Appendix V

Drainage Proposal

[redacted]

J24.00171.HK.01

S.16 Planning Application for Proposed Temporary Concrete Batching Plant with Ancillary Facilities for a Period of 5 Years at Lots 573 RP and 1710 in D.D. 114, Shek Kong, Yuen Long, New Territories

Drainage Proposal

Prepared for:

Join Bright Warehousing Limited

30 December 2024

[redacted]

S.16 Planning Application for Proposed Temporary Concrete Batching Plant with Ancillary Facilities for a Period of 5 Years at Lots 573 RP and 1710 in D.D. 114, Shek Kong, Yuen Long, New Territories

Drainage Proposal

Prepared for

Join Bright Warehousing Limited

For and on behalf of
EnviroSolutions & Consulting

Alexi BHANJA
Group COO

ESC Project No. J24.00171.HK.01

Deliverable No. D02

Revision No. 1

File Location

https://envirosc.sharepoint.com/teams/newsharepoint/shared documents/new sharepoint/05. jobs/j24.00171.hk.01 kam tin cbp s16/06. deliverables/d01 drainage proposal rev0.2_aw.docx

Rev.	Description	Prepared	Reviewed	Approved	Date
0	Drainage Proposal	MJW	CL	AW	01/08/2024
1	Drainage Proposal	MJW	CL	AW	30/12/2024

Distribution ☐ Internal ☒ Confidential ☐ Public

CONTENTS

APPENDICES

FIGURES

TABLES

1 PROJECT BACKGROUND

1.1 Introduction

1.1.1 Land resumption will be carried out to facilitate the development of Hung Shui Kiu/ Ha Tsuen New Development Area. An existing Concrete Batching Plant ("CBP") in Hung Shui Kiu will be affected by the land resumption. Thus, a site located at Lots 573 RP and 1710 in D.D. 114, Shek Kong ("the Site") has been identified for relocating the existing CBP to the Site ("the Proposed Development").

1.1.2 The Site is currently zoned "Industrial (Group D)" ("I(D)") on the Approved Shek Kong Outline Zoning Plan ("OZP") No. S/YL-SK/9 which "Concrete Batching Plant" is under Column 2 in accordance with the Schedule of Use for I(D) zone. As such, a planning application is required to submit and obtain permission from the Town Planning Board under Section 16 of the *Town Planning Ordinance* for the Proposed Development.

1.1.3 EnviroSolutions & Consulting Limited ("ESC") has been engaged to carry out a Drainage Proposal to support the abovementioned application.

1.2 Site Description

1.2.1 The Site locations and its environs are shown in **Figure 1-1** which the uses surrounding the Site include:

- To the North: temporary structures with industrial use and vegetated slope
- To the East: temporary structures with industrial use and vegetation
- To the South: temporary structures with industrial use
- To the West: temporary structures with industrial use

1.3 Objectives of this Report

1.3.1 The objectives of this Drainage Proposal are to:

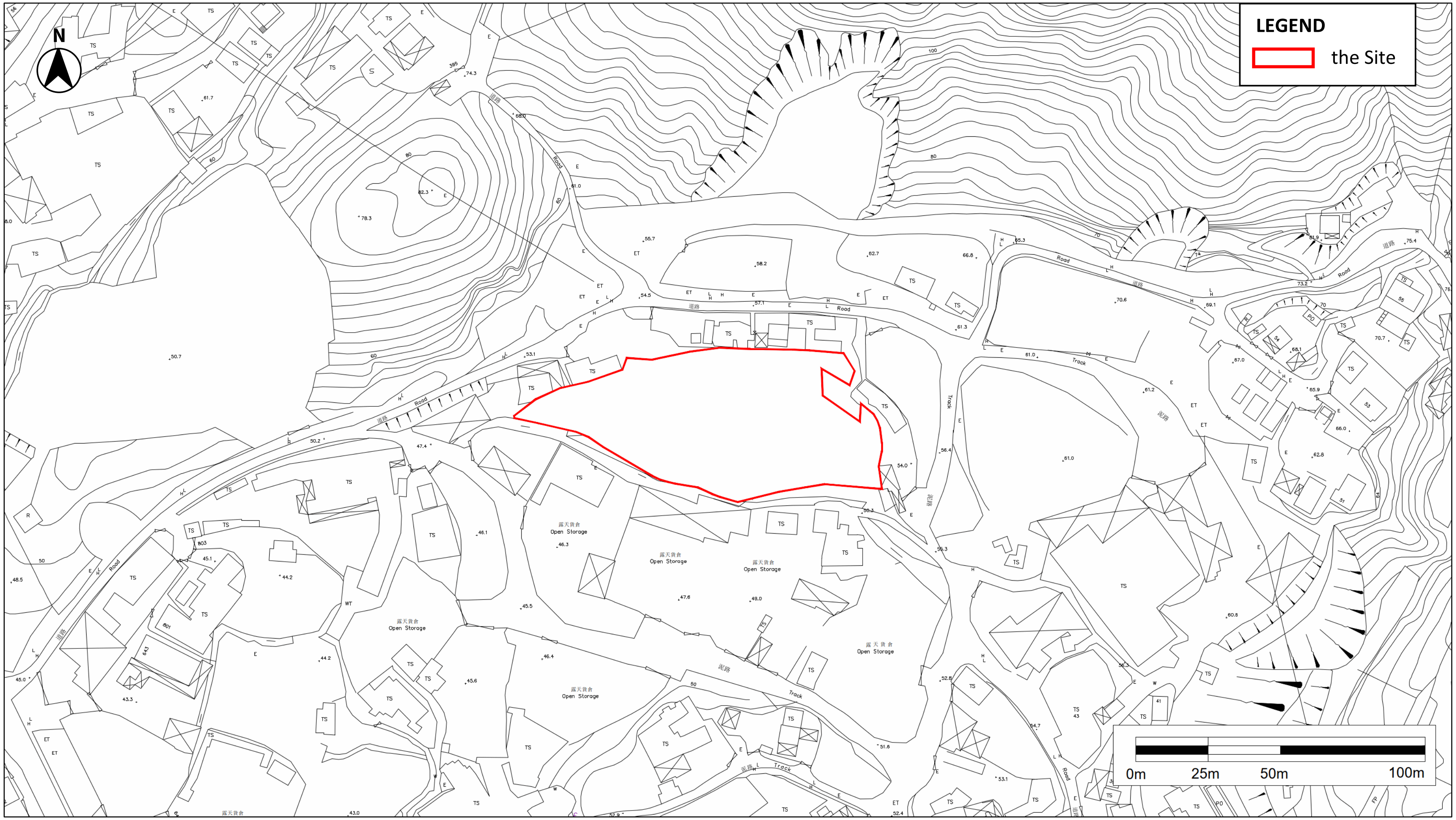
- Assess the potential drainage impacts arising from the Proposed Development.
- Recommend the necessary mitigation measures to alleviate any impacts, if any.

1.4 Reference Materials

1.4.1 In evaluating the drainage impact arising from the Proposed Development, the following materials have been referred to:

- Stormwater Drainage Manual (with Eurocodes incorporated) – Planning, Design and Management (Fifth Edition, January 2018)
- Stormwater Drainage Manual – Corrigenda Nos. 1/2022, 1/2024 and 2/2024
- DSD Advice Note No. 1 – Application of the Drainage Impact Assessment Process to Private Sector Projects
- Technical Note to prepare a Drainage Submission
- Drainage Data of GeoInfo Map reviewed on 11 July 2024.

Figure 1-1 Site Location and its Environs



2 DESCRIPTION OF EXISTING ENVIRONMENT AND DRAINAGE CONDITIONS

2.1 Site Location and Topography

2.1.1 As illustrated in **Figure 1-1**, the Site is surrounded by various temporary structures with industrial use and vegetated slopes to the north and east.

2.1.2 The Site is situated at Lots 573 RP and 1710 in D.D. 114. The Site area is about 4,411m^2 with elevation ranging from +52.9mPD to +48.1mPD.

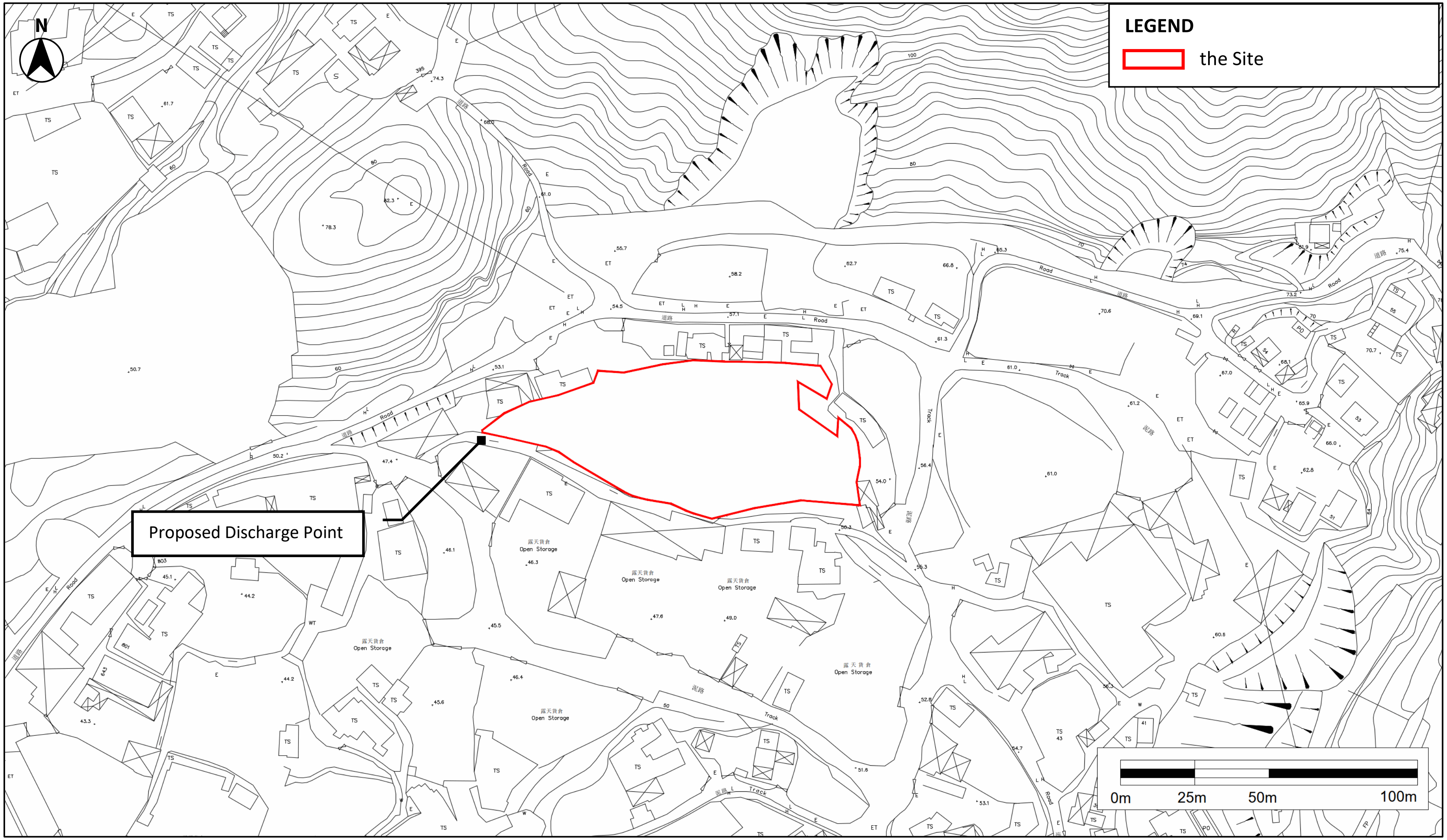
2.2 Existing Baseline Conditions

2.2.1 According to the drainage record provided in Geoinfo Map, no public drainage system was observed in the vicinity of the Site. A site inspection was conducted on 10 January 2023 to review the existing site condition and identify the drainage connection of the surrounding catchments. The entire Site is currently paved, with 100% of the Site being paved with concrete. The detailed discussion about surrounding catchments is provided in the following sections.

2.3 Proposed Discharge Point

2.3.1 It is proposed to discharge the stormwater runoff from the Site to the existing stream to the south of the Site. The indicative discharge point is shown in **Figure 2-1**.

Figure 2-1 Proposed Discharge Point



3 DRAINAGE ANALYSIS

3.1 Assumptions and Methodology

3.1.1 Peak instantaneous run off before and after the Proposed Development was calculated based on the Rational Method. The recommended physical parameters, including runoff coefficient (C) and storm constants for different return periods, are as per the *Stormwater Drainage Manual*.

3.1.2 The Rational Method has been adopted for hydraulic analysis and the peak runoff is given by the following expression:

$$Q_p = 0.278\,C\,i\,A \qquad \text{--- Equation 1}$$

where Q_p = peak runoff in m^3/s
C = runoff coefficient
i = rainfall intensity in mm/hr
A = catchment area in km^2

3.1.3 Rainfall intensity is calculated using the following expression:

$$i = \frac{a}{(t_d + b)^c} \qquad \text{--- Equation 2}$$

where i = rainfall intensity in mm/hr
t_d = duration in minutes ($t_d \leq 240$)
a,b,c = storm constants given in table 3 of SDM

3.1.4 For a single catchment, duration (t_d) can be assumed equal to the time of concentration (t_c) which is calculated as follows:

$$t_c = t_0 + t_f \qquad \text{--- Equation 3}$$

where t_c = time of correction
t_0 = inlet time (time taken for flow from the remotest point to reach the most upstream point of the urban drainage system)
t_f = flow time

3.1.5 Generally, t_0 is much larger than t_f. As shown in Equation 2, t_d is the divisor. Therefore, larger t_d will result in smaller rainfall intensity (i) as well as smaller Q_p. For the worst-case scenario, t_f is assumed to be negligible and so:

$$t_c = t_0 = t_f$$

$$t_0 = \frac{0.14465\,L}{H^{0.2}A^{0.1}} \qquad \text{--- Equation 4}$$

where A = catchment area (m^2)
H = average slope (m per 100m), measured along the line of natural flow, from the summit of the catchment to the point under consideration
L = distance (on plan) measured on the line of natural flow between the summit and the point under consideration (m)

3.1.6 The Colebrook-White Equation was adopted for calculation of drainage capacity of pipes. Full bore flow with no surcharge is assumed, and 10% sedimentation was incorporated in the calculation of drainage capacity in accordance with the *Stormwater Drainage Manual*.

$$V = -\sqrt{8gDsg} * \log(\frac{ks}{3.7D} + \frac{2.51v}{D\sqrt{2gDs}})$$ ***--- Equation 5***

where V = mean velocity (m/s)
g = gravitational acceleration (m/s^2)
D = internal pipe diameter (m)
ks = hydraulic pipeline roughness (m)
v = kinematic viscosity of fluid (m^2/s)
s = hydraulic gradient (energy loss per unit length due to friction)

3.1.7 On the other hand, the capacity of open channel has been calculated using the Manning's Equation:

$$V = \frac{R^{1/6}}{n} \times \sqrt{Rs}$$ ***--- Equation 6***

where V = mean velocity (m/s)
R = hydraulic radius (m)
n = Meaning coefficient (s/m$^{1/3}$)
s = hydraulic gradient (energy loss per unit length due to friction)

3.2 Assessment Assumptions

Identification of Catchments

3.2.1 Based on the site visit and the topographic maps obtained from the Lands Department, seven (7) catchments namely Catchments A to G were identified as shown in **Figure 3-1**.

Internal Catchment (the Site)

3.2.2 The Site includes Catchment A. The entire Site is currently 100% paved with some concrete-paved roads and temporary structures.

3.2.3 After the Proposed Development, the Site will be occupied by the CBP and other structures and will still be entirely paved. A peripheral drainage is proposed to intercept the stormwater runoff from the Site. It is assumed that the runoff will be finally discharged to the stream to the south of the Site via an underground pipe. The details will be further discussed in the following sections.

3.2.4 With reference to the *Stormwater Drainage Manual*, the runoff coefficients vary from different surface characteristics, as summarized in **Table 3-1** below.

Table 3-1 Runoff Coefficients with Different Surface Characteristics and

SURFACE CHARACTERISTICS	RUNOFF COEFFICIENT
Concrete	0.80 – 0.95
Flat Grassland (heavy soil)	0.13 – 0.25
Steep Grassland (heavy soil)	0.25 – 0.35

3.2.5 As the Site is 100% paved before and after development, runoff coefficient of 0.95 before and after development should be adopted. The surface characteristics and runoff coefficients of Catchment A are summarised in **Table 3-2** below.

Table 3-2 Surface Characteristics and Runoff Coefficients of the Site

SCENARIO	AREA	SURFACE CHARACTERISTICS	RUNOFF COEFFICIENT
Before and After Development	A: 4,411m^2	100% paved + 0% unpaved	0.95

Surrounding Catchments

3.2.6 **Catchment B** – According to the site visit, Catchment B is occupied by some temporary structures with industrial use, which is assumed to be 100% paved with concrete. As there is no drainage system observed in the vicinity, it is assumed that stormwater runoff from Catchment B would overflow to Catchment A as conservative approach. Runoff from Catchment B will be taken into account in the proposed perimeter drainage system of Catchment A.

3.2.7 **Catchment C** – Similarly, Catchment C is occupied by some temporary structures with industrial use, which is assumed to be 100% paved with concrete. According to level differences, it is assumed that stormwater runoff from Catchment C would overflow to Catchment A as conservative approach. Runoff from Catchment C will be taken into account in the proposed perimeter drainage system of Catchment A.

3.2.8 **Catchment D** – Catchment D is a piece of vegetated slope located to the north of the Site. The stormwater runoff from Catchment D should be collected and drained by its toe drain and will not flow into the Site. The runoff from this catchment will not have any drainage impact on the Site.

3.2.9 **Catchment E** – Catchment E is located to the east of the Site. The runoff from Catchment E would be discharged to the existing stream. There is no drainage connect between Catchment E and the Site, the runoff from this catchment will not have any drainage impact on the Site.

3.2.10 **Catchment F** – Catchment F is located to the south of the Site. According to the topographic levels, the runoff from Catchment F would be discharged to existing stream to the south. There is no drainage connect between Catchment F and the Site, the runoff from this catchment will not have any drainage impact on the Site.

3.2.11 **Catchment G** – Catchment G is located to the west of the Site. According to the topographic levels, the runoff from Catchment G would go further to the west. There is no drainage connect between Catchment F and the Site, the runoff from this catchment will not have any drainage impact on the Site.

3.2.12 The runoff of Catchments B and C are estimated using the Rational Method. The surface characteristics and runoff coefficients of the surrounding catchments are summarised in **Table 3-3** below.

Table 3-3 Surface Characteristics and Runoff Coefficients of Surrounding Catchments

CATCHMENTS	AREA	SURFACE CHARACTERISTICS	RUNOFF COEFFICIENT

B	1,654m^2	100% paved (flat) + 0% unpaved	0.95
C	1,577m^2	100% paved (flat) + 0% unpaved	0.95

3.3 Estimated Runoff

Peak Runoff from the Site

3.3.1 Based on the assumptions as described in **Section 3.2**, the runoff from the Site before and after development has been estimated based on the return periods of 2, 10 and 50 years. The increase in rainfall due to climate change effect of 11.1% has been considered in the runoff estimation. As summarised in **Table 3-4**, there will be no change on the stormwater runoff before and after the Proposed Development under all assessed return periods. The detailed calculation is provided in **Appendix A**.

Table 3-4 Estimated Peak Runoff of the Site

RETURN PERIOD	ESTIMATED PEAK RUNOFF (m^3/s)		
	BEFORE DEVELOPMENT	AFTER DEVELOPMENT	INCREMENT
2 Years	0.214	0.214	0%
10 Years	0.271	0.271	0%
50 Years	0.307	0.307	0%

Cumulative Peak Runoff

3.3.2 As mentioned in **Paragraph 3.2.6**, it is assumed that the runoff from Catchments B and C may overflow to Catchment A in the worst-case scenario. Therefore, runoff from Catchments B and C will be regarded as the cumulative runoff. The estimated cumulative runoff is summarised in **Table 3-5.** below and detailed in **Appendix A**.

Table 3-5 Estimated Cumulative Runoff of the Site and Catchment B

RETURN PERIOD	ESTIMATED PEAK RUNOFF (m^3/s)			
	CATCHMENT A	CATCHMENT B	CATCHMENT C	CUMULATIVE
2 Years	0.214	0.094	0.099	0.408
10 Years	0.271	0.118	0.123	0.512
50 Years	0.307	0.205	0.135	0.572

3.4 Capacity of Proposed Perimeter Surface Drains and Underground Pipe

3.4.1 A series of perimeter surface drains with sand trap/catch pit was proposed to collect the cumulative runoff, which will finally connect to proposed discharge point at the stream to the south of the Site via a stormwater drainage pipe. The indicative location of surface drains, catchpits, terminal manhole and proposed Ø650mm stormwater drainage pipe is shown in **Figure 3-2**.

3.4.2 The calculation on the capacity of the indicative perimeter surface drains and proposed Ø650 stormwater pipe are summarised in **Table 3-6** below and detailed in **Appendix B**.

Table 3-6 Summary of Indicative Perimeter Drainage System

DESCRIPTION	SIZE (mm)	RELATED CATCHMENT	RUNOFF (m^3/s)	CAPACITY (m^3/s)	% OF CAPACITY	SUFFICIENT CAPACITY?
U-Channel with gradient of 1:200	Ø600mm	Catchment A and B	0.284	0.449	63%	Yes
U-Channel with gradient of 1:200	Ø600mm	Catchment A and C	0.288	0.449	64%	Yes
Underground Pipe with gradient of 1:200	Ø650mm	Catchment A, B and C	0.572	0.663	86%	Yes

3.4.3 The calculation shows that both the proposed perimeter surface drains and Ø650mm stormwater drainage pipe have sufficient capacity for the cumulative runoff. Therefore, no adverse drainage impact due to the Proposed Development is anticipated.

Figure 3-1 Identification of Catchments

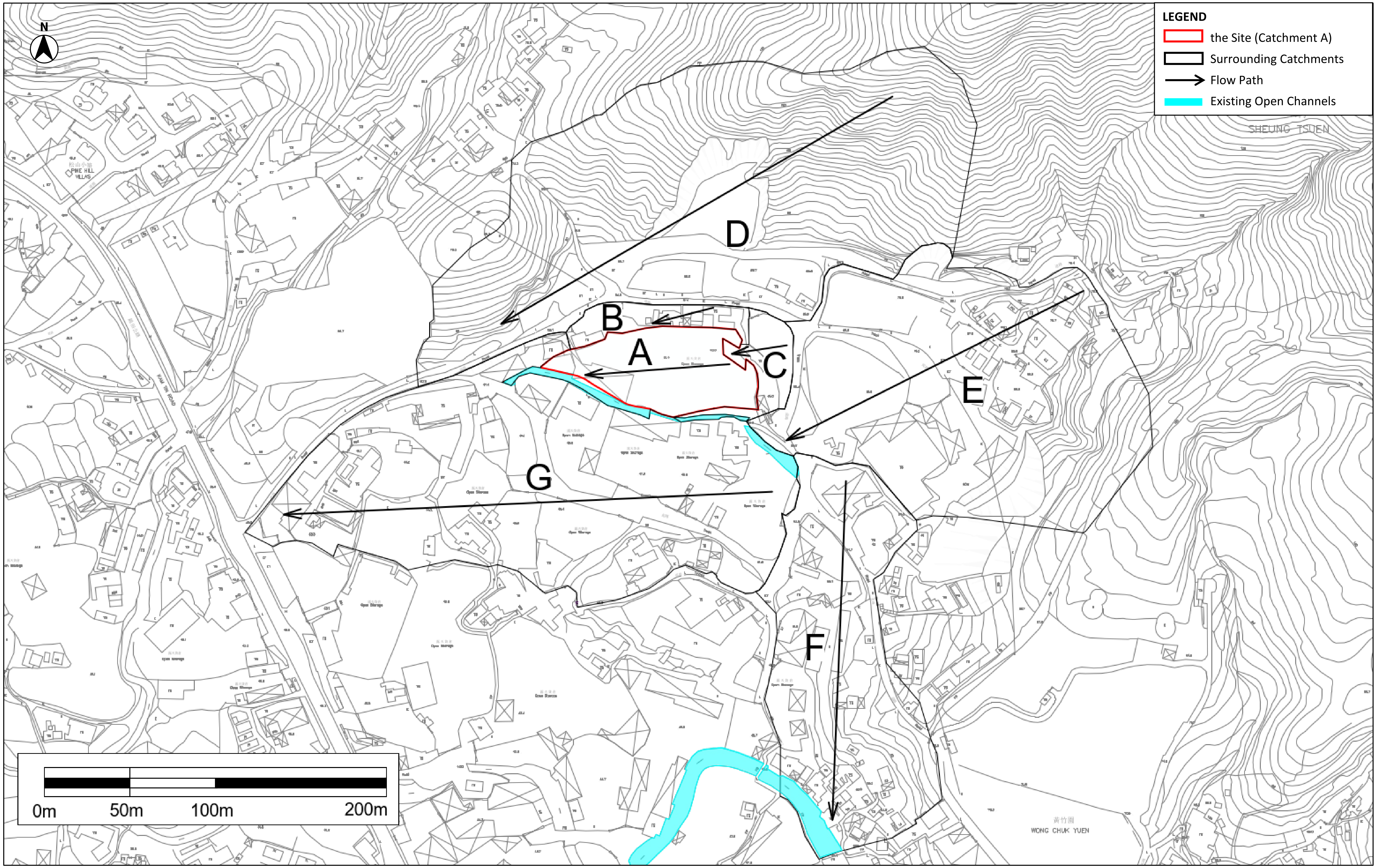
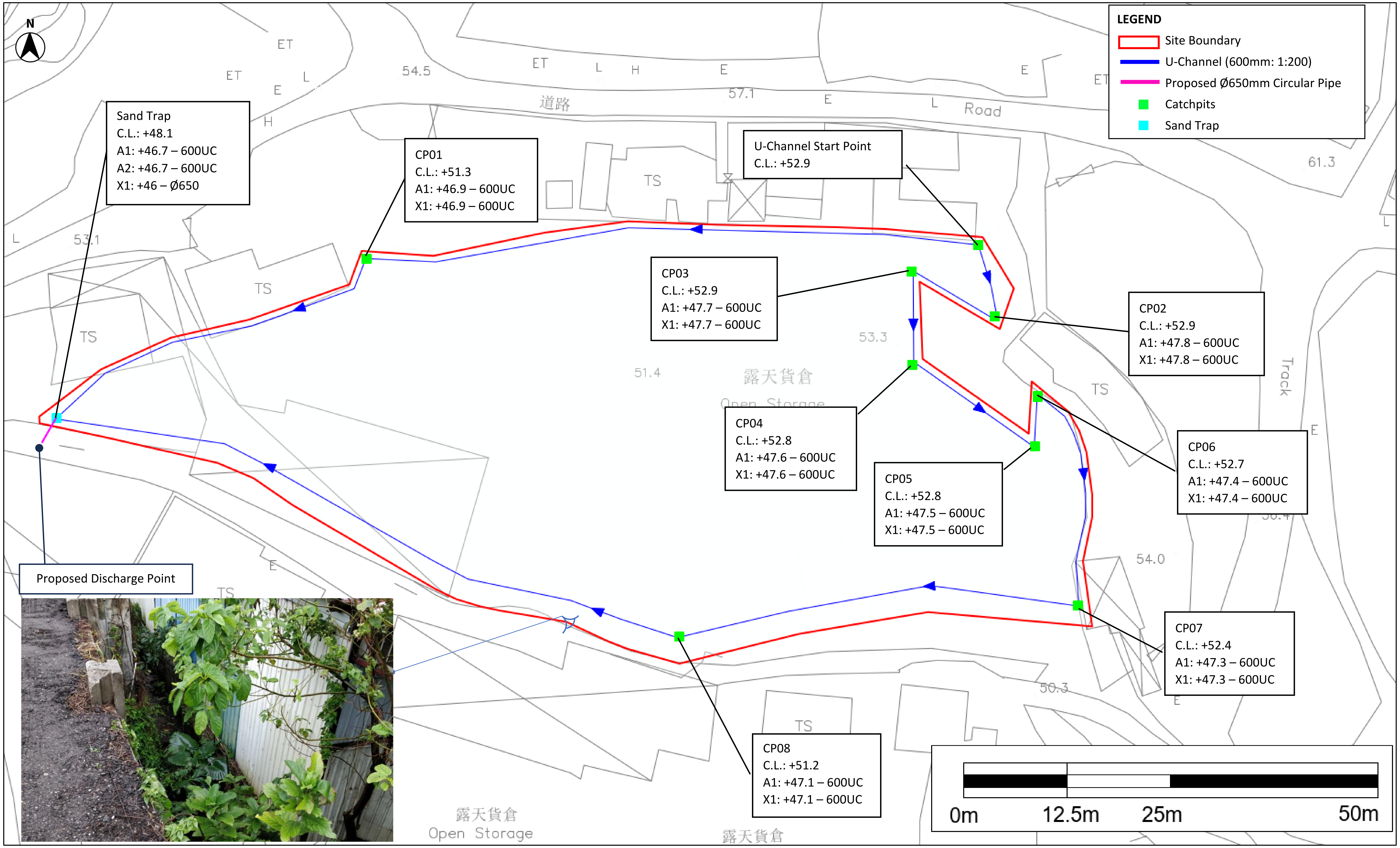
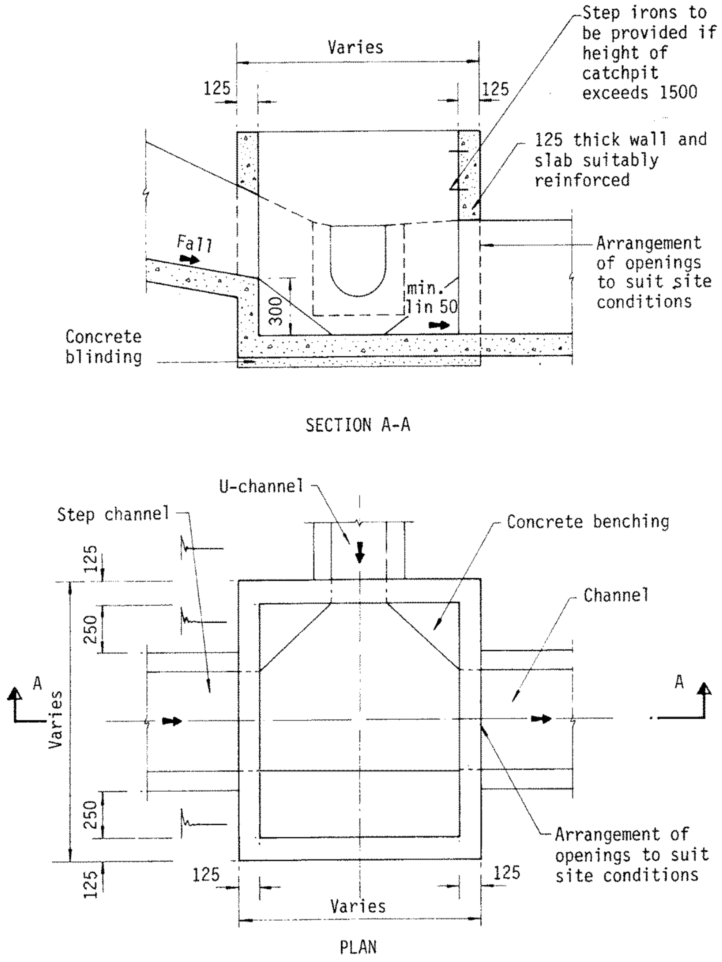


Figure 3-2 Indicative Location of Proposed Terminal Manhole and Stormwater Pipe

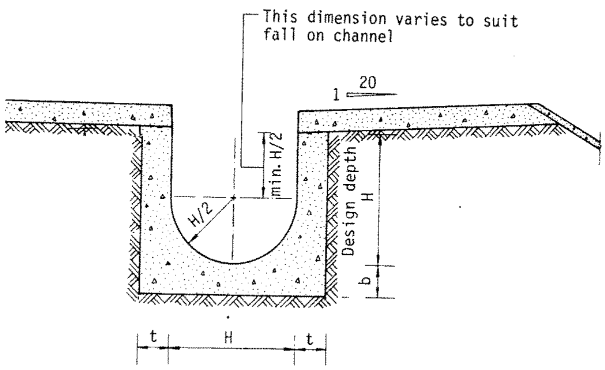


Note: Some buffer is provided between the southern border of the Site and the perimeter surface drain as there are some concrete blocks located on the south of the Site.

Figure 3-3 Typical Details of Catchpit and Sand Trap

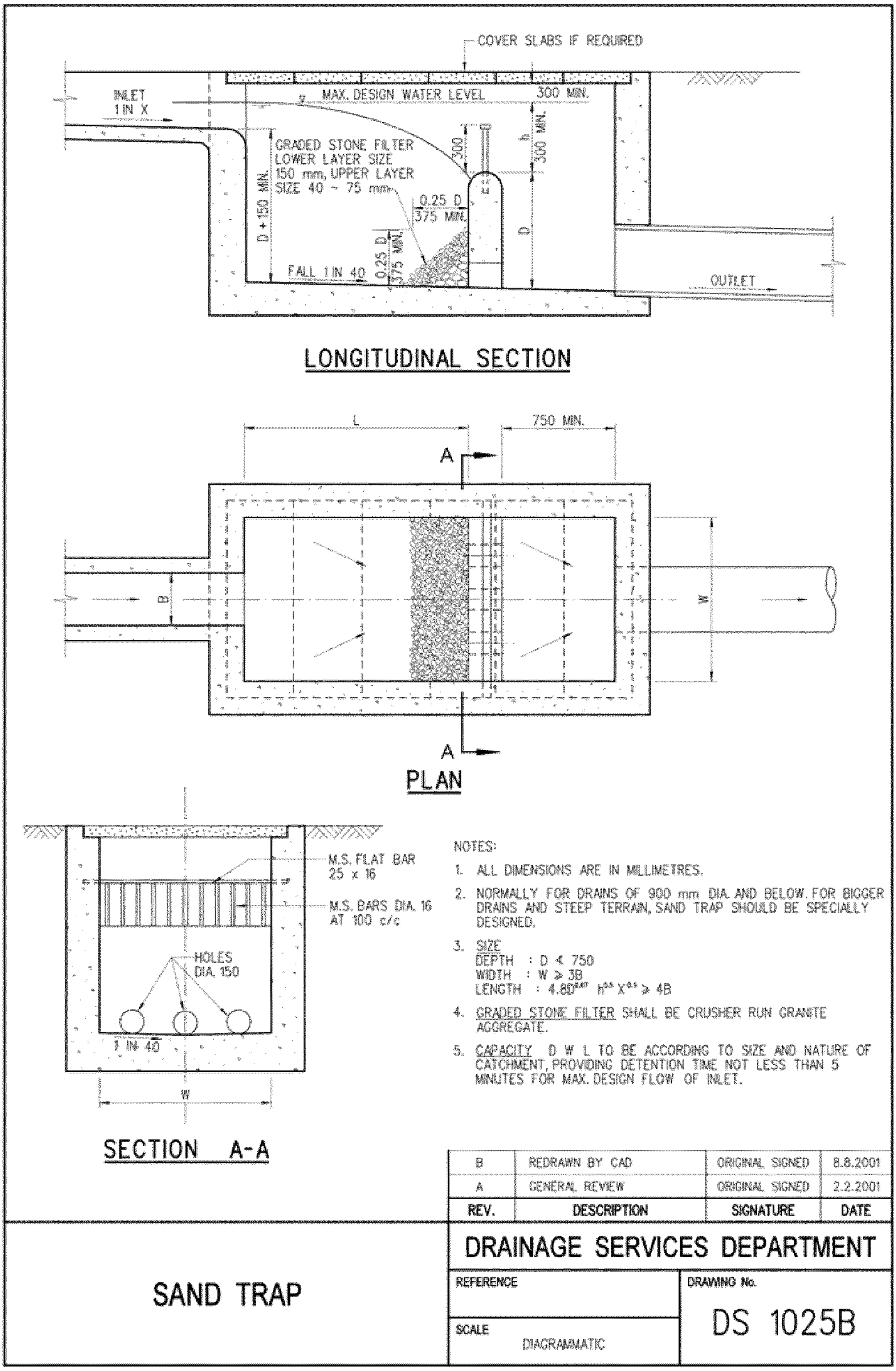


TYPICAL DETAILS OF CATCHPIT



TYPICAL DETAILS OF U CHANNEL

Figure 3-4 Typical Details of Sand Trap



4 CONCLUSION

4.1.1 Potential drainage impacts that may arise from the Site after the Proposed Development have been assessed.

4.1.2 The peak runoff before and after development of the Site has been estimated using the Rational Method and based on the catchment surface characteristics for the existing environment and the Proposed Development. There will be no change to runoff before and after the Proposed Development under all assessed return periods. The estimated peak runoff generated from the Site is $0.307m^3/s$ under a 50-year return period.

4.1.3 The indicative location of proposed perimeter surface drains, terminal manhole and Ø650 stormwater pipe shown on **Figure 3-2** will properly divert the runoff arising from the Site including cumulative runoff from Catchments B and C, which may overflow into the Site. The runoff would finally be discharged to the stream to the south of the Site via the proposed Ø650 stormwater drainage pipe.

4.1.4 The capacity of proposed perimeter surface drains and proposed Ø650 stormwater drainage pipe has been checked. The calculation shows that it can handle the cumulative runoff from the Site and surrounding catchments. As such, no adverse drainage impact is anticipated.

4.1.5 This Drainage Proposal Report indicates the initial findings regarding drainage impact and indicative drainage layout. A qualified engineer should be engaged by the Architect/Contractor of the Proposed Development to review and provide detailed designs for the internal Site drainage layout.

4.1.6 Overall, adverse drainage impact from the Proposed Development is not anticipated.

Appendix A Runoff Calculations

Calculation of Runoff for Return Period of 10 Years

Catchment ID	Catchment Area (A), km^2	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t_0), min	Duration (t_d), min	Storm Constants [Note 2]			Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s	Peak runoff with Climate Change (Q'_p), m^3/s [Note 3]
						a	b	c					
Before the Proposed Development													
Site Area (Catchment A)	0.0044	4.64	112.0	5.15	5.15	485	3.11	0.397	209.76	0.95	0.0042	0.244	0.271
Catchment B	0.0017	11.45	62.0	2.62	2.62	485	3.11	0.397	242.44	0.95	0.0016	0.106	0.118
Catchment C	0.0016	14.44	36.0	1.46	1.46	485	3.11	0.397	265.27	0.95	0.0015	0.110	0.123
											Total	**0.461**	**0.512**
After the Proposed Development													
Site Area (Catchment A)	0.0044	4.64	112.0	5.15	5.15	485	3.11	0.397	209.76	0.95	0.0042	0.244	0.271
Catchment B	0.0017	11.45	62.0	2.62	2.62	485	3.11	0.397	242.44	0.95	0.0016	0.106	0.118
Catchment C	0.0016	14.44	36.0	1.46	1.46	485	3.11	0.397	265.27	0.95	0.0015	0.110	0.123
											Total	**0.461**	**0.512**

Calculation of Runoff for Return Period of 50 Years

Catchment ID	Catchment Area (A), km^2	Average slope (H), m/100m	Flow path length (L), m	Inlet time (t_0), min	Duration (t_d), min	Storm Constants [Note 2]			Runoff intensity (i) mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s	Peak runoff with Climate Change (Q'_p), m^3/s [Note 3]
						a	b	c					
Before the Proposed Development													
Site Area (Catchment A)	0.0044	4.64	112.0	5.15	5.15	505.5	3.29	0.355	237.08	0.95	0.0042	0.276	0.307
Catchment B	0.0017	11.45	62.0	2.62	2.62	505.5	3.29	0.355	268.96	0.95	0.0016	0.117	0.131
Catchment C	0.0016	14.44	36.0	1.46	1.46	505.5	3.29	0.355	290.69	0.95	0.0015	0.121	0.135
											Total	**0.515**	**0.572**
After the Proposed Development													
Site Area (Catchment A)	0.0044	4.64	112.0	5.15	5.15	505.5	3.29	0.355	237.08	0.95	0.0042	0.276	0.307
Catchment B	0.0017	11.45	62.0	2.62	2.62	505.5	3.29	0.355	268.96	0.95	0.0016	0.117	0.131
Catchment C	0.0016	14.44	36.0	1.46	1.46	505.5	3.29	0.355	290.69	0.95	0.0015	0.121	0.135
											Total	**0.515**	**0.572**

Note:

1. Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual (with Eurocodes incorporated) - Planning, Design and Managemen*t" (SDM), fifth edition, January 2018.
2. Storm Constants were adopted from Table 3a Storm Constants for Different Return Periods of HKO Headquarters of DSD's *Corrigendum No. 1/2024.*
3. Table 28 Rainfall Increase due to Climate Change of DSD's *Corrigendum No. 1/2022* of 11.1% for mid-21st Century is adopted.

Appendix B Calculation of Drainage Capacity

Calculation of Drainage Capacity for Return Period of 50 Years

Indicative Drainage capacity of the Internal Drainage System

Channel	Shape	Catchment Description	d	Depth, m	Slope (s)	Aw	Pw	R	n	V	Qc	Qp'	Is Qc > Qp' ?	% of capacity
U-Channel 1	U-Shape	1/2 Catchment A, Catchment B	0.600	0.300	0.005	0.321	1.542	0.208	0.016	1.553	0.449	0.284	OK	63%
U-Channel 2	U-Shape	1/2 Catchment A, Catchment C	0.600	0.300	0.005	0.321	1.542	0.208	0.016	1.553	0.449	0.288	OK	64%

Legend

d = diameter, m
A_w = Cross Section Area of Flow, m^2
P_w = Wetted Perimeter, m
R = Hydraulic Radius = A_w/P_w, m
s = Hydraulic Gradient
n = Manning's roughness coefficient
V = Mean Velocity, m/s
Q_c = Flow Capacity (10% sedimentation inclusive), m^3/s
Q_p = Estimated Peak Flow, m^3/s

Note
1. Flow capacity of pipe segment is calculated based on Manning's Equation.
2. The diameter and gradient of the proposed stormwater pipe is indicative only. Its details will be subject to change during the detailed design stage.

Drainage Capacity of Proposed Stormwater Drainage Pipe

Description	Shape	Catchment Description	d	r	Aw	Pw	R	s	ks	V	Qc	Qp'	Is Qc > Qp' ?	% of capacity
Proposed Stormwater Pipe Connecting to Proposed Discharge Point	Circular Pipe	Catchment A, Catchment B	0.650	0.325	0.332	2.042	0.163	0.005	0.06	2.220	0.663	0.572	Y	86%

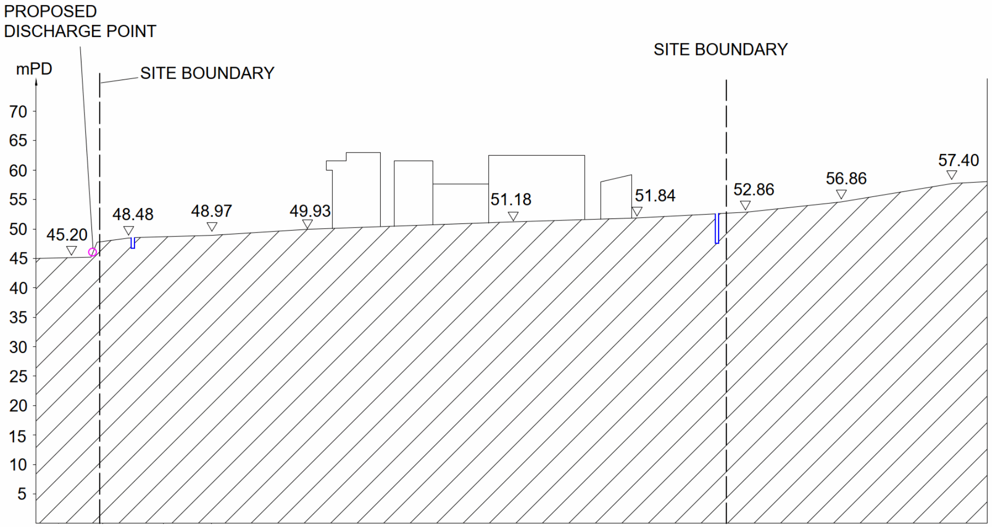
Where

d = pipe diameter, m
r = pipe radius (m) = 0.5d
A_w = wetted area (m^2) = (r^2/2) (b + sinq)
P_w = wetted perimeter (m) = br
R = Hydraulic radius (m) = A_w/P_w
k_s = hydraulic pipeline roughness, mm
V = Velocity of flow calculated based on Colebrook-White Equation, m/s
Q_c = Flow Capacity including 10% for siltation, m^3/s
Q_p = Estimated total peak flow from the Site during peak season, m^3/s

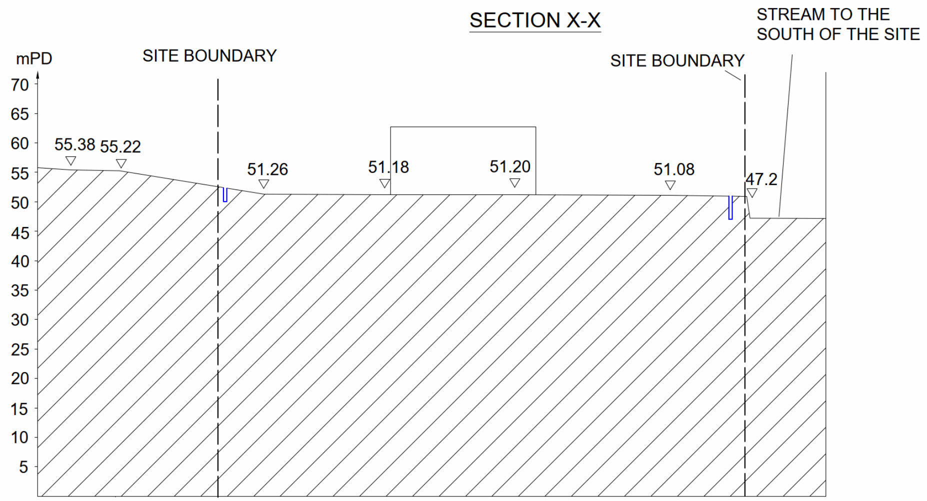
Note
1. Flow capacity of pipe segment is calculated based on Colebrook-White Equation.
2. The diameter and gradient of the proposed stormwater pipe is indicative only. Its details will be subject to change during the detailed design stage.
3. The ks value of 0.06 in good condition for precast concrete pipes with ‘O’ ring joints recommended in Table 14 of the SDM for design purpose is adopted.

Appendix C Cross Section of the Site and the Surrounding Area After the Proposed Development

Figure C-1 Cross Section of the Site



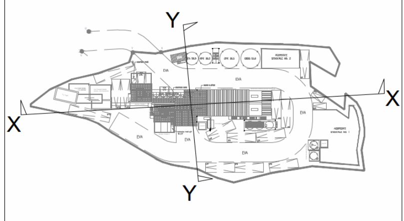
SECTION X-X



SECTION Y-Y

Legend

- U-Channel (600mm, 1:200)
- Underground Pipe (650mm, 1:200)



KEY PLAN

EnviroSolutions & Consulting Ltd
16/F & 17/F
700 Nathan Road
Mong Kok
Kowloon
Hong Kong

Tel: No. +852 3960 7000 | Fax: +852 3960 7111
Email: enquiries@envirosc.com
Web: www.envirosc.com | www.simplyehs.com

Accountability

We understand the importance of being accountable to each other and our clients.

Passion

We are completely passionate about providing practical solutions and outcomes that deliver for our clients.

Insight

We work in an environment that encourages and values insight as a critical quality which informs our decisions and our clients and supports practical solutions and project delivery.

Integrity

We behave with respect and honesty toward each other, our clients and our stakeholders.