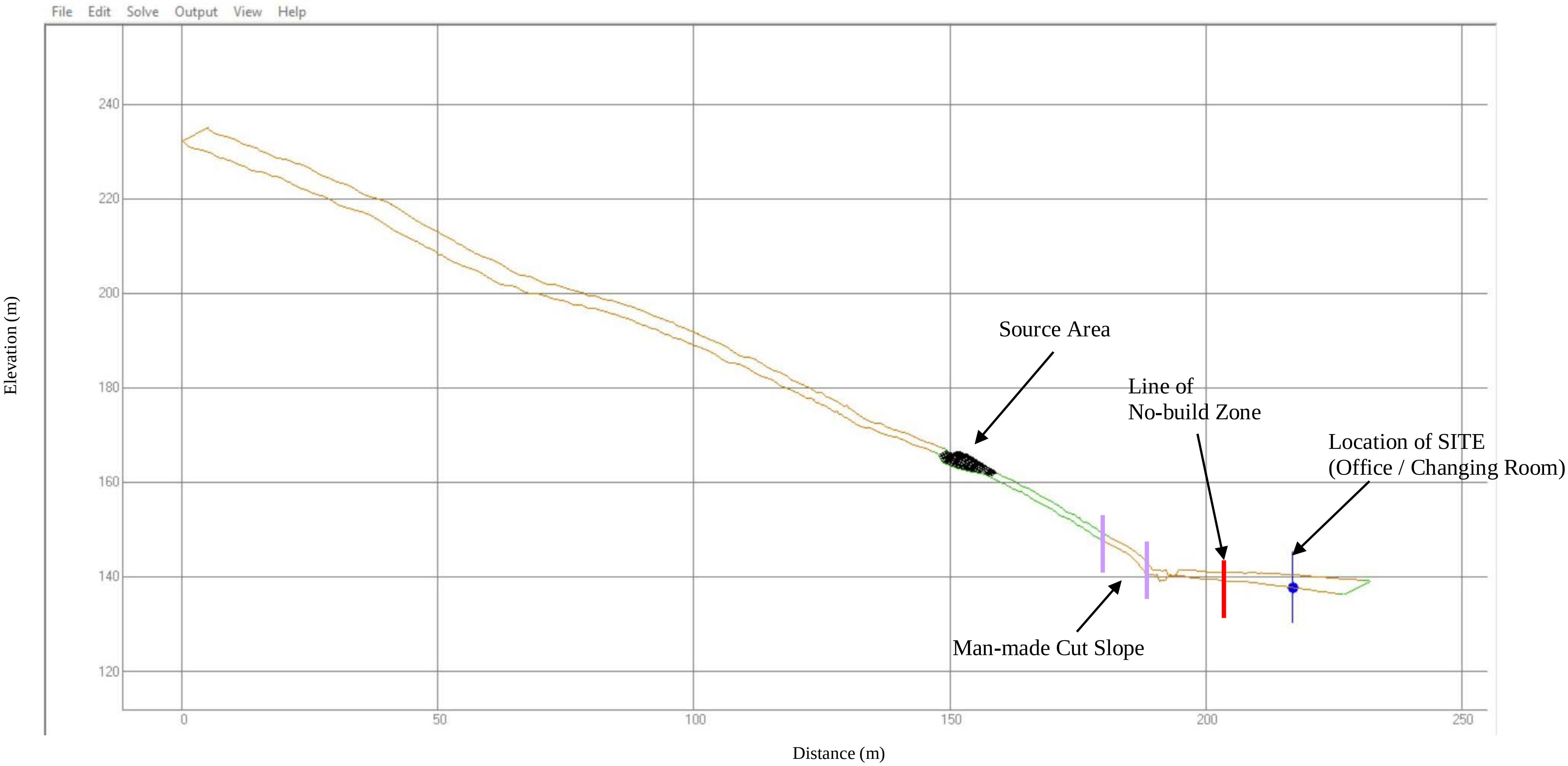
Debris Mobility Analysis for the Credible Runout Path RP9 (Case 2) within Catchment No. OH3

Landslide Type = OHL

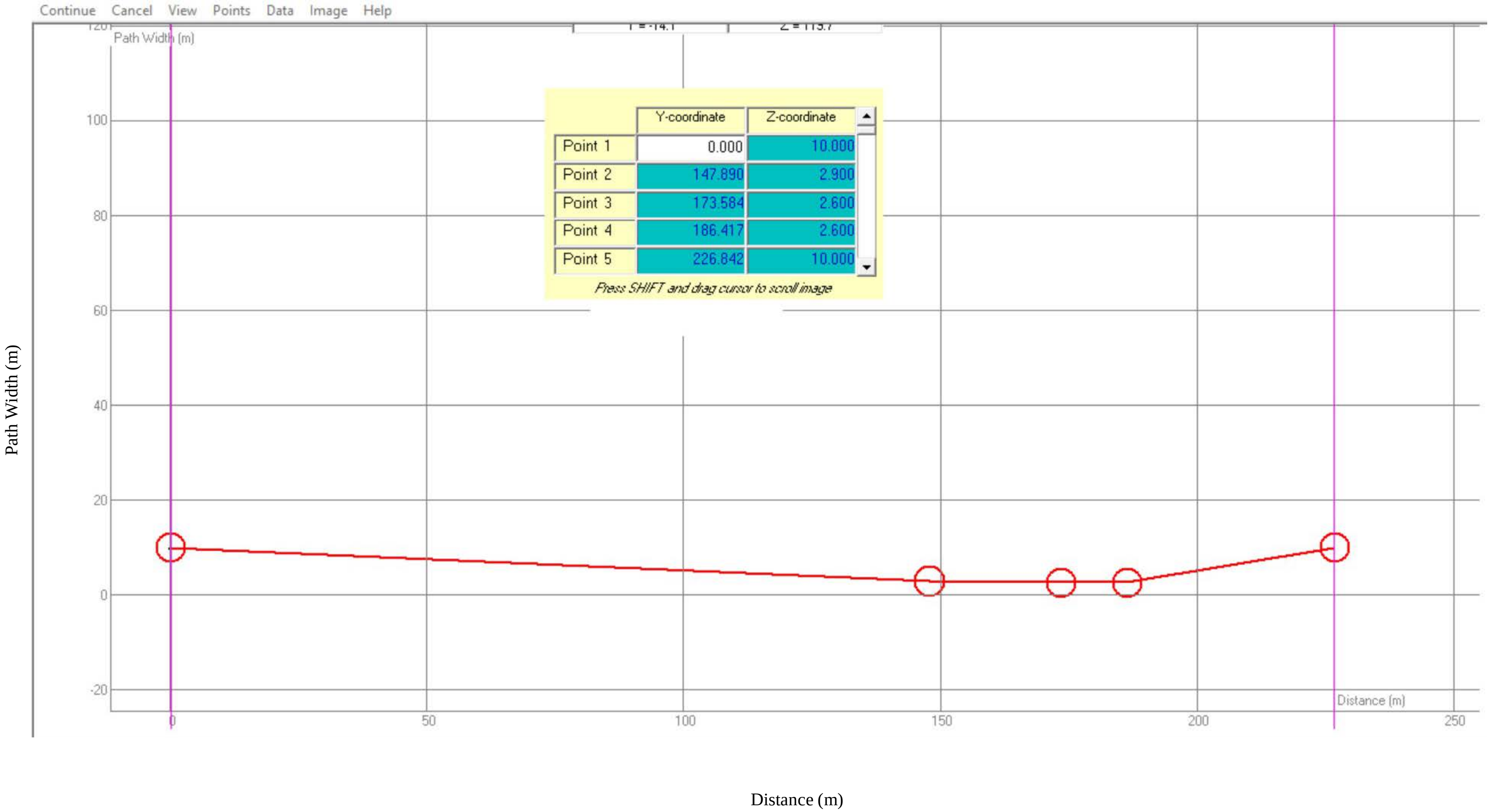
Design Source Volume = 40m^3

Figure D16

Section Profile – (pre-sliding)


File Edit Solve Output View Help
240
220
200
180
160
140
120
0
50
100
150
200
250
Elevation (m)
Distance (m)
Source Area
Line of No-build Zone
Location of SITE (Office / Changing Room)
Man-made Cut Slope

Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = -14.1
Z = 113.7
Path Width (m)
120
100
80
60
40
20
0
-20
0
50
100
150
200
250
Distance (m)
Path Width (m)
Distance (m)

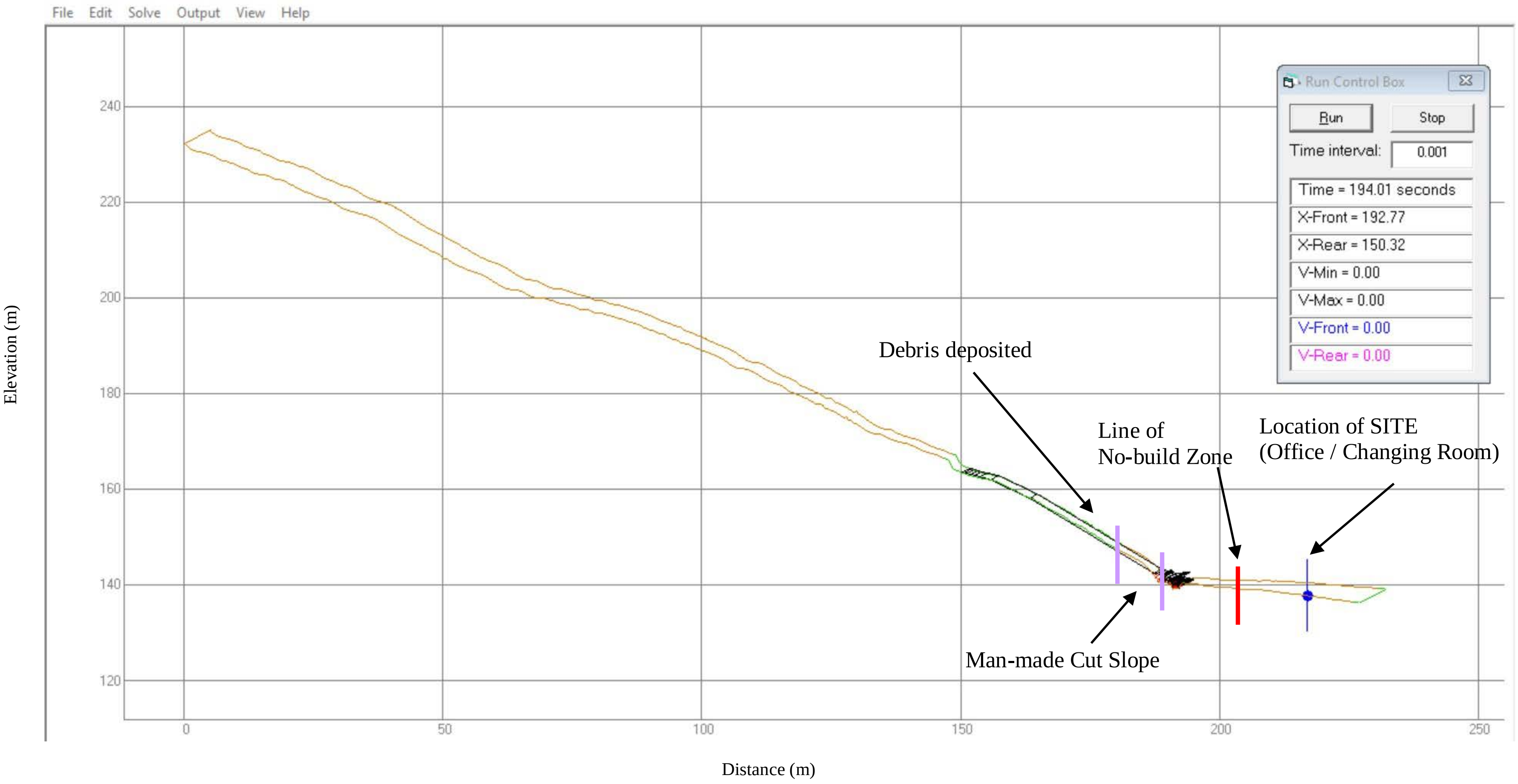
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	147.890	2.900
Point 3	173.584	2.600
Point 4	186.417	2.600
Point 5	226.842	10.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.18	40.18	34.95	No

Section Profile – (post-sliding)



Run Control Box

Time interval: 0.001

Time = 194.01 seconds

X-Front = 192.77

X-Rear = 150.32

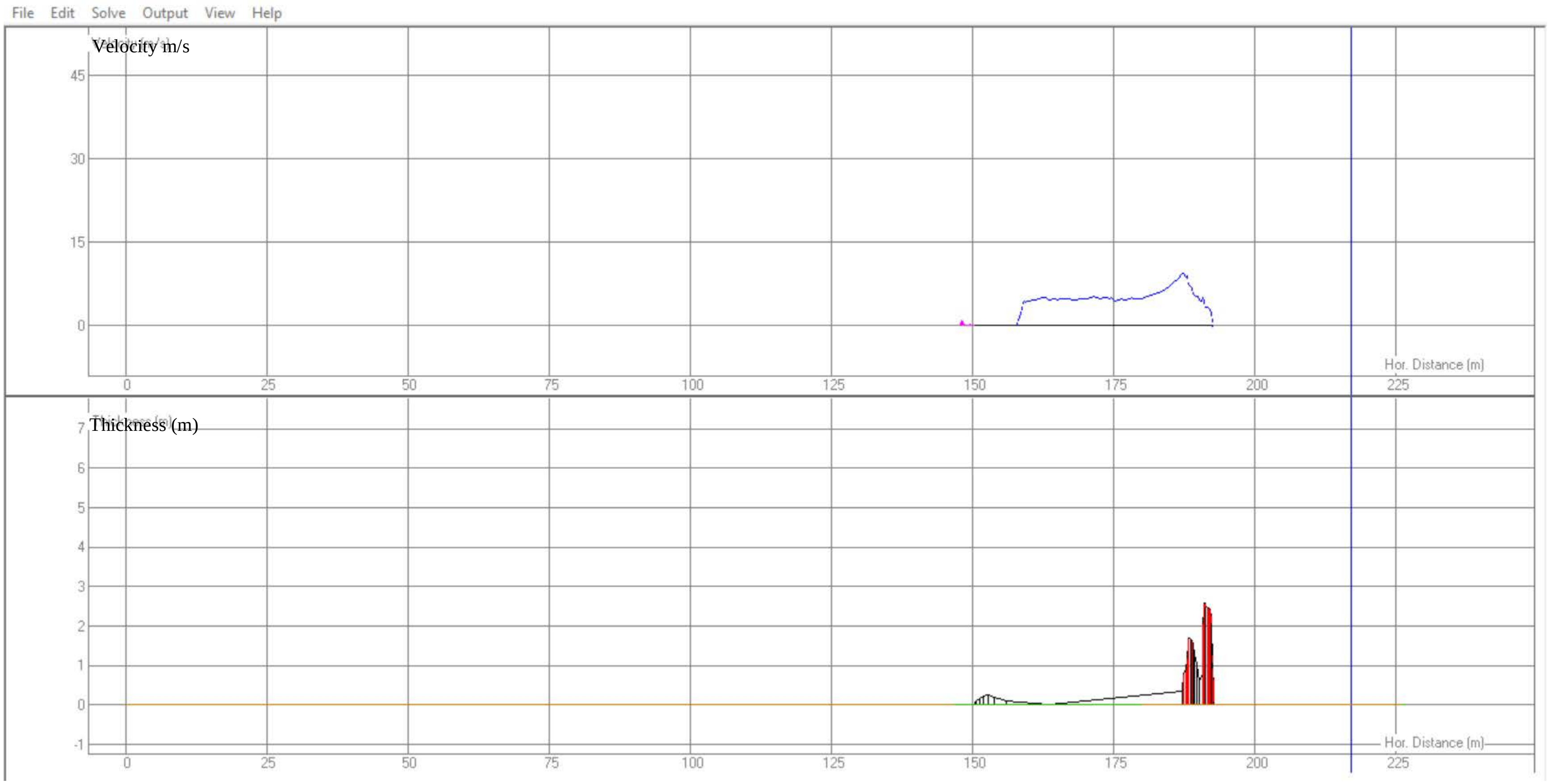
V-Min = 0.00

V-Max = 0.00

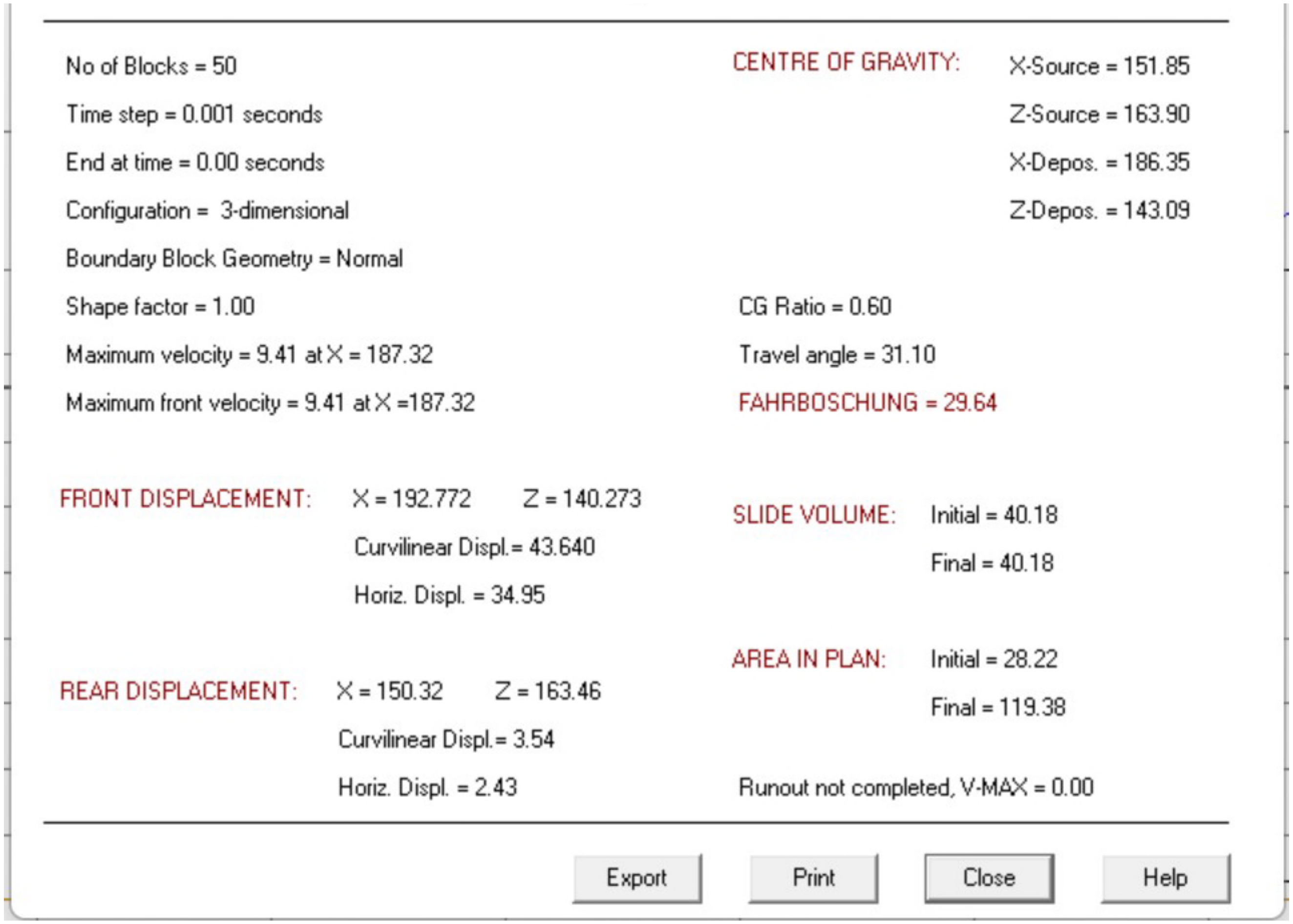
V-Front = 0.00

V-Rear = 0.00

File
Edit
Solve
Output
View
Help
Run
Stop
240
220
200
180
160
140
120
0
50
100
150
200
250
Elevation (m)
Distance (m)
Debris deposited
Line of
No-build Zone
Location of SITE
(Office / Changing Room)
Man-made Cut Slope


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
0
25
50
75
100
125
150
175
200
225
Hor. Distance (m)
Thickness (m)
7
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
Hor. Distance (m)

Distance (m)


No of Blocks = 50

Time step = 0.001 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 9.41 at X = 187.32

Maximum front velocity = 9.41 at X =187.32

CENTRE OF GRAVITY: X-Source = 151.85

Z-Source = 163.90

X-Depos. = 186.35

Z-Depos. = 143.09

CG Ratio = 0.60

Travel angle = 31.10

FAHRBOSCHUNG = 29.64

FRONT DISPLACEMENT: X = 192.772 Z = 140.273

Curvilinear Displ.= 43.640

Horiz. Displ. = 34.95

REAR DISPLACEMENT: X = 150.32 Z = 163.46

Curvilinear Displ.= 3.54

Horiz. Displ. = 2.43

SLIDE VOLUME: Initial = 40.18

Final = 40.18

AREA IN PLAN: Initial = 28.22

Final = 119.38

Runout not completed, V-MAX = 0.00

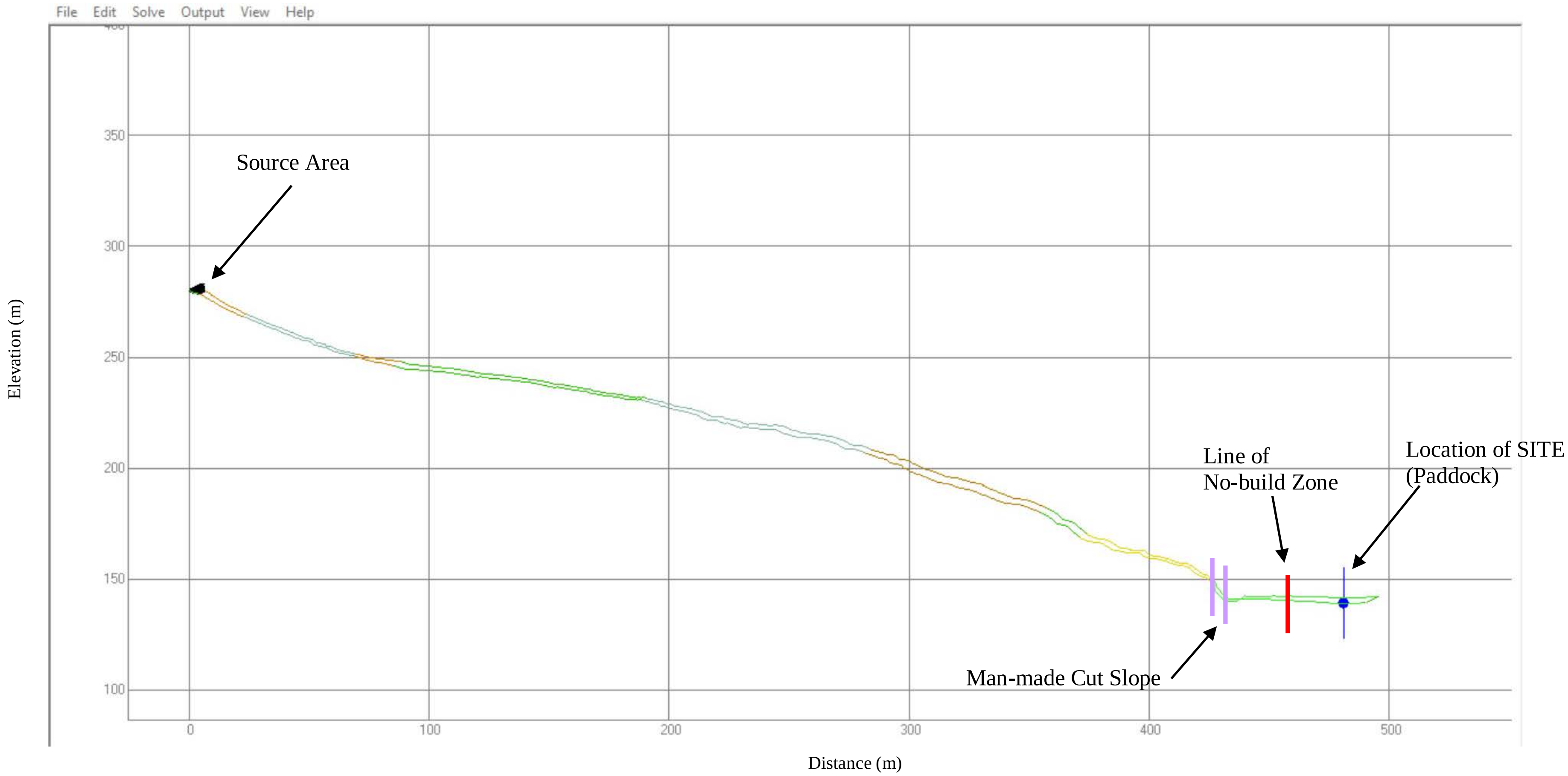
Debris Mobility Analysis for the Credible Runout Path RP10 (Case 1) within Catchment No. CD3

Landslide Type = CDF

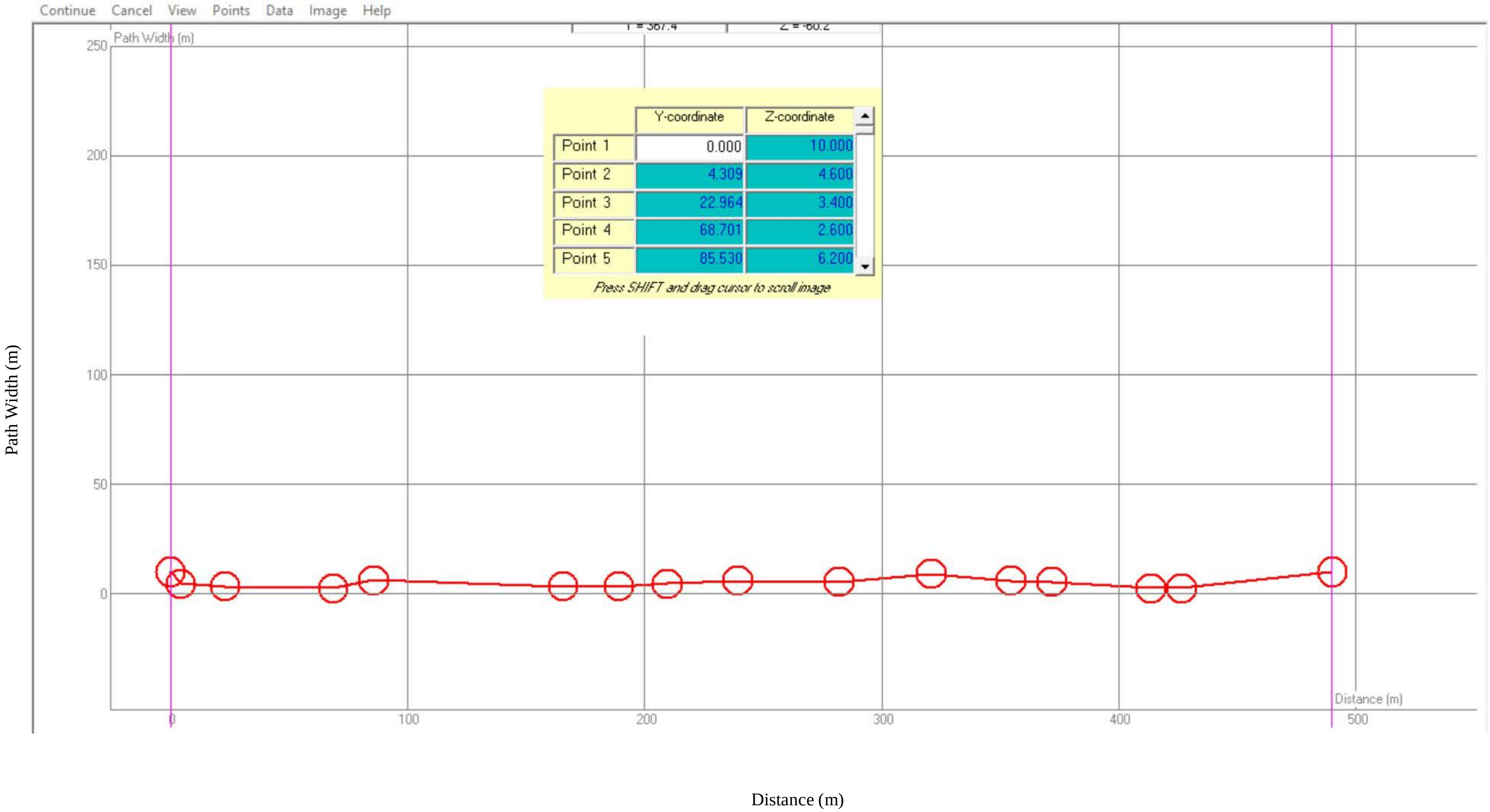
Design Source Volume = 40m^3

Figure D17

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = 367.4
Z = -60.2
Path Width (m)
250
200
150
100
50
0
0
100
200
300
400
500
Distance (m)
Path Width (m)
Distance (m)

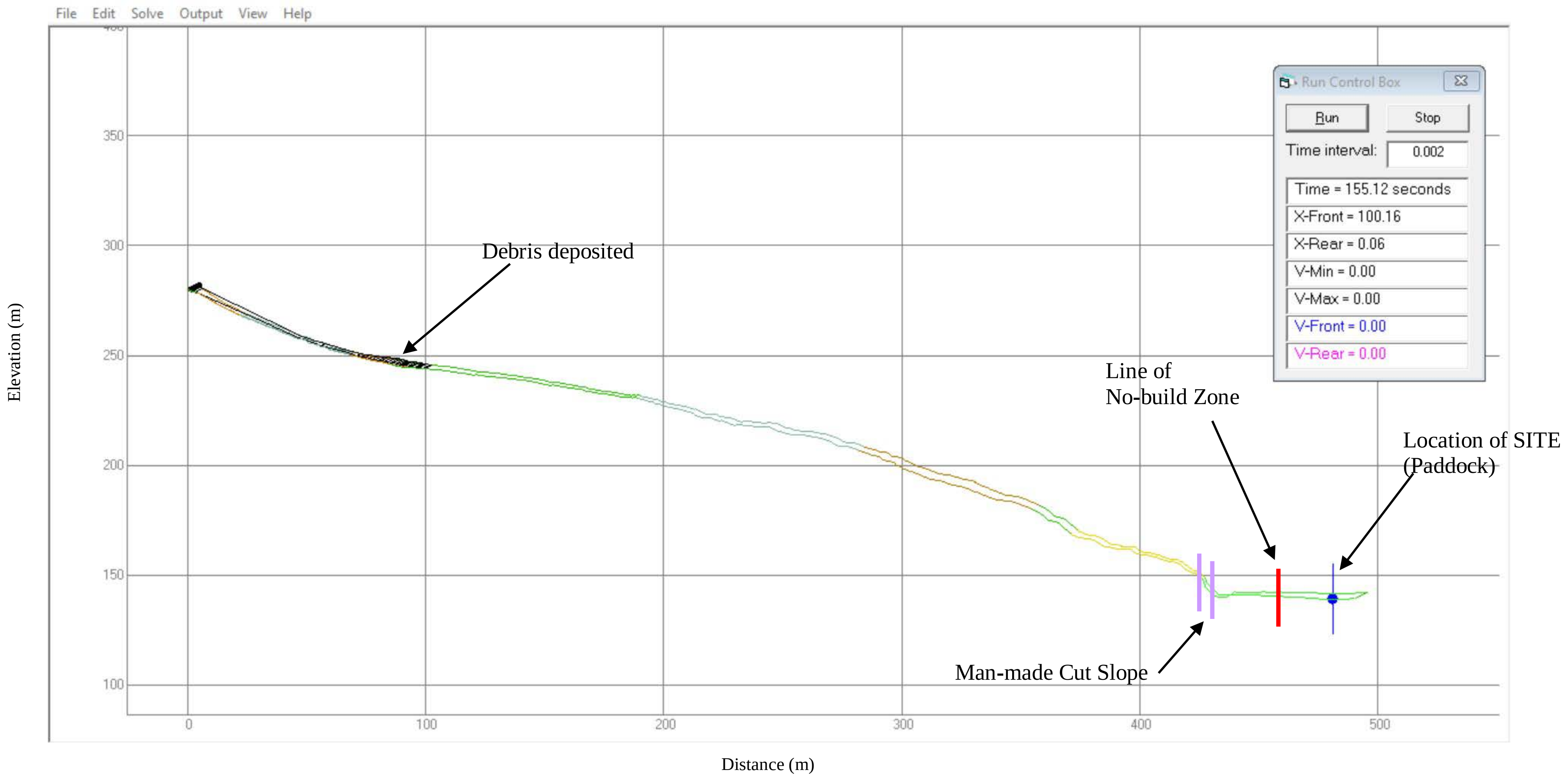
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	4.309	4.600
Point 3	22.964	3.400
Point 4	68.701	2.600
Point 5	85.530	6.200

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.58	106.83	95.63	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
400
350
300
250
200
150
100
0
100
200
300
400
500
Elevation (m)
Distance (m)

Time interval: 0.002

Time = 155.12 seconds

X-Front = 100.16

X-Rear = 0.06

V-Min = 0.00

V-Max = 0.00

V-Front = 0.00

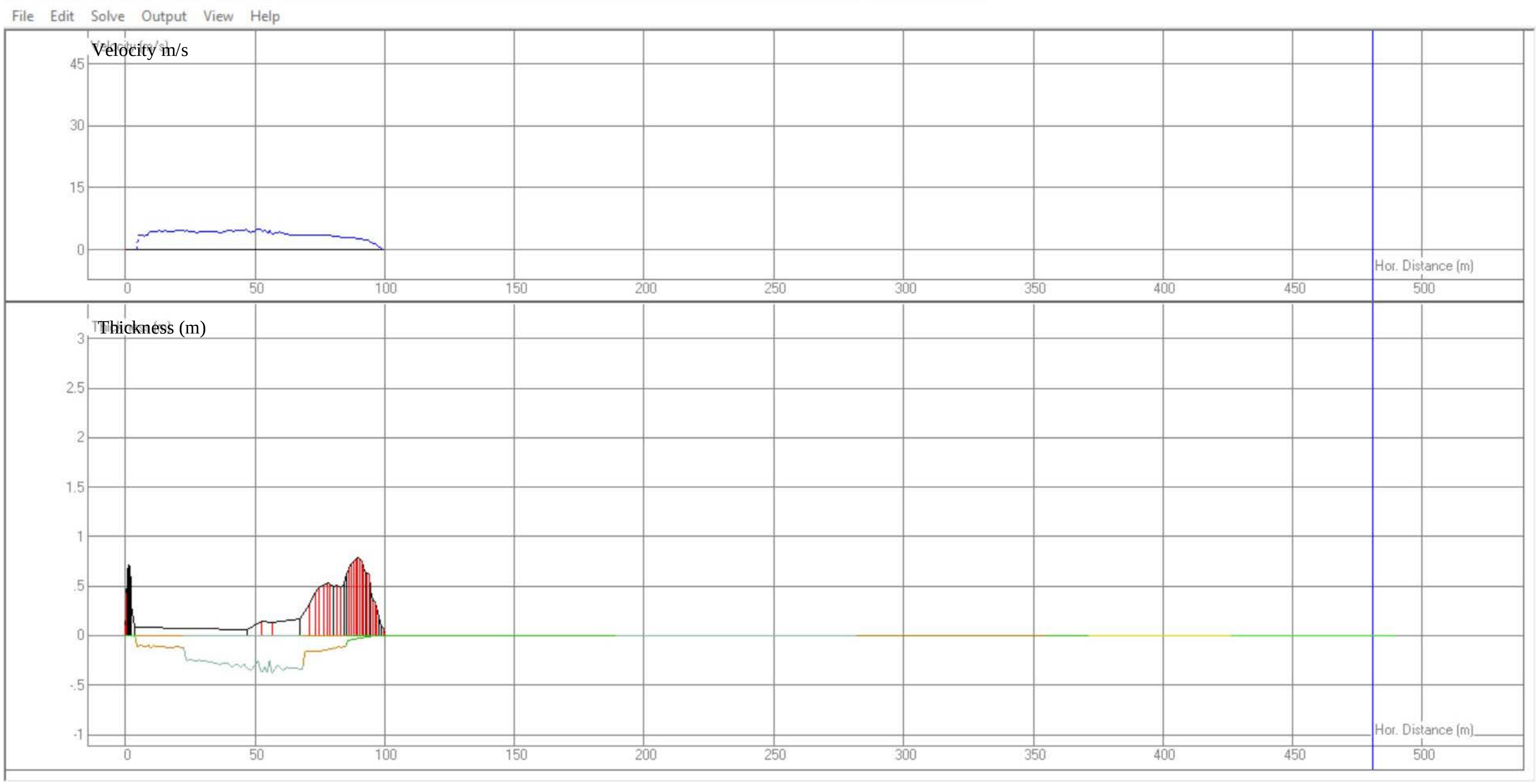
V-Rear = 0.00

Debris deposited

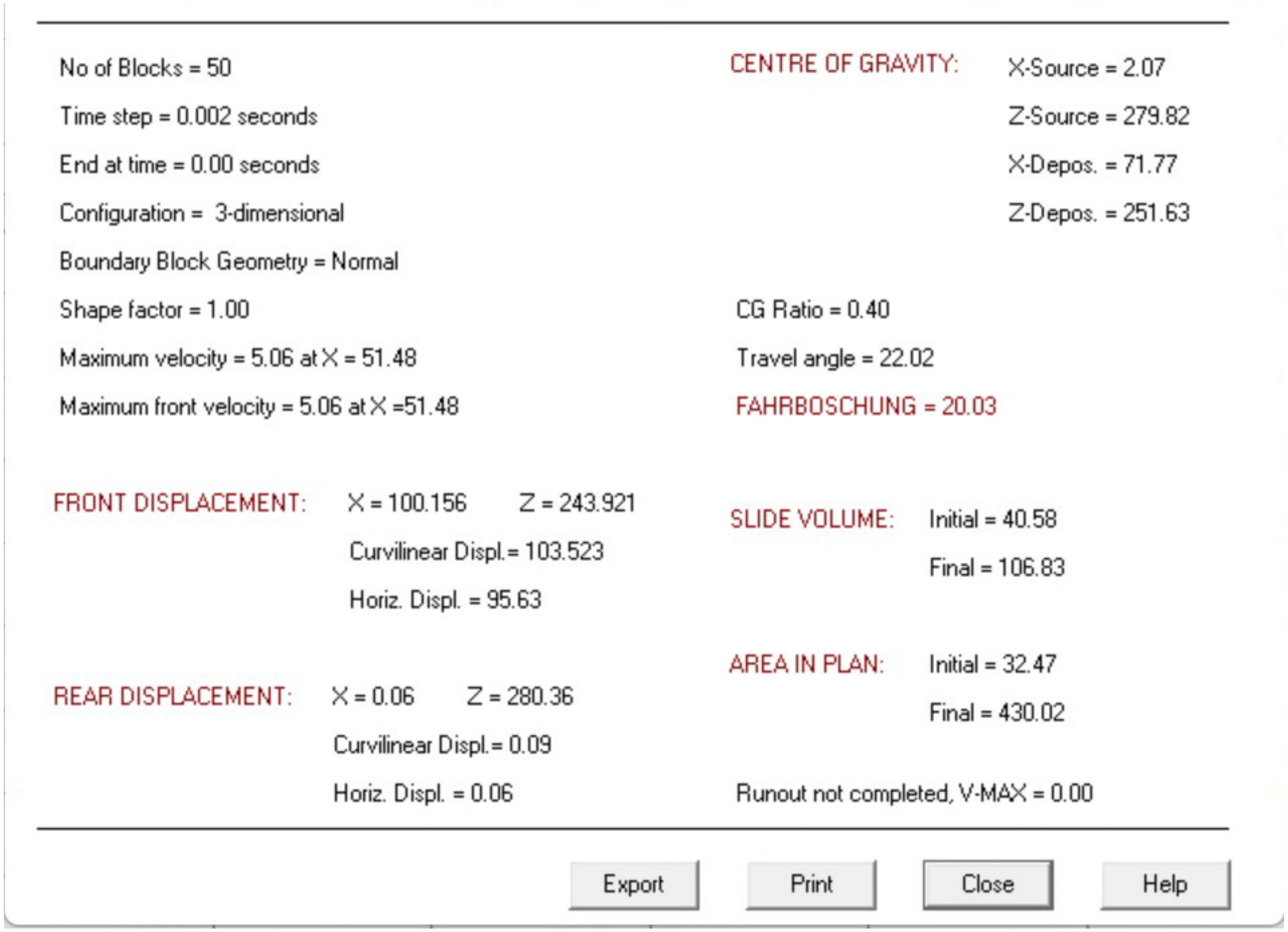
Line of
No-build Zone

Location of SITE
(Paddock)

Man-made Cut Slope


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
500
Thickness (m)
3
2.5
2
1.5
1
.5
0
-.5
-1
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
500

Distance (m)



No of Blocks = 50

Time step = 0.002 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 5.06 at X = 51.48

Maximum front velocity = 5.06 at X =51.48

FRONT DISPLACEMENT: X = 100.156 Z = 243.921

Curvilinear Displ.= 103.523

Horiz. Displ. = 95.63

REAR DISPLACEMENT: X = 0.06 Z = 280.36

Curvilinear Displ.= 0.09

Horiz. Displ. = 0.06

CENTRE OF GRAVITY: X-Source = 2.07

Z-Source = 279.82

X-Depos. = 71.77

Z-Depos. = 251.63

CG Ratio = 0.40

Travel angle = 22.02

FAHRBOSCHUNG = 20.03

SLIDE VOLUME: Initial = 40.58

Final = 106.83

AREA IN PLAN: Initial = 32.47

Final = 430.02

Runout not completed, V-MAX = 0.00

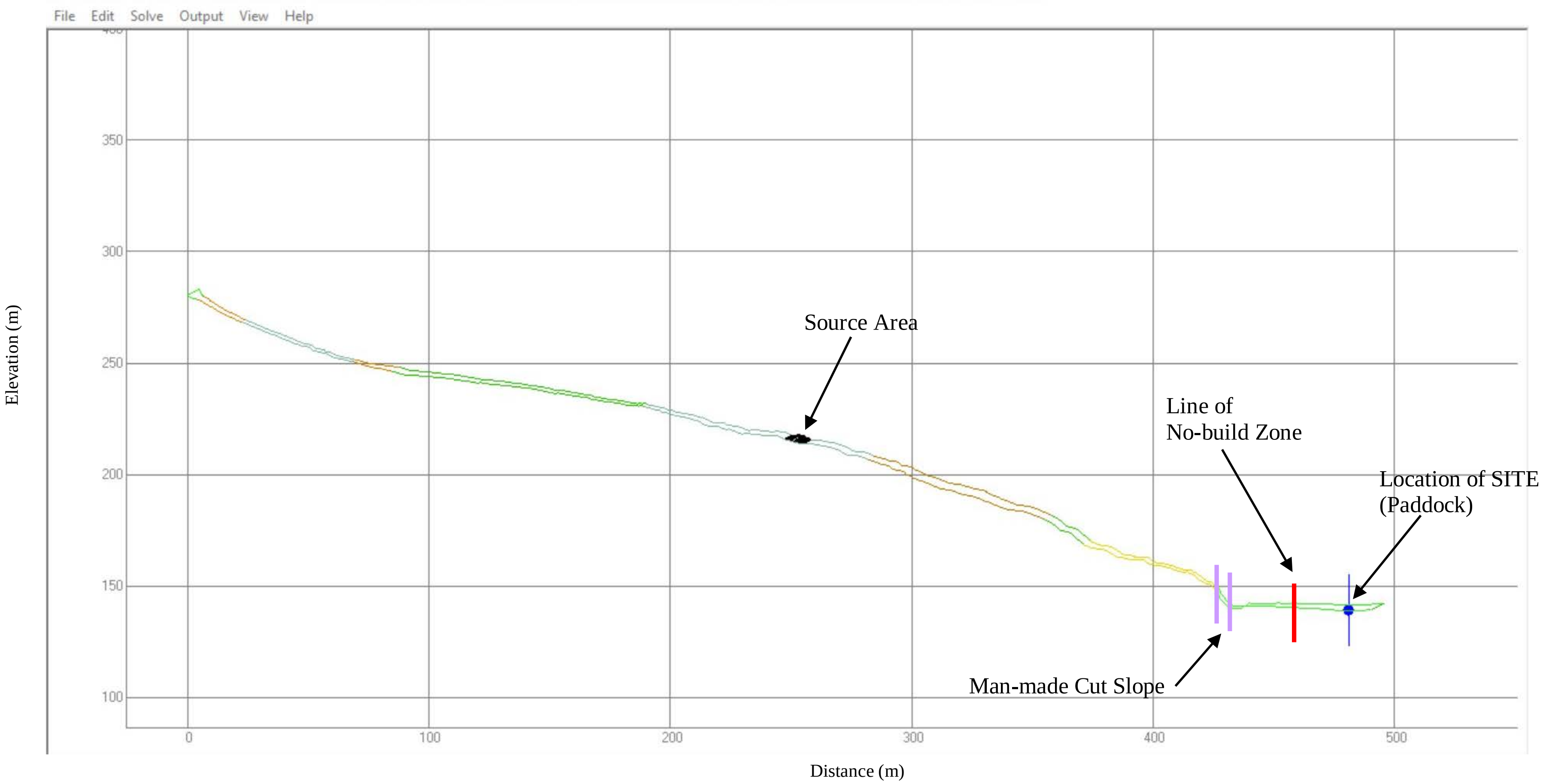
Debris Mobility Analysis for the Credible Runout Path RP10 (Case 2) within Catchment No. CD3

Landslide Type = CDF

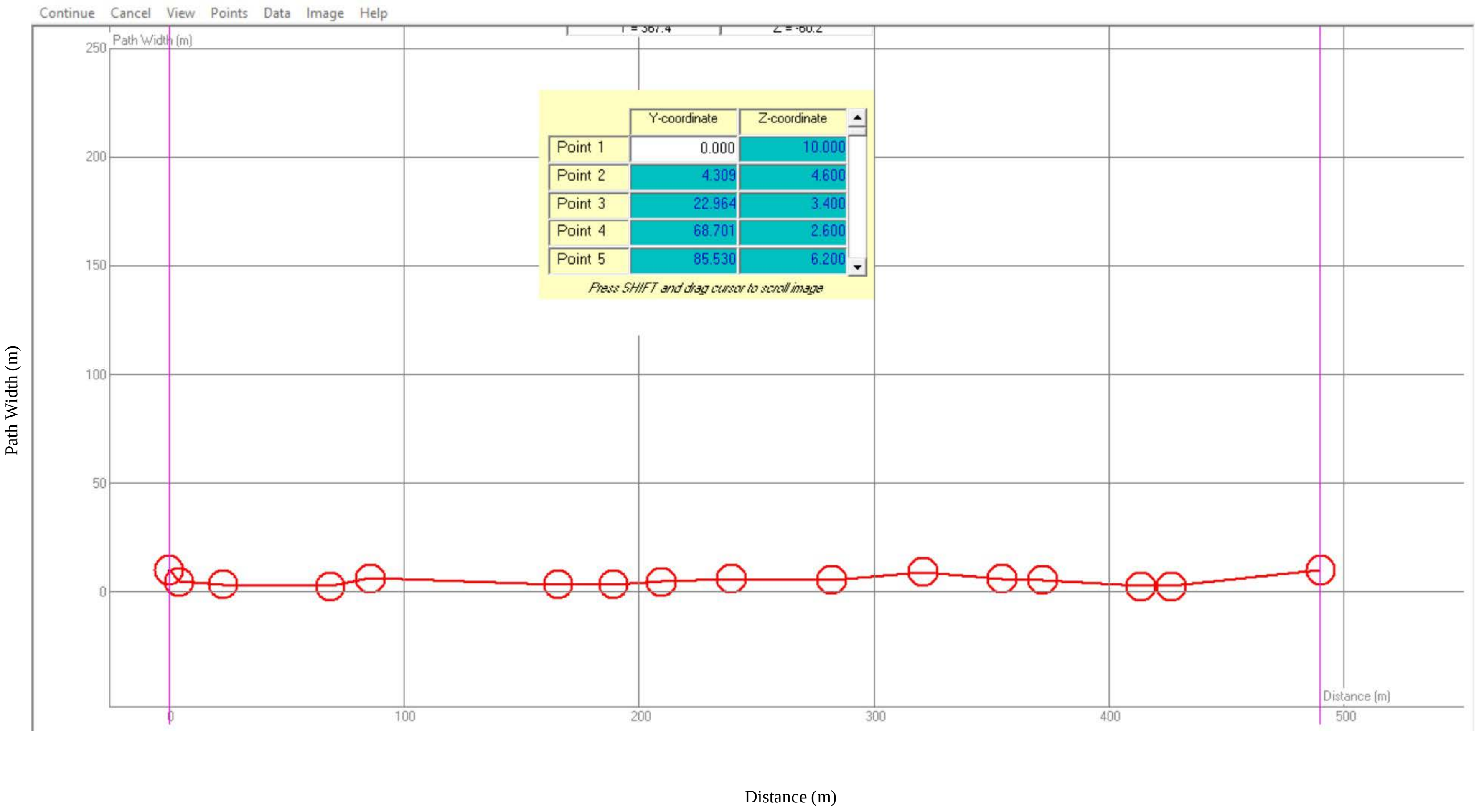
Design Source Volume = 40m^3

Figure D18

Section Profile – (pre-sliding)



Width Profile



Continue
Cancel
View
Points
Data
Image
Help
Y = 367.4
Z = -60.2
Path Width (m)
250
200
150
100
50
0
0
100
200
300
400
500
Distance (m)
Path Width (m)
Distance (m)

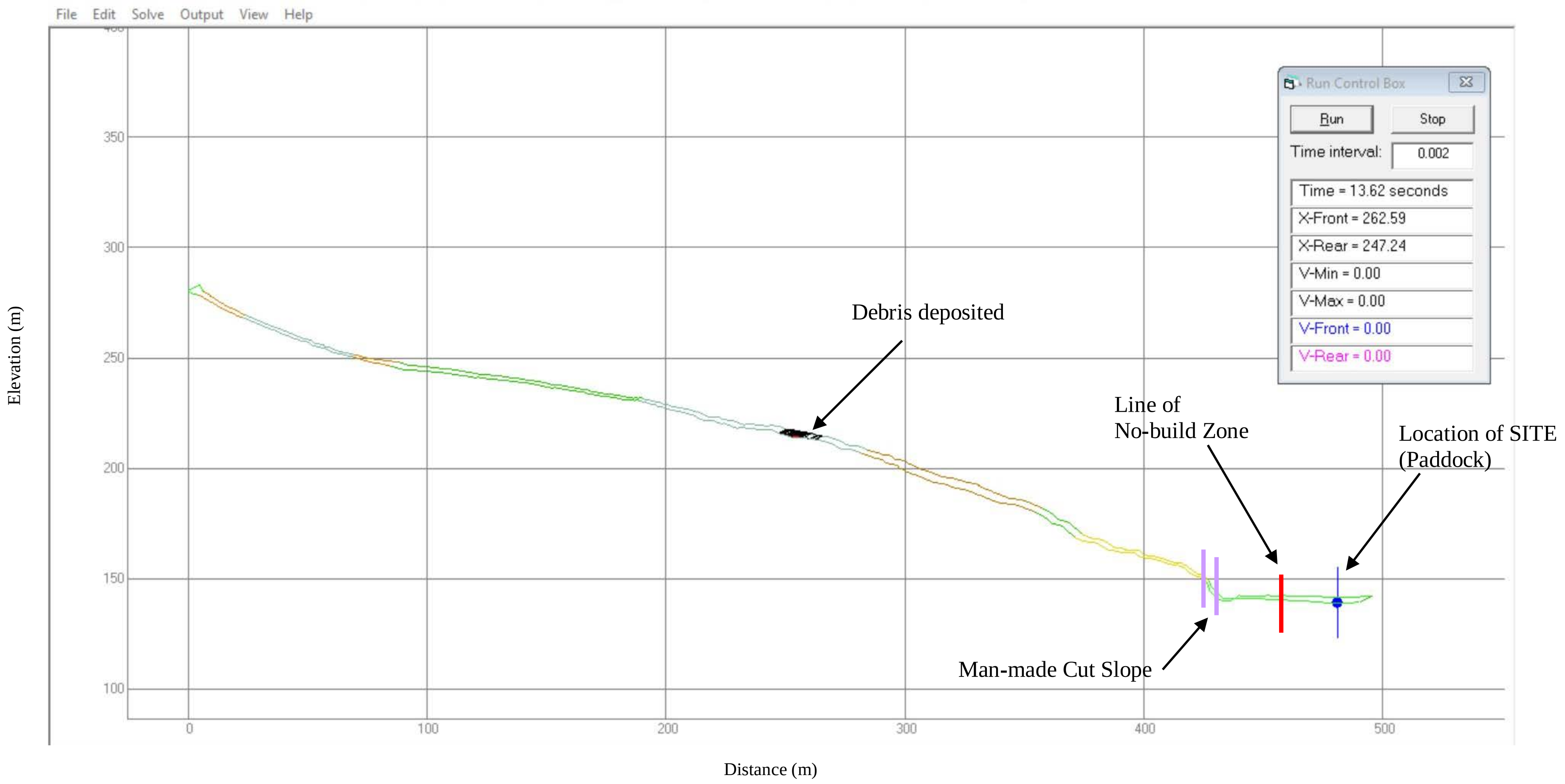
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	4.309	4.600
Point 3	22.964	3.400
Point 4	68.701	2.600
Point 5	85.530	6.200

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

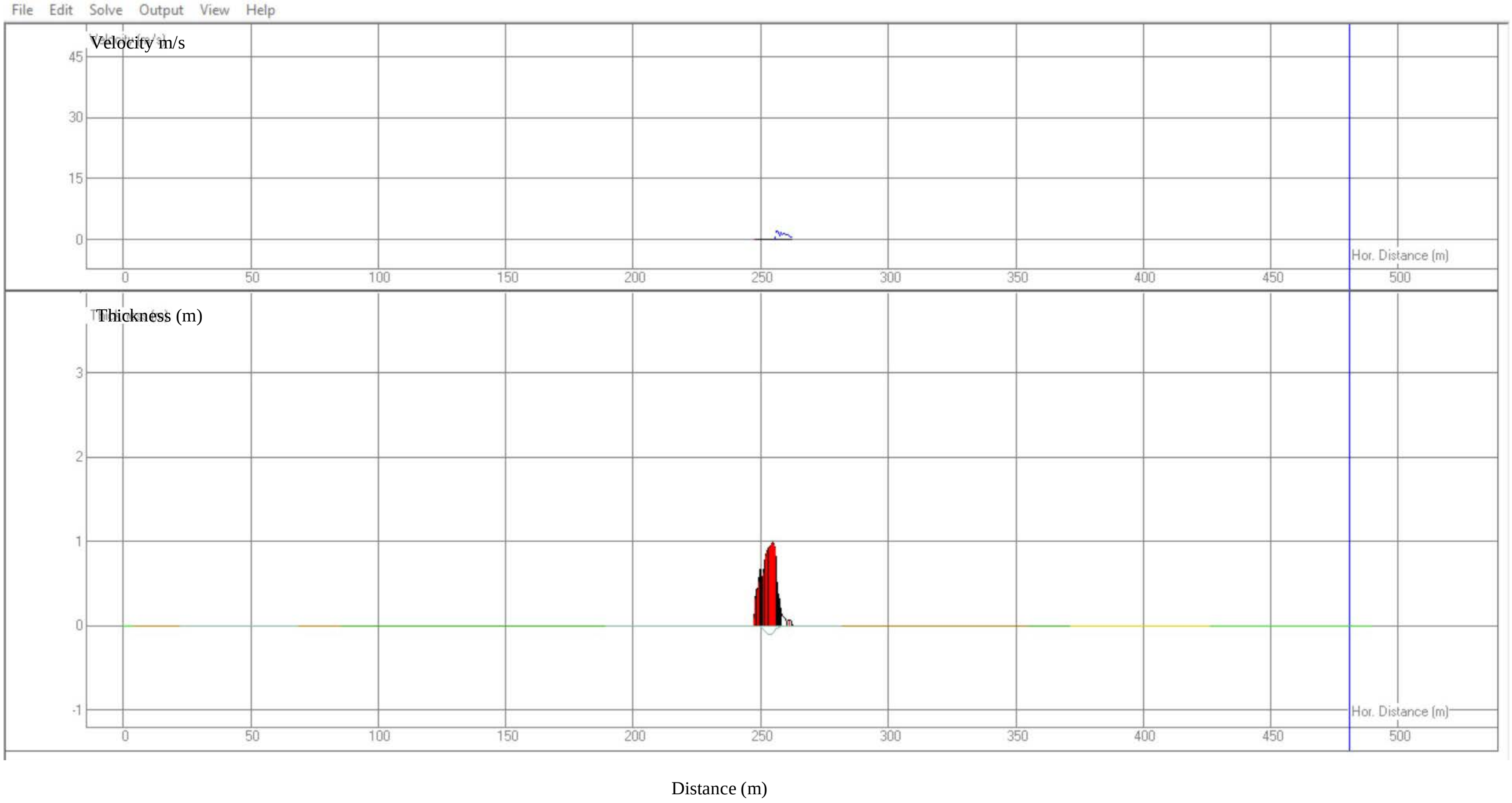
Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.14	43.68	7.07	No

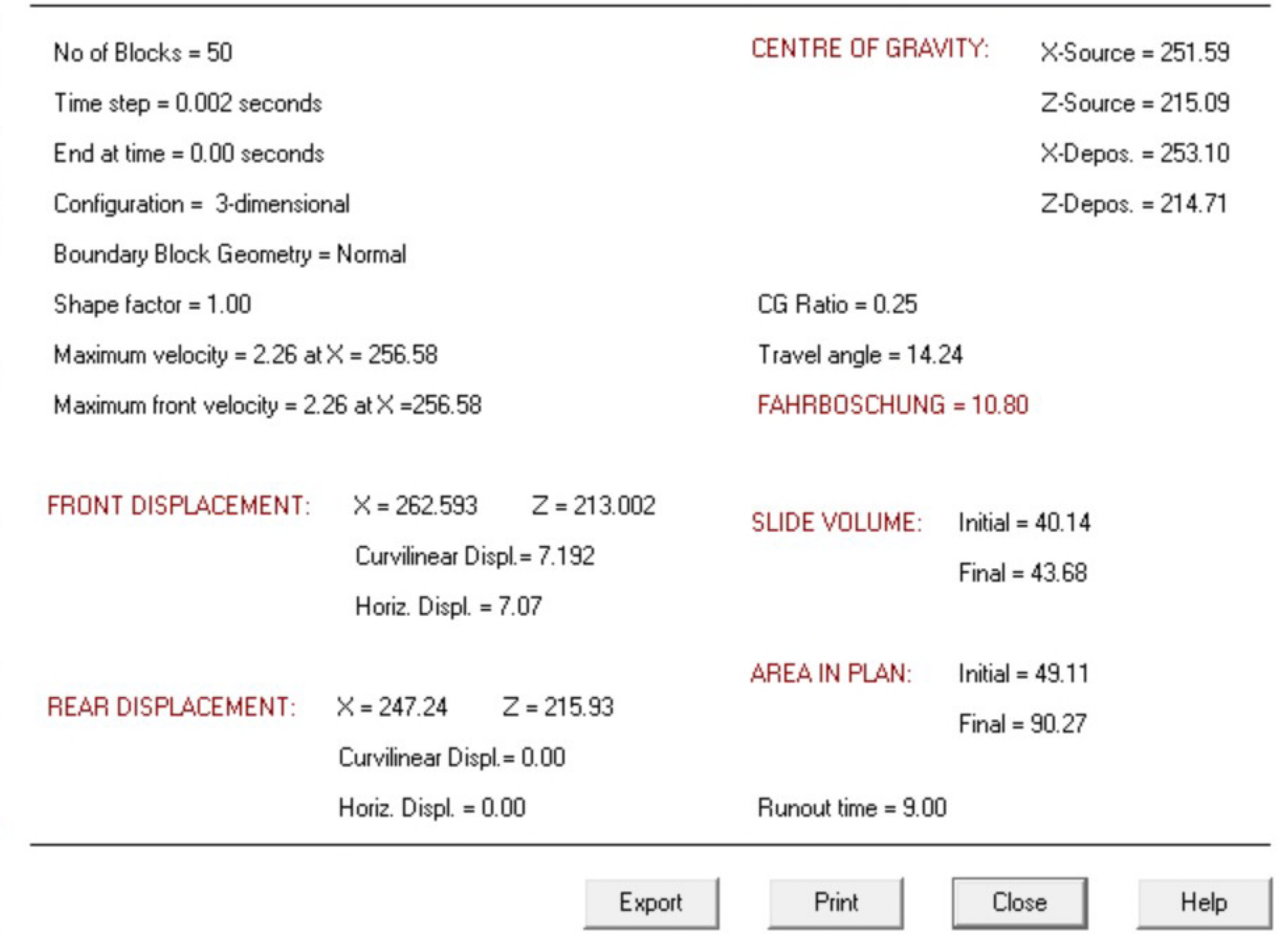
Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Elevation (m)
400
350
300
250
200
150
100
0
100
200
300
400
500
Distance (m)
Debris deposited
Line of
No-build Zone
Location of SITE
(Paddock)
Man-made Cut Slope

Time interval: 0.002

Time = 13.62 seconds
X-Front = 262.59
X-Rear = 247.24
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00


File Edit Solve Output View Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
500
Thickness (m)
3
2
1
0
-1
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
500
Distance (m)



No of Blocks = 50

Time step = 0.002 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 2.26 at X = 256.58

Maximum front velocity = 2.26 at X =256.58

FRONT DISPLACEMENT: X = 262.593 Z = 213.002

Curvilinear Displ.= 7.192

Horiz. Displ. = 7.07

REAR DISPLACEMENT: X = 247.24 Z = 215.93

Curvilinear Displ.= 0.00

Horiz. Displ. = 0.00

CENTRE OF GRAVITY: X-Source = 251.59

Z-Source = 215.09

X-Depos. = 253.10

Z-Depos. = 214.71

CG Ratio = 0.25

Travel angle = 14.24

FAHRBOSCHUNG = 10.80

SLIDE VOLUME: Initial = 40.14

Final = 43.68

AREA IN PLAN: Initial = 49.11

Final = 90.27

Runout time = 9.00

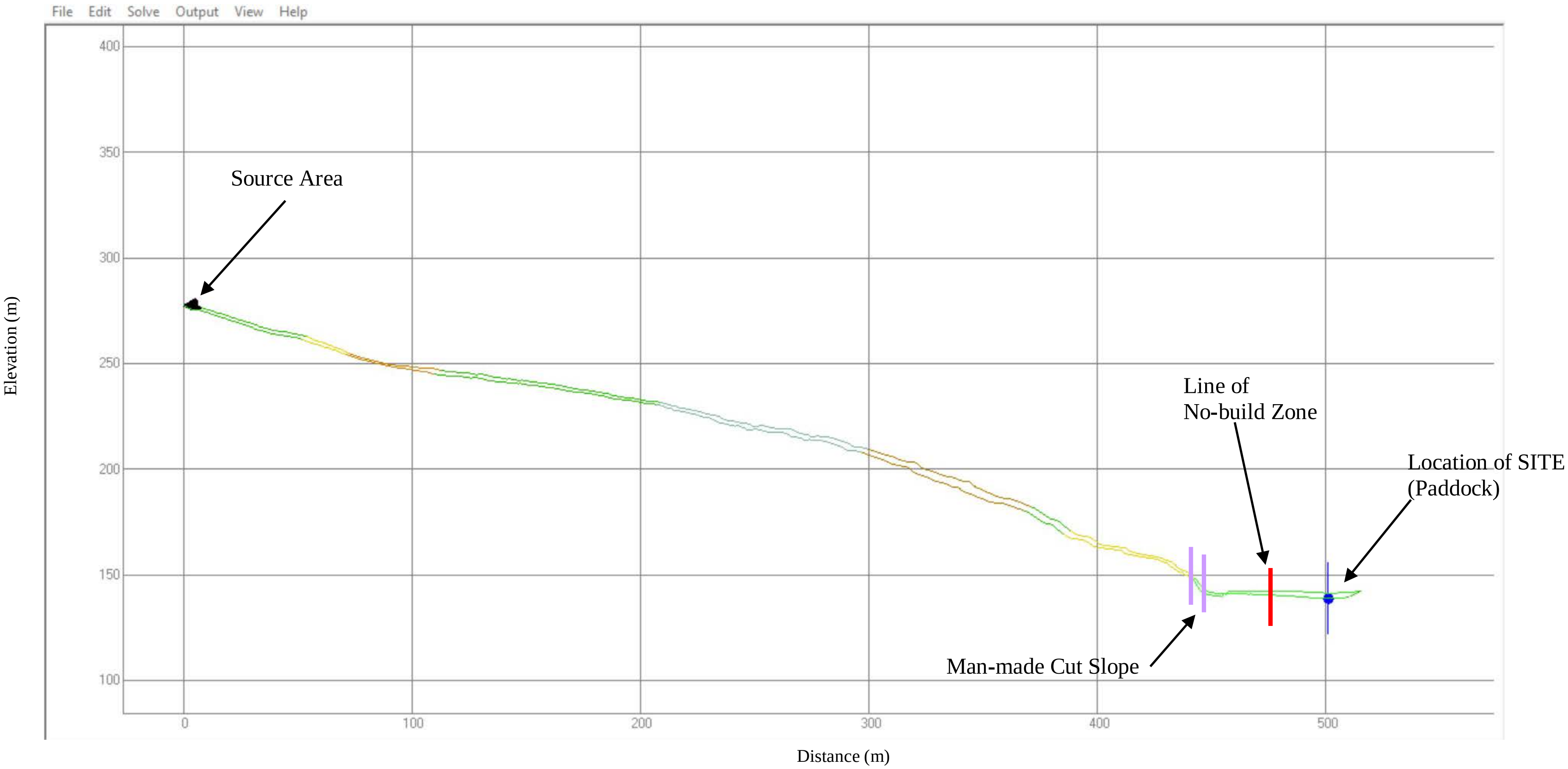
Debris Mobility Analysis for the Credible Runout Path RP11 (Case 1) within Catchment No. CD3

Landslide Type = CDF

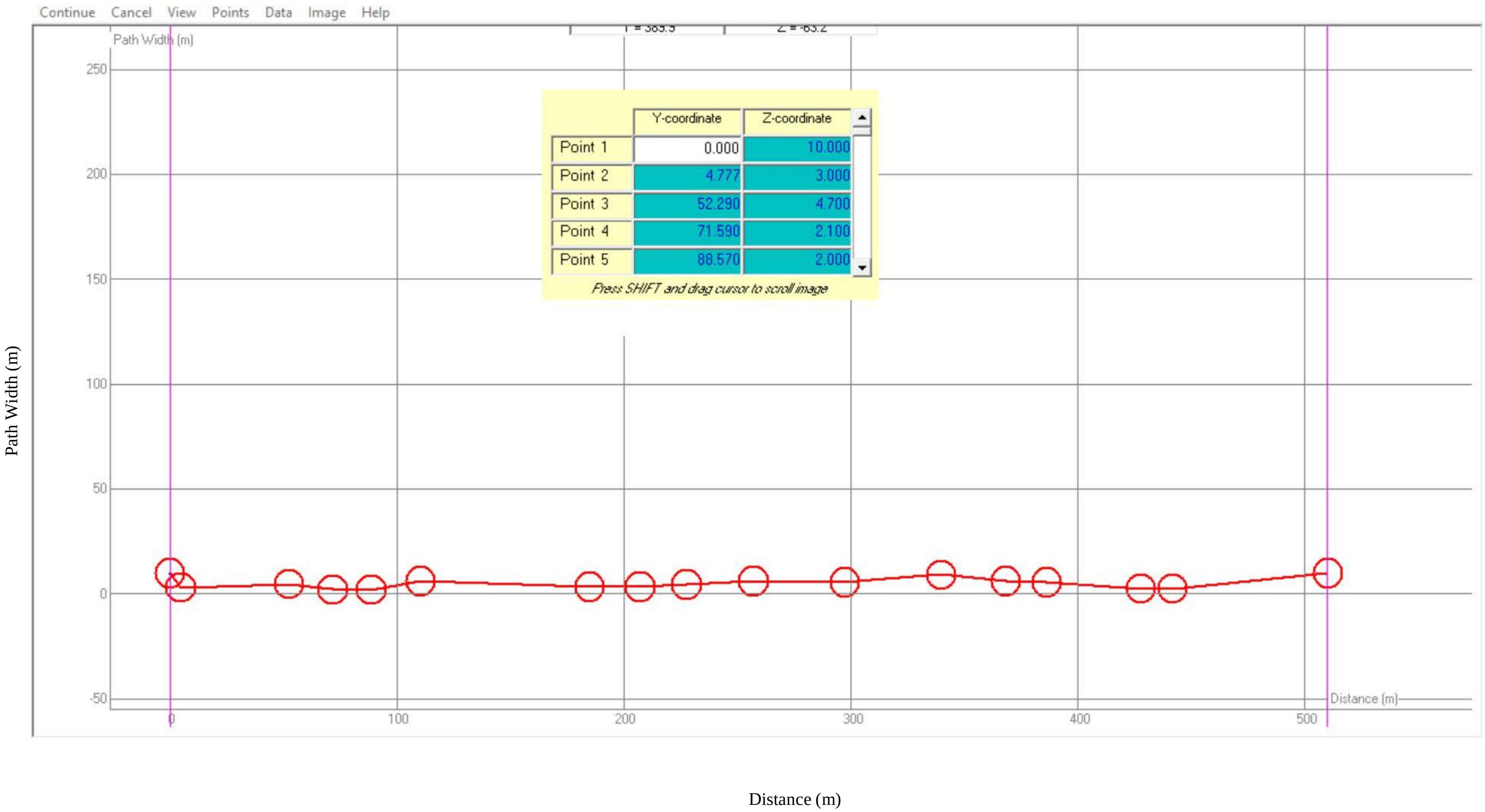
Design Source Volume = 40m^3

Figure D19

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = 385.5
Z = -63.2
Path Width (m)
250
200
150
100
50
0
-50
0
100
200
300
400
500
Distance (m)
Path Width (m)
Distance (m)

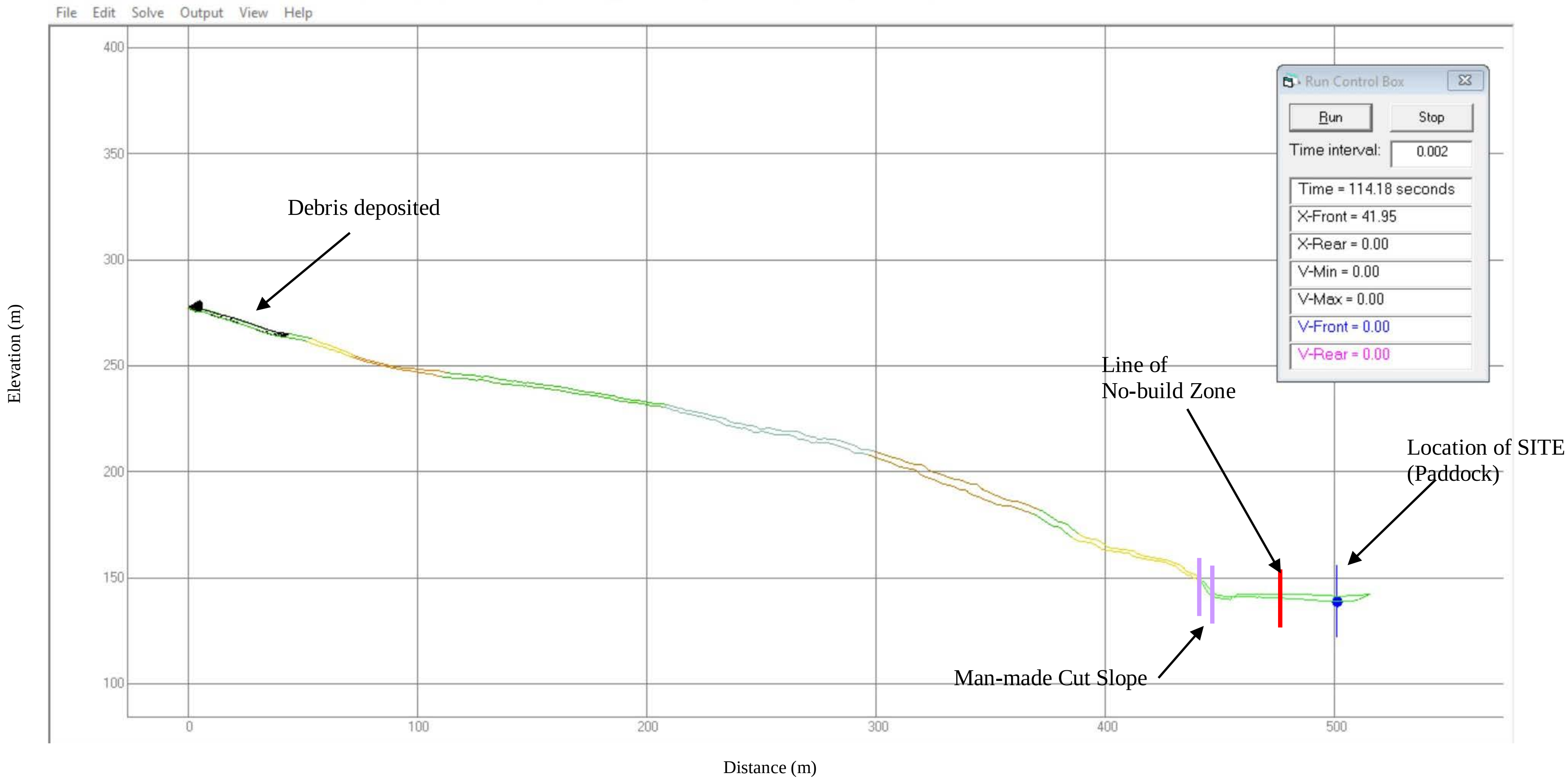
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	4.777	3.000
Point 3	52.290	4.700
Point 4	71.590	2.100
Point 5	88.570	2.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.50	41.00	35.35	No

Section Profile – (post-sliding)



File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Elevation (m)
400
350
300
250
200
150
100
0
100
200
300
400
500
Distance (m)
Debris deposited
Line of
No-build Zone
Location of SITE
(Paddock)
Man-made Cut Slope

Time interval: 0.002

Time = 114.18 seconds

X-Front = 41.95

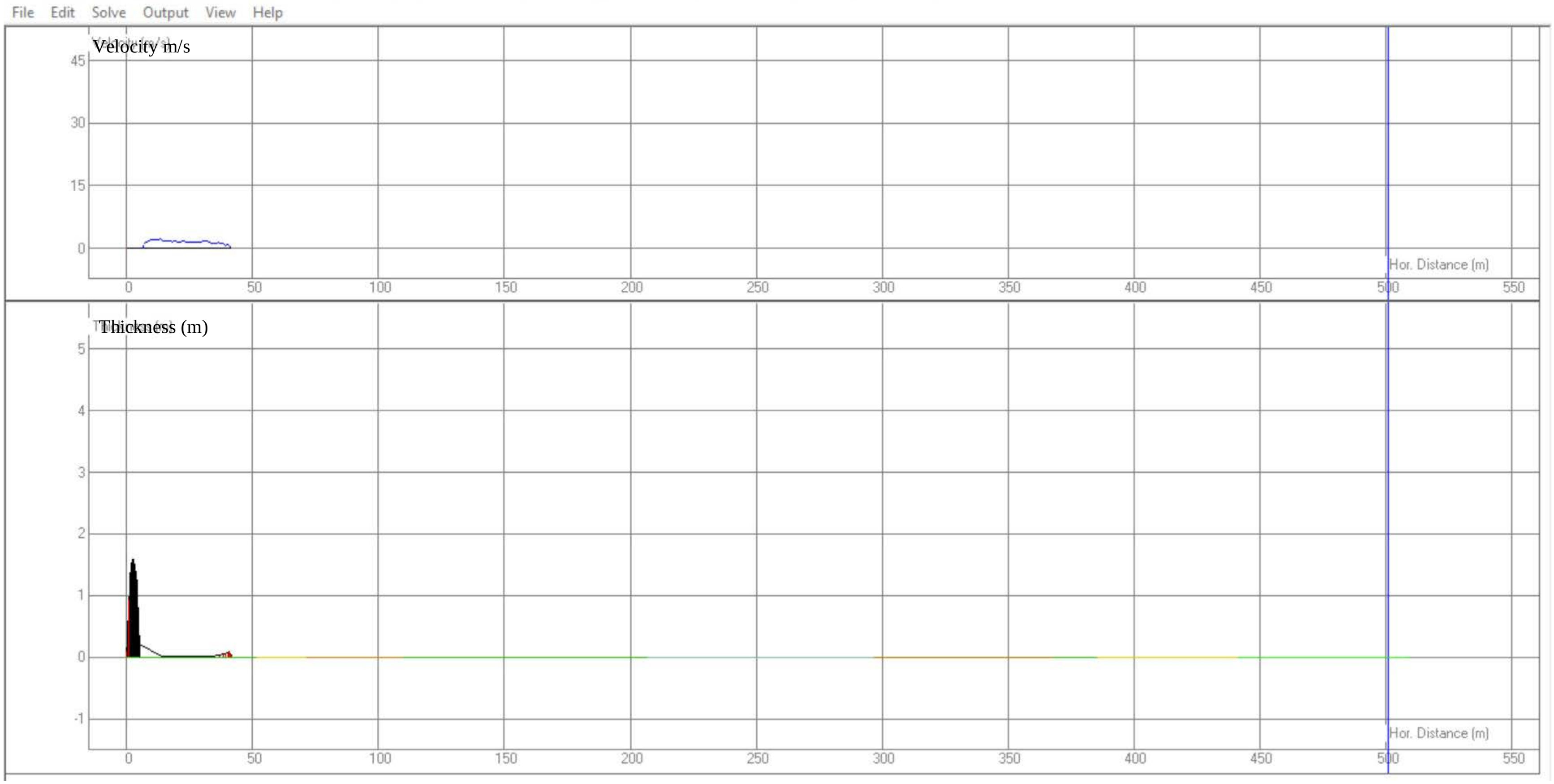
X-Rear = 0.00

V-Min = 0.00

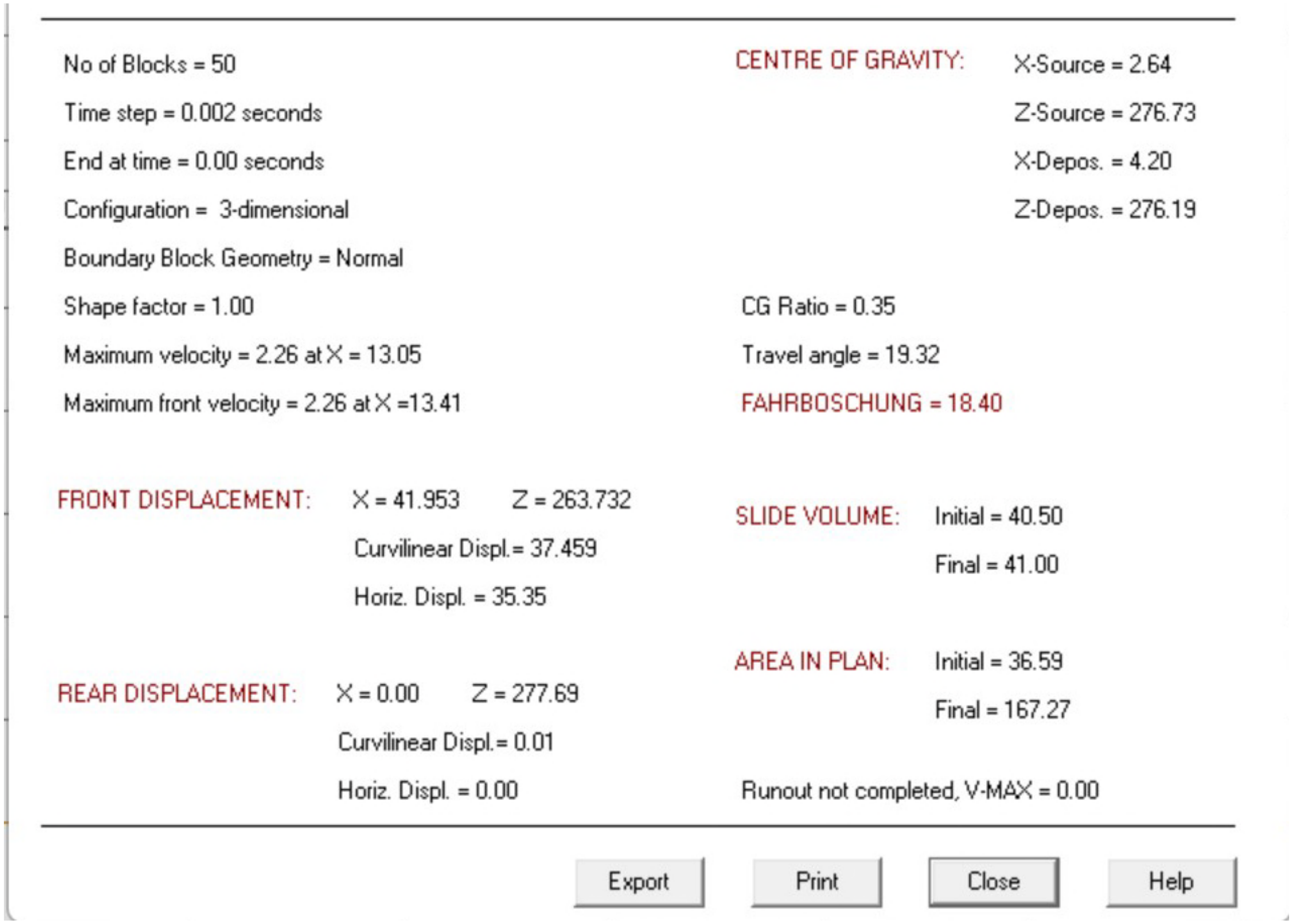
V-Max = 0.00

V-Front = 0.00

V-Rear = 0.00


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
500
550
Thickness (m)
5
4
3
2
1
0
-1
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
500
550

Distance (m)



No of Blocks = 50

Time step = 0.002 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 2.26 at X = 13.05

Maximum front velocity = 2.26 at X =13.41

FRONT DISPLACEMENT: X = 41.953 Z = 263.732

Curvilinear Displ.= 37.459

Horiz. Displ. = 35.35

REAR DISPLACEMENT: X = 0.00 Z = 277.69

Curvilinear Displ.= 0.01

Horiz. Displ. = 0.00

CENTRE OF GRAVITY: X-Source = 2.64

Z-Source = 276.73

X-Depos. = 4.20

Z-Depos. = 276.19

CG Ratio = 0.35

Travel angle = 19.32

FAHRBOSCHUNG = 18.40

SLIDE VOLUME: Initial = 40.50

Final = 41.00

AREA IN PLAN: Initial = 36.59

Final = 167.27

Runout not completed, V-MAX = 0.00

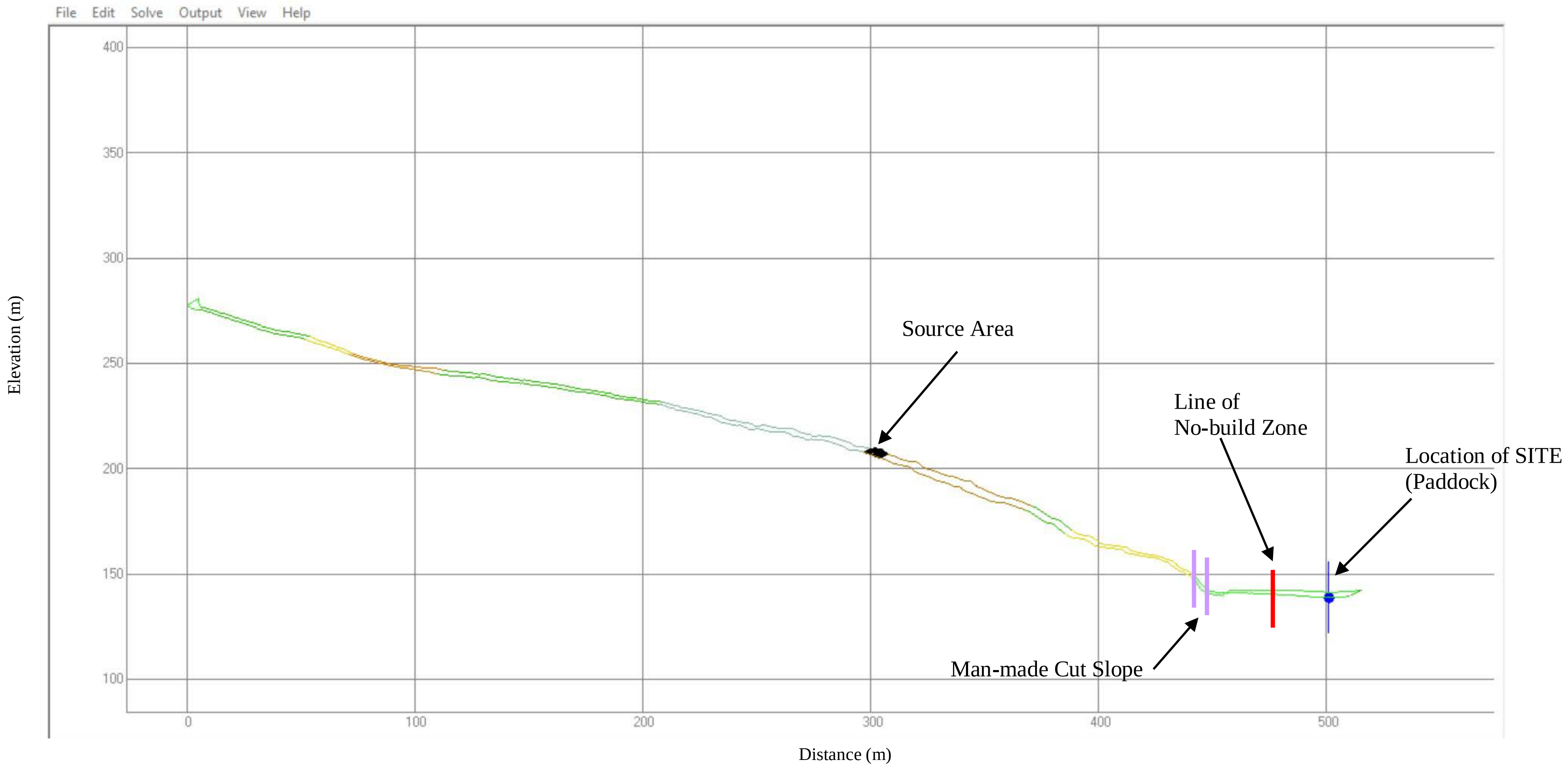
Debris Mobility Analysis for the Credible Runout Path RP11 (Case 2) within Catchment No. CD3

Landslide Type = CDF

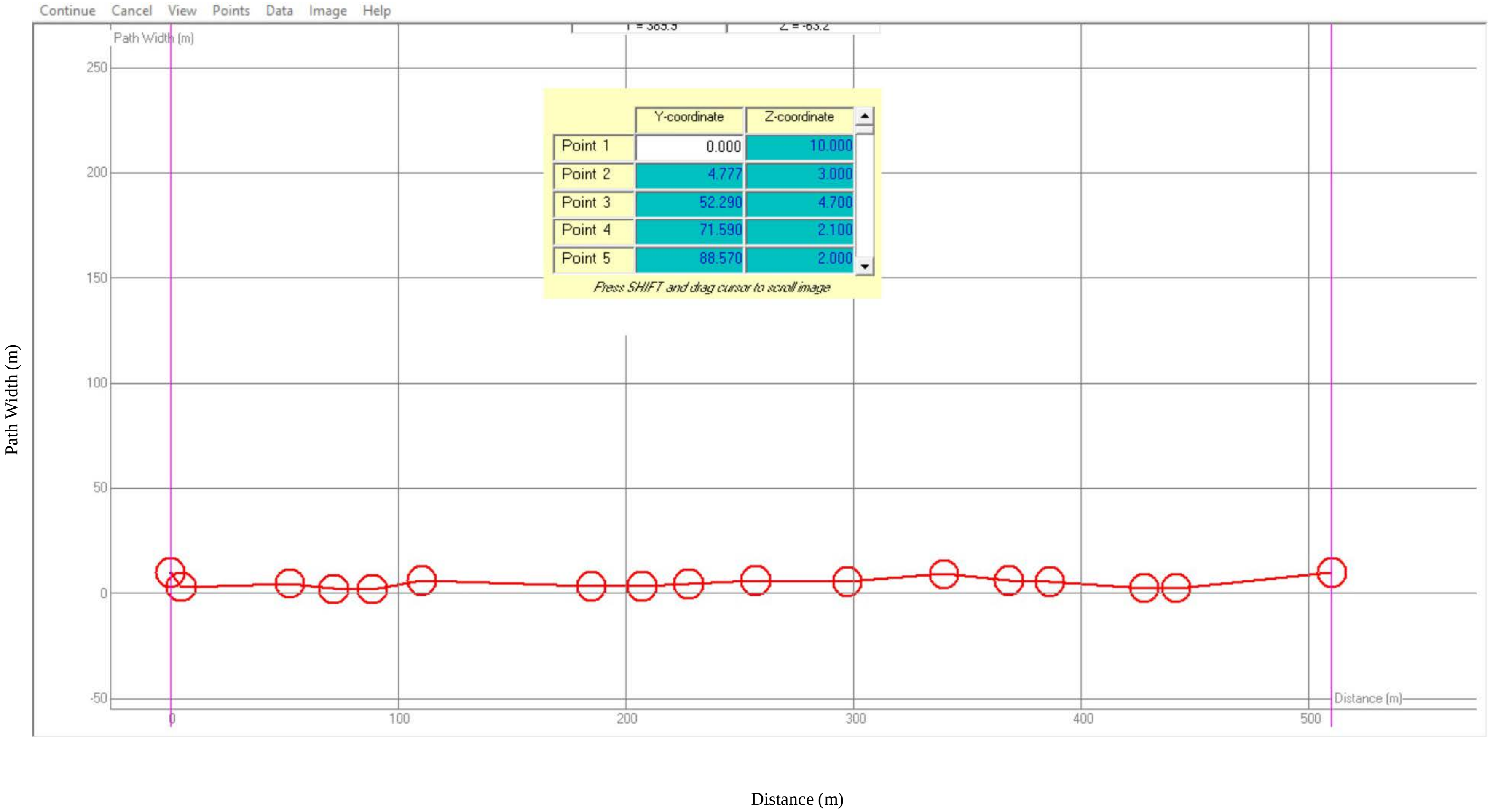
Design Source Volume = 40m^3

Figure D20

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
= 385.9
Z = -63.2
Path Width (m)
250
200
150
100
50
0
-50
0
100
200
300
400
500
Distance (m)
Path Width (m)
Distance (m)

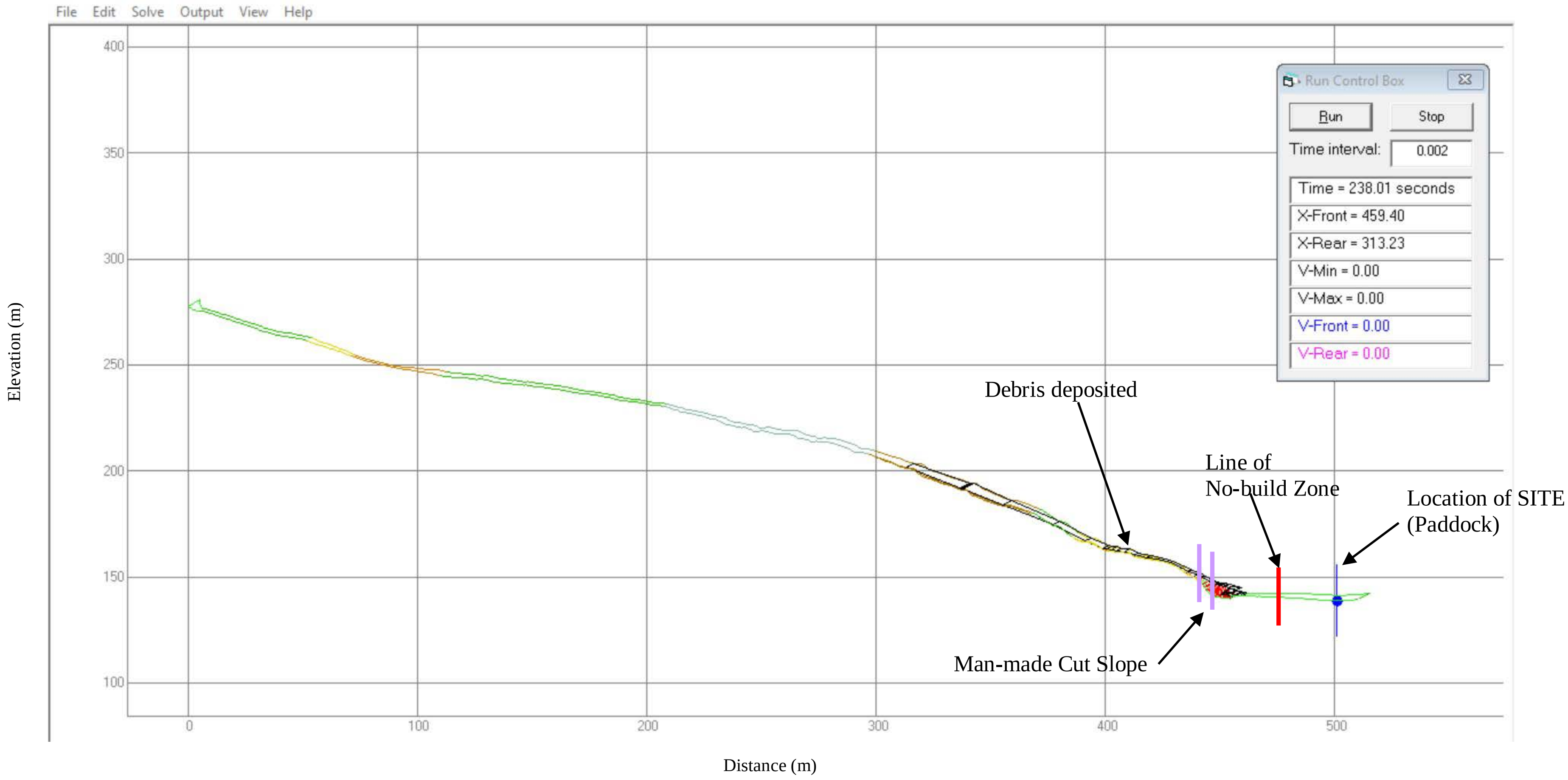
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	4.777	3.000
Point 3	52.290	4.700
Point 4	71.590	2.100
Point 5	88.570	2.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.10	382.83	154.81	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
400
350
300
250
200
150
100
0
100
200
300
400
500
Elevation (m)
Distance (m)

Time interval: 0.002

Time = 238.01 seconds

X-Front = 459.40

X-Rear = 313.23

V-Min = 0.00

V-Max = 0.00

V-Front = 0.00

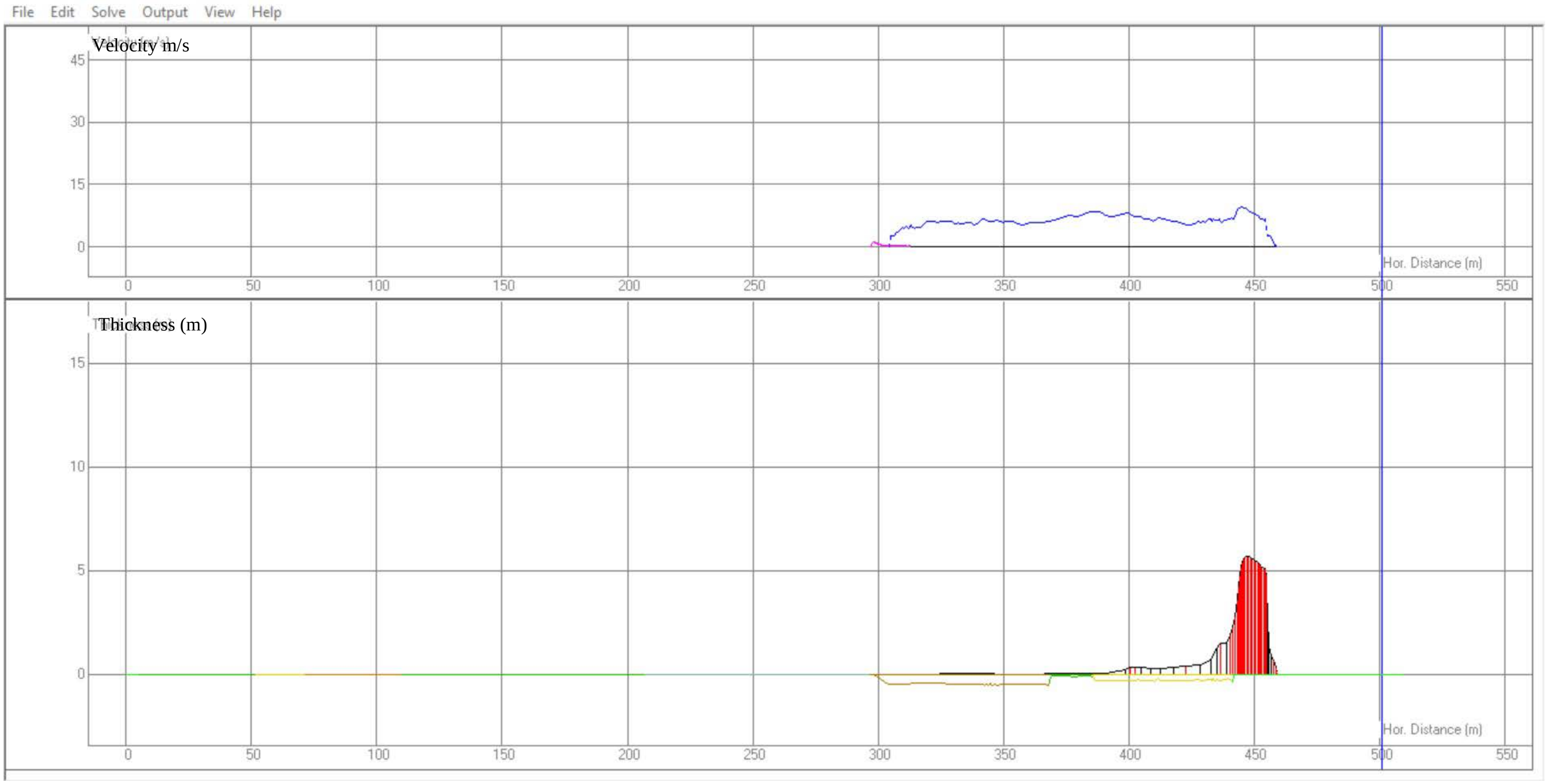
V-Rear = 0.00

Debris deposited

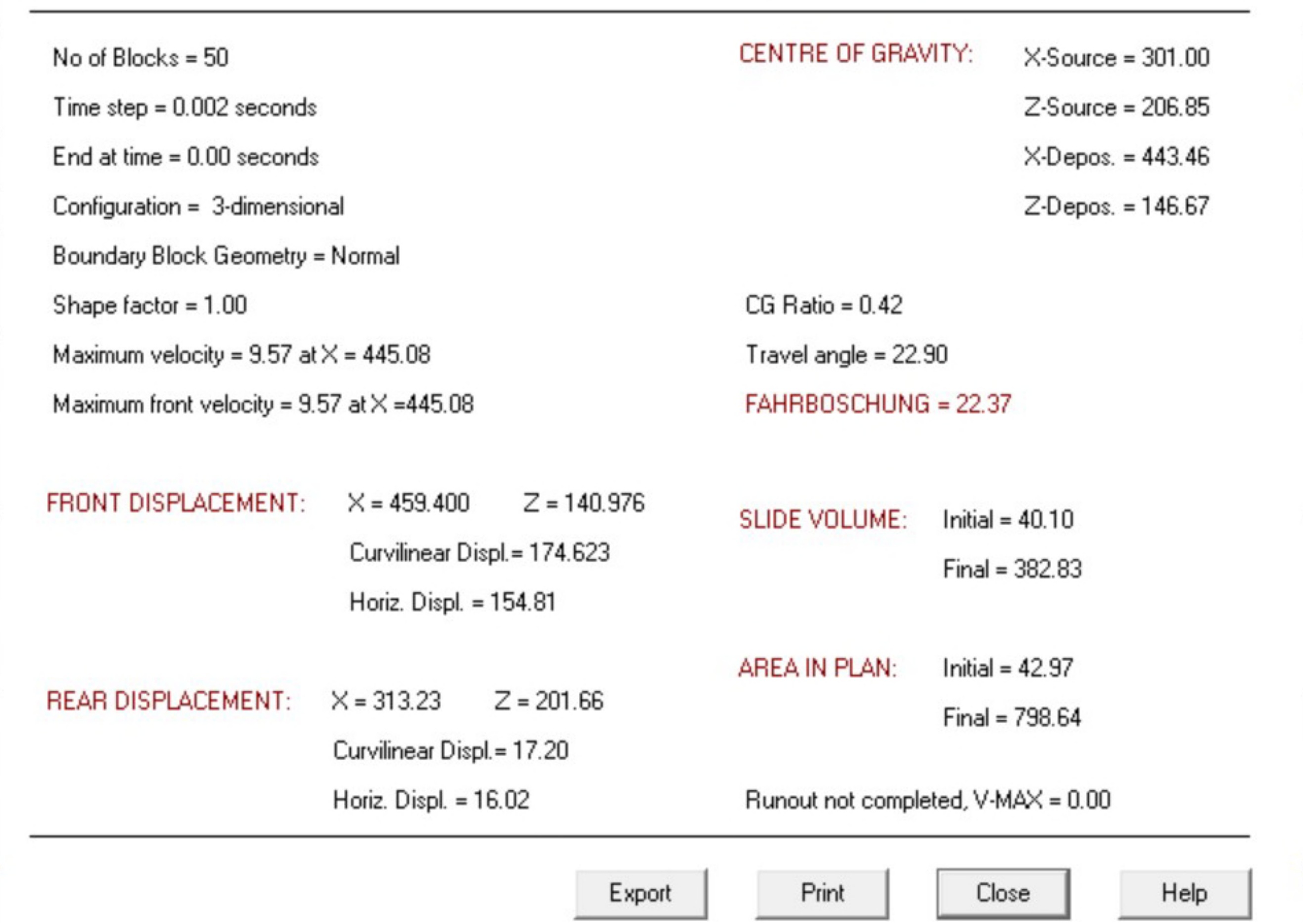
Line of No-build Zone

Location of SITE (Paddock)

Man-made Cut Slope


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
0
50
100
150
200
250
300
350
400
450
500
550
Hor. Distance (m)
Thickness (m)
15
10
5
0
0
50
100
150
200
250
300
350
400
450
500
550
Hor. Distance (m)

Distance (m)



No of Blocks = 50

Time step = 0.002 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 9.57 at X = 445.08

Maximum front velocity = 9.57 at X =445.08

CENTRE OF GRAVITY: X-Source = 301.00

Z-Source = 206.85

X-Depos. = 443.46

Z-Depos. = 146.67

CG Ratio = 0.42

Travel angle = 22.90

FAHRBOSCHUNG = 22.37

FRONT DISPLACEMENT: X = 459.400 Z = 140.976

Curvilinear Displ.= 174.623

Horiz. Displ. = 154.81

REAR DISPLACEMENT: X = 313.23 Z = 201.66

Curvilinear Displ.= 17.20

Horiz. Displ. = 16.02

SLIDE VOLUME: Initial = 40.10

Final = 382.83

AREA IN PLAN: Initial = 42.97

Final = 798.64

Runout not completed, V-MAX = 0.00

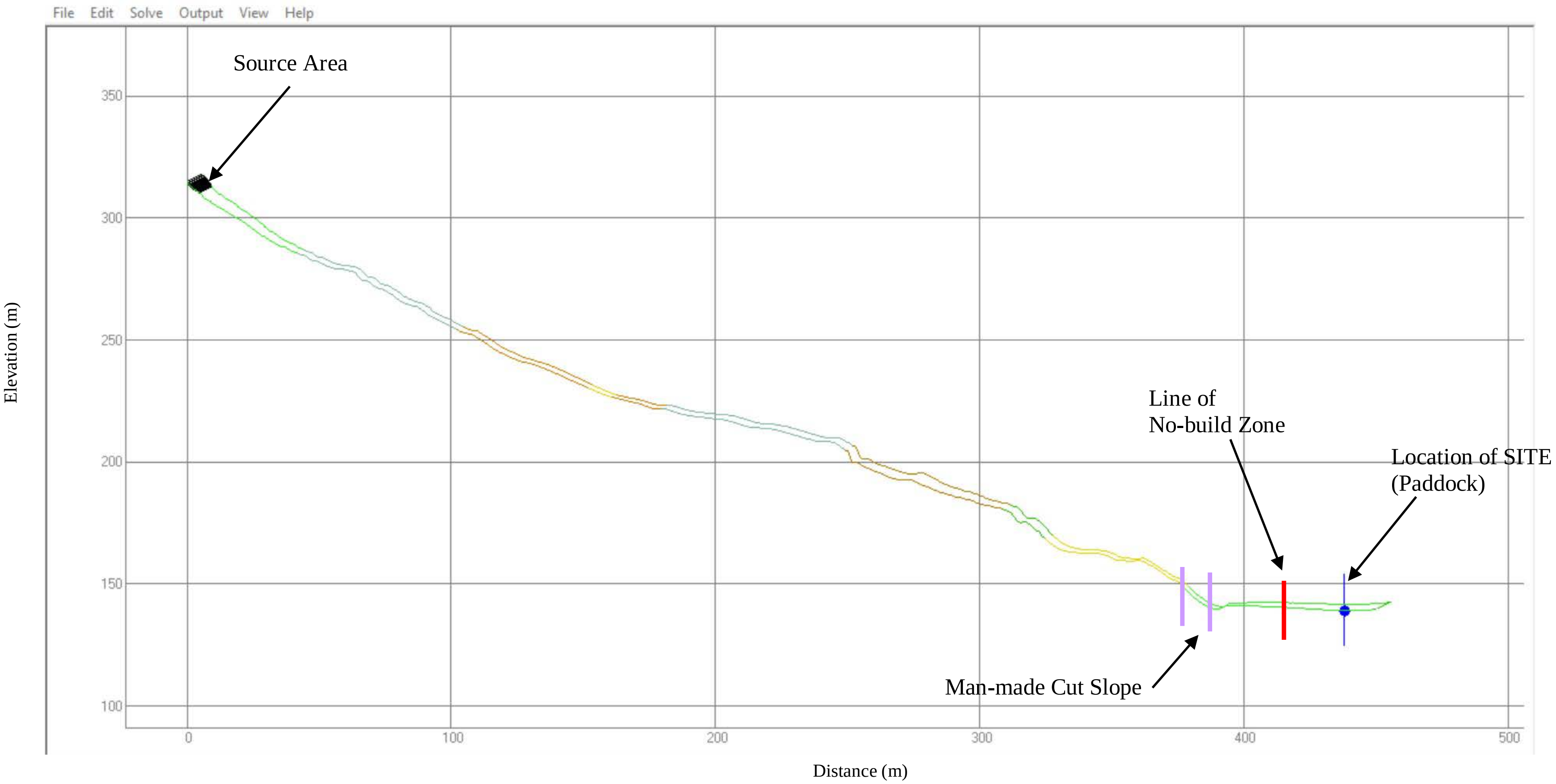
Debris Mobility Analysis for the Credible Runout Path RP12 (Case 1) within Catchment No. CD3

Landslide Type = CDF

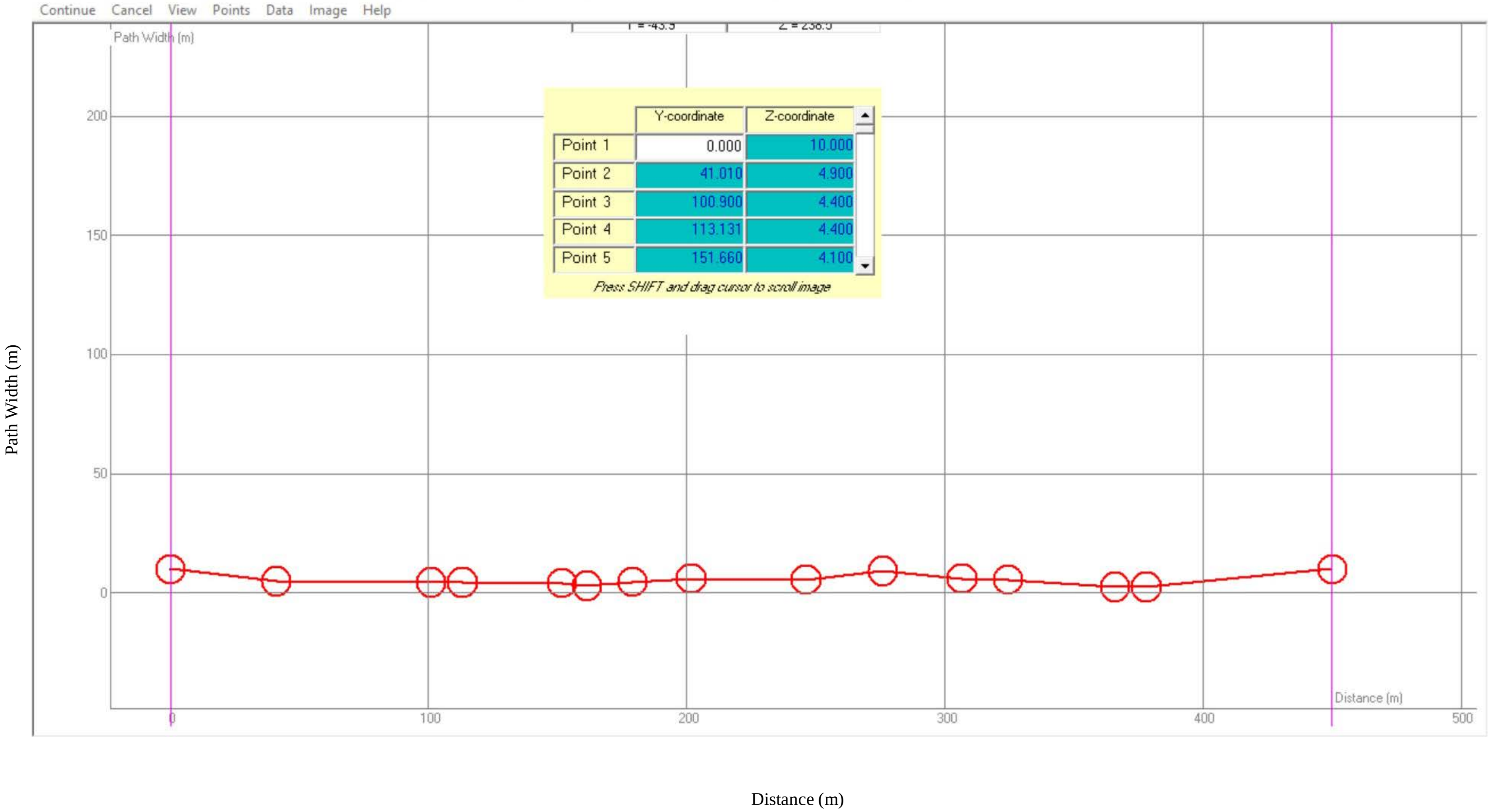
Design Source Volume = 40m^3

Figure D21

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
200
150
100
50
0
0
100
200
300
400
500
Distance (m)
Path Width (m)
Distance (m)

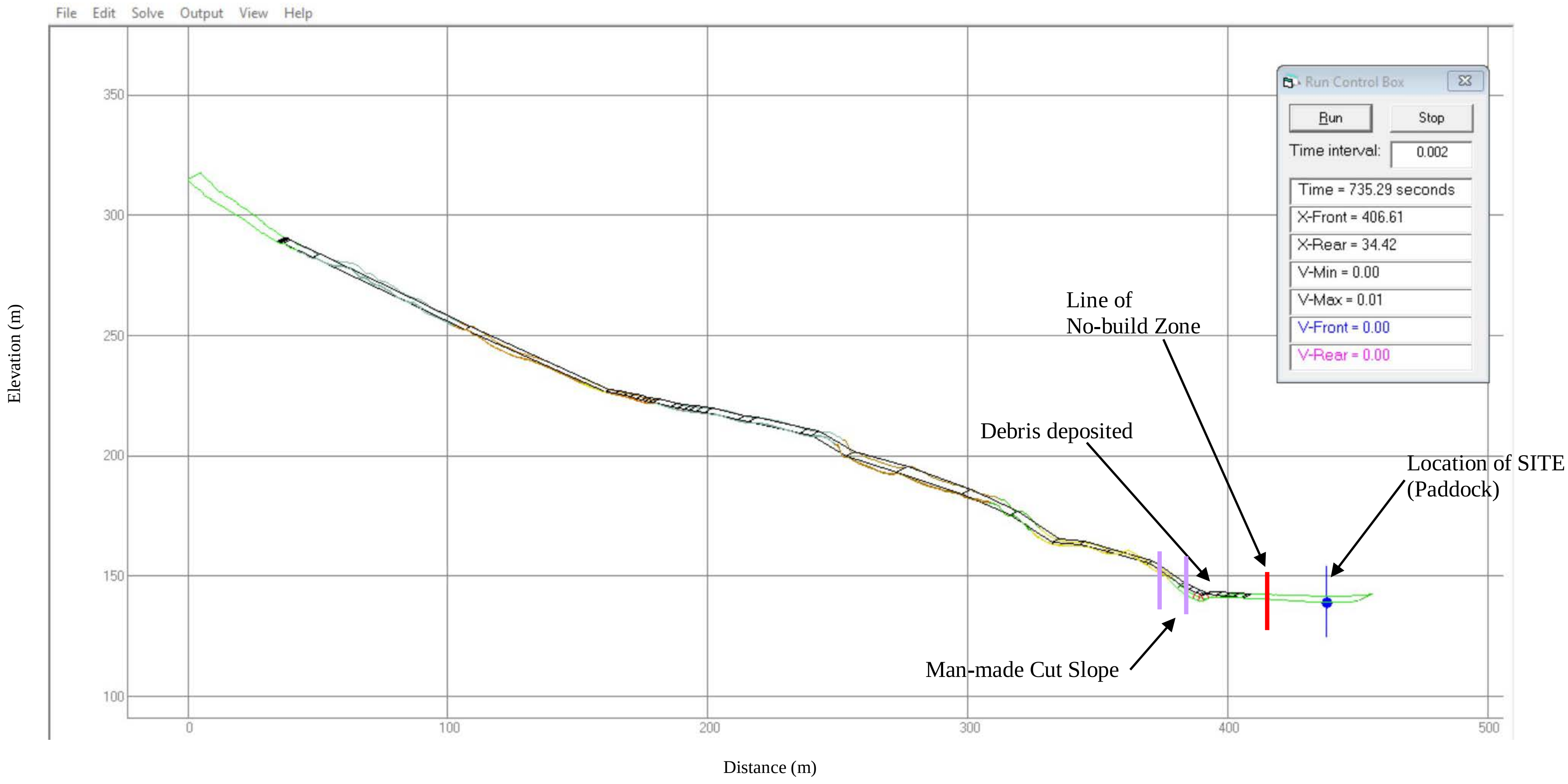
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	41.010	4.900
Point 3	100.900	4.400
Point 4	113.131	4.400
Point 5	151.660	4.100

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.07	517.11	402.06	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
350
300
250
200
150
100
0
100
200
300
400
500
Elevation (m)
Distance (m)

Time interval: 0.002

Time = 735.29 seconds

X-Front = 406.61

X-Rear = 34.42

V-Min = 0.00

V-Max = 0.01

V-Front = 0.00

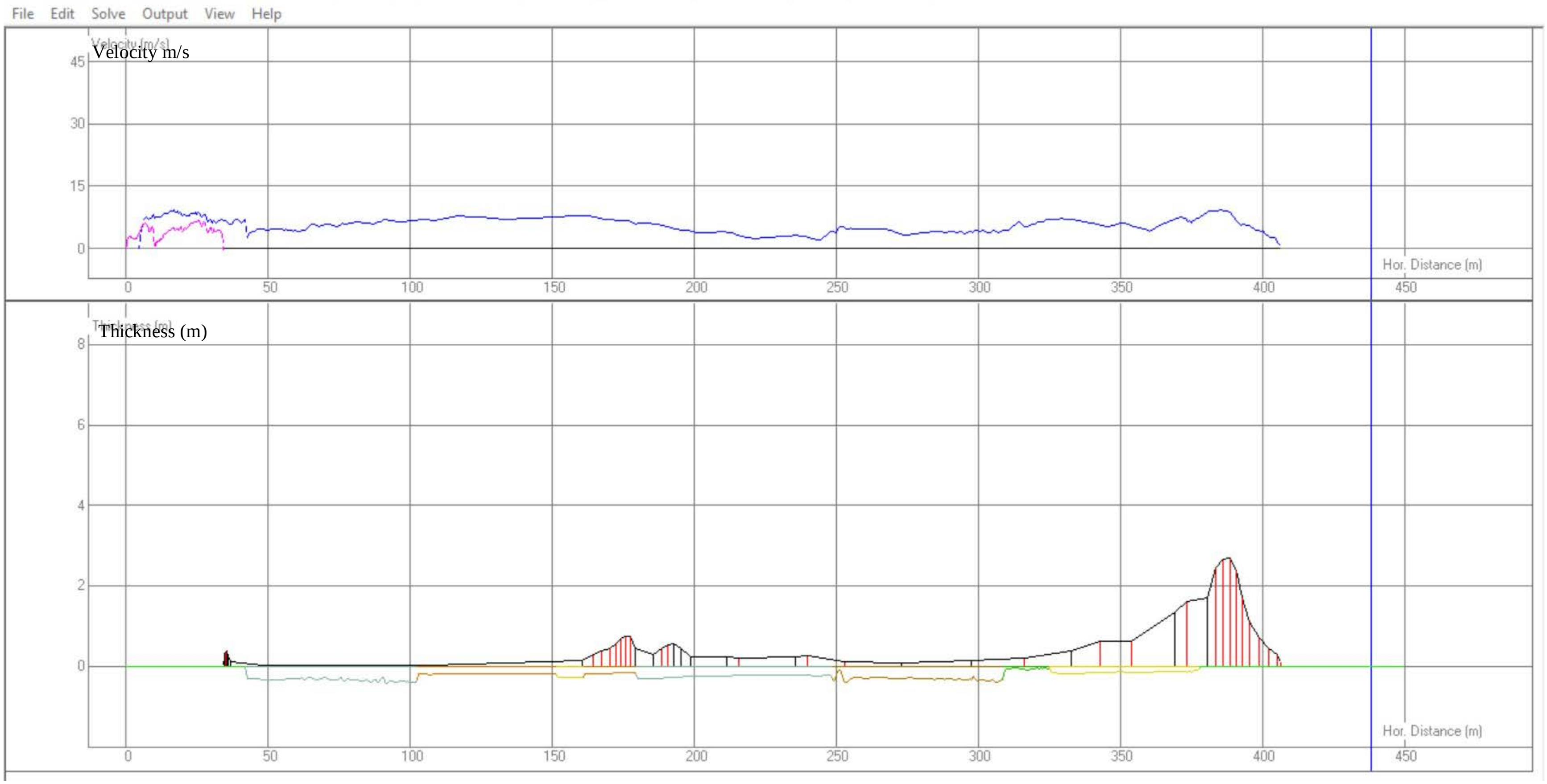
V-Rear = 0.00

Line of No-build Zone

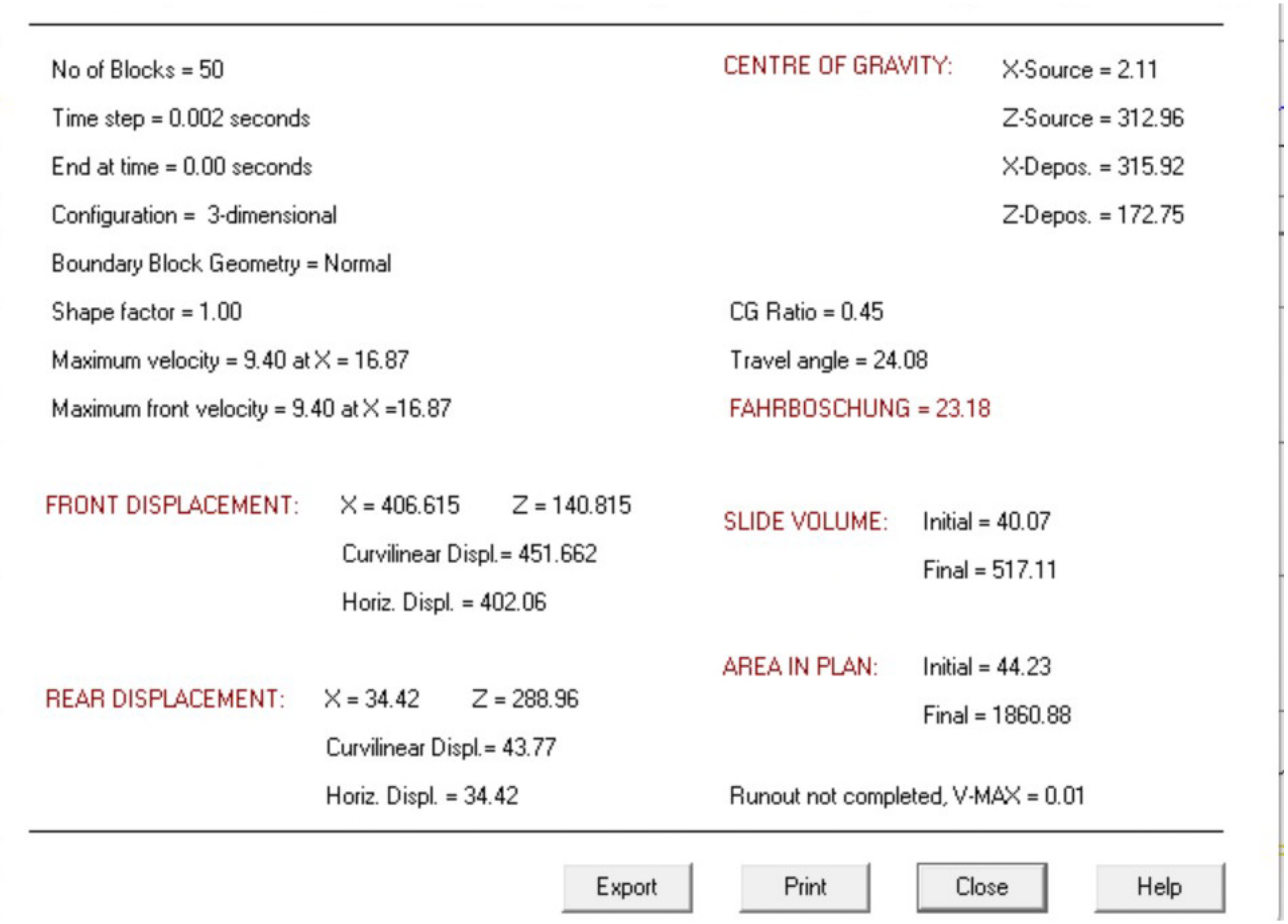
Debris deposited

Location of SITE (Paddock)

Man-made Cut Slope


File Edit Solve Output View Help
Velocity (m/s)
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
Thickness (m)
Thickness (m)
8
6
4
2
0
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450

Distance (m)



No of Blocks = 50

Time step = 0.002 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 9.40 at X = 16.87

Maximum front velocity = 9.40 at X =16.87

FRONT DISPLACEMENT: X = 406.615 Z = 140.815
Curvilinear Displ.= 451.662
Horiz. Displ. = 402.06

REAR DISPLACEMENT: X = 34.42 Z = 288.96
Curvilinear Displ.= 43.77
Horiz. Displ. = 34.42

CENTRE OF GRAVITY: X-Source = 2.11
Z-Source = 312.96
X-Depos. = 315.92
Z-Depos. = 172.75

CG Ratio = 0.45

Travel angle = 24.08

FAHRBOSCHUNG = 23.18

SLIDE VOLUME: Initial = 40.07
Final = 517.11

AREA IN PLAN: Initial = 44.23
Final = 1860.88

Runout not completed, V-MAX = 0.01

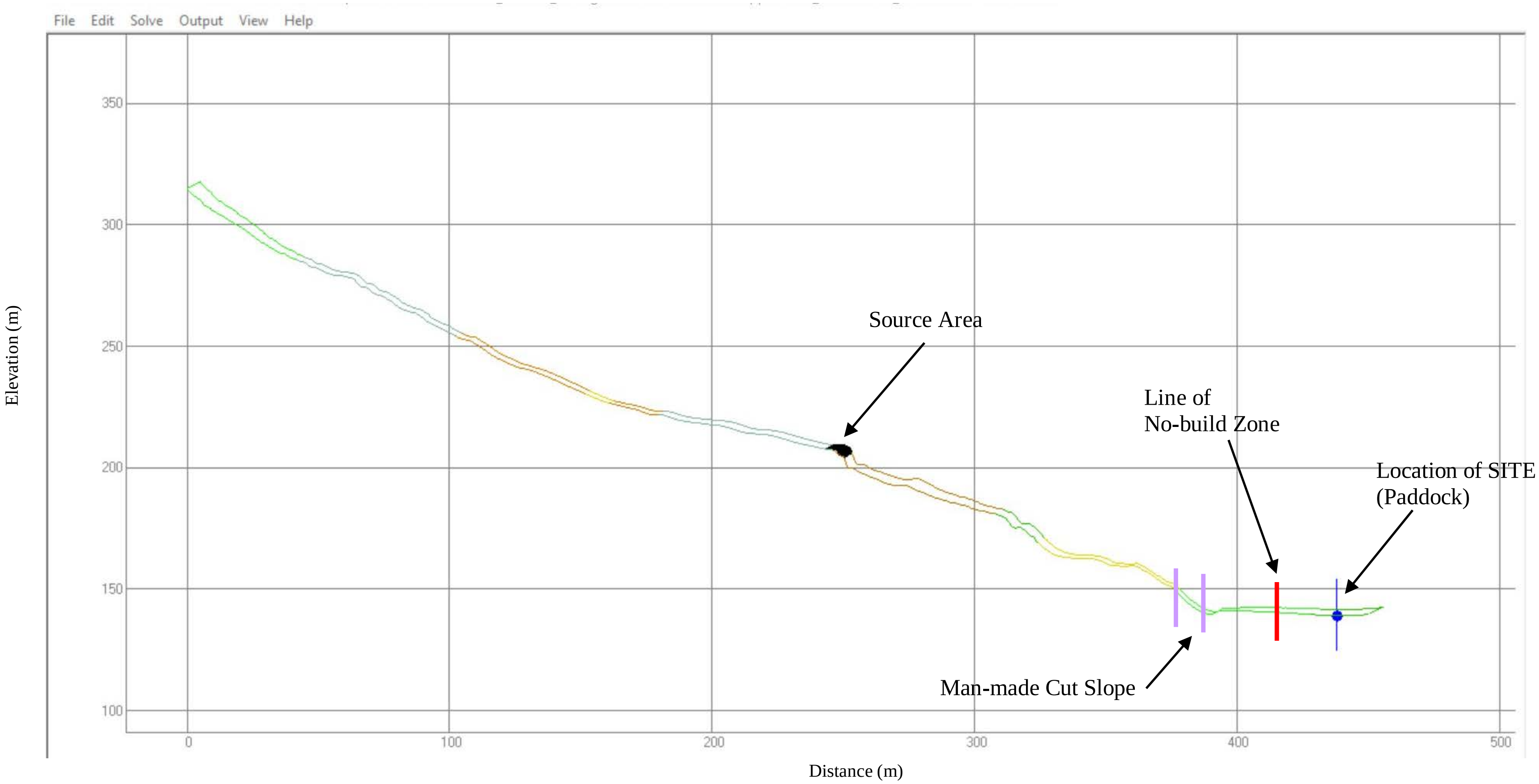
Debris Mobility Analysis for the Credible Runout Path RP12 (Case 2) within Catchment No. CD3

Landslide Type = CDF

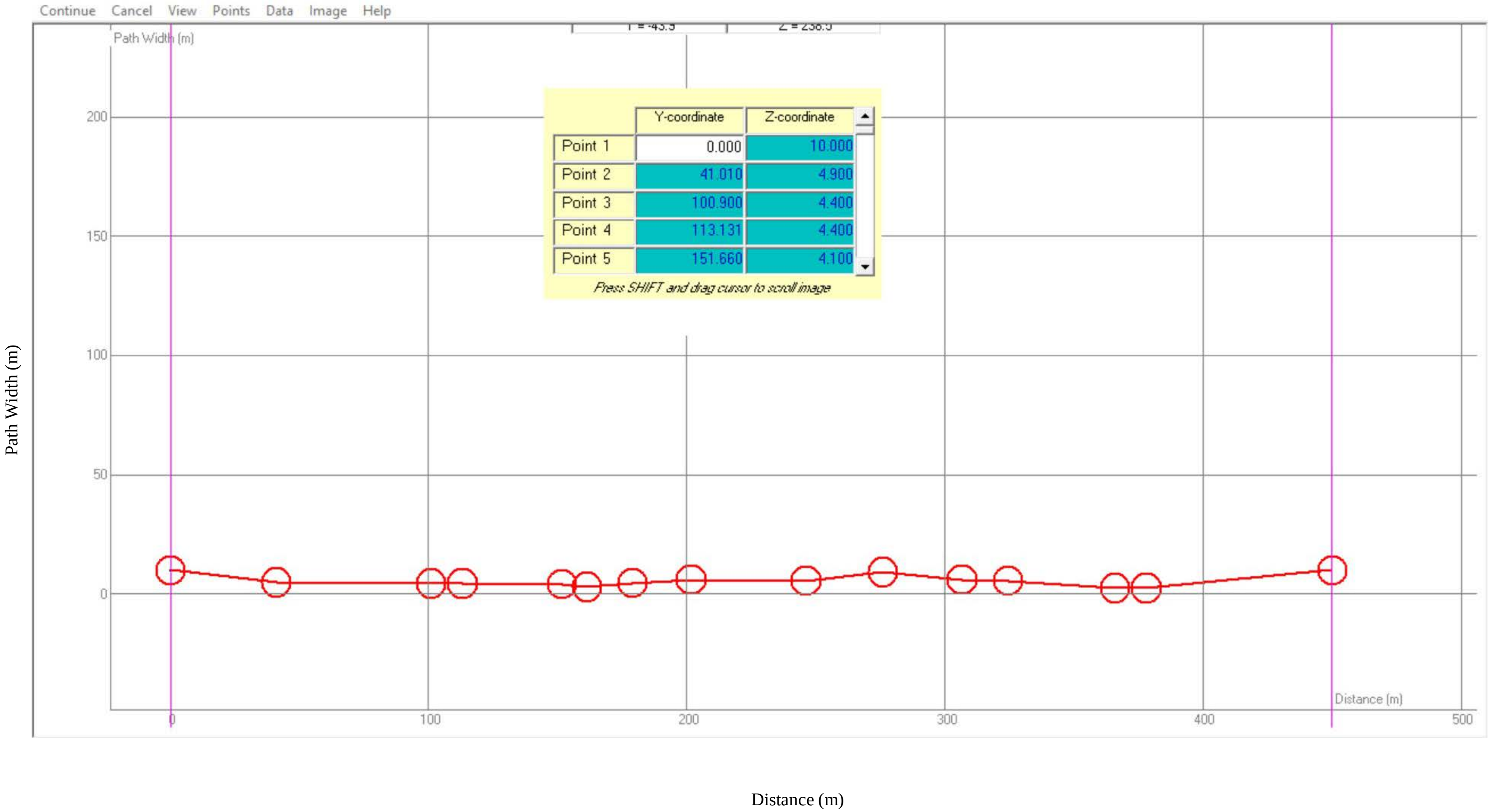
Design Source Volume = 40m^3

Figure D22

Section Profile – (pre-sliding)



Width Profile

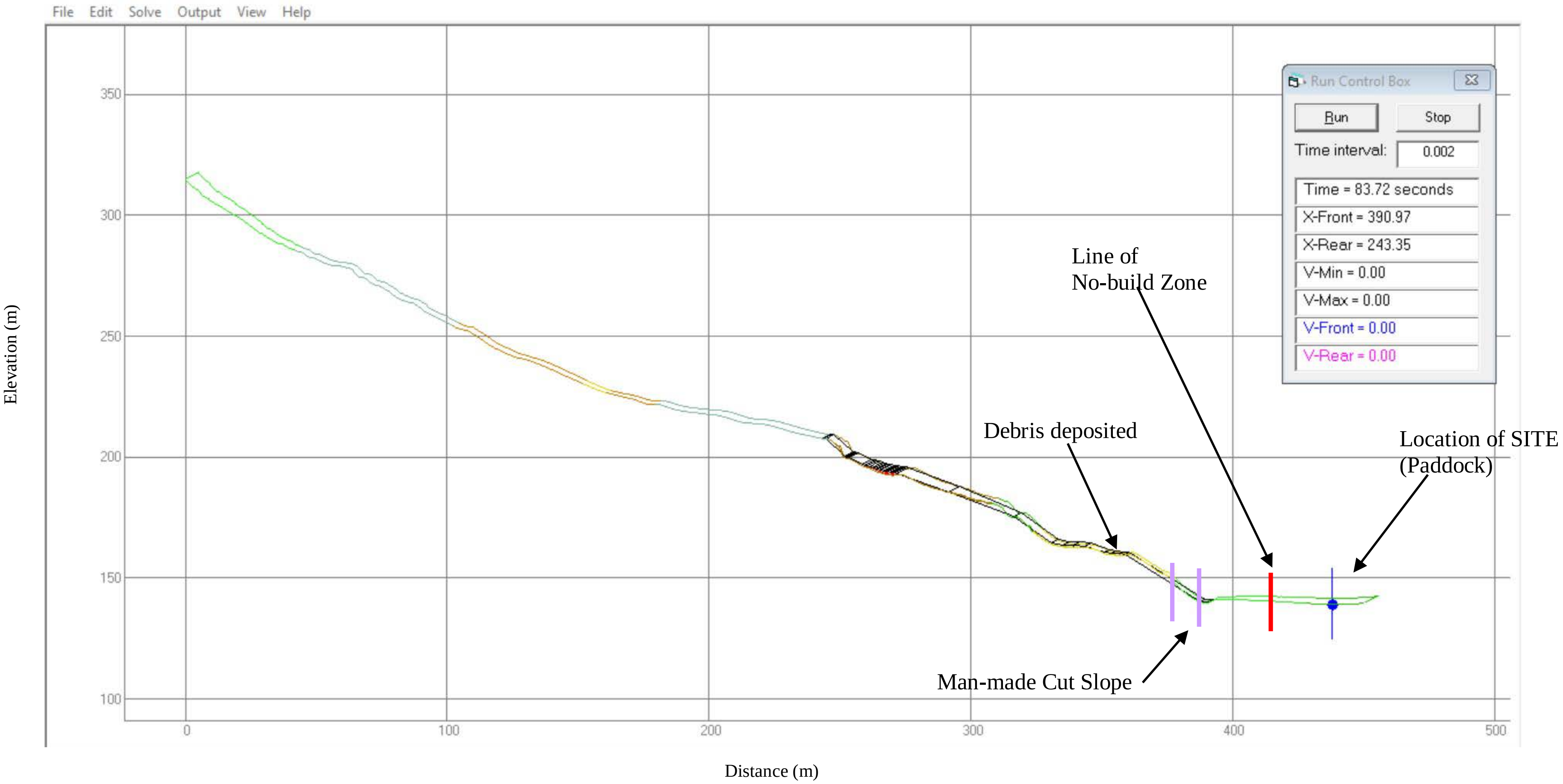

Continue
Cancel
View
Points
Data
Image
Help
Path Width (m)
200
150
100
50
0
Distance (m)
0
100
200
300
400
500
Press SHIFT and drag cursor to scroll image
Path Width (m)
Distance (m)

	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	41.010	4.900
Point 3	100.900	4.400
Point 4	113.131	4.400
Point 5	151.660	4.100

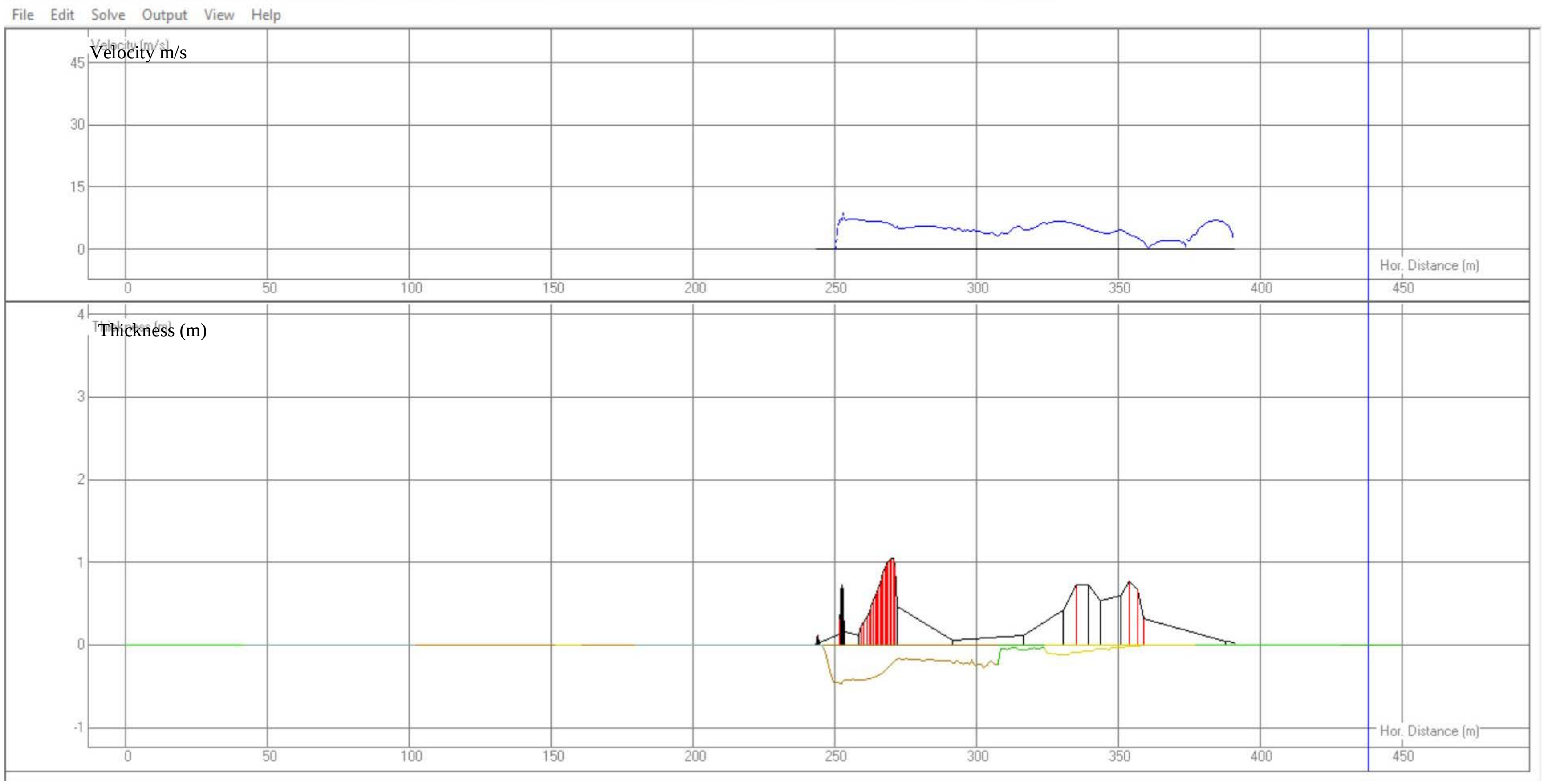
Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.34	196.99	140.64	No

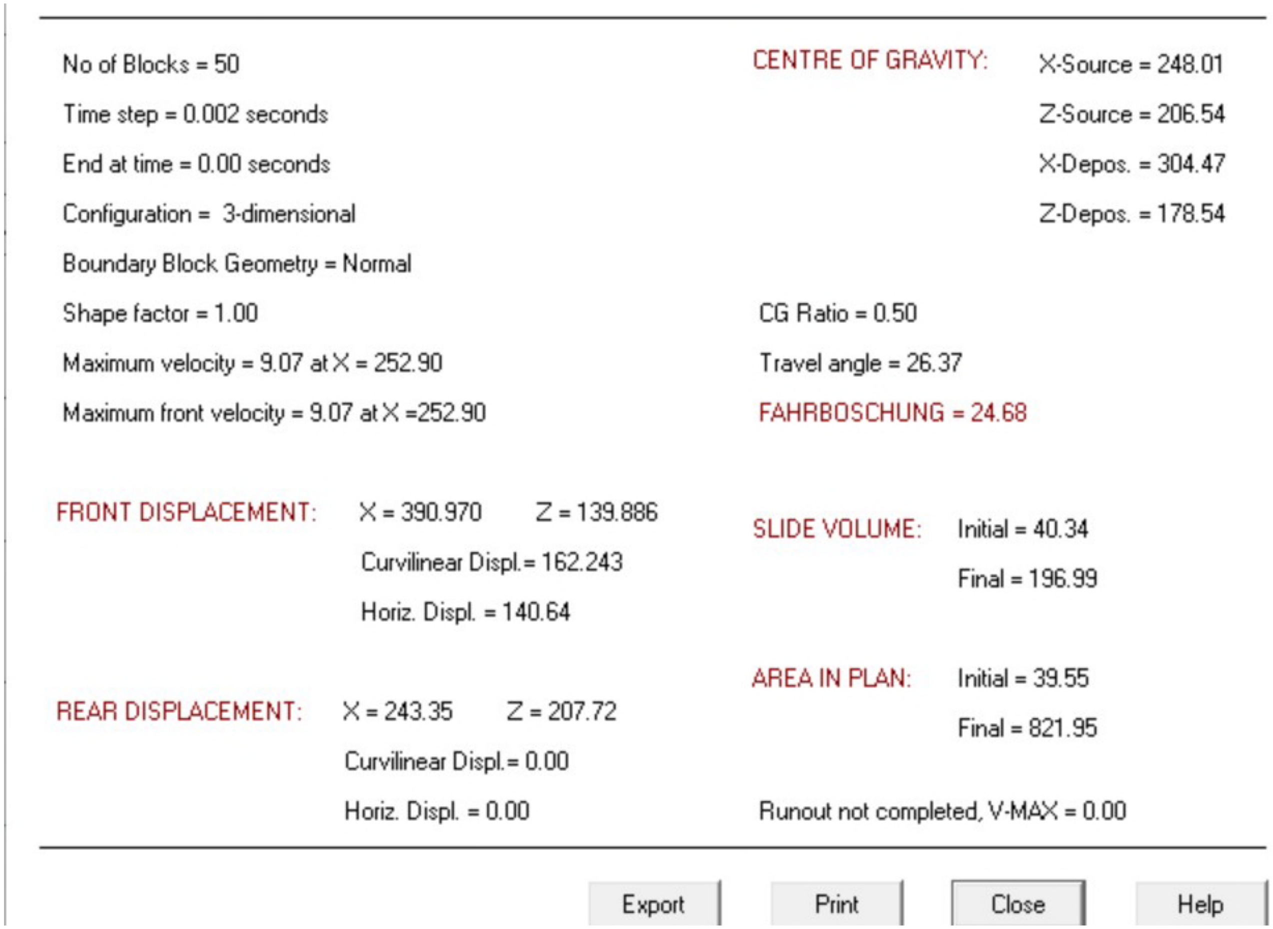
Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Elevation (m)
350
300
250
200
150
100
Distance (m)
0
100
200
300
400
500
Line of No-build Zone
Debris deposited
Location of SITE (Paddock)
Man-made Cut Slope

Time interval: 0.002
Time = 83.72 seconds
X-Front = 390.97
X-Rear = 243.35
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00

File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
Thickness (m)
4
3
2
1
0
-1
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450

Distance (m)



No of Blocks = 50

Time step = 0.002 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 9.07 at X = 252.90

Maximum front velocity = 9.07 at X =252.90

FRONT DISPLACEMENT: X = 390.970 Z = 139.886

Curvilinear Displ.= 162.243

Horiz. Displ. = 140.64

REAR DISPLACEMENT: X = 243.35 Z = 207.72

Curvilinear Displ.= 0.00

Horiz. Displ. = 0.00

CENTRE OF GRAVITY: X-Source = 248.01

Z-Source = 206.54

X-Depos. = 304.47

Z-Depos. = 178.54

CG Ratio = 0.50

Travel angle = 26.37

FAHRBOSCHUNG = 24.68

SLIDE VOLUME: Initial = 40.34

Final = 196.99

AREA IN PLAN: Initial = 39.55

Final = 821.95

Runout not completed, V-MAX = 0.00

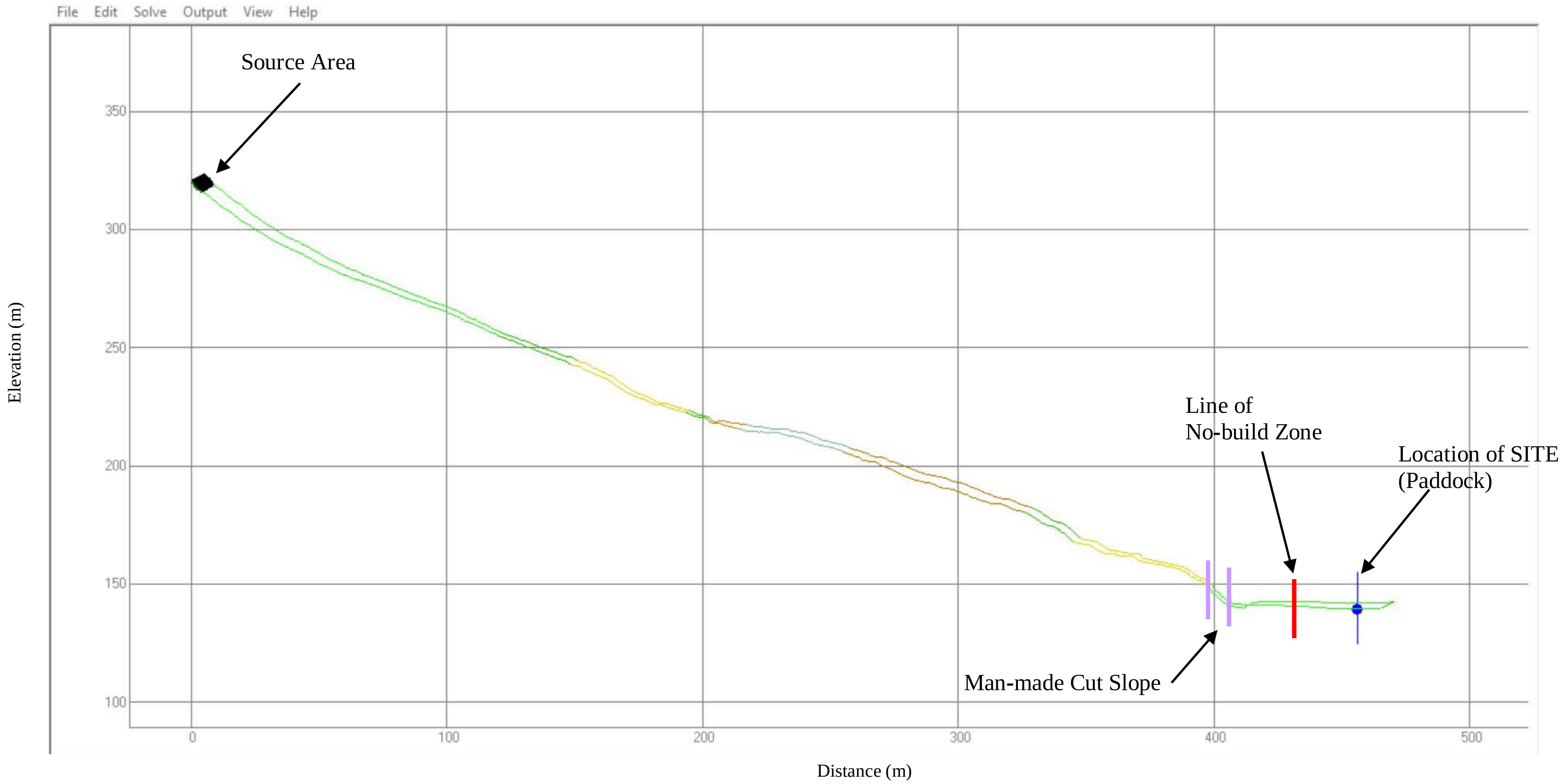
Debris Mobility Analysis for the Credible Runout Path RP13 (Case 1) within Catchment No. CD3

Landslide Type = CDF

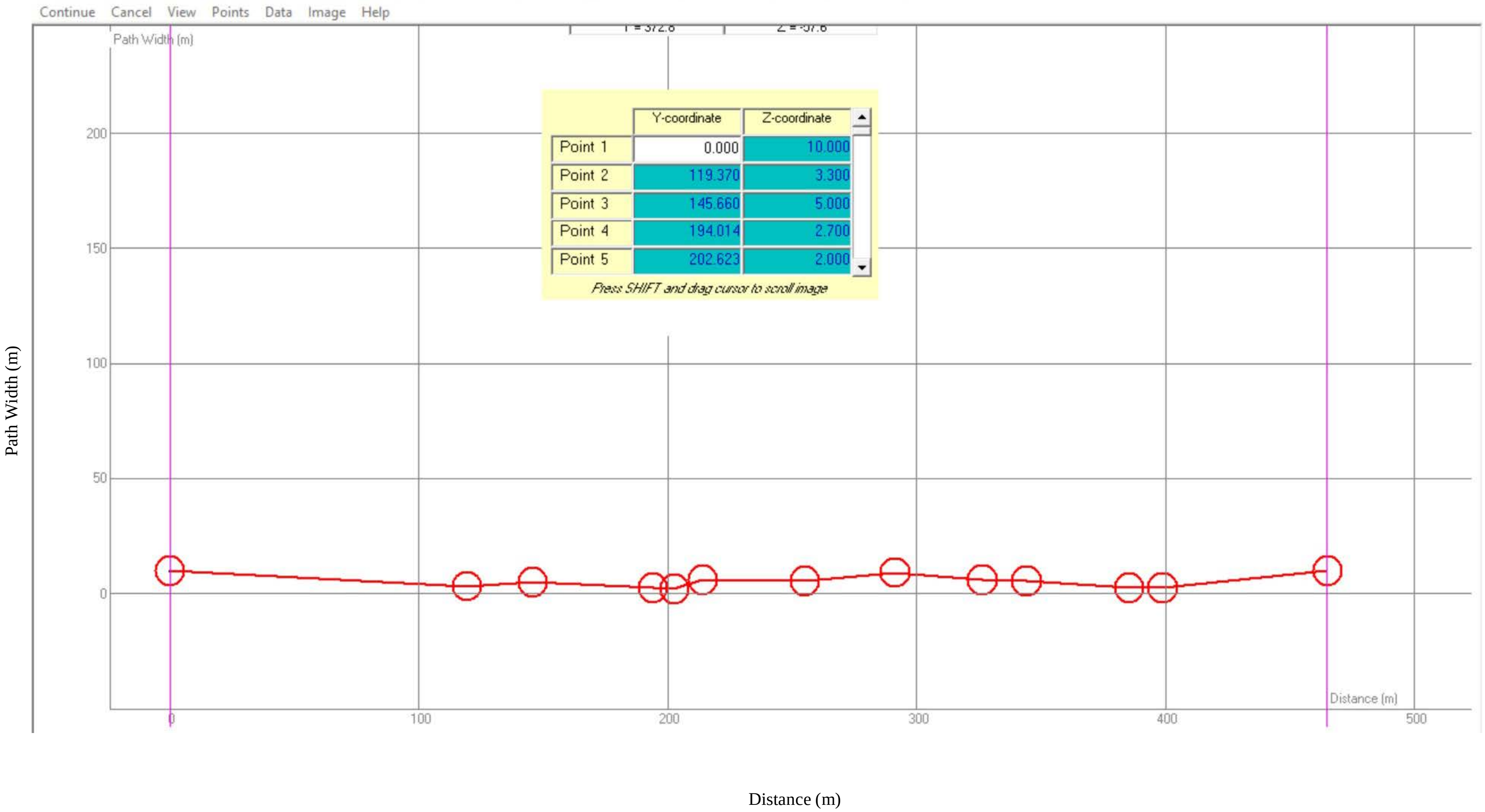
Design Source Volume = 40m^3

Figure D23

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = 372.8
Z = -57.6
Path Width (m)
200
150
100
50
0
Distance (m)
0
100
200
300
400
500
Path Width (m)
Distance (m)

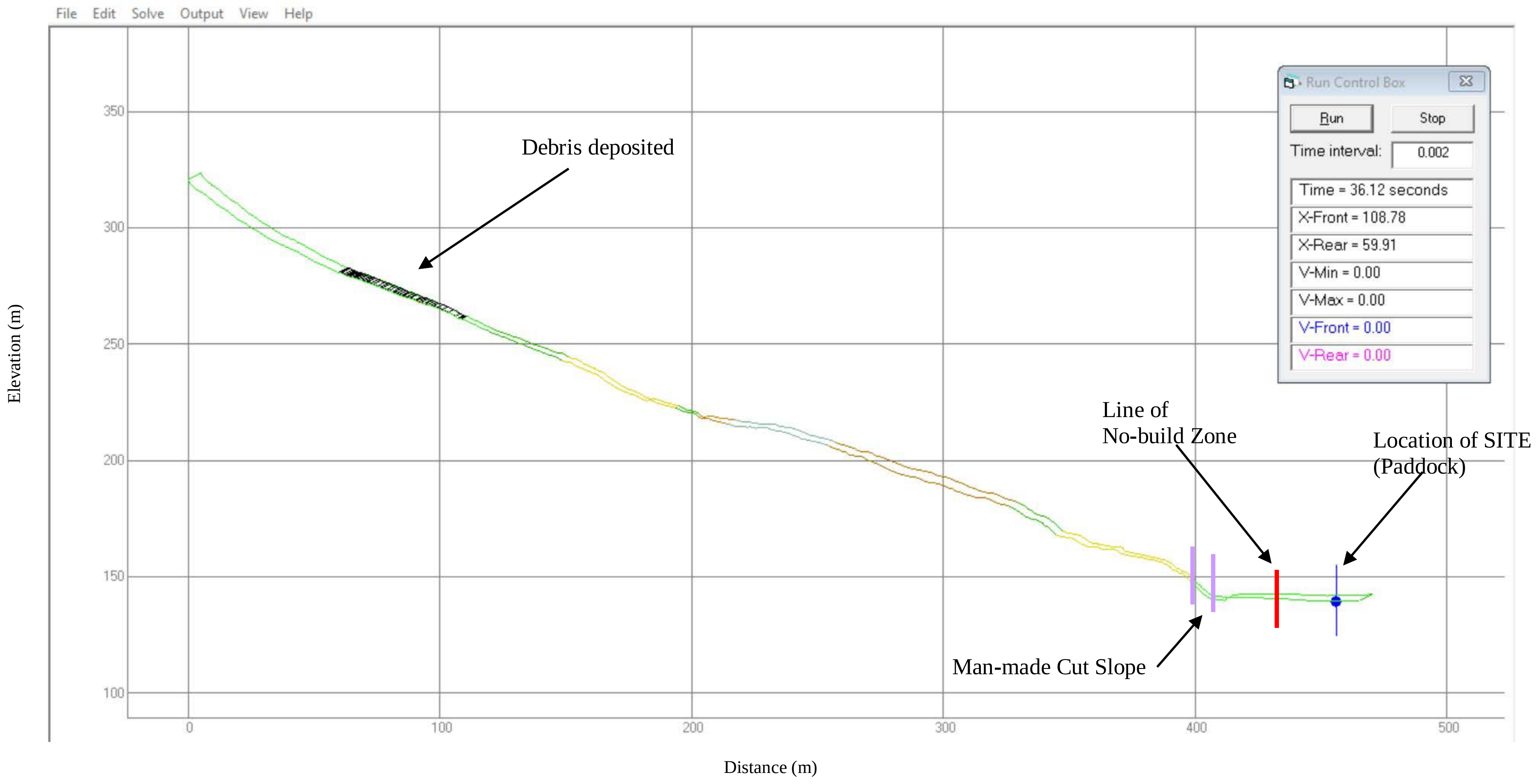
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	119.370	3.300
Point 3	145.660	5.000
Point 4	194.014	2.700
Point 5	202.623	2.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.51	40.51	104.65	No

Section Profile – (post-sliding)



File Edit Solve Output View Help
Run Control Box
Run
Stop
Elevation (m)
350
300
250
200
150
100
Distance (m)
0
100
200
300
400
500

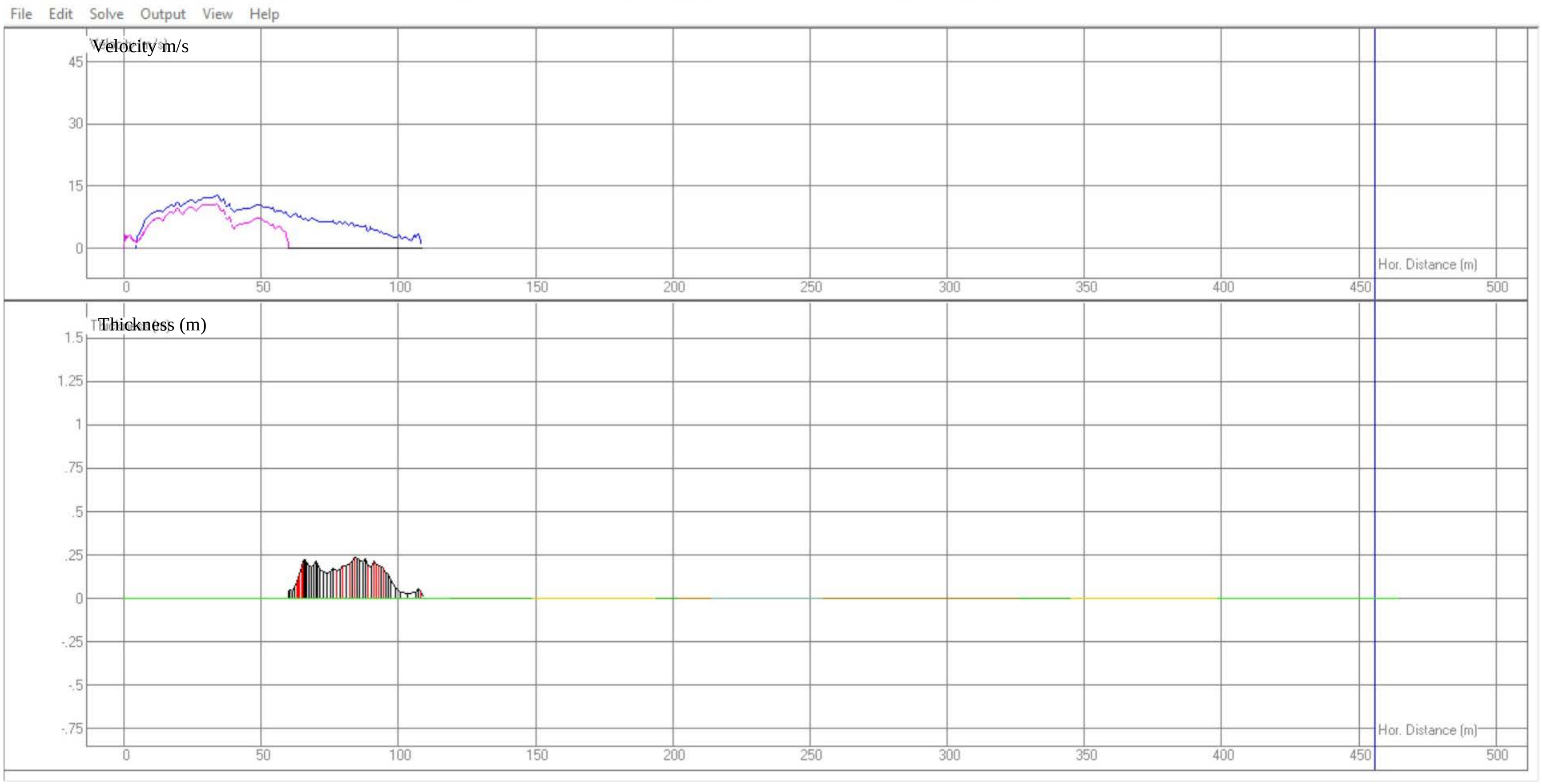
```
Time interval: 0.002
Time = 36.12 seconds
X-Front = 108.78
X-Rear = 59.91
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00
```

Debris deposited

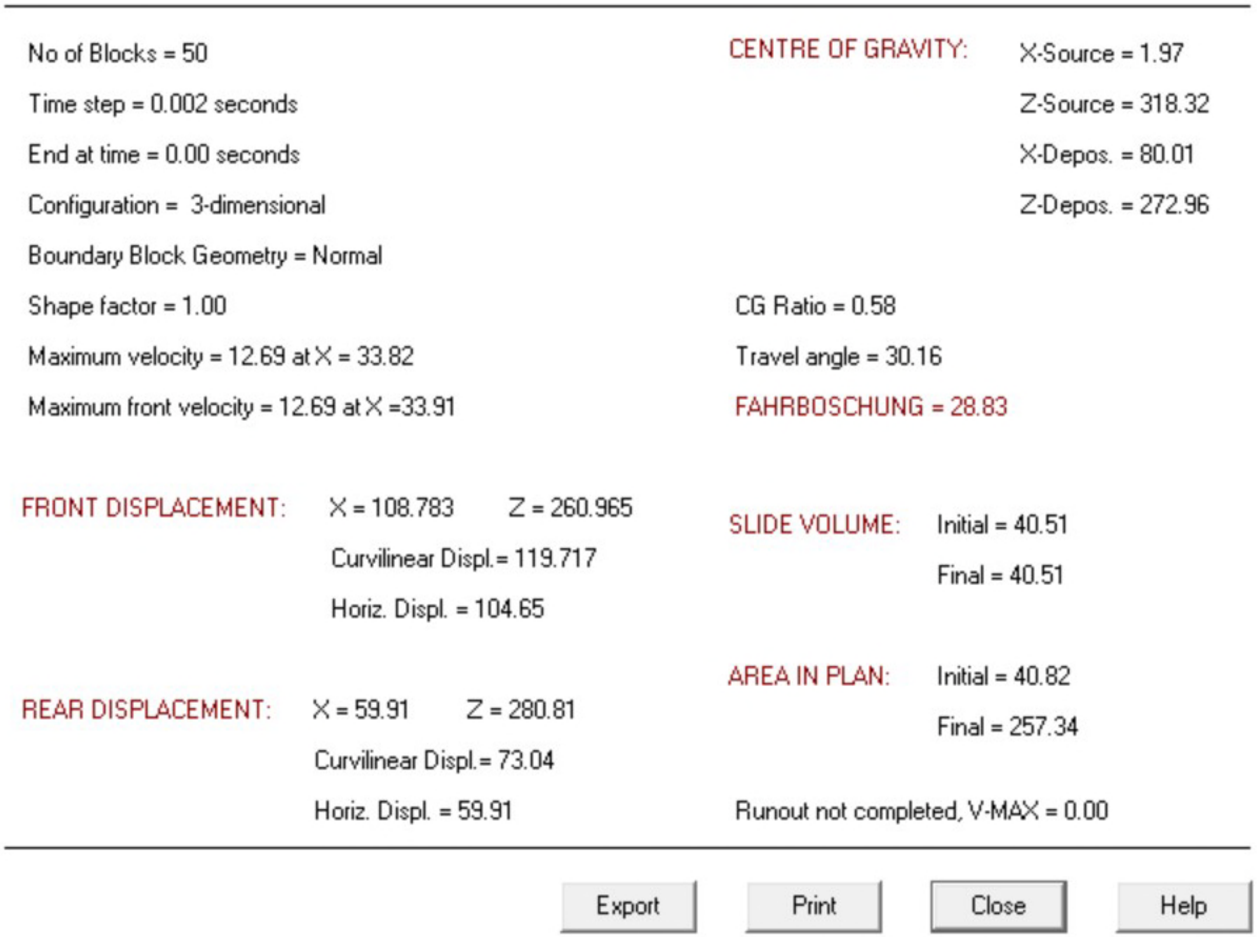
Line of
No-build Zone

Location of SITE
(Paddock)

Man-made Cut Slope


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
500
Thickness (m)
1.5
1.25
1
.75
.5
.25
0
-.25
-.5
-.75
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
500

Distance (m)



No of Blocks = 50

Time step = 0.002 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 12.69 at X = 33.82

Maximum front velocity = 12.69 at X =33.91

CENTRE OF GRAVITY: X-Source = 1.97

Z-Source = 318.32

X-Depos. = 80.01

Z-Depos. = 272.96

CG Ratio = 0.58

Travel angle = 30.16

FAHRBOSCHUNG = 28.83

FRONT DISPLACEMENT: X = 108.783 Z = 260.965

Curvilinear Displ.= 119.717

Horiz. Displ. = 104.65

SLIDE VOLUME: Initial = 40.51

Final = 40.51

AREA IN PLAN: Initial = 40.82

Final = 257.34

REAR DISPLACEMENT: X = 59.91 Z = 280.81

Curvilinear Displ.= 73.04

Horiz. Displ. = 59.91

Runout not completed, V-MAX = 0.00

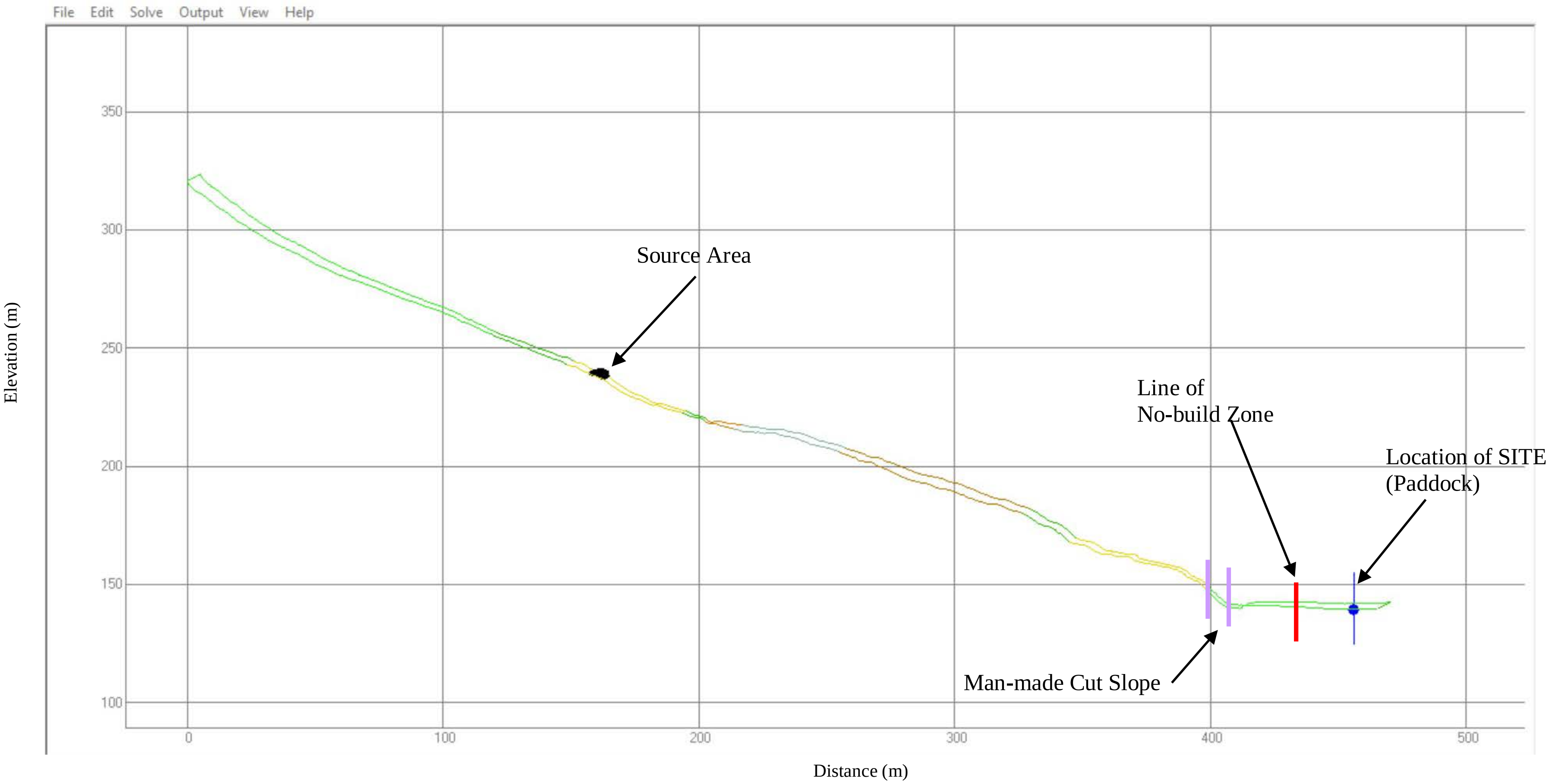
Debris Mobility Analysis for the Credible Runout Path RP13 (Case 2) within Catchment No. CD3

Landslide Type = CDF

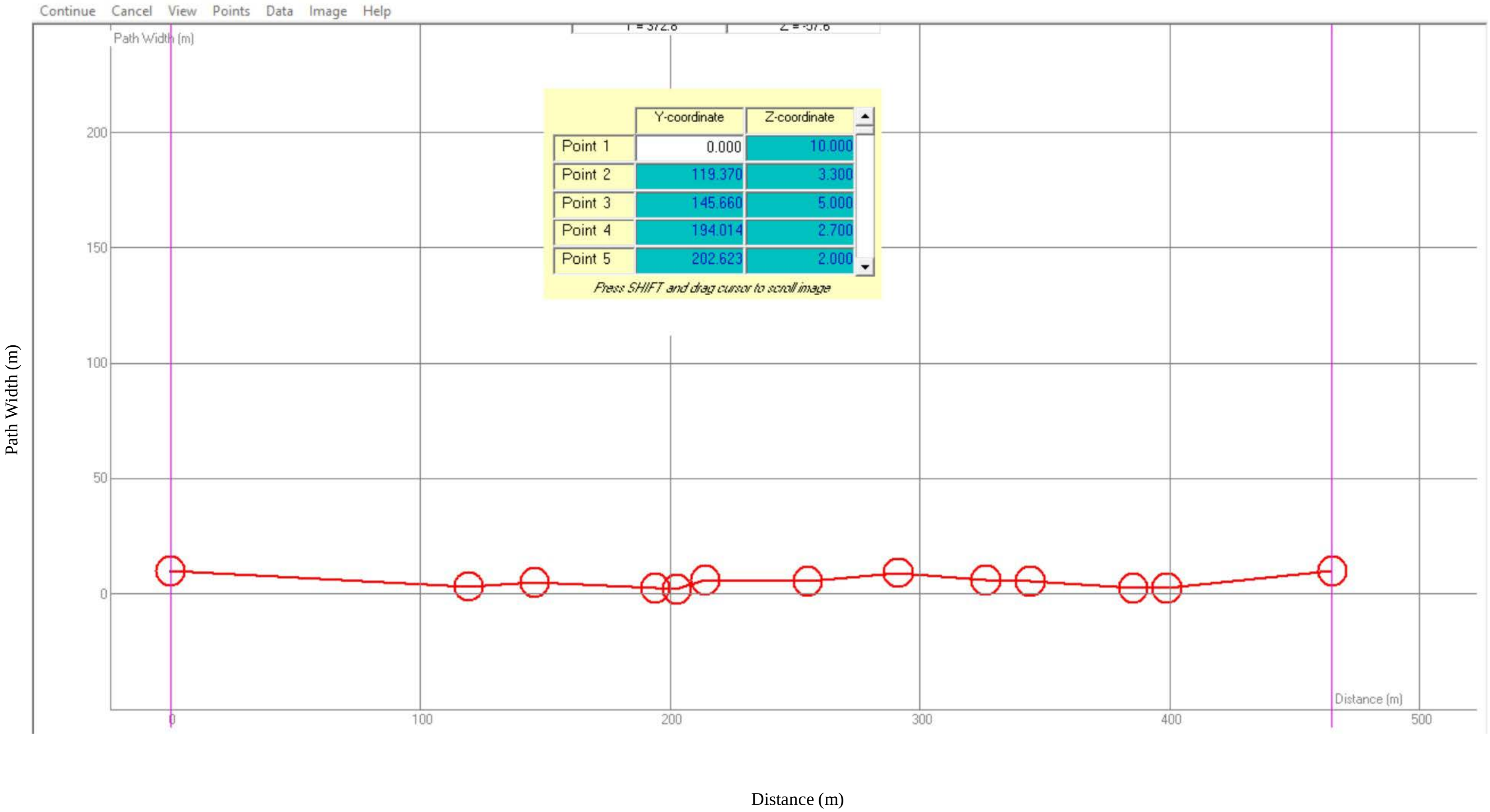
Design Source Volume = 40m^3

Figure D24

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = 372.8
Z = -37.6
Path Width (m)
200
150
100
50
0
Distance (m)
0
100
200
300
400
500
Path Width (m)
Distance (m)

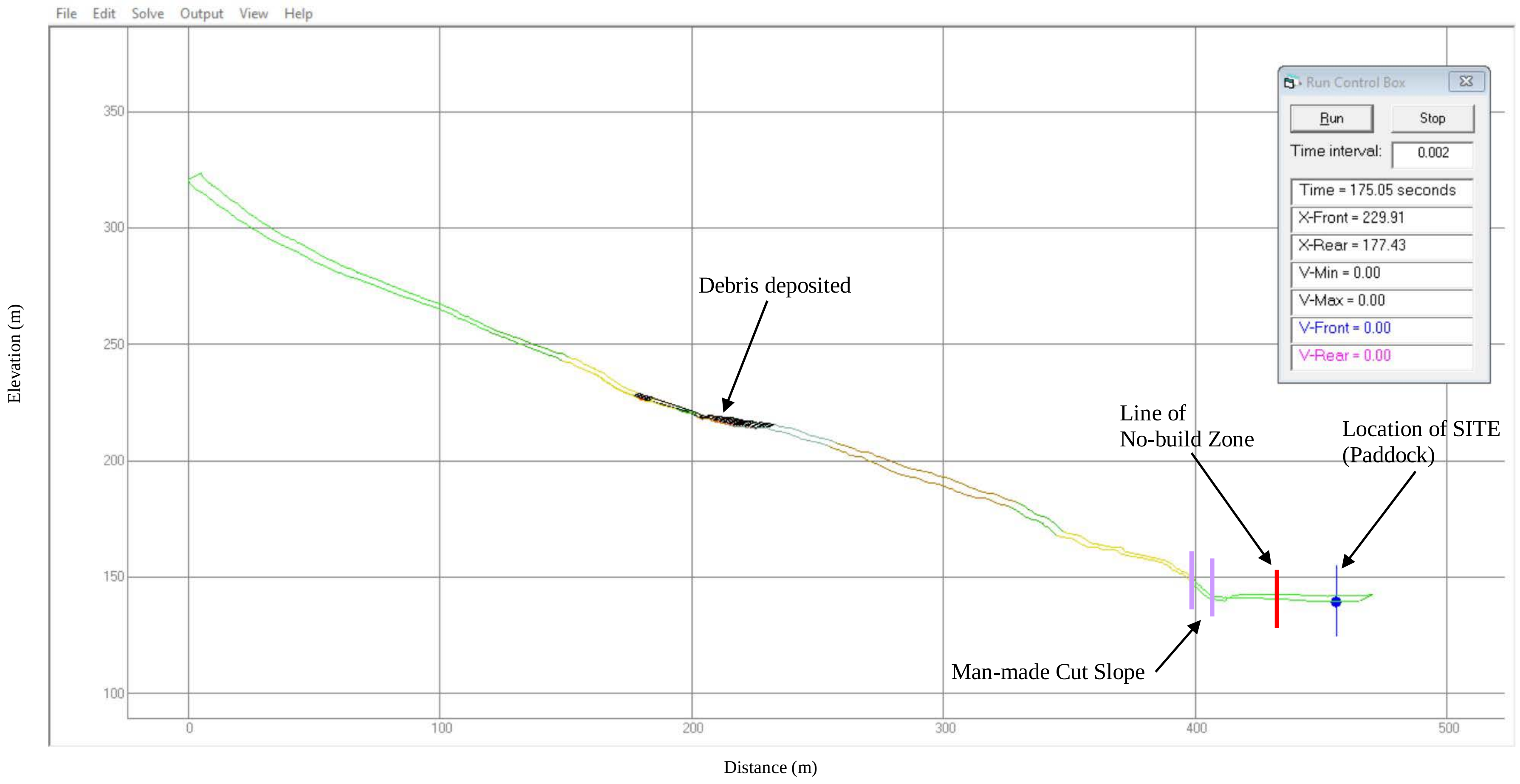
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	119.370	3.300
Point 3	145.660	5.000
Point 4	194.014	2.700
Point 5	202.623	2.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.81	96.65	67.08	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
350
300
250
200
150
100
0
100
200
300
400
500
Elevation (m)
Distance (m)

Time interval: 0.002

Time = 175.05 seconds

X-Front = 229.91

X-Rear = 177.43

V-Min = 0.00

V-Max = 0.00

V-Front = 0.00

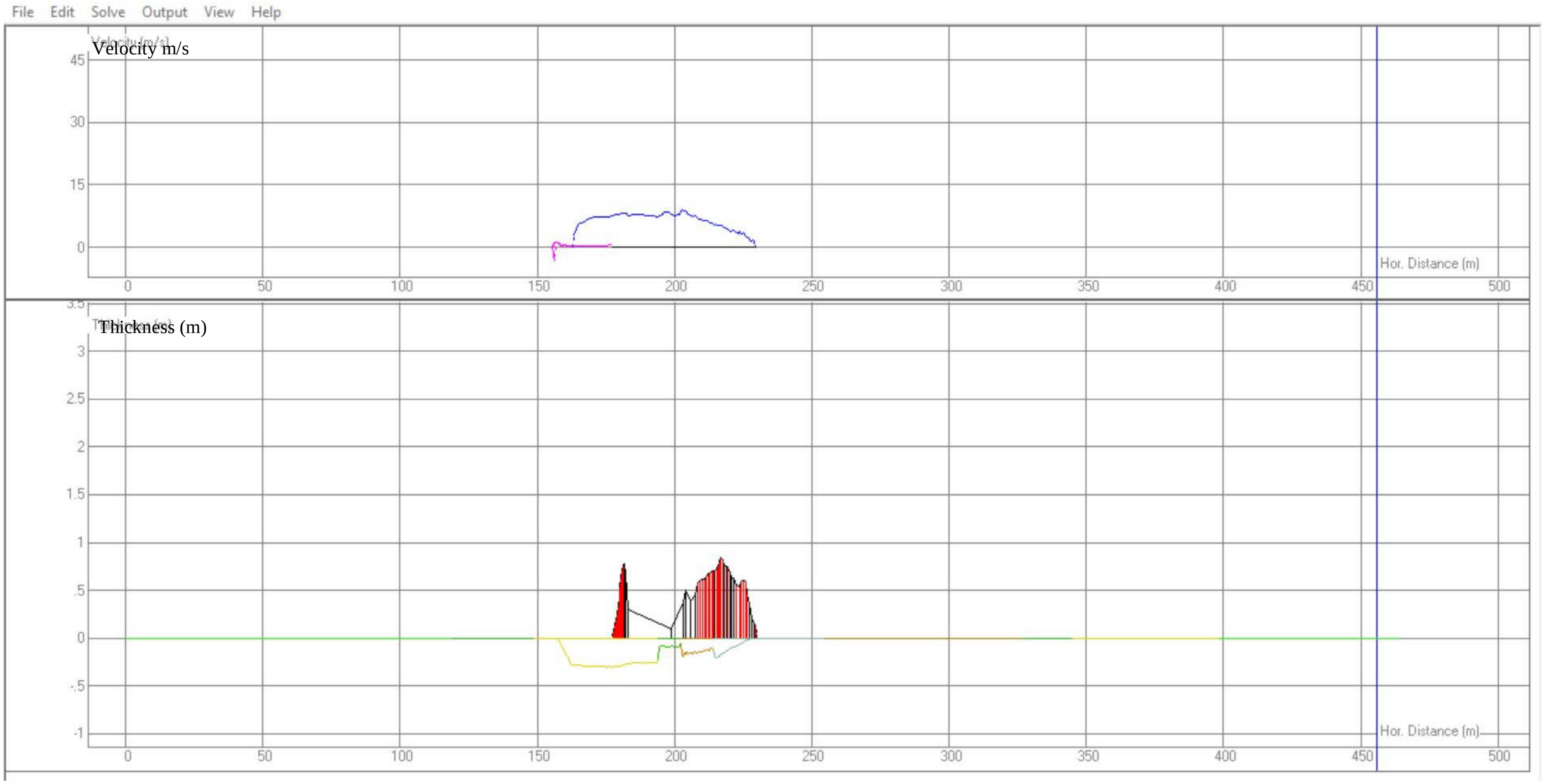
V-Rear = 0.00

Debris deposited

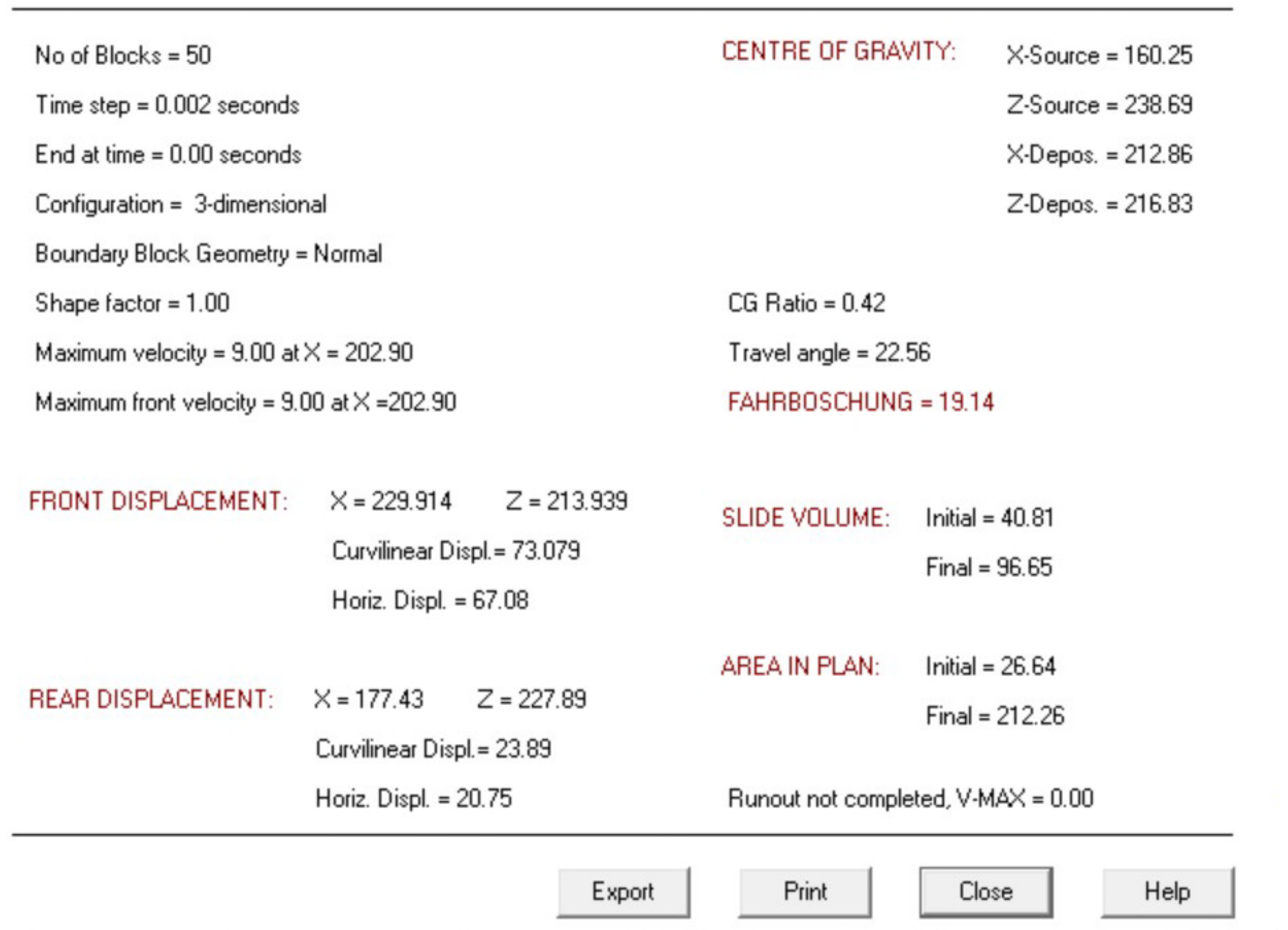
Line of
No-build Zone

Location of SITE
(Paddock)

Man-made Cut Slope


File
Edit
Solve
Output
View
Help
Velocity (m/s)
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
500
3.5
Thickness (m)
Thickness (m)
3
2.5
2
1.5
1
.5
0
-.5
-1
Hor. Distance (m)
0
50
100
150
200
250
300
350
400
450
500

Distance (m)



No of Blocks = 50

Time step = 0.002 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 9.00 at X = 202.90

Maximum front velocity = 9.00 at X =202.90

FRONT DISPLACEMENT: X = 229.914 Z = 213.939

Curvilinear Displ.= 73.079

Horiz. Displ. = 67.08

REAR DISPLACEMENT: X = 177.43 Z = 227.89

Curvilinear Displ.= 23.89

Horiz. Displ. = 20.75

CENTRE OF GRAVITY: X-Source = 160.25

Z-Source = 238.69

X-Depos. = 212.86

Z-Depos. = 216.83

CG Ratio = 0.42

Travel angle = 22.56

FAHRBOSCHUNG = 19.14

SLIDE VOLUME: Initial = 40.81

Final = 96.65

AREA IN PLAN: Initial = 26.64

Final = 212.26

Runout not completed, V-MAX = 0.00

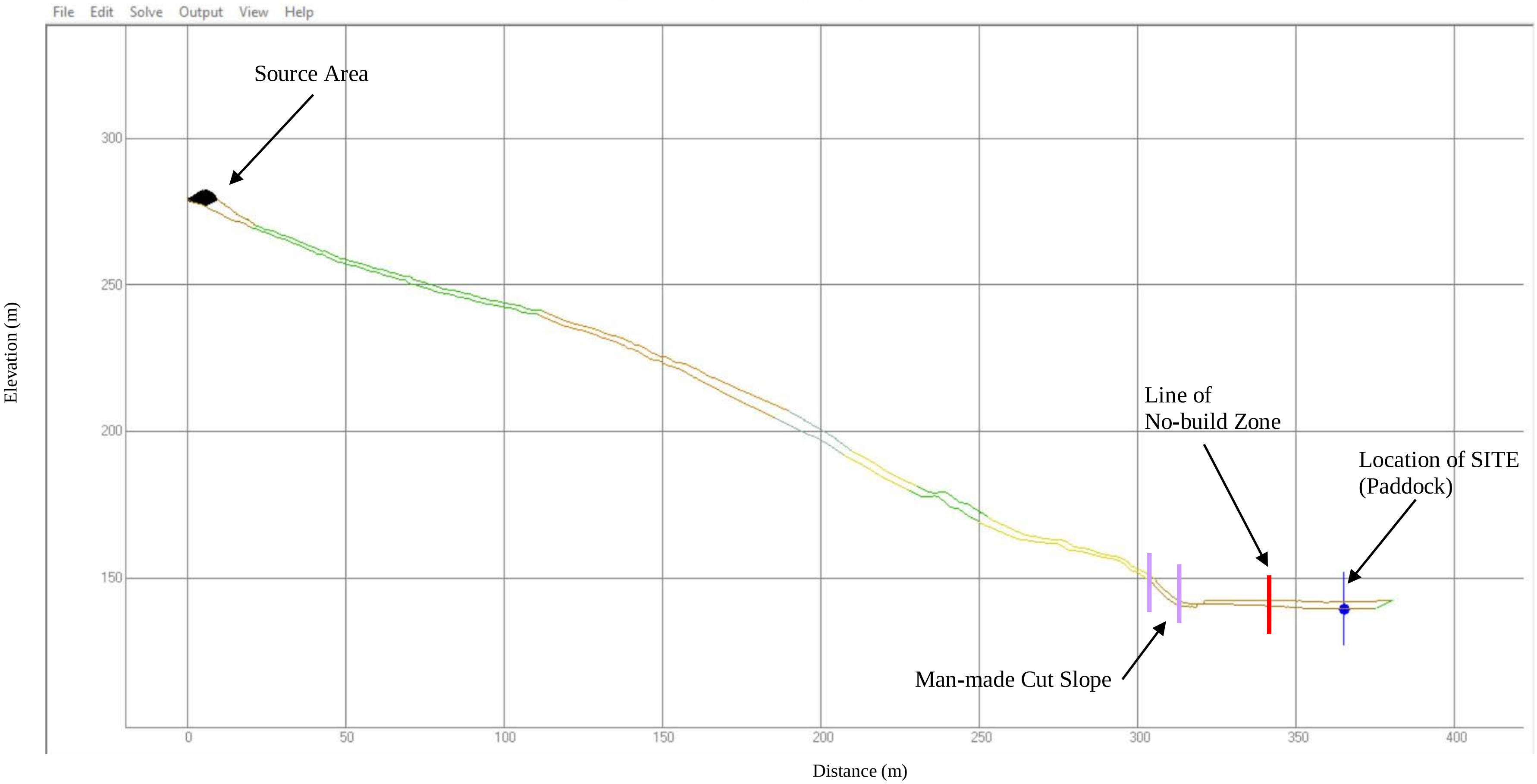
Debris Mobility Analysis for the Credible Runout Path RP14 (Case 1) within Catchment No. CD3

Landslide Type = CDF

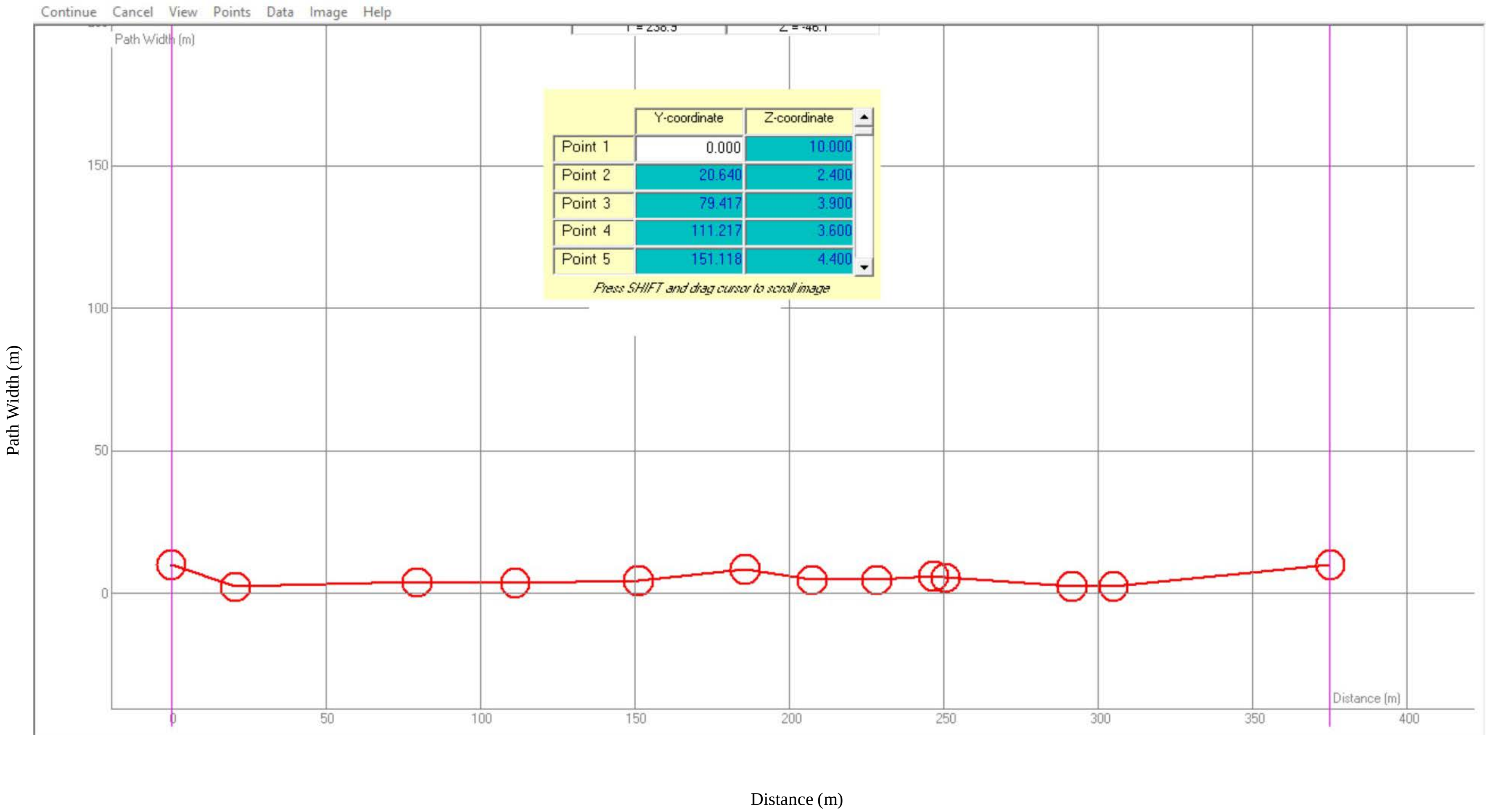
Design Source Volume = 40m^3

Figure D25

Section Profile – (pre-sliding)


File Edit Solve Output View Help
Source Area
300
250
200
150
Elevation (m)
Line of
No-build Zone
Location of SITE
(Paddock)
Man-made Cut Slope
0
50
100
150
200
250
300
350
400
Distance (m)

Width Profile

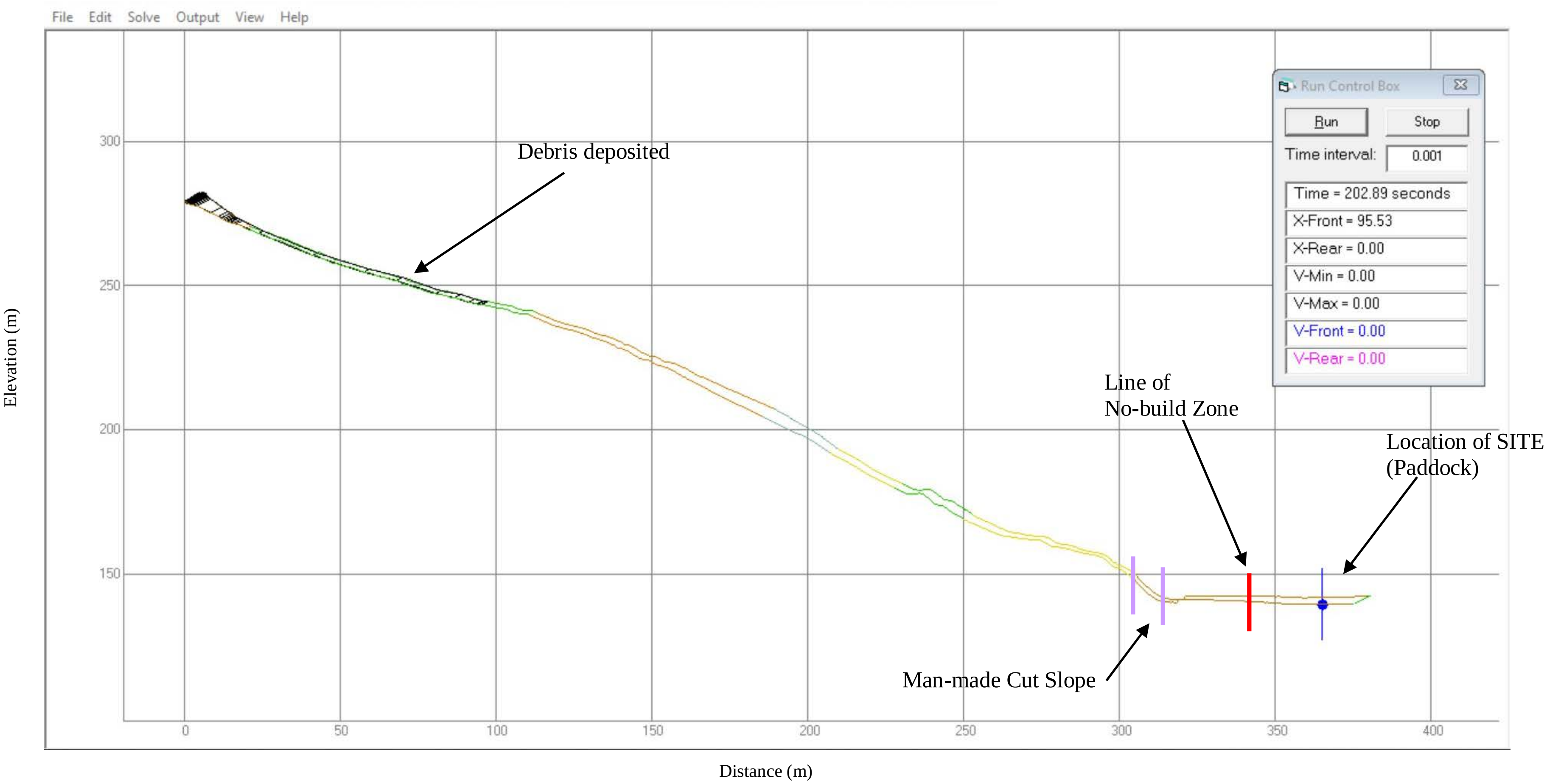

Continue
Cancel
View
Points
Data
Image
Help
Y = 238.5
Z = -46.1
Path Width (m)
150
100
50
0
Distance (m)
0
50
100
150
200
250
300
350
400
Press SHIFT and drag cursor to scroll image
Path Width (m)
Distance (m)

	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	20.640	2.400
Point 3	79.417	3.900
Point 4	111.217	3.600
Point 5	151.118	4.400

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.88	41.54	89.85	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Elevation (m)
300
250
200
150
0
50
100
150
200
250
300
350
400
Distance (m)

Time interval: 0.001

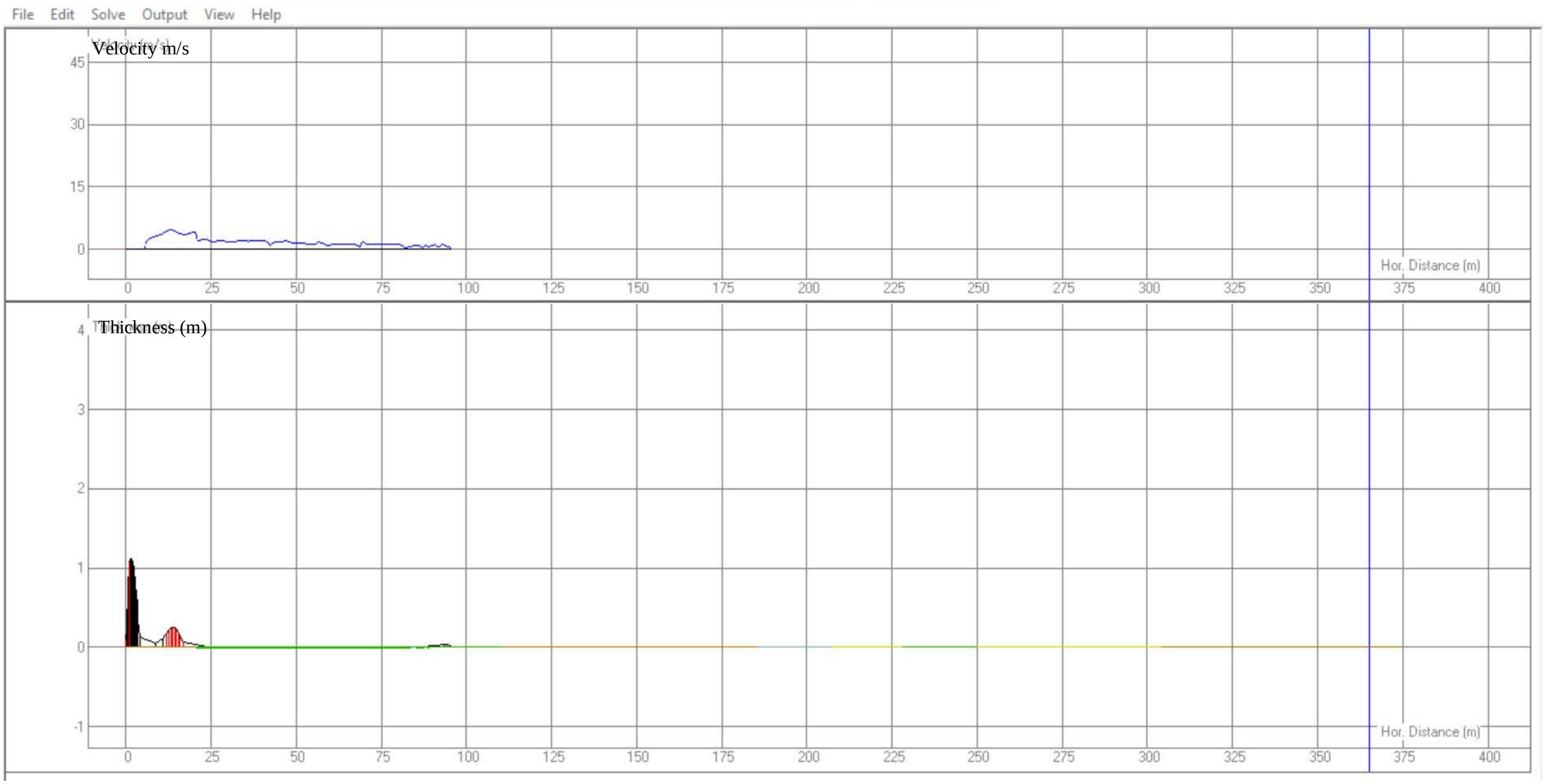
Time = 202.89 seconds
X-Front = 95.53
X-Rear = 0.00
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00

Debris deposited

Line of
No-build Zone

Location of SITE
(Paddock)

Man-made Cut Slope


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
25
50
75
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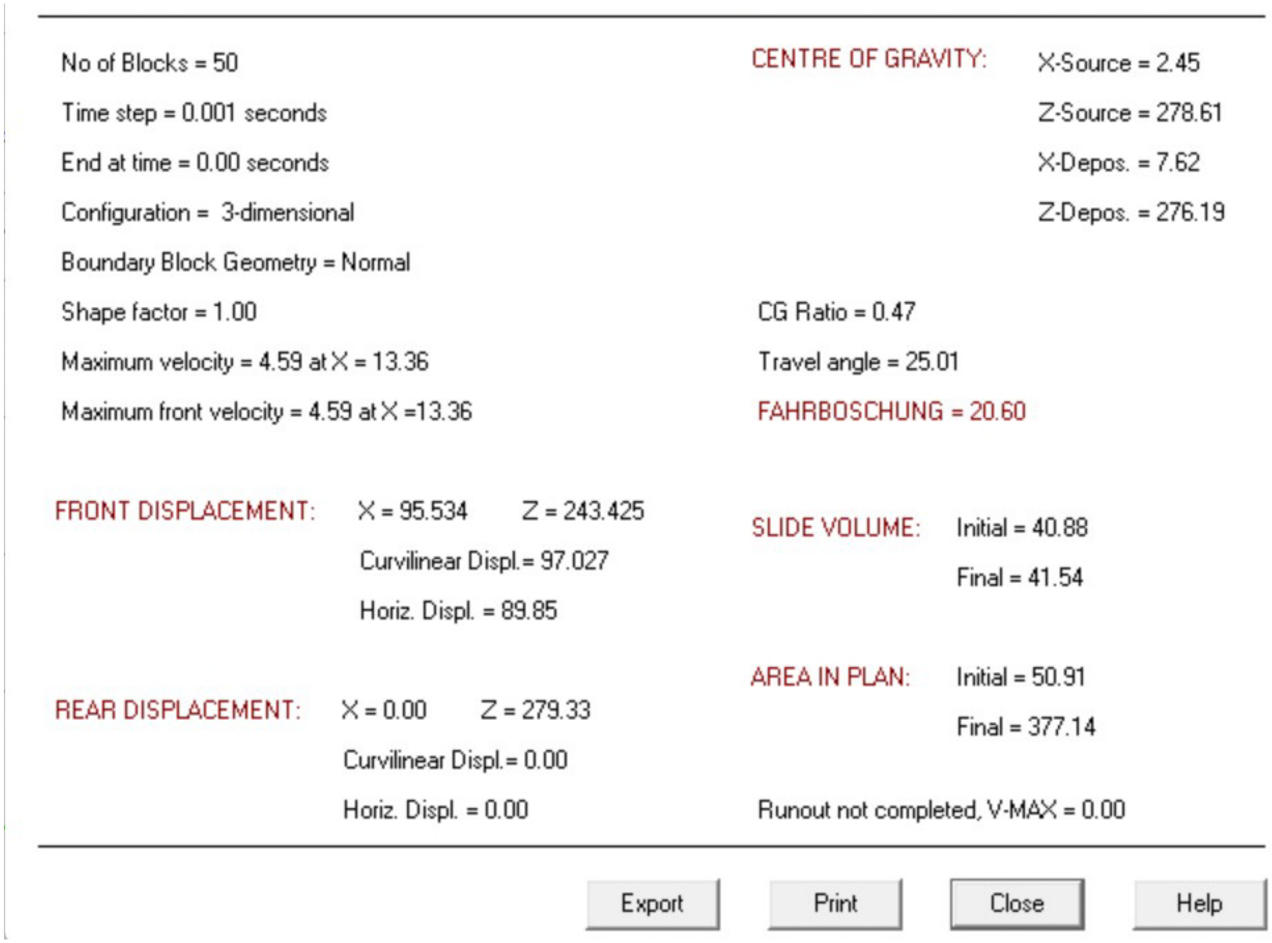
125
150
175
200
225
250
275
300
325
350
375
400
Thickness (m)
4
3
2
1
0
-1
Hor. Distance (m)
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400

Distance (m)



No of Blocks = 50

Time step = 0.001 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 4.59 at X = 13.36

Maximum front velocity = 4.59 at X =13.36

CENTRE OF GRAVITY: X-Source = 2.45

Z-Source = 278.61

X-Depos. = 7.62

Z-Depos. = 276.19

CG Ratio = 0.47

Travel angle = 25.01

FAHRBOSCHUNG = 20.60

FRONT DISPLACEMENT: X = 95.534 Z = 243.425

Curvilinear Displ.= 97.027

Horiz. Displ. = 89.85

SLIDE VOLUME: Initial = 40.88

Final = 41.54

AREA IN PLAN: Initial = 50.91

Final = 377.14

REAR DISPLACEMENT: X = 0.00 Z = 279.33

Curvilinear Displ.= 0.00

Horiz. Displ. = 0.00

Runout not completed, V-MAX = 0.00

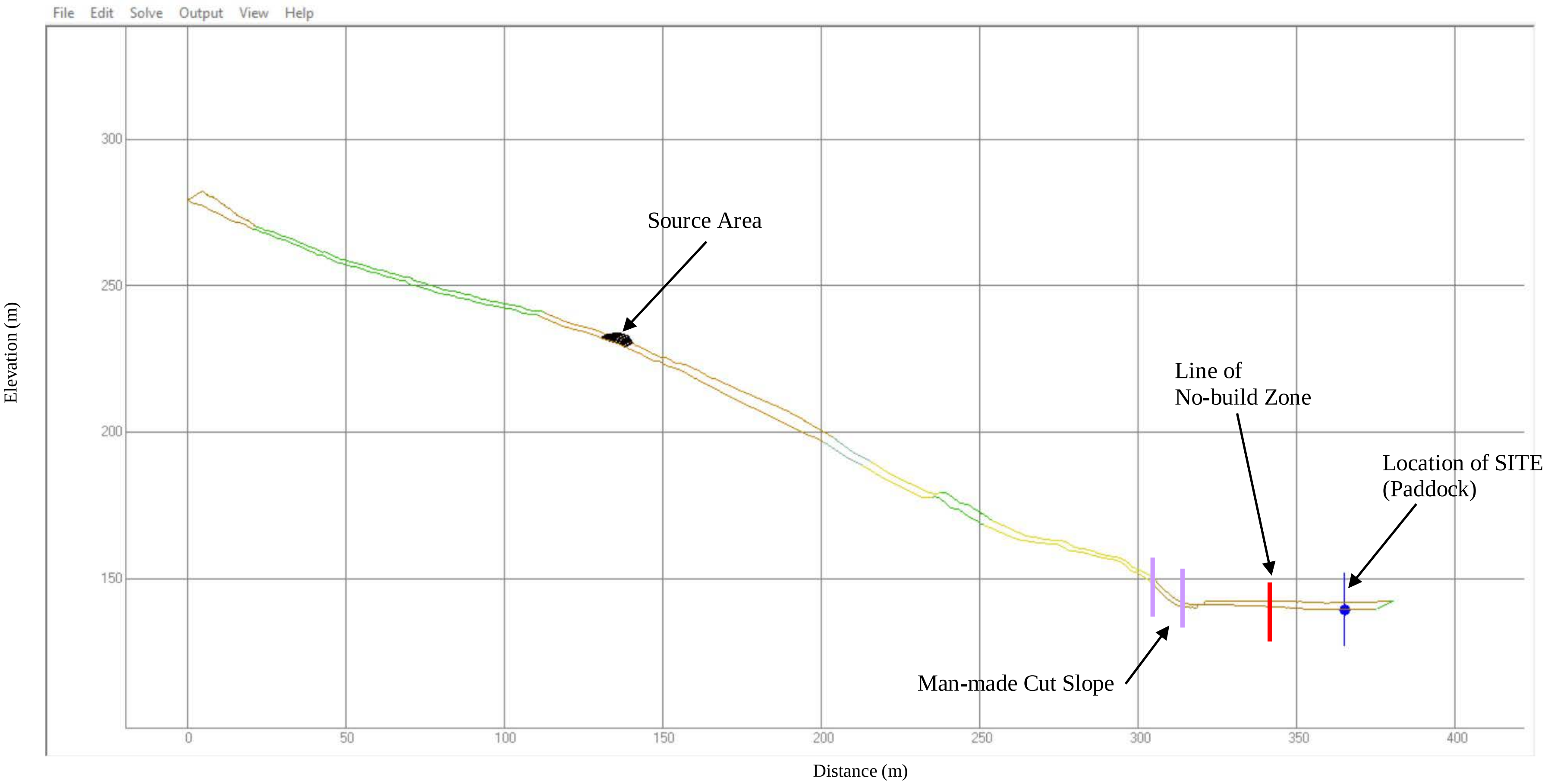
Debris Mobility Analysis for the Credible Runout Path RP14 (Case 2) within Catchment No. CD3

Landslide Type = CDF

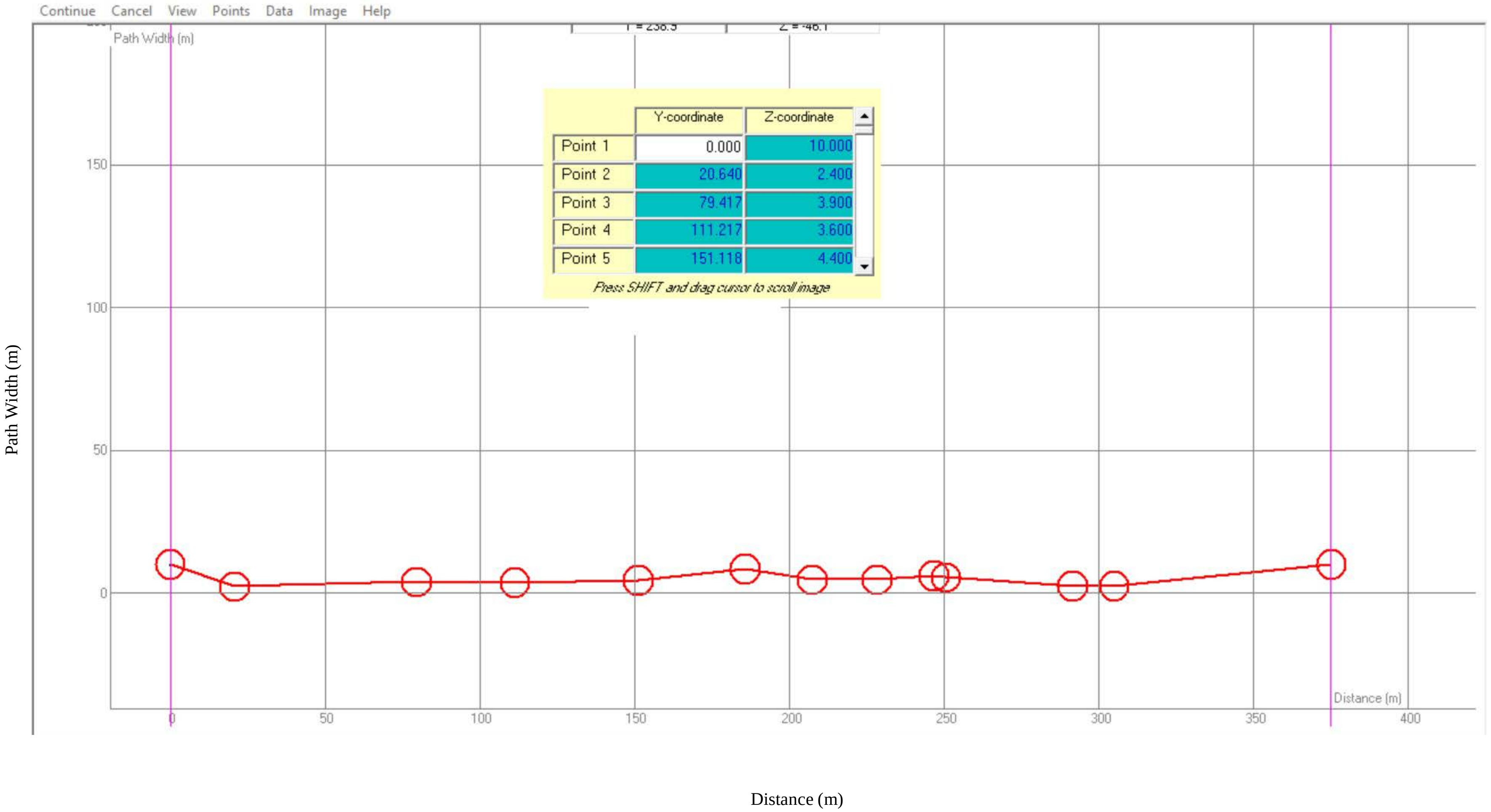
Design Source Volume = 40m^3

Figure D26

Section Profile – (pre-sliding)


File Edit Solve Output View Help
Elevation (m)
300
250
200
150
0
50
100
150
200
250
300
350
400
Distance (m)
Source Area
Line of
No-build Zone
Location of SITE
(Paddock)
Man-made Cut Slope

Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = 238.5
Z = -46.1
Path Width (m)
150
100
50
0
Distance (m)
0
50
100
150
200
250
300
350
400
Path Width (m)
Distance (m)

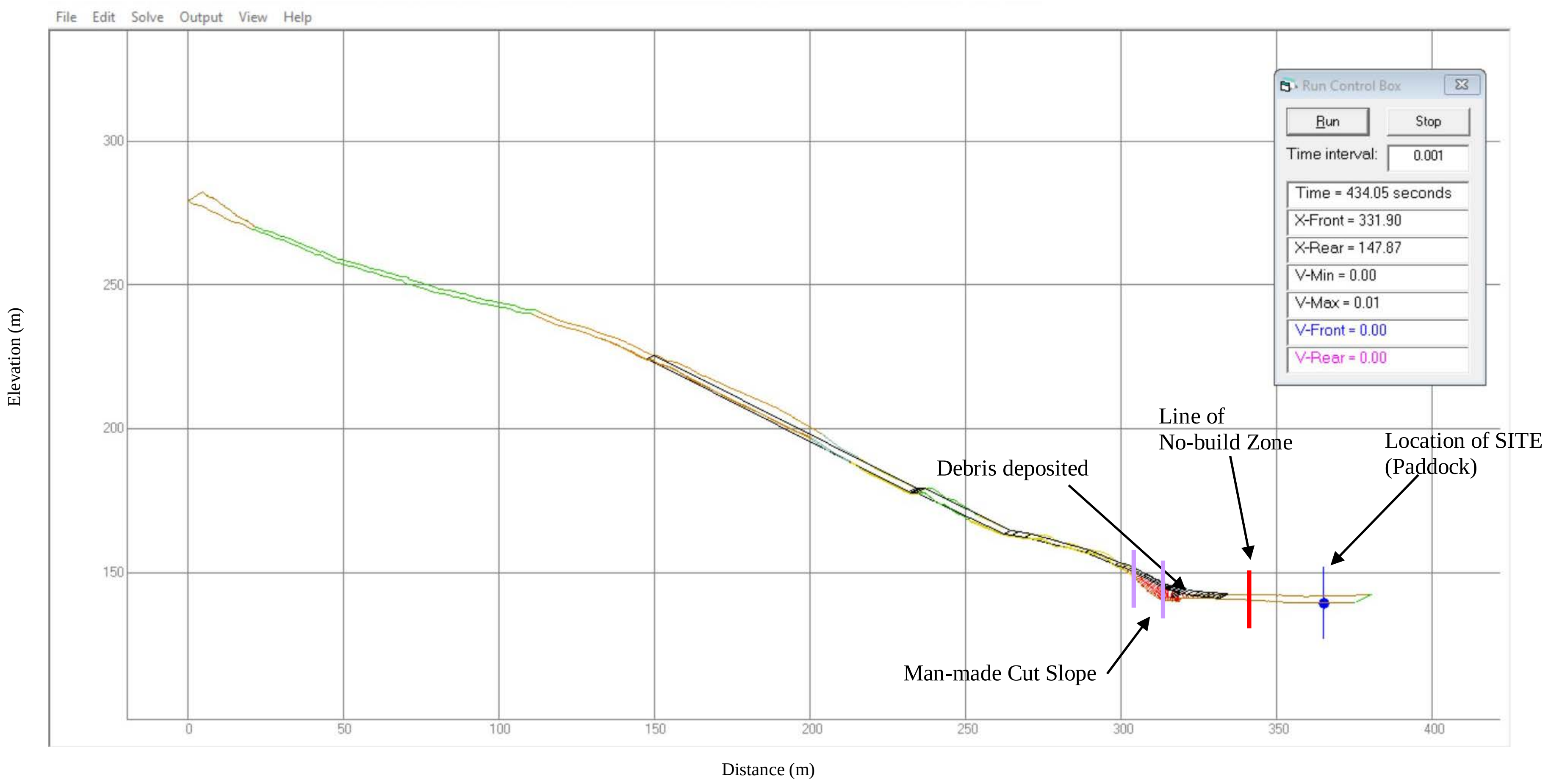
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	20.640	2.400
Point 3	79.417	3.900
Point 4	111.217	3.600
Point 5	151.118	4.400

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.17	272.87	193.52	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Elevation (m)
300
250
200
150
0
50
100
150
200
250
300
350
400
Distance (m)
Line of No-build Zone
Location of SITE (Paddock)
Debris deposited
Man-made Cut Slope

Time interval: 0.001

Time = 434.05 seconds

X-Front = 331.90

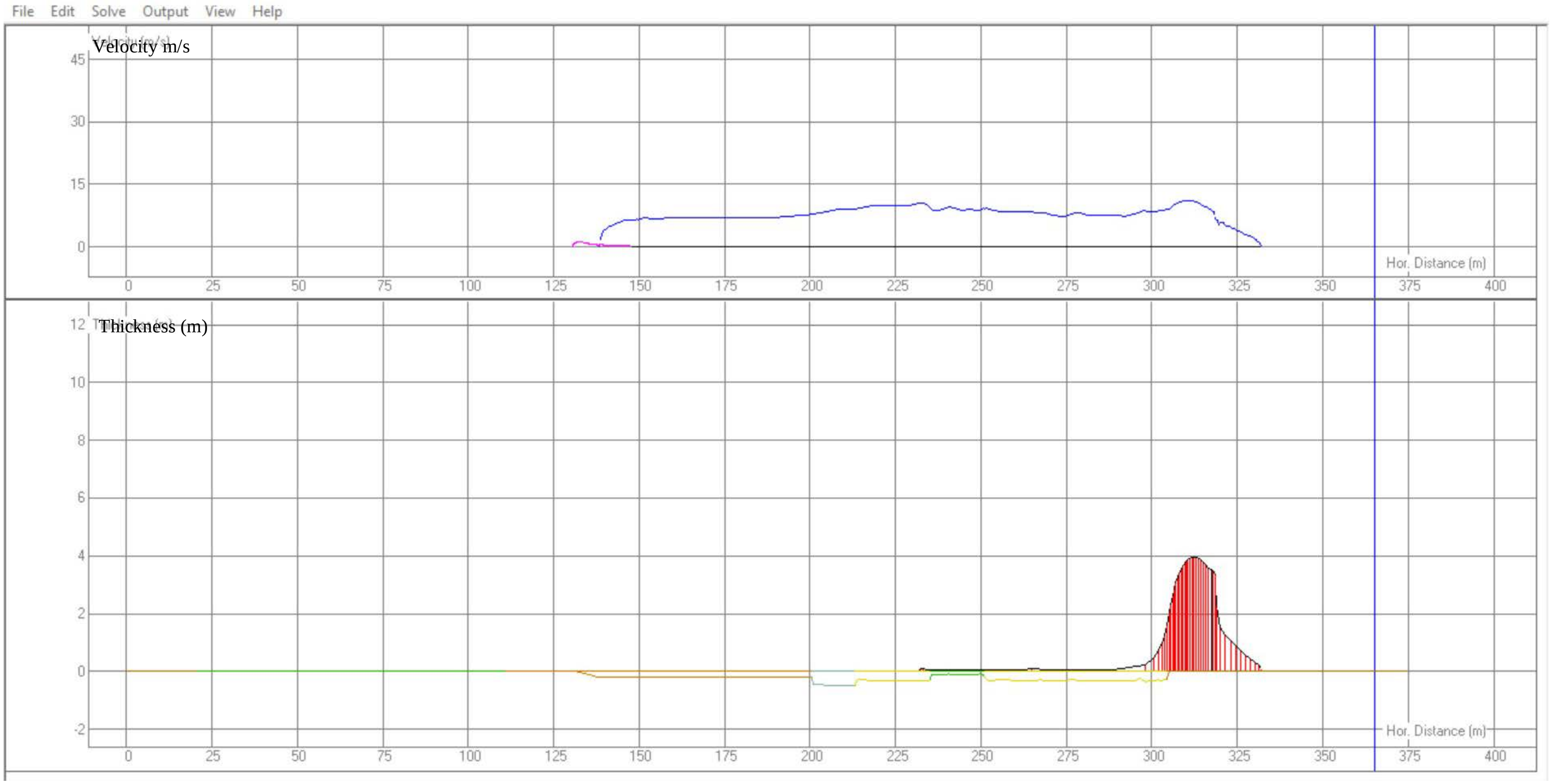
X-Rear = 147.87

V-Min = 0.00

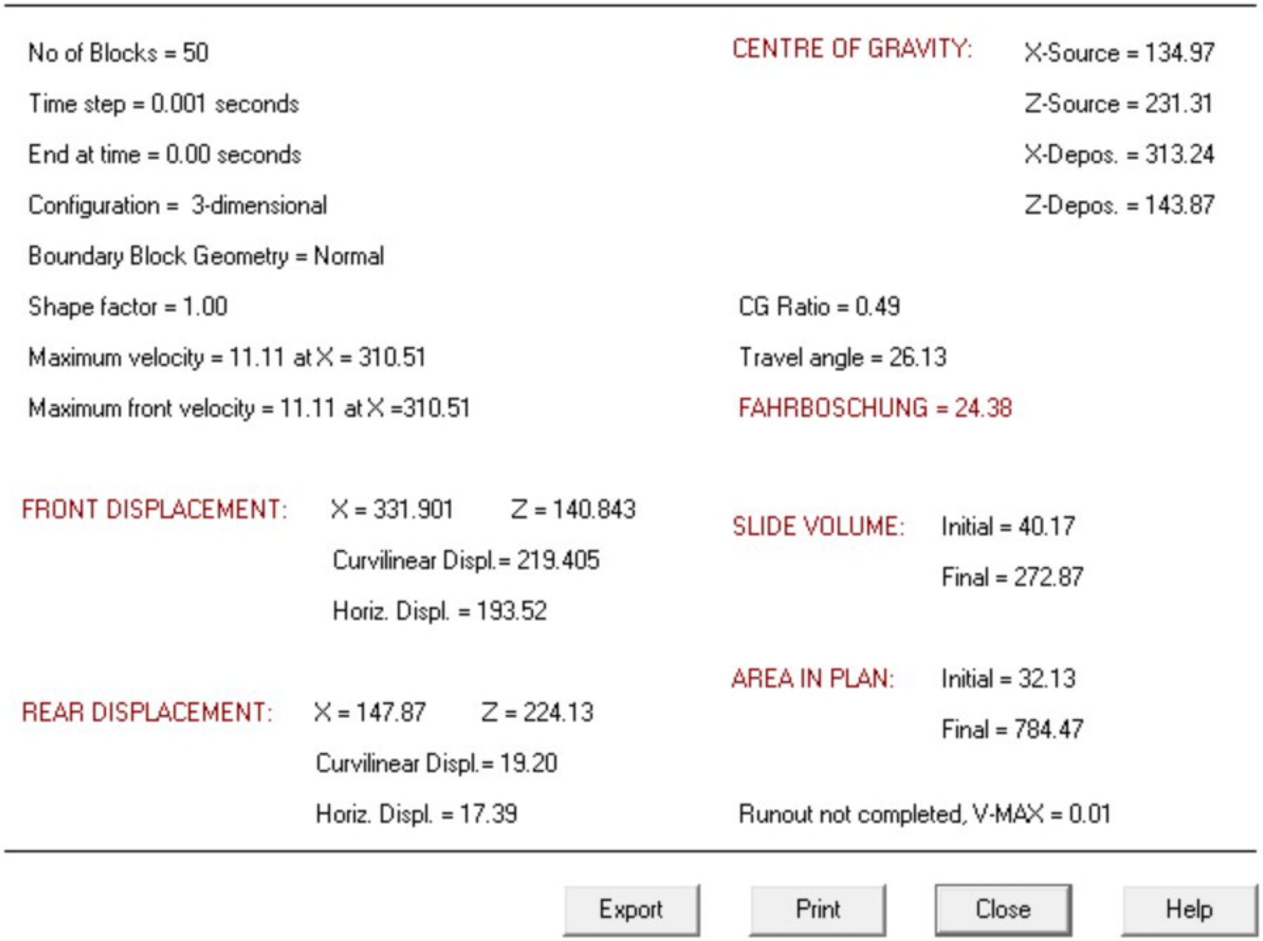
V-Max = 0.01

V-Front = 0.00

V-Rear = 0.00


File Edit Solve Output View Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400
Thickness (m)
12
10
8
6
4
2
0
-2
Hor. Distance (m)
0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400

Distance (m)



```
No of Blocks = 50                                  CENTRE OF GRAVITY:   X-Source = 134.97
Time step = 0.001 seconds                                               Z-Source = 231.31
End at time = 0.00 seconds                                              X-Depos. = 313.24
Configuration =  3-dimensional                                          Z-Depos. = 143.87
Boundary Block Geometry = Normal
Shape factor = 1.00                                 CG Ratio = 0.49
Maximum velocity = 11.11 at X = 310.51              Travel angle = 26.13
Maximum front velocity = 11.11 at X =310.51         FAHRBOSCHUNG = 24.38

FRONT DISPLACEMENT:   X = 331.901     Z = 140.843
                      Curvilinear Displ.= 219.405   SLIDE VOLUME:   Initial = 40.17
                      Horiz. Displ. = 193.52                        Final = 272.87

                                                    AREA IN PLAN:   Initial = 32.13
REAR DISPLACEMENT:   X = 147.87     Z = 224.13                      Final = 784.47
                     Curvilinear Displ.= 19.20
                     Horiz. Displ. = 17.39          Runout not completed, V-MAX = 0.01
```

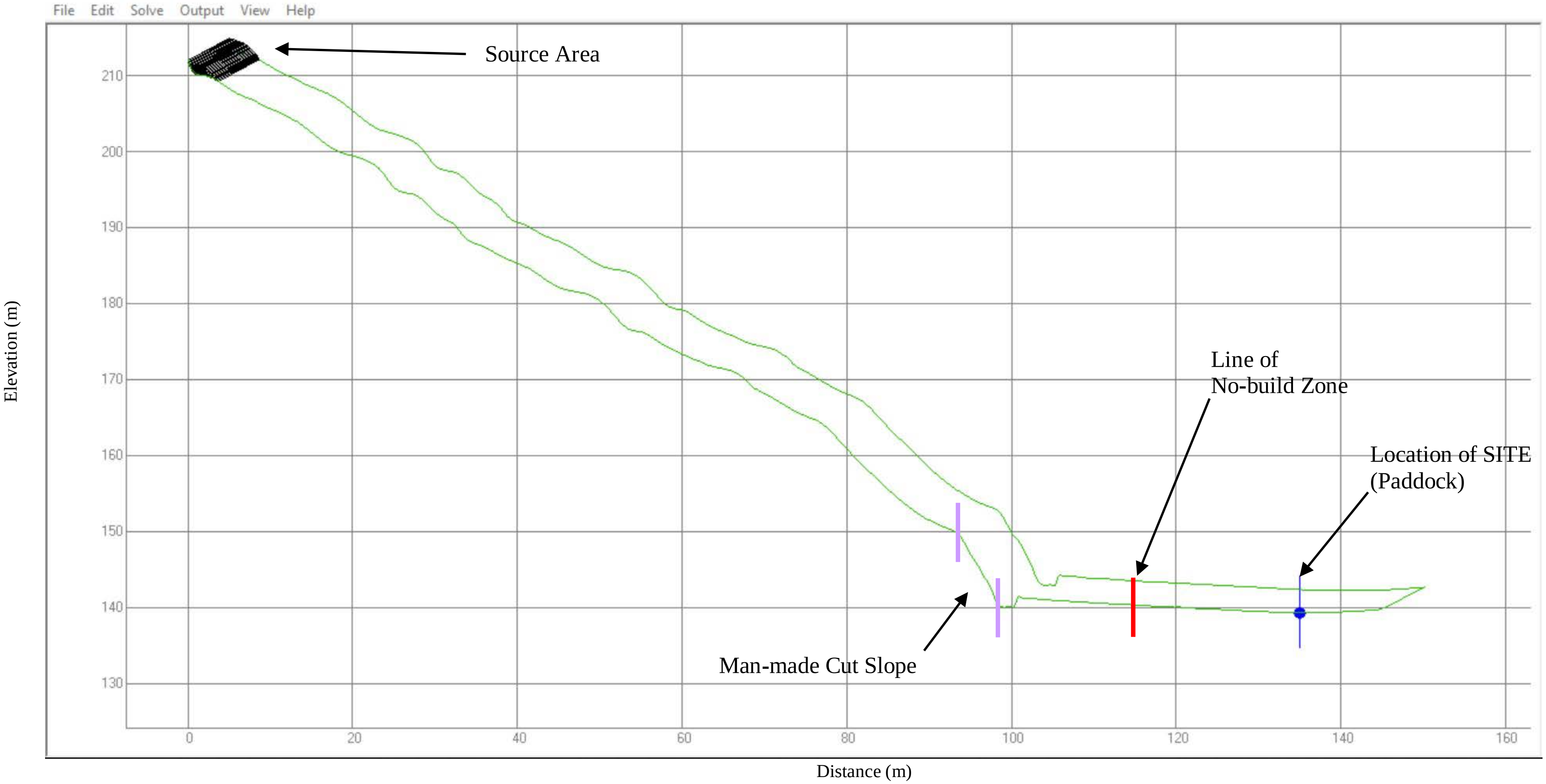
Debris Mobility Analysis for the Credible Runout Path RP15 within Catchment No. OH4

Landslide Type = OHL

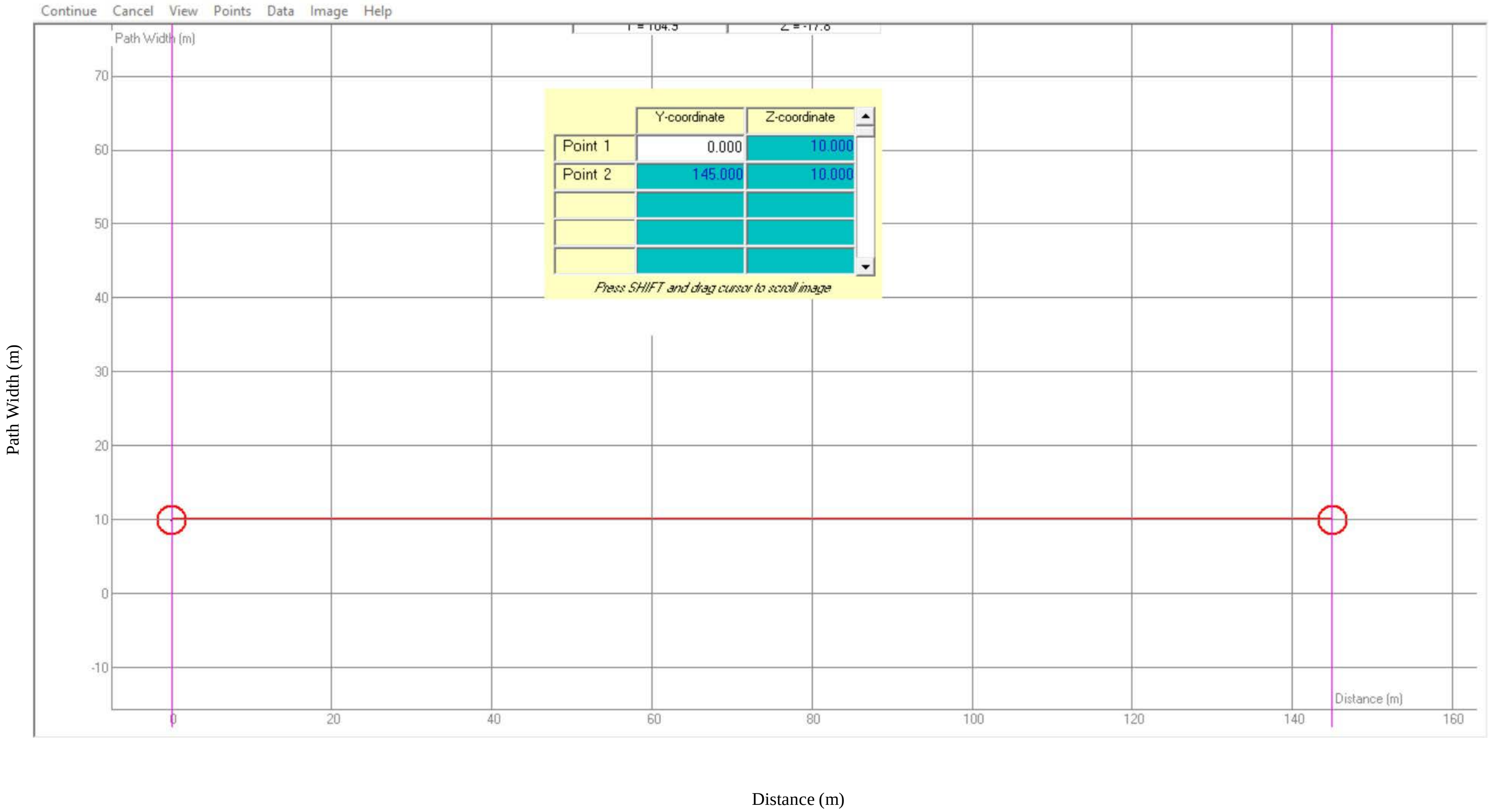
Design Source Volume = 40m^3

Figure D27

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = 104.5
Z = -17.8
Path Width (m)
70
60
50
40
30
20
10
0
-10
Distance (m)
0
20
40
60
80
100
120
140
160
Path Width (m)
Distance (m)

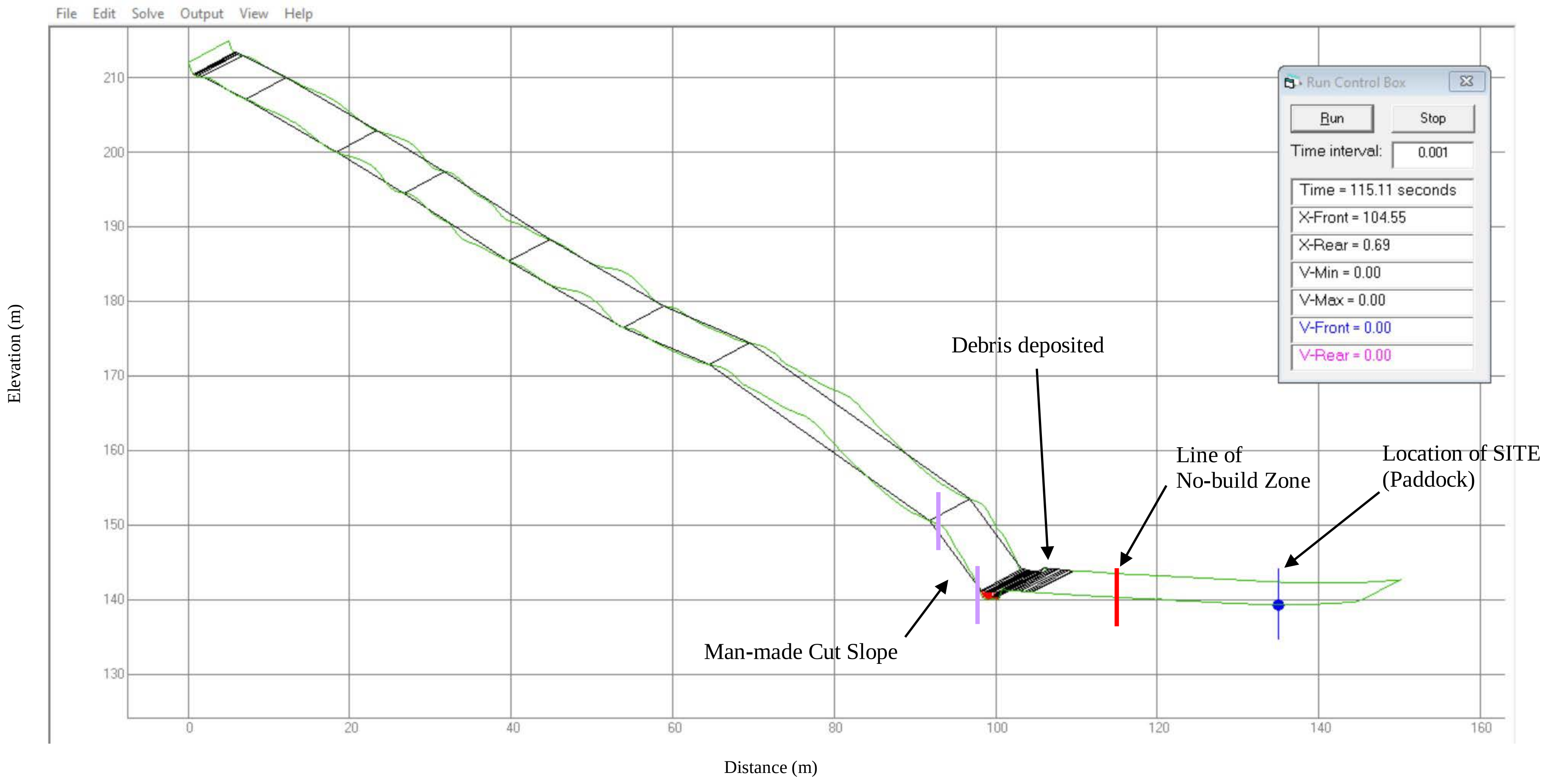
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	145.000	10.000

Press SHIFT and drag cursor to scroll image

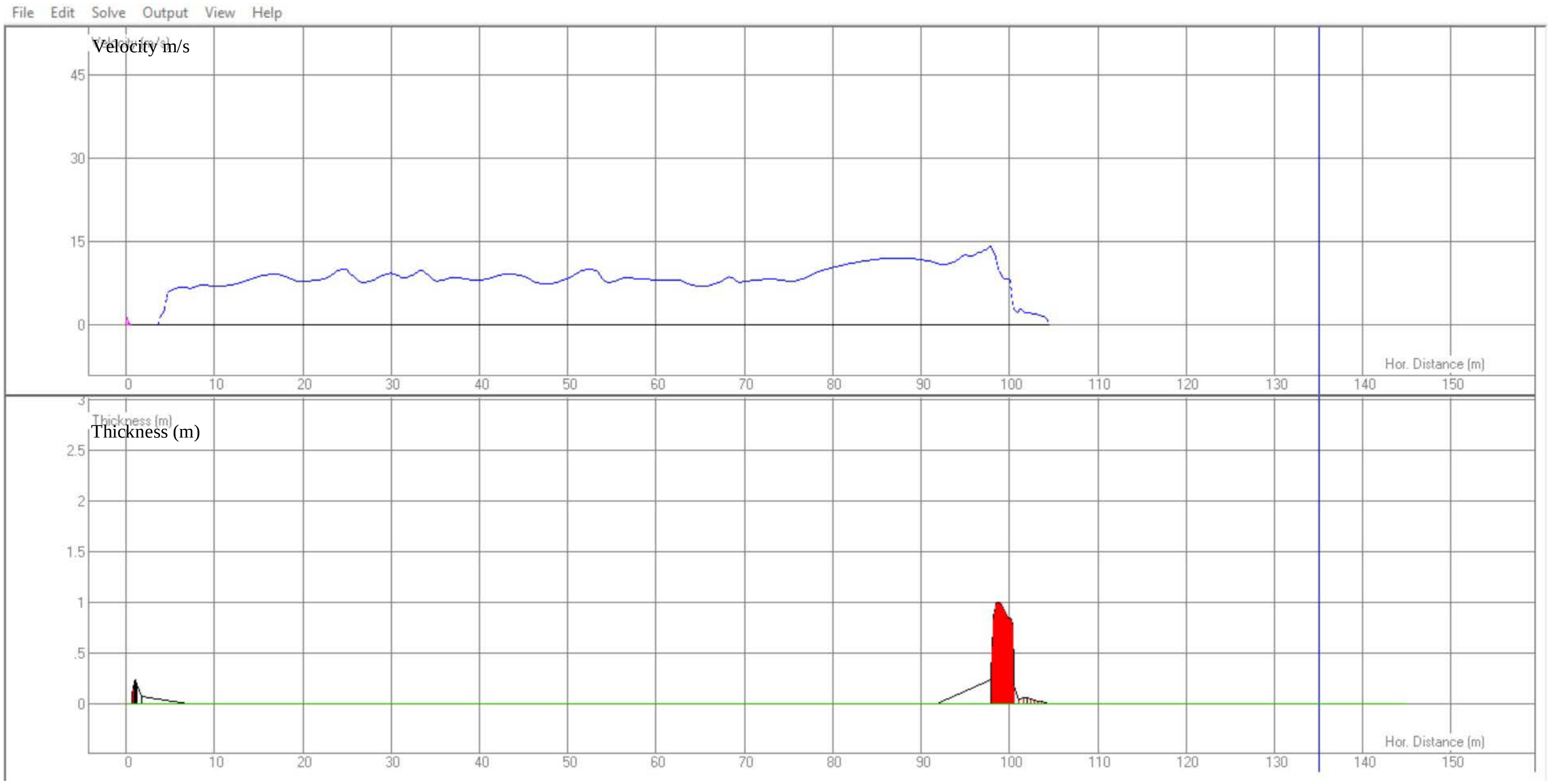
Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.67	40.67	100.87	No

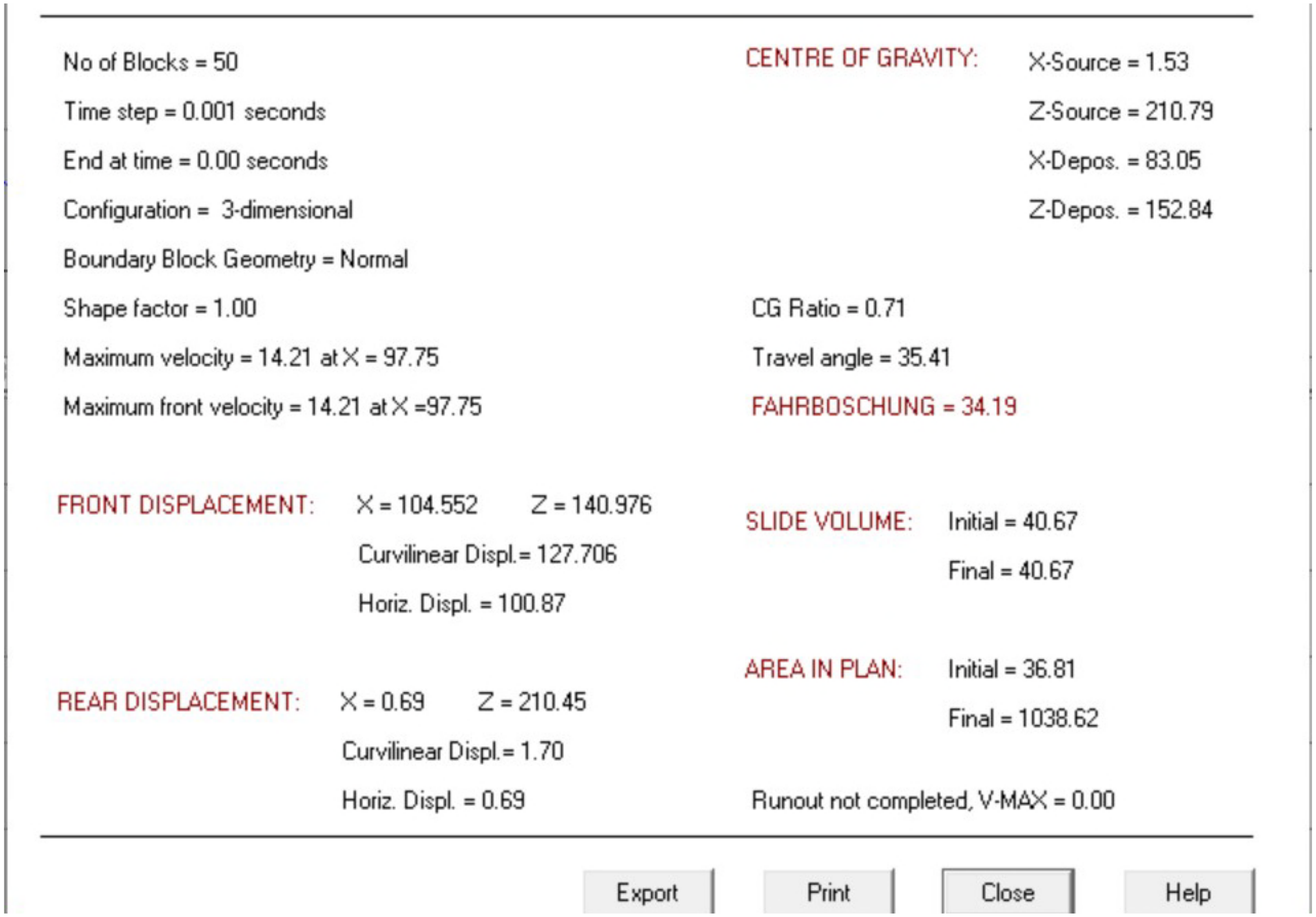
Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Elevation (m)
210
200
190
180
170
160
150
140
130
0
20
40
60
80
100
120
140
160
Distance (m)
Debris deposited
Line of
No-build Zone
Location of SITE
(Paddock)
Man-made Cut Slope

```
Time interval: 0.001
Time = 115.11 seconds
X-Front = 104.55
X-Rear = 0.69
V-Min = 0.00
V-Max = 0.00
V-Front = 0.00
V-Rear = 0.00
```


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Thickness (m)
3
2.5
2
1.5
1
.5
0
Hor. Distance (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Distance (m)



No of Blocks = 50
Time step = 0.001 seconds
End at time = 0.00 seconds
Configuration = 3-dimensional
Boundary Block Geometry = Normal
Shape factor = 1.00
Maximum velocity = 14.21 at X = 97.75
Maximum front velocity = 14.21 at X =97.75

CENTRE OF GRAVITY: X-Source = 1.53
Z-Source = 210.79
X-Depos. = 83.05
Z-Depos. = 152.84

CG Ratio = 0.71
Travel angle = 35.41
FAHRBOSCHUNG = 34.19

FRONT DISPLACEMENT: X = 104.552 Z = 140.976
Curvilinear Displ.= 127.706
Horiz. Displ. = 100.87

REAR DISPLACEMENT: X = 0.69 Z = 210.45
Curvilinear Displ.= 1.70
Horiz. Displ. = 0.69

SLIDE VOLUME: Initial = 40.67
Final = 40.67

AREA IN PLAN: Initial = 36.81
Final = 1038.62

Runout not completed, V-MAX = 0.00

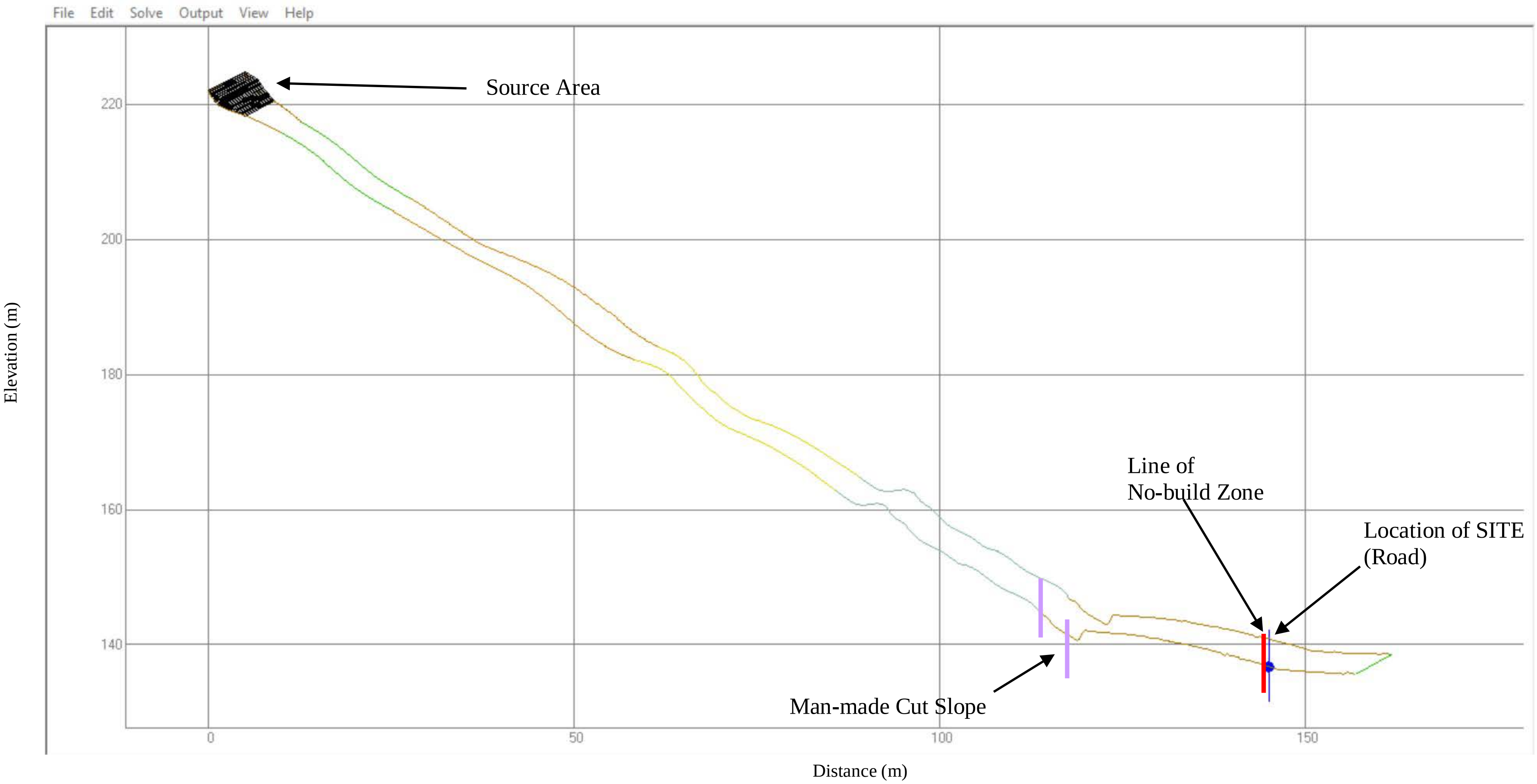
Debris Mobility Analysis for the Credible Runout Path RP16 within Catchment No. TD7

Landslide Type = DF

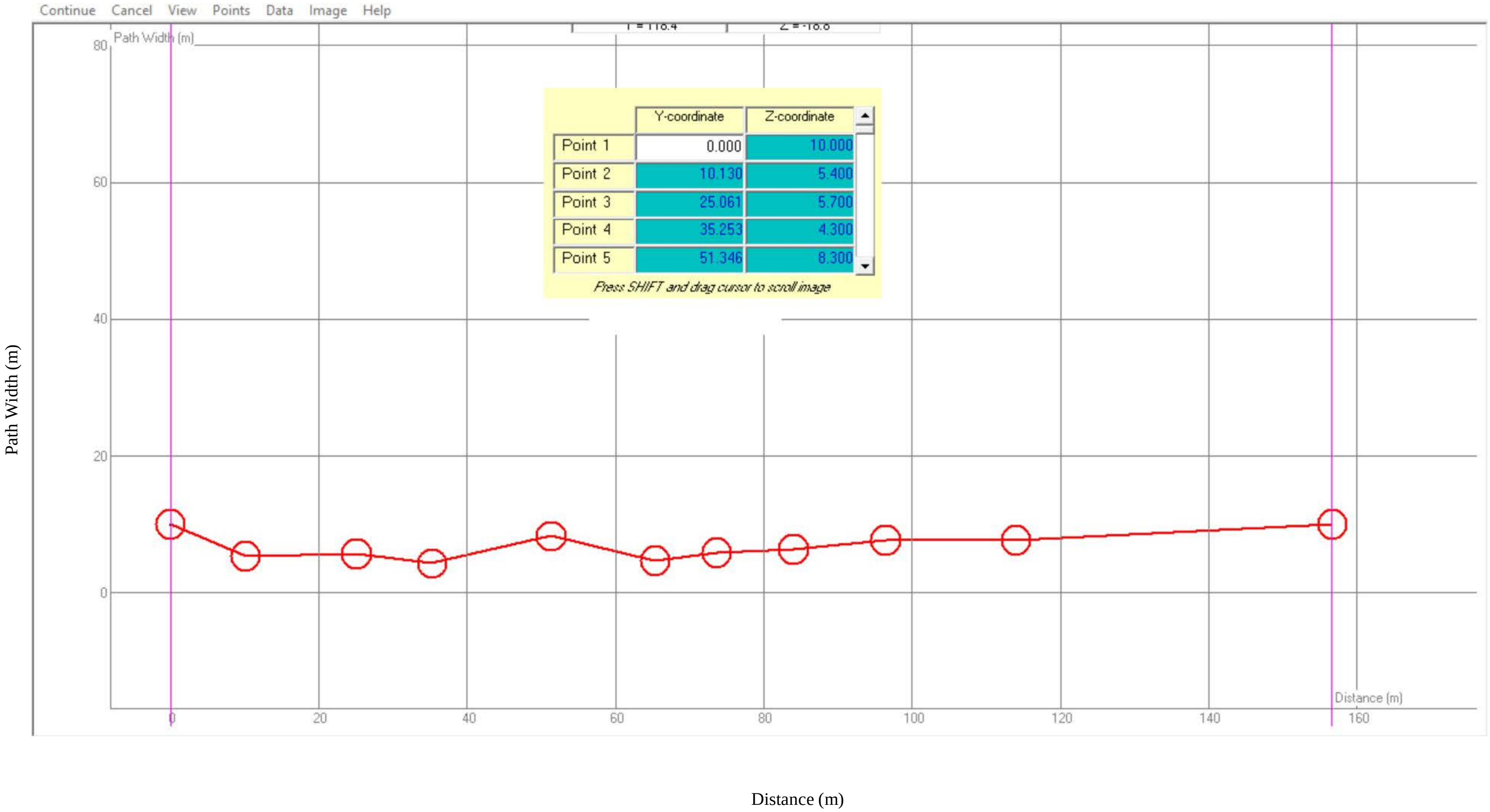
Design Source Volume = 40m^3

Figure D28

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = 118.4
Z = -18.8
Path Width (m)
80
60
40
20
0
Distance (m)
0
20
40
60
80
100
120
140
160
Path Width (m)
Distance (m)

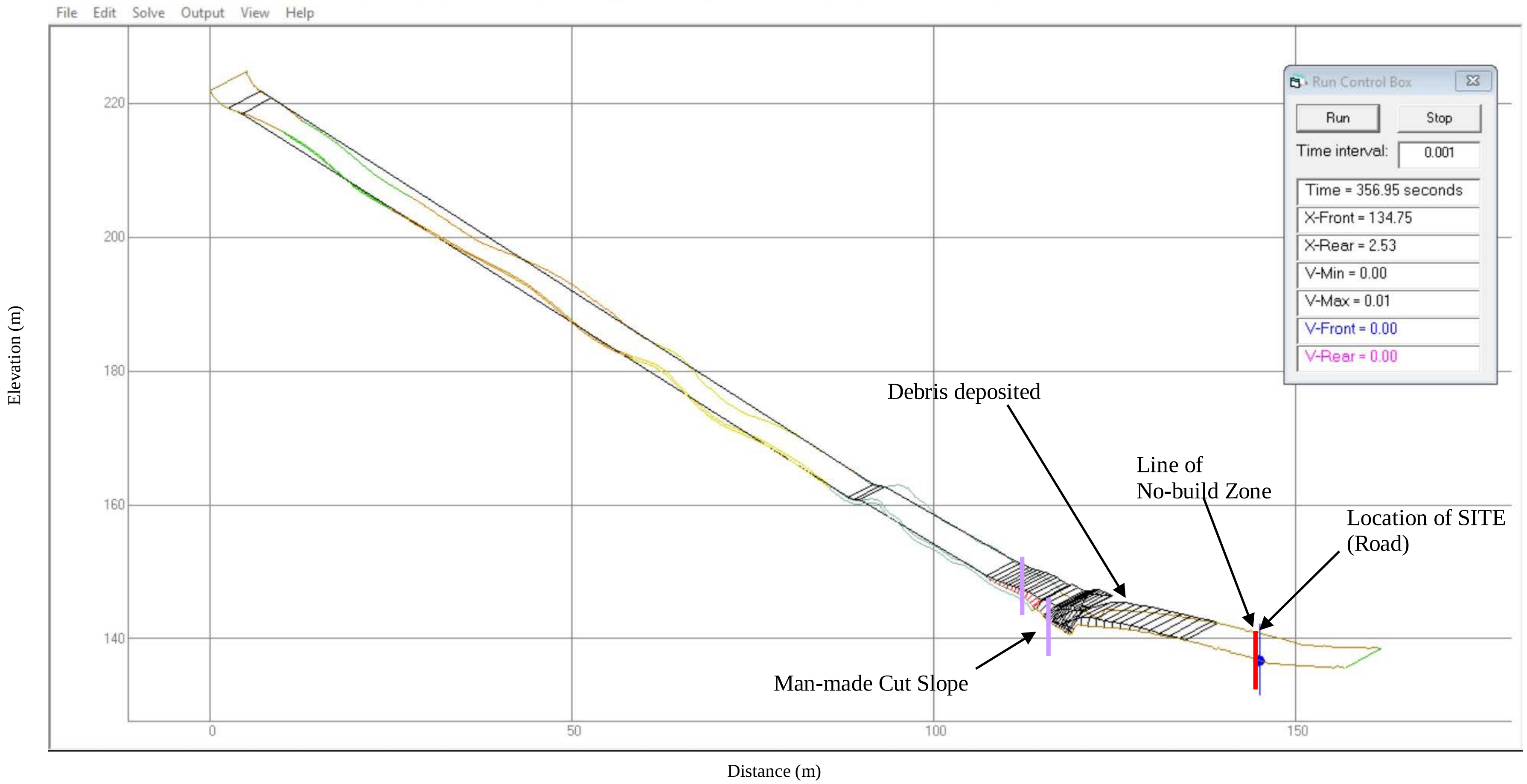
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	10.130	5.400
Point 3	25.061	5.700
Point 4	35.253	4.300
Point 5	51.346	8.300

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.28	321.11	129.70	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
220
200
180
160
140
0
50
100
150
Elevation (m)
Distance (m)
Debris deposited
Line of
No-build Zone
Location of SITE
(Road)
Man-made Cut Slope

Time interval: 0.001

Time = 356.95 seconds

X-Front = 134.75

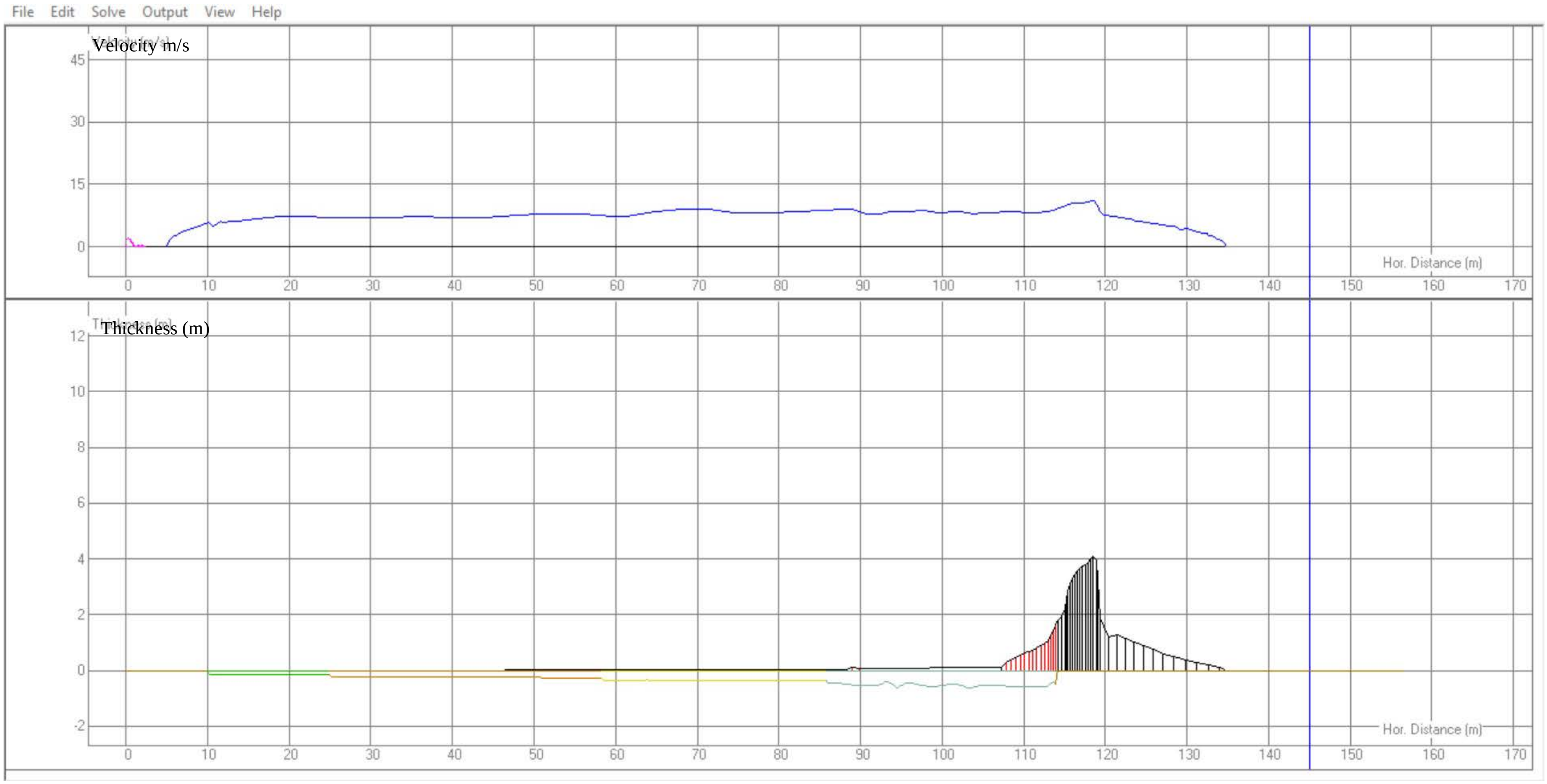
X-Rear = 2.53

V-Min = 0.00

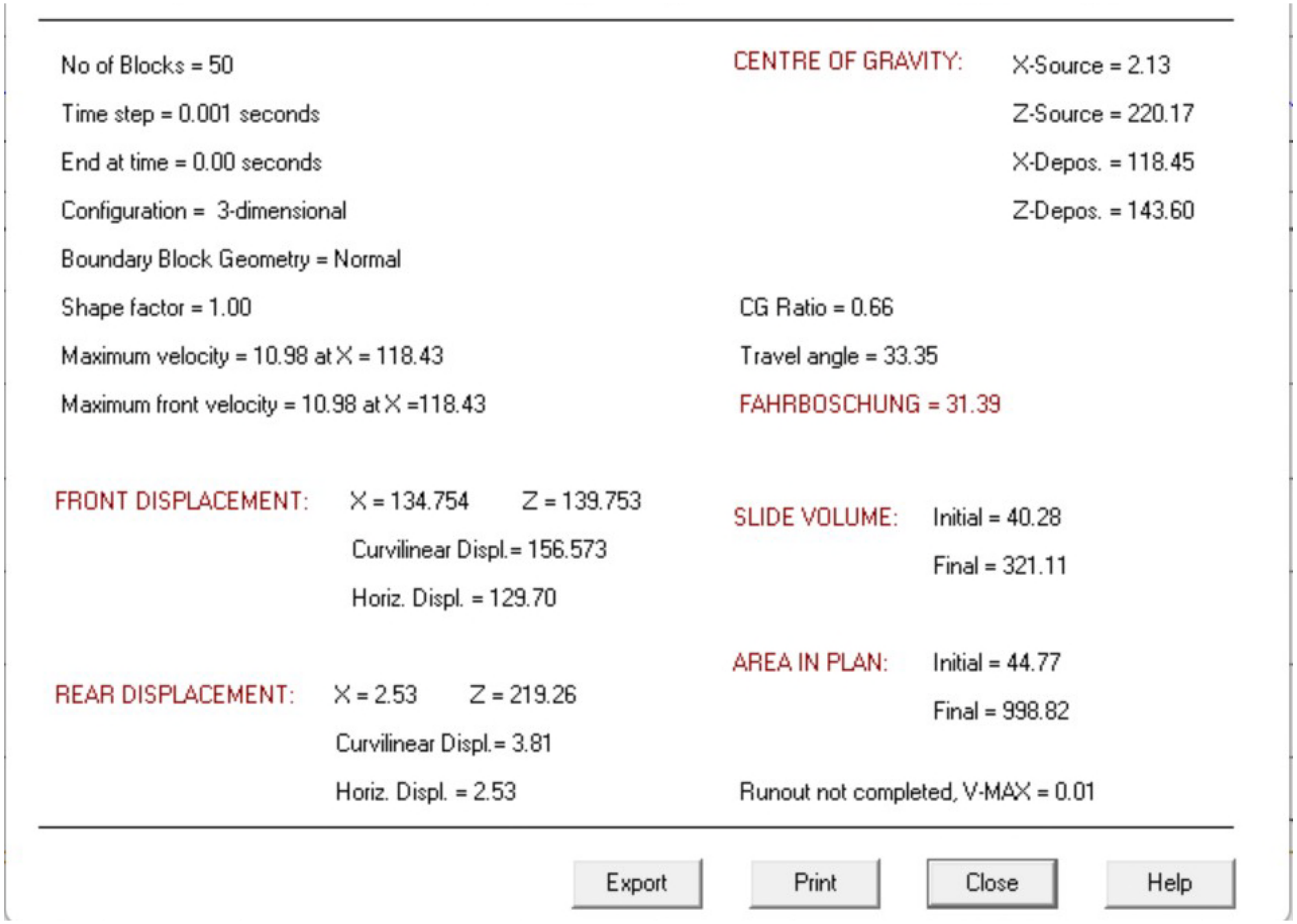
V-Max = 0.01

V-Front = 0.00

V-Rear = 0.00


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
Hor. Distance (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
Thickness (m)
12
10
8
6
4
2
0
-2
Hor. Distance (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

Distance (m)



No of Blocks = 50

Time step = 0.001 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 10.98 at X = 118.43

Maximum front velocity = 10.98 at X =118.43

FRONT DISPLACEMENT: X = 134.754 Z = 139.753

Curvilinear Displ.= 156.573

Horiz. Displ. = 129.70

REAR DISPLACEMENT: X = 2.53 Z = 219.26

Curvilinear Displ.= 3.81

Horiz. Displ. = 2.53

CENTRE OF GRAVITY: X-Source = 2.13

Z-Source = 220.17

X-Depos. = 118.45

Z-Depos. = 143.60

CG Ratio = 0.66

Travel angle = 33.35

FAHRBOSCHUNG = 31.39

SLIDE VOLUME: Initial = 40.28

Final = 321.11

AREA IN PLAN: Initial = 44.77

Final = 998.82

Runout not completed, V-MAX = 0.01

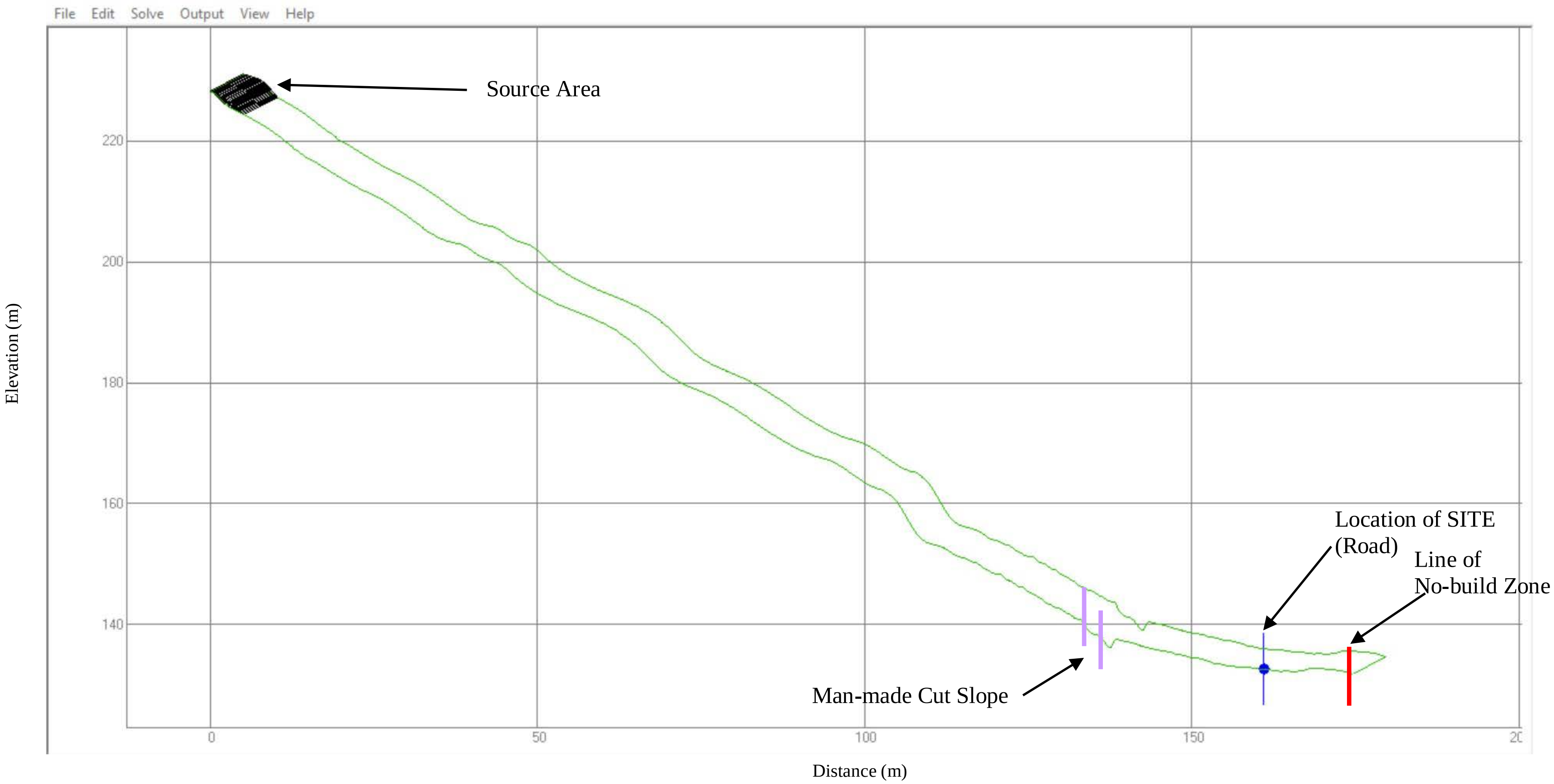
Debris Mobility Analysis for the Credible Runout Path RP17 within Catchment No. OH5

Landslide Type = OHL

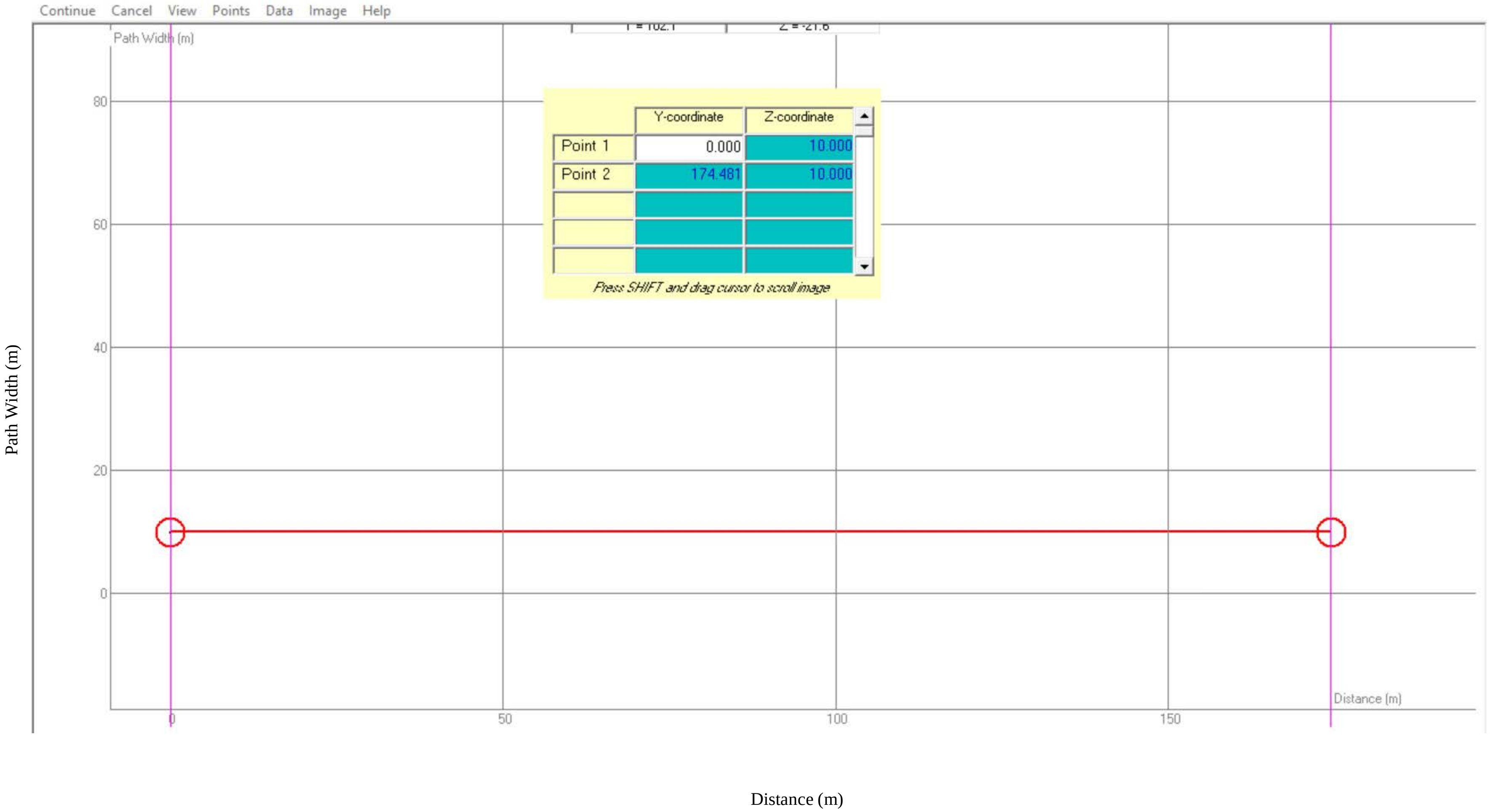
Design Source Volume = 40m^3

Figure D29

Section Profile – (pre-sliding)



Width Profile


Continue
Cancel
View
Points
Data
Image
Help
Y = 102.1
Z = -21.8
Path Width (m)
80
60
40
20
0
Distance (m)
0
50
100
150
Path Width (m)
Distance (m)

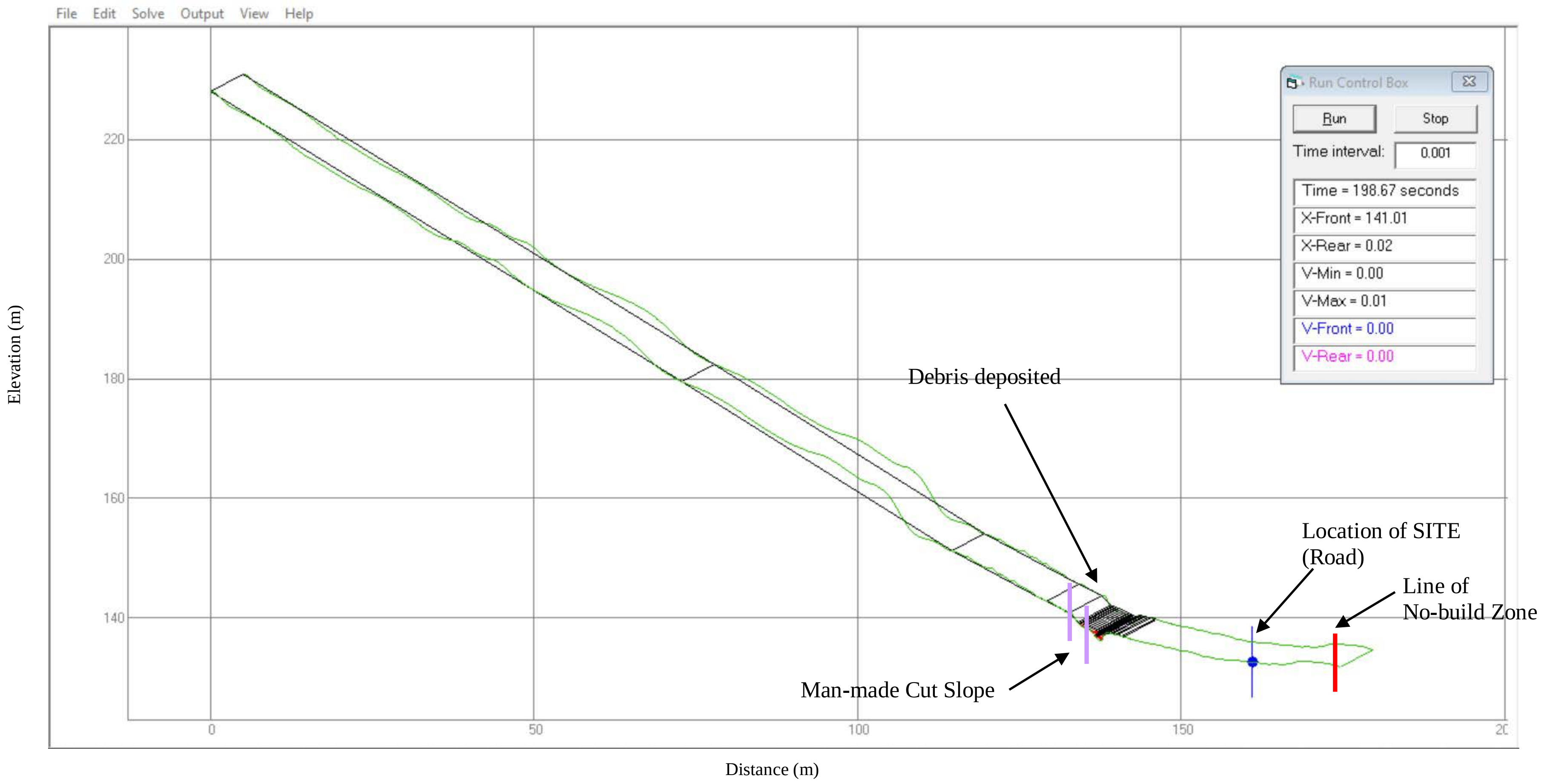
	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	174.481	10.000

Press SHIFT and drag cursor to scroll image

Result of Debris Mobility Analysis

Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.89	40.89	135.74	No

Section Profile – (post-sliding)


File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Elevation (m)
220
200
180
160
140
0
50
100
150
2
Distance (m)

Time interval: 0.001

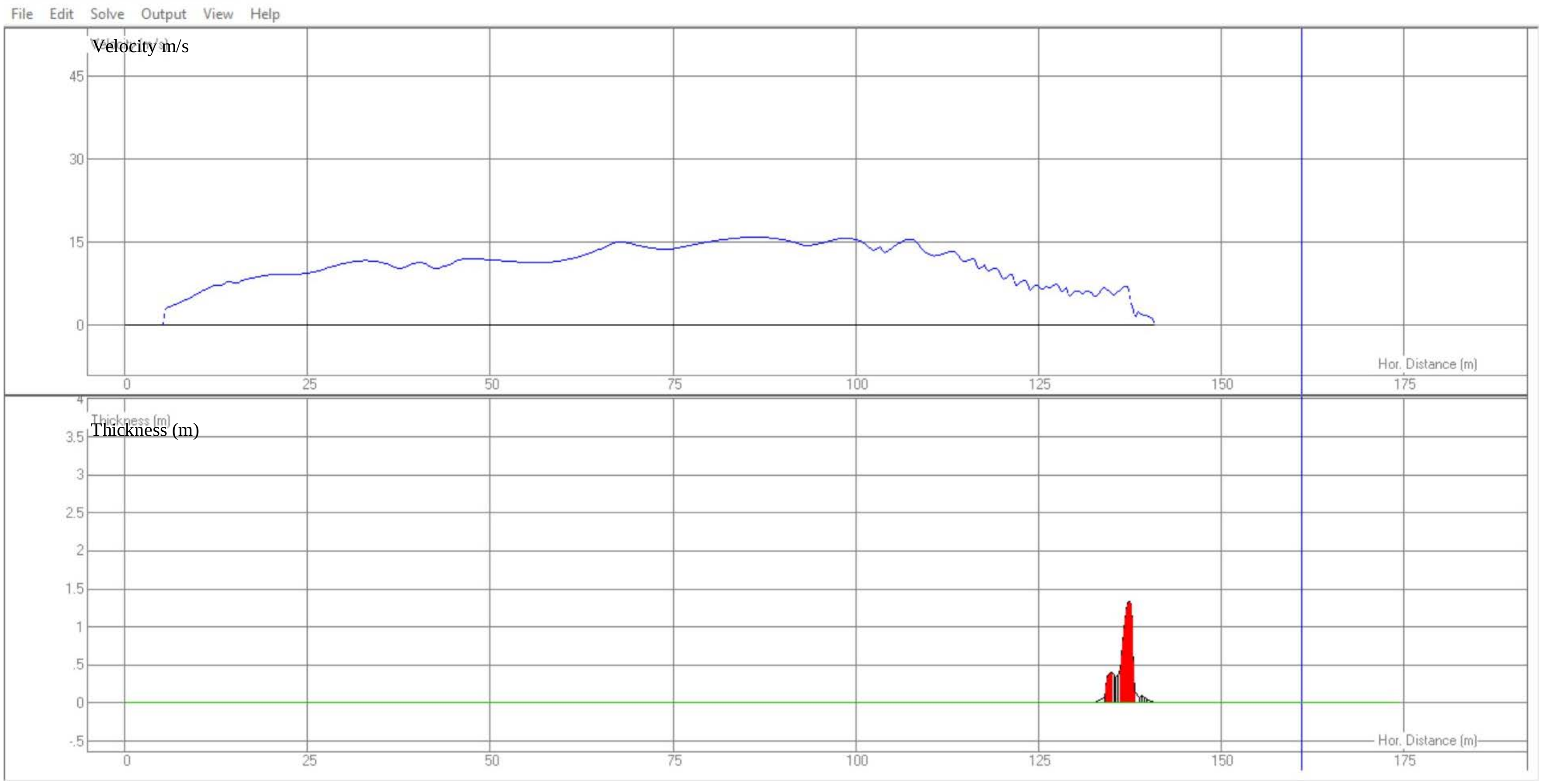
```
Time = 198.67 seconds
X-Front = 141.01
X-Rear = 0.02
V-Min = 0.00
V-Max = 0.01
V-Front = 0.00
V-Rear = 0.00
```

Debris deposited

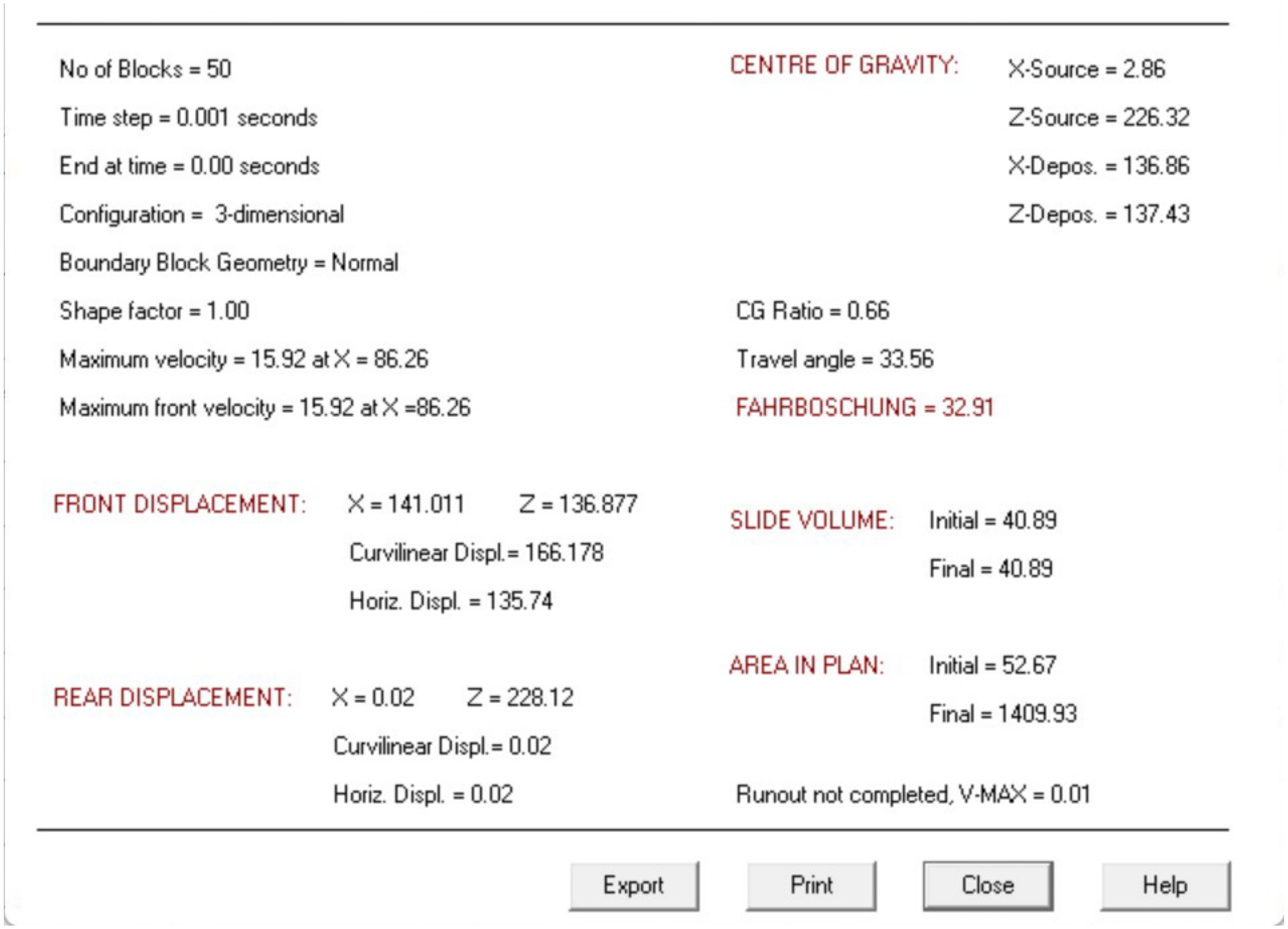
Location of SITE (Road)

Line of No-build Zone

Man-made Cut Slope


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
0
25
50
75
100
125
150
175
Hor. Distance (m)
Thickness (m)
4
3.5
3
2.5
2
1.5
1
.5
0
-.5
0
25
50
75
100
125
150
175
Hor. Distance (m)

Distance (m)



No of Blocks = 50
Time step = 0.001 seconds
End at time = 0.00 seconds
Configuration = 3-dimensional
Boundary Block Geometry = Normal
Shape factor = 1.00
Maximum velocity = 15.92 at X = 86.26
Maximum front velocity = 15.92 at X =86.26

CENTRE OF GRAVITY: X-Source = 2.86
Z-Source = 226.32
X-Depos. = 136.86
Z-Depos. = 137.43

CG Ratio = 0.66
Travel angle = 33.56
FAHRBOSCHUNG = 32.91

FRONT DISPLACEMENT: X = 141.011 Z = 136.877
Curvilinear Displ.= 166.178
Horiz. Displ. = 135.74

REAR DISPLACEMENT: X = 0.02 Z = 228.12
Curvilinear Displ.= 0.02
Horiz. Displ. = 0.02

SLIDE VOLUME: Initial = 40.89
Final = 40.89

AREA IN PLAN: Initial = 52.67
Final = 1409.93

Runout not completed, V-MAX = 0.01

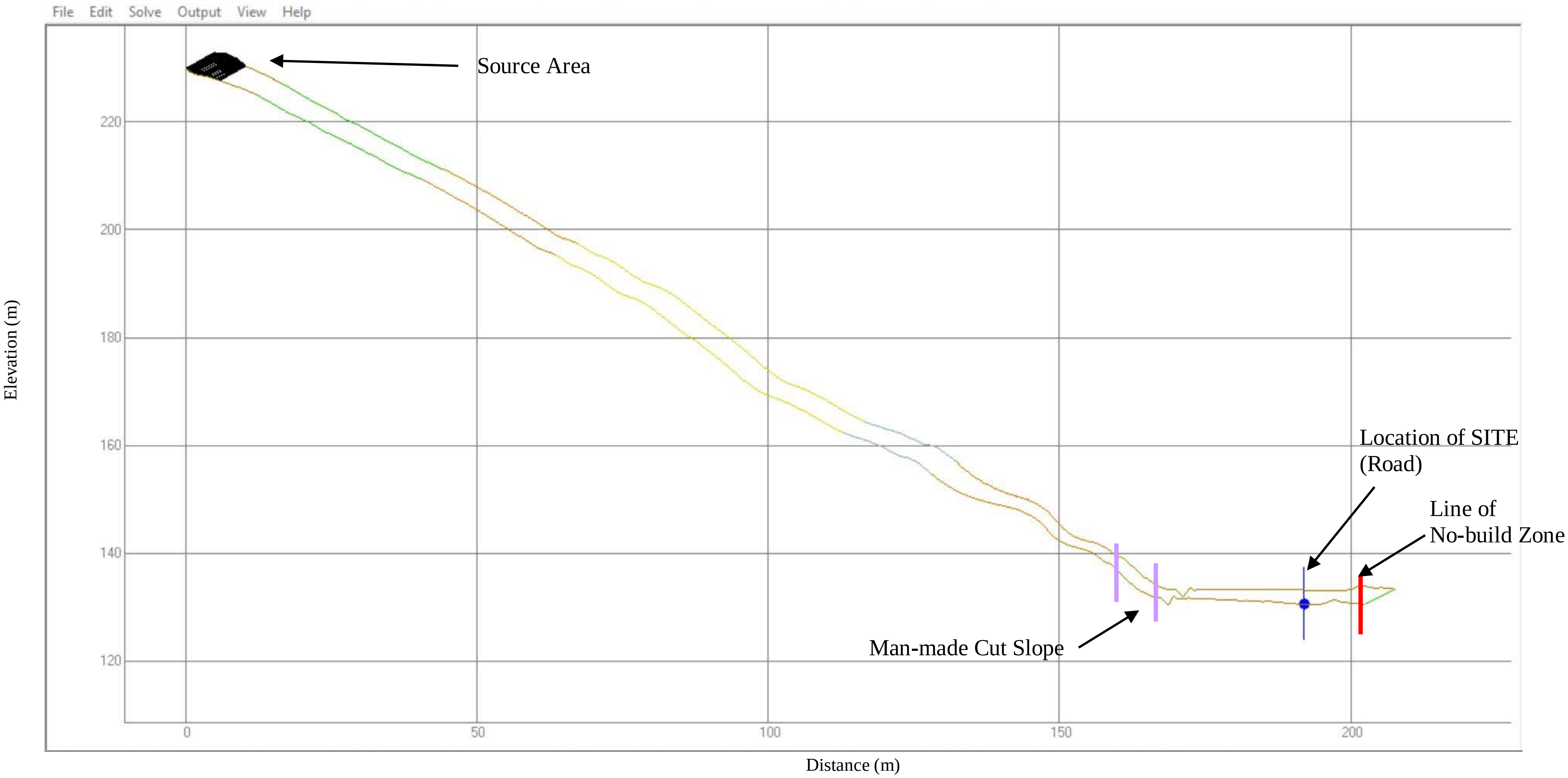
Debris Mobility Analysis for the Credible Runout Path RP18 within Catchment No. TD8

Landslide Type = DF

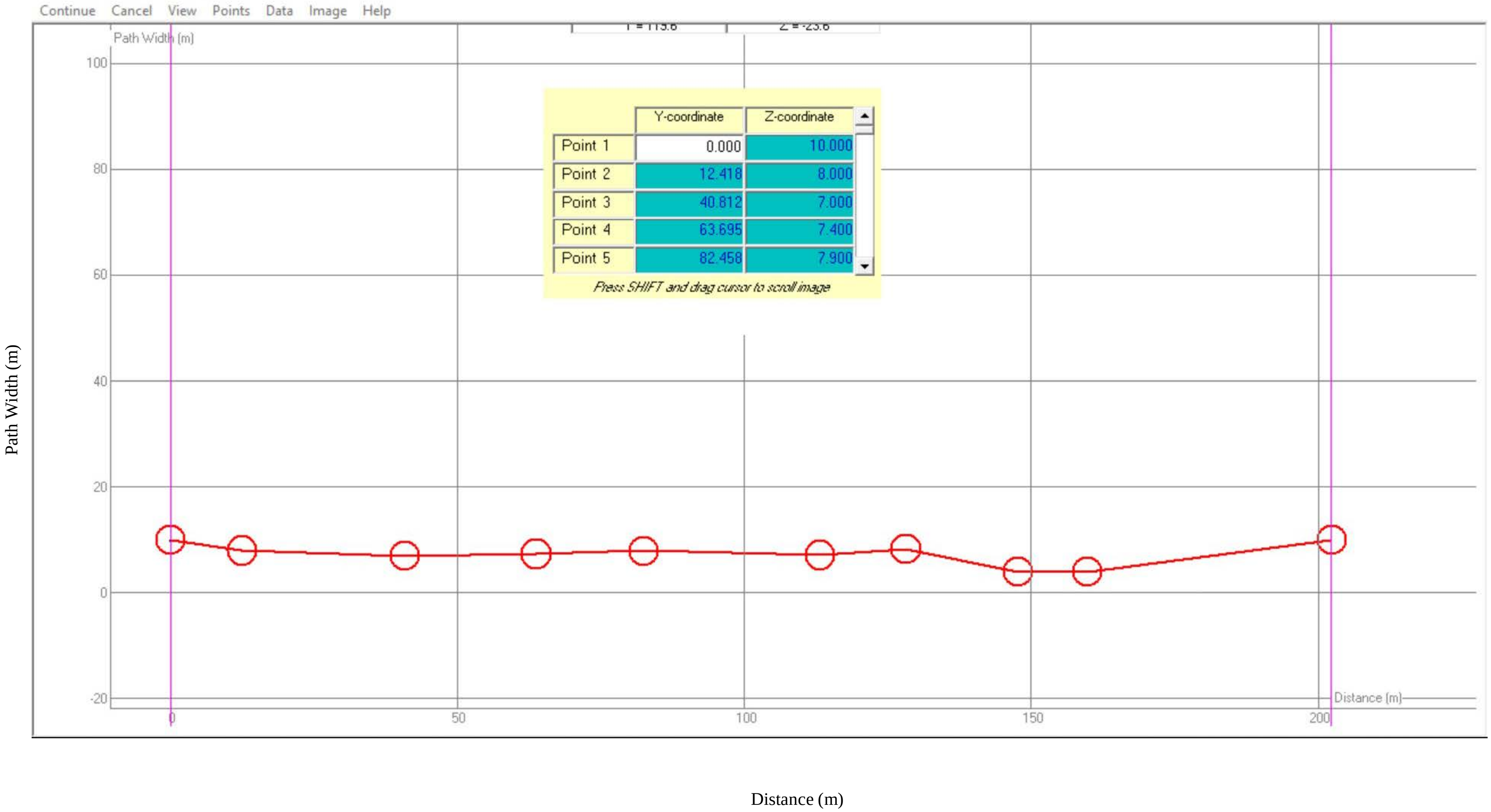
Design Source Volume = 40m^3

Figure D30

Section Profile – (pre-sliding)



Width Profile

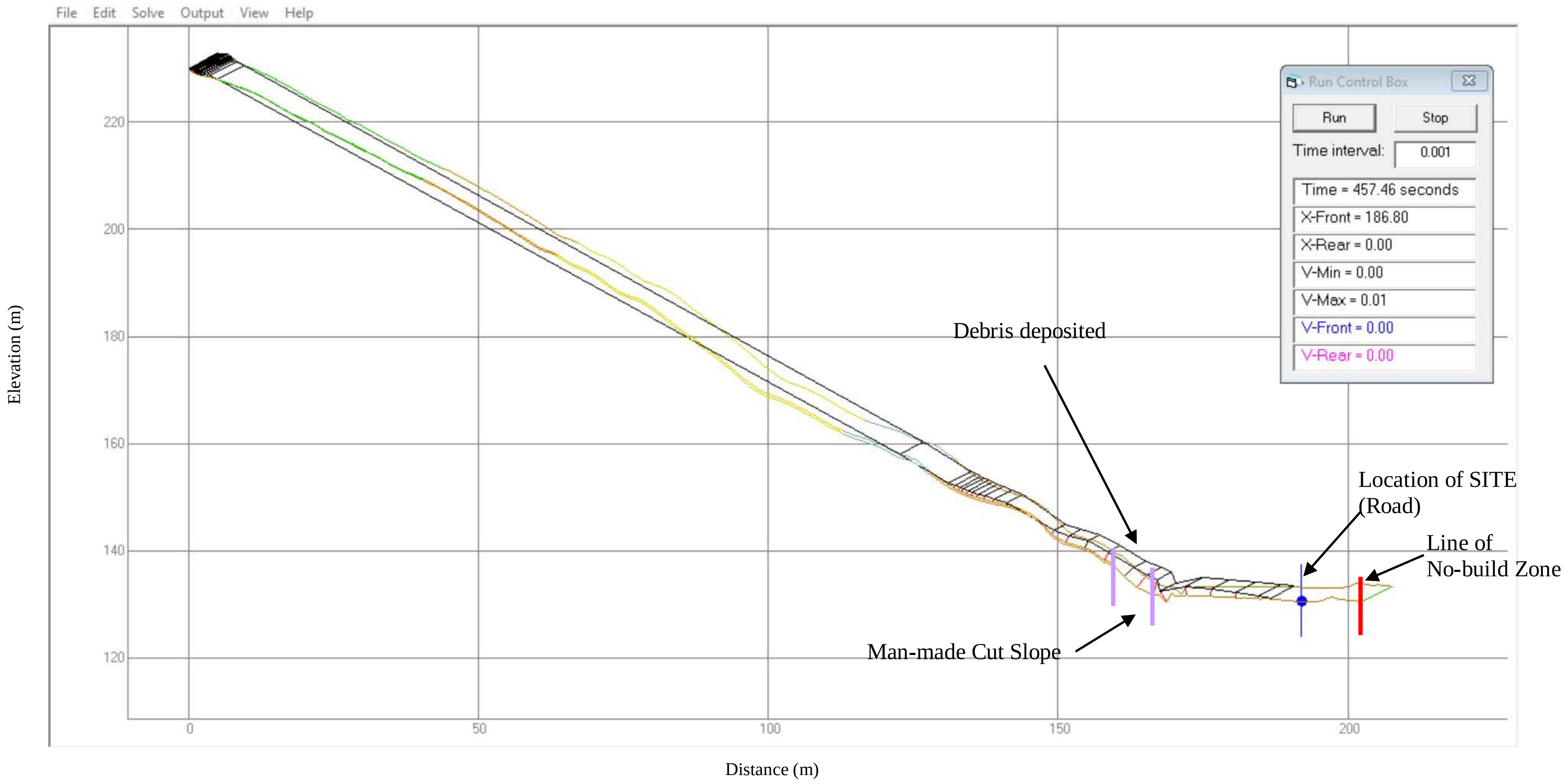

Continue
Cancel
View
Points
Data
Image
Help
Y = 115.6
Z = -23.6
Path Width (m)
100
80
60
40
20
0
-20
0
50
100
150
200
Distance (m)
Press SHIFT and drag cursor to scroll image
Path Width (m)
Distance (m)

	Y-coordinate	Z-coordinate
Point 1	0.000	10.000
Point 2	12.418	8.000
Point 3	40.812	7.000
Point 4	63.695	7.400
Point 5	82.458	7.900

Result of Debris Mobility Analysis

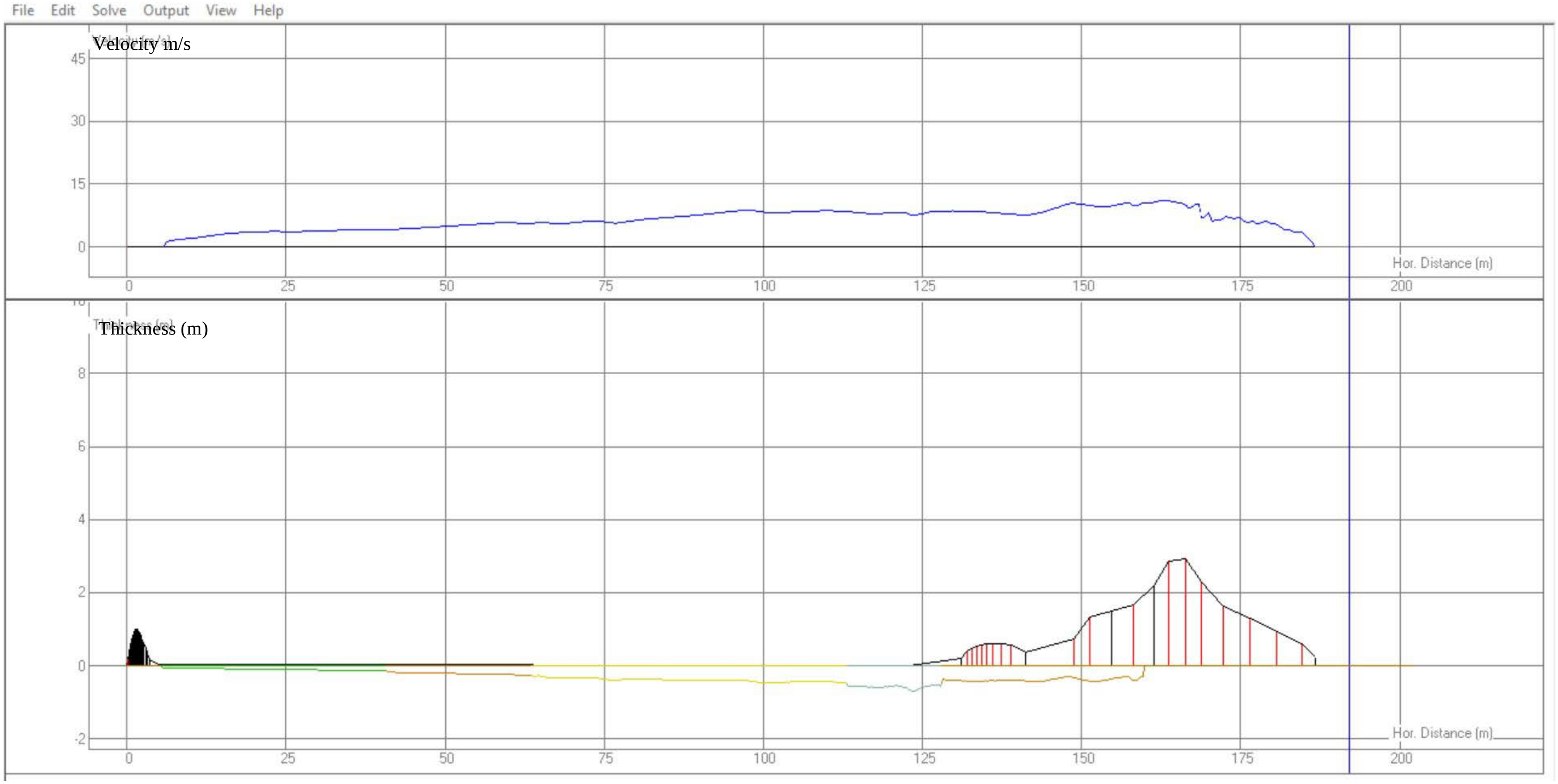
Source Volume (m^3)	Final Volume (m^3)	Travel Distance (m)	Debris Reached Proposed SITE Facility
40.61	434.97	180.95	No

Section Profile – (post-sliding)

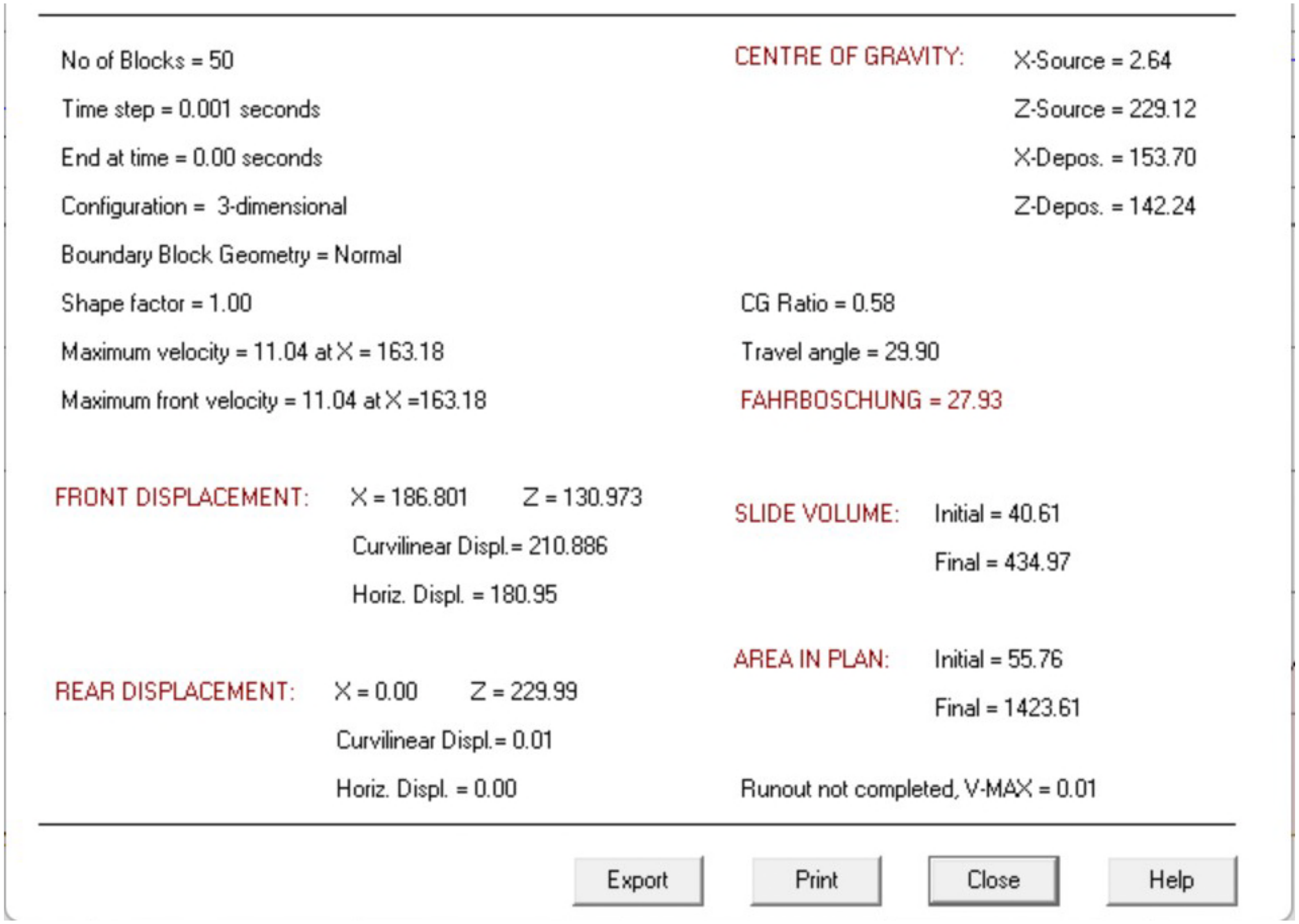

File
Edit
Solve
Output
View
Help
Run Control Box
Run
Stop
Elevation (m)
220
200
180
160
140
120
0
50
100
150
200
Distance (m)
Debris deposited
Man-made Cut Slope
Location of SITE (Road)
Line of No-build Zone

Time interval: 0.001

```
Time = 457.46 seconds
X-Front = 186.80
X-Rear = 0.00
V-Min = 0.00
V-Max = 0.01
V-Front = 0.00
V-Rear = 0.00
```


File
Edit
Solve
Output
View
Help
Velocity m/s
45
30
15
0
0
25
50
75
100
125
150
175
200
Hor. Distance (m)
Thickness (m)
8
6
4
2
0
-2
0
25
50
75
100
125
150
175
200
Hor. Distance (m)

Distance (m)



No of Blocks = 50

Time step = 0.001 seconds

End at time = 0.00 seconds

Configuration = 3-dimensional

Boundary Block Geometry = Normal

Shape factor = 1.00

Maximum velocity = 11.04 at X = 163.18

Maximum front velocity = 11.04 at X =163.18

FRONT DISPLACEMENT: X = 186.801 Z = 130.973

Curvilinear Displ.= 210.886

Horiz. Displ. = 180.95

REAR DISPLACEMENT: X = 0.00 Z = 229.99

Curvilinear Displ.= 0.01

Horiz. Displ. = 0.00

CENTRE OF GRAVITY: X-Source = 2.64

Z-Source = 229.12

X-Depos. = 153.70

Z-Depos. = 142.24

CG Ratio = 0.58

Travel angle = 29.90

FAHRBOSCHUNG = 27.93

SLIDE VOLUME: Initial = 40.61

Final = 434.97

AREA IN PLAN: Initial = 55.76

Final = 1423.61

Runout not completed, V-MAX = 0.01

Appendix E

Unstable Boulders Extracted from the Boulder Survey Report

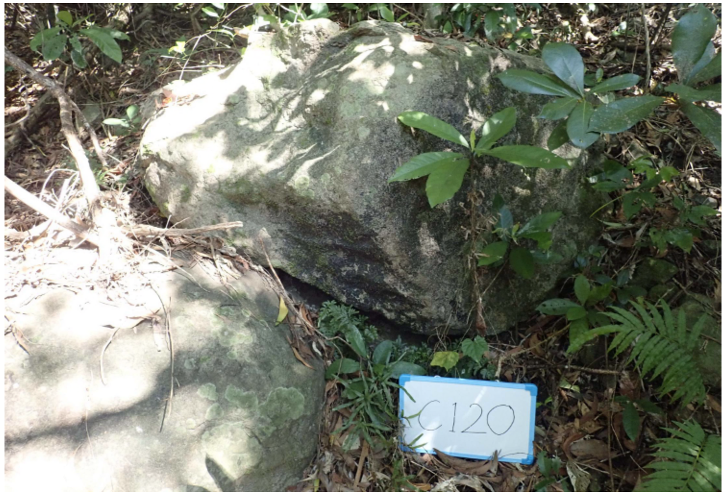
Boulder Investigation Sheet

Project Title: Engineering Study for Proposed New Public Riding School at Tseung Kwan O for the Hong Kong Jockey Club

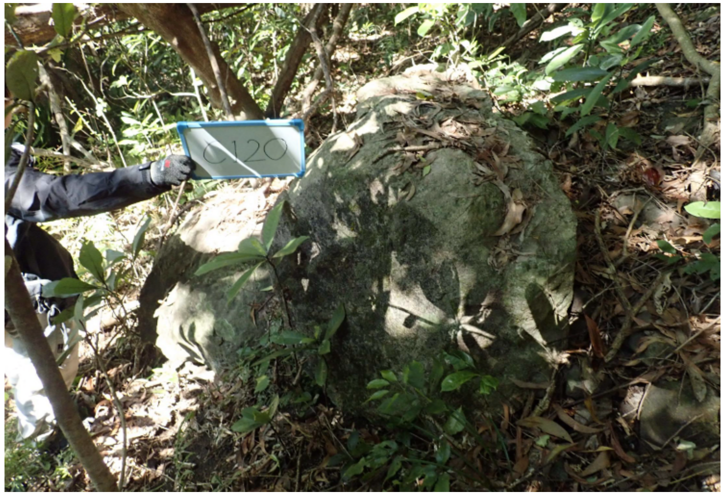
Boulder No.: C120 Compiled by: SS, KG Checked by: AN Date: 02/12/2022

Boulder Characteristics							Boulder Setting Characteristics									(Use combinations as necessary)
Boulder Grouping	Visible Dimensions (m) (Multiple boulders: Maximum Dimensions)			Shape (Angularity)	Form		Support Type	Contact Condition	Local Slope Gradient Below Boulder (°)	Topography	Vegetation Type and Density Downslope	Nearest Proposed Facilities Downslope (Type/Distance) (m) (Paddock, stable blocks, changing room, etc.)	Risk Rating	Stability Rating	Potential Failure Mechanism	In-situ Preventive Works Required
	L1	L2	L3													
S	1	0.9	1.7	SR	ED		MS, DS, BS	3	30	CB	B, M	Public riding school, 50	H	M	R	R

Photo:



Upslope View



Cross-section View

Shape (Angularity)
A = Angular
SA = Sub-angular
SR = Sub-rounded
R = Rounded

Form
ED = Equidimensional
F = Flat
E = Elongated
FE = Flat and Elongated

Topography
PS = Planar Slope
VS = Valley Side Slope
S = Spur
LS = Landslide Scar
T = Terrace
CB = Channel Bed
F = Footslope
M = Man-made Slope
C = Cliff

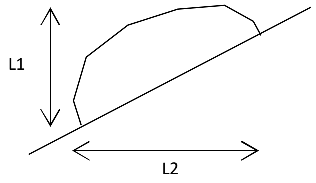
Grouping
S = Single
M = Multiple

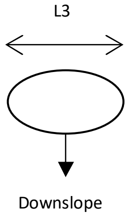
Support Type
MS = Matrix Supported
  R = Rock
  DS = Dense Soil
  LS = Loose Soil
  Sh = Shotcrete
BS = Boulder Supported
VS = Vegetation Supported
U = Undermined
Other (please specify, e.g. Buttress)

Contact Condition
1 = Buried
2 = Lie firmly
3 = Lie firmly but with overhanging portion
4 = Lie loosely
5 = Lie loosely and with overhanging portion

Vegetation Type (25 m downslope of boulder)
MT = Mature Tree ≥ 100 mm trunk
YT = Young Tree < 100 mm trunk
B = Bushes
O = Other
N/A = No vegetation
Use combinations as necessary

Density of Vegetation
D = Dense (≥ 1/1 m^2))
M = Medium (1/25 m^2 – 1/1 m^2)
S = Sparse (< 1/25 m^2)





Preventive Works
S = Splitting
I = Infilling of Voids
M = Masonry Buttress
C = Concrete Buttress
SP = Surface Protection
D = Drainage Channel
R = Removal
RD = Rock Dowel
N/A = No Works Required

Risk Rating
L = Low: If movement occurred, it is highly unlikely that the boulder would reach the site area
H = High: If movement occurred, it is possible that the boulder would reach the site area

Stability Rating
L = Low: Active soil erosion removing support from around and/or beneath boulder, movement of boulder possible in the foreseeable future
M = Medium: Some vegetation present in the vicinity of the boulder with no active erosion evident
H = High: Dense vegetation with no active erosion evident in the vicinity of boulder, movement of boulder unlikely in the foreseeable future

Potential Failure Mechanism
R = Rolling: Removal of downhill support would enable boulder to roll forward
T = Toppling: Removal of downhill support would enable boulder to fall from steep slope
S = Sliding: Removal of downhill support would enable boulder to slide down from steep slope
N = Nil

Boulder Investigation Sheet

Project Title: Engineering Study for Proposed New Public Riding School at Tseung Kwan O for the Hong Kong Jockey Club

Boulder No.: C126

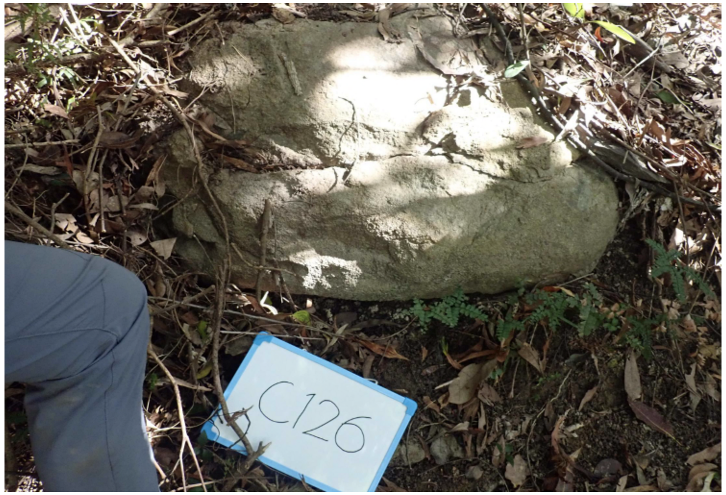
Compiled by: SS, KG

Checked by: AN

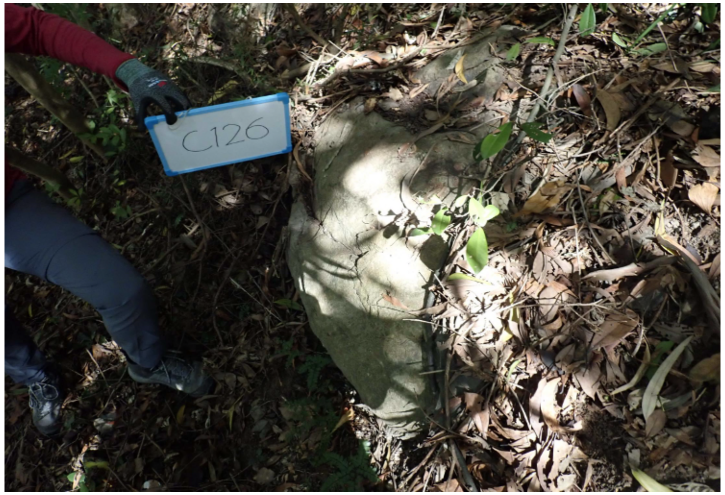
Date: 02/12/2022

Boulder Characteristics						Boulder Setting Characteristics									(Use combinations as necessary)
Boulder Grouping	Visible Dimensions (m) (Multiple boulders: Maximum Dimensions)			Shape (Angularity)	Form	Support Type	Contact Condition	Local Slope Gradient Below Boulder (°)	Topography	Vegetation Type and Density Downslope	Nearest Proposed Facilities Downslope (Type/Distance) (m) (Paddock, stable blocks, changing room, etc.)	Risk Rating	Stability Rating	Potential Failure Mechanism	In-situ Preventive Works Required
	L1	L2	L3												
S	0.8	0.8	1	SR	ED	MS, DS, U	3	35	S	B, YT, D	Public riding school, 20	H	L	R	R

Photo:



Upslope View



Cross-section View

Shape (Angularity)
A = Angular
SA = Sub-angular
SR = Sub-rounded
R = Rounded

Form
ED = Equidimensional
F = Flat
E = Elongated
FE = Flat and Elongated

Topography
PS = Planar Slope
VS = Valley Side Slope
S = Spur
LS = Landslide Scar
T = Terrace
CB = Channel Bed
F = Footslope
M = Man-made Slope
C = Cliff

Grouping
S = Single
M = Multiple

Support Type
MS = Matrix Supported
  R = Rock
  DS = Dense Soil
  LS = Loose Soil
  Sh = Shotcrete
BS = Boulder Supported
VS = Vegetation Supported
U = Undermined
Other (please specify, e.g. Buttress)

Contact Condition
1 = Buried
2 = Lie firmly
3 = Lie firmly but with overhanging portion
4 = Lie loosely
5 = Lie loosely and with overhanging portion

Vegetation Type (25 m downslope of boulder)
MT = Mature Tree ≥ 100 mm trunk
YT = Young Tree < 100 mm trunk
B = Bushes
O = Other
N/A = No vegetation
Use combinations as necessary

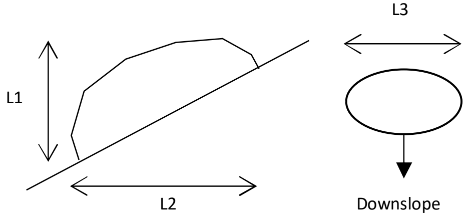
Density of Vegetation
D = Dense (≥ 1/1 m^2))
M = Medium (1/25 m^2 – 1/1 m^2)
S = Sparse (< 1/25 m^2)

Preventive Works
S = Splitting
I = Infilling of Voids
M = Masonry Buttress
C = Concrete Buttress
SP = Surface Protection
D = Drainage Channel
R = Removal
RD = Rock Dowel
N/A = No Works Required

Risk Rating
L = Low: If movement occurred, it is highly unlikely that the boulder would reach the site area
H = High: If movement occurred, it is possible that the boulder would reach the site area

Stability Rating
L = Low: Active soil erosion removing support from around and/or beneath boulder, movement of boulder possible in the foreseeable future
M = Medium: Some vegetation present in the vicinity of the boulder with no active erosion evident
H = High: Dense vegetation with no active erosion evident in the vicinity of boulder, movement of boulder unlikely in the foreseeable future

Potential Failure Mechanism
R = Rolling: Removal of downhill support would enable boulder to roll forward
T = Toppling: Removal of downhill support would enable boulder to fall from steep slope
S = Sliding: Removal of downhill support would enable boulder to slide down from steep slope
N = Nil



Boulder Investigation Sheet

Project Title: Engineering Study for Proposed New Public Riding School at Tseung Kwan O for the Hong Kong Jockey Club

Boulder No.: C127

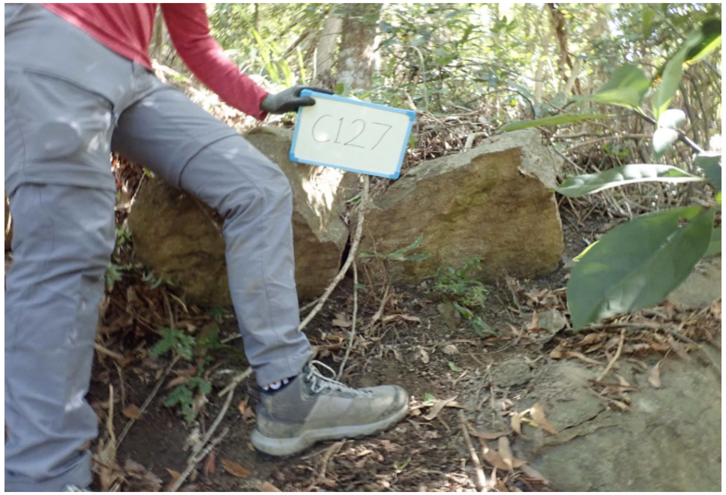
Compiled by: SS, KG

Checked by: AN

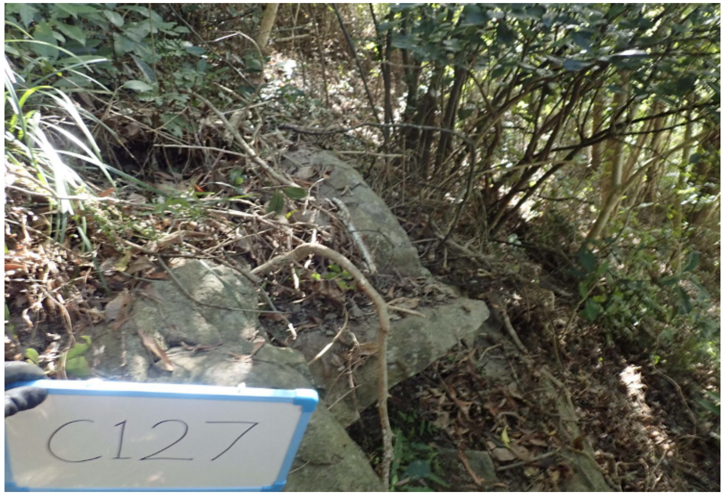
Date: 02/12/2022

Boulder Characteristics						Boulder Setting Characteristics									(Use combinations as necessary)
Boulder Grouping	Visible Dimensions (m) (Multiple boulders: Maximum Dimensions)			Shape (Angularity)	Form	Support Type	Contact Condition	Local Slope Gradient Below Boulder (°)	Topography	Vegetation Type and Density Downslope	Nearest Proposed Facilities Downslope (Type/Distance) (m) (Paddock, stable blocks, changing room, etc.)	Risk Rating	Stability Rating	Potential Failure Mechanism	In-situ Preventive Works Required
	L1	L2	L3												
S	1	0.8	1.1	SR	ED	MS, BS, LS	3	35	S	B, YT, D	Public riding school, 30	H	M	R	R

Photo:



Upslope View



Cross-section View

Shape (Angularity)
A = Angular
SA = Sub-angular
SR = Sub-rounded
R = Rounded

Form
ED = Equidimensional
F = Flat
E = Elongated
FE = Flat and Elongated

Topography
PS = Planar Slope
VS = Valley Side Slope
S = Spur
LS = Landslide Scar
T = Terrace
CB = Channel Bed
F = Footslope
M = Man-made Slope
C = Cliff

Grouping
S = Single
M = Multiple

Support Type
MS = Matrix Supported
- R = Rock
- DS = Dense Soil
- LS = Loose Soil
- Sh = Shotcrete

BS = Boulder Supported
VS = Vegetation Supported
U = Undermined
Other (please specify, e.g. Buttress)

Contact Condition
1 = Buried
2 = Lie firmly
3 = Lie firmly but with overhanging portion
4 = Lie loosely
5 = Lie loosely and with overhanging portion

Vegetation Type (25 m downslope of boulder)
MT = Mature Tree ≥ 100 mm trunk
YT = Young Tree < 100 mm trunk
B = Bushes
O = Other
N/A = No vegetation
Use combinations as necessary

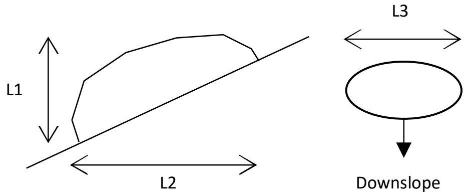
Density of Vegetation
D = Dense (≥ 1/1 m²))
M = Medium (1/25 m² – 1/1 m²)
S = Sparse (< 1/25 m²)

Preventive Works
S = Splitting
I = Infilling of Voids
M = Masonry Buttress
C = Concrete Buttress
SP = Surface Protection
D = Drainage Channel
R = Removal
RD = Rock Dowel
N/A = No Works Required

Risk Rating
L = Low: If movement occurred, it is highly unlikely that the boulder would reach the site area
H = High: If movement occurred, it is possible that the boulder would reach the site area

Stability Rating
L = Low: Active soil erosion removing support from around and/or beneath boulder, movement of boulder possible in the foreseeable future
M = Medium: Some vegetation present in the vicinity of the boulder with no active erosion evident
H = High: Dense vegetation with no active erosion evident in the vicinity of boulder, movement of boulder unlikely in the foreseeable future

Potential Failure Mechanism
R = Rolling: Removal of downhill support would enable boulder to roll forward
T = Toppling: Removal of downhill support would enable boulder to fall from steep slope
S = Sliding: Removal of downhill support would enable boulder to slide down from steep slope
N = Nil



Boulder Investigation Sheet

Project Title: Engineering Study for Proposed New Public Riding School at Tseung Kwan O for the Hong Kong Jockey Club

Boulder No.: C128 | Compiled by: SS, KG | Checked by: AN | Date: 02/12/2022

Boulder Characteristics						Boulder Setting Characteristics								(Use combinations as necessary)
Boulder Grouping	Visible Dimensions (m) (Multiple boulders: Maximum Dimensions) L1	L2	L3	Shape (Angularity)	Form	Support Type	Contact Condition	Local Slope Gradient Below Boulder (°)	Topography	Vegetation Type and Density Downslope	Nearest Proposed Facilities Downslope (Type/Distance) (m) (Paddock, stable blocks, changing room, etc.)	Risk Rating	Stability Rating	Potential Failure Mechanism	In-situ Preventive Works Required
S	2	1.9	2.5	SR	ED	MS, R, DS	3	35	S	B, YT, D	Public riding school, 20	H	M	R	R

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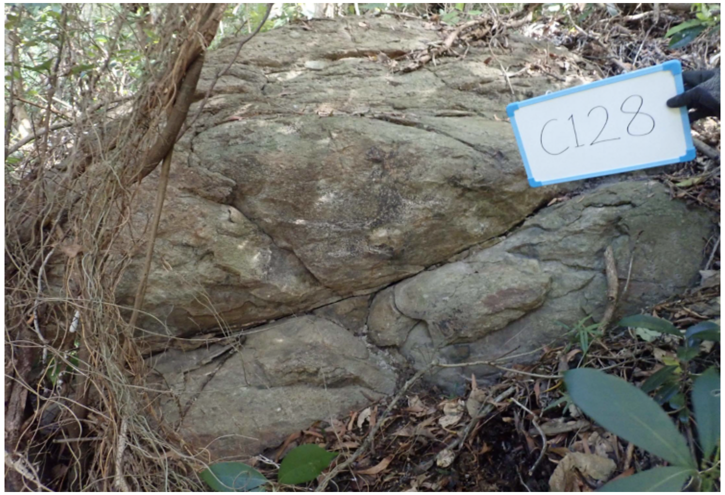
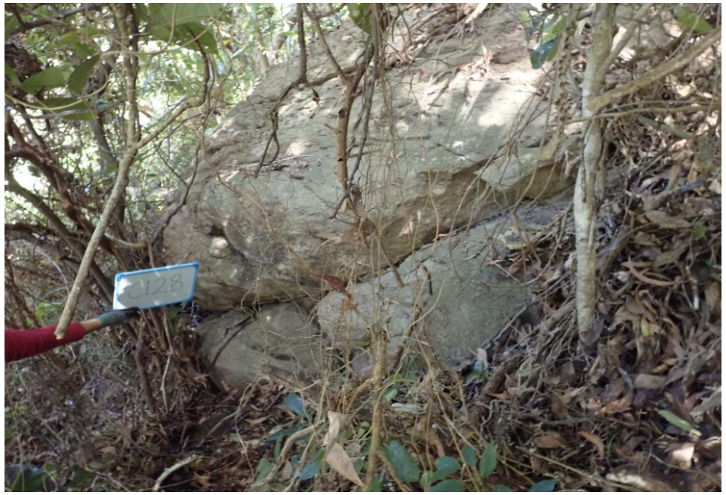


Upslope View



Cross-section View

Shape (Angularity)
A = Angular
SA = Sub-angular
SR = Sub-rounded
R = Rounded

Form
ED = Equidimensional
F = Flat
E = Elongated
FE = Flat and Elongated

Topography
PS = Planar Slope
VS = Valley Side Slope
S = Spur
LS = Landslide Scar
T = Terrace
CB = Channel Bed
F = Footslope
M = Man-made Slope
C = Cliff

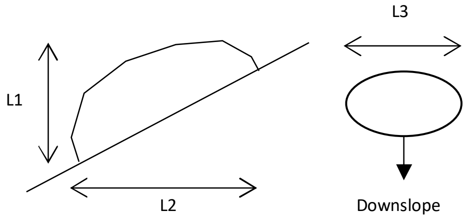
Grouping
S = Single
M = Multiple

Support Type
MS = Matrix Supported
R = Rock
DS = Dense Soil
LS = Loose Soil
Sh = Shotcrete
BS = Boulder Supported
VS = Vegetation Supported
U = Undermined
Other (please specify, e.g. Buttress)

Contact Condition
1 = Buried
2 = Lie firmly
3 = Lie firmly but with overhanging portion
4 = Lie loosely
5 = Lie loosely and with overhanging portion

Vegetation Type (25 m downslope of boulder)
MT = Mature Tree ≥ 100 mm trunk
YT = Young Tree < 100 mm trunk
B = Bushes
O = Other
N/A = No vegetation
Use combinations as necessary

Density of Vegetation
D = Dense (≥ 1/1 m²))
M = Medium (1/25 m² – 1/1 m²)
S = Sparse (< 1/25 m²)



Preventive Works
S = Splitting
I = Infilling of Voids
M = Masonry Buttress
C = Concrete Buttress
SP = Surface Protection
D = Drainage Channel
R = Removal
RD = Rock Dowel
N/A = No Works Required

Risk Rating
L = Low: If movement occurred, it is highly unlikely that the boulder would reach the site area
H = High: If movement occurred, it is possible that the boulder would reach the site area

Stability Rating
L = Low: Active soil erosion removing support from around and/or beneath boulder, movement of boulder possible in the foreseeable future
M = Medium: Some vegetation present in the vicinity of the boulder with no active erosion evident
H = High: Dense vegetation with no active erosion evident in the vicinity of boulder, movement of boulder unlikely in the foreseeable future

Potential Failure Mechanism
R = Rolling: Removal of downhill support would enable boulder to roll forward
T = Toppling: Removal of downhill support would enable boulder to fall from steep slope
S = Sliding: Removal of downhill support would enable boulder to slide down from steep slope
N = Nil

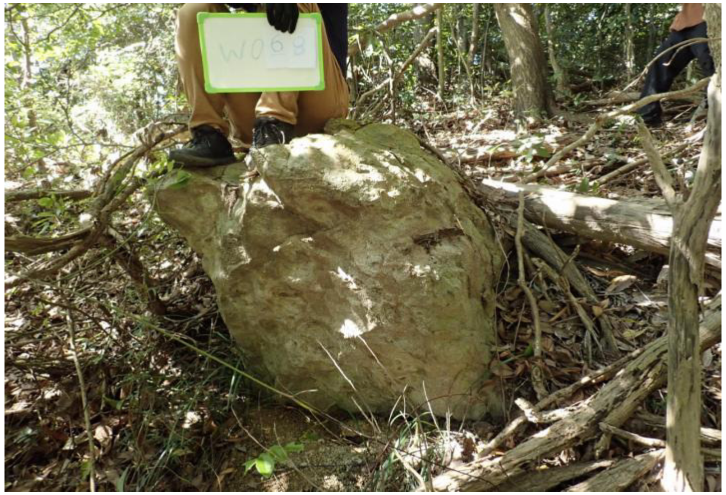
Boulder Investigation Sheet

Project Title: Engineering Study for Proposed New Public Riding School at Tseung Kwan O for the Hong Kong Jockey Club

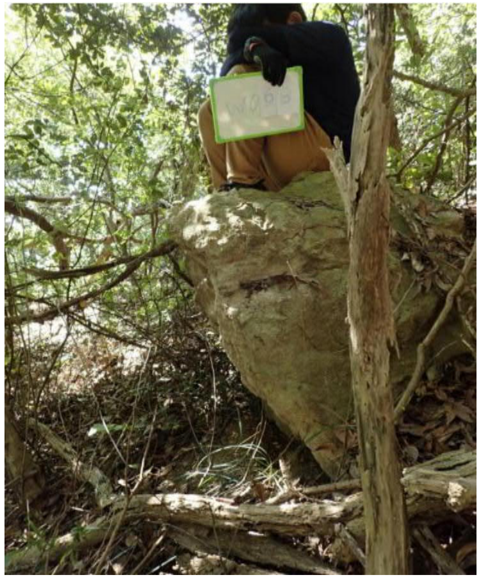
Boulder No.: W068 Compiled by: LS Checked by: AN Date: 10/11/2022

Boulder Characteristics						Boulder Setting Characteristics									(Use combinations as necessary)
Boulder Grouping	Visible Dimensions (m) (Multiple boulders: Maximum Dimensions)			Shape (Angularity)	Form	Support Type	Contact Condition	Local Slope Gradient Below Boulder (°)	Topography	Vegetation Type and Density Downslope	Nearest Proposed Facilities Downslope (Type/Distance) (m) (Paddock, stable blocks, changing room, etc.)	Risk Rating	Stability Rating	Potential Failure Mechanism	In-situ Preventive Works Required
	L1	L2	L3												
S	1.3	1.2	0.9	SA	ED	MS, LS, U	3	30	PS	MT, YT, D	Public riding school, 40	H	L	R	R

Photo:



Upslope View



Cross-section View

Shape (Angularity)
A = Angular
SA = Sub-angular
SR = Sub-rounded
R = Rounded

Form
ED = Equidimensional
F = Flat
E = Elongated
FE = Flat and Elongated

Topography
PS = Planar Slope
VS = Valley Side Slope
S = Spur
LS = Landslide Scar
T = Terrace
CB = Channel Bed
F = Footslope
M = Man-made Slope
C = Cliff

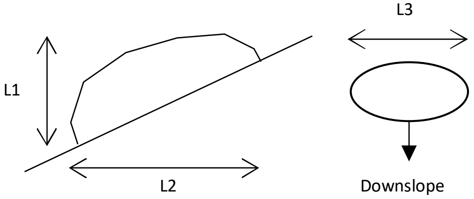
Grouping
S = Single
M = Multiple

Support Type
MS = Matrix Supported
R = Rock
DS = Dense Soil
LS = Loose Soil
Sh = Shotcrete
BS = Boulder Supported
VS = Vegetation Supported
U = Undermined
Other (please specify, e.g. Buttress)

Contact Condition
1 = Buried
2 = Lie firmly
3 = Lie firmly but with overhanging portion
4 = Lie loosely
5 = Lie loosely and with overhanging portion

Vegetation Type (25 m downslope of boulder)
MT = Mature Tree ≥ 100 mm trunk
YT = Young Tree < 100 mm trunk
B = Bushes
O = Other
N/A = No vegetation
Use combinations as necessary

Density of Vegetation
D = Dense (≥ 1/1 m^2))
M = Medium (1/25 m^2 – 1/1 m^2)
S = Sparse (< 1/25 m^2)



Preventive Works
S = Splitting
I = Infilling of Voids
M = Masonry Buttress
C = Concrete Buttress
SP = Surface Protection
D = Drainage Channel
R = Removal
RD = Rock Dowel
N/A = No Works Required

Risk Rating
L = Low: If movement occurred, it is highly unlikely that the boulder would reach the site area
H = High: If movement occurred, it is possible that the boulder would reach the site area

Stability Rating
L = Low: Active soil erosion removing support from around and/or beneath boulder, movement of boulder possible in the foreseeable future
M = Medium: Some vegetation present in the vicinity of the boulder with no active erosion evident
H = High: Dense vegetation with no active erosion evident in the vicinity of boulder, movement of boulder unlikely in the foreseeable future

Potential Failure Mechanism
R = Rolling: Removal of downhill support would enable boulder to roll forward
T = Toppling: Removal of downhill support would enable boulder to fall from steep slope
S = Sliding: Removal of downhill support would enable boulder to slide down from steep slope
N = Nil

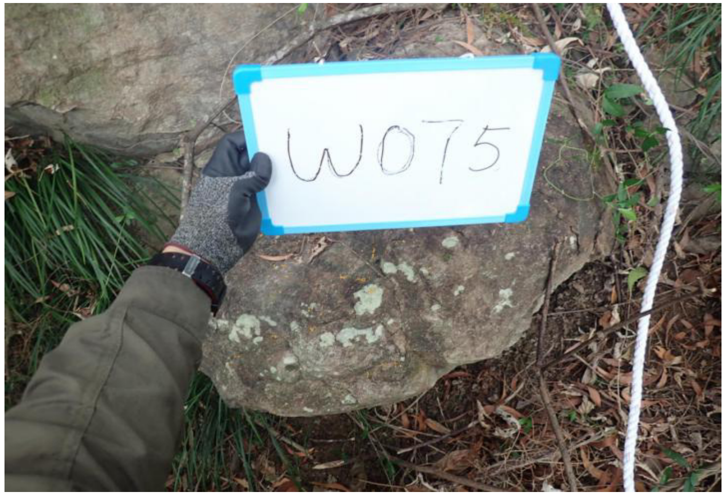
Boulder Investigation Sheet

Project Title: Engineering Study for Proposed New Public Riding School at Tseung Kwan O for the Hong Kong Jockey Club

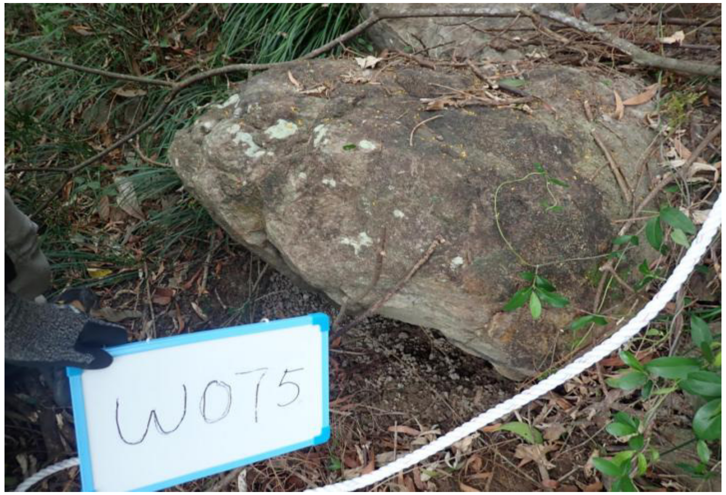
Boulder No.: W075 | Compiled by: LS | Checked by: AN | Date: 14/11/2022

Boulder Characteristics						Boulder Setting Characteristics									(Use combinations as necessary)
Boulder Grouping	Visible Dimensions (m) (Multiple boulders: Maximum Dimensions)			Shape (Angularity)	Form	Support Type	Contact Condition	Local Slope Gradient Below Boulder (°)	Topography	Vegetation Type and Density Downslope	Nearest Proposed Facilities Downslope (Type/Distance) (m) (Paddock, stable blocks, changing room, etc.)	Risk Rating	Stability Rating	Potential Failure Mechanism	In-situ Preventive Works Required
	L1	L2	L3												
S	0.8	0.8	0.9	SA	ED	MS, DS, U	3	20	PS	YT, B, M	Public riding school, 30	H	M	R	R

Photo:



Upslope View



Cross-section View

Shape (Angularity)
A = Angular
SA = Sub-angular
SR = Sub-rounded
R = Rounded

Form
ED = Equidimensional
F = Flat
E = Elongated
FE = Flat and Elongated

Topography
PS = Planar Slope
VS = Valley Side Slope
S = Spur
LS = Landslide Scar
T = Terrace
CB = Channel Bed
F = Footslope
M = Man-made Slope
C = Cliff

Grouping
S = Single
M = Multiple

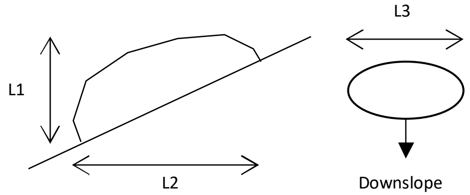
Support Type
MS = Matrix Supported
- R = Rock
- DS = Dense Soil
- LS = Loose Soil
- Sh = Shotcrete

BS = Boulder Supported
VS = Vegetation Supported
U = Undermined
Other (please specify, e.g. Buttress)

Contact Condition
1 = Buried
2 = Lie firmly
3 = Lie firmly but with overhanging portion
4 = Lie loosely
5 = Lie loosely and with overhanging portion

Vegetation Type (25 m downslope of boulder)
MT = Mature Tree ≥ 100 mm trunk
YT = Young Tree < 100 mm trunk
B = Bushes
O = Other
N/A = No vegetation
Use combinations as necessary

Density of Vegetation
D = Dense (≥ 1/1 m^2))
M = Medium (1/25 m^2 – 1/1 m^2)
S = Sparse (< 1/25 m^2)



Preventive Works
S = Splitting
I = Infilling of Voids
M = Masonry Buttress
C = Concrete Buttress
SP = Surface Protection
D = Drainage Channel
R = Removal
RD = Rock Dowel
N/A = No Works Required

Risk Rating
L = Low: If movement occurred, it is highly unlikely that the boulder would reach the site area
H = High: If movement occurred, it is possible that the boulder would reach the site area

Stability Rating
L = Low: Active soil erosion removing support from around and/or beneath boulder, movement of boulder possible in the foreseeable future
M = Medium: Some vegetation present in the vicinity of the boulder with no active erosion evident
H = High: Dense vegetation with no active erosion evident in the vicinity of boulder, movement of boulder unlikely in the foreseeable future

Potential Failure Mechanism
R = Rolling: Removal of downhill support would enable boulder to roll forward
T = Toppling: Removal of downhill support would enable boulder to fall from steep slope
S = Sliding: Removal of downhill support would enable boulder to slide down from steep slope
N = Nil

Appendix F

Boulder Fall Modelling

F1. Introduction

This appendix presents the results of boulder fall analysis for the Study Area preformed by a computer program Colorado Rock Fall Simulation Program (CRSP) Version 4 developed jointly by the Colorado Department of Transport, the Colorado Geological Survey and the Colorado School of Mines. This is a windows based program to assess the velocities and energies of boulders, which have sufficient mobility to affect the facilities located below the Study Area.

F2. Boulder Fall Analysis for the Study Area

Based on the field observation, four potential unstable boulders are identified at the lower portion of Catchment Nos. OH4 and TD7 (Figure F1). The predicted trajectories for these boulders are simulated by the steepest paths generated based on 1:1000 topographic data using the software ArcGIS version 10.3.1. Boulder fall parameters used in the study were based on published data in Chau et al. (1996).

a. Input Parameters:

The behavior of boulders is influenced by slope geometry, slope material properties, rock block geometry and boulder material properties (Table F1). These parameters are estimated from field mapping and with reference to Chau et al, 1996.

Table F1 – Parameters determining behavior of boulder fall

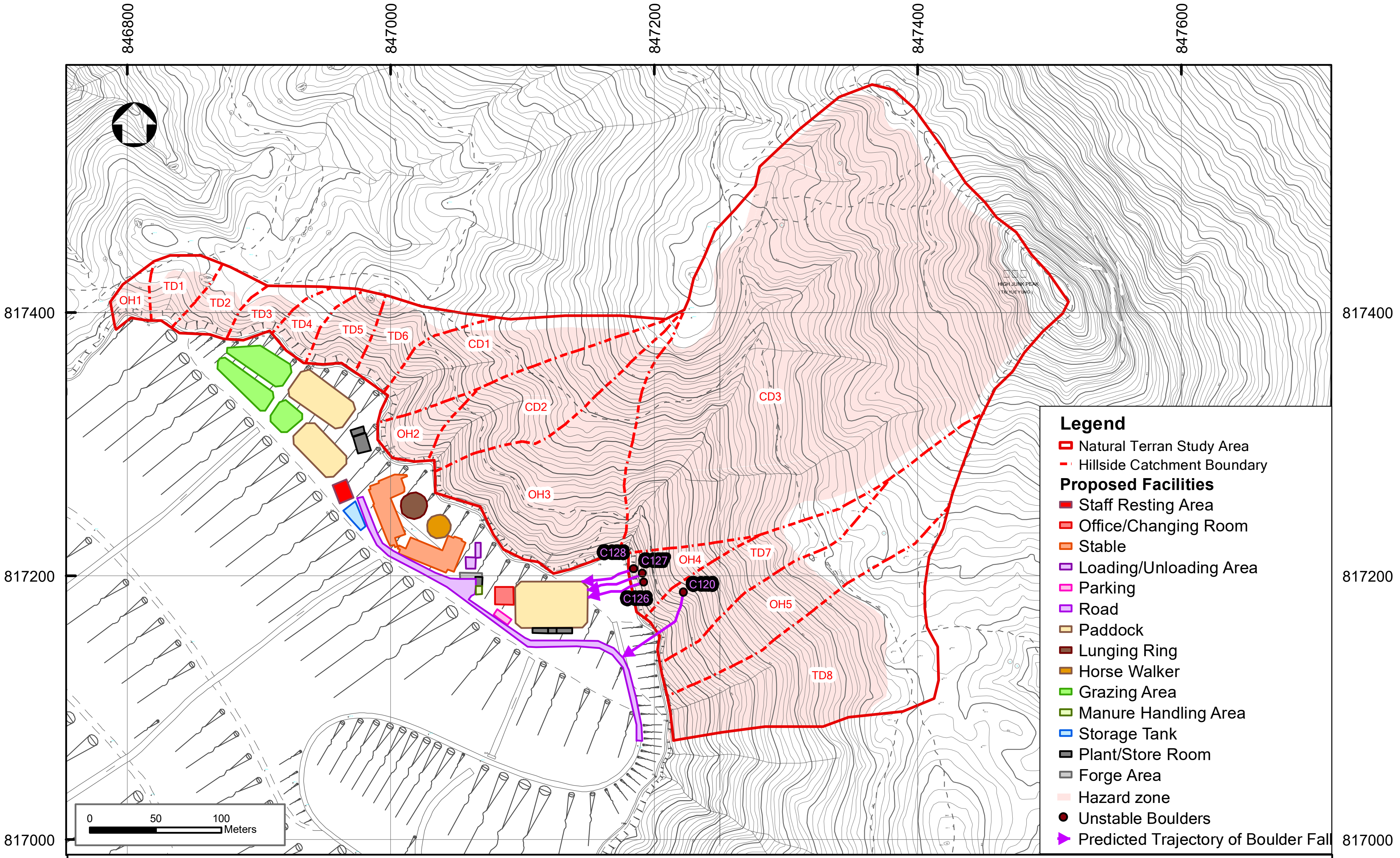
Factors	**Parameters**
Slope Geometry	*Slope inclination*
	Slope length
	Surface roughness
	Lateral variability
Slope Material Properties	*Slope coefficients*
	Rock coefficients
Rock Geometry	*Rock size*
	Rock Shape
Rock Material Properties	*Rock Durability*
	Rock mass

b. Summary of Findings:

The results of analysis are shown in Figures F2 to F5 and summarized in Table F2. Mobility analysis demonstrated that C120, C126, C127 and C128 cannot reach the proposed facilities.

Table F2 – Results of Analysis

Boulder No.	Catchment No.	% of Boulder Passing Analysis Point 1 (AP1, location of proposed facility)	Max. velocity at AP1 (m/s)	Max. bounce height at AP1 (m)	Max. energy at analysis point at AP1 (kJ)
C120	TD7	0	-	-	-
C126	OH4	0	-	-	-
C127	OH4	0	-	-	-
C128	OH4	0	-	-	-


846800
847000
847200
847400
847600
817400
817200
817000
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
CD3
OH2
OH3
OH4
OH5
TD7
TD8
C128
C127
C126
C120
HIGH JUNK PEAK
0
50
100
Meters
Legend
Natural Terran Study Area
Hillside Catchment Boundary
Proposed Facilities
Staff Resting Area
Office/Changing Room
Stable
Loading/Unloading Area
Parking
Road
Paddock
Lunging Ring
Horse Walker
Grazing Area
Manure Handling Area
Storage Tank
Plant/Store Room
Forge Area
Hazard zone
Unstable Boulders
Predicted Trajectory of Boulder Fall

PROJECT: Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Landfill Site (TKOL II/III) in Tseung Kwan O

TITLE: Predicted Trajectory of Boulder Fall

SCALE:
1 :4000

Modern Consulting Engineers Limited
In association with
CALVINT GEO-SERVICES LIMITED

FIGURE NO :
FIGURE F1

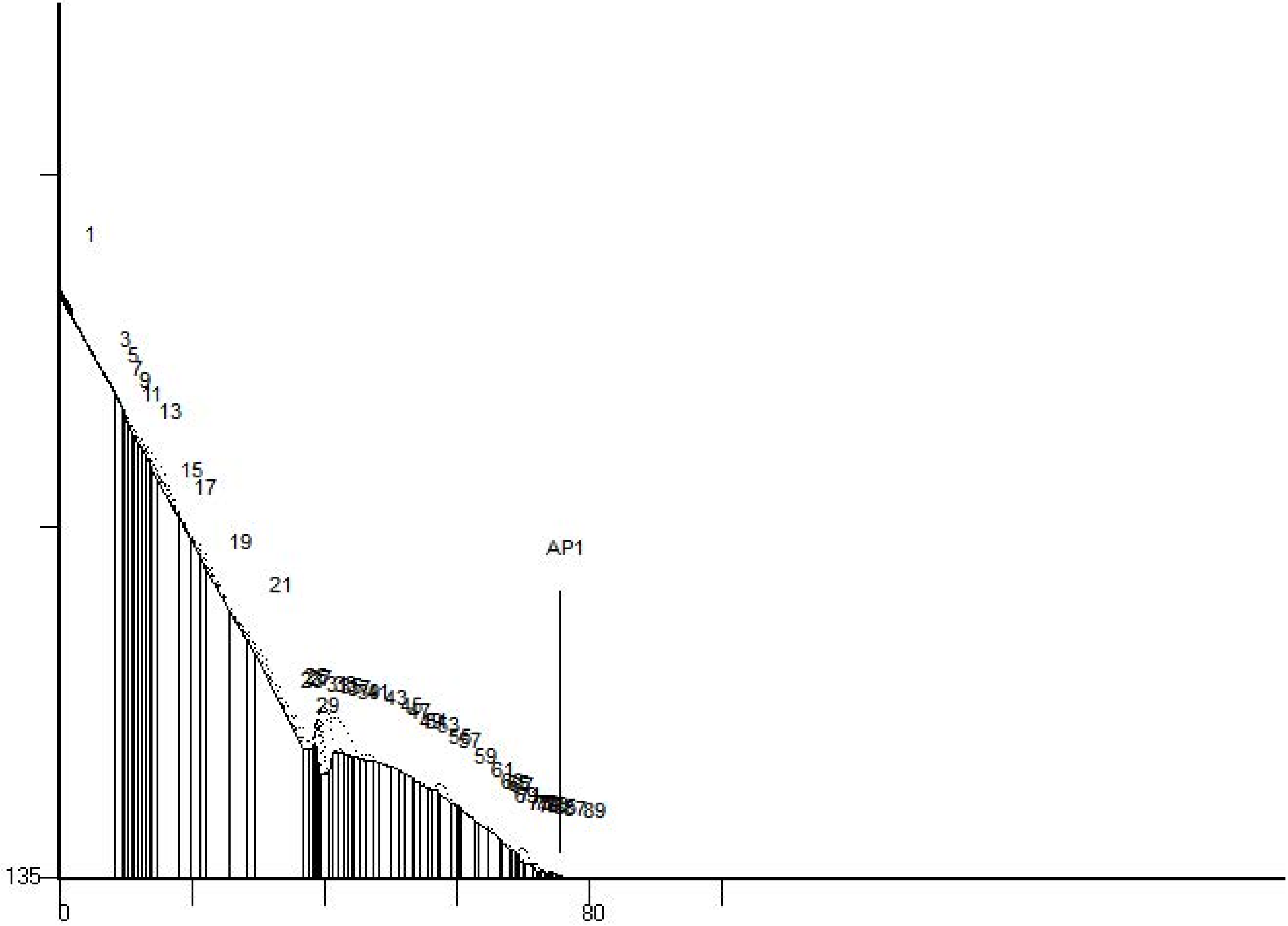


Figure F2 - Boulder Fall Modelling (C120)

CRSP Input File -C:\Users\Tseung Kwan O Landfill NTHS\After comments\Boulder Fall Anaysis\C120\C120.doc

Input File Specifications

Units of Measure: Metric
Total Number of Cells: 89
Analysis Point 1 X-Coordinate: 75.51
Analysis Point 2 X-Coordinate:
Analysis Point 3 X-Coordinate:
Initial Y-Top Starting Zone Coordinate: 168
Initial Y-Base Starting Zone Coordinate: 167

Remarks:

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	0.1	0.567	0.393	0	168	8.067	162.57
2	0.1	0.567	0.393	8.067	162.57	9.255	161.7
3	0.1	0.567	0.393	9.255	161.7	9.706	161.15
4	0.1	0.567	0.393	9.706	161.15	10.241	160.79
5	0.1	0.567	0.393	10.241	160.79	10.684	160.44
6	0.1	0.567	0.393	10.684	160.44	10.986	160.1
7	0.1	0.567	0.393	10.986	160.1	11.548	159.71
8	0.1	0.567	0.393	11.548	159.71	12.18	159.44
9	0.1	0.567	0.393	12.18	159.44	12.67	159.01
10	0.1	0.567	0.393	12.67	159.01	13.284	158.6
11	0.1	0.567	0.393	13.284	158.6	13.798	158.25
12	0.1	0.567	0.393	13.798	158.25	14.599	157.66
13	0.1	0.567	0.393	14.599	157.66	17.673	155.47
14	0.1	0.567	0.393	17.673	155.47	19.446	154.3
15	0.1	0.567	0.393	19.446	154.3	19.629	154.31
16	0.1	0.567	0.393	19.629	154.31	20.952	153.28
17	0.1	0.567	0.393	20.952	153.28	21.881	152.56
18	0.1	0.567	0.393	21.881	152.56	25.425	150.13

19	0.1	0.567	0.393	25.425	150.13	28.027	148.55
20	0.1	0.567	0.393	28.027	148.55	29.218	147.76
21	0.1	0.567	0.393	29.218	147.76	36.725	142.33
22	0.1	0.567	0.393	36.725	142.33	37.387	142.27
23	0.1	0.567	0.393	37.387	142.27	37.966	142.29
24	0.1	0.567	0.393	37.966	142.29	38.167	142.52
25	0.1	0.567	0.393	38.167	142.52	38.404	142.63
26	0.1	0.567	0.393	38.404	142.63	38.625	142.44
27	0.1	0.567	0.393	38.625	142.44	38.983	140.8
28	0.1	0.567	0.393	38.983	140.8	39.243	140.83
29	0.1	0.567	0.393	39.243	140.83	40.545	140.84
30	0.1	0.567	0.393	40.545	140.84	41.01	142.06
31	0.1	0.567	0.393	41.01	142.06	41.792	142.08
32	0.1	0.567	0.393	41.792	142.08	42.681	142.08
33	0.1	0.567	0.393	42.681	142.08	42.868	141.99
34	0.1	0.567	0.393	42.868	141.99	43.273	141.95
35	0.1	0.567	0.393	43.273	141.95	43.96	141.83
36	0.1	0.567	0.393	43.96	141.83	44.335	141.88
37	0.1	0.567	0.393	44.335	141.88	45.303	141.78
38	0.1	0.567	0.393	45.303	141.78	45.953	141.63
39	0.1	0.567	0.393	45.953	141.63	46.187	141.61
40	0.1	0.567	0.393	46.187	141.61	47.232	141.6
41	0.1	0.567	0.393	47.232	141.6	48.188	141.48
42	0.1	0.567	0.393	48.188	141.48	49.846	141.27
43	0.1	0.567	0.393	49.846	141.27	50.948	141.07
44	0.1	0.567	0.393	50.948	141.07	52.025	140.9
45	0.1	0.567	0.393	52.025	140.9	53.171	140.6
46	0.1	0.567	0.393	53.171	140.6	53.381	140.54
47	0.1	0.567	0.393	53.381	140.54	54.266	140.34

48	0.1	0.567	0.393	54.266	140.34	55.564	140.03
49	0.1	0.567	0.393	55.564	140.03	55.933	140
50	0.1	0.567	0.393	55.933	140	56.19	140.03
51	0.1	0.567	0.393	56.19	140.03	56.8	140
52	0.1	0.567	0.393	56.8	140	57.297	139.74
53	0.1	0.567	0.393	57.297	139.74	58.974	139.23
54	0.1	0.567	0.393	58.974	139.23	59.989	139.04
55	0.1	0.567	0.393	59.989	139.04	60.258	138.93
56	0.1	0.567	0.393	60.258	138.93	60.413	138.87
57	0.1	0.567	0.393	60.413	138.87	62.593	138.23
58	0.1	0.567	0.393	62.593	138.23	63.19	138.03
59	0.1	0.567	0.393	63.19	138.03	64.566	137.74
60	0.1	0.567	0.393	64.566	137.74	66.229	137.16
61	0.1	0.567	0.393	66.229	137.16	66.548	137.03
62	0.1	0.567	0.393	66.548	137.03	67.866	136.59
63	0.1	0.567	0.393	67.866	136.59	68.154	136.54
64	0.1	0.567	0.393	68.154	136.54	68.77	136.41
65	0.1	0.567	0.393	68.77	136.41	68.922	136.29
66	0.1	0.567	0.393	68.922	136.29	69.177	136.35
67	0.1	0.567	0.393	69.177	136.35	69.433	136.04
68	0.1	0.567	0.393	69.433	136.04	69.878	135.79
69	0.1	0.567	0.393	69.878	135.79	69.957	135.94
70	0.1	0.567	0.393	69.957	135.94	70.074	135.72
71	0.1	0.567	0.393	70.074	135.72	71.264	135.61
72	0.1	0.567	0.393	71.264	135.61	71.89	135.32
73	0.1	0.567	0.393	71.89	135.32	71.997	135.24
74	0.1	0.567	0.393	71.997	135.24	72.101	135.34
75	0.1	0.567	0.393	72.101	135.34	72.242	135.28
76	0.1	0.567	0.393	72.242	135.28	72.559	135.31

```
 77     0.1   0.567          0.393          72.559         135.31     73.255
135.28
 78     0.1   0.567          0.393          73.255         135.28     73.489
135.26
 79     0.1   0.567          0.393          73.489         135.26     73.691
135.36
 80     0.1   0.567          0.393          73.691         135.36     74.069
135.33
 81     0.1   0.567          0.393          74.069         135.33     74.211
135.36
 82     0.1   0.567          0.393          74.211         135.36     74.402
135.23
 83     0.1   0.567          0.393          74.402         135.23     75.006
135.17
 84     0.1   0.567          0.393          75.006         135.17     75.259
135.15
 85     0.1   0.567          0.393          75.259         135.15     76.579
135.04
 86     0.1   0.567          0.393          76.579         135.04     76.945
135.02
 87     0.1   0.567          0.393          76.945         135.02     78.091
134.93
 88     0.1   0.567          0.393          78.091         134.93     79.87
134.92
 89     0.1   0.567          0.393          79.87          134.92     81.048
134.94
```

```
CRSP Simulation Specifications:  Used with C:\Users\Tseung Kwan O
Landfill NTHS\After comments\Boulder Fall Anaysis\C120\C120.doc


Total Number of Rocks Simulated:  100
Starting Velocity in X-Direction:  0.3 m/sec
Starting Velocity in Y-Direction:  -0.3 m/sec
Starting Cell Number:  1
Ending Cell Number:  89
Rock Density:  2646 kg/m^3
Rock Shape:  Discoidal
Diameter:  0.9 m
Thickness:  1.7 m



CRSP Analysis Point 1 Data - C:\Users\Tseung Kwan O Landfill NTHS\After
comments\Boulder Fall Anaysis\C120\C120.doc


Analysis Point 1: X =  75.51, Y =  135



                            NO ROCKS PAST ANALSYSIS POINT 1
```

CRSP Data Collected at End of Each Cell - C:\Users\Tseung Kwan O Landfill NTHS\After comments\Boulder Fall Anaysis\C120\C120.doc

Velocity Units: m/sec   Bounce Height Units: m

Cell #	Max. Vel.	Avg. Vel.	S.D. Vel.	Max. Bounce Ht.	Avg. Bounce Ht.
1	7	7	.31	0	0
2	8	7	.4	0	0
3	8	8	.47	0	0
4	9	8	.53	0	0
5	9	8	.67	0	0
6	9	8	.78	0	0
7	9	8	.56	1	0
8	9	8	.64	0	0
9	9	8	.78	1	0
10	10	9	1.13	1	0
11	10	9	1.12	1	0
12	10	9	.61	1	0
13	11	10	.88	0	0
14	10	10	.25	0	0
15	10	10	.25	0	0
16	11	11	.22	1	0
17	12	11	.81	1	0
18	14	12	.9	1	0
19	12	11	.39	1	0
20	12	12	.45	1	0
21	14	13	.57	1	0
22	14	13	1.46	1	0
23	14	11	1.65	0	0
24	10	6	2.45	0	0
25	7	4	2.01	1	0
26	7	4	2.43	1	1
27	7	3	2.05	4	2
28	6	4	1.83	4	2
29	6	4	0	3	2
30	6	6	0	2	1
31	6	5	0	2	1
32	6	5	0	2	0
33	6	5	0	2	0
34	7	5	0	1	0
35	7	5	0	1	0
36	8	6	0	1	0
37	6	4	0	0	0
38	6	5	0	0	0
39	6	4	0	0	0
40	6	6	0	0	0
41	6	6	0	0	0
42	6	6	0	0	-1
43	6	6	0	0	-1
44	6	6	0	0	0
45	6	6	0	0	0
46	6	6	0	0	0
47	5	5	0	0	0
48	6	6	0	0	0

```
 49            6             6             0             0            -1
 50            5             5             0             0             0
 51            4             4             0             0             0
 52            4             4             0             1             0
 53            6             6             0             0             0
 54            5             5             0             0             0
 55            5             5             0             0             0
 56            5             5             0             0             0
 57            5             5             0             0             0
 58            5             5             0             0             0
 59            5             5             0             0             0
 60            6             6             0             0            -1
 61            5             5             0             0             0
 62            5             5             0             0             0
 63            6             6             0             0             0
 64            6             6             0             0            -1
 65            6             6             0             0             0
 66            4             4             0             0             0
 67            3             3             0             1             0
 68            3             3             0             1             0
 69            3             3             0             1             0
 70            3             3             0             1             0
 71            3             3             0             0             0
 72            2             2             0             0             0
 73            3             3             0             0             0
 74            3             3             0             0             0
 75            3             3             0             0             0
 76            2             2             0             0             0
 77           No rocks      past end of cell
 78           No rocks      past end of cell
 79           No rocks      past end of cell
 80           No rocks      past end of cell
 81           No rocks      past end of cell
 82           No rocks      past end of cell
 83           No rocks      past end of cell
 84           No rocks      past end of cell
 85           No rocks      past end of cell
 86           No rocks      past end of cell
 87           No rocks      past end of cell
 88           No rocks      past end of cell
 89           No rocks      past end of cell
```

CRSP Rocks Stopped Data - C:\Users\Tseung Kwan O Landfill NTHS\After comments\Boulder Fall Anaysis\C120\C120.doc

```
                              X Interval                   Rocks Stopped

                             0 To  10 m                    94
                             10 To  20 m                    0
                             20 To  30 m                    0
                             30 To  40 m                    2
                             40 To  50 m                    3
                             50 To  60 m                    0
                             60 To  70 m                    0
                             70 To  80 m                    1
                             80 To  81.048 m                0
```

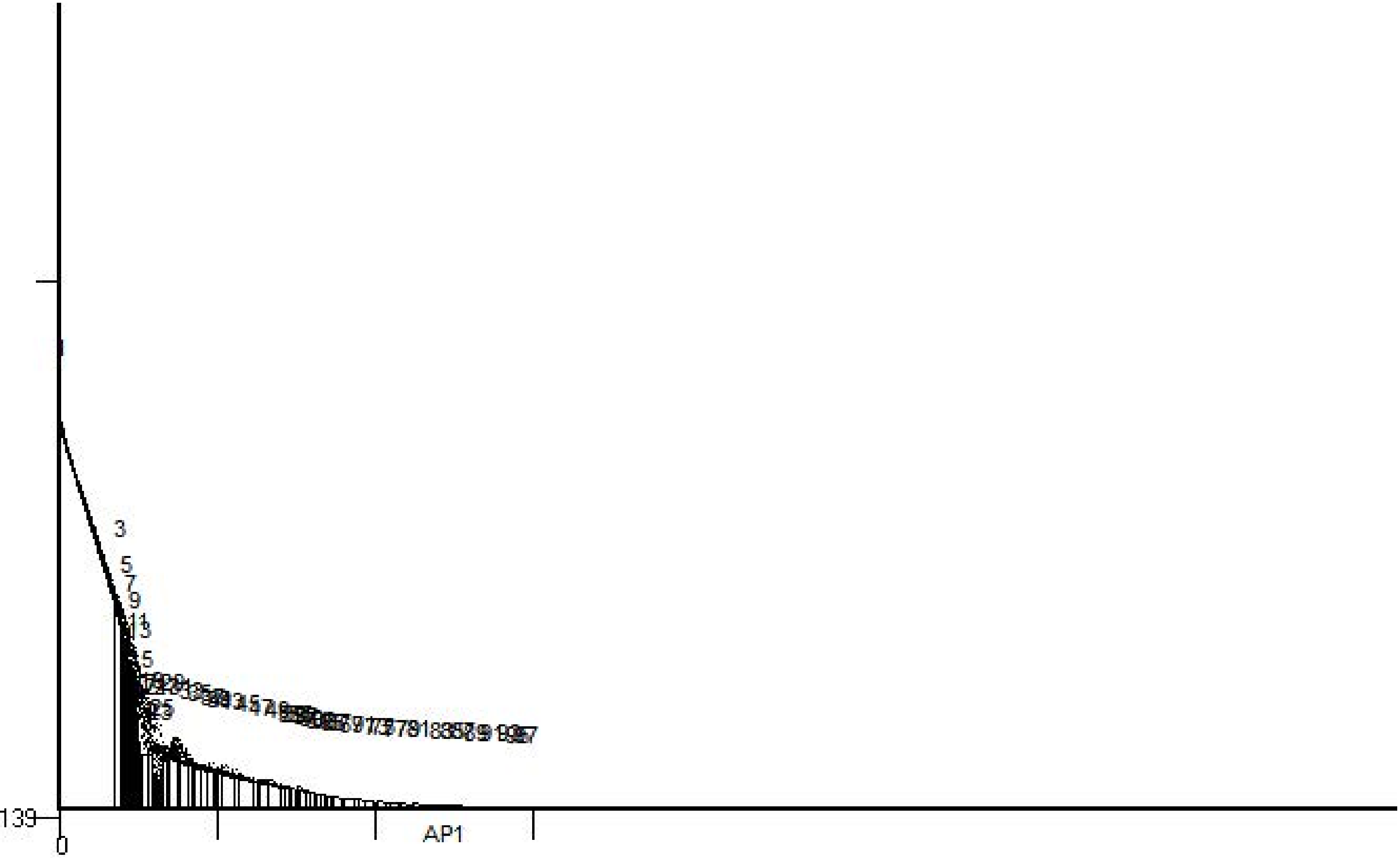


Figure F3 - Boulder Fall Modelling (C126)

CRSP Input File –C:\Users\ Tseung Kwan O Landfill NTHS\After comments\Boulder Fall Anaysis\C126\C126.doc

Input File Specifications

Units of Measure: Metric
Total Number of Cells: 97
Analysis Point 1 X-Coordinate: 48.07
Analysis Point 2 X-Coordinate:
Analysis Point 3 X-Coordinate: 0
Initial Y-Top Starting Zone Coordinate: 154
Initial Y-Base Starting Zone Coordinate: 153

Remarks:

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	.1	.567	.393	0	154	.14	153.53
2	.1	.567	.393	.14	153.53	7.102	147
3	.1	.567	.393	7.102	147	7.832	146.12
4	.1	.567	.393	7.832	146.12	7.972	145.67
5	.1	.567	.393	7.972	145.67	8.392	145.32
6	.1	.567	.393	8.392	145.32	8.6	144.96
7	.1	.567	.393	8.6	144.96	8.882	144.62
8	.1	.567	.393	8.882	144.62	9.154	144.39
9	.1	.567	.393	9.154	144.39	9.479	144.01
10	.1	.567	.393	9.479	144.01	9.576	143.6
11	.1	.567	.393	9.576	143.6	9.698	143.22
12	.1	.567	.393	9.698	143.22	9.747	143.26
13	.1	.567	.393	9.747	143.26	9.921	142.73
14	.1	.567	.393	9.921	142.73	10.086	142.13
15	.1	.567	.393	10.086	142.13	10.235	141.57
16	.1	.567	.393	10.235	141.57	10.541	141.32
17	.1	.567	.393	10.541	141.32	10.549	141.34
18	.1	.567	.393	10.549	141.34	11.288	141.36

```
 19     .1    .567          .393          11.288        141.36     11.72
141.37
 20     .1    .567          .393          11.72         141.37     11.894
141.1
 21     .1    .567          .393          11.894        141.1     12.011
140.24
 22     .1    .567          .393          12.011        140.24     12.443
140.17
 23     .1    .567          .393          12.443        140.17     12.65
140.34
 24     .1    .567          .393          12.65         140.34     12.718
140.35
 25     .1    .567          .393          12.718        140.35     12.933
140.24
 26     .1    .567          .393          12.933        140.24     13.108
141.15
 27     .1    .567          .393          13.108        141.15     13.712
141.2
 28     .1    .567          .393          13.712        141.2     13.966
141.33
 29     .1    .567          .393          13.966        141.33     14.084
141.2
 30     .1    .567          .393          14.084        141.2     15.041
141.11
 31     .1    .567          .393          15.041        141.11     15.263
141.06
 32     .1    .567          .393          15.263        141.06     16.251
140.97
 33     .1    .567          .393          16.251        140.97     16.892
140.93
 34     .1    .567          .393          16.892        140.93     17.226
140.86
 35     .1    .567          .393          17.226        140.86     17.888
140.81
 36     .1    .567          .393          17.888        140.81     18.786
140.75
 37     .1    .567          .393          18.786        140.75     19.471
140.71
 38     .1    .567          .393          19.471        140.71     19.715
140.65
 39     .1    .567          .393          19.715        140.65     20.093
140.68
 40     .1    .567          .393          20.093        140.68     20.134
140.68
 41     .1    .567          .393          20.134        140.68     20.537
140.64
 42     .1    .567          .393          20.537        140.64     20.632
140.61
 43     .1    .567          .393          20.632        140.61     22.263
140.53
 44     .1    .567          .393          22.263        140.53     22.702
140.5
 45     .1    .567          .393          22.702        140.5     24.509
140.35
 46     .1    .567          .393          24.509        140.35     25.288
140.32
 47     .1    .567          .393          25.288        140.32     25.467
140.29
```

48	.1	.567	.393	25.467	140.29	26.628	140.26
49	.1	.567	.393	26.628	140.26	28.196	140.15
50	.1	.567	.393	28.196	140.15	28.638	140.13
51	.1	.567	.393	28.638	140.13	29.289	140.06
52	.1	.567	.393	29.289	140.06	29.444	140.09
53	.1	.567	.393	29.444	140.09	29.847	140.04
54	.1	.567	.393	29.847	140.04	30.297	140.08
55	.1	.567	.393	30.297	140.08	30.389	140.01
56	.1	.567	.393	30.389	140.01	30.632	140.02
57	.1	.567	.393	30.632	140.02	31.262	139.98
58	.1	.567	.393	31.262	139.98	31.405	139.99
59	.1	.567	.393	31.405	139.99	31.752	139.94
60	.1	.567	.393	31.752	139.94	32.503	139.88
61	.1	.567	.393	32.503	139.88	32.538	139.9
62	.1	.567	.393	32.538	139.9	33.1	139.88
63	.1	.567	.393	33.1	139.88	33.633	139.85
64	.1	.567	.393	33.633	139.85	34.067	139.83
65	.1	.567	.393	34.067	139.83	34.507	139.78
66	.1	.567	.393	34.507	139.78	34.815	139.77
67	.1	.567	.393	34.815	139.77	35.793	139.75
68	.1	.567	.393	35.793	139.75	36.084	139.73
69	.1	.567	.393	36.084	139.73	37.336	139.7
70	.1	.567	.393	37.336	139.7	38.099	139.69
71	.1	.567	.393	38.099	139.69	38.897	139.62
72	.1	.567	.393	38.897	139.62	39.745	139.62
73	.1	.567	.393	39.745	139.62	40.102	139.6
74	.1	.567	.393	40.102	139.6	40.414	139.62
75	.1	.567	.393	40.414	139.62	41.368	139.6
76	.1	.567	.393	41.368	139.6	42.048	139.57

```
 77     .1    .567          .393          42.048        139.57     42.969
139.57
 78     .1    .567          .393          42.969        139.57     43.179
139.55
 79     .1    .567          .393          43.179        139.55     44.774
139.52
 80     .1    .567          .393          44.774        139.52     44.799
139.55
 81     .1    .567          .393          44.799        139.55     46.007
139.5
 82     .1    .567          .393          46.007        139.5     47.973
139.49
 83     .1    .567          .393          47.973        139.49     48.315
139.48
 84     .1    .567          .393          48.315        139.48     49.305
139.45
 85     .1    .567          .393          49.305        139.45     50.109
139.48
 86     .1    .567          .393          50.109        139.48     50.983
139.48
 87     .1    .567          .393          50.983        139.48     51.031
139.43
 88     .1    .567          .393          51.031        139.43     52.15
139.42
 89     .1    .567          .393          52.15         139.42     52.767
139.36
 90     .1    .567          .393          52.767        139.36     54.347
139.38
 91     .1    .567          .393          54.347        139.38     55.05
139.37
 92     .1    .567          .393          55.05         139.37     56.473
139.38
 93     .1    .567          .393          56.473        139.38     56.997
139.37
 94     .1    .567          .393          56.997        139.37     57.467
139.36
 95     .1    .567          .393          57.467        139.36     58.054
139.36
 96     .1    .567          .393          58.054        139.36     58.61
139.36
 97     .1    .567          .393          58.61         139.36     59.072
139.34


CRSP Simulation Specifications:  Used with C:\Users\Tseung Kwan O
Landfill NTHS\After comments\Boulder Fall Anaysis\C126\C126.doc


Total Number of Rocks Simulated:  100
Starting Velocity in X-Direction:  0.3 m/sec
Starting Velocity in Y-Direction:  -0.3 m/sec
Starting Cell Number:  1
Ending Cell Number:  97
Rock Density:  2646 kg/m^3
Rock Shape:  Discoidal
Diameter:  0.8 m
Thickness:  1 m
```

CRSP Analysis Point 1 Data - C:\Users\Tseung Kwan O Landfill NTHS\After comments\Boulder Fall Anaysis\C126\C126.doc

Analysis Point 1: X = 48.07, Y = 139

NO ROCKS PAST ANALSYSIS POINT 1

CRSP Data Collected at End of Each Cell - C:\Users\Tseung Kwan O Landfill NTHS\After comments\Boulder Fall Anaysis\C126\C126.doc

Velocity Units: m/sec Bounce Height Units: m

Cell #	Max. Vel.	Avg. Vel.	S.D. Vel.	Max. Bounce Ht.	Avg. Bounce Ht.
1	4	2	1.05	0	0
2	9	8	.59	1	0
3	10	9	.64	1	0
4	10	9	.65	1	0
5	11	9	.76	1	0
6	11	10	.77	1	0
7	12	10	.79	2	0
8	12	10	.94	2	0
9	12	10	.98	2	0
10	12	10	1.01	2	0
11	12	10	1.05	2	1
12	12	10	1.06	2	0
13	13	10	1.11	2	1
14	13	11	1.16	3	1
15	13	11	1.2	3	2
16	13	11	1.28	3	1
17	13	11	1.29	3	1
18	13	10	3.14	3	0
19	13	8	3.46	2	0
20	13	8	3.6	2	0
21	14	8	3.69	3	1
22	14	9	3.93	3	1
23	14	8	3.76	2	1
24	14	8	3.75	2	1
25	14	8	3.48	2	1
26	12	6	2.73	1	0
27	12	6	2.25	0	0
28	7	4	1.36	0	0
29	7	4	1.47	0	0
30	7	4	1.22	1	0
31	7	4	1.15	1	0
32	7	4	1.27	1	0

33	7	4	1.35	0	0
34	7	4	1.29	0	0
35	8	4	1.21	0	0
36	7	4	1.03	0	0
37	6	4	1.11	0	0
38	6	4	1.07	0	0
39	6	4	1.06	0	0
40	6	4	1.07	0	0
41	6	4	1.11	0	0
42	6	4	1.09	0	0
43	6	4	.94	0	0
44	6	4	.82	0	0
45	5	4	.85	0	0
46	5	4	.69	0	0
47	5	4	.74	0	0
48	4	4	.49	0	0
49	4	3	.81	0	0
50	4	3	0	0	0
51	4	4	0	0	0
52	4	4	0	0	-1
53	4	4	0	0	0
54	4	3	0	0	0
55	4	3	0	0	0
56	4	3	0	0	0
57	3	3	0	0	0
58	4	3	0	0	0
59	3	3	0	0	0
60	3	3	0	0	0
61	3	3	0	0	-1
62	No rocks	past end of cell			
63	No rocks	past end of cell			
64	No rocks	past end of cell			
65	No rocks	past end of cell			
66	No rocks	past end of cell			
67	No rocks	past end of cell			
68	No rocks	past end of cell			
69	No rocks	past end of cell			
70	No rocks	past end of cell			
71	No rocks	past end of cell			
72	No rocks	past end of cell			
73	No rocks	past end of cell			
74	No rocks	past end of cell			
75	No rocks	past end of cell			
76	No rocks	past end of cell			
77	No rocks	past end of cell			
78	No rocks	past end of cell			
79	No rocks	past end of cell			
80	No rocks	past end of cell			
81	No rocks	past end of cell			
82	No rocks	past end of cell			
83	No rocks	past end of cell			
84	No rocks	past end of cell			
85	No rocks	past end of cell			
86	No rocks	past end of cell			
87	No rocks	past end of cell			
88	No rocks	past end of cell			
89	No rocks	past end of cell			
90	No rocks	past end of cell			

```
 91           No rocks      past end of cell
 92           No rocks      past end of cell
 93           No rocks      past end of cell
 94           No rocks      past end of cell
 95           No rocks      past end of cell
 96           No rocks      past end of cell
 97           No rocks      past end of cell


CRSP Rocks Stopped Data - C:\Users\Tseung Kwan O Landfill NTHS\After
comments\Boulder Fall Anaysis\C126\C126.doc

                              X Interval                 Rocks Stopped

                             0 To  10 m                    4
                             10 To  20 m                   70
                             20 To  30 m                   24
                             30 To  40 m                   2
                             40 To  50 m                   0
                             50 To  59.072 m               0
```

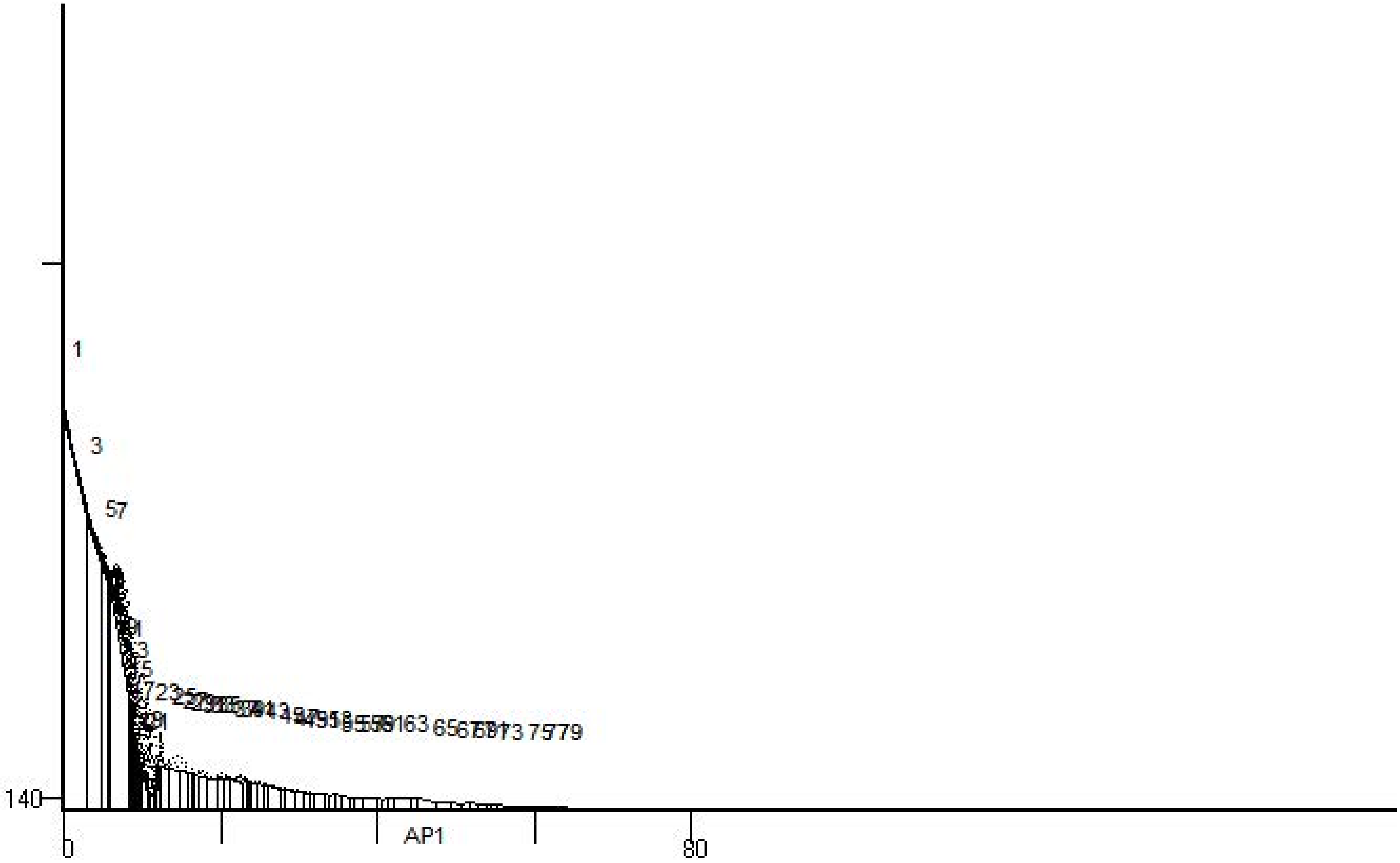


Figure F4 - Boulder Fall Modelling (C127)

CRSP Input File -C:\Users\Tseung Kwan O Landfill NTHS\After comments\Boulder Fall Anaysis\C127\C127.doc

Input File Specifications

Units of Measure: Metric
Total Number of Cells: 79
Analysis Point 1 X-Coordinate: 45.2
Analysis Point 2 X-Coordinate:
Analysis Point 3 X-Coordinate:
Initial Y-Top Starting Zone Coordinate: 154.2
Initial Y-Base Starting Zone Coordinate: 153.2

Remarks:

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	0.1	0.567	0.393	0	154.2	2.853	150.58
2	0.1	0.567	0.393	2.853	150.58	2.993	150.39
3	0.1	0.567	0.393	2.993	150.39	4.82	148.72
4	0.1	0.567	0.393	4.82	148.72	5.698	148.02
5	0.1	0.567	0.393	5.698	148.02	5.847	147.86
6	0.1	0.567	0.393	5.847	147.86	5.984	147.94
7	0.1	0.567	0.393	5.984	147.94	8.166	143.83
8	0.1	0.567	0.393	8.166	143.83	8.438	143.62
9	0.1	0.567	0.393	8.438	143.62	8.441	143.73
10	0.1	0.567	0.393	8.441	143.73	8.481	143.53
11	0.1	0.567	0.393	8.481	143.53	8.724	143.35
12	0.1	0.567	0.393	8.724	143.35	8.935	142.79
13	0.1	0.567	0.393	8.935	142.79	9.104	142.27
14	0.1	0.567	0.393	9.104	142.27	9.36	142.05
15	0.1	0.567	0.393	9.36	142.05	9.474	141.55
16	0.1	0.567	0.393	9.474	141.55	9.757	141.28
17	0.1	0.567	0.393	9.757	141.28	9.967	141.11
18	0.1	0.567	0.393	9.967	141.11	10.736	140.2

```
 19     0.1   0.567          0.393          10.736         140.2     11.064
140.07
 20     0.1   0.567          0.393          11.064         140.07     11.54
140.08
 21     0.1   0.567          0.393          11.54          140.08     11.633
140.03
 22     0.1   0.567          0.393          11.633         140.03     12.33
141.18
 23     0.1   0.567          0.393          12.33          141.18     13.476
141.11
 24     0.1   0.567          0.393          13.476         141.11     14.701
141.02
 25     0.1   0.567          0.393          14.701         141.02     15.646
140.96
 26     0.1   0.567          0.393          15.646         140.96     16.29
140.91
 27     0.1   0.567          0.393          16.29          140.91     16.714
140.86
 28     0.1   0.567          0.393          16.714         140.86     17.108
140.81
 29     0.1   0.567          0.393          17.108         140.81     18.07
140.76
 30     0.1   0.567          0.393          18.07          140.76     18.298
140.74
 31     0.1   0.567          0.393          18.298         140.74     19.485
140.71
 32     0.1   0.567          0.393          19.485         140.71     19.517
140.72
 33     0.1   0.567          0.393          19.517         140.72     20.224
140.72
 34     0.1   0.567          0.393          20.224         140.72     20.356
140.72
 35     0.1   0.567          0.393          20.356         140.72     21.046
140.68
 36     0.1   0.567          0.393          21.046         140.68     22.764
140.6
 37     0.1   0.567          0.393          22.764         140.6     23.164
140.61
 38     0.1   0.567          0.393          23.164         140.61     23.526
140.58
 39     0.1   0.567          0.393          23.526         140.58     23.937
140.56
 40     0.1   0.567          0.393          23.937         140.56     24.715
140.53
 41     0.1   0.567          0.393          24.715         140.53     25.469
140.52
 42     0.1   0.567          0.393          25.469         140.52     26.062
140.47
 43     0.1   0.567          0.393          26.062         140.47     27.696
140.35
 44     0.1   0.567          0.393          27.696         140.35     28.245
140.32
 45     0.1   0.567          0.393          28.245         140.32     29.438
140.25
 46     0.1   0.567          0.393          29.438         140.25     30.578
140.22
 47     0.1   0.567          0.393          30.578         140.22     30.586
140.19
```

```
 48     0.1   0.567         0.393         30.586        140.19     31.447
140.17
 49     0.1   0.567         0.393         31.447        140.17     31.956
140.16
 50     0.1   0.567         0.393         31.956        140.16     33.144
140.16
 51     0.1   0.567         0.393         33.144        140.16     33.665
140.11
 52     0.1   0.567         0.393         33.665        140.11     34.574
140.15
 53     0.1   0.567         0.393         34.574        140.15     35.362
140.11
 54     0.1   0.567         0.393         35.362        140.11     36.295
140.05
 55     0.1   0.567         0.393         36.295        140.05     37.05
140.05
 56     0.1   0.567         0.393         37.05         140.05     38.097
140.01
 57     0.1   0.567         0.393         38.097        140.01     39.813
139.99
 58     0.1   0.567         0.393         39.813        139.99     39.944
140
 59     0.1   0.567         0.393         39.944        140     40.577
139.96
 60     0.1   0.567         0.393         40.577        139.96     41.245
140.01
 61     0.1   0.567         0.393         41.245        140.01     42.192
140.02
 62     0.1   0.567         0.393         42.192        140.02     44.171
139.98
 63     0.1   0.567         0.393         44.171        139.98     45.022
139.99
 64     0.1   0.567         0.393         45.022        139.99     47.488
139.83
 65     0.1   0.567         0.393         47.488        139.83     49.362
139.82
 66     0.1   0.567         0.393         49.362        139.82     50.737
139.79
 67     0.1   0.567         0.393         50.737        139.79     51.648
139.82
 68     0.1   0.567         0.393         51.648        139.82     52.881
139.8
 69     0.1   0.567         0.393         52.881        139.8     53.867
139.78
 70     0.1   0.567         0.393         53.867        139.78     54.469
139.77
 71     0.1   0.567         0.393         54.469        139.77     55.151
139.78
 72     0.1   0.567         0.393         55.151        139.78     56.345
139.67
 73     0.1   0.567         0.393         56.345        139.67     57.209
139.7
 74     0.1   0.567         0.393         57.209        139.7     59.931
139.68
 75     0.1   0.567         0.393         59.931        139.68     60.792
139.7
 76     0.1   0.567         0.393         60.792        139.7     62.359
139.68
```

```
 77     0.1   0.567         0.393         62.359        139.68     62.76
139.69
 78     0.1   0.567         0.393         62.76         139.69     63.674
139.68
 79     0.1   0.567         0.393         63.674        139.68     64.743
139.57


CRSP Simulation Specifications:  Used with C:\Users\Tseung Kwan O
Landfill NTHS\After comments\Boulder Fall Anaysis\C127\C127.doc


Total Number of Rocks Simulated:  100
Starting Velocity in X-Direction:  0.3 m/sec
Starting Velocity in Y-Direction:  -0.3 m/sec
Starting Cell Number:  1
Ending Cell Number:  79
Rock Density:  2646 kg/m^3
Rock Shape:  Discoidal
Diameter:  0.8 m
Thickness:  1.1 m



CRSP Analysis Point 1 Data - C:\Users\Tseung Kwan O Landfill NTHS\After
comments\Boulder Fall Anaysis\C127\C127.doc


Analysis Point 1: X =  45.2, Y =  140




                            NO ROCKS PAST ANALSYSIS POINT 1



CRSP Data Collected at End of Each Cell -
C:\Users\Esther\Desktop\Freelance\# NTHS\005_Modern_Tseung Kwan O
Landfill NTHS\After comments\Boulder Fall Anaysis\C127\C127.doc


Velocity Units: m/sec       Bounce Height Units: m


Cell #   Max. Vel.   Avg. Vel.   S.D. Vel.   Max. Bounce Ht.   Avg.
Bounce Ht.

 1             7             6             .49           0             0
 2             8             6             .52           0             0
 3             8             7             .4            1             0
 4             9             8             .6            1             0
 5             9             8             .62           1             0
 6             9             6             2.1           0             0
 7             12            9             1.77          4             1
 8             12            9             1.87          3             1
 9             12            10            1.74          3             1
```

10	12	10	1.73	3	1
11	13	10	1.88	3	1
12	13	10	1.9	3	1
13	13	10	1.92	3	1
14	14	11	2.11	3	1
15	14	11	2.13	4	1
16	14	11	2.32	4	1
17	14	11	2.46	4	1
18	15	11	2.46	4	1
19	15	10	2.54	3	0
20	14	9	3.1	2	0
21	14	9	3.17	2	0
22	13	6	5.31	1	0
23	7	5	0	0	0
24	7	7	0	1	0
25	7	7	0	0	0
26	8	7	0	0	0
27	7	7	0	0	0
28	7	6	0	0	0
29	7	6	0	0	0
30	7	6	0	0	0
31	6	6	0	0	0
32	6	6	0	0	0
33	6	6	0	0	0
34	6	6	0	0	0
35	6	5	0	0	0
36	5	5	0	0	0
37	5	5	0	0	0
38	5	5	0	0	0
39	6	5	0	0	-1
40	5	4	0	0	0
41	5	4	0	0	0
42	5	4	0	0	0
43	4	4	0	0	0
44	4	4	0	0	0
45	4	4	0	0	0
46	3	3	0	0	0
47	3	3	0	0	0
48	3	3	0	0	0
49	3	3	0	0	-1
50	No rocks	past end of cell			
51	No rocks	past end of cell			
52	No rocks	past end of cell			
53	No rocks	past end of cell			
54	No rocks	past end of cell			
55	No rocks	past end of cell			
56	No rocks	past end of cell			
57	No rocks	past end of cell			
58	No rocks	past end of cell			
59	No rocks	past end of cell			
60	No rocks	past end of cell			
61	No rocks	past end of cell			
62	No rocks	past end of cell			
63	No rocks	past end of cell			
64	No rocks	past end of cell			
65	No rocks	past end of cell			
66	No rocks	past end of cell			
67	No rocks	past end of cell			

```
 68            No rocks      past end of cell
 69            No rocks      past end of cell
 70            No rocks      past end of cell
 71            No rocks      past end of cell
 72            No rocks      past end of cell
 73            No rocks      past end of cell
 74            No rocks      past end of cell
 75            No rocks      past end of cell
 76            No rocks      past end of cell
 77            No rocks      past end of cell
 78            No rocks      past end of cell
 79            No rocks      past end of cell


CRSP Rocks Stopped Data - C:\Users\Tseung Kwan O Landfill NTHS\After
comments\Boulder Fall Anaysis\C127\C127.doc

                              X Interval                   Rocks Stopped

                             0 To  10 m                   15
                             10 To  20 m                   82
                             20 To  30 m                   1
                             30 To  40 m                   2
                             40 To  50 m                   0
                             50 To  60 m                   0
                             60 To  64.743 m               0
```

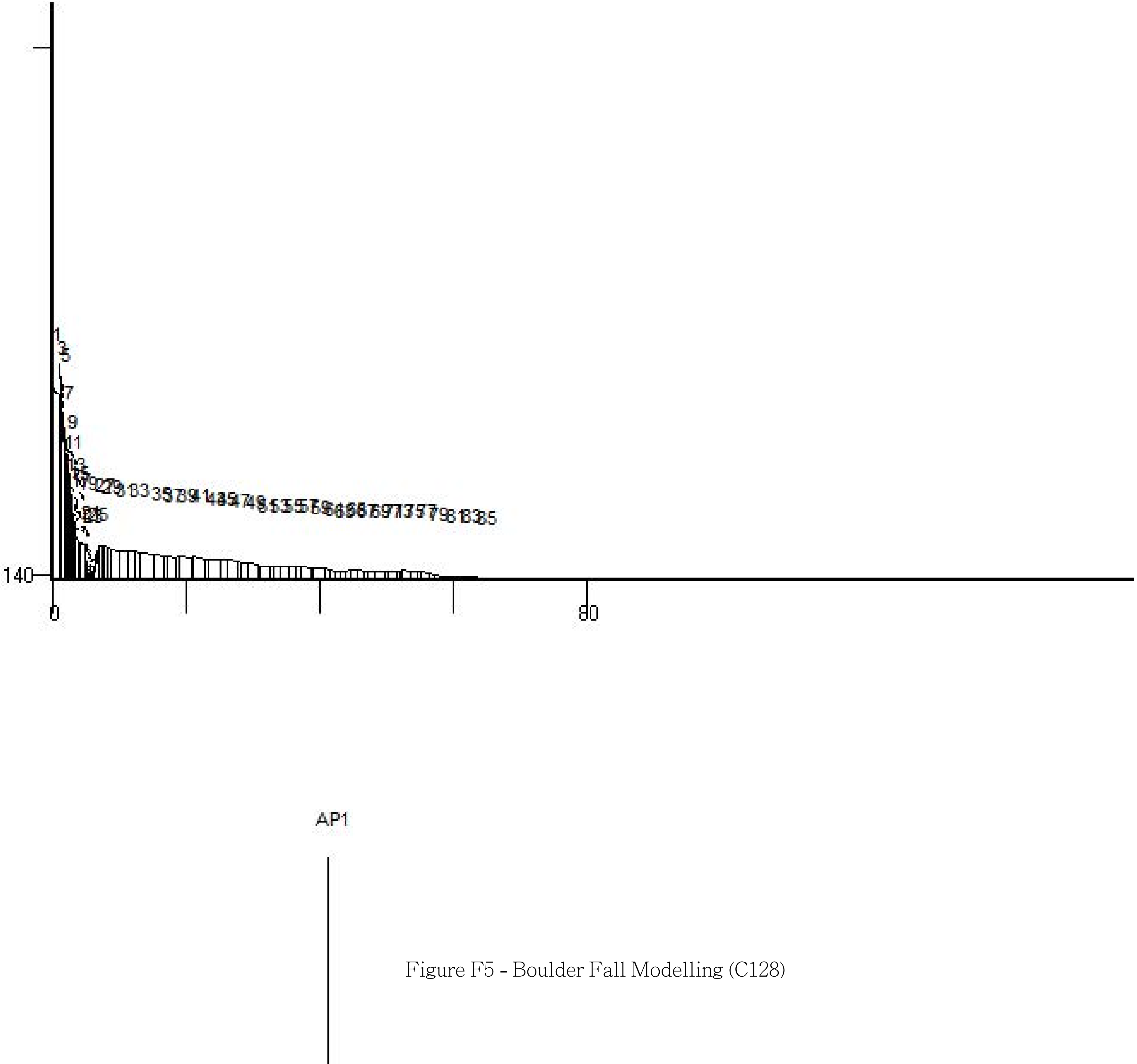


Figure F5 - Boulder Fall Modelling (C128)

CRSP Input File -C:\Users\Tseung Kwan O Landfill NTHS\After comments\Boulder Fall Anaysis\C128\C128.doc

Input File Specifications

Units of Measure: Metric
Total Number of Cells: 85
Analysis Point 1 X-Coordinate: 41.3
Analysis Point 2 X-Coordinate:
Analysis Point 3 X-Coordinate:
Initial Y-Top Starting Zone Coordinate: 147
Initial Y-Base Starting Zone Coordinate: 146

Remarks:

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	0.1	0.567	0.393	0	147	1.093	146.81
2	0.1	0.567	0.393	1.093	146.81	1.182	146.31
3	0.1	0.567	0.393	1.182	146.31	1.289	146.32
4	0.1	0.567	0.393	1.289	146.32	1.44	146.03
5	0.1	0.567	0.393	1.44	146.03	1.966	144.67
6	0.1	0.567	0.393	1.966	144.67	2.166	144.63
7	0.1	0.567	0.393	2.166	144.63	2.243	143.87
8	0.1	0.567	0.393	2.243	143.87	2.632	143.51
9	0.1	0.567	0.393	2.632	143.51	2.665	143.39
10	0.1	0.567	0.393	2.665	143.39	2.82	142.71
11	0.1	0.567	0.393	2.82	142.71	3.05	142.12
12	0.1	0.567	0.393	3.05	142.12	3.25	141.88
13	0.1	0.567	0.393	3.25	141.88	3.345	142
14	0.1	0.567	0.393	3.345	142	3.417	141.6
15	0.1	0.567	0.393	3.417	141.6	3.85	141.26
16	0.1	0.567	0.393	3.85	141.26	3.906	141.34
17	0.1	0.567	0.393	3.906	141.34	4.144	141.17
18	0.1	0.567	0.393	4.144	141.17	4.867	141.18

19	0.1	0.567	0.393	4.867	141.18	5.21	140.01
20	0.1	0.567	0.393	5.21	140.01	5.426	140.08
21	0.1	0.567	0.393	5.426	140.08	5.523	140.08
22	0.1	0.567	0.393	5.523	140.08	5.733	139.93
23	0.1	0.567	0.393	5.733	139.93	5.754	139.95
24	0.1	0.567	0.393	5.754	139.95	6.303	140
25	0.1	0.567	0.393	6.303	140	6.985	141.11
26	0.1	0.567	0.393	6.985	141.11	7.422	141.1
27	0.1	0.567	0.393	7.422	141.1	7.715	141.14
28	0.1	0.567	0.393	7.715	141.14	8.266	141.04
29	0.1	0.567	0.393	8.266	141.04	8.78	140.99
30	0.1	0.567	0.393	8.78	140.99	10.101	140.95
31	0.1	0.567	0.393	10.101	140.95	11.415	140.91
32	0.1	0.567	0.393	11.415	140.91	12.329	140.9
33	0.1	0.567	0.393	12.329	140.9	13.129	140.88
34	0.1	0.567	0.393	13.129	140.88	15.233	140.82
35	0.1	0.567	0.393	15.233	140.82	16.752	140.7
36	0.1	0.567	0.393	16.752	140.7	17.265	140.71
37	0.1	0.567	0.393	17.265	140.71	18.613	140.66
38	0.1	0.567	0.393	18.613	140.66	19.061	140.7
39	0.1	0.567	0.393	19.061	140.7	20.84	140.64
40	0.1	0.567	0.393	20.84	140.64	21.035	140.71
41	0.1	0.567	0.393	21.035	140.71	22.961	140.62
42	0.1	0.567	0.393	22.961	140.62	23.415	140.61
43	0.1	0.567	0.393	23.415	140.61	25.075	140.6
44	0.1	0.567	0.393	25.075	140.6	25.287	140.58
45	0.1	0.567	0.393	25.287	140.58	26.092	140.57
46	0.1	0.567	0.393	26.092	140.57	27.698	140.51
47	0.1	0.567	0.393	27.698	140.51	28.243	140.49

48	0.1	0.567	0.393	28.243	140.49	29.261	140.44
49	0.1	0.567	0.393	29.261	140.44	30.875	140.38
50	0.1	0.567	0.393	30.875	140.38	31.02	140.36
51	0.1	0.567	0.393	31.02	140.36	32.657	140.36
52	0.1	0.567	0.393	32.657	140.36	33.164	140.35
53	0.1	0.567	0.393	33.164	140.35	34.091	140.35
54	0.1	0.567	0.393	34.091	140.35	35.381	140.34
55	0.1	0.567	0.393	35.381	140.34	36.372	140.33
56	0.1	0.567	0.393	36.372	140.33	37.303	140.33
57	0.1	0.567	0.393	37.303	140.33	38.81	140.25
58	0.1	0.567	0.393	38.81	140.25	39.012	140.28
59	0.1	0.567	0.393	39.012	140.28	40.796	140.25
60	0.1	0.567	0.393	40.796	140.25	41.682	140.19
61	0.1	0.567	0.393	41.682	140.19	42.385	140.16
62	0.1	0.567	0.393	42.385	140.16	43.163	140.14
63	0.1	0.567	0.393	43.163	140.14	43.95	140.16
64	0.1	0.567	0.393	43.95	140.16	44.547	140.18
65	0.1	0.567	0.393	44.547	140.18	45.793	140.18
66	0.1	0.567	0.393	45.793	140.18	46.676	140.17
67	0.1	0.567	0.393	46.676	140.17	47.169	140.16
68	0.1	0.567	0.393	47.169	140.16	48.298	140.12
69	0.1	0.567	0.393	48.298	140.12	49.703	140.12
70	0.1	0.567	0.393	49.703	140.12	50.38	140.14
71	0.1	0.567	0.393	50.38	140.14	51.535	140.16
72	0.1	0.567	0.393	51.535	140.16	52.035	140.14
73	0.1	0.567	0.393	52.035	140.14	52.231	140.2
74	0.1	0.567	0.393	52.231	140.2	53.502	140.13
75	0.1	0.567	0.393	53.502	140.13	54.735	140.12
76	0.1	0.567	0.393	54.735	140.12	55.281	140.12

```
 77     0.1   0.567         0.393         55.281        140.12     56.401
140.07
 78     0.1   0.567         0.393         56.401        140.07     57.259
140.04
 79     0.1   0.567         0.393         57.259        140.04     58.11
139.98
 80     0.1   0.567         0.393         58.11         139.98     59.988
139.93
 81     0.1   0.567         0.393         59.988        139.93     60.229
139.93
 82     0.1   0.567         0.393         60.229        139.93     61.931
139.92
 83     0.1   0.567         0.393         61.931        139.92     63.1
139.92
 84     0.1   0.567         0.393         63.1          139.92     64.065
139.91
 85     0.1   0.567         0.393         64.065        139.91     65.27
139.84


CRSP Simulation Specifications:  Used with C:\Users\Tseung Kwan O
Landfill NTHS\After comments\Boulder Fall Anaysis\C128\C128.doc


Total Number of Rocks Simulated:  100
Starting Velocity in X-Direction:  0.3 m/sec
Starting Velocity in Y-Direction:  -0.3 m/sec
Starting Cell Number:  1
Ending Cell Number:  85
Rock Density:  2646 kg/m^3
Rock Shape:  Discoidal
Diameter:  2.5 m
Thickness:  1.9 m



CRSP Analysis Point 1 Data - C:\Users\Tseung Kwan O Landfill NTHS\After
comments\Boulder Fall Anaysis\C128\C128.doc


Analysis Point 1: X =  41.3, Y =  140



                            NO ROCKS PAST ANALSYSIS POINT 1



CRSP Data Collected at End of Each Cell -
C:\Users\Esther\Desktop\Freelance\# NTHS\005_Modern_Tseung Kwan O
Landfill NTHS\After comments\Boulder Fall Anaysis\C128\C128.doc


Velocity Units: m/sec       Bounce Height Units: m
```

```
Cell #   Max. Vel.   Avg. Vel.   S.D. Vel.   Max. Bounce Ht.   Avg.
Bounce Ht.

 1            No rocks      past end of cell
 2             3             2             .81           1             1
 3             6             5             .56           0             0
 4             5             3             1.12          1             0
 5             6             6             .21           1             0
 6             7             5             1.39          0             0
 7             7             6             1.55          1             0
 8             8             6             1.98          1             0
 9             8             6             2.02          1             0
 10            9             6             2.23          2             0
 11            10            6             2.29          2             1
 12            10            6             1.4           3             1
 13            7             5             1.31          2             1
 14            7             5             1.62          3             1
 15            7             6             1.14          3             1
 16            7             6             1.12          3             1
 17            8             6             1.15          2             1
 18            9             8             1.55          1             0
 19            9             8             1.62          2             1
 20            10            9             1.62          1             0
 21            10            9             1.83          1             0
 22            10            9             2             1             0
 23            10            9             2.01          1             0
 24            6             4             1.32          0             0
 25           No rocks      past end of cell
 26           No rocks      past end of cell
 27           No rocks      past end of cell
 28           No rocks      past end of cell
 29           No rocks      past end of cell
 30           No rocks      past end of cell
 31           No rocks      past end of cell
 32           No rocks      past end of cell
 33           No rocks      past end of cell
 34           No rocks      past end of cell
 35           No rocks      past end of cell
 36           No rocks      past end of cell
 37           No rocks      past end of cell
 38           No rocks      past end of cell
 39           No rocks      past end of cell
 40           No rocks      past end of cell
 41           No rocks      past end of cell
 42           No rocks      past end of cell
 43           No rocks      past end of cell
 44           No rocks      past end of cell
 45           No rocks      past end of cell
 46           No rocks      past end of cell
 47           No rocks      past end of cell
 48           No rocks      past end of cell
 49           No rocks      past end of cell
 50           No rocks      past end of cell
 51           No rocks      past end of cell
 52           No rocks      past end of cell
 53           No rocks      past end of cell
 54           No rocks      past end of cell
 55           No rocks      past end of cell
 56           No rocks      past end of cell
 57           No rocks      past end of cell
 58           No rocks      past end of cell
 59           No rocks      past end of cell
 60           No rocks      past end of cell
 61           No rocks      past end of cell
 62           No rocks      past end of cell
 63           No rocks      past end of cell
 64           No rocks      past end of cell
 65           No rocks      past end of cell
 66           No rocks      past end of cell
 67           No rocks      past end of cell
 68           No rocks      past end of cell
 69           No rocks      past end of cell
 70           No rocks      past end of cell
 71           No rocks      past end of cell
 72           No rocks      past end of cell
 73           No rocks      past end of cell
 74           No rocks      past end of cell
 75           No rocks      past end of cell
 76           No rocks      past end of cell
 77           No rocks      past end of cell
 78           No rocks      past end of cell
 79           No rocks      past end of cell
 80           No rocks      past end of cell
 81           No rocks      past end of cell
 82           No rocks      past end of cell
 83           No rocks      past end of cell
 84           No rocks      past end of cell
 85           No rocks      past end of cell
```

```
CRSP Rocks Stopped Data - C:\Users\Tseung Kwan O Landfill NTHS\After
comments\Boulder Fall Anaysis\C128\C128.doc

                              X Interval                    Rocks Stopped

                             0 To  10 m                     100
                             10 To  20 m                     0
                             20 To  30 m                     0
                             30 To  40 m                     0
                             40 To  50 m                     0
                             50 To  60 m                     0
                             60 To  65.27 m                  0
```

Appendix D

Detailed Aerial Photograph Interpretation Extracted from Previous NTHS Report 2023

Appendix B

Detailed Aerial Photograph Interpretations

B.1 DETAILED AERIAL PHOTOGRAPH INTERPRETATION

The following report comprises the detailed observations made from the examination of aerial photographs taken between 1924 and 2021. A list of aerial photographs examined in this study is presented in Table B1. The interpretations on geomorphology and man-made features are shown in Figure B1 to B21.

YEAR	**OBSERVATIONS**
1924 (Figure B1)	High altitude and poor resolution stereo pairs. The NTSA appears as southwest facing natural hillsides emerging from a northwest trending ridgeline below High Junk Peak. Due to the poor resolution of aerial photographs, the entire NTSA and the Site (proposed public riding school development area) appears as high reflectance, no detail observation can be examined.
1945 (Figure B2)	High altitude and fair resolution stereo pairs. The eastern and western boundary of the NTSA is bounded by indistinct rounded spurs. Several linear hollows, possibly ephemeral drainage lines DL1, DL2, DL3, DL4 and DL5 and their sub-ordinate drainage lines can be discerned within the NTSA. No perennial drainage line can be discerned within the NTSA. The area below the NTSA and the Site is extensively cultivated.
1956	Low altitude and fair resolution stereo pairs. No substantial change to the NTSA since 1945.
1963 (Figure B3, B4 & B5)	Low altitude and high resolution stereo pairs. The smooth surface of the NTSA indicates the NTSA is probably covered by in-situ materials without significant mass wasting process, possibly a thin layer veneer (< 2m thick) of hillslope colluvium blanket the majority of the hillsides within the NTSA. Valley colluvium is confined along the drainage lines. Small portion of intermittent rock outcrops can be discerned at the crest of the NTSA which located along the ridgeline at upper portion of Catchment Nos. CD3, OH5 and TD8. Rock cliff is present at the hillside behind the crest of the NTSA which facing northeast. Ephemeral drainage lines: Ten linear hollows, possibly ephemeral drainage lines DLl, DL2, DL3, DL4 and DL5 and sub-ordinate ephemeral drainage lines DL4.1, DL4.2, DL4.3,

YEAR **OBSERVATIONS**

DL4.4 and DL4.5 are observed in Catchment Nos. TD1, CD1, CD2, CD3, TD7 and TD8. Drainage lines DL1, DL2, DL3 and DL5 are present at the lower half portion of Catchment Nos. TD1, CD1, CD2 and TD8 respectively. DL4 contains five sub-ordinate drainage lines, namely DL4.1, DL4.2, DL4.3, DL4.4 and DL4.5. Main drainage line DL4 flows from the top of Catchment No. CD3 towards the bottom of Catchment No. CD3; sub-ordinates drainage line DL4.1 is discerned approximately 20m away from the top of Catchment No. CD3, whilst DL4.2, DL4.3 and DL4.4 are apparent at the upper, middle and lower portion of Catchment No. CD3 respectively. DL4.5 is located along Catchment No. TD7. These five southwest trending drainage lines are running towards the toe of the NTSA. Sub-ordinate drainage lines DL4.1, DL4.2, DL4.3 and DL4.4 are generally west trending and flowing towards DL4 which finally converge towards the toe of the NTSA. Sub-ordinates DL4.5 is apparent as an individual southwest trending drainage line flowing towards the toe of the NTSA. However, DL4.5 was converging towards DL4 below the NTSA. DL1 and DL5 appeared to be subtle depression, whilst DL2 and DL3 is relatively incisive, DL4 is the most distinctive. This probably indicates more water concentrate along DL4 and therefore the erosion of DL4 is more active than the other four drainage lines. Some boulders, probably colluvial boulders are concentrated along DL4.

Topographic depressions:

Seven linear hollows were observed in Catchment Nos. TD2, TD3, TD4, TD5, TD6 and OH3. They are part of the head of ephemeral drainage lines or sub-drainage lines which located below the NTSA. Since they appeared as broad and subtle depressions, this indicate no significant water concentration and therefore the erosion activities are relatively small. These seven hollows within Catchment Nos. TD2, TD3, TD4, TD5, TD6 and OH3 can be regarded as minor topographic depressions.

Relict landslide scars within NTSA:

A break of slope and a concave depression is observed near the head of ephemeral sub-ordinate drainage line DL4.2, possibly instability (RL1) had taken place. The estimated landslide volume of RL1 is about 35m^3. This location was possibly the ENTLI record no. 12SWA0004E. Another three concave depressions (RL2 to RL4) are discerned adjacent to RL1 which located at the crest of Catchment No. CD3. RL3 and RL4 are appeared as a spoon-shaped depression with distinct landslide trails whilst RL2 is a relatively subtle depression when compare with the other three landslides. RL3 and RL4 has an estimated failure volume of 29m^3 and 18m^3 respectively, whilst RL2 is about 24m^3. However, RL2 may not be regarded as genuine landslide scar, further verification on site is required. RL2 and RL3 are possibly the locations of ENTLI record Nos. 12SWA0220E and 12SWA0005E respectively. RL4 does not recorded in the ENTLI.

Relict landslide scars to the east of NTSA:

Four broad and shallow concave depressions are observed adjacent to the upper portion of Catchment No. CD3, possibly four landslide incidents (RL5, RL6, RL7 and RL8) were occurred. RL5 is located at the NTSA boundary,

YEAR **OBSERVATIONS**

whilst another three depressions (RL6, RL7 and RL8) are apparent approximately 9m to 37m to the east of the upper portion of Catchment No. CD3. These four landslide scarps are very degraded which indicate probably were occurred for a long period of time. The estimated failure source volume of these four landslides is about 11m^3 to 37m^3. They are possibly registered as ENTLI Nos. 12SWA0341E, 12SWA0006E, 12SWA0007E and 12SWA0339E.

A distinct break of slope and depression is discerned on the bank of an ephemeral drainage line located outside the NTSA, which located approximately 20m to the south of the middle portion of Catchment No. TD8, probably represent a relict landslide scar, RL9. RL9 has a failure volume of about 30m^3 which is possibly the location of ENTLI No. 12SWA0273E.

Relict landslide scars below the NTSA:

Two concave depressions were apparent below the NTSA, probably two landslide events (RL10 and RL11) were occurred previously. RL10 is located approximately 52m below Catchment No. TD4 whilst RL11 is discerned 165m below Catchment No. OH2. RL10 apparent as a sharp break of slope, therefore the landslide scarp was distinct which indicated it has a relatively higher certainly and this relict landslide possibly happened in a more recently period of time. The depression of RL10 is relatively shallow and small in size, the failure volume estimated to be 16m^3. RL11 is observed at the head of a sub-ordinate drainage line. Its landslide source area appears more incisive than RL10. The estimated failure volume of RL11 is about 39m^3. RL10 and RL11 are possibly the locations of ENTLI Nos. 12SWA0198E and 12SWA0199E respectively.

Landslide scars adjacent to the Catchment OH1:

Ten concave depressions are evident in the adjacent catchment of Catchment No. OH1, which located approximately 170 to 345m to the west of the NTSA. They are probably relict landslides scars (RL12 to RL21). RL12 to RL15 are located on the bank of a drainage line which located outside the NTSA. They are hardly observed since broad and shallow depressions without obvious break of slope, therefore possibly have been degraded for a long period of time and the certainty of these landslide features are relatively low. The estimated failure volume is relatively small, about 10 m^3 to 30m^3. RL12 to RL15 are recorded as ENTLI Nos. 12SWA0195E, 12SWA0196E, 12SWA0197E and 12SWA0272E respectively. RL16 to RL21 are discerned on an open hillslope. They apparent as rounded scarps with very distinct linear-shaped landslide trails, therefore these six landslide features have a relatively higher certainty. Their failure source areas are relatively bigger and more incisive than RL12 to RL15, therefore RL16 to RL21 has a larger failure volume range between 30m^3 to 60m^3. The locations of RL16 to RL21 are registered as ENTLI Nos. 12SWA0017E, 12SWA0018E, 12SWA0194E, 12SWA0019E, 12SWA0021E and 12SWA0020E respectively.

Landslide scars adjacent to the Catchment TD8:

Eighteen concave depressions are apparent on the adjacent catchment of

YEAR **OBSERVATIONS**

Catchment No. TD8, which located approximately 190 to 670m to the south of the NTSA. They are probably relict landslides scars (RL22 to RL39). RL22 to RL29 are discerned immediately below the ridgeline. Their depression sizes are relatively broad, but most of them are located at the head of drainage lines, the suspected landslide scars are mostly rounded which is hardly to distinguish whether the depressions are related to the shape of the drainage lines or landslide failures, therefore the certainties are not too high. Geomorphologically, since these eight landslides were occurred on the over-steepened slopes immediately below the convex break of slope forming the boundary between the upper and lower landforms. These failures may be possibly part of the hillside retreat process. The estimated failure volumes of RL22 to RL29 are range in between $37m^3$ to $57m^3$. RL22 to RL29 are registered as ENTLI Nos. 12SWA0068E, 12SWA0069E, 12SWA0184E, 12SWA0183E, 12SWA0015E, 12SWA0179E, 12SWA0178E and 12SWA0016E respectively. Another ten landslides are evident in the lower portion of the catchment, namely RL30 to RL39. They have a smaller scale of depressions when compares to RL22 to RL29. Most of them are located on the bank of drainage lines or open hillslope which also apparent as sharper scars, therefore the certainty of RL30 to RL39 are relatively higher. The failure volumes of RL30 to RL39 are about $24m^3$ to $38m^3$. Locations of RL30 to RL39 are probably the location of ENTLI Nos. 12SWA0187E, 12SWA0188E, 12SWA0186E, 12SWA0185E, 12SWA0328E, 12SWA0182E, 12SWA0330E, 12SWA0329E, 12SWA0181E and 12SWA0180E respectively.

RL1 to RL39 are discerned in dark grey tone, therefore they may have been happened long period ago. Among these relict landslide scars, RL22, RL23 and RL24 are considered to have similar geological and geomorphological setting with the NTSA and their estimated failure volumes range from $37m^3$ to $39m^3$. All these landslide events are regarded as relict landslides. No recent landslide is present within or in the close vicinity of the NTSA.

A spot of high reflectance feature was existed at the upper portion of Catchment No. OH5, possibly grave.

Four high reflectance linear features were traversed within the NTSA, probably footpaths (FP1 to FP4). FP1 were present along the middle portion of Catchment No. CD3 downwards to the upper portion of Catchment Nos. TD7, OH5 and TD8. FP2 were discerned from the top of Catchment No. OH1 which run along the ridgeline across Catchment Nos. TD1, TD2, TD3, TD4, TD5, TD6, CD1, CD2, OH3 and finally CD3 adjoining FP1. FP3 was relatively less reflective, possibly lightly in use when compares to FP1 and FP2. It apparent at the top of Catchment No. TD6 then passed through Catchment Nos. CD1, OH2, CD2 and along the toe of Catchment Nos. OH3, CD3, OH4, TD7, OH5 and TD8. FP4 existed along the ridgeline which located at the crest of the NTSA.

The agricultural terraces and farmlands observed below the NTSA in year 1945 were still actively in use. Many cottages were constructed around the agricultural terraces and farmlands.

YEAR	**OBSERVATIONS**
	Morphologically, a convex change of slope is discerned immediately below the ridgeline which bounded the upper boundary of the NTSA. The convex change of slope is discerned at about +142mPD at Catchment No. OH1 and then extend up to about +234mPD at Catchment No. CD3. Another distinct convex change of slope is apparent at approximately +228mPD which located along the upper portion of Catchment Nos. TD7, OH5 and TD8. These convex changes of slope demarcate the upper and middle slope terrain. The upper slope terrain comprises of gentle slope with gradient less than 20° whilst the transportation middle slope terrain comprises of relatively steeper slope with gradient lies in between 25° to 35°.
1964	High altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1963.
1967	High altitude and high resolution stereo pairs. Most of the NTSA was obscured by cloud. No observable significant change to the visible portion of the NTSA since 1963.
1973 (Figure B6)	High altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1967. Two high reflectance concave depressions are discerned approximately 415m and 535m adjacent to Catchment No. TD8, bare soil without any vegetation is observed, probably recent landslides (RC1 and RC2) occurred recently. RC1 is located on a topographic depression whilst RC2 located on the bank of a drainage line, both of them appears as shallow depressions. The estimated failure volumes of RC1 and RC2 are about 20m^3 and 25m^3 respectively. These two locations are registered as ENTLI Nos. 12SWA0376E (RC1) and 12SWA0377E (RC2). A new footpath (FP5) is formed along the eastern boundary of the NTSA which traversed along the spurline from the top of Catchment No. CD3 downslope to the top of Catchment No. TD8 which adjoining FP1.
1974	Low altitude and high resolution stereo pairs. No significant changes could be observed since 1973.
1975 (Figure B7)	High altitude and high resolution stereo pairs.

YEAR	**OBSERVATIONS**
	No observable significant change to the NTSA since 1967. A very shallow depression is evident on an open hillslope at about 102m below Catchment No. OH1. It is highly reflective bare soil surface without any vegetation, possibly recent landslide RC3. The failure area is relatively small and therefore the estimated source volume is only about 10m^3. This is probably the location of ENTLI No. 12SWA0378E. An elongated depression is apparent along a drainage line which located approximately 477m adjacent to Catchment No. TD8. It is highly reflective, bare soil is observed, probably a channelized debris flow (RC4) was occurred very recently due to no vegetation is present. The source area is narrow but long in shaped, and it is relatively incisive when compares to RC3. RC4 has an estimated failure volume of 40m^3. This recent landslide event is registered as ENTLI No. 12SWA0380E.
1976	High altitude and high resolution stereo pairs. No significant changes could be observed since 1975.
1978	High altitude and high resolution stereo pairs. No significant changes could be observed since 1976.
1979	High altitude and high resolution stereo pairs. No significant changes could be observed since 1978.
1980	Low altitude and high resolution stereo pairs. No significant changes could be observed since 1979.
1981	High altitude and high resolution stereo pairs. No significant changes could be observed since 1980.
1982	High altitude and high resolution stereo pairs. No significant changes could be observed since 1981.
1983	Low altitude and high resolution stereo pairs. No significant changes could be observed since 1982.

YEAR	OBSERVATIONS
1984	High altitude and high resolution stereo pairs. No significant changes could be observed since 1983.
1985 (Figure B8 & B9)	Low altitude and high resolution stereo pairs. Part of the NTSA does not cover by these stereo pairs. Several tiny high reflectance features are present below Catchment Nos. TD2, OH2, OH3 and TD7. Bare soil is observed, sharp break of slopes are discerned within the bare soil features. This is possibly due to minor excavation by anthropogenic activities, the excavated soil were then dumped and pushed downslope which formed the soil trails. The boundary in between the excavated areas and the soil trails formed the convex break of slopes. These locations are possibly the trial pit locations of TP12, TP13, TP14, TP15 and TP16 under GIU No. 05553. The upper portion of Catchment Nos. TD7, OH5 and TD8 were appeared as lighter tone, bare soil is observed, possibly due to hill fire.
1986	Low altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1985.
1987	Low altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1986.
1988 (Figure B10)	Low altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1987 except some vegetation grew on the slope surface. The agricultural terraces and cottages located below the NTSA were demolished. Site formation and reclamation works were commenced below the NTSA, probably the area was begun to use as landfill site.
1989 (Figure B11)	Low altitude and high resolution stereo pairs. Three highly reflective white spot features are discerned at the lower portion of Catchment Nos. TD5, OH2 and OH3. Bare soil is observed. The locations within Catchment Nos. OH2 and OH3 are possibly the Borehole locations of BH17 and BH18 under GIU No. 12800. The bare soil existed in Catchment No. TD5 appeared as rounded bare soil surface and thus likely created by anthropogenic activities, possibly this was an inspection pit for the proposed

YEAR	**OBSERVATIONS**
	ground investigation, but no ground investigation record could be found at that location, possible the proposed GI station has been deleted. The site formation works below the NTSA was ongoing, the area was continued to serve as landfill site.
1990 (Figure B12)	High altitude and high resolution single photograph. No observable significant change to the NTSA since 1989. A linear feature, probably catchwater is aligned along the toe of the NTSA. Formation of eight man-made cut slopes were commenced along the toe of the NTSA, probably in association with the alignment of the catchwater. They were registered as Feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188. A cross-shaped features are apparent in the middle portion of Catchment No. OH3. It was located at the intersection of two footpaths, possibly a resting place or sign indicator for hikers.
1991	Low altitude and high resolution stereo pairs. Formation of feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188 were ongoing. The area below the NTSA was continued to serve as landfill site.
1992 (Figure B13)	Low altitude and high resolution stereo pairs. A small patch of high reflectance bare soil is observed at the upper portion of Catchment No. CD3, possible a grave was constructed. Formation of feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188 were completed. A cut slope was formed below Catchment Nos. TD7 and OH5, probably in association with the extension of the landfill site. This man-made slope was registered as Feature No. 12SW-A/C227. The area below the NTSA was continued to serve as landfill site.

YEAR	**OBSERVATIONS**
1993	Low altitude and high resolution stereo pairs. No observable significant change to the NTSA since 1992 except footpath FP1 was partially widened. The area below the NTSA was continued to serve as landfill site.
1994 (Figure B14)	Low altitude and high resolution stereo pairs. Entire footpath FP1 was being widened. The landfill site located below the NTSA is apparent as being filled up and the surface was smoothened. It was probably closed and no longer in use. The Site area is filled up as a platform.
1995 (Figure B15)	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 1994. Eight man-made fill slopes were formed at the former landfill site which located below the NTSA. Man-made drainage channels are formed on the slope surfaces. They are registered as Feature Nos. 12SW-A/F67, 12SW-A/F68, 12SW-A/F69, 12SW-A/F70, 12SW-A/F72, 12SW-A/F73, 12SW-A/F74 and 12SW-A/F96.
1996 (Figure B16)	Low altitude and high resolution stereo pairs. Many linear features are apparent parallel to the contour lines in Catchment Nos. TD6, CD1, OH2, CD2, OH3 and CD3. A very thin layer of surface soil may be disturbed along these linear features by anthropogenic activities, possibly plantation.
1997 (Figure B17)	Low altitude and high resolution colour photograph. No observable significant change to the NTSA since 1996. The linear features observed in year 1996 were no longer observable.
1998	Low altitude and fair resolution colour photograph. Part of the NTSA was obscured by cloud. No observable significant change to the NTSA since 1997.
1999	Low altitude and high resolution colour stereo pairs.

YEAR	**OBSERVATIONS**
	No observable significant change to the NTSA since 1998.
2000	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 1999.
2001	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2000 except some vegetation grew on the slope surface.
2002	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2001.
2003	Low altitude and fair resolution colour stereo pairs. No observable significant change to the NTSA since 2002.
2004 (Figure B18)	Low altitude and high resolution colour stereo photo. The upper portion of Catchment Nos. CD3, TD7, OH5 and TD8 are apparent as grey tone, possibly hill fire was occurred. A linear feature is discerned at the Site area, probably it is used as model aeroplane training field.
2005	Low altitude and high resolution colour stereo photo. No observable significant change to the NTSA since 2004.
2006	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2005 except denser vegetation grew on the slope surface.
2007	Low altitude and high resolution stereo pairs. No observable significant change to the NTSA since 2006 except denser vegetation grew on the slope surface.
2008	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2007 except denser

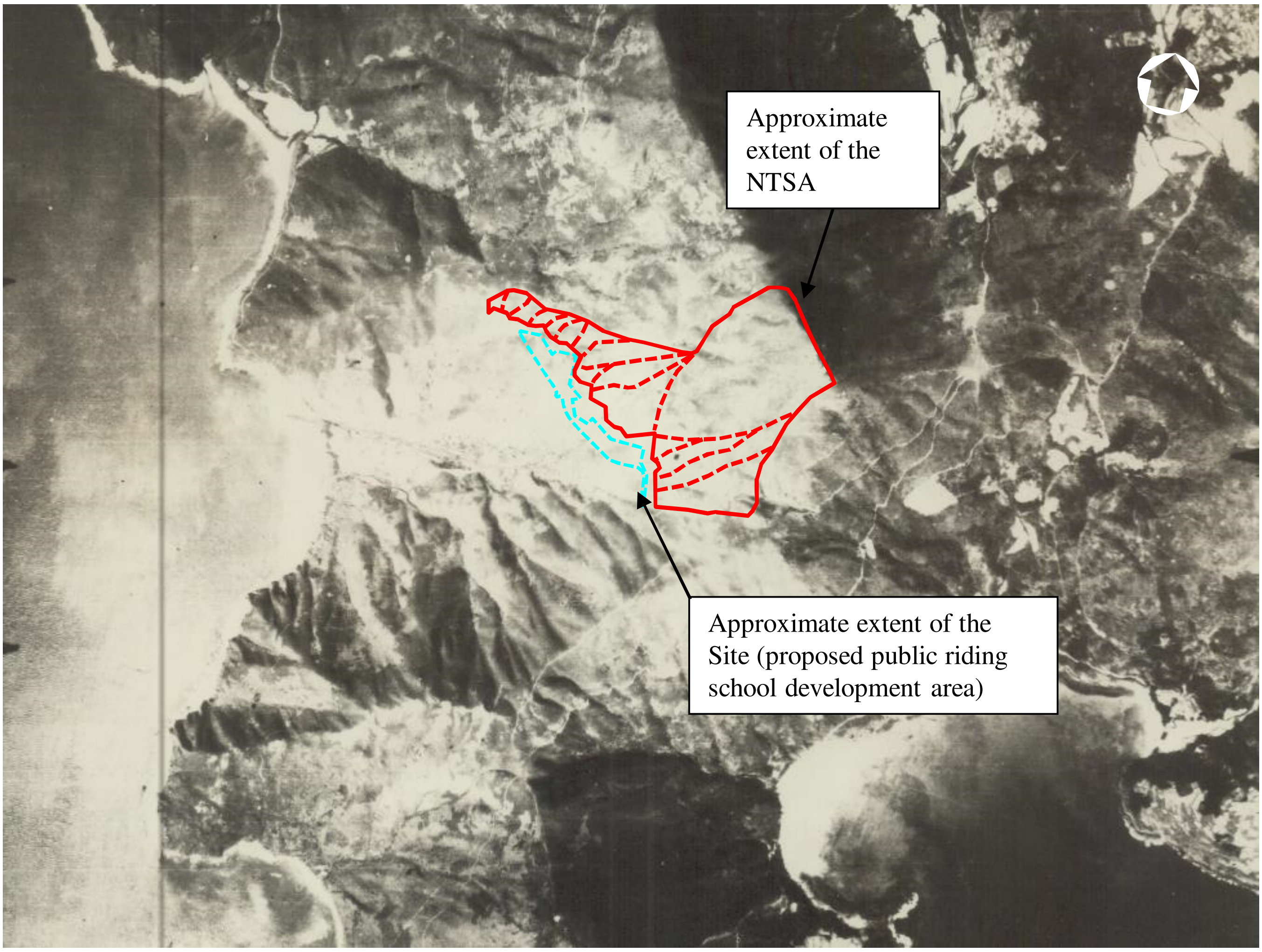
YEAR	**OBSERVATIONS**
	vegetation grew on the slope surface.
2009	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2008 except denser vegetation grew on the slope surface.
2010	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2009 except denser vegetation grew on the slope surface.
2011	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2010 except denser vegetation grew on the slope surface.
2012	Low altitude and high resolution colour stereo pairs. The stereo pairs only covered part of the NTSA. No observable significant change to the NTSA since 2011.
2013	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2012 except denser vegetation grew on the slope surface.
2014	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2013 except denser vegetation grew on the slope surface.
2015	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2014 except denser vegetation grew on the slope surface.
2016	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2015 except denser vegetation grew on the slope surface.
2017	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2016 except denser

YEAR	**OBSERVATIONS**
	vegetation grew on the slope surface.
2018 (Figure B19)	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2017 except vegetation clearance by anthropogenic activities at the upper portion of Catchment Nos. CD3 and OH5.
2019	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2018 except denser vegetation grew on the slope surface.
2020	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2019 except denser vegetation grew on the slope surface.
2021	Low altitude and high resolution colour stereo pairs. No observable significant change to the NTSA since 2020 except denser vegetation grew on the slope surface.

Table B1 – List of Photographs

Photo Year	Aerial Photo Reference No.	Flight Altitude (Feet)
1924	Y00031-2	12,500
1945	Y00433-4	20,000
1956	Y03253-4	-
1963	Y08354-5	3,900
1963	Y08392-3	3,900
1964	Y12906-7	12,500
1967	Y13343-4	6,250
1973	8037-8	12,500
1974	9304-5	4,000
1975	12055-6	12,500
1976	15928-9	12,500
1978	20763-4	12,500
1979	28028-9	10,000
1980	29753-5	4,000
1981	39036-7	10,000
1982	44514-5	10,000
1983	47499-501	4,000
1984	56489-90	11,000
1985	65987-8	4,000
1986	A04254-5	4,000
1987	A08668-9	4,000
1988	A12790-1	4,000
1989	A16793-4	4,000
1990	A24427-8	10,000
1991	A27706-7	4,000
1992	A32762-4	4,000
1993	A37382-3	4,000
1994	A39049-50	4,000
1995	CN10018-9	3,500
1996	A42220-1	4,000
1997	CN17110-1	4,000
1998	CN21383-4	4,000
1999	CN25165-6	4,000
2000	CN26669-70	4,000
2001	CW34867-8	4,000
2002	CW39242-3	3,000
2003	CW47869-70	4,000

Photo Year	Aerial Photo Reference No.	Flight Altitude (Feet)
2004	CW62910-1	4,000
2005	CW67596-7	4,000
2006	CS02206-8	6,000
2007	CS09051-2	6,000
2008	CS20259-60	6,000
2009	CS23448-9	6,000
2010	CS30143-4	6,000
2011	CW89762-4	3,000
2012	CW94555-6	2,000
2013	CS44655-7	6,000
2014	CS47084-6	6,000
2015	CS55027-9	6,000
2016	CS62116-7	6,000
2017	E027935-6C	6,900
2018	E046899-900C	6,900
2019	E079751-3C	6900
2020	E117651-3C	6,900
2021	E118313-5C	6,900



Approximate extent of the NTSA

Approximate extent of the Site (proposed public riding school development area)

Photograph No.: Y00032 **Date of Photograph: 1924** **Altitude: 12,500**

Legend:

Approximate Boundary of the NTSA

Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

- The NTSA appears as southwest facing natural hillsides emerging from a northwest trending ridgeline below High Junk Peak.
- Due to the poor resolution of aerial photographs, the entire NTSA and the Site (proposed public riding school development area) appears as high reflectance, no detail observation can be examined.

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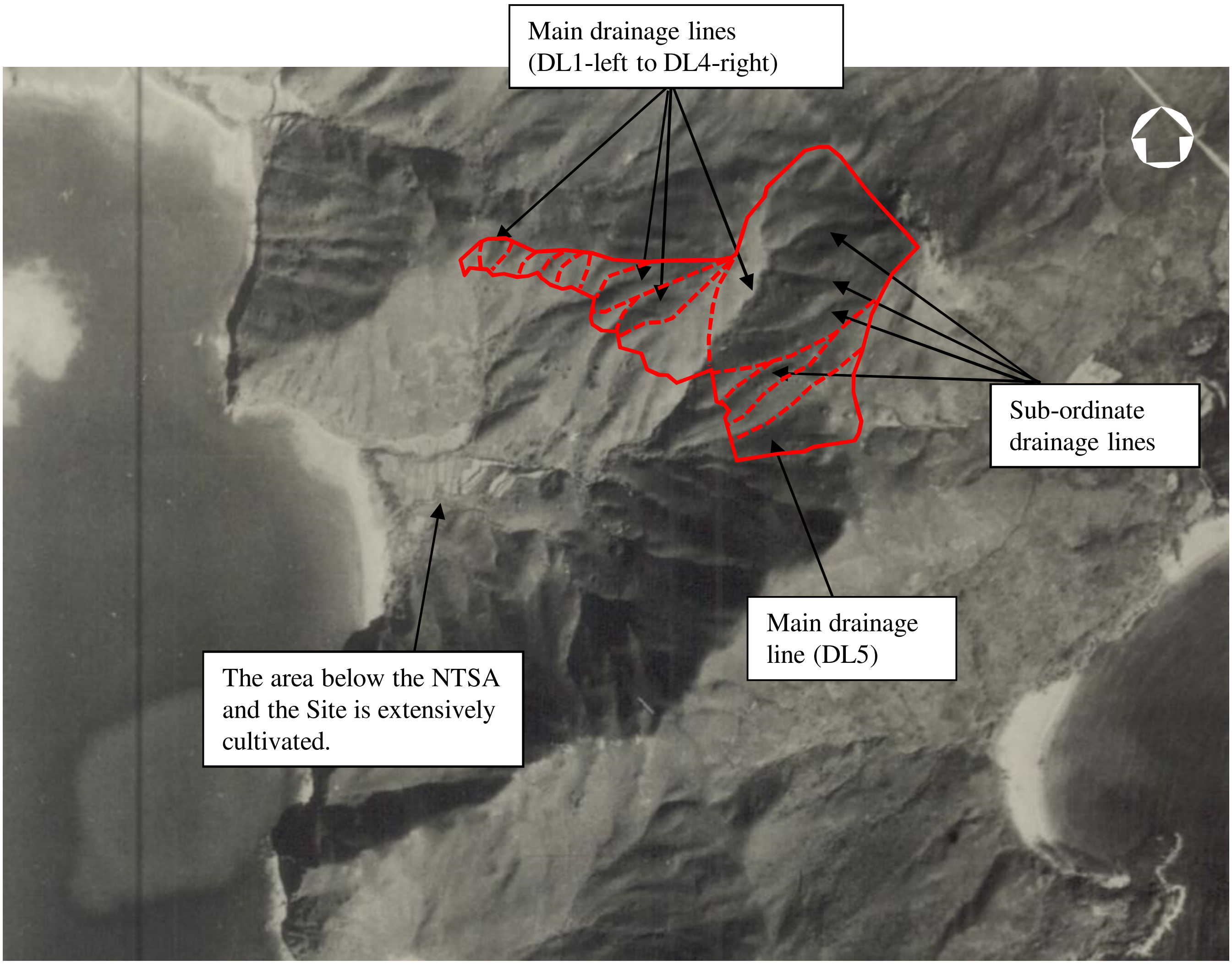
Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

FIGURE B1

Location
Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022


Main drainage lines
(DL1-left to DL4-right)
Sub-ordinate drainage lines
Main drainage line (DL5)
The area below the NTSA and the Site is extensively cultivated.

Photograph No.: Y00433 **Date of Photograph: 11 Nov 1945** **Altitude: 20,000'**

Legend: Approximate Boundary of the NTSA ---- Catchment Boundary

- The eastern and western boundary of the NTSA is bounded by indistinct rounded spurs.
- Several linear hollows, possibly ephemeral drainage lines DL1, DL2, DL3, DL4 and DL5 and their sub-ordinate drainage lines are observed within the NTSA.
- No perennial drainage line can be discerned within the NTSA.
- The area below the NTSA and the Site is extensively cultivated.

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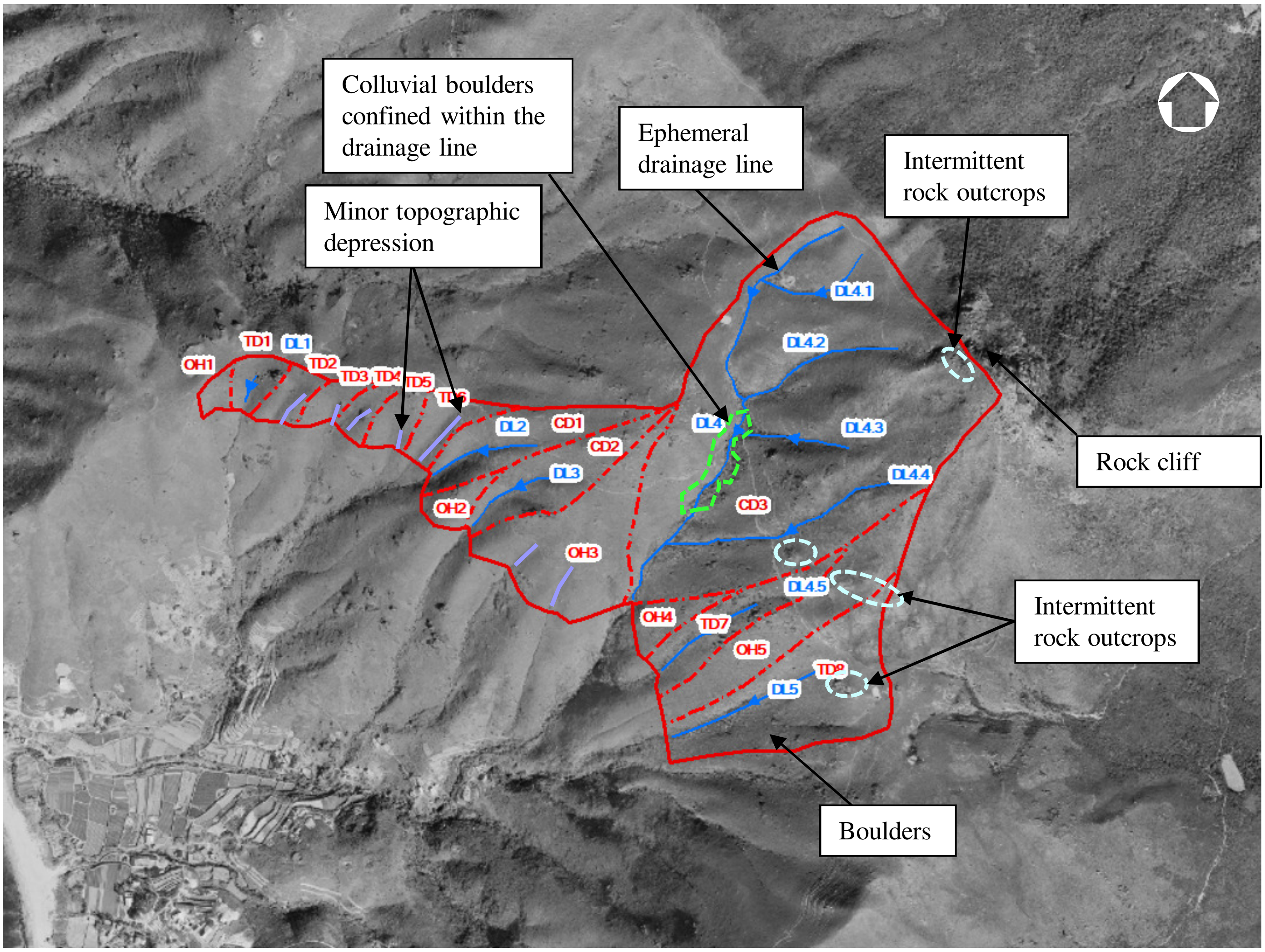
FIGURE B2

Location
Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022


Colluvial boulders confined within the drainage line
Ephemeral drainage line
Intermittent rock outcrops
Minor topographic depression
Rock cliff
Intermittent rock outcrops
Boulders
OH1
TD1
DL1
TD2
TD3
TD4
TD5
TD6
DL2
CD1
CD2
DL3
OH2
OH3
DL4
DL4.1
DL4.2
DL4.3
DL4.4
CD3
DL4.5
OH4
TD7
OH5
TD8
DL5

Photograph No.: Y08354 **Date of Photograph: 17 Feb 1963** **Altitude: 3,900'**

Legend:

Approximate Boundary of the NTSA

Catchment Boundary

Intermittent rock outcrop

Colluvial boulders

Ephemeral drainage line

Minor topographic depression

- The smooth surface of the NTSA indicates the NTSA is probably covered by in-situ materials without significant mass wasting process, possibly a thin layer veneer (< 2m thick) of hillslope colluvium blanket the majority of the hillsides within the NTSA. Valley colluvium is confined along the drainage lines.
- Intermittent rock outcrops are discerned at the crest of the NTSA which located along the ridgeline at upper portion of Catchment Nos. CD3, OH5 and TD8. Some boulder fields were deposited at the middle portion of Catchment Nos. CD3.
- DL1 and DL5 appeared to be subtle depression, whilst DL2 and DL3 is relatively incisive, DL4 is the most distinctive. This probably indicates more water concentrate along DL4 and therefore the erosion of DL4 is more active than the other four drainage lines. Some boulders, probably colluvial boulders are concentrated along DL4.
- Morphologically, a convex change of slope is discerned immediately below the ridgeline which bounded the upper boundary of the NTSA. The convex change of slope is discerned at about +142mPD at Catchment No. OH1 and then extend up to about +234mPD at Catchment No. CD3. Another distinct convex change of slope is apparent at approximately +228mPD which located along the upper portion of Catchment Nos. TD7, OH5 and TD8. These convex changes of slope demarcate the upper and middle slope terrain. The upper slope terrain comprises of gentle slope with gradient less than 20° whilst the transportation middle slope terrain comprises of relatively steeper slope with gradient lies in between 25° to 35°.

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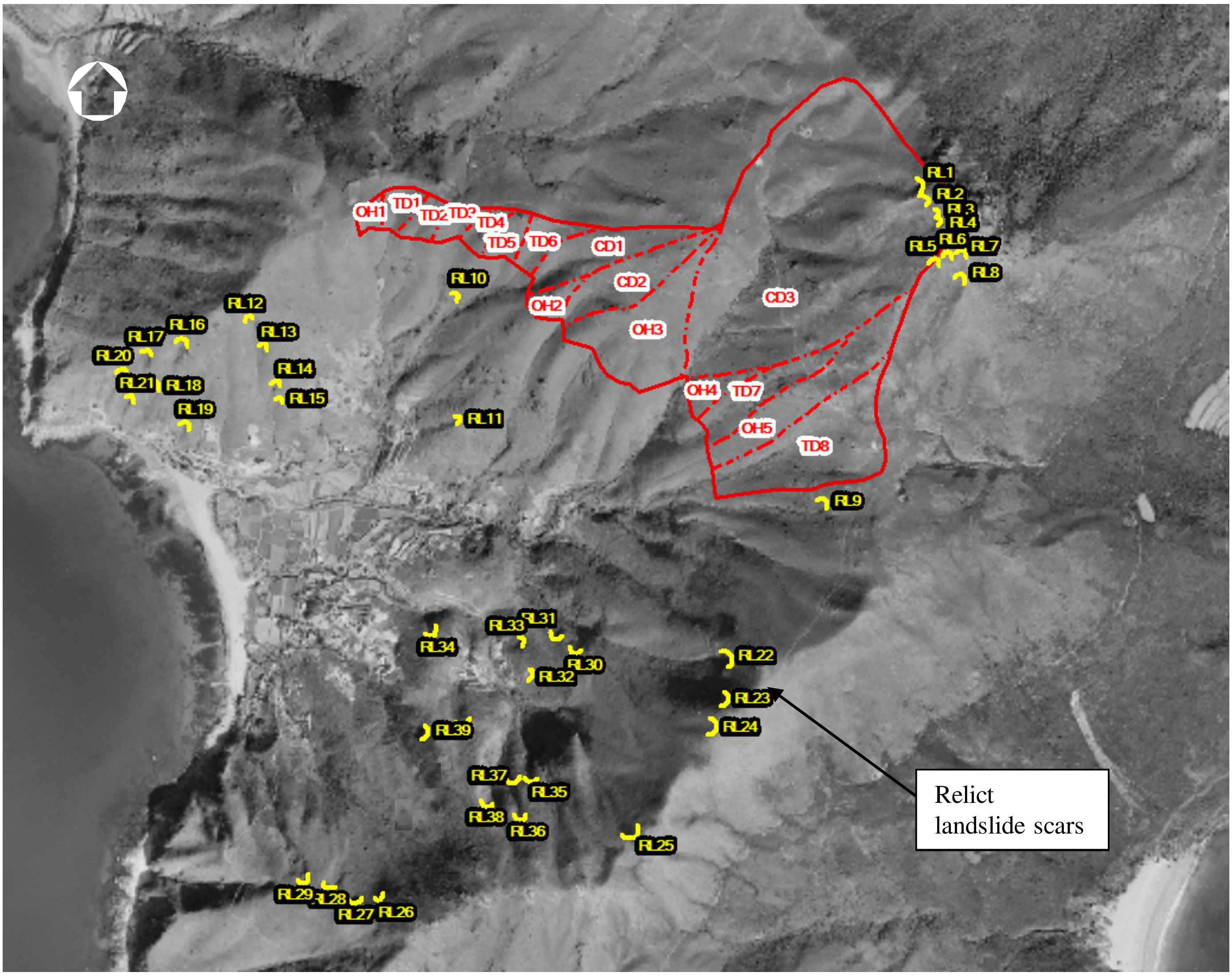
FIGURE B3

Location

Landfill Site II/III, Tseung Kwan O

Scale	Date
NTS	29 May 2022



RL1
RL2
RL3
RL4
RL5
RL6
RL7
RL8
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
RL10
CD2
OH2
CD3
OH3
RL12
RL16
RL13
RL17
RL20
RL14
RL21
RL18
RL15
RL19
RL11
OH4
TD7
OH5
TD8
RL9
RL31
RL33
RL34
RL30
RL32
RL22
RL23
RL24
RL39
RL37
RL35
RL38
RL36
RL25
RL29
RL28
RL27
RL26
Relict landslide scars

Photograph No.: Y08354 **Date of Photograph: 17 Feb 1963** **Altitude: 3,900'**

Legend:

Approximate Boundary of the NTSA

- - - Catchment Boundary

Relict landslide scar

- RL1 to RL39 are discerned in dark grey tone, therefore they probably occurred in a long period ago. All these landslide events are regarded as relict landslides.
- No recent landslide is discerned within or in the close vicinity of the NTSA.

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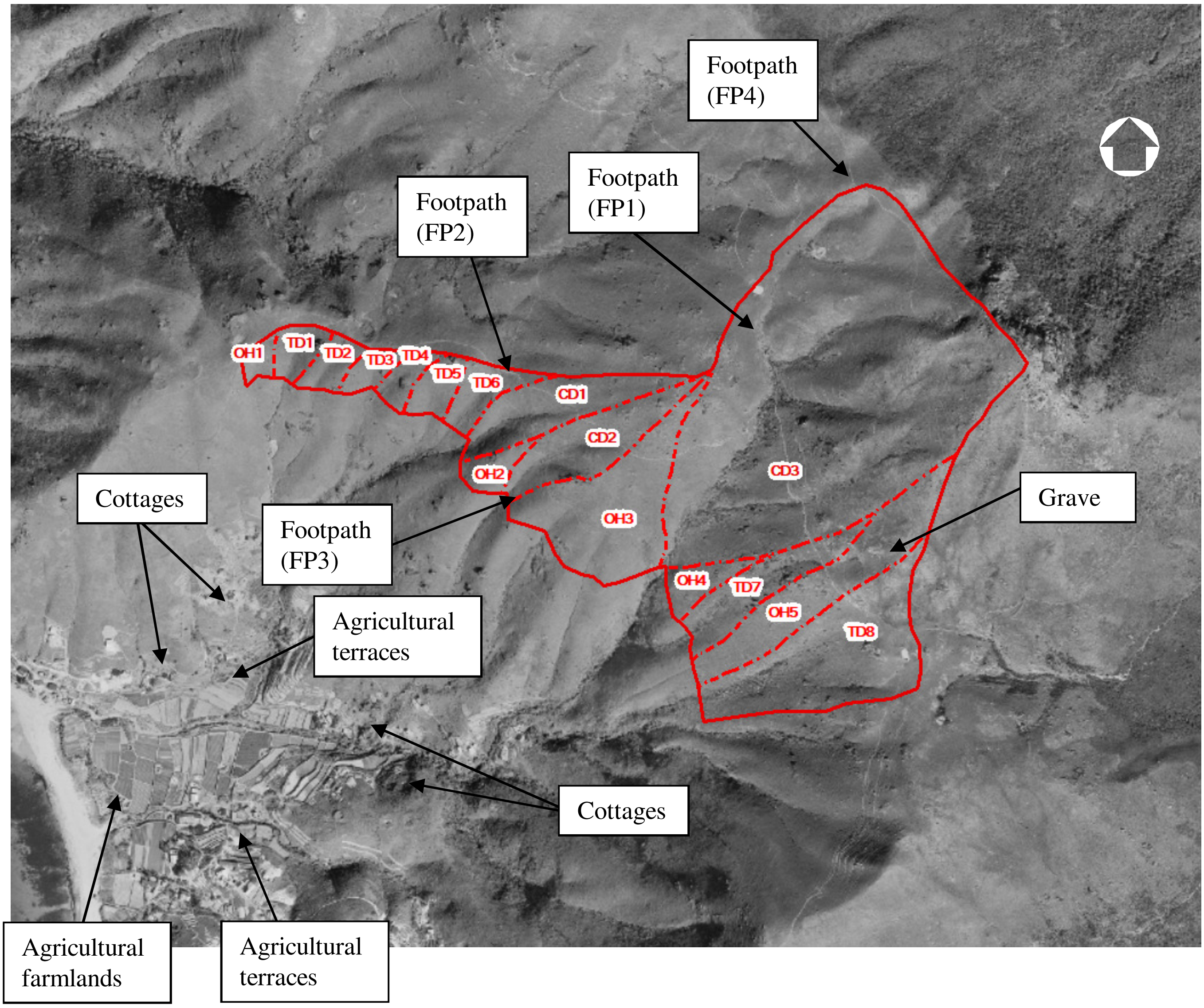
FIGURE B4

Location

Landfill Site II/III,
Tseung Kwan O

Scale	Date
NTS	29 May 2022


Footpath (FP4)
Footpath (FP1)
Footpath (FP2)
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
Grave
OH4
TD7
OH5
TD8
Cottages
Footpath (FP3)
Agricultural terraces
Cottages
Agricultural farmlands
Agricultural terraces

Photograph No.: Y08354 **Date of Photograph: 17 Feb 1963** **Altitude: 3,900'**

Legend:

Approximate Boundary of the NTSA

- - - Catchment Boundary

- A spot of high reflectance feature was existed at the upper portion of Catchment No. OH5, possibly grave.
- Four high reflectance linear features were traversed within the NTSA, probably footpaths (FP1 to FP4). FP1 were present along the middle portion of Catchment No. CD3 downwards to the upper portion of Catchment Nos. TD7, OH5 and TD8. FP2 were discerned from the top of Catchment No. OH1 which run along the ridgeline across Catchment Nos. TD1, TD2, TD3, TD4, TD5, TD6, CD1, CD2, OH3 and finally CD3 adjoining FP1. FP3 was relatively less reflective, possibly lightly in use when compares to FP1 and FP2. It apparent at the top of Catchment No. TD6 then passed through Catchment Nos. CD1, OH2, CD2 and along the toe of Catchment Nos. OH3, CD3, OH4, TD7, OH5 and TD8. FP4 existed along the ridgeline which located at the crest of the NTSA.
- The agricultural terraces and farmlands observed below the NTSA in year 1945 were still actively in use.
- Many cottages were constructed around the agricultural terraces and farmlands.

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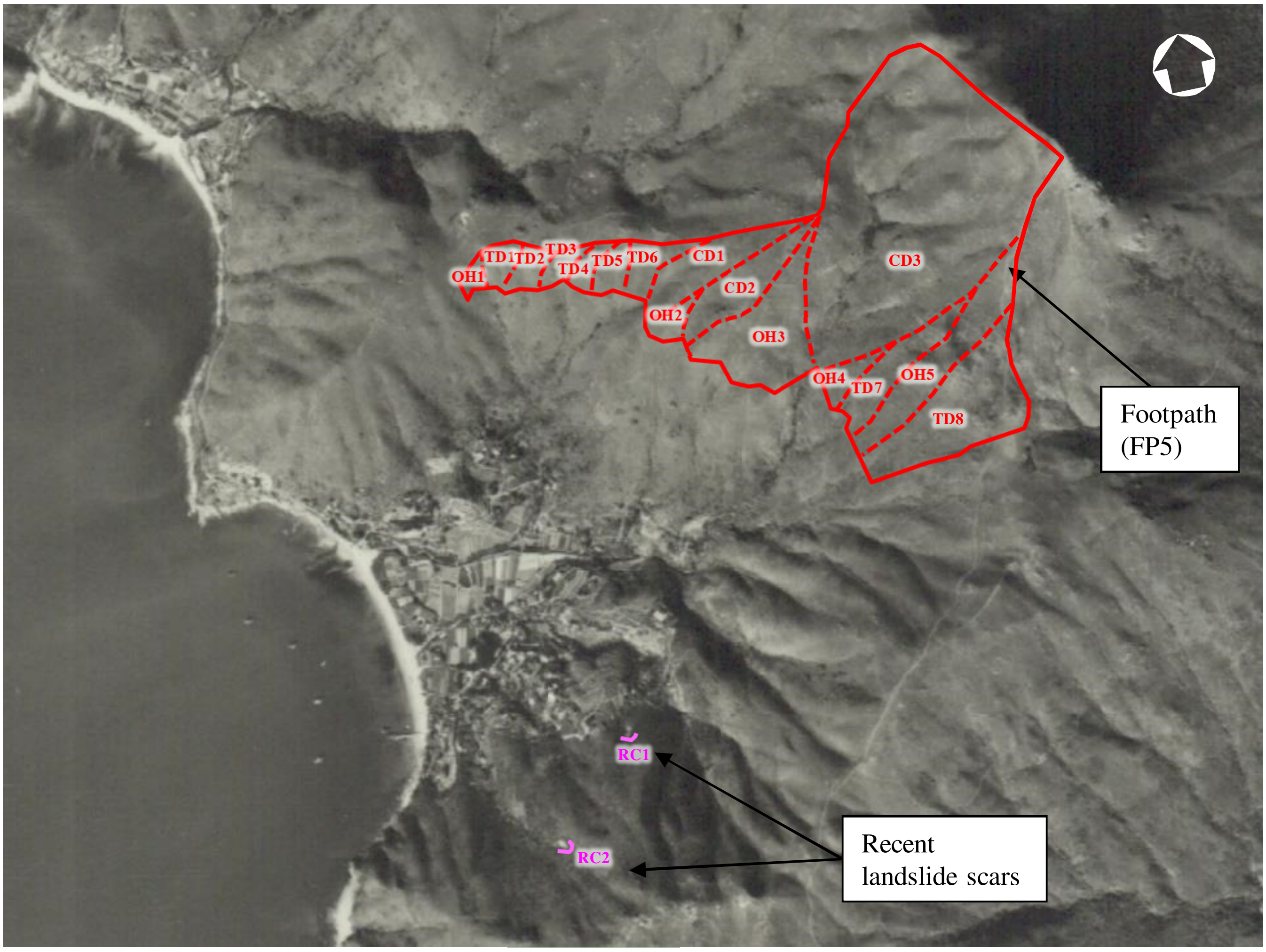
FIGURE B5

Location

Landfill Site II/III, Tseung Kwan O

Scale
NTS

Date
29 May 2022



Photograph No.: 8038 **Date of Photograph: 20 Dec 1973** **Altitude: 12,500'**

Legend:

- 🟥 Approximate Boundary of the NTSA
- - - - Catchment Boundary
- ⌒ Recent landslide scar

- Two high reflectance concave depressions are discerned approximately 415m and 535m adjacent to Catchment No. TD8, bare soil without any vegetation is observed, probably recent landslides (RC1 and RC2). RC1 is located on a topographic depression whilst RC2 located on the bank of a drainage line, both of them appears as shallow depressions. The estimated failure volumes of RC1 and RC2 are about 20m³ and 25m³ respectively. These two locations are registered as ENTLI Nos. 12SWA0376E (RC1) and 12SWA0377E (RC2).
- A new footpath (FP5) is formed along the eastern boundary of the NTSA which traversed along the spurline from the top of Catchment No. CD3 downslope to the top of Catchment No. TD8 which adjoining FP1.

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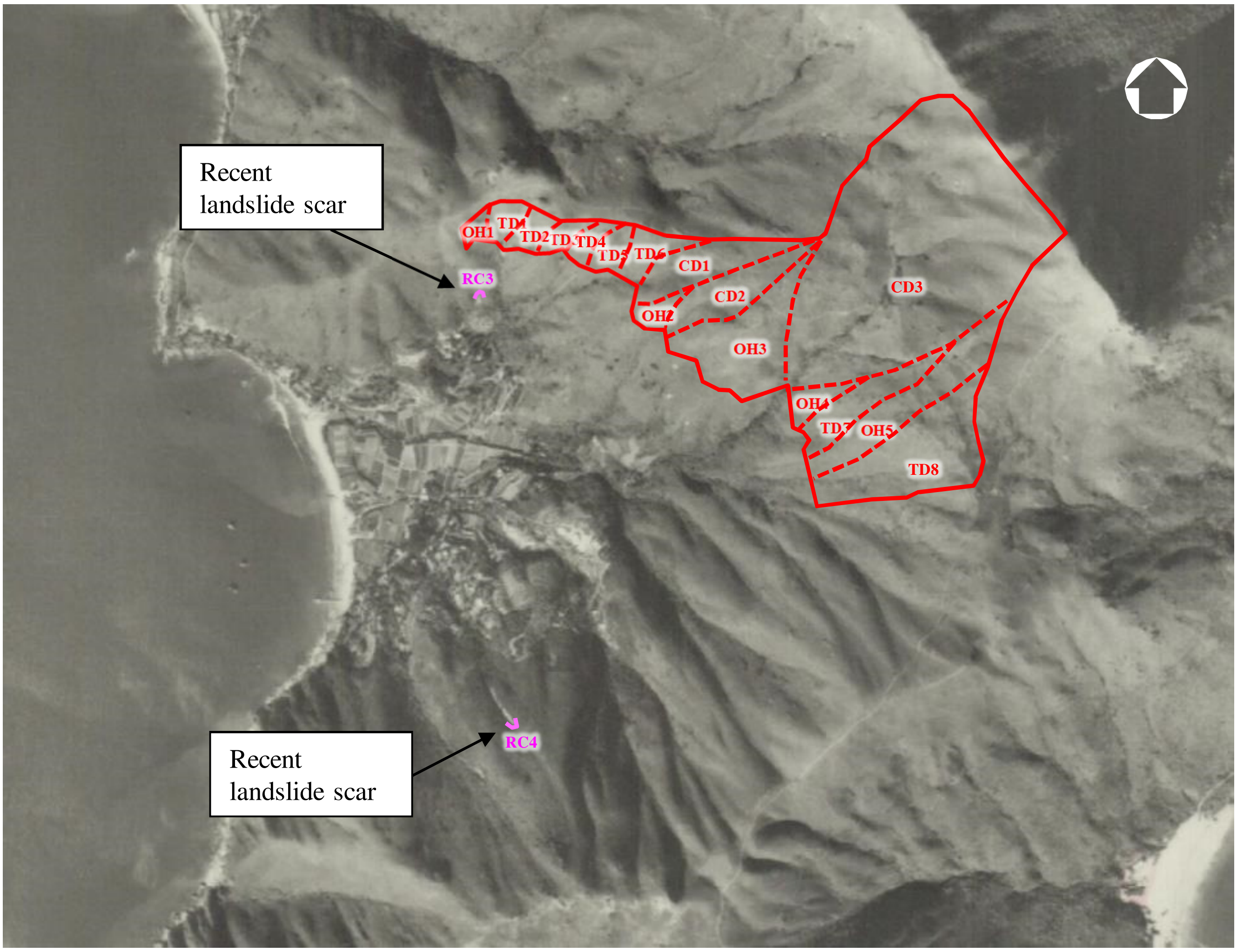
FIGURE B6

Location
Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022



Photograph No.: 12055 **Date of Photograph: 24 Dec 1975** **Altitude: 12,500'**

Legend:

Approximate Boundary of the NTSA

---- Catchment Boundary

Recent landslide scar

- A very shallow depression is evident on an open hillslope at about 102m below Catchment No. OH1. It is highly reflective bare soil surface without any vegetation, possibly recent landslide RC3. The failure area is relatively small and therefore the estimated source volume is only about 10m³. This is probably the location of ENTLI No. 12SWA0378E.
- An elongated depression is apparent along a drainage line which located approximately 477m adjacent to Catchment No. TD8. It is highly reflective, bare soil is observed, probably a channelized debris flow (RC4) was occurred very recently due to no vegetation is present. The source area is narrow but long in shaped, and it is relatively incisive when compares to RC3. RC4 has an estimated failure source volume of 40m³. This recent landslide event is registered as ENTLI No. 12SWA0380E.

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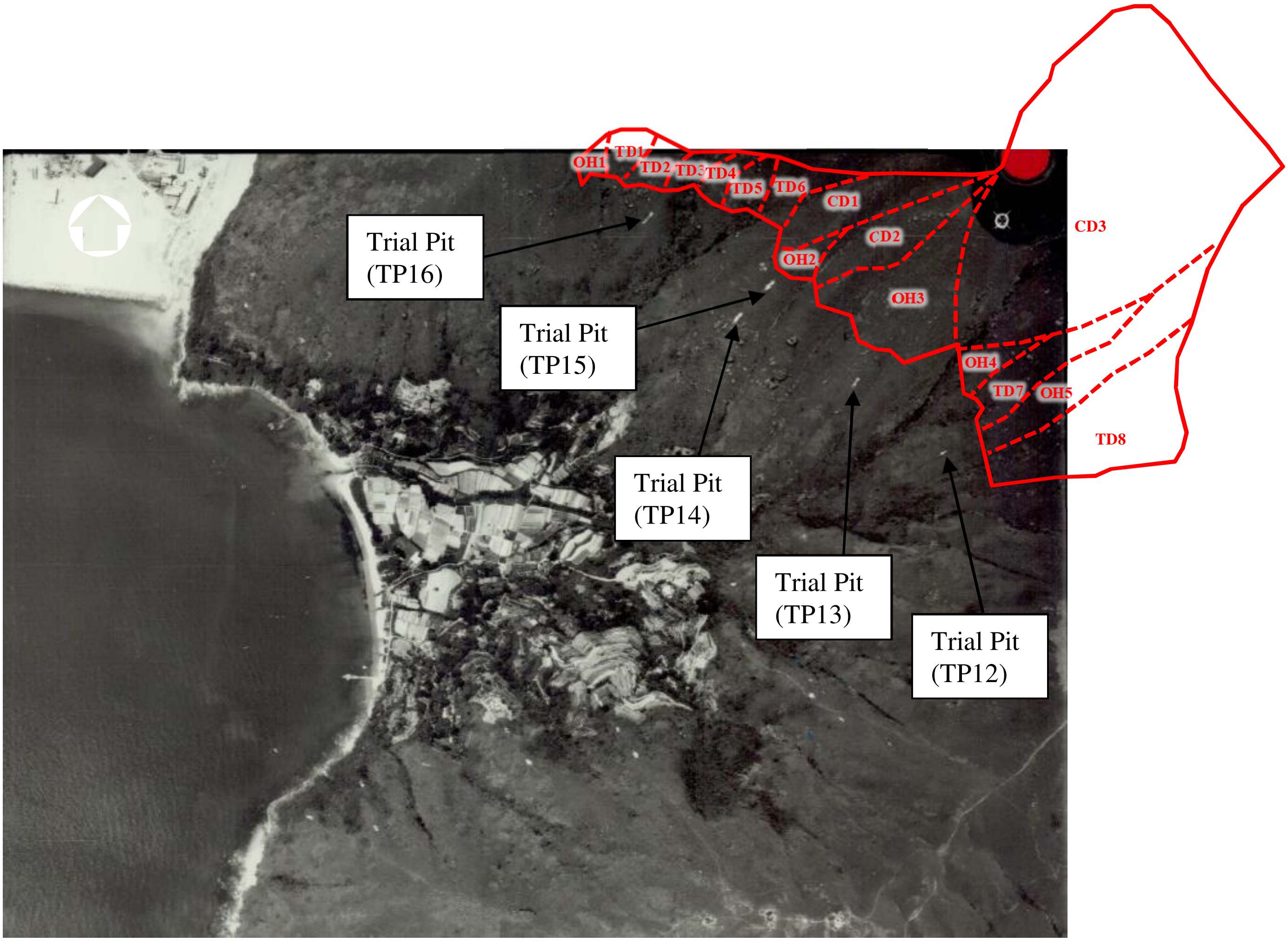
FIGURE B7

Location

Landfill Site II/III,
Tseung Kwan O

Scale NTS

Date 29 May 2022


OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
OH4
TD7
OH5
TD8
Trial Pit (TP16)
Trial Pit (TP15)
Trial Pit (TP14)
Trial Pit (TP13)
Trial Pit (TP12)

Photograph No.: 65988 **Date of Photograph: 24 Apr 1985** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

- - - - Catchment Boundary

- Several tiny high reflectance features are present below Catchment Nos. TD2, OH2, OH3 and TD7. Bare soil is observed, sharp break of slopes are discerned within the bare soil features. This is possibly due to minor excavation by anthropogenic activities, the excavated soil were then dumped and pushed downslope which formed the soil trails. The boundary in between the excavated areas and the soil trails formed the convex break of slopes. These locations are possibly the trial pit locations of TP12, TP13, TP14, TP15 and TP16 under GIU No. 05553.

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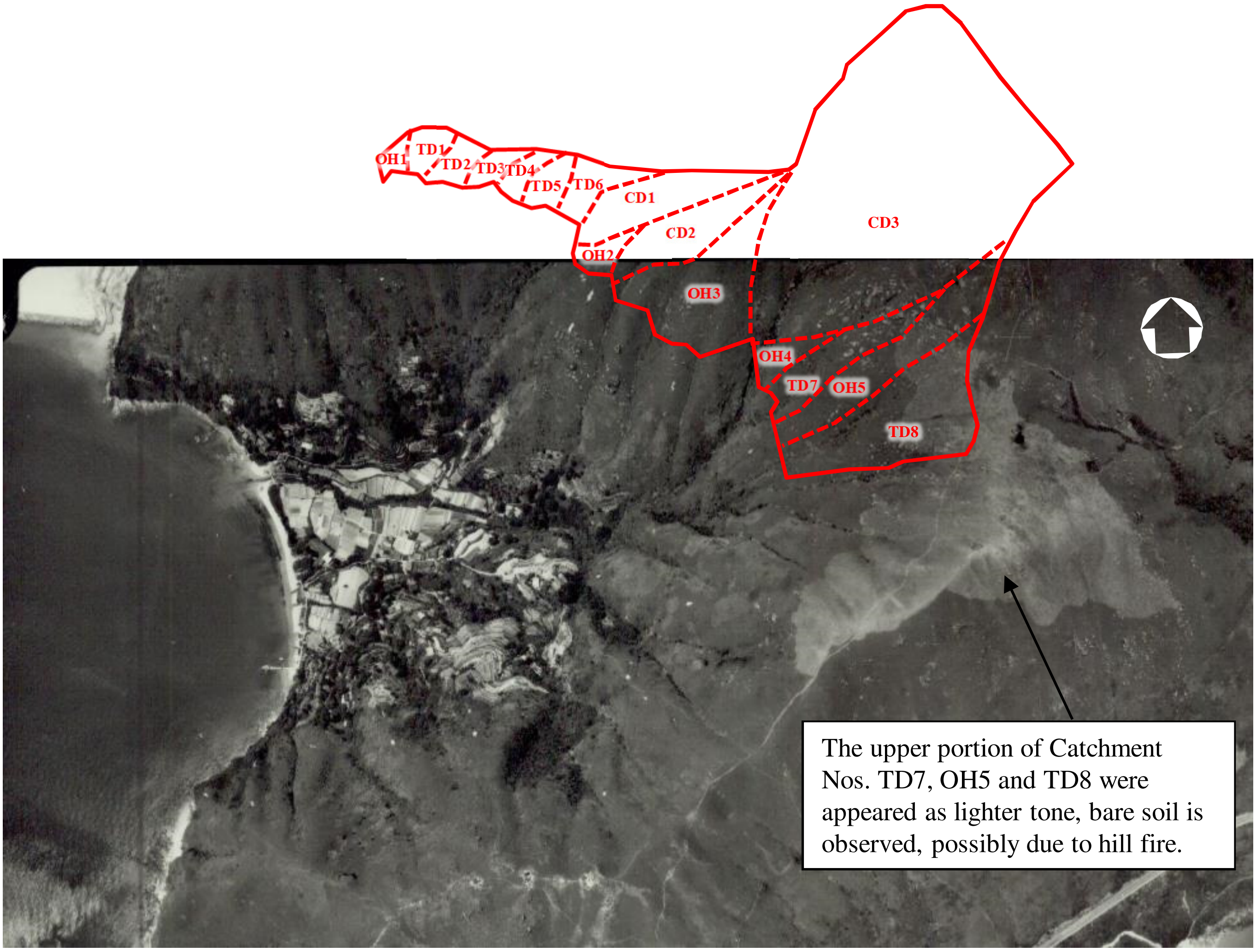
FIGURE B18

Location
Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022



The upper portion of Catchment Nos. TD7, OH5 and TD8 were appeared as lighter tone, bare soil is observed, possibly due to hill fire.

Photograph No.: 65987 **Date of Photograph: 24 Apr 1985** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

- - - - Catchment Boundary

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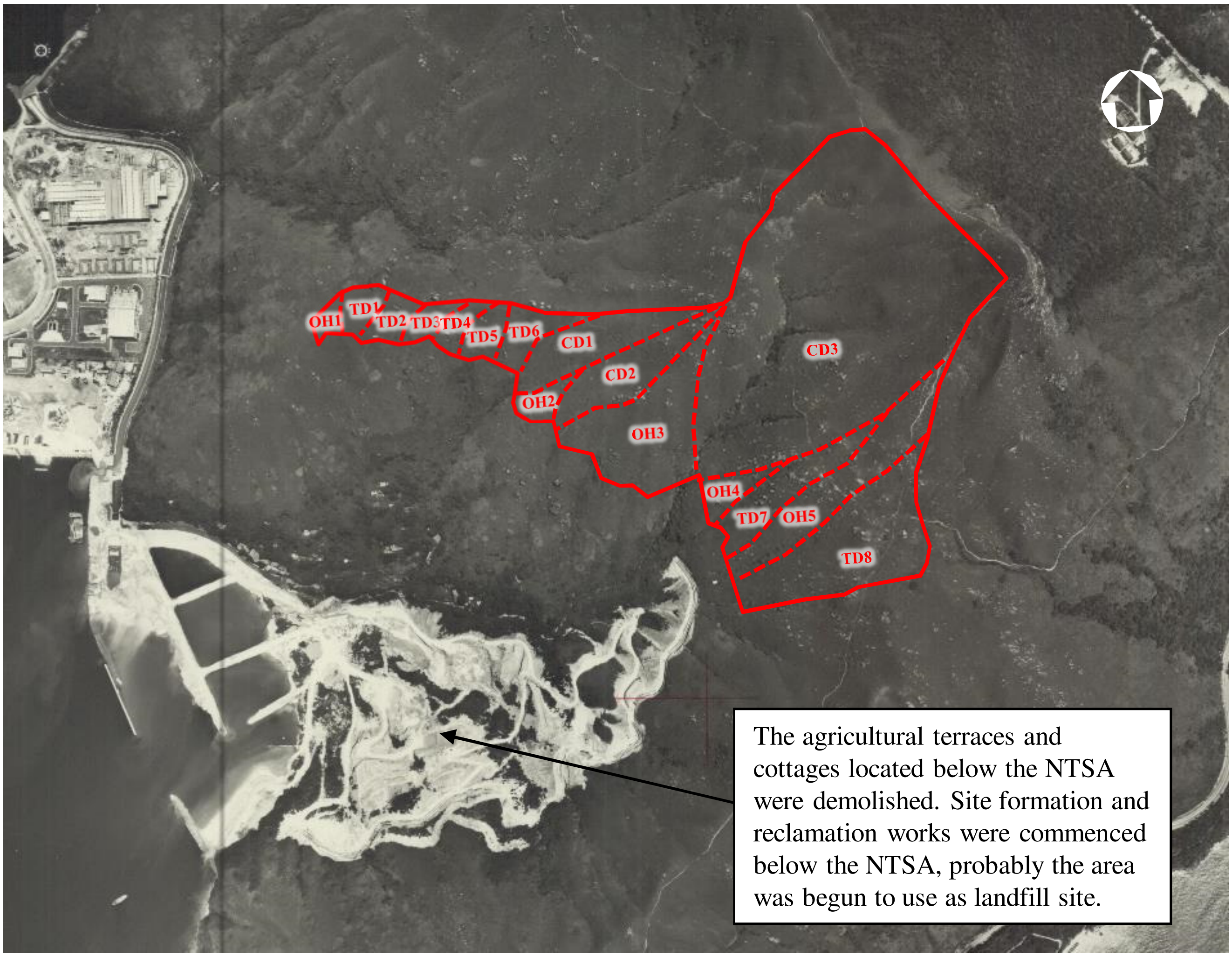
FIGURE B9

Location

Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022



The agricultural terraces and cottages located below the NTSA were demolished. Site formation and reclamation works were commenced below the NTSA, probably the area was begun to use as landfill site.

Photograph No.: A12791 **Date of Photograph: 2 Jun 1988** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

- - - - Catchment Boundary

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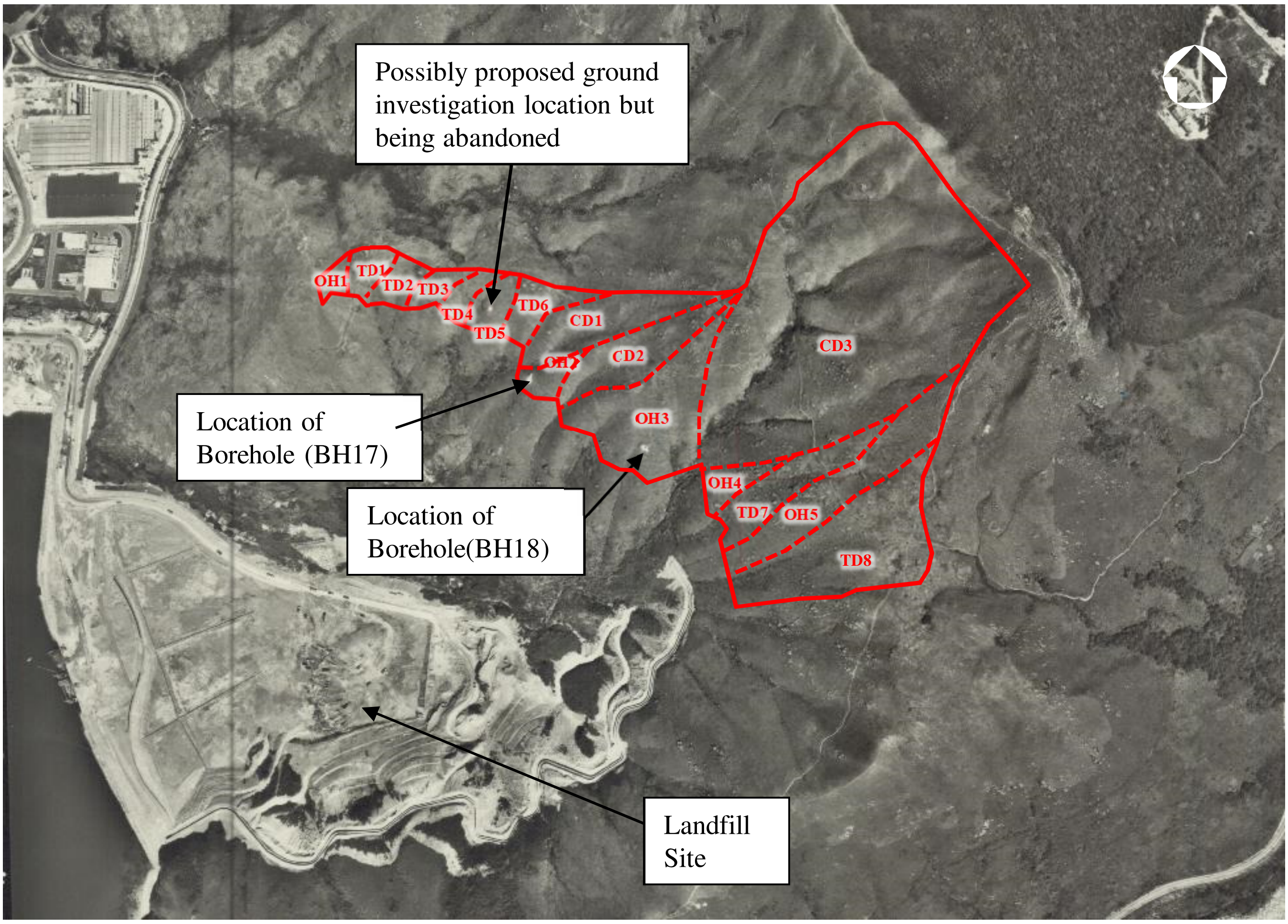
FIGURE B10

Location

Landfill Site II/III,
Tseung Kwan O

Scale NTS	Date 29 May 2022


Possibly proposed ground investigation location but being abandoned
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
OH2
CD2
CD3
OH3
Location of Borehole (BH17)
Location of Borehole(BH18)
OH4
TD7
OH5
TD8
Landfill Site

Photograph No.: A16793 **Date of Photograph: 28 Mar 1989** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

- - - - Catchment Boundary

- The locations within Catchment Nos. OH2 and OH3 are possibly the Borehole locations of BH17 and BH18 under GIU No. 12800.
- The bare soil existed in Catchment No. TD5 appeared as rounded bare soil surface and thus likely created by anthropogenic activities, possibly this was a proposed ground investigation location but being abandoned, therefore no ground investigation record could be found.
- The site formation works below the NTSA was ongoing, the area was continued to serve as landfill site.

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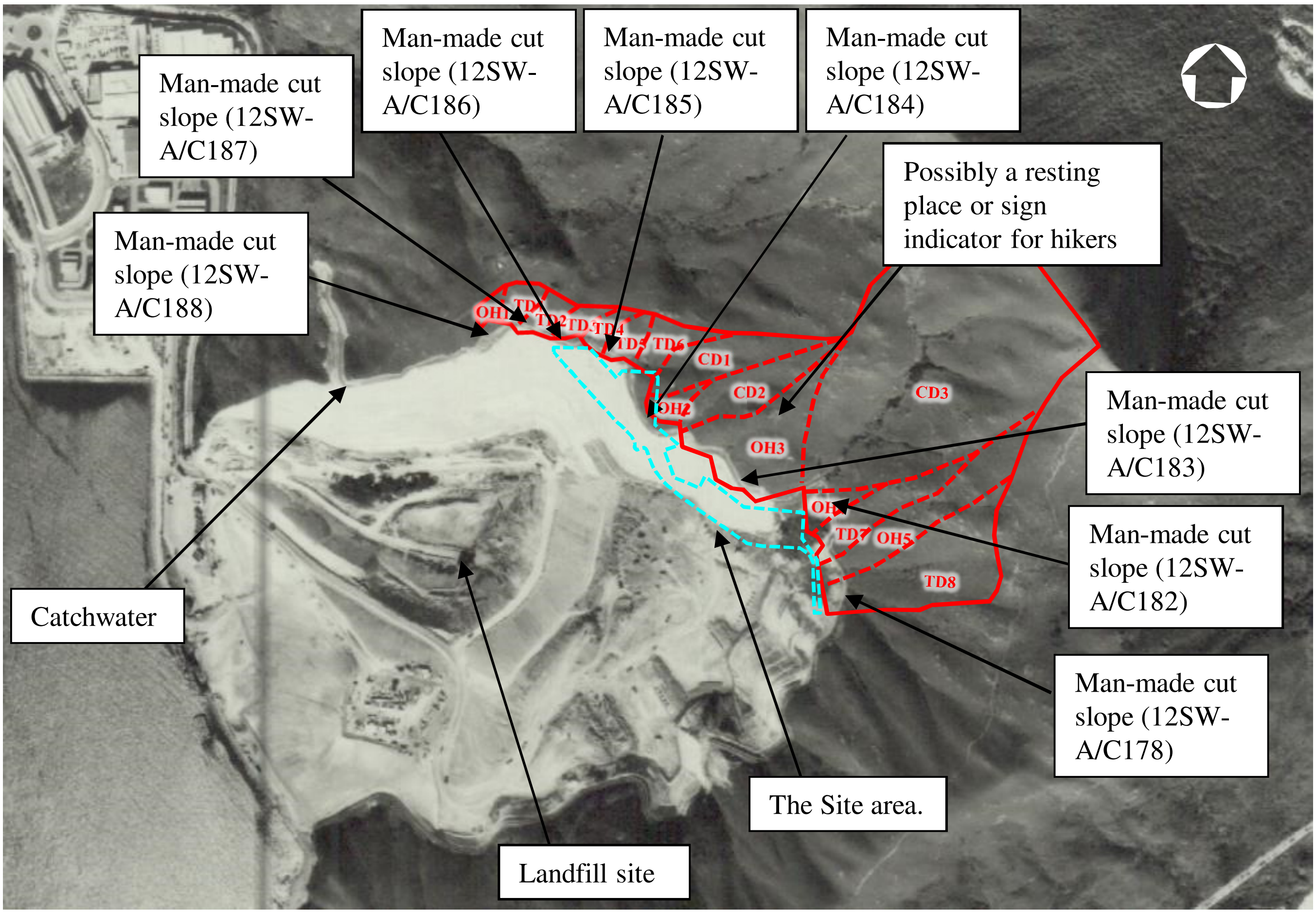
FIGURE B11

Location

Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022


Man-made cut slope (12SW-A/C187)
Man-made cut slope (12SW-A/C186)
Man-made cut slope (12SW-A/C185)
Man-made cut slope (12SW-A/C184)
Possibly a resting place or sign indicator for hikers
Man-made cut slope (12SW-A/C188)
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
CD3
OH3
OH4
TD7
OH5
TD8
Man-made cut slope (12SW-A/C183)
Man-made cut slope (12SW-A/C182)
Man-made cut slope (12SW-A/C178)
Catchwater
The Site area.
Landfill site

Photograph No.: A24428 **Date of Photograph: 3 Dec 1990** **Altitude: 10,000'**

Legend:

Approximate Boundary of the NTSA

---- Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

- A linear feature, probably catchwater is aligned along the toe of the NTSA. Formation of eight man-made cut slopes were commenced along the toe of the NTSA, probably in association with the alignment of the catchwater. They were registered as Feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188.
- A cross-shaped features are apparent in the middle portion of Catchment No. OH3. It was located at the intersection of two footpaths, possibly a resting place or sign indicator for hikers.

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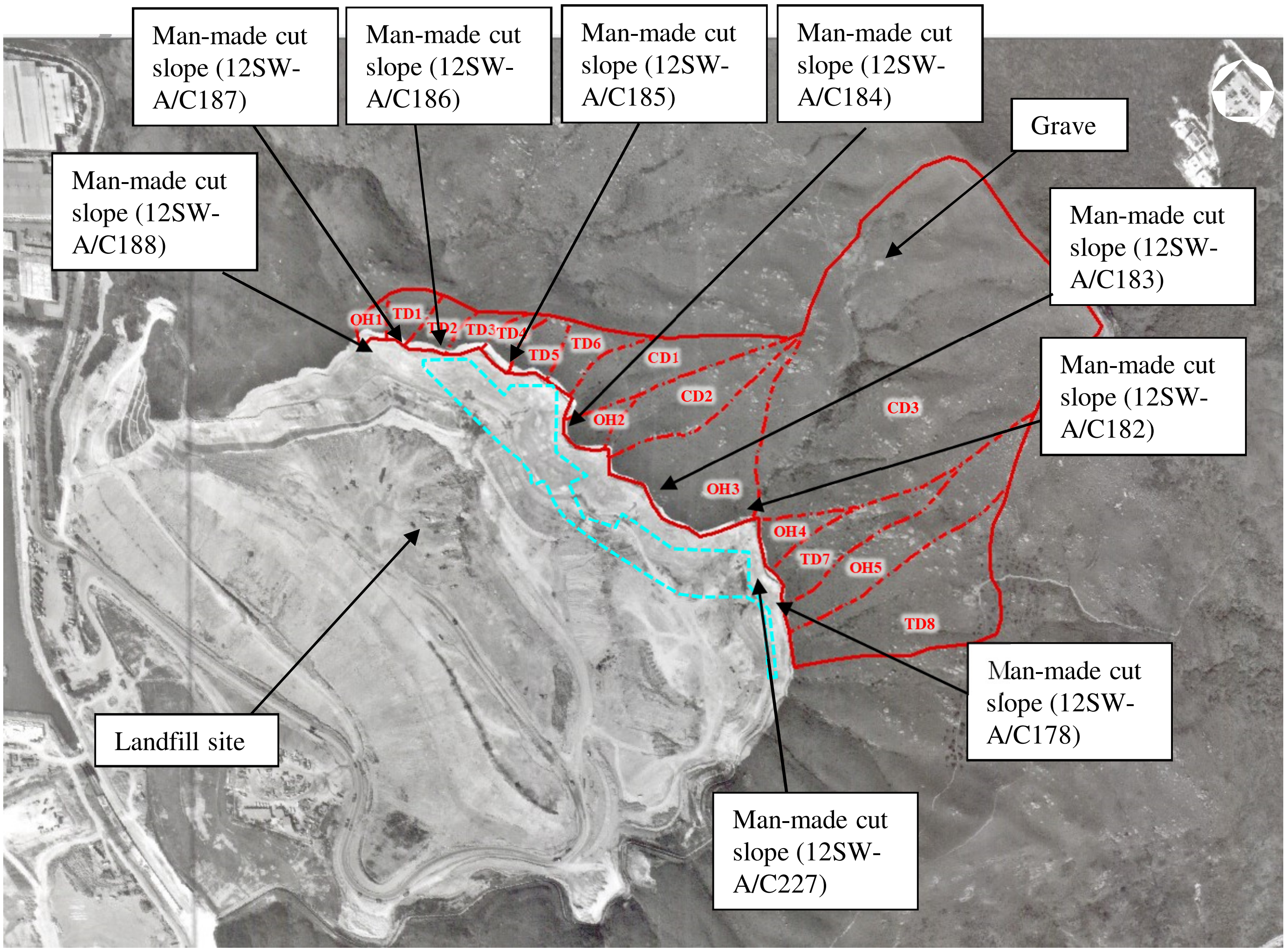
FIGURE B12

Location

Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022



Man-made cut slope (12SW-A/C187)
Man-made cut slope (12SW-A/C186)
Man-made cut slope (12SW-A/C185)
Man-made cut slope (12SW-A/C184)
Grave
Man-made cut slope (12SW-A/C188)
Man-made cut slope (12SW-A/C183)
Man-made cut slope (12SW-A/C182)
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
CD3
OH3
OH4
TD7
OH5
TD8
Landfill site
Man-made cut slope (12SW-A/C178)
Man-made cut slope (12SW-A/C227)

Photograph No.: A32763 **Date of Photograph: 20 Oct 1992** **Altitude: 4,000'**

Legend:

🟥 Approximate Boundary of the NTSA

---- Catchment Boundary

🟦 Approximate Boundary of the Site (Proposed public riding school development area)

- A small patch of high reflectance bare soil is observed at the upper portion of Catchment No. CD3, possible a grave was constructed.
- Formation of feature Nos. 12SW-A/C178, 12SW-A/C182, 12SW-A/C183, 12SW-A/C184, 12SW-A/C185, 12SW-A/C186, 12SW-A/C187 and 12SW-A/C188 were completed.
- A cut slope was formed below Catchment Nos. TD7 and OH5, probably in association with the extension of the landfill site. This man-made slope was registered as Feature No. 12SW-A/C227.
- The area below the NTSA was continued to serve as landfill site.

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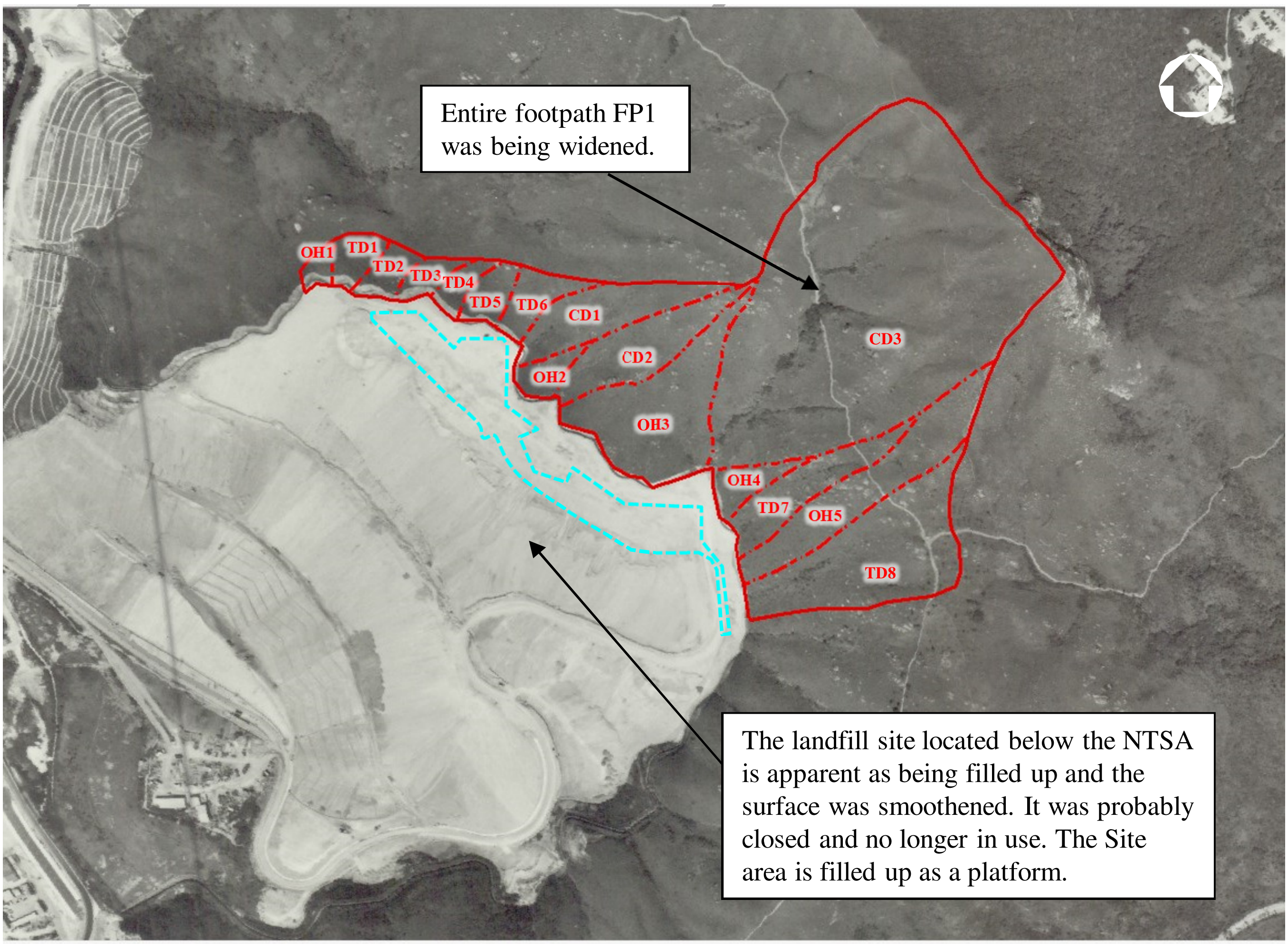
FIGURE B13

Location
Landfill Site II/III, Tseung Kwan O

Scale
NTS

Date
29 May 2022



Entire footpath FP1 was being widened.

The landfill site located below the NTSA is apparent as being filled up and the surface was smoothened. It was probably closed and no longer in use. The Site area is filled up as a platform.

Photograph No.: A39049 **Date of Photograph: 17 Oct 1994** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

---- Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

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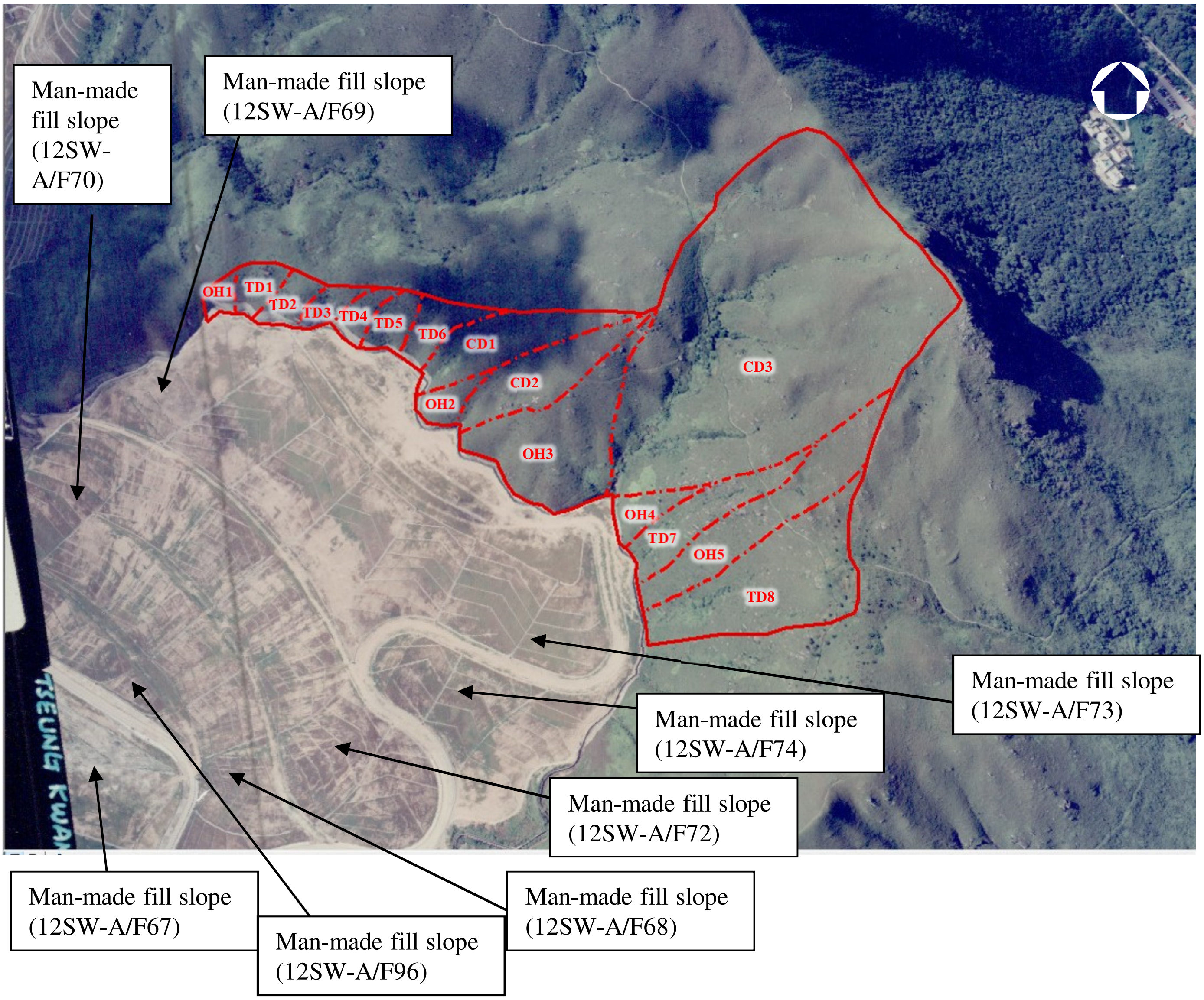
FIGURE B14

Location

Landfill Site II/III,
Tseung Kwan O

Scale
NTS

Date
29 May 2022


Man-made fill slope (12SW-A/F70)
Man-made fill slope (12SW-A/F69)
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
CD3
OH3
OH4
TD7
OH5
TD8
TSEUNG KWAN
Man-made fill slope (12SW-A/F73)
Man-made fill slope (12SW-A/F74)
Man-made fill slope (12SW-A/F72)
Man-made fill slope (12SW-A/F67)
Man-made fill slope (12SW-A/F96)
Man-made fill slope (12SW-A/F68)

Photograph No.: CN10018 **Date of Photograph: 18 Jul 1995** **Altitude: 3,500'**

Legend:

⬠	Approximate Boundary of the NTSA
- - - -	Catchment Boundary
⬚	Approximate Boundary of the Site (Proposed public riding school development area)

- Eight man-made fill slopes were formed at the former landfill site which located below the NTSA. Man-made drainage channels are formed on the slope surfaces. They are registered as Feature Nos. 12SW-A/F67, 12SW-A/F68, 12SW-A/F69, 12SW-A/F70, 12SW-A/F72, 12SW-A/F73, 12SW-A/F74 and 12SW-A/F96.

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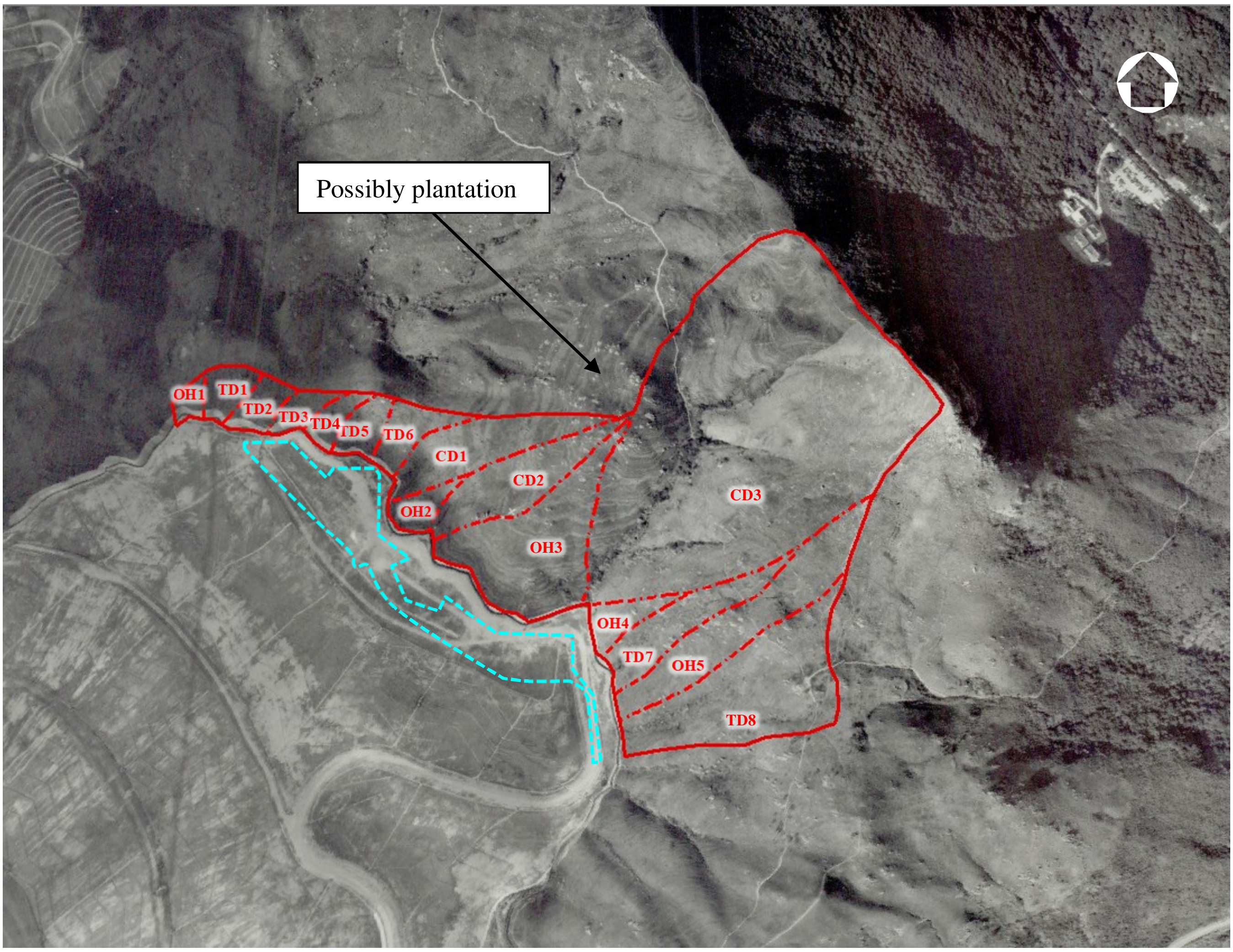
FIGURE B15

Location
Landfill Site II/III, Tseung Kwan O

Scale
NTS

Date
29 May 2022



Photograph No.: A42221 **Date of Photograph: 18 Jan 1996** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

---- Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

- Many linear features are apparent parallel to the contour lines in Catchment Nos. TD6, CD1, OH2, CD2, OH3 and CD3. A very thin layer of surface soil may be disturbed along these linear features by anthropogenic activities, possibly plantation.

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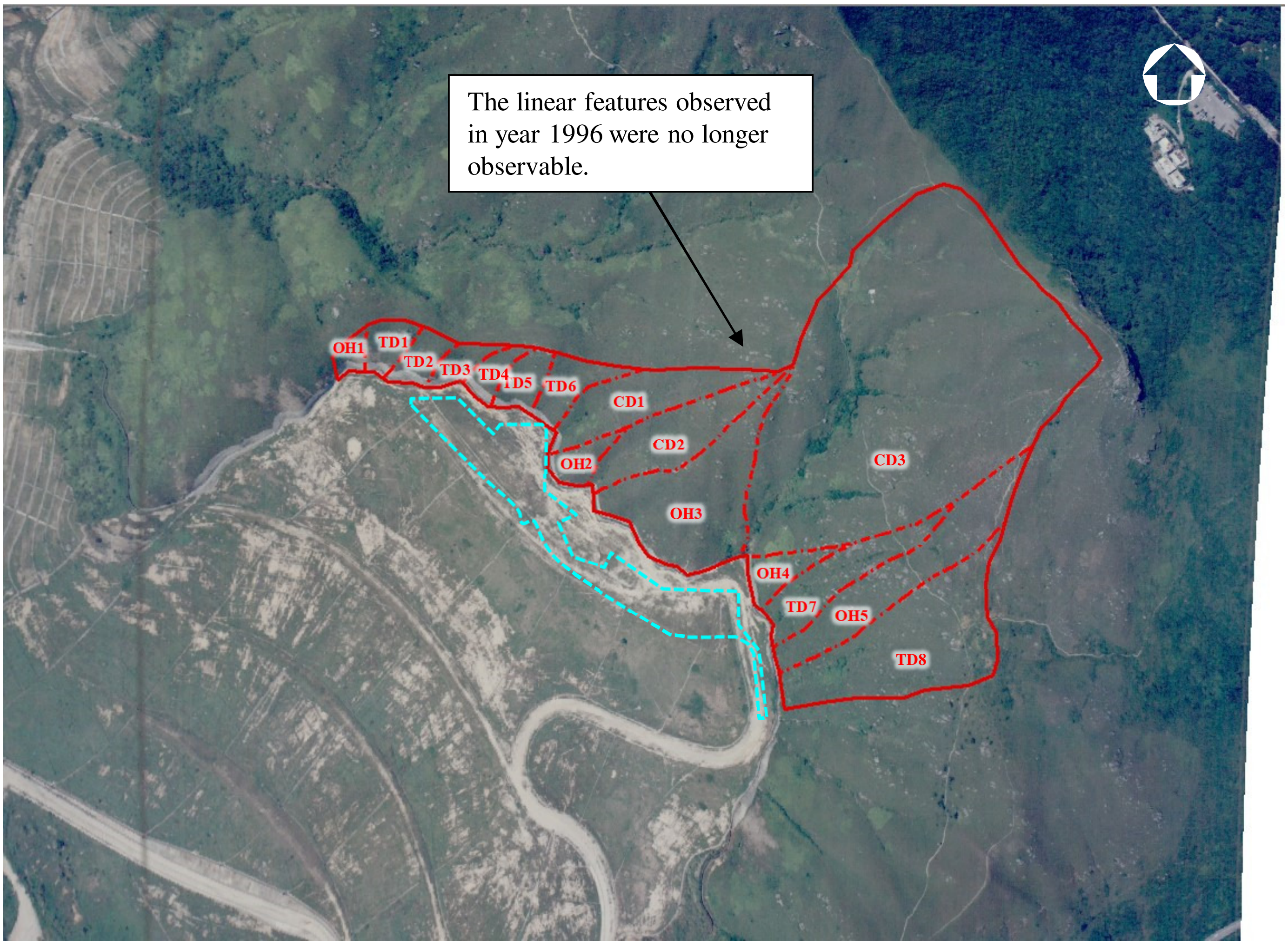
The linear features observed in year 1996 were no longer observable.
OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
OH4
TD7
OH5
TD8

Photograph No.: CN17111 **Date of Photograph: 26 May 1997** **Altitude: 4,000'**

Legend:

Approximate Boundary of the NTSA

Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

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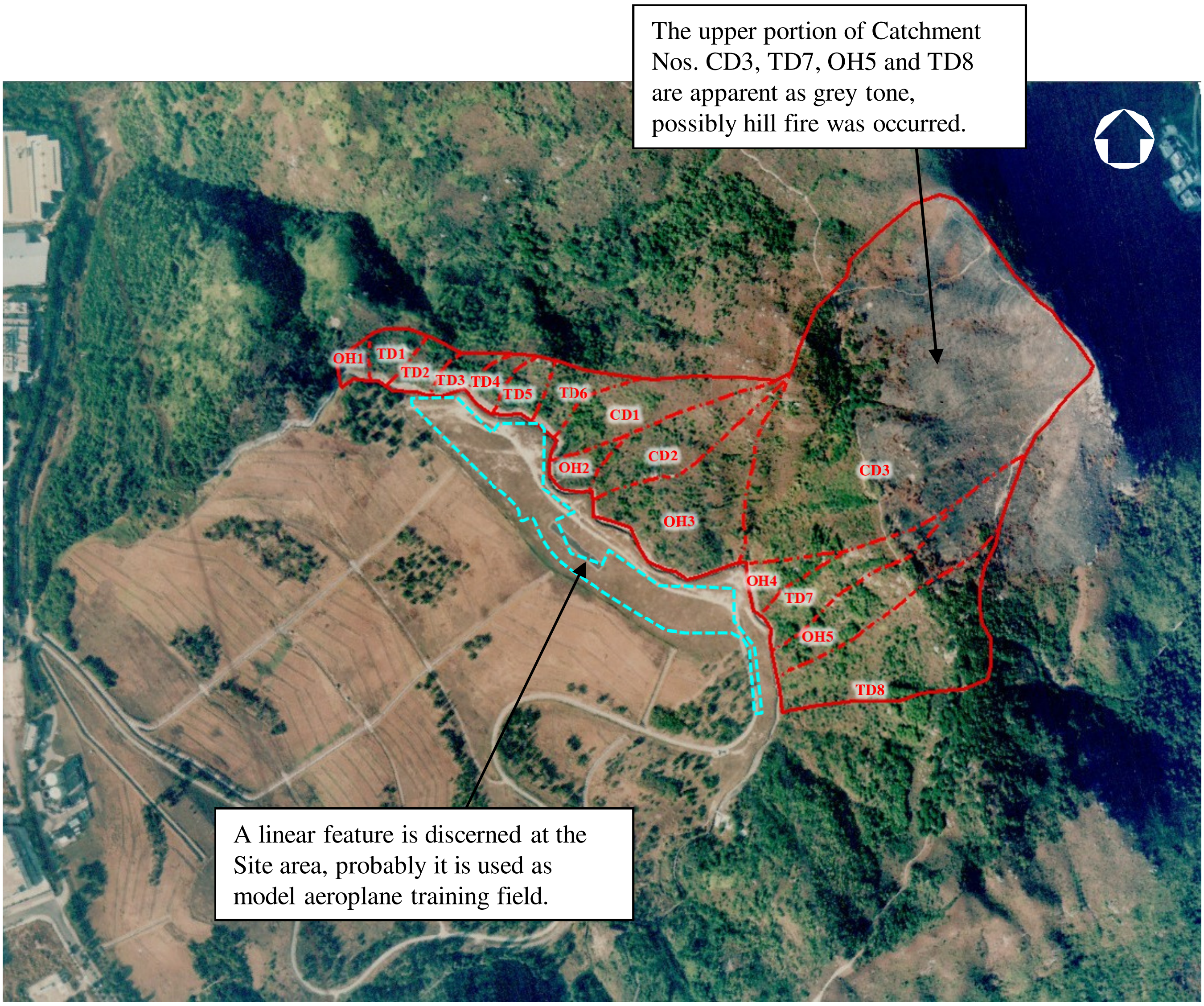
FIGURE B17

Location

Landfill Site II/III,
Tseung Kwan O

Scale
NTS

Date
29 May 2022



The upper portion of Catchment Nos. CD3, TD7, OH5 and TD8 are apparent as grey tone, possibly hill fire was occurred.

A linear feature is discerned at the Site area, probably it is used as model aeroplane training field.

Photograph No.: CW62911 **Date of Photograph: 16 Dec 2004** **Altitude: 4,000'**

Legend:

▭	Approximate Boundary of the NTSA	- - - -	Catchment Boundary
⋯	Approximate Boundary of the Site (Proposed public riding school development area)		

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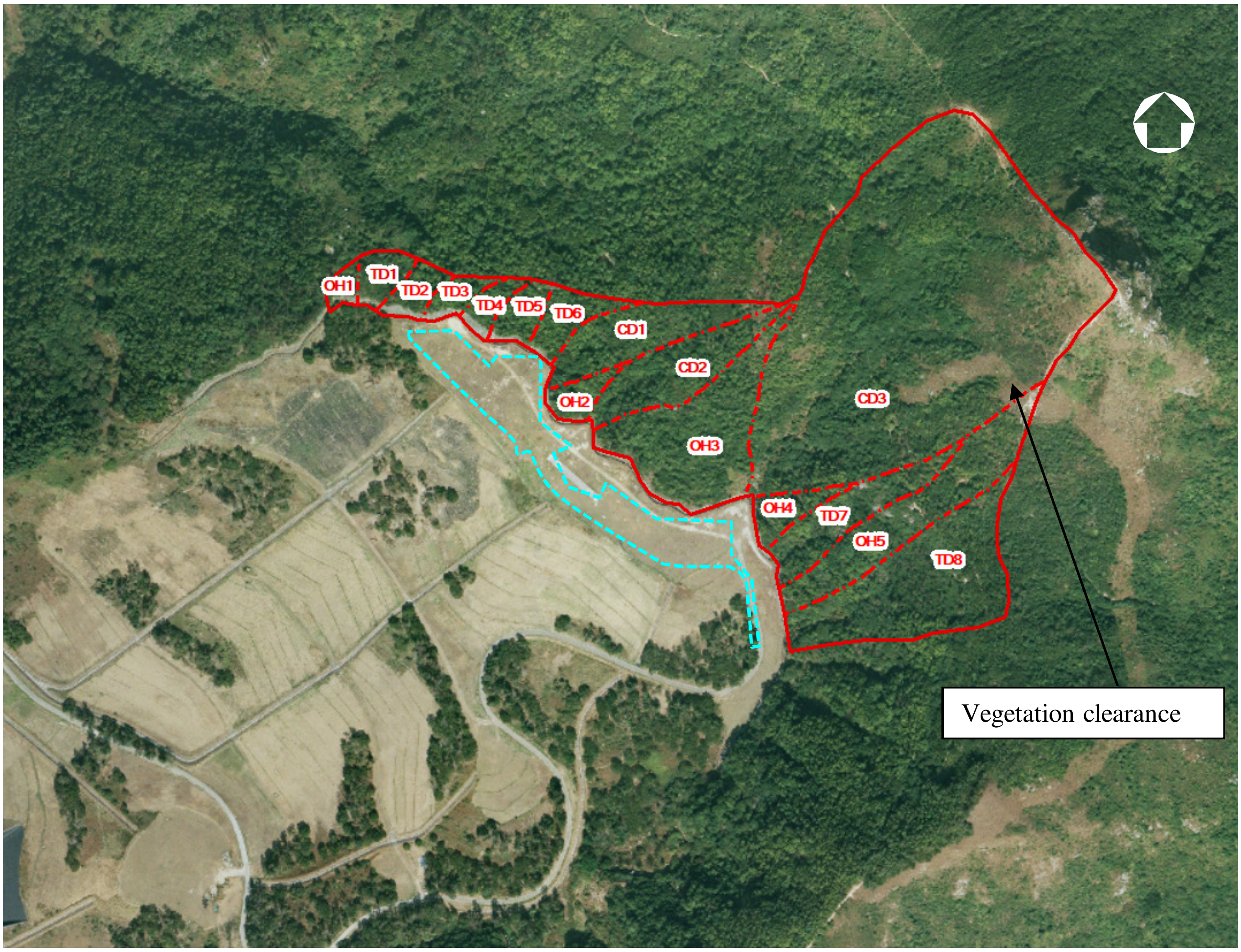
FIGURE B18

Location

Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022


OH1
TD1
TD2
TD3
TD4
TD5
TD6
CD1
CD2
OH2
OH3
CD3
OH4
TD7
OH5
TD8
Vegetation clearance

Photograph No.: E046899C **Date of Photograph: 5 Oct 2018** **Altitude: 6,900'**

Legend:

Approximate Boundary of the NTSA

Catchment Boundary

Approximate Boundary of the Site (Proposed public riding school development area)

- No observable significant change to the NTSA since 2010s till present except the vegetation growth or clearance.

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CALVINT GEO-SERVICES LIMITED
THE BEST SOLUTION FOR YOU

Project:

Natural Terrain Hazard Study for the Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

FIGURE B19

Location

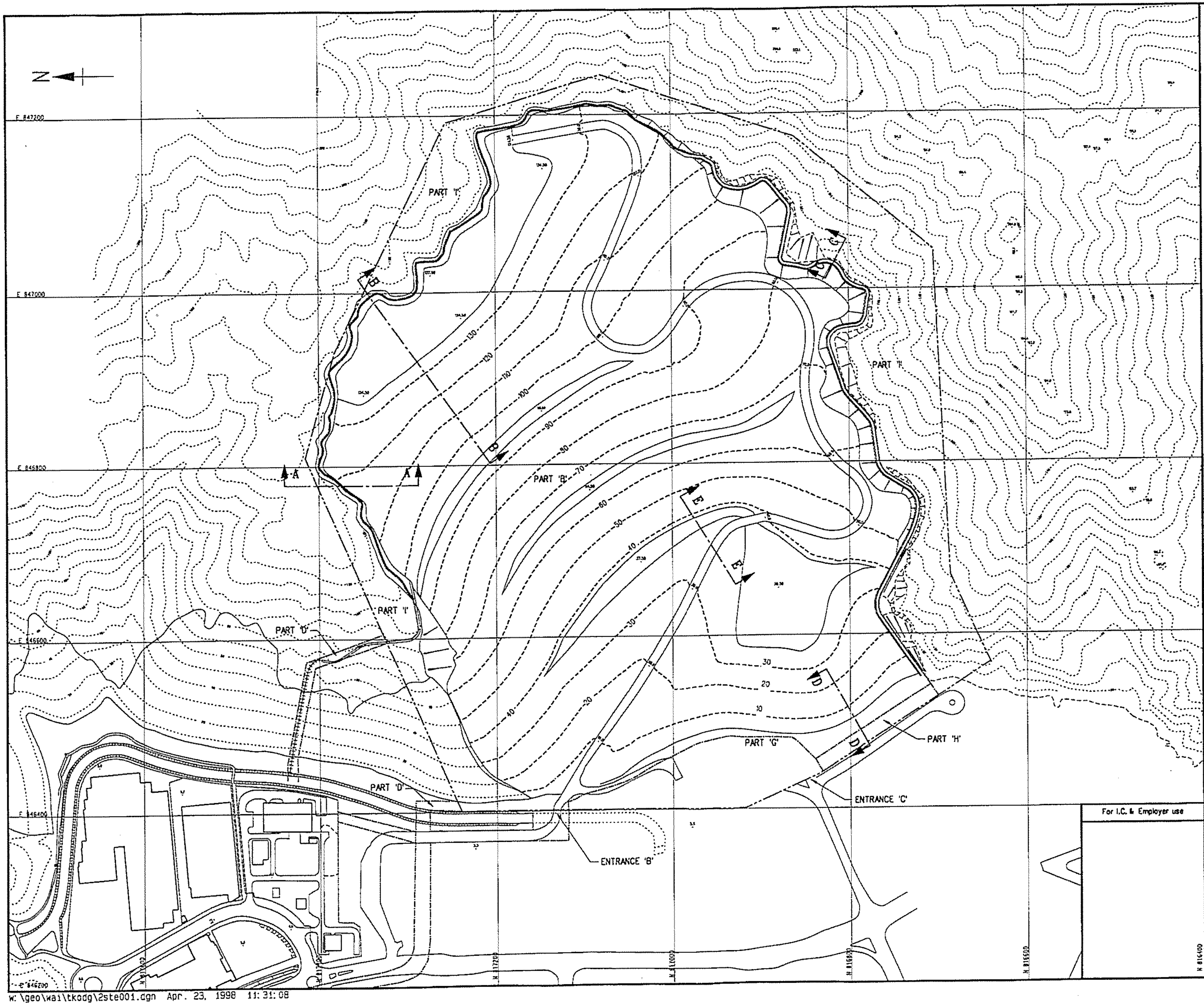
Landfill Site II/III, Tseung Kwan O

Scale NTS

Date 29 May 2022

Appendix E

Relevant As-built Drawings of Stage II/III Landfill


N
E 847200
E 847000
E 846800
E 846600
E 846400
E 846200
PART 'I'
PART 'B'
PART 'D'
PART 'G'
PART 'H'
ENTRANCE 'B'
ENTRANCE 'C'
A
B
C
D
E
130
120
110
100
90
80
70
60
50
40
30
20
10

For I.C. & Employer use

NOTES:

1. ALL GRIDS ARE HONG KONG GRID 1980.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. FOR SECTIONS REFER TO DRAWING NOS. STG2/STE/DRW/011 AND STG2/STE/DRW/012.
4. FORMATION LEVELS TO BE CONFIRMED ONCE DEPTH OF EXISTING COVER KNOWN.

LEGEND:

— - - — - -	SITE BOUNDARY
————	BOUNDARY BETWEEN OFF SITE PARTS
········	EXISTING CONTOURS
- - - - - -	CONTOURS AFTER REPROFILING

Rev.	Date	Description	Initial

	Designed	Drawn	Checked
Initial			
Date			

Approved

CAD ref. MAIN 2STE001.DGN REF: TKOPROF, TKO-ALDON

Contract no. EP/SP/29/95

Contract

TSEUNG KWAN O
LANDFILLS RESTORATION

Drawing title

STAGE II/III
FINAL INTERMEDIATE COVER
LAYER FORMATION PLAN

Drawing no. STG2/STE/DRW/001

Scale 1:2000

BINNIE CONSULTANTS LIMITED
賓尼工程顧問有限公司
ENGINEERS & SCIENTISTS
賓尼

Construction Contractor

CHUN WO CONSTRUCTION & ENGINEERING CO., LTD.

Environmental Consultants

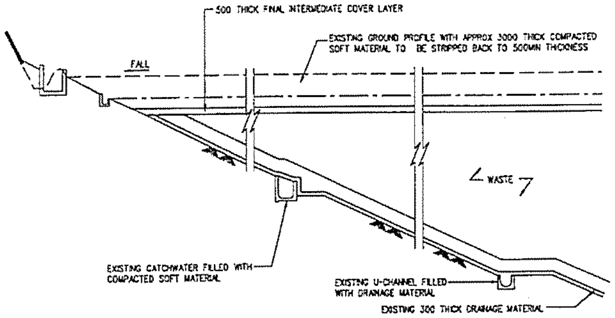
ERM (HK) LTD.

Independent Checking Engineer

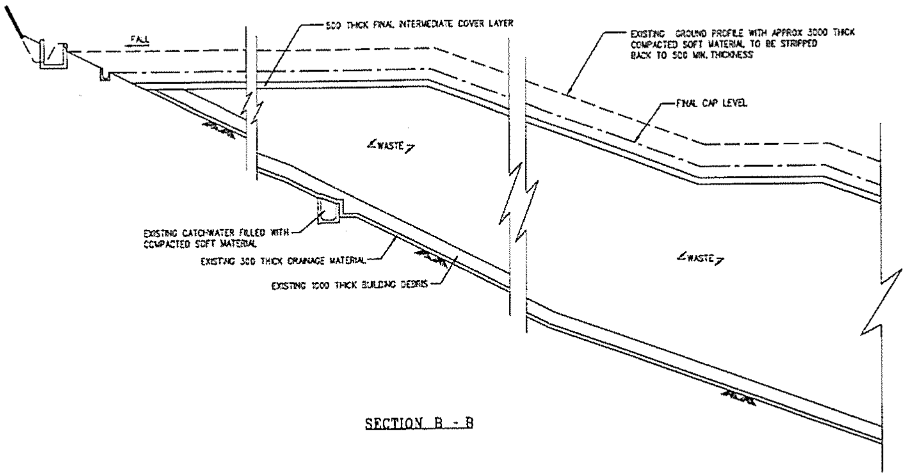
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE BFI WASTE SERVICES LTD.

W:\geo\wai\tkodg\2ste001.dgn Apr. 23, 1998 11:31:08


500 THICK FINAL INTERMEDIATE COVER LAYER
EXISTING GROUND PROFILE WITH APPROX 3000 THICK COMPACTED SOFT MATERIAL TO BE STRIPPED BACK TO 500MIN THICKNESS
FALL
WASTE
EXISTING CATCHWATER FILLED WITH COMPACTED SOFT MATERIAL
EXISTING U-CHANNEL FILLED WITH DRAINAGE MATERIAL
EXISTING 300 THICK DRAINAGE MATERIAL

SECTION A - A


FALL
500 THICK FINAL INTERMEDIATE COVER LAYER
EXISTING GROUND PROFILE WITH APPROX 3000 THICK COMPACTED SOFT MATERIAL TO BE STRIPPED BACK TO 500 MIN. THICKNESS
FINAL CAP LEVEL
WASTE
EXISTING CATCHWATER FILLED WITH COMPACTED SOFT MATERIAL
EXISTING 300 THICK DRAINAGE MATERIAL
EXISTING 1000 THICK BUILDING DEBRIS
WASTE

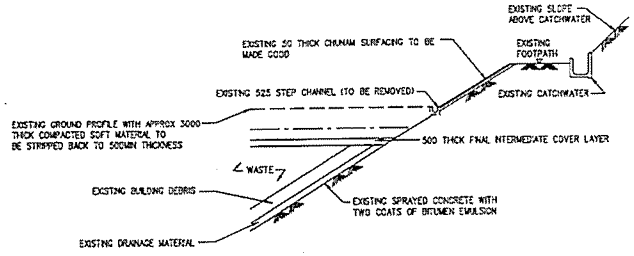
SECTION B - B

NOTES :

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. FOR LOCATIONS OF SECTIONS REFER TO DRAWING NO. STG2/STE/DRW/001.
4. THICKNESS OF EXISTING COVER LAYER TO BE CONFIRMED ON SITE.

LEGEND:

— — — —	EXISTING GROUND PROFILE
——— - ———	FINAL CAP PROFILE


EXISTING SLOPE ABOVE CATCHWATER
EXISTING 50 THICK CHUNAM SURFACING TO BE MADE GOOD
EXISTING FOOTPATH
EXISTING 525 STEP CHANNEL (TO BE REMOVED)
EXISTING CATCHWATER
EXISTING GROUND PROFILE WITH APPROX 3000 THICK COMPACTED SOFT MATERIAL TO BE STRIPPED BACK TO 500MIN THICKNESS
500 THICK FINAL INTERMEDIATE COVER LAYER
WASTE
EXISTING BUILDING DEBRIS
EXISTING SPRAYED CONCRETE WITH TWO COATS OF BITUMEN EMULSION
EXISTING DRAINAGE MATERIAL

SECTION C - C

Rev.	Date	Description	Initial

	Designed	Drawn	Checked
Initial			
Date			

Approved

CAD ref. MAIN 2STEO11.DGN REF: TKO-A1.DGN

Contract no. EP/SP/29/95

Contract

TSEUNG KWAN O
LANDFILLS RESTORATION

Drawing title

STAGE II/III
FINAL INTERMEDIATE
COVER LAYER CROSS SECTIONS
SHEET 1 OF 2

Drawing no.	Scale
STG2/STE/DRW/011	1 : 200

For I.C. & Employer use

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ENGINEERS & SCIENTISTS
賓尼

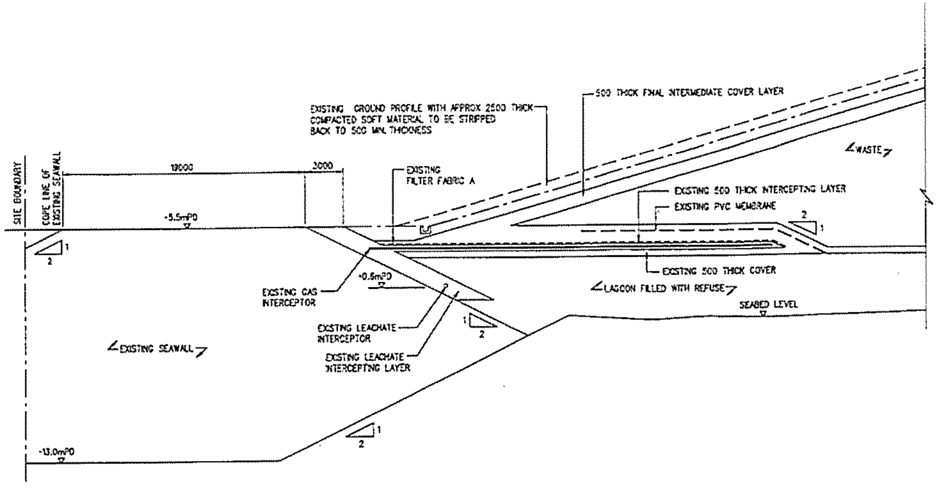
Construction Contractor
CHUN WO CONSTRUCTION & ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

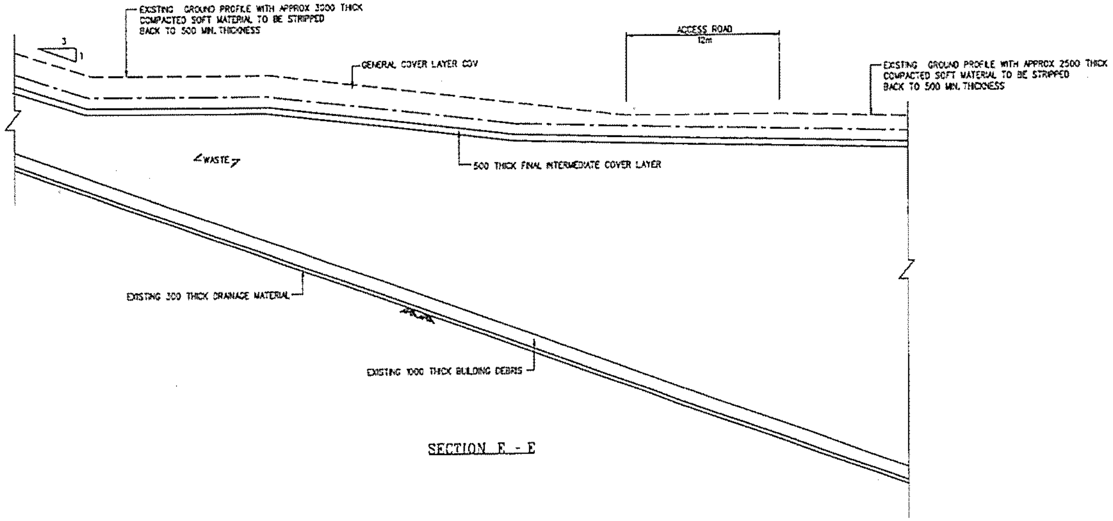
Independent Checking Engineer
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE BFI WASTE
SERVICES LTD.

w:\geo\wai\tkodq\2ste011.dgn Apr. 23, 1998 11:45:09


EXISTING GROUND PROFILE WITH APPROX 2500 THICK COMPACTED SOFT MATERIAL TO BE STRIPPED BACK TO 500 MIN. THICKNESS
500 THICK FINAL INTERMEDIATE COVER LAYER
WASTE
SITE BOUNDARY
COPE LINE OF EXISTING SEAWALL
19000
3000
EXISTING FILTER FABRIC A
EXISTING 500 THICK INTERCEPTING LAYER
EXISTING PVC MEMBRANE
2
1
+5.5mPD
EXISTING 500 THICK COVER
+0.5mPD
EXISTING GAS INTERCEPTOR
LAGOON FILLED WITH REFUSE
SEABED LEVEL
EXISTING LEACHATE INTERCEPTOR
EXISTING LEACHATE INTERCEPTING LAYER
EXISTING SEAWALL
-13.0mPD

SECTION D - D


EXISTING GROUND PROFILE WITH APPROX 3000 THICK COMPACTED SOFT MATERIAL TO BE STRIPPED BACK TO 500 MIN. THICKNESS
3
1
ACCESS ROAD
12m
GENERAL COVER LAYER COV
EXISTING GROUND PROFILE WITH APPROX 2500 THICK COMPACTED SOFT MATERIAL TO BE STRIPPED BACK TO 500 MIN. THICKNESS
WASTE
500 THICK FINAL INTERMEDIATE COVER LAYER
EXISTING 300 THICK DRAINAGE MATERIAL
EXISTING 1000 THICK BUILDING DEBRIS

SECTION E - E

NOTES :

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. FOR LOCATIONS OF SECTIONS REFER TO DRAWING NO. STG2/STE/DRW/001.
4. THICKNESS OF EXISTING COVER LAYER TO BE CONFIRMED ON SITE.

LEGEND:

— — — —	EXISTING GROUND PROFILE
——— - ———	FINAL CAP PROFILE

Rev.	Date	Description	Initial

	Designed	Drawn	Checked
Initial			
Date			

Approved

CAD ref. MAIN 2STE012.DGN
REF: TKO-ALDGN

Contract no. EP/SP/29/95

Contract

TSEUNG KWAN O
LANDFILLS RESTORATION

Drawing title

STAGE II/III
FINAL INTERMEDIATE
COVER LAYER CROSS SECTIONS
SHEET 2 OF 2

Drawing no. STG2/STE/DRW/012

Scale 1 : 200

For I.C. & Employer use

BINNIE CONSULTANTS LIMITED
賓尼工程顧問有限公司
ENGINEERS & SCIENTISTS
賓尼

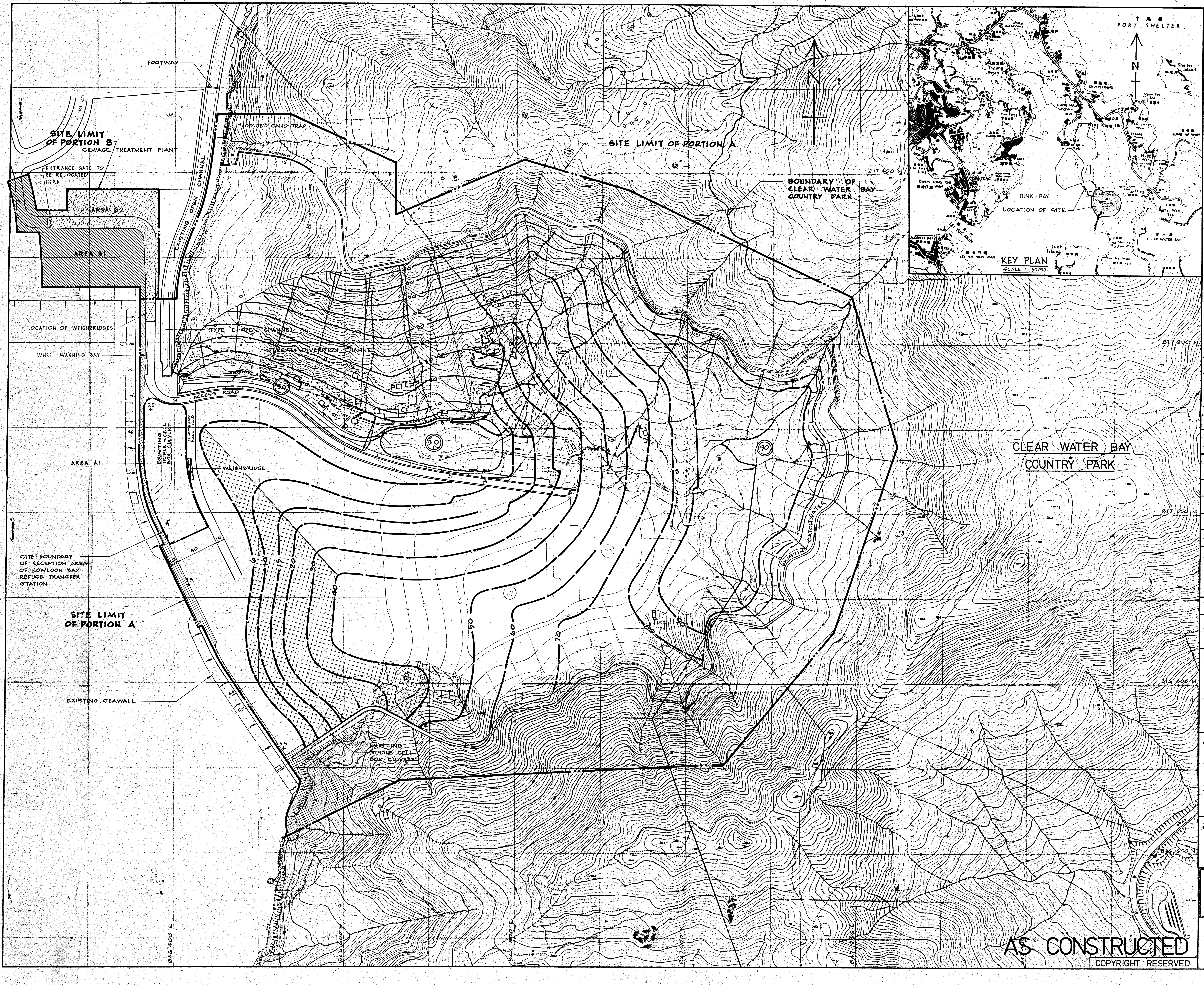
Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Checking Engineer
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE BFI WASTE
SERVICES LTD.

w:\geo\wai\tkodo\2ste012.dgn Apr 23 1998 11:45:55


FOOTWAY
EXISTING RD.
SITE LIMIT OF PORTION B
SEWAGE TREATMENT PLANT
ENTRANCE GATE TO BE RELOCATED HERE
AREA B2
AREA B1
EXISTING OPEN CHANNEL
PROPOSED SAND TRAP
PROPOSED FOOTPATH
SITE LIMIT OF PORTION A
BOUNDARY OF CLEAR WATER BAY COUNTRY PARK
PROPOSED CATCHWATER
LOCATION OF WEIGHBRIDGES
TYPE E OPEN CHANNEL
STREAM DIVERSION CHANNEL
WHEEL WASHING BAY
ACCESS ROAD
EXISTING TRIPLE-CELL BOX CULVERT
TEMPORARY HAUL ROAD
AREA A1
WEIGHBRIDGE
SITE BOUNDARY OF RECEPTION AREA OF KOWLOON BAY REFUSE TRANSFER STATION
SITE LIMIT OF PORTION A
EXISTING SEAWALL
EXISTING SINGLE CELL BOX CULVERT
EXISTING CATCHWATER
CLEAR WATER BAY COUNTRY PARK
N
817 400 N
817 200 N
817 000 N
816 800 N
816 600 N
846 400 E
846 600 E
846 800 E
847 000 E
5.0
20
27
50
90
KEY PLAN
SCALE 1:50 000
牛尾海
PORT SHELTER
N
Shelter Island
牛尾洲
SILVERSTRAND
HANG HAU TOWN
Hang Kung Uk
Tseung Kwan O
Yau Yue Wan
Yau Tong
SAI WAN PING
KWUN TONG TSAI WAN
Cha Kwo Ling
LEI YUE MUN
LEI YUE MUN WAN
ALDRICH BAY
SHAU KEI WAN
JUNK BAY
LOCATION OF SITE
Junk Island
Pak Shing Kok
LUNG HA WAN
CLEAR WATER BAY
Sheung Lau Wan
Tin Ha Wan
Ngam Tau Sha
Po Toi O

AS CONSTRUCTED
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NOTES:

1. ALL LEVELS ARE SHOWN IN METRES ABOVE P.D.
2. ALL DIMENSIONS ARE SHOWN IN METRES.
3. HYDROSEEDING SHALL BE APPLIED IN SECTOR A ONLY.
4. THE SITE IS COMPOSED OF PORTION A, PORTION B AND PORTION C.
5. PORTION C IS SHOWN ON DRAWING No. NDD 6236

LEGEND :-

┴┴┴┴	EXISTING SLOPE
30 / 20	PROPOSED LANDFILL CONTOUR
70 / 60 / 50	PROPOSED CUT SLOPE CONTOUR
6.0 +	EXISTING LEVEL
(20)	EXISTING PLATFORM LEVEL
◎90	PROPOSED PLATFORM
15 / 10 / 6	EXISTING LANDFILL CONTOUR
40 / 30 / 20	EXISTING CUT SLOPE CONTOUR
××××	SECTOR A

AS CONSTRUCTED

B	CHECKED: (S.I.O.W.)	20-11-92	S.T. TSE
	CERTIFIED: (ENGINEER)	11/2/93	M.Y. TANG

no.	date	description	initial
A	21.3.91	LIMITS OF AREA A1 AND AREA B1 TO BE RELEASED BY THE CONTRACTOR SHOWN	

REVISION

	name	date
surveyed		
designed	K.S. CHAN	3.2.89
drawn	T.C. ANGEL CHAN	10.2.89
traced	T.C. ANGEL CHAN	11.2.89
checked	K.S. CHAN	18.4.89
approved	S.C. YIP	20.4.89

Chief Engineer 10.5.89

contract no. CV / 89 / 05

file no. SP 9/1/44 1Ⅲ

project no. 17 DR

contract

JUNK BAY LANDFILL
STAGE Ⅱ PHASE Ⅱ — SITE WORKS AND SANITARY LANDFILL

drawing title

GENERAL LAYOUT OF LANDFILL

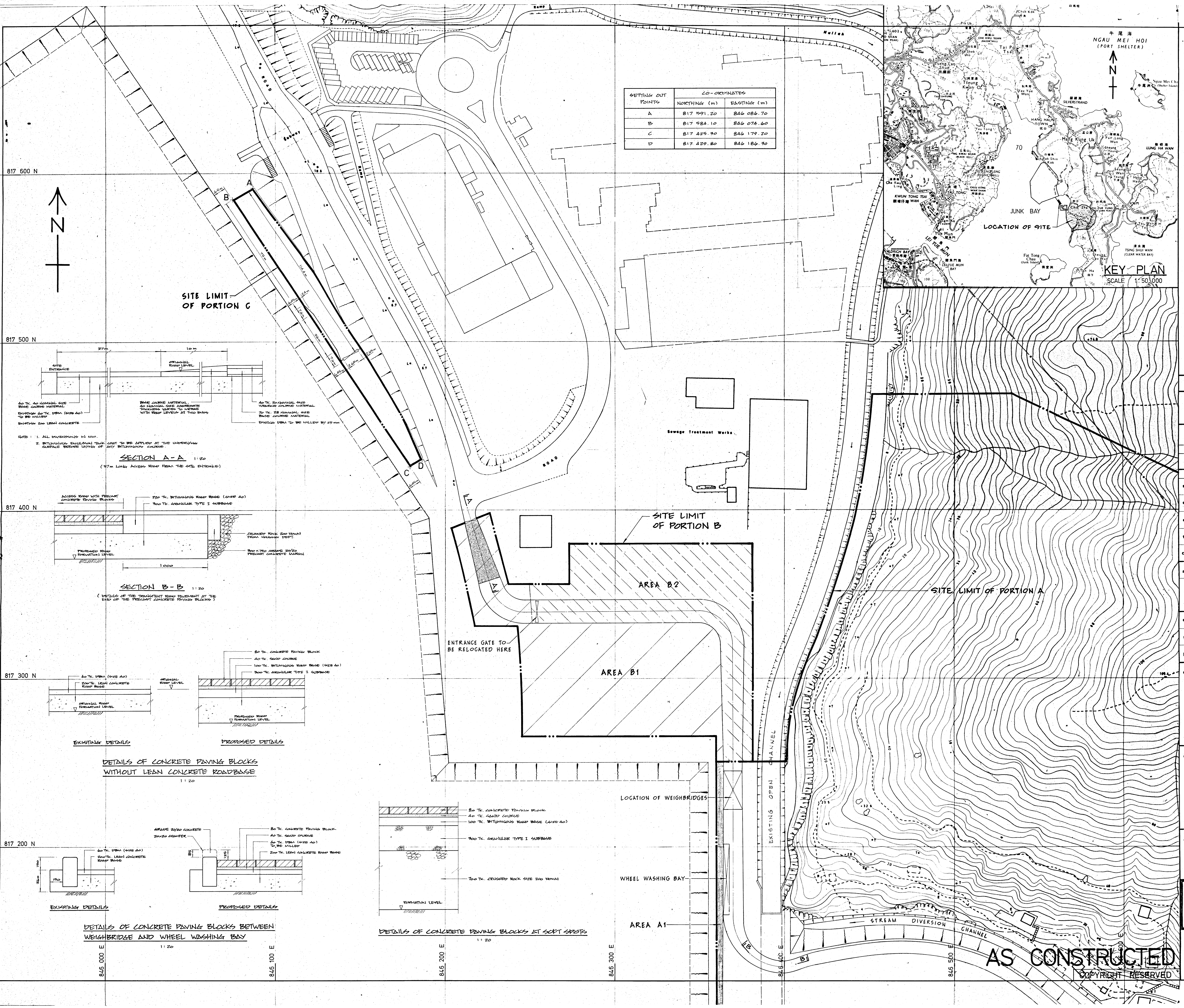
drawing no. NDD 6235 B

scale 1:2 000

office

DRAINAGE (DESIGN) DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING SERVICES DEPARTMENT HONG KONG



KEY PLAN
SCALE 1:50 000
NGAU MEI HOI (PORT SHELTER)
JUNK BAY
LOCATION OF SITE
N
817 600 N
817 500 N
817 400 N
817 300 N
817 200 N
846 000 E
846 100 E
846 200 E
846 300 E
846 400 E
846 500 E
SITE LIMIT OF PORTION C
SITE LIMIT OF PORTION B
SITE LIMIT OF PORTION A
AREA B2
AREA B1
AREA A1
ENTRANCE GATE TO BE RELOCATED HERE
Sewage Treatment Works
LOCATION OF WEIGHBRIDGES
WHEEL WASHING BAY
EXISTING OPEN CHANNEL
STREAM DIVERSION CHANNEL
ROAD
Subway
Nullah
Ramp
A
B
C
D
27m
10m
SITE ENTRANCE
ORIGINAL ROAD LEVEL
60 TK. 40 NOMINAL SIZE BASE COURSE MATERIAL
EXISTING 60 TK. DBM (SIZE 40) TO BE MILLED
EXISTING 200 LEAN CONCRETE
BASE COURSE MATERIAL, 40 NOMINAL SIZE AGGREGATE THICKNESS VARIES TO MERGE WITH ROAD LEVELS AT TWO ENDS
40 TK. 20 NOMINAL SIZE WEARING COURSE MATERIAL
70 TK. 28 NOMINAL SIZE BASE COURSE MATERIAL
EXISTING DBM TO BE MILLED BY 25 mm
ACCESS ROAD WITH PRECAST CONCRETE PAVING BLOCKS
220 TK. BITUMINOUS ROAD BASE (SIZE 40)
300 TK. GRANULAR TYPE I SUBBASE
CRUSHED ROCK 200 DOWN FROM HOUSING DEPT.
300 x 150 GRADE 20/20 PRECAST CONCRETE MARGIN
PROPOSED ROAD FORMATION LEVEL
1000
60 TK. DBM (SIZE 40)
200 TK. LEAN CONCRETE ROAD BASE
ORIGINAL ROAD FORMATION LEVEL
80 TK. CONCRETE PAVING BLOCK
40 TK. SAND COURSE
100 TK. BITUMINOUS ROAD BASE (SIZE 40)
GRADE 20/20 CONCRETE
20x20 CHAMFER
60 TK. DBM (SIZE 40) TO BE MILLED
85
125
150
260
700 TK. CRUSHED ROCK SIZE 200 DOWN
FORMATION LEVEL

SETTING OUT POINTS	CO-ORDINATES	
	NORTHING (m)	EASTING (m)
A	817 591.20	846 086.70
B	817 584.10	846 074.60
C	817 425.30	846 179.20
D	817 429.80	846 186.30

NOTE : 1. ALL DIMENSIONS IN MM.
2. BITUMINOUS EMULSION TACK COAT TO BE APPLIED AT THE UNDERLYING SURFACE BEFORE LAYING OF ANY BITUMINOUS COURSE.

SECTION A - A 1:20

(37m LONG ACCESS ROAD FROM THE SITE ENTRANCE)

SECTION B - B 1:20

(DETAILS OF THE TRANSITENT ROAD PAVEMENT AT THE END OF THE PRECAST CONCRETE PAVING BLOCKS)

EXISTING DETAILS

PROPOSED DETAILS

DETAILS OF CONCRETE PAVING BLOCKS WITHOUT LEAN CONCRETE ROADBASE

1:20

EXISTING DETAILS

PROPOSED DETAILS

DETAILS OF CONCRETE PAVING BLOCKS BETWEEN WEIGHBRIDGE AND WHEEL WASHING BAY

1:20

DETAILS OF CONCRETE PAVING BLOCKS AT SOFT SPOTS

1:20

AS CONSTRUCTED

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NOTES:

1. ALL LEVELS ARE SHOWN IN METRES ABOVE P.D.
2. ALL DIMENSIONS ARE SHOWN IN METRES
3. FOR SITE LIMIT OF PORTION A REFER TO DRAWING NO. NDD 6235.
4. PORTION C OF THE SITE TO BE USED AS WORKS AREA WHEN PORTION B IS REVERTED TO DLO/SK.

AS CONSTRUCTED

B	CHECKED: (S.I.O.W.)	20-11-92	S.T. TSE
	CERTIFIED: (ENGINEER)	25/8/	M.Y. TANG

no.	date	description	initial
A	21.3.91	LIMITS OF AREA A1 AND AREA B1 TO BE RELEASED BY THE CONTRACTOR SHOWN	

REVISION

	name		date
surveyed			
designed		K. S. CHAN	11-4-89
drawn	Chan Siu Chun	S. C. CHAN	21-4-89
traced	Chan Siu Chun	S. C. CHAN	24-4-89
checked	KC	K. S. CHAN	26-4-89
approved		S. C. YIP	1-5-89

chief engineer

contract no. CV / 89 / 05

file no. SP 9/1/44 1 III

project no. 17 DR

contract

JUNK BAY LANDFILL
STAGE II PHASE II — SITE WORKS
AND SANITARY LANDFILL

drawing title

GENERAL LAYOUT OF WORKS AREA

drawing no. NDD 6236 B

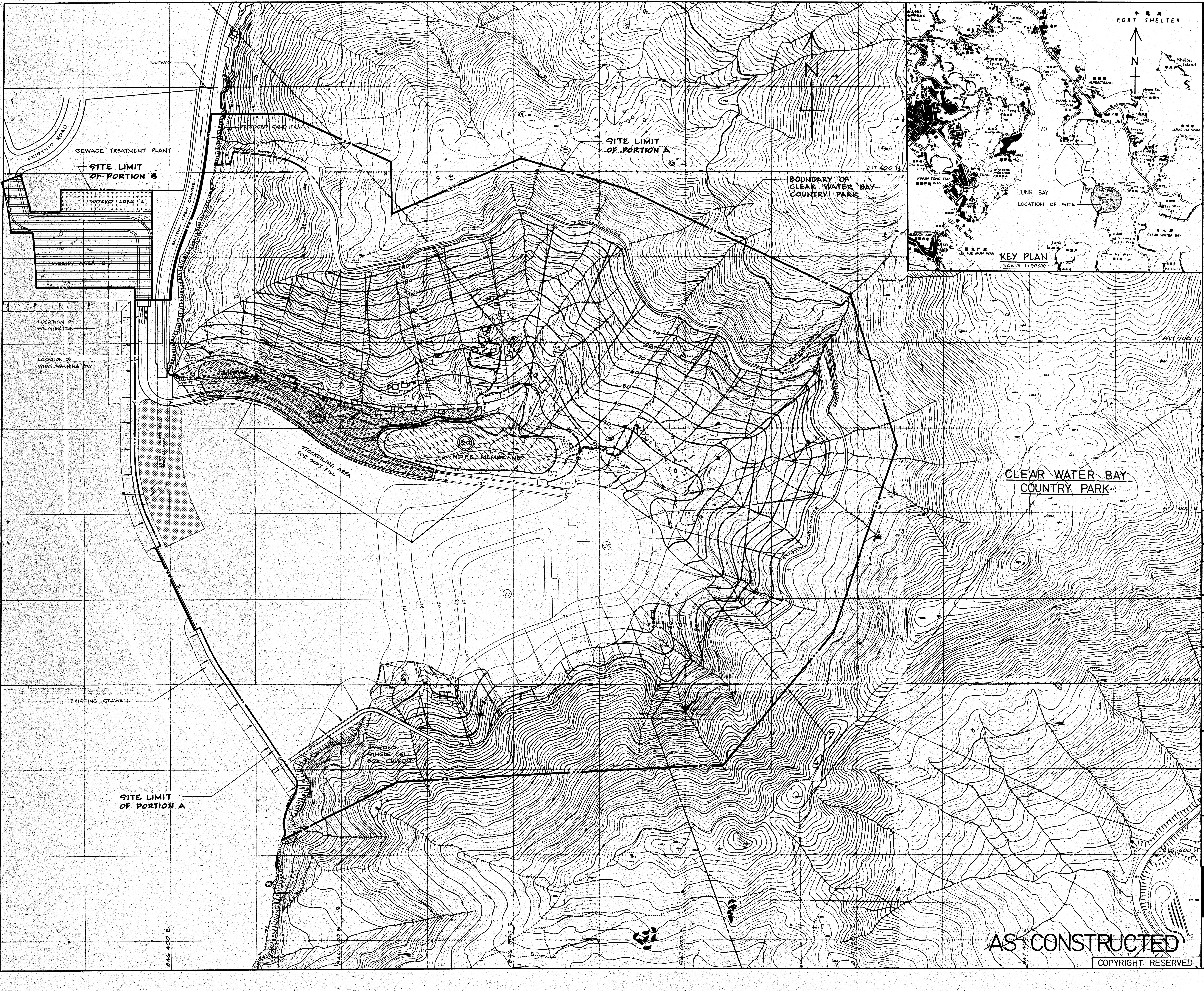
scale 1:1 000

office

DRAINAGE (DESIGN) DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING
SERVICES DEPARTMENT
HONG KONG

A1 841 x 594


FOOTWAY
EXISTING ROAD
SEWAGE TREATMENT PLANT
SITE LIMIT OF PORTION B
WORKS AREA A
WORKS AREA B
PROPOSED SAND TRAP
PROPOSED FOOTPATH
EXISTING OPEN CHANNEL
SITE LIMIT OF PORTION A
BOUNDARY OF CLEAR WATER BAY COUNTRY PARK
N
LOCATION OF WEIGHBRIDGE
LOCATION OF WHEELWASHING BAY
STOCKPILING AREA FOR SOFT FILL
HDPE MEMBRANE
5.0
20
27
PROPOSED CATCHWATER
EXISTING CATCHWATER
CLEAR WATER BAY COUNTRY PARK
EXISTING SEAWALL
EXISTING SINGLE CELL BOX CULVERT
SITE LIMIT OF PORTION A
817 400 N
817 200 N
817 000 N
816 800 N
816 600 N
846 400 E
846 600 E
846 800 E
847 000 E
847 400 E
PORT SHELTER
Shelter Island
JUNK BAY
LOCATION OF SITE
CLEAR WATER BAY
KWUN TONG
LEI YUE MUN
KEY PLAN
SCALE 1:50000

AS CONSTRUCTED

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NOTES:

1. ALL DIMENSIONS ARE SHOWN IN METRES.
2. ALL LEVELS ARE SHOWN IN METRES ABOVE P.D.
3. THE CONTRACTOR SHALL BUILD UP THE PROPOSED STOCKPILE AREA OF APPROX. CAPACITY 50,000 CU M WITHIN THE TIME FOR COMPLETION FOR SECTION 1 OF WORKS.
4. ALL SURFACE CHANNELS WITHIN THE STOCKPILE AREA SHALL BE PROPERLY COVERED WITH TIMBER BOARDS OR OTHERS APPROVED MATERIAL BEFORE BUILDING UP THE STOCKPILE AREA.
5. FOR DETAILS OF STOCKPILE AREA, PLEASE REFER TO DRAWING No. NDD 6243 AND NDD 6245.
6. FOR DETAILS OF HDPE MEMBRANE, PLEASE REFER TO DRAWING No. NDD 6245

LEGEND :-

10 20	PROPOSED CUT SLOPE CONTOUR
	EXISTING SLOPE
5.5 +	EXISTING LEVEL
(20)	EXISTING PLATFORM LEVEL
▨	PROPOSED PLATFORM TO BE COVERED WITH PVC MEMBRANE.
15 10 6	EXISTING LANDFILL CONTOUR
40 30 20	EXISTING CUT SLOPE CONTOUR
◎ 5.0	PROPOSED PLATFORM LEVEL
▒	KOWLOON BAY REFUSE TRANSFER STATION
8.7	PROPOSED LEVEL

AS CONSTRUCTED

A	CHECKED: (S.I.O.W.) 20-11-92 S.T. TSE CERTIFIED: (ENGINEER) 15/2/93 M.Y. TANG

no.	date	description	initial
REVISION			

	name	date
surveyed		
designed	KC K. S. CHAN	10·1·89
drawn	T. C. ANGEL CHAN	11·1·89
traced	T. C. ANGEL CHAN	13·1·89
checked	KC K. S. CHAN	18·5·89
approved	S. C. YIP	22·5·89

Chief Engineer 31.5.89

contract no. CV / 89 / 05

file no. SP 9 / 1 / 44 1Ⅲ

project no. 17 DR

contract

JUNK BAY LANDFILL
STAGE II PHASE II — SITE WORKS
AND SANITARY LANDFILL

drawing title

SITE PREPARATION WORKS —
CUT SLOPES AND STOCKPILE AREA

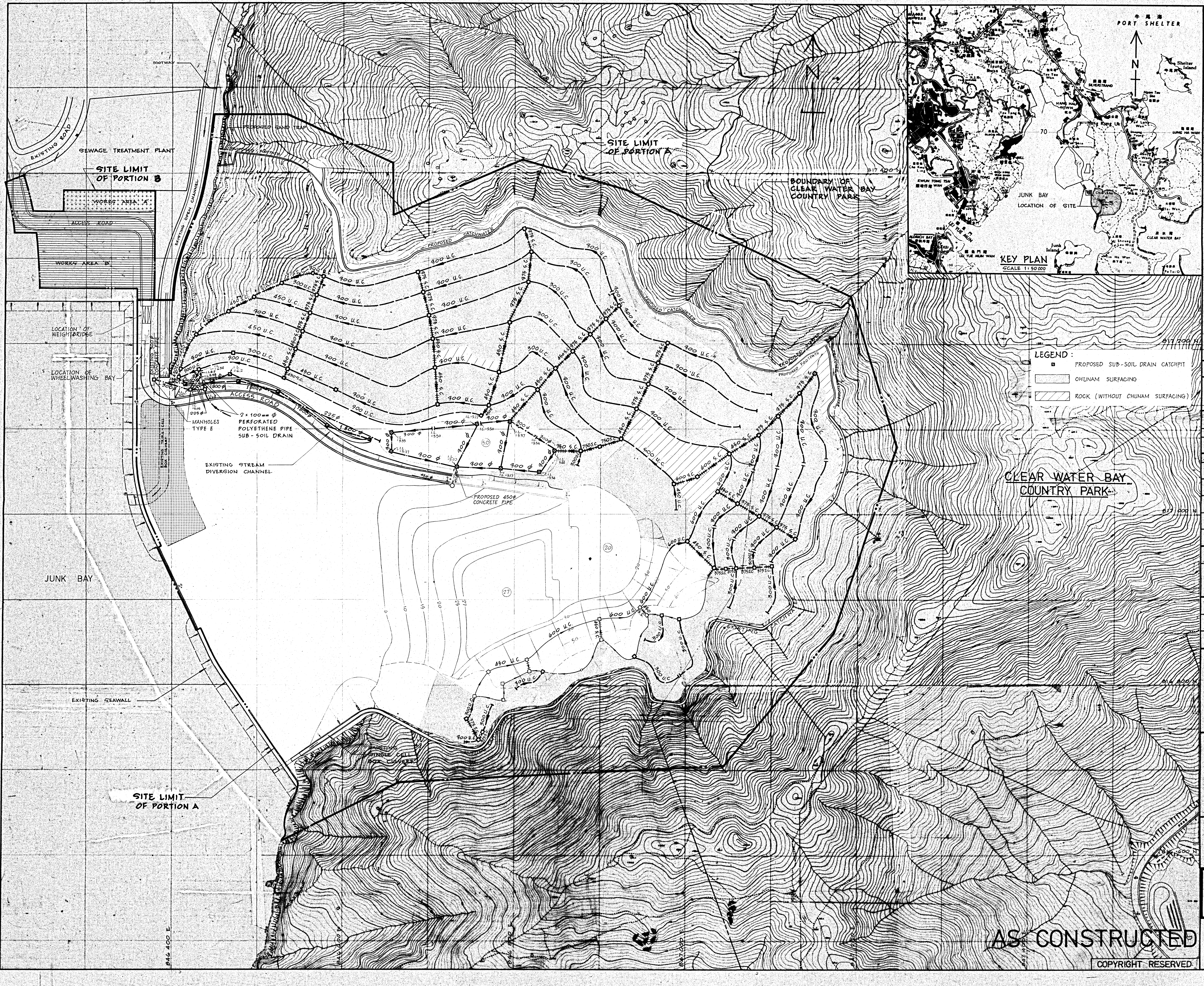
drawing no. NDD 6237A

scale 1 : 2 000

office

DRAINAGE (DESIGN) DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING
SERVICES
DEPARTMENT
HONG KONG



PORT SHELTER
N
KEY PLAN
SCALE 1:50 000
JUNK BAY
LOCATION OF SITE
CLEAR WATER BAY
EXISTING ROAD
SEWAGE TREATMENT PLANT
SITE LIMIT OF PORTION B
WORKS AREA 'A'
ACCESS ROAD
WORKS AREA 'B'
FOOTWAY
EXISTING OPEN CHANNEL
PROPOSED SAND TRAP
SITE LIMIT OF PORTION A
BOUNDARY OF CLEAR WATER BAY COUNTRY PARK
PROPOSED CATCHWATER
LOCATION OF WEIGHTBRIDGE
LOCATION OF WHEELWASHING BAY
MANHOLES TYPE E
2 × 100mm φ PERFORATED POLYETHENE PIPE SUB-SOIL DRAIN
EXISTING STREAM DIVERSION CHANNEL
PROPOSED 450φ CONCRETE PIPE
LEGEND:
PROPOSED SUB-SOIL DRAIN CATCHPIT
CHUNAM SURFACING
ROCK (WITHOUT CHUNAM SURFACING)
CLEAR WATER BAY COUNTRY PARK
JUNK BAY
EXISTING SEAWALL
EXISTING SINGLE CELL BOX CULVERT
EXISTING CATCHWATER
SITE LIMIT OF PORTION A
817 400 N
817 200 N
817 000 N
816 800 N
816 600 N
846 400 E
846 600 E
846 800 E
847 000 E
847 200 E
300 U.C.
450 U.C.
600 U.C.
900 U.C.
300 φ
1800 φ
225 φ
AS CONSTRUCTED
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NOTES :

1. ALL LEVELS ARE SHOWN IN METRES ABOVE P.D.
2. ALL DIMENSIONS ARE SHOWN IN METRES EXCEPT PIPE SIZE IN MILLIMETRES.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRAWING No. NDD 6237.
4. FOR DRAINAGE DETAILS, PLEASE REFER TO DRAWING No. NDD 6244 AND NDD 6245
5. FOR EXISTING DRAINAGE RECORD, PLEASE REFER TO DRAWING No. NDD 6275

LEGEND :

PROPOSED CUTTING SLOPE
EXISTING SLOPE
10.0 + EXISTING LEVEL
(20) EXISTING PLATFORM LEVEL
EXISTING LANDFILL CONTOUR
EXISTING CUT SLOPE CONTOUR
EXISTING MANHOLE AND SEWER
PROPOSED SURFACE CHANNEL
PROPOSED STEPPED CHANNEL AND CATCHPIT
300 φ PROPOSED SUB-SOIL DRAIN
☒ PROPOSED CATCHPIT WITH CONCRETE COVER
EXISTING SURFACE CHANNEL
EXISTING STEPPED CHANNEL AND CATCHPIT
▨ KOWLOON BAY REFUSE TRANSFER STATION
■ PROPOSED STANDARD MANHOLE TYPE 'J'
1800 φ PROPOSED CONCRETE PIPE
225φ PROPOSED CONCRETE PIPE WITH 150 mm THICK CONCRETE SURROUND

AS CONSTRUCTED

B	CHECKED: (S.I.O.W) 20-11-92 S.T. TSE **CERTIFIED: (ENGINEER)** 11/2/93 M.Y. TANG		
A	1.11.91	GENERAL REVISION	
no.	date	description	initial

REVISION

	name	date
surveyed		
designed	K. S. CHAN	9.2.89
drawn	Chan Sui Chun S. C. CHAN	10-2-89
traced	Chan Sui Chun S. C. CHAN	13-2-89
checked	K. S. CHAN	18.5.89
approved	S. C. YIP	22.5.89

Chief Engineer 31.5.89

contract no. CV / 89 / 05

file no. SP 9 / 1 / 44 1Ⅲ

project no. 17 DR

contract

JUNK BAY LANDFILL
STAGE II PHASE II — SITE WORKS
AND SANITARY LANDFILL

drawing title

SITE PREPARATION WORKS —
SURFACE DRAIN AND
SUB-SOIL DRAIN

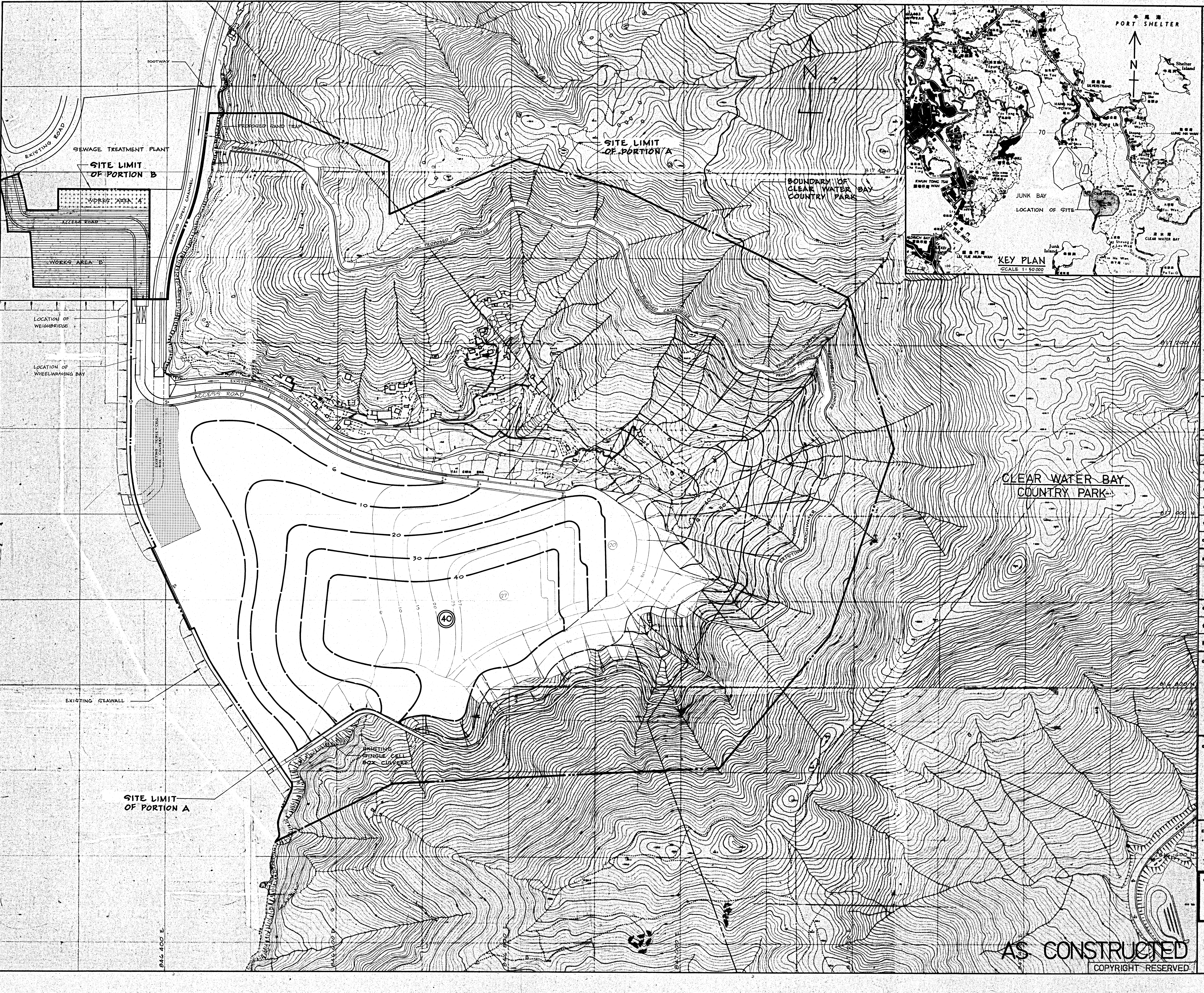
drawing no. NDD 6238B

scale 1:2000

office

DRAINAGE (DESIGN) DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING
SERVICES
DEPARTMENT
HONG KONG


FOOTWAY
EXISTING ROAD
SEWAGE TREATMENT PLANT
SITE LIMIT OF PORTION B
WORKS AREA 'A'
ACCESS ROAD
WORKS AREA 'B'
EXISTING OPEN CHANNEL
PROPOSED SAND TRAP
PROPOSED FOOTPATH
SITE LIMIT OF PORTION A
BOUNDARY OF CLEAR WATER BAY COUNTRY PARK
PROPOSED CATCHWATER
LOCATION OF WEIGHBRIDGE
LOCATION OF WHEELWASHING BAY
ACCESS ROAD
CLEAR WATER BAY COUNTRY PARK
EXISTING SEAWALL
EXISTING SINGLE CELL BOX CULVERT
SITE LIMIT OF PORTION A
EXISTING CATCHWATER
N
6
10
20
30
40
27
20
817 400 N
817 200 N
817 000 N
816 800 N
816 600 N
846 400 E
846 600 E
846 800 E
847 000 E
847 200 E
PORT SHELTER
Shelter Island
JUNK BAY
LOCATION OF SITE
CLEAR WATER BAY
Junk Island
KEY PLAN
SCALE 1:50 000
AS CONSTRUCTED
COPYRIGHT RESERVED

NOTES:

1. ALL DIMENSIONS ARE SHOWN IN METRES.
2. ALL LEVELS ARE SHOWN IN METRES ABOVE P.D.
3. THE SEQUENCE OF LANDFILLING IS TENTATIVE ONLY. THE CONTRACTOR MAY PROPOSE ALTERNATIVE LANDFILLING SEQUENCE FOR ENGINEER'S AGREEMENT.

LEGEND :-

┃┃┃	EXISTING SLOPE
5.5 +	EXISTING LEVEL
(27)	EXISTING PLATFORM LEVEL
((40))	PROPOSED PLATFORM LEVEL
15 10 6	EXISTING LANDFILL CONTOUR
40 30 20	EXISTING CUT SLOPE CONTOUR
20 30	PROPOSED LANDFILL CONTOUR
70 60 50	PROPOSED CUT SLOPE CONTOUR
▨	KOWLOON BAY REFUSE TRANSFER STATION

AS CONSTRUCTED

A

CHECKED: (S.I.O.W.) 20-11-92 S.T. TSE

CERTIFIED: (ENGINEER) 25-8-93 M.Y. TANG

no.	date	description	initial

REVISION

	name	date
surveyed		
designed	K. S. CHAN	28·1·89
drawn	T.C. ANGEL CHAN	30·1·89
traced	T.C. ANGEL CHAN	31·1·89
checked	K. S. CHAN	18·5·89
approved	S. C. YIP	

31.5.89

Chief Engineer

contract no. CV / 89 / 05

file no. SP 9/1/44 1Ⅲ

project no. 17 DR

contract

JUNK BAY LANDFILL
STAGE Ⅱ PHASE Ⅱ — SITE WORKS
AND SANITARY LANDFILL

drawing title

SITE WORKS
AND TENTATIVE LANDFILL SEQUENCE
(SHEET 1 OF 3)

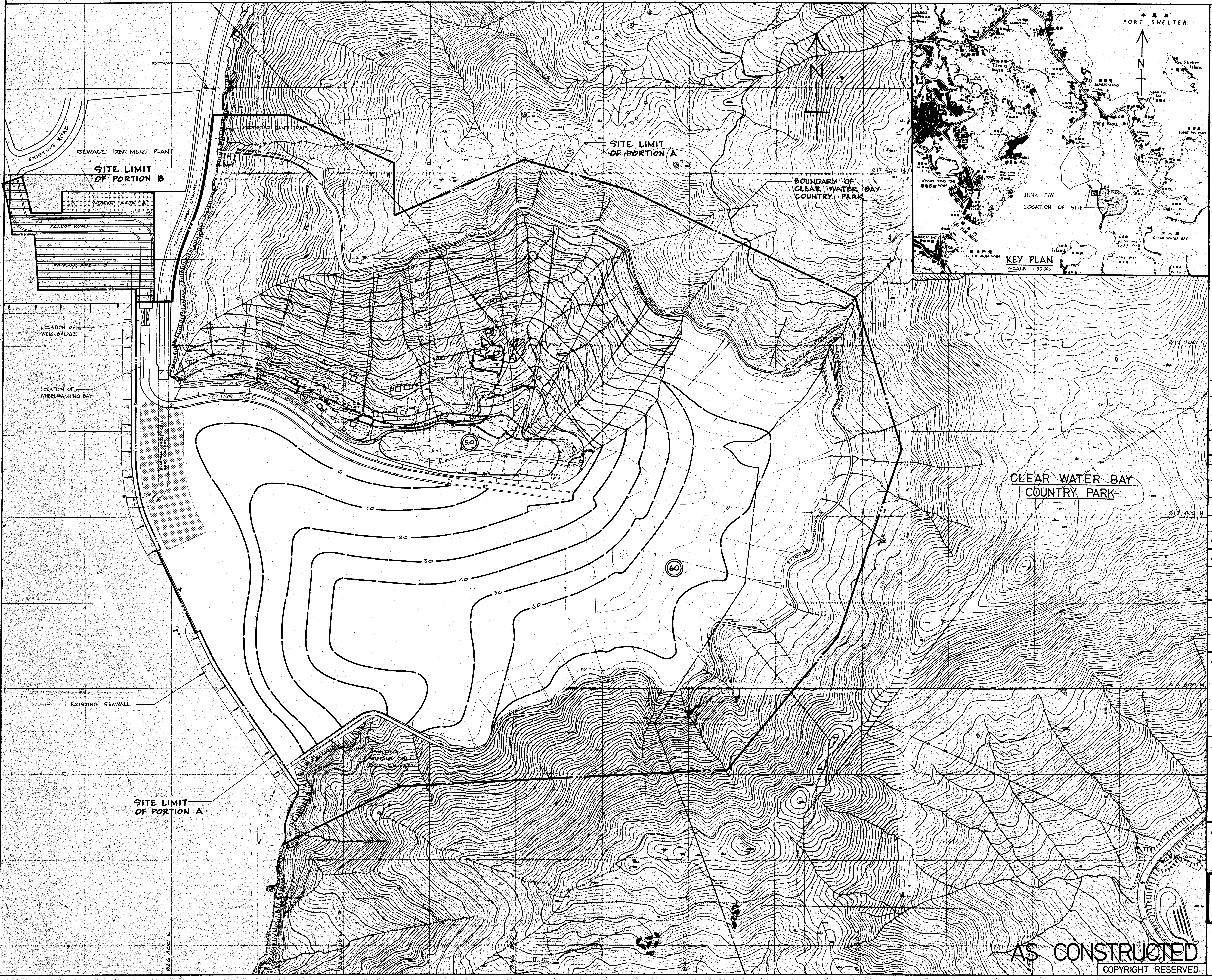
drawing no. NDD 6239A

scale 1:2 000

office

DRAINAGE (DESIGN) DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING
SERVICES
DEPARTMENT
HONG KONG


FOOTWAY
PROPOSED SAND TRAP
PROPOSED FOOTPATH
SITE LIMIT OF PORTION A
EXISTING ROAD
SEWAGE TREATMENT PLANT
SITE LIMIT OF PORTION B
WORKS AREA 'A'
ACCESS ROAD
WORKS AREA 'B'
EXISTING OPEN CHANNEL
BOUNDARY OF CLEAR WATER BAY COUNTRY PARK
PROPOSED CATCHWATER
LOCATION OF WEIGHBRIDGE
LOCATION OF WHEELWASHING BAY
ACCESS ROAD
N
817 400 N
817 200 N
817 000 N
816 800 N
816 600 N
CLEAR WATER BAY COUNTRY PARK
5.0
6
10
20
30
40
50
60
70
100
EXISTING CATCHWATER
EXISTING SEAWALL
EXISTING SINGLE CELL BOX CULVERT
SITE LIMIT OF PORTION A
846 400 E
846 600 E
846 800 E
847 000 E
PORT SHELTER
Shelter Island
JUNK BAY
LOCATION OF SITE
LEI YUE MUN
Junk Island
CLEAR WATER BAY
KEY PLAN
SCALE 1:50 000

AS CONSTRUCTED

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NOTES:

1. ALL DIMENSIONS ARE SHOWN IN METRES.
2. ALL LEVELS ARE SHOWN IN METRES ABOVE P.D.
3. THE SEQUENCE OF LANDFILLING IS TENTATIVE ONLY. THE CONTRACTOR MAY PROPOSE ALTERNATIVE LANDFILLING SEQUENCE FOR ENGINEER'S AGREEMENT.

LEGEND:-

⊥⊥⊥	EXISTING SLOPE
5.5 +	EXISTING LEVEL
⑳	EXISTING PLATFORM LEVEL
(60)	PROPOSED PLATFORM LEVEL
20 30 40	EXISTING LANDFILL CONTOUR
40 30 20	EXISTING CUT SLOPE CONTOUR
20 30	PROPOSED LANDFILL CONTOUR
70 60 50	PROPOSED CUT SLOPE CONTOUR
▨	KOWLOON BAY REFUSE TRANSFER STATION

AS CONSTRUCTED

A	CHECKED: (S.I.O.W) 20-11-92 S. T. TSE CERTIFIED: (ENGINEER) 25-8-93 M. Y. TANG

no.	date	description	initial
REVISION			

	name	date
surveyed		
designed	K. S. CHAN	31.1.89
drawn	T. C. ANGEL CHAN	1.2.89
traced	T. C. ANGEL CHAN	2.2.89
checked	K. S. CHAN	18.5.89
approved	S. C. YIP	22.5.89

Chief Engineer 31.5.89

contract no.	CV / 89 / 05
file no.	SP 9 / 1 / 44 1III
project no.	17 DR

contract

JUNK BAY LANDFILL
STAGE II PHASE II — SITE WORKS
AND SANITARY LANDFILL

drawing title

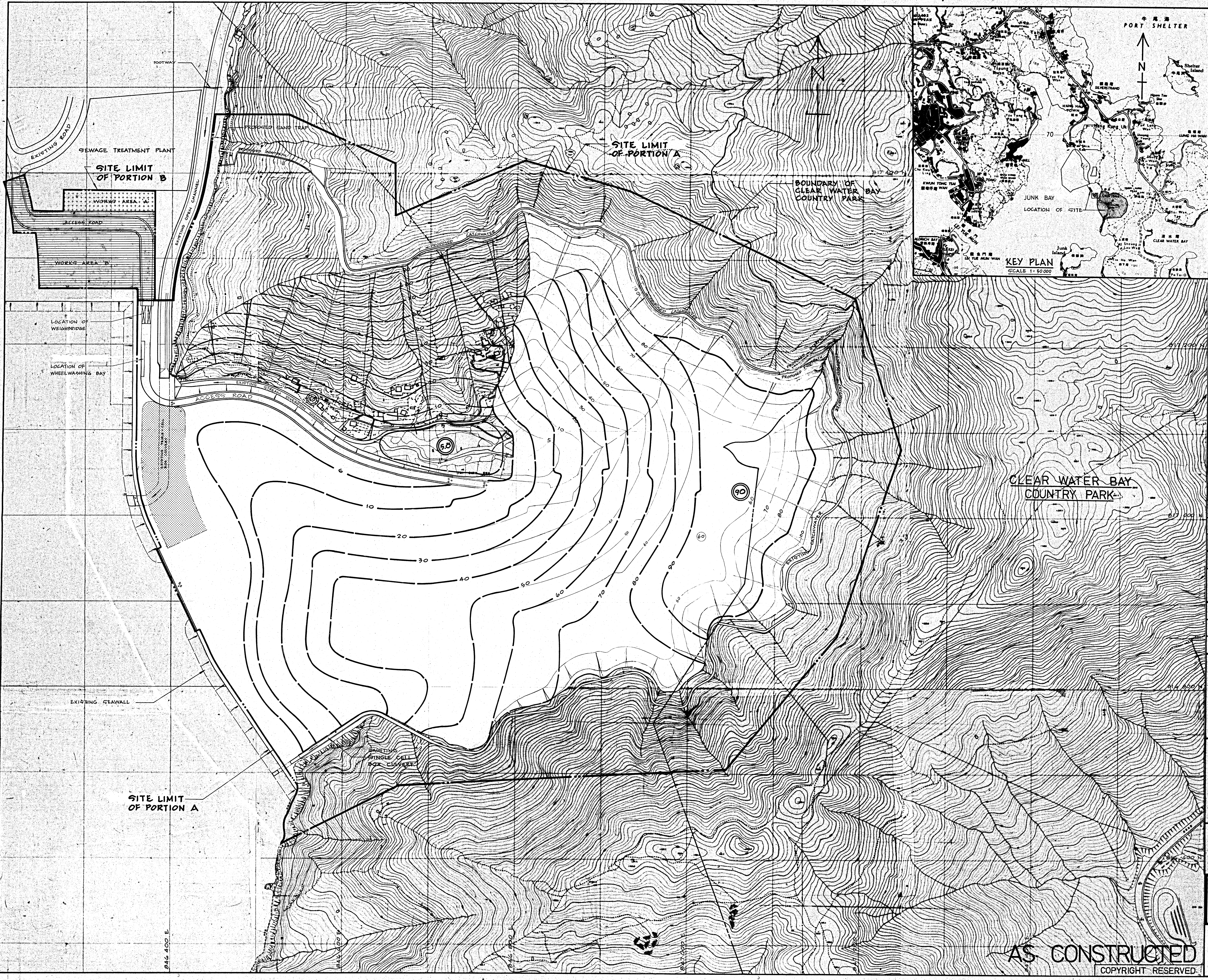
SITE WORKS
AND TENTATIVE LANDFILL SEQUENCE
(SHEET 2 OF 3)

drawing no.	scale
NDD 6240 A	1 : 2 000

office

DRAINAGE (DESIGN) DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING
SERVICES
DEPARTMENT
HONG KONG


PORT SHELTER
N
KEY PLAN
SCALE 1:50000
JUNK BAY
LOCATION OF SITE
CLEAR WATER BAY
FOOTWAY
EXISTING ROAD
SEWAGE TREATMENT PLANT
SITE LIMIT OF PORTION B
WORKS AREA A
ACCESS ROAD
WORKS AREA B
EXISTING OPEN CHANNEL
PROPOSED SAND TRAP
PROPOSED FOOTPATH
SITE LIMIT OF PORTION A
BOUNDARY OF CLEAR WATER BAY COUNTRY PARK
LOCATION OF WEIGHBRIDGE
LOCATION OF WHEELWASHING BAY
EXISTING TRIPLE CELL BOX CULVERT
EXISTING STREAM DIVERSION CHANNEL
ACCESS ROAD
PROPOSED CATCHWATER
EXISTING CATCHWATER
CLEAR WATER BAY COUNTRY PARK
EXISTING SEAWALL
EXISTING SINGLE CELL BOX CULVERT
SITE LIMIT OF PORTION A
50
90
60
6
10
20
30
40
50
60
70
80
90

AS CONSTRUCTED

COPYRIGHT RESERVED

NOTES:

1. ALL DIMENSIONS ARE SHOWN IN METRES.
2. ALL LEVELS ARE SHOWN IN METRES ABOVE P.D.
3. THE SEQUENCE OF LANDFILLING IS TENTATIVE ONLY. THE CONTRACTOR MAY PROPOSE ALTERNATIVE LANDFILLING SEQUENCE FOR ENGINEER'S AGREEMENT.

LEGEND:-

┃ ┃ ┃	EXISTING SLOPE
5.5 +	EXISTING LEVEL
(60)	EXISTING PLATFORM LEVEL
◎90	PROPOSED PLATFORM LEVEL
40 50 60	EXISTING LANDFILL CONTOUR
40 30 20	EXISTING CUT SLOPE CONTOUR
20 30	PROPOSED LANDFILL CONTOUR
70 60 50	PROPOSED CUT SLOPE CONTOUR
▨	KOWLOON BAY REFUSE TRANSFER STATION

AS CONSTRUCTED

A	CHECKED (S.I.O.W.) Tse 20-11-92 S.T. TSE CERTIFIED: (ENGINEER) 25-8-93 M.Y. TANG		
no.	date	description	initial

REVISION

	name	date
surveyed		
designed	KC K.S. CHAN	2.2.89
drawn	Gjc T.C. ANGEL CHAN	3.2.89
traced	Gjc T.C. ANGEL CHAN	4.2.89
checked	KC K.S. CHAN	18.5.89
approved	S.C. YIP	22.5.89

31.5.89
Chief Engineer

contract no. CV / 89 / 05

file no. SP 9 / 1 / 44 1Ⅲ

project no. 17 DR

contract

JUNK BAY LANDFILL
STAGE II PHASE II — SITE WORKS
AND SANITARY LANDFILL

drawing title

SITE WORKS
AND TENTATIVE LANDFILL SEQUENCE
(SHEET 3 OF 3)

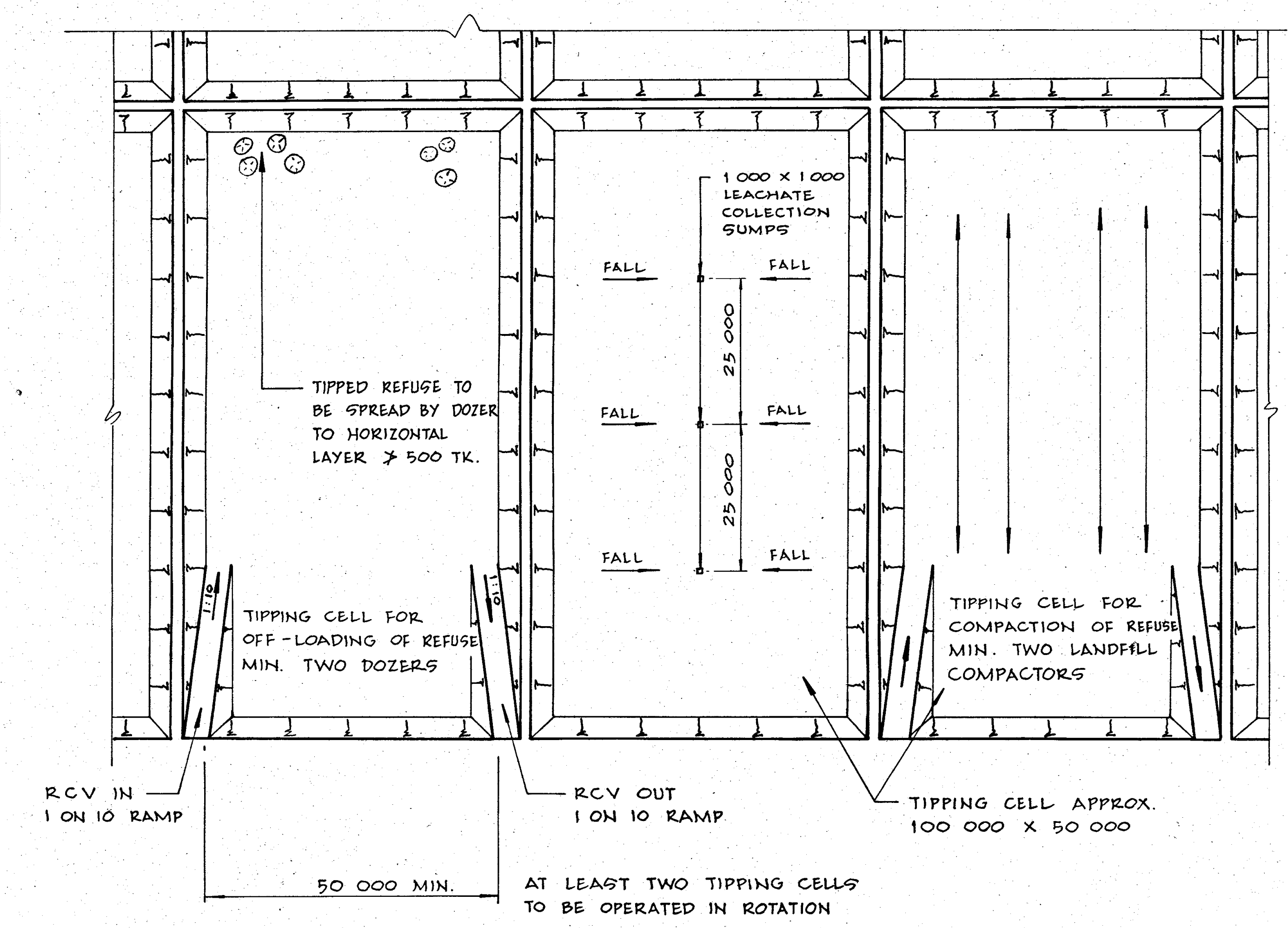
drawing no. NDD 6241A

scale 1:2000

office

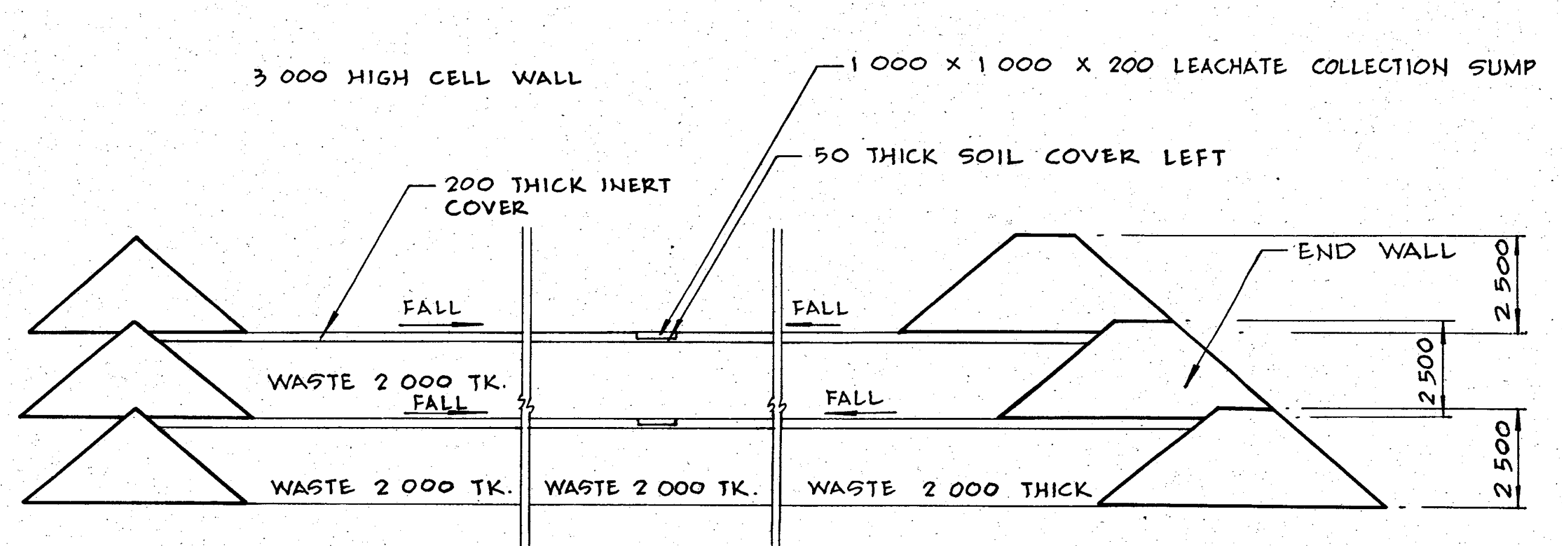
DRAINAGE (DESIGN) DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING
SERVICES
DEPARTMENT
HONG KONG


1 000 x 1 000
LEACHATE
COLLECTION
SUMPS
FALL
FALL
FALL
FALL
FALL
FALL
25 000
25 000
TIPPED REFUSE TO
BE SPREAD BY DOZER
TO HORIZONTAL
LAYER ≯ 500 TK.
1:10
1:10
TIPPING CELL FOR
OFF-LOADING OF REFUSE
MIN. TWO DOZERS
TIPPING CELL FOR
COMPACTION OF REFUSE
MIN. TWO LANDFILL
COMPACTORS
RCV IN
1 ON 10 RAMP
RCV OUT
1 ON 10 RAMP
TIPPING CELL APPROX.
100 000 x 50 000
50 000 MIN.
AT LEAST TWO TIPPING CELLS
TO BE OPERATED IN ROTATION

TYPICAL OPERATION OF CELL COMPACTION METHOD

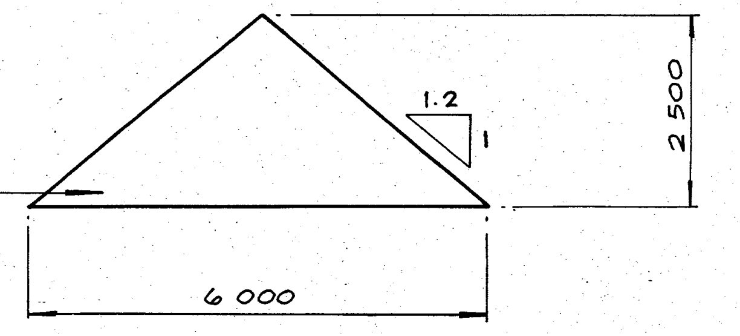
SCALE 1 : 1 000


3 000 HIGH CELL WALL
1 000 x 1 000 x 200 LEACHATE COLLECTION SUMP
50 THICK SOIL COVER LEFT
200 THICK INERT
COVER
END WALL
FALL
FALL
FALL
FALL
WASTE 2 000 TK.
WASTE 2 000 TK.
WASTE 2 000 TK.
WASTE 2 000 THICK
2 500
2 500
2 500

TYPICAL SECTION OF TIPPING CELL

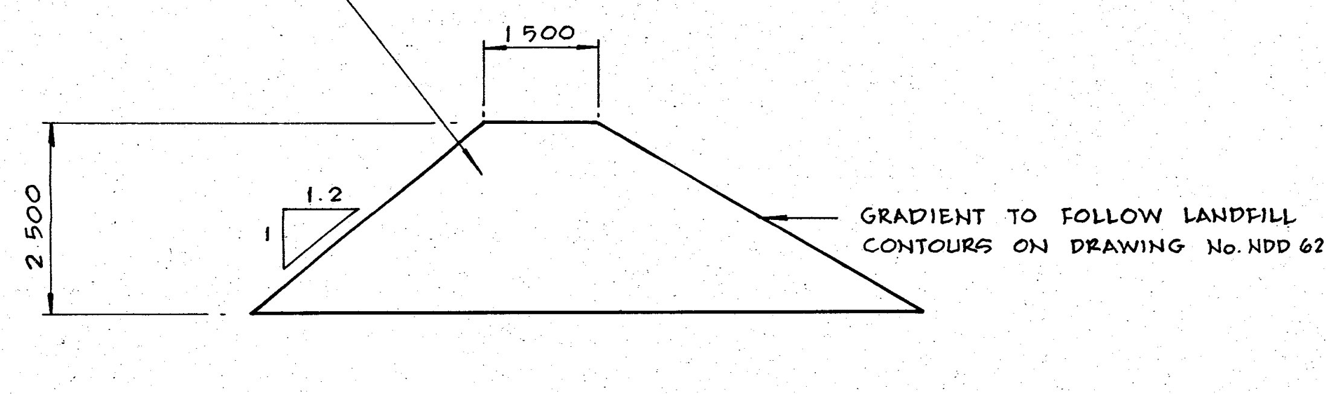
SCALE 1 : 200

CELL WALLS SHALL BE FORMED BY APPROVED INCOMING INERT WASTE OR APPROVED GRANULAR MATERIAL WITH NOMINAL COMPACTION WHICH ARE CAPABLE FOR RETAINING REFUSE THROUGHOUT THE LANDFILL OPERATION


1.2
1
2 500
6 000

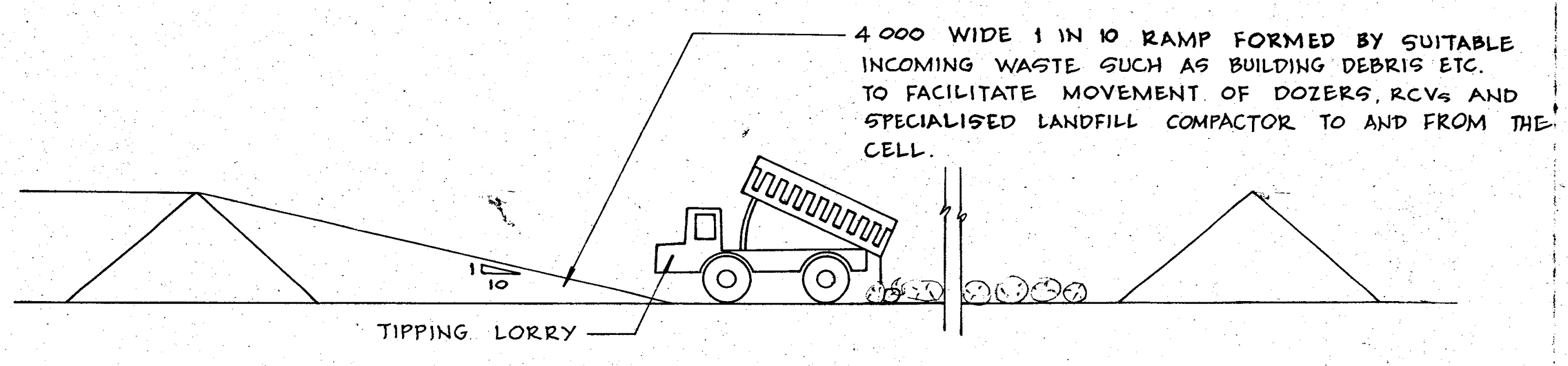
CELL WALL

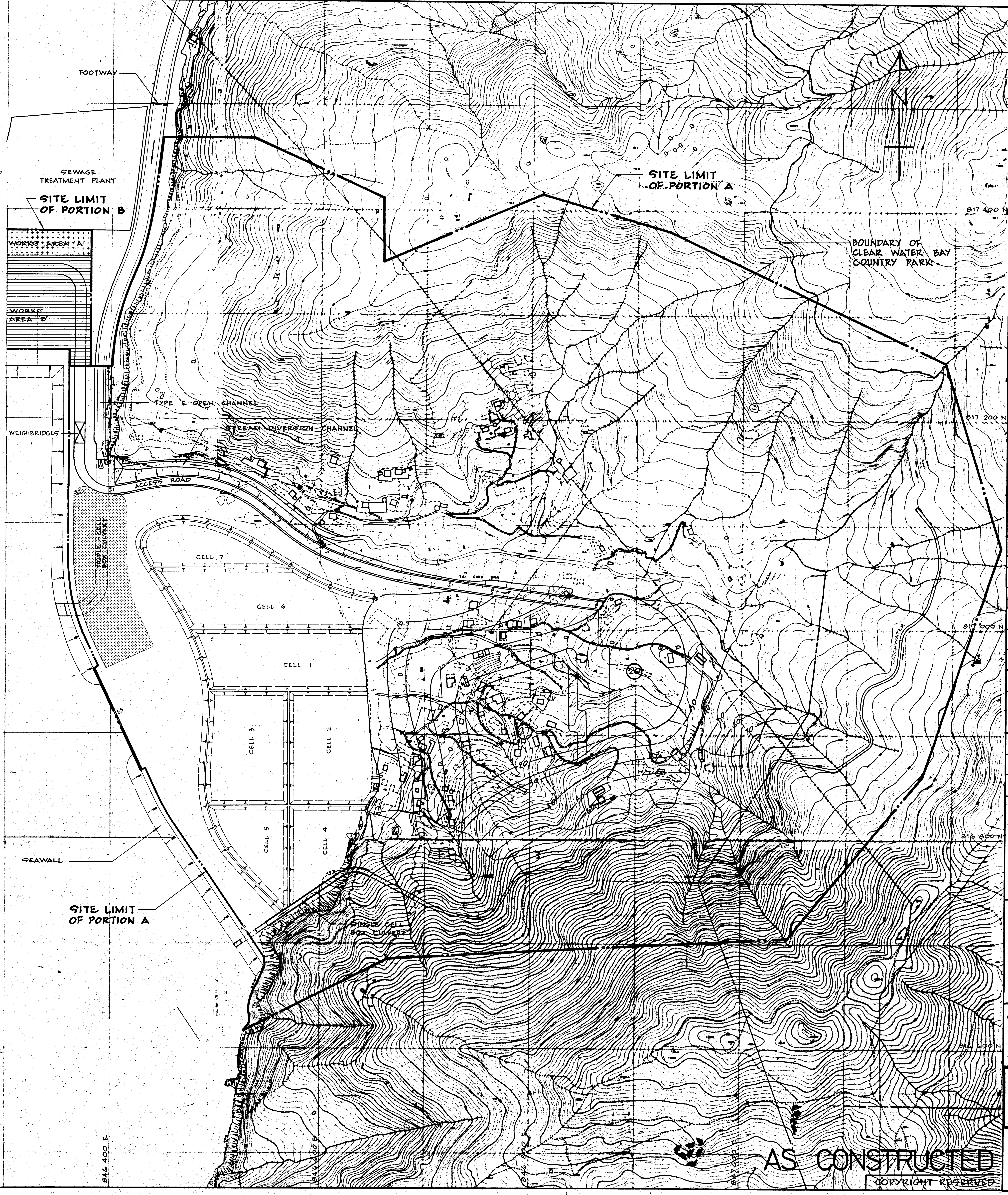
SCALE 1 : 100


1 500
1.2
1
2 500
GRADIENT TO FOLLOW LANDFILL
CONTOURS ON DRAWING No. NDD 6235

END WALL CONSTRUCTION

SCALE 1:100


4 000 WIDE 1 IN 10 RAMP FORMED BY SUITABLE
INCOMING WASTE SUCH AS BUILDING DEBRIS ETC.
TO FACILITATE MOVEMENT OF DOZERS, RCVs AND
SPECIALISED LANDFILL COMPACTOR TO AND FROM THE
CELL.
1
10
TIPPING LORRY


FOOTWAY
SEWAGE
TREATMENT PLANT
SITE LIMIT
OF PORTION B
WORKS AREA 'A'
WORKS
AREA 'B'
WEIGHBRIDGES
TYPE 'E' OPEN CHANNEL
STREAM DIVERSION CHANNEL
ACCESS ROAD
TRIPLE-CELL
BOX CULVERT
CELL 7
CELL 6
CELL 1
CELL 3
CELL 2
CELL 5
CELL 4
SEAWALL
SITE LIMIT
OF PORTION A
SINGLE CELL
BOX CULVERT
SITE LIMIT
OF PORTION A
BOUNDARY OF
CLEAR WATER BAY
COUNTRY PARK
CATCHWATER
817 400 N
817 200 N
817 000 N
816 800 N
816 600 N
846 400 E
846 600 E
846 800 E
847 000 E
AS CONSTRUCTED
COPYRIGHT RESERVED

NOTES:

1. ALL LEVELS ARE SHOWN IN METRES ABOVE P.D.
2. ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT GRIDS IN METRES.
3. THE LAYOUT OF TIPPING CELLS TO BE PROPOSED BY THE CONTRACTOR IN ACCORDANCE WITH P.S. CL. 33.03
4. MINIMUM 3 Nos. OF LEACHATE COLLECTION SUMPS SHALL BE PROVIDED IN EACH CELL.

LEGEND :-

⊥ ⊥ ⊥	EXISTING SLOPE
⊤ ⊤ ⊤	PROPOSED SLOPE
⑳	EXISTING PLATFORM LEVEL
—6—	PROPOSED CONTOUR LEVEL
10.4 +	EXISTING LEVEL
5.5	PROPOSED LEVEL
▨	KOWLOON BAY REFUSE TRANSFER STATION

AS CONSTRUCTED

A	CHECKED (S.I.O.W.)	20-11-92 S.T. TSE
	CERTIFIED: (ENGINEER)	25-8-93 M.Y. TANG

no.	date	description	initial
REVISION			

	name	date
surveyed		
designed	K. S. CHAN	19.4.89
drawn	T. C. ANGEL CHAN	20.4.89
traced	T. C. ANGEL CHAN	26.4.89
checked	K. S. CHAN	18.5.89
approved	S. C. YIP	[illegible]

Chief Engineer

contract no. CV / 89 / 05

file no. SP 9 / 1 / 44 1 III

project no. 17 DR

contract

JUNK BAY LANDFILL
STAGE II PHASE II — SITE WORK
AND SANITARY LANDFILL

drawing title

GENERAL ARRANGEMENT OF
LANDFILL OPERATIONS

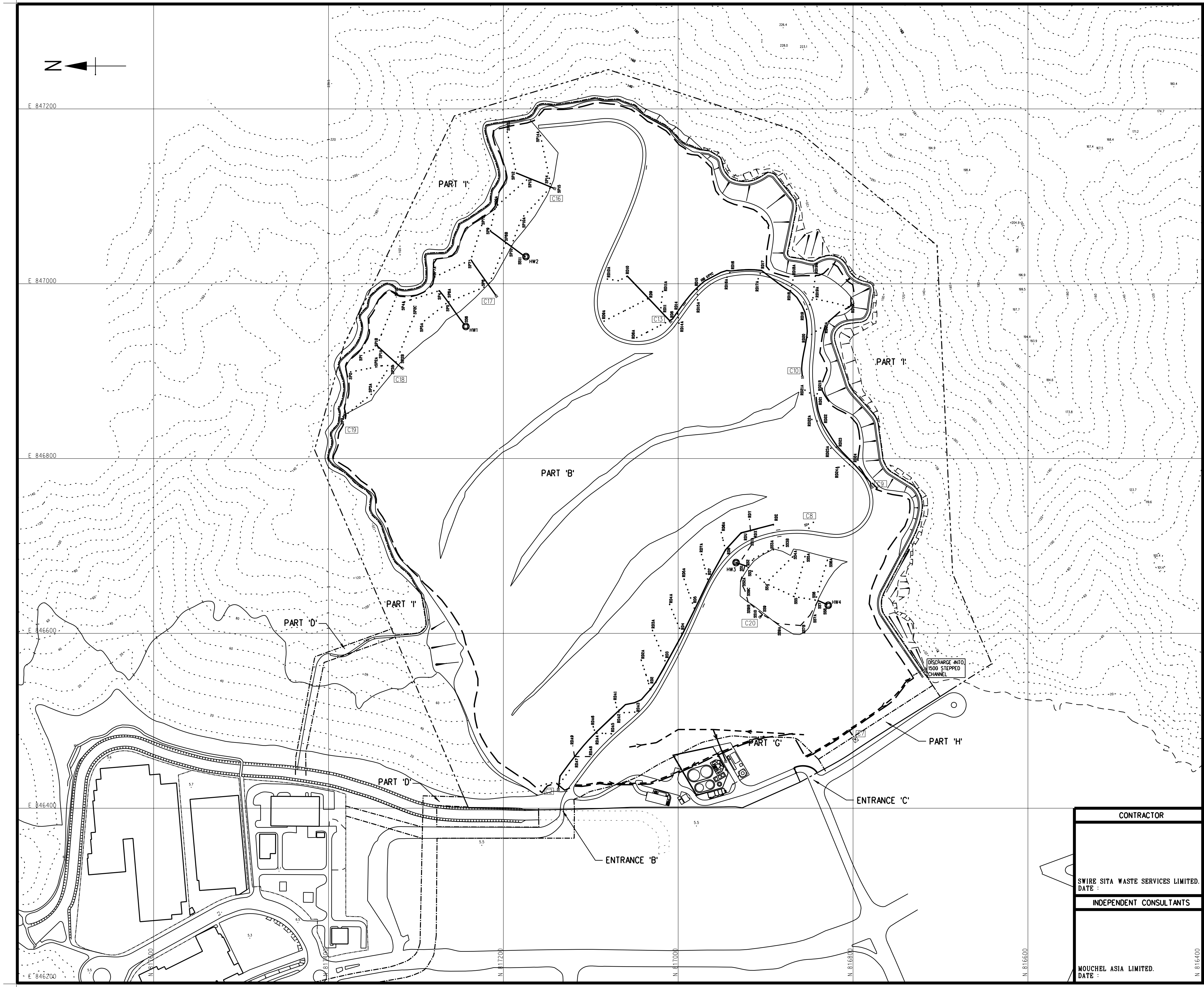
drawing no. NDD 6242 A

scale 1 : 2 000

office

DRAINAGE (DESIGN) DIVISION
CIVIL ENGINEERING OFFICE

CIVIL ENGINEERING
SERVICES
DEPARTMENT
HONG KONG



N
E 847200
E 847000
E 846800
E 846600
E 846400
E 846200
N 817400
N 817200
N 817000
N 816800
N 816600
PART 'I'
PART 'I'
PART 'I'
PART 'B'
PART 'D'
PART 'D'
PART 'C'
PART 'H'
ENTRANCE 'B'
ENTRANCE 'C'
HW1
HW2
HW3
HW4
C7
C8
C9
C10
C13
C16
C17
C18
C19
C20
DISCHARGE INTO 1500 STEPPED CHANNEL

NOTES:

1. ALL GRIDS ARE HONG KONG GRID (1980).
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM.
3. FOR LOCATION OF DAYLIGHT SUB-SURFACE DRAINAGE REFER TO DRAWING NO. STG2/SUR/DRW/001/R.

LEGEND :

— - - — - -	SITE BOUNDARY
————	SITE BOUNDARY (FENCE)
· · · · · · · ·	80 UPVC PIPE (RIB DRAIN)
————	100 UPVC PIPE (SPINE DRAIN)
→ — — —	100 UPVC (COLLECTOR PIPE)
HW1 ⊡	100 UPVC PIPE HEADWALL
—— ——	LIMIT OF LLDPE

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN: A2STE006.DGN
REF: TKOSF-AB, S2-PTRD, S2SUBDRN & RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

STAGE II/III
SUB SOIL DRAIN
LAYOUT PLAN

AS CONSTRUCTED RECORD DRAWING

Drawing no. STG2/STE/DRW/006/R

Scale 1 : 2000

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

Binnie

Binnie Black & Veatch
Hong Kong Limited

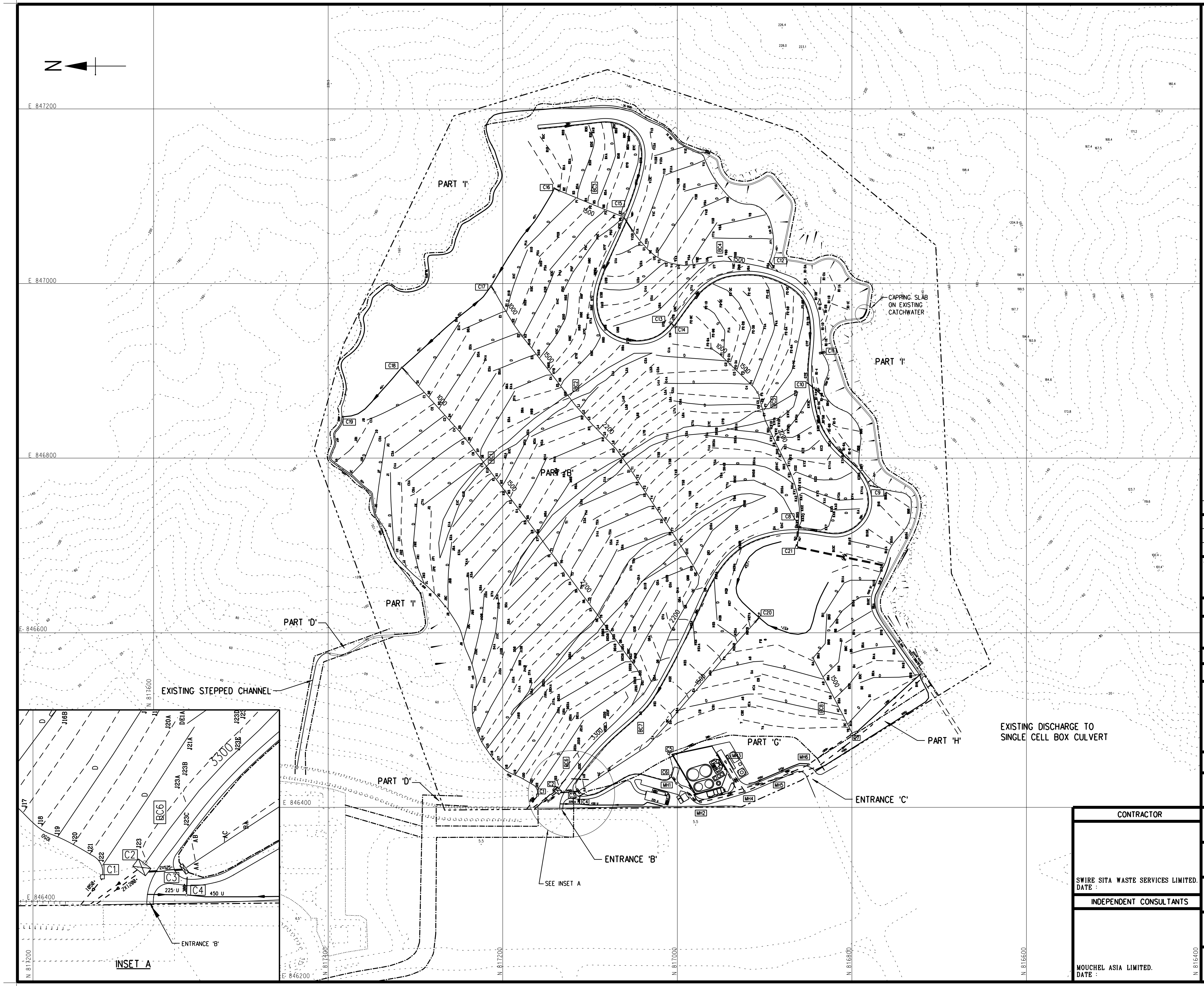
Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE SITA WASTE
SERVICES LTD.

D:\a2ste006.dgn 2008/12/17 上午 08:45:57


N
E 847200
E 847000
E 846800
E 846600
E 846400
E 846200
N 817600
N 817400
N 817200
N 817000
N 816800
N 816600
N 816400
PART 'I'
PART 'I'
PART 'I'
PART 'B'
PART 'D'
PART 'D'
PART 'G'
PART 'H'
CAPPING SLAB ON EXISTING CATCHWATER
EXISTING STEPPED CHANNEL
EXISTING DISCHARGE TO SINGLE CELL BOX CULVERT
ENTRANCE 'B'
ENTRANCE 'C'
SEE INSET A
INSET A
ENTRANCE 'B'
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
MH1
MH2
MH3
MH4
MH5
MH6
BC6
3300
2200
1500
1000
225 U
450 U

NOTES:

1. ALL GRIDS ARE HONG KONG GRID 1980.
2. ALL LEVEL ARE METRES ABOVE PRINCIPAL DATUM.
3. FOR SURFACE WATER DETAILS REFER TO DRAWING NOS. GENL/SUR/DRW/001/R TO 008/R AND STG2/SUR/DRW/011/R TO 020/R.
4. PLATFORM PERIMETER DRAINS LAID AT 1 : 125.
5. FOR PRECAST CONCRETE PIPE, ALL PIPES BEDDINGS CLASS B AS PER DSD DRAWING NO. 1048.
6. ALL PRECAST CONCRETE PIPES CLASS H TO BS 5911: PART 100 : 1988 UNLESS OTHERWISE STATED.
7. FOR AS-CONSTRUCTED DETAILS OF CATCHPITS AND MANHOLES, REFER TO STG2/SUR/DRW/002/R.

LEGEND :

— - - — - -	SITE BOUNDARY
═══	EXISTING STEPPED CHANNEL
1000 BC1	BAFFLED CHANNEL OF BC1 WITH BASE WIDTH 1000mm
— — — —	250mm DIAMETER NETLON PIPE
—o—	NETLON WITH DAYLIGHT
457	PERIMETER DRAIN PERFORATED HDPE PIPE OF DIA. 457mm
1050 SC	STEPPED CHANNEL OF SIZE 1050mm
300	ROADWAY DRAIN 300mm DIA. PERFORATED PIPE
600 U	U-CHANNEL WITH SIZE 600mm
300	HDPE PIPE OF DIAMETER 300mm
300	PRECAST CONCRETE PIPE OF DIAMETER 300mm
——	RECTANGULAR CHANNEL WITH WIDTH 1200mm
▬	PIPEWORK CONNECTION TO DOWNSLOPE SURFACE CHANNEL
⊠	CATCHPIT
C1	CATCHPIT NUMBER
○	CONNECTION BETWEEN DIFFERENT SIZES OF BAFFLED CHANNELS / U-CHANNELS
●	TAPER SECTION / APRON STRUCTURE

Details of Revision			Date
	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN: A2SUR001.DGN
REF: TKOSF-AB, S2-PTRD, S2TOPDRN & RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

STAGE II/III
SURFACE WATER DRAINAGE
LAYOUT PLAN

AS CONSTRUCTED RECORD DRAWING

Drawing no.	Scale
STG2/SUR/DRW/001/R	1:2000

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

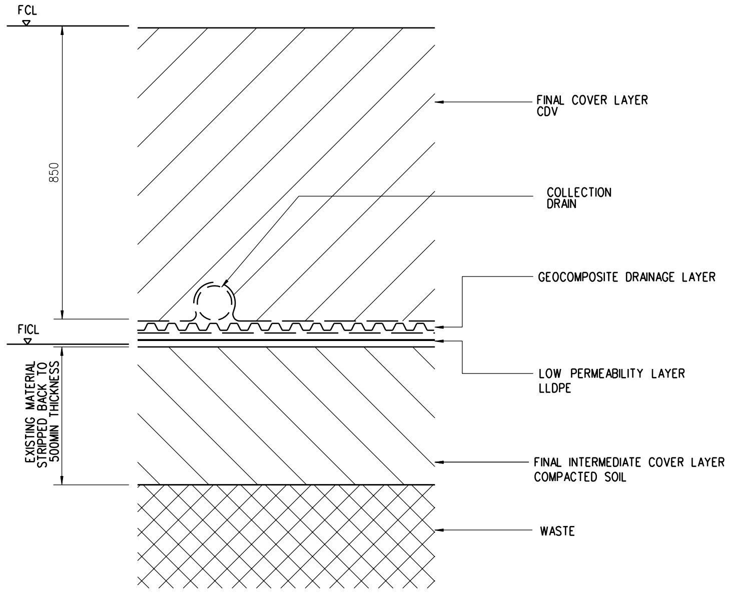
Binnie
Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

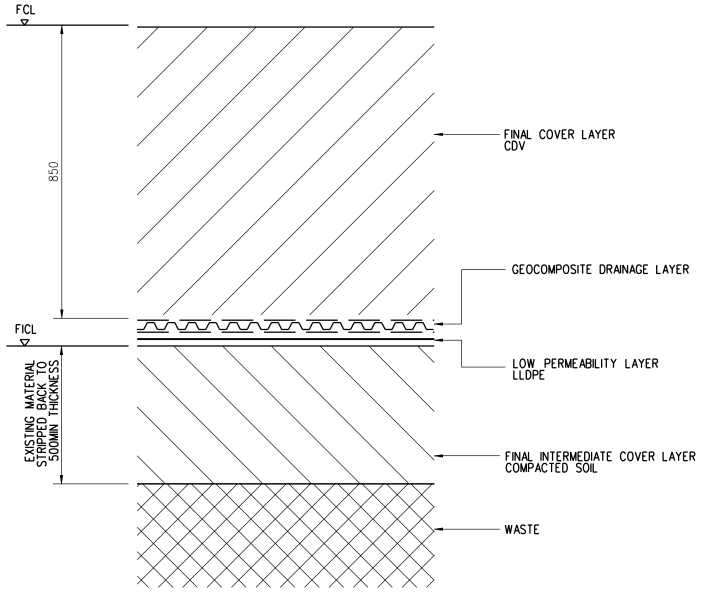
Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

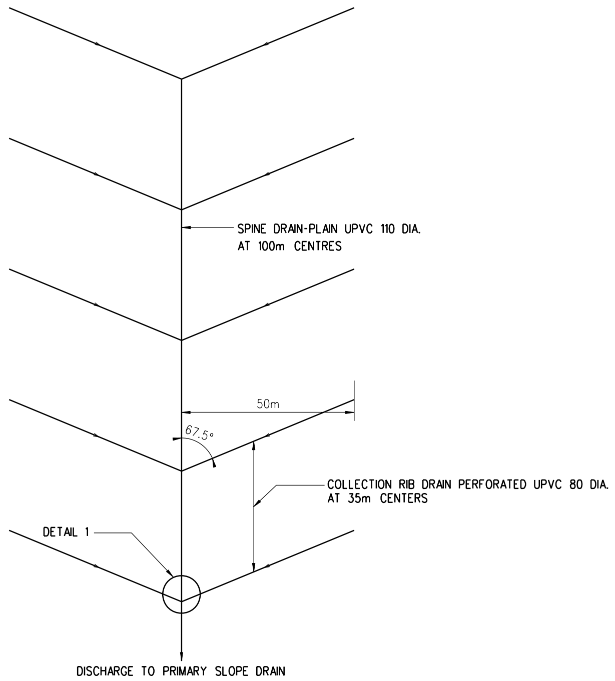
SWIRE SITA WASTE
SERVICES LTD.


FCL
850
FINAL COVER LAYER
CDV
COLLECTION
DRAIN
GEOCOMPOSITE DRAINAGE LAYER
FICL
LOW PERMEABILITY LAYER
LLDPE
EXISTING MATERIAL
STRIPPED BACK TO
500MIN THICKNESS
FINAL INTERMEDIATE COVER LAYER
COMPACTED SOIL
WASTE

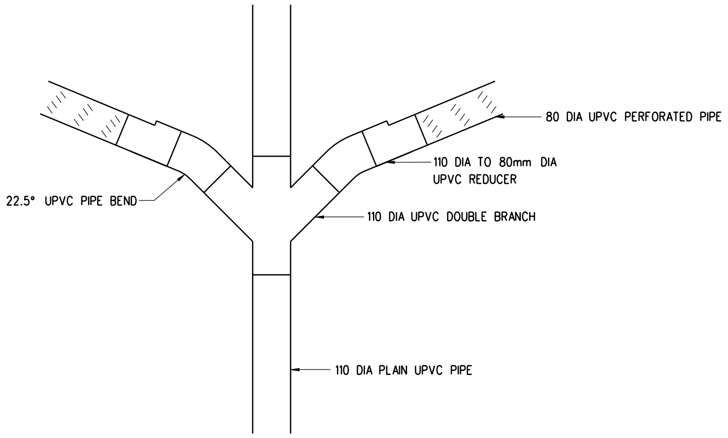
CAP TYPE 1
PLATFORMS
1 : 10


FCL
850
FINAL COVER LAYER
CDV
GEOCOMPOSITE DRAINAGE LAYER
FICL
LOW PERMEABILITY LAYER
LLDPE
EXISTING MATERIAL
STRIPPED BACK TO
500MIN THICKNESS
FINAL INTERMEDIATE COVER LAYER
COMPACTED SOIL
WASTE

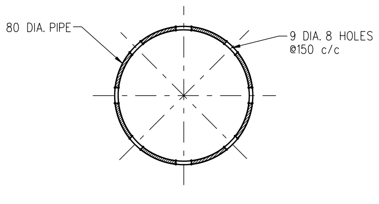
CAP TYPE 2
SLOPES
1 : 10


SPINE DRAIN-PLAIN UPVC 110 DIA.
AT 100m CENTRES
50m
67.5°
COLLECTION RIB DRAIN PERFORATED UPVC 80 DIA.
AT 35m CENTERS
DETAIL 1
DISCHARGE TO PRIMARY SLOPE DRAIN

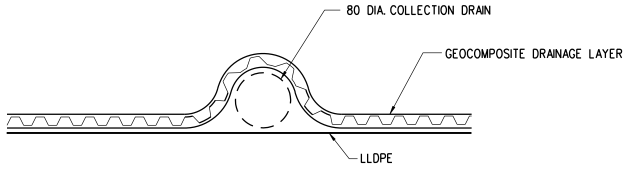
PLATFORM SUB-SOIL DRAIN
(PROVIDED ON ALL PLATFORMS)
1 : 1000


80 DIA UPVC PERFORATED PIPE
110 DIA TO 80mm DIA
UPVC REDUCER
22.5° UPVC PIPE BEND
110 DIA UPVC DOUBLE BRANCH
110 DIA PLAIN UPVC PIPE

TYPICAL CONNECTION DETAIL
DETAIL 1
1 : 10


80 DIA. PIPE
9 DIA. 8 HOLES
@150 c/c

DETAIL OF PERFORATIONS
1 : 2


80 DIA. COLLECTION DRAIN
GEOCOMPOSITE DRAINAGE LAYER
LLDPE

COLLECTION RIB DRAIN DETAILS
1 : 5

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

Details of Revision	Date
COLLECTION RIB DRAIN DETAILS REVISED	12/99

	Designed	Drawn	Checked
Initial			
Date			

Amendment to the Registered Design approved

CAD ref. MAIN: AGSTE001A.DGN
REF: RTKO-A1.DGN

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Contract no. EP/SP/29/95

Contract title
TSEUNG KWAN O LANDFILLS RESTORATION

Drawing title

CAP GENERAL DETAILS
SHEET 1 OF 3

AS CONSTRUCTED RECORD DRAWING

Drawing no.	Scale
GENL/STE/DRW/001/R	AS SHOWN

Binnie Black & Veatch
Hong Kong Limited

Construction Contractor
CHUN WO CONSTRUCTION &
ENGINEERING CO., LTD.

Environmental Consultants
ERM (HK) LTD.

Independent Consultants
MOUCHEL ASIA LIMITED
CONSULTING ENGINEERS

SWIRE SITA WASTE
SERVICES LTD.

CONTRACTOR

SWIRE SITA WASTE SERVICES LIMITED.
DATE :

INDEPENDENT CONSULTANTS

MOUCHEL ASIA LIMITED.
DATE :

D:\agste001.dgn 2008/12/17 上午 09:08:19

Appendix F

GEO Memo for Previous NTHS Report 2023

MEMO

From	CGE/ME, GEO, CEDD	*To*	Environmental Assessment Division, EPD
Ref. ( ) *in*	ME-30-2010-5-6	*(Attn.:*	Mr. H L HO)
Tel. No.	2762 5199	*Your Ref.* ( ) *in*	EP 183/06/B/10-01
Fax. No.	2714 0245	*dated*	3.4.2023 *Fax. No.* 2591 6662
Date	18 May 2023	*Total page*	1

Contract No. EP/SP/29/95
Tseung Kwan O Landfills Restoration
Proposed Public Riding School at Tseung Kwan O Stage II/III Landfill
Submission of Natural Terrain Hazard Study Report (NTHS) (Rev.1)

I refer to your above-referenced memo enclosing the NTHS report (Rev.1) and responses to comments submitted by the Consultants, Modern Consulting Engineers Limited for the proposed public riding school at the captioned site.

2. This Office has no further geotechnical comment on the NTHS report (Rev.1).

3. The submitted NTHS report is retained in our Office for reference.

(Alan K L CHU)
for Chief Geotechnical Engineer/Mainland East
Geotechnical Engineer Office
Civil Engineering and Development Department

ATFY/AKLC
ME3064058

Appendix G

Technical Information Kit for TKOL II/III by EPD

Tseung Kwan O Stage II/III Landfill

Background & Technical Information

Environmental Protection Department

(ver 202003)

Tseung Kwan O Stage II/III Landfill (TKOL-II/III)

1 Background

1.1 Tseung Kwan O Stage II/III Landfill (TKOL-II/III) is one of the remaining restored landfills and is available for development into community or recreational facilities.

1.2 TKOL-II/III is located at TKO Area 105, Tseung Kwan O, New Territories and was formed by infilling of the Tai Chik Sha Valley. The site is now surrounded by Green Belt zone of High Junk Peak, while the western part is facing to commercial and residential developments, such as LOHAS Park and HSBC Data Centre. Its location, along with some general information, is shown in **Annex I**.

1.3 TKOL-II/III was operated by the Civil Engineering Department (CED)[1] between 1988 and 1995; during which time, it received approximately 12.6 million tonnes of domestic, commercial, construction, industrial and special wastes.

1.4 Upon its completion as a waste disposal site, TKOL-II/III was allocated to Environmental Protection Department (EPD) by Lands Department (LandsD) under the arrangement of Temporary Government Land Allocation up to 2029. EPD has implemented comprehensive restoration works on the site, which were completed in 1999. The site is now in the Aftercare period[2] undertaken by EPD's Restoration Contractor – SUEZ NWS R&R (Hong Kong) Limited.

1.5 Both the environmental performance and the long term settlement characteristics of TKOL-II/III are being closely monitored in the Aftercare period. The Restoration Contractor has been carrying out regular inspections on leachate, landfill gas, groundwater, surface water, noise, air and settlement. All measurements indicated compliance of pre-set standards, confirming that, with necessary mitigation measures, TKOL-II/III is safe for Afteruse development. The annual average monitoring results in 2018 are tabulated in **Annex II** for reference.

---

[1] CED was the predecessor of the current Civil Engineering and Development Department

[2] Aftercare includes the operation and maintenance of the landfill gas and leachate management systems, maintenance of the capping system and the carrying out of regular environmental monitoring and audit for the restored landfills.

2 Site Information of Platforms

2.1 TKOL-II/III covers a total area of approximately 42 hectares (ha), of which about 2.8 ha is flat area. Three pieces of flat areas, namely Lot A (upper platform of about 1.7 ha at +140 mPD), Lot B (middle platform of about 0.7 ha at +40 mPD), and Lot C (lower platform of about 0.4 ha at +6 mPD) are available for the development of afteruse facilities for compatible uses. Proposed afteruse facilities could be developed at Lot A, Lot B, and Lot C. Survey maps with the approximate footprint of Lot A and Lot B are shown in **Annex III**.

2.2 Lot A and Lot B are currently open to government departments and non-profit-making organizations as a training field of Unmanned Aerial Vehicle for land surveying. The temporary use of the Lots will be terminated when the Lots are granted to the successful applicant for the proposed Afteruse Facility. Lot C located adjacent to the existing treatment facilities and site office has an area of about 0.4 ha for development. Site photos of the Lots and the surrounding are shown in **Annex IV**.

2.3 The approximate datum level of TKOL-II/III is shown in **Annex IV**. Technical information of the Lots is summarised below:

Area	Approximate Datum Level (mPD)	Maximum Allowable Loading (kPa)(Note)	Approximate Flat Area (ha)
Lot A	+140	50	1.7
Lot B	+40	~~50~~ 40	0.7
Lot C	+6	50	0.4

Note: To protect the underground restoration facilities, development of any Afteruse Facility at Lot A, Lot B and Lot C shall not exceed the maximum allowable loading.

3 Site Access

3.1 The main entrance of the Site is located at the junction of Chun Yat Street and Chun Sing Street, Tseung Kwan O.

3.2 Lot A, Lot B and Lot C can be accessed via a vehicle access road within the TKOL-II/III. This access road is basically a paved one-lane road with narrow shoulders. Vehicles heavier than 5.5 tonnes are not allowed to use this access road. The traffic speed on the access road is limited to 10 km/hr. The road is currently possessed and managed by the Restoration Contractor and is not open to the public. As this access is intended to be used for operation and maintenance of the restoration facilities and carrying out aftercare works, it is not up to public road standard, e.g. no street lighting. A plan of the access road is shown in **Annex V**.

3.3 It is necessary to obtain consent from the Restoration Contractor for using the vehicular access during construction and operation stage of the proposed works.

3.4 It is required either to upgrade the existing access road or construct a new road leading directly to Lot A, Lot B and Lot C in order to facilitate its development.

4 Site Conditions and Constraints

4.1 Restoration Facilities and On-going Aftercare Works

4.1.1 The restoration works at TKOL-II/III include a multi-layer capping system (consisting of compacted soil, geomembrane, geonet and geotextile), a landfill gas and leachate extraction, collection and treatment system, and other ancillary facilities. If there are any proposed works which may affect, modify, interfere with or interrupt the restoration facilities and the Aftercare works, modification / re-provision proposal is required to be submitted for the concerned parties' agreement.

4.2 Settlement and Geotechnical Condition

4.2.1 TKOL-II/III used to be a dumping site for domestic, commercial, construction, industrial and special wastes; therefore it may not exhibit homogeneous geotechnical properties. Due to the diverse nature and depth of wastes buried in landfill, settlement of the landfill surface may be resulted. It affects the serviceability of the infrastructure (including road pavement, drains, utilities, etc.). When structures are constructed on site, loading of the structure and its foundation may cause additional settlement that could be greater than those in surrounding unloaded areas.

4.2.2 Since the site is overlooked by steep natural terrain, natural terrain hazard study would probably be required for any proposed infrastructure works to the satisfaction of the Geotechnical Engineering Office.

4.3 Landfill Gas Hazard

4.3.1 Landfill gas is a generic term used to describe the mixture of gaseous product generated as a result of the waste decomposition in landfills. It is both flammable and asphyxiating, and has the potential to cause fire and explosion. It may pose potential hazard to construction and maintenance of the proposed works and hence the design of the works should take into consideration of this potential hazard and incorporate mitigation measures as necessary.

4.4 Public Utilities

4.4.1 There is no provision of water supply, electricity, public drainage / sewerage system and other public utilities at both Lot A, Lot B and Lot C. It is required to make arrangement with the utility undertakers for the provision of such utilities and services in order to enable the development of the platforms, including how to connect to the existing network / system of these utilities and services in the vicinity.

4.5 Fire Services

4.5.1 The existing vehicular access within TKOL-II/III may not be up to an emergency vehicular access (EVA), and improvement works may be required subject to the development requirements of potential interim uses / permanent uses.

4.6 Outline Zoning Plan (OZP)

4.6.1 The Site falls into the “Open Space” zone in the Outline Zoning Plan (OZP) No. S/TKO/20. The full set of OZP including the Plan, Notes and Explanatory Statement is available at the website of the Town Planning Board (TPB) (http://www.info.gov.hk/tpb/index.html). An extract of OZP highlighting the vicinity of TKOL-II/III is shown in **Annex VI**. The always permitted uses for Open Space and the permitted uses with or without conditions on application to the TPB are also shown in **Annex VI**.

4.6.2 In accordance with the OZP for the Site, no new development, or addition, alteration, and / or modification to or redevelopment of an existing building shall result in a total development and / or redevelopment in excess of a maximum plot ratio of 0.1 and a maximum building height of 1 storey, or the plot ratio and height of the existing building, whichever is the greater.

5 Reference Documents

For more detailed information of TKOL-II/III site, reference can be made to the following documents.

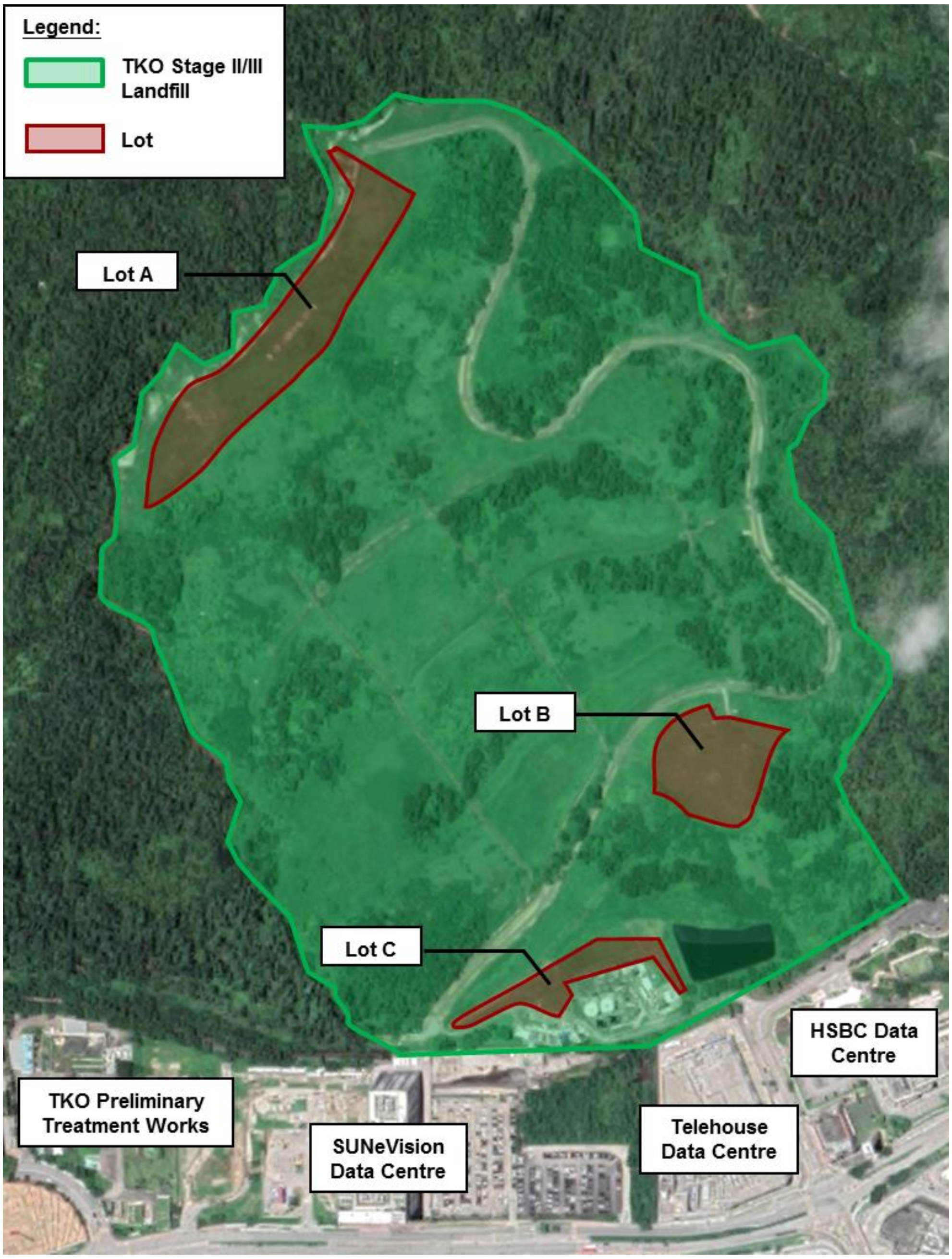
Document No.	Title
1	Contract No. EP/SP/29/95 Tseung Kwan O Landfills Restoration Contract - Specification - Contract Drawings - Slope Design Review Reports (2017) - Environmental Monitoring Data (2018)
2	Contract No. FD 01-052 Provision of Services for Geotechnical Review and Site Investigation Works for Tseung Kwan O Landfills Afteruse Development (2004)
3	Contract No. EP/SP/29/95 Tseung Kwan O II/III Landfill Topographic Survey (2020)
4	Contract No. EP/SP/29/95 Restoration of Tseung Kwan O Landfills - Detail Environmental Impact Assessment Report (1998)

Contract No. EP/SP/29/95 Tseung Kwan O Landfills Restoration Contract As-built Drawing List		
	Drawing Number	**Drawing Title**
1	STG2/STE/DRW/003/R	Stage II/III Cap Layout Plan
2	STG2/STE/DRW/021/R	Stage II/III Final Cap Cross Sections Sheet 1 of 3
3	GENL/STE/DRW/001/R	Cap General Details Sheet 1 of 3
4	GENL/STE/DRW/002/R	Cap General Details Sheet 2 of 3
5	GENL/STE/DRW/003/R	Cap General Details Sheet 3 of 3

Contract No. EP/SP/29/95
Tseung Kwan O Landfills Restoration Contract As-built Drawing List

	Drawing Number	**Drawing Title**
6	STG2/SUR/DRW/001/R	Stage II/III Surface Water Drainage Layout Plan
7	STG2/G&L/DRW/002/R	Stage II/III Gas and Leachate Management Schematic Layout Plan
8	STG2/G&L/DRW/003/R	Stage II/III Gas and Leachate Extraction System P&ID

Annex I – General Information of Tseung Kwan O Stage II/III Landfill


Legend:
TKO Stage II/III Landfill
Lot
Lot A
Lot B
Lot C
HSBC Data Centre
TKO Preliminary Treatment Works
SUNeVision Data Centre
Telehouse Data Centre

District	Sai Kung
Completion of Restoration Works	1999
Land Use Zoning	Open Space
Flat Area (approx.)	2.8 ha
Current Status	• Lot A and Lot B are currently used as an Unmanned Aerial Vehicles (UAVs) Training Area and are opened for booking by government departments or non-profit making organization.

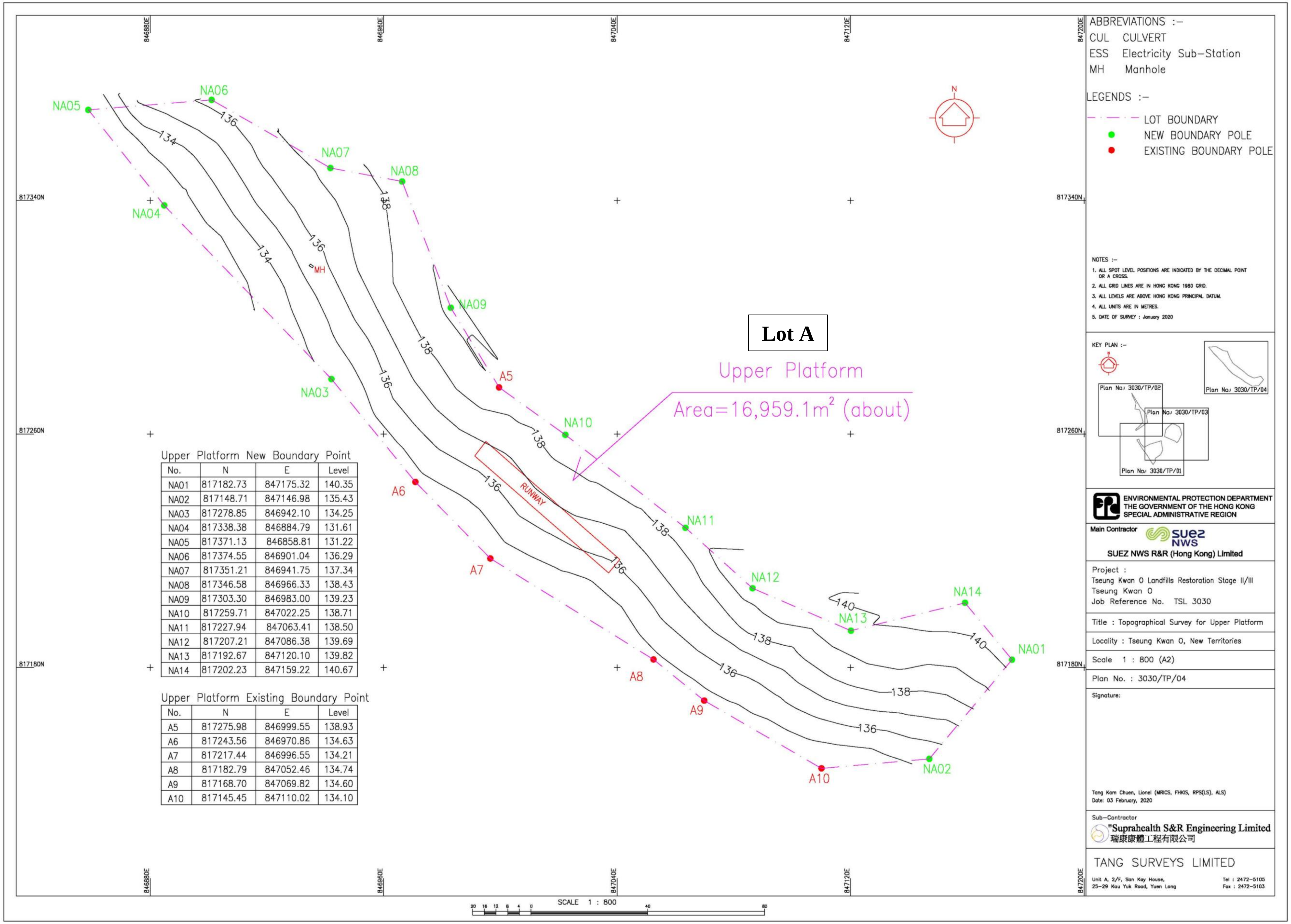
Other Information

- TKOL-II/III mainly comprises slopes.
- Existing site access road is not opened to the public and is not up to public road standard.
- TKOL-II/III is surrounded by Green Belt zone of High Junk Peak and its western part is facing to commercial and residential areas.
- There are landfill restoration facilities including landfill gas and leachate management systems installed at TKOL-II/III and the Restoration Contractor is carrying out landfill aftercare works on a regular basis; any proposed uses shall be compatible with these facilities and the aftercare works.

Annex II – Annual Average Landfill Gas Monitoring and Ground Settlement Data in 2018

Description	Average value in 2018	Safety Limit
Methane content in passive vent pipes located at the landfill boundary	Non-detectable	N/A
Methane content in landfill gas monitoring wells located at the landfill boundary	Non-detectable	N/A
Total landfill gas collected	About 4,730,000 m^3	N/A
Surface emission (Methane)	2.8 ppm	10,000 ppm
Ground settlement (Compared with 2017)	About 8 mm	N/A

Annex III - Site Survey Map of Tseung Kwan O Stage II/III Landfill


846880E
846960E
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847120E
847200E
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817180N
N
NA05
NA06
NA07
NA08
NA04
NA09
NA03
NA10
NA11
NA12
NA13
NA14
NA01
NA02
A5
A6
A7
A8
A9
A10
134
136
138
140
MH
RUNWAY
Lot A
Upper Platform
Area=16,959.1m² (about)
SCALE 1 : 800
20 16 12 8 4 0 40 80
Plan No: 3030/TP/02
Plan No: 3030/TP/03
Plan No: 3030/TP/01
Plan No: 3030/TP/04

ABBREVIATIONS :–

CUL CULVERT
ESS Electricity Sub–Station
MH Manhole

LEGENDS :–

— · —	LOT BOUNDARY
●	NEW BOUNDARY POLE
●	EXISTING BOUNDARY POLE

Upper Platform New Boundary Point

No.	N	E	Level
NA01	817182.73	847175.32	140.35
NA02	817148.71	847146.98	135.43
NA03	817278.85	846942.10	134.25
NA04	817338.38	846884.79	131.61
NA05	817371.13	846858.81	131.22
NA06	817374.55	846901.04	136.29
NA07	817351.21	846941.75	137.34
NA08	817346.58	846966.33	138.43
NA09	817303.30	846983.00	139.23
NA10	817259.71	847022.25	138.71
NA11	817227.94	847063.41	138.50
NA12	817207.21	847086.38	139.69
NA13	817192.67	847120.10	139.82
NA14	817202.23	847159.22	140.67

Upper Platform Existing Boundary Point

No.	N	E	Level
A5	817275.98	846999.55	138.93
A6	817243.56	846970.86	134.63
A7	817217.44	846996.55	134.21
A8	817182.79	847052.46	134.74
A9	817168.70	847069.82	134.60
A10	817145.45	847110.02	134.10

NOTES :–

1. ALL SPOT LEVEL POSITIONS ARE INDICATED BY THE DECIMAL POINT OR A CROSS.
2. ALL GRID LINES ARE IN HONG KONG 1980 GRID.
3. ALL LEVELS ARE ABOVE HONG KONG PRINCIPAL DATUM.
4. ALL UNITS ARE IN METRES.
5. DATE OF SURVEY : January 2020

KEY PLAN :–

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Main Contractor
SUEZ NWS R&R (Hong Kong) Limited

Project :
Tseung Kwan O Landfills Restoration Stage II/III
Tseung Kwan O
Job Reference No. TSL 3030

Title : Topographical Survey for Upper Platform

Locality : Tseung Kwan O, New Territories

Scale 1 : 800 (A2)

Plan No. : 3030/TP/04

Signature:

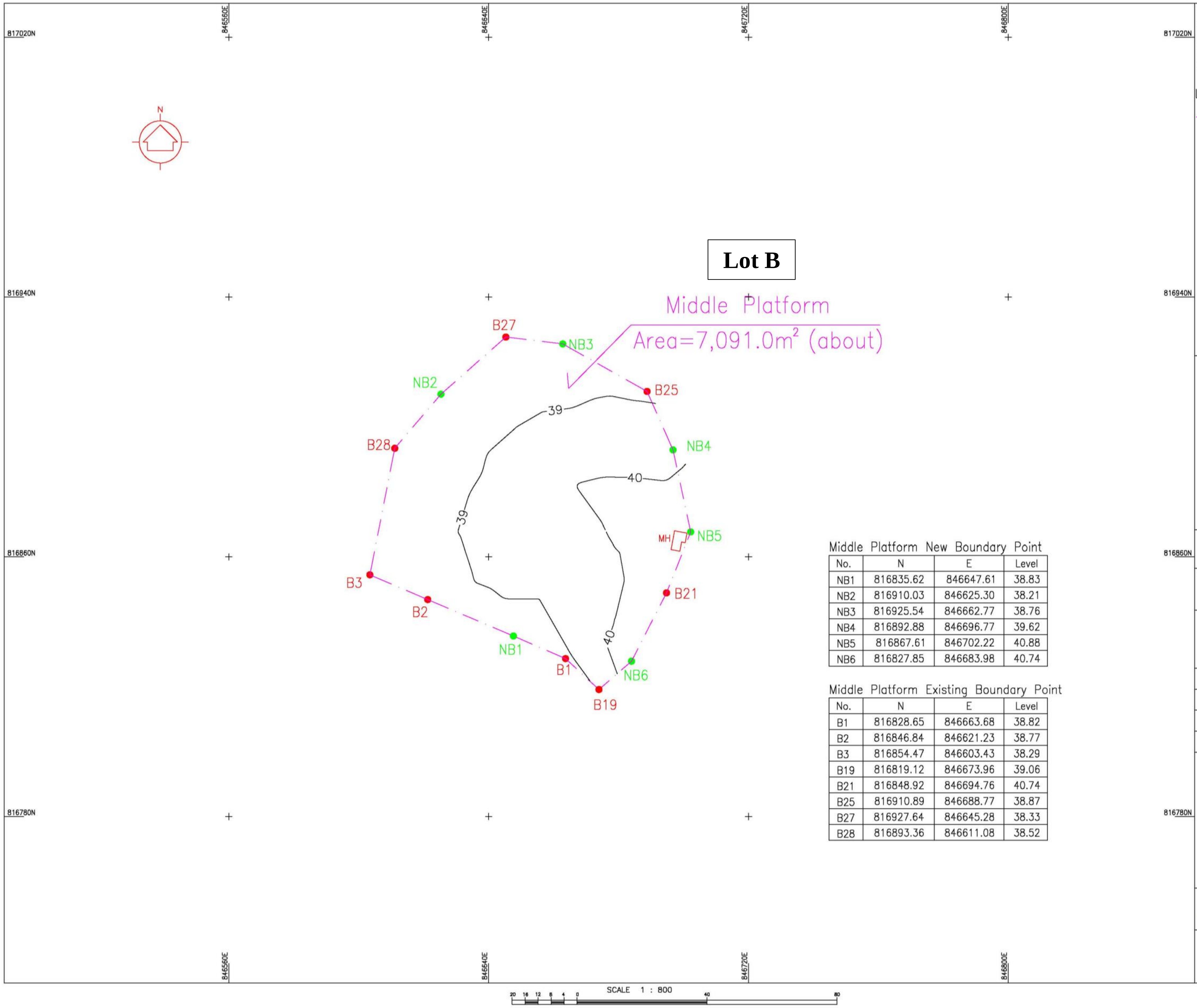
Tang Kam Chuen, Lionel (MRICS, FHKIS, RPS(LS), ALS)
Date: 03 February, 2020

Sub–Contractor
"Suprahealth S&R Engineering Limited
瑞康康體工程有限公司

TANG SURVEYS LIMITED

Unit A, 2/F, San Kay House,
25–29 Kau Yuk Road, Yuen Long

Tel : 2472–5105
Fax : 2472–5103


817020N
846560E
846640E
846720E
846800E
816940N
816860N
816780N
N
Lot B
Middle Platform
Area=7,091.0m² (about)
B27
NB3
NB2
B25
39
B28
NB4
40
39
MH
NB5
B3
B21
B2
40
NB1
B1
NB6
B19
SCALE 1 : 800
20 16 12 8 4 0
40
80

Middle Platform New Boundary Point

No.	N	E	Level
NB1	816835.62	846647.61	38.83
NB2	816910.03	846625.30	38.21
NB3	816925.54	846662.77	38.76
NB4	816892.88	846696.77	39.62
NB5	816867.61	846702.22	40.88
NB6	816827.85	846683.98	40.74

Middle Platform Existing Boundary Point

No.	N	E	Level
B1	816828.65	846663.68	38.82
B2	816846.84	846621.23	38.77
B3	816854.47	846603.43	38.29
B19	816819.12	846673.96	39.06
B21	816848.92	846694.76	40.74
B25	816910.89	846688.77	38.87
B27	816927.64	846645.28	38.33
B28	816893.36	846611.08	38.52

ABBREVIATIONS :–

CUL	CULVERT
ESS	Electricity Sub–Station
MH	Manhole

LEGENDS :–

— · — · —	LOT BOUNDARY
●	NEW BOUNDARY POLE
●	EXISTING BOUNDARY POLE

NOTES :–

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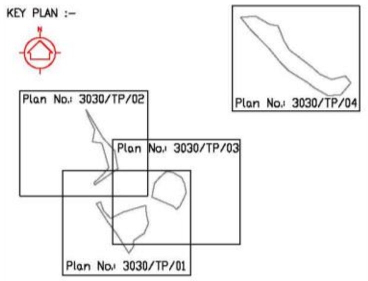
3. ALL LEVELS ARE ABOVE HONG KONG PRINCIPAL DATUM.
4. ALL UNITS ARE IN METRES.
5. DATE OF SURVEY : January 2020

KEY PLAN :–


Plan No.: 3030/TP/02
Plan No.: 3030/TP/04
Plan No.: 3030/TP/03
Plan No.: 3030/TP/01

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Main Contractor
suez
NWS
SUEZ NWS R&R (Hong Kong) Limited

Project :
Tseung Kwan O Landfills Restoration Stage II/III
Tseung Kwan O
Job Reference No. TSL 3030

Title : Topographical Survey for Middle Platform

Locality : Tseung Kwan O, New Territories

Scale 1 : 800 (A2)

Plan No. : 3030/TP/03

Signature:

Tang Kam Chuen, Lionel (MRICS, FHKIS, RPS(LS), ALS)
Date: 03 February, 2020

Sub–Contractor
"Suprahealth S&R Engineering Limited
瑞康康體工程有限公司

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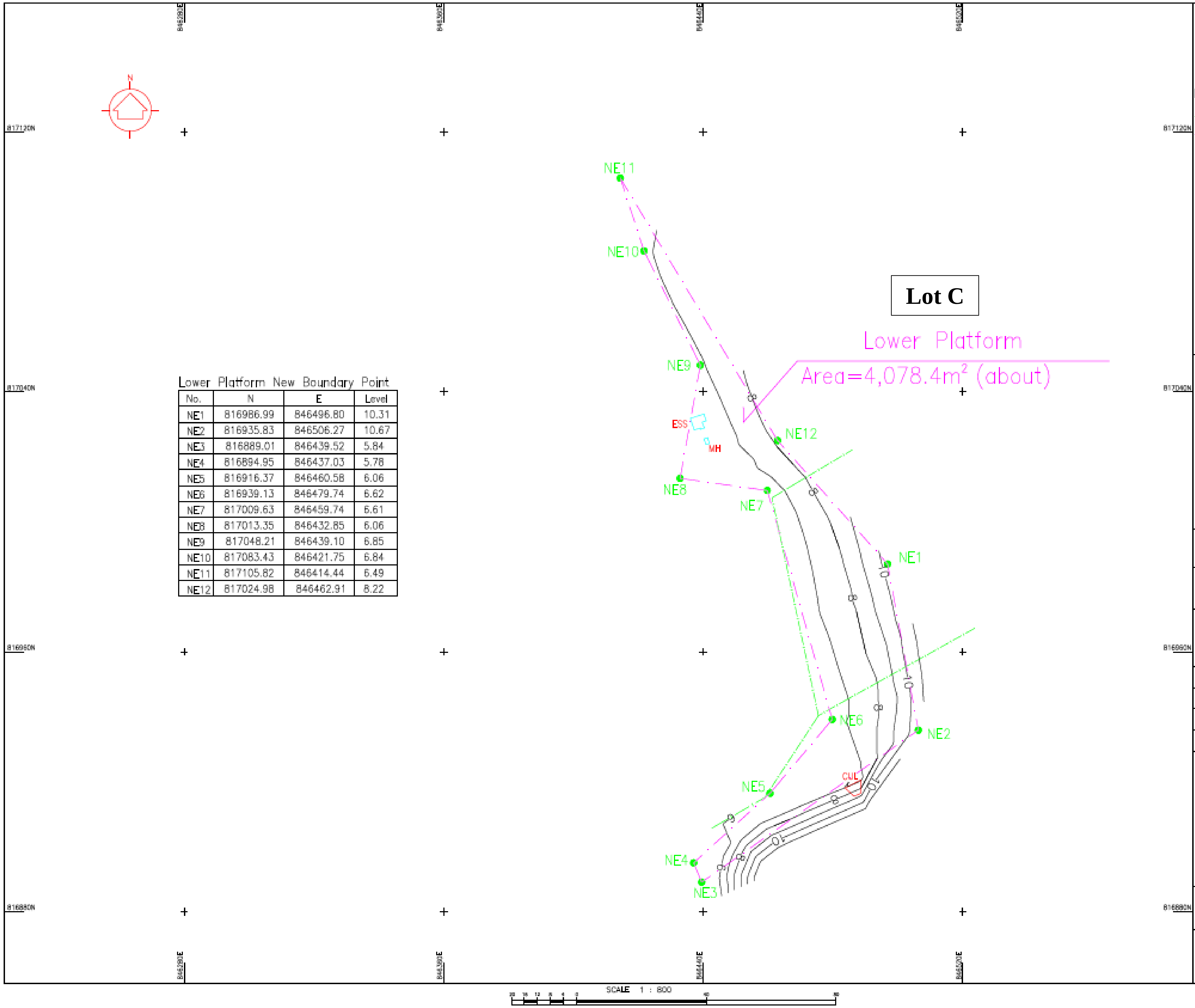
Tel : 2472–5105
Fax : 2472–5103


N
846280E
846360E
846440E
846520E
817120N
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816960N
816880N
NE11
NE10
NE9
ESS
MH
NE8
NE7
NE12
NE1
NE6
NE2
NE5
CUL
NE4
NE3
Lot C
Lower Platform
Area=4,078.4m² (about)
SCALE 1 : 800
20 16 12 8 4 0
40
80

Lower Platform New Boundary Point

No.	N	E	Level
NE1	816986.99	846496.80	10.31
NE2	816935.83	846506.27	10.67
NE3	816889.01	846439.52	5.84
NE4	816894.95	846437.03	5.78
NE5	816916.37	846460.58	6.06
NE6	816939.13	846479.74	6.62
NE7	817009.63	846459.74	6.61
NE8	817013.35	846432.85	6.06
NE9	817048.21	846439.10	6.85
NE10	817083.43	846421.75	6.84
NE11	817105.82	846414.44	6.49
NE12	817024.98	846462.91	8.22

ABBREVIATIONS :-

CUL	CULVERT
ESS	Electricity Sub-Station
MH	Manhole

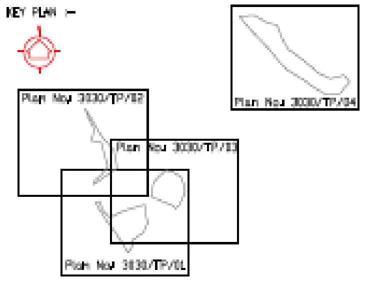
LEGENDS :-

—·—·—	FENCE/RAILING
—·—·—	LOT BOUNDARY
●	NEW BOUNDARY POLE
●	EXISTING BOUNDARY POLE

NOTES :-

1. ALL SPOT LEVEL POSITIONS ARE INDICATED BY THE DECIMAL POINT OR A CROSS.
2. ALL GRID LINES ARE IN HONG KONG 1980 GRID.
3. ALL LEVELS ARE ABOVE HONG KONG PRINCIPAL DATUM.
4. ALL UNITS ARE IN METRES.
5. DATE OF SURVEY : January 2020

KEY PLAN :-


Plan No: 3030/TP/02
Plan No: 3030/TP/03
Plan No: 3030/TP/04
Plan No: 3030/TP/01

ENVIRONMENTAL PROTECTION DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

Main Contractor
SUEZ NWS R&R (Hong Kong) Limited

Project :
Tseung Kwan O Landfills Restoration Stage II/III
Tseung Kwan O
Job Reference No. TSL 3030

Title : Topographical Survey for Lower Platform

Locality : Tseung Kwan O, New Territories

Scale 1 : 800 (A2)

Plan No. : 3030/TP/02

Signature:

Tang Kam Chuen, Lionel (MRICS, MHKIS, RPS(LS), ALS)
Date: 03 February, 2020

Sub-Contractor
"Suprahealth S&R Engineering Limited
瑞康康體工程有限公司

TANG SURVEYS LIMITED

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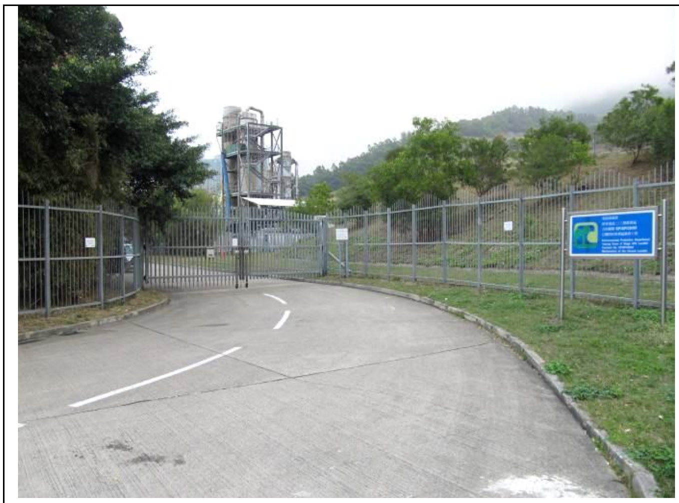
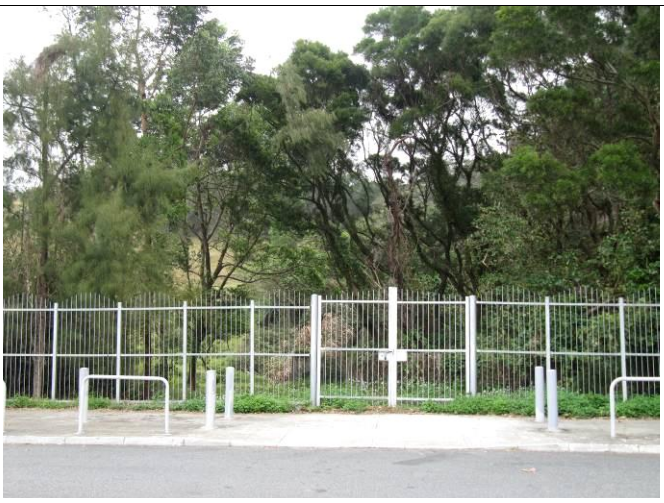
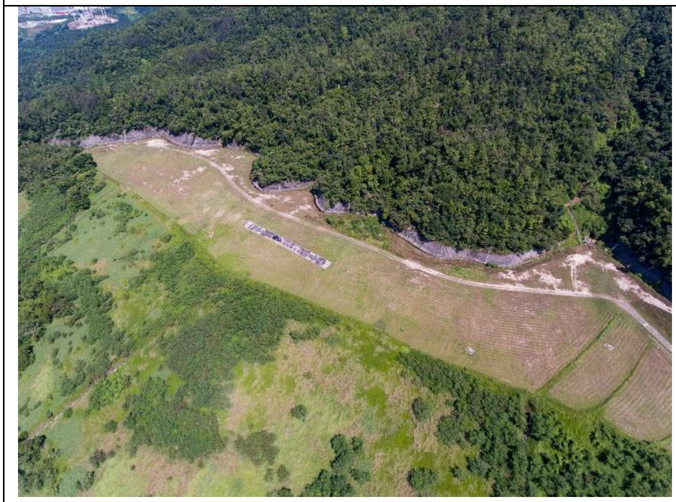
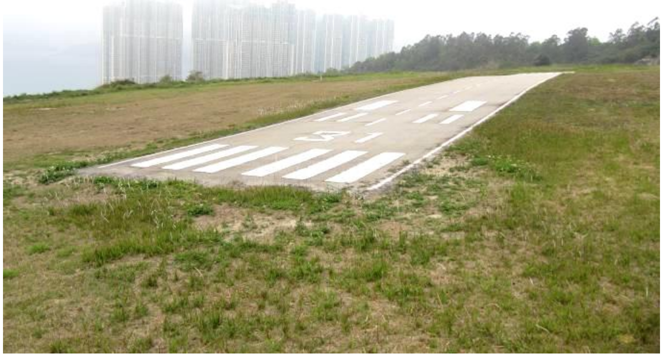
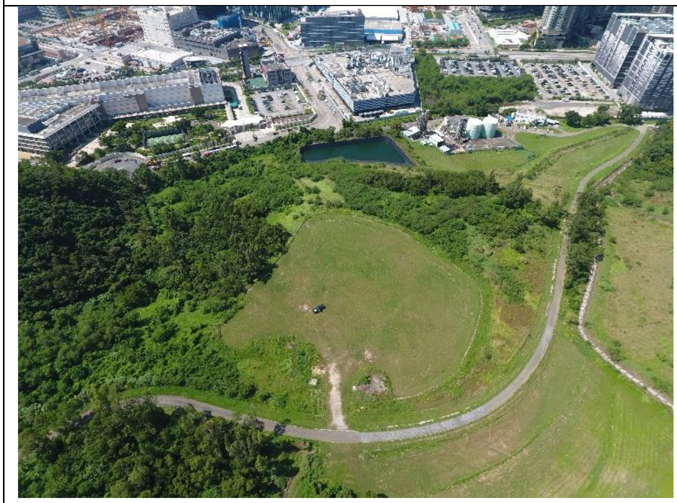
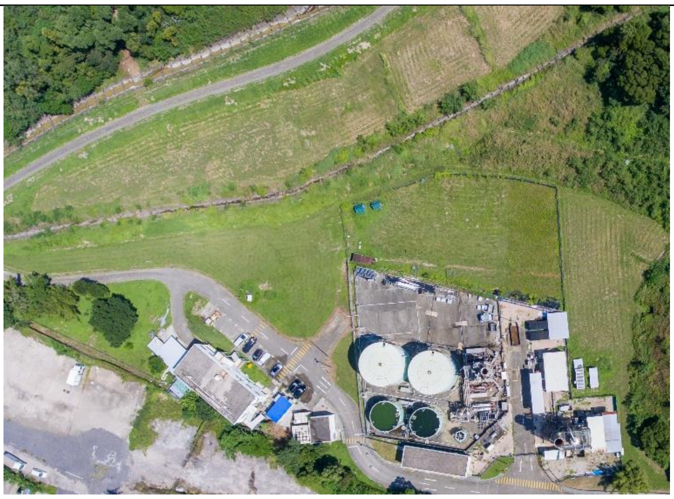
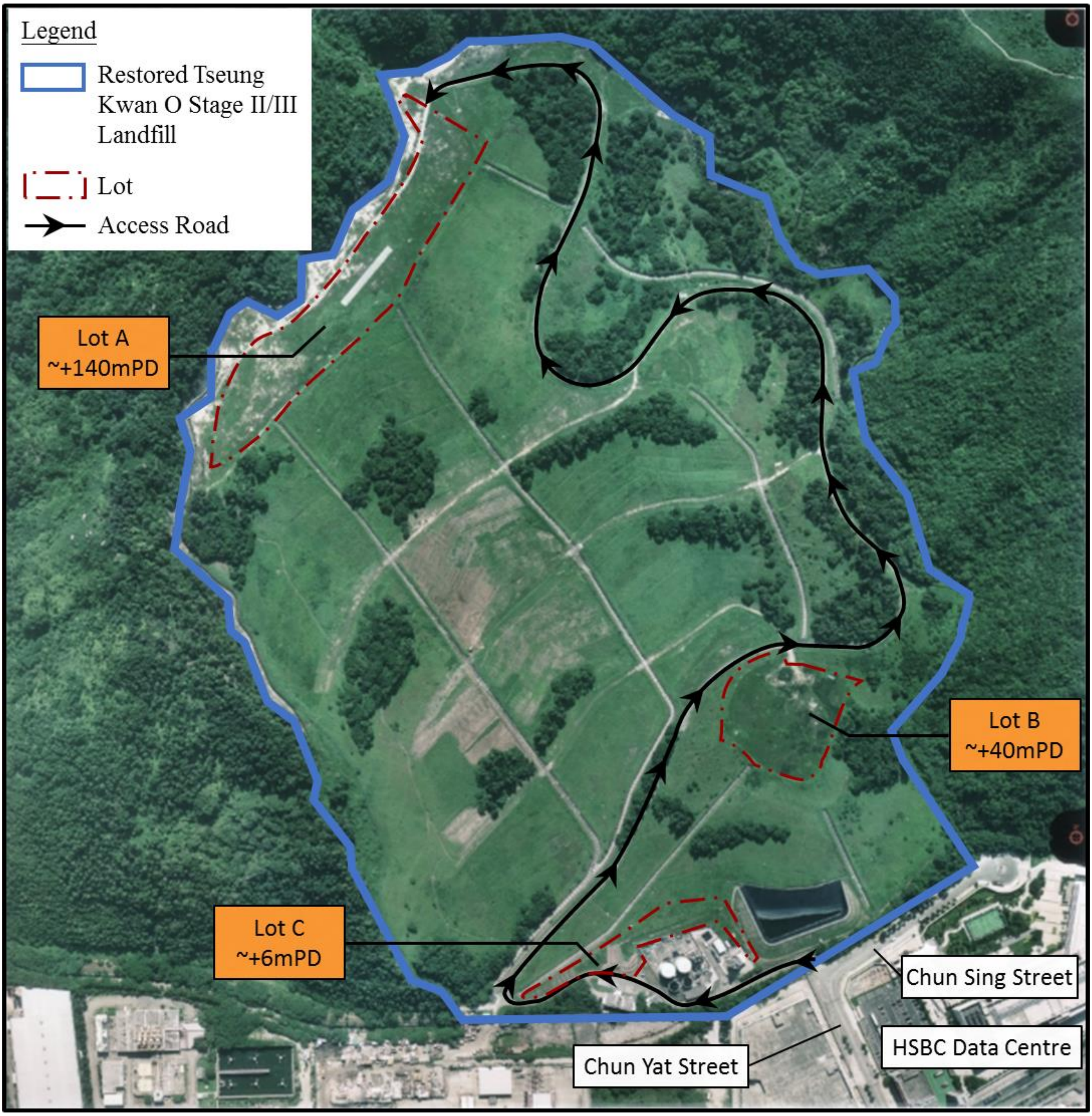
35-39 Kau Yuk Road, Yuen Long

Tel : 2472-9109
Fax : 2472-8103

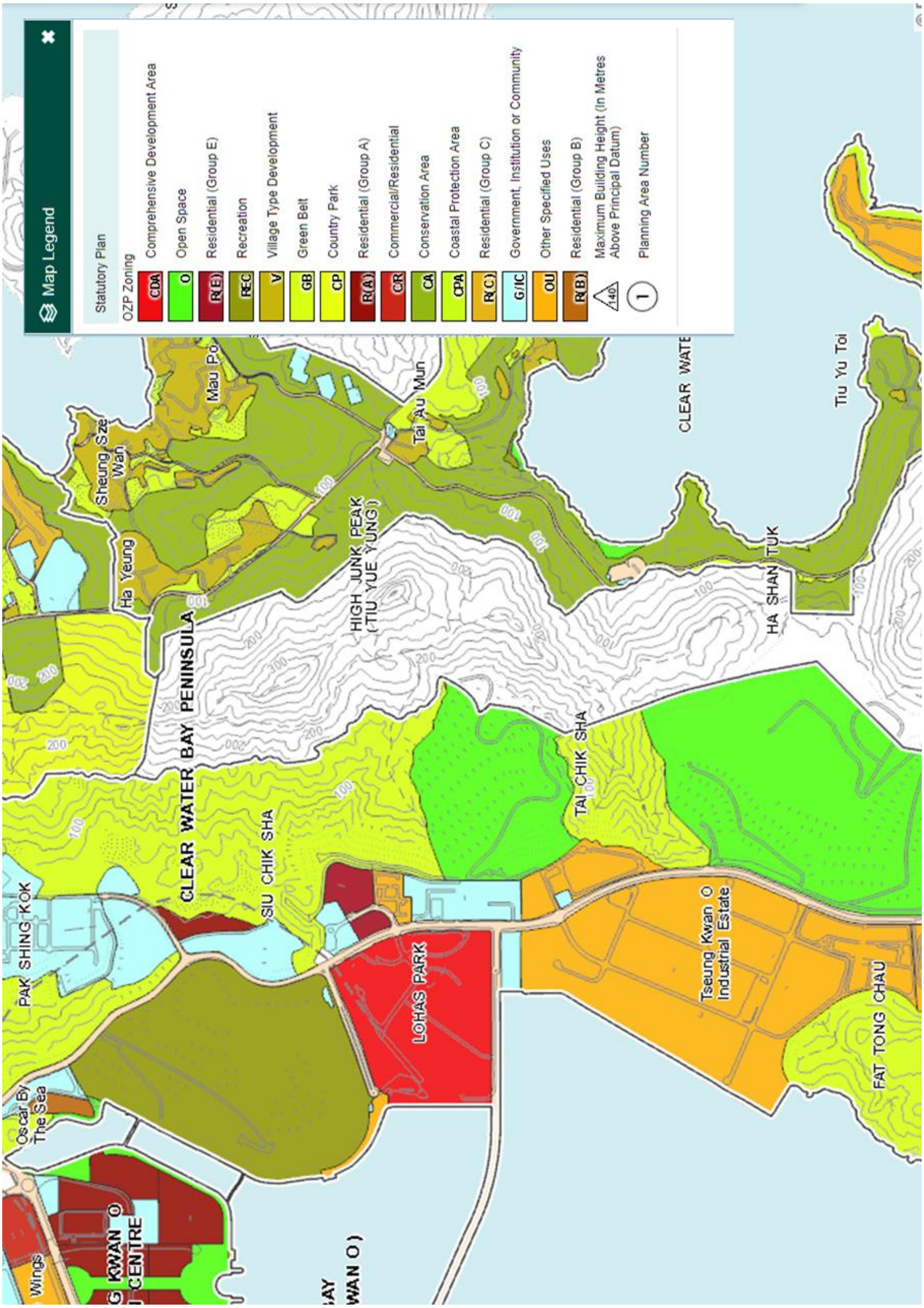
Annex IV – Site Photos of Tseung Kwan O Stage II/III Landfill

 Main Entrance of TKO-II/III	 Entrance of TKO-II/III at Chun Sing Street
 Aerial View of the Lot A	 General View of the Lot A
 Aerial View of the Lot B	 Aerial View of the Lot C, Site Office and Treatment Facilities

Annex V – Datum Levels and Site Access of Tseung Kwan O Stage II/III Landfill


Legend
Restored Tseung Kwan O Stage II/III Landfill
Lot
Access Road
Lot A
~+140mPD
Lot B
~+40mPD
Lot C
~+6mPD
Chun Sing Street
HSBC Data Centre
Chun Yat Street

Annex VI – Extract of the Tseung Kwan O Outline Zoning Plan


Map Legend
Statutory Plan
OZP Zoning
CDA Comprehensive Development Area
O Open Space
R(E) Residential (Group E)
REC Recreation
V Village Type Development
GB Green Belt
CP Country Park
R(A) Residential (Group A)
C/R Commercial/Residential
CA Conservation Area
CPA Coastal Protection Area
R(C) Residential (Group C)
G/IC Government, Institution or Community
OU Other Specified Uses
R(B) Residential (Group B)
140 Maximum Building Height (In Metres Above Principal Datum)
1 Planning Area Number
Mau Po
Tai Au Mun
Sheung Sze Wan
Ha Yeung
CLEAR WATER BAY PENINSULA
HIGH JUNK PEAK (TIU YUE YUNG)
CLEAR WATE
Tiu Yu Toi
HA SHAN TUK
TAI CHIK SHA
SIU CHIK SHA
PAK SHING KOK
LOHAS PARK
Tseung Kwan O Industrial Estate
FAT TONG CHAU
Oscar By The Sea
G KWAN O
CENTRE
Wings
BAY
WAN O)
100
200
300

Appendix B5

OPEN SPACE

Column 1 Uses always permitted	Column 2 Uses that may be permitted with or without conditions on application to the Town Planning Board
Aviary Barbecue Spot* Bathing Beach* Field Study/Education/Visitor Centre Park and Garden Pavilion Pedestrian Area Picnic Area Playground/Playing Field Promenade* Public Convenience Sitting Out Area Zoo*	Cable Car Route and Terminal Building* Eating Place Government Refuse Collection Point Government Use (not elsewhere specified) Holiday Camp Mass Transit Railway Vent Shaft and/or Other Structure above Ground Level other than Entrances* Pier* Place of Entertainment Place of Recreation, Sports or Culture Private Club Public Transport Terminus or Station Public Utility Installation Public Vehicle Park (excluding container vehicle) Religious Institution Service Reservoir Shop and Services Tent Camping Ground Utility Installation for Private Project

** Add where appropriate*

Planning Intention

This zone is intended primarily for the provision of outdoor open-air public space for active and/or passive recreational uses serving the needs of local residents as well as the general public.