Attachment 5

REPLACEMENT PAGES OF GEOTECHNICAL PLANNING REVIEW REPORT

Contents

Appendices

Figures

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 4.5m 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.

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 3-2 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/F72	EPD	28	470	25
12SW-A/F73	EPD	30	145	25
12SW-A/F96	EPD	8	200	35
12SW-A/C 183	EPD	6	215	55
12SW-A/C 184	EPD	6	120	70
12SW-A/C 185	EPD	6	50	45
12SW-A/C 186	EPD	6	80	40

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 Middle Platform. The southern portion of the feature is overlapping with the Application Site at the Lower Platform.

Classification of Consequence-to-life Category under GEO Technical Guidance Note No. 15 is reviewed with the proposed facilities under PRS development. The crest facility is originally footpath with very low traffic density which belongs to Facility Group 4, where the proposed development at Middle Platform (i.e. Pony Paddock & Pavilion I) is classified as "Lightly Used Building" under Facility Group 2(a). The toe facility is originally manned substation which belongs to Facility Group 1(a), where the proposed development at Lower Platform (i.e. Reception and Hospitality Lounges) will not change the Facility Group 1(a) for toe facility due to the presence of manned substation. The Consequence-to-life Category remains unchanged as 1.

Classification of Economic Consequence under WBTC No. 13/99 is also reviewed with the proposed facilities under PRS development. The economic consequence of this feature is classified as Category A due to the presence of manned substation where slope failure could affect the substation and lead to loss of the service for a considerable period of time. With the proposed PRS development in Middle and Lower Platforms, the economic consequence of this feature will still be controlled by the manned substation and hence remains Category A.

Accordingly, the stability of this feature shall be studied at detailed design stage with target FoS of 1.4.

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.

As per GEO Technical Guidance Note No. 15, Classification of Consequence-to-life Category is reviewed taking into account the proposed facilities under PRS development. The original facilities at crest and toe of the feature are district open space and road/footpath with very low traffic density respectively; as both facilities at toe and crest belongs to Facility Group 5, the GEO SIS has recorded a Consequence to Life Category 3 for the feature. With the development of PRS, the crest facility would stay as road with very low traffic density, even after the proposed upgrading work of the existing access road. The toe facilities will be the proposed PRS at Middle Platform (i.e. Horse Paddock & Pavilion I), which shall be classified as "Lightly Used Building" under Facility Group 2(a). As a result, the Consequence to Life Category will be changed from Category 3 to Category 1.

Classification of Economic Consequence under WBTC No. 13/99 is also reviewed with the proposed PRS development. The economic consequence of this feature is originally classified as Category B as its failure will affect the existing access road which is considered as rural road. With the proposed PRS development in Middle Platform and the upgrading work of the existing access road, the economic consequence of this feature is classified to be Category A for its failure affecting the structures of the proposed PRS development, which could cause excessive structural damage.

Accordingly, the stability of this feature shall be studied at detailed design stage with target FoS of 1.4.

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.

Classification of Consequence-to-life Category is reviewed as per GEO Technical Guidance Note No. 15. The crest facility is originally undeveloped green belt and the toe facility is originally the road/footpath with very low traffic density where both facilities are under Facility Group 5. Consequence-to-life is originally considered to be Category 3 for this feature. With the development of PRS, at the crest of the feature, utility trenches have been proposed as part of the PRS development, but for Consequence-to-life Category assessment the ground is treated as

remote area, which is under Facility Group 5. The toe facility would remain as road with low traffic density even with the upgrading of existing access road. However, since this feature sits at crest of Feature No. 12SW-A/F96 and overlook the proposed PRS at Middle Platform (i.e. Horse Paddock & Pavilion I), which shall be classified as "Lightly Used Building" under Facility Group 2(a). Accordingly, the Consequence-to-life Category will be changed from Category 3 to Category 1.

Classification of Economic Consequence under WBTC No. 13/99 is also reviewed with the proposed PRS development. The economic consequence of this feature is originally classified as Category B as its failure will affect the existing access road which is considered as rural road. After the development of PRS and upgrading works of access road, the access road at the toe of the feature would remain as rural road. The facility at the crest of the feature will be utility trenches, which means failure of the slope affects essential services that could cause loss of that service for an extended period. In this regard, the economic consequence after PRS development is considered to be changed to Category A.

Accordingly, the stability of this feature shall be studied at detailed design stage with target FoS of 1.4.

3.7.5 Feature No. 12SW-A/F72

The feature is a southwestern-facing soil fill slope, located in the middle portion of TKOL II/III. The slope portion is about 6m high with a slope angle of 55°.

The feature is not overlapping with any of the platforms but the proposed utility trenches as part of the PRS development will sit on top of this feature.

Classification of Consequence-to-life Category is reviewed as per GEO Technical Guidance Note No. 15. Both the crest and toe facilities are originally road/footpath with very low traffic density, which is under Facility Group 5. Consequence-to-life is originally considered to be Category 3 for this feature. With the development of PRS, utility trenches have been proposed at the crest and toe of the feature and for Consequence-to-life Category assessment the ground is still treated as remote area, which is under Facility Group 5. However, considering this feature sits at crest of Feature No. 12SW-A/F68 and overlook the proposed PRS at Middle Platform (i.e. Horse Paddock & Pavilion I), which shall be classified as "Lightly Used Building" under Facility Group 2(a). Accordingly, the Consequence-to-life Category will be changed from Category 3 to Category 1.

Classification of Economic Consequence under WBTC No. 13/99 is also reviewed with the proposed PRS development. The economic consequence of this feature is originally classified as Category B as its failure will affect the existing road/footpath which is considered as rural road. After the development of PRS, the facility at the crest and toe of the feature will be utility trenches, which means failure of the slope affects essential services that could cause loss of that service for an extended period. In this regard, the economic consequence after PRS development is considered to be changed to Category A.

Accordingly, the stability of this feature shall be studied at detailed design stage with target FoS of 1.4.

3.7.6 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.

Classification of Consequence-to-life Category is reviewed as per GEO Technical Guidance Note No. 15. Both the crest and toe facilities are originally road/foot path very low traffic density which belongs to Facility Group 5. Consequence-to-life is originally considered to be Category 3 for this feature. With the development of PRS, the toe facility would remain as road with very low traffic density even with the upgrading of existing access road. For the crest facility, it will comprise PRS

development at Upper Platform which has Facility Group 2(a) structures like Staff Block/Room. Accordingly, the Consequence-to-life Category would be changed to Category 1.

Classification of Economic Consequence under WBTC No. 13/99 is also reviewed with the proposed PRS development. The economic consequence of this feature is classified as Category B as its failure will affect the existing access road which is considered as rural road. After the development of PRS and upgrading works of access road, the access road at the toe of the feature would remain as rural road. The facility at the crest of the feature will be PRS development at Upper Platform (e.g. Staff Block/Room etc.), where failure of the slope will lead to excessive structural damage of the PRS development in Upper Platform. Therefore, the Economic Consequence after PRS development shall be changed to Category A.

Accordingly, the stability of this feature shall be studied at detailed design stage with target FoS of 1.4.

3.7.7 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.

Classification of Consequence-to-life Category is reviewed as per GEO Technical Guidance Note No. 15. The crest facility is originally district open space, which is deemed as lightly used open-air recreation area under Facility Group 3 and the toe facility is originally road/footpath with very low traffic density under Facility Group 5. Consequence-to-life is originally considered to be Category 3 for this feature. After the development of PRS, the crest facility would remain as road with very low traffic density even with the upgrading of existing access road. For the toe facility, it will be PRS development at Middle Platform (i.e. Horse Paddock & Pavilion I), which shall be classified as "Lightly Used Building" under Facility Group 2(a). Accordingly, the Consequence-to-life Category would be changed to Category 1.

Classification of Economic Consequence under WBTC No. 13/99 is also reviewed with the proposed PRS development. The economic consequence of this feature is originally classified as Category B as its failure will affect the existing access road which is considered as rural road. After the development of PRS and upgrading works of access road, the access road at the crest of the feature would remain as rural road. The facility at the toe of the feature will be PRS development at Middle Platform (i.e. Horse Paddock & Pavilion I), where failure of the slope will lead to excessive structural damage of the PRS development in Lower Platform. Therefore, the Economic Consequence after PRS development shall be changed to Category A.

Accordingly, the stability of this feature shall be studied at detailed design stage with target FoS of 1.4.

3.7.8 Feature Nos. 12SW-A/C 183, 184, 185, 186

Feature Nos. 12SW-A/C 183, 184, 185 and 186 are found to be located outside the Application Site to the north.

Initial studies have been carried out following the GEO Technical Guidance Note No.15 (TGN15) – Guidelines for Classification of Consequence-to-Life Category of Slope Features requirement on the extreme travel distance of landslide debris for those features. The minimum distance between the Application Site boundary and the features' crests were found to be 10.5m. As per TGN No. 15's guidance, with a travel angle of 30 degrees projecting from the slope crest and feature height of 6m, the possible extreme travel distance of landslide is estimated to be 10.4m, which is slightly smaller than the distance between feature crest and Application Site boundary; therefore, the Features Nos. 12SW-A/C 183, 184, 185 and 186 will not affect or be affected by the proposed PRS development.

3.8 Stage 2 Study Report

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 with the recent landslide events, GEO Incident Nos. 2024/05/3754, 2024/05/3722 and 2024/05/3769, for the PRS development area as shown in **Figure 1.2**. This review report (our Report Ref: REP-002-01) has been submitted to GEO checking panel for endorsement (Case G92A). The findings suggest that the previously adopted design event volumes remain valid, and thus the 'no-build zone' was established in a reasonably conservative manner and is considered still valid for the purpose of current assessment. The extent of the natural terrain catchment covered in the review report is presented in **Figure 4-1**.

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 facilities, and wash box facilities located within the 'no-build zone'. With the consideration of the operation arrangement of the proposed PRS at Upper Platform, the access road in risk of being damaged and/or blockage of the road by landslide debris could lead to impact to the PRS's daily operation thus horse's health and safety. Mitigation measure in the form of concrete retaining wall will be initially proposed along those facilities located within the 'no-build zone'. The need to relocate or mitigate the EVA, ancillary E&M facilities 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.

5.2 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 and additional surcharge due to EPD's proposed access road widening also suggested the FoS of all features affecting or being affecting Middle Platform and EPD's proposed access road widening 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 Town 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

[1] Anon (1972). The Preparation of Maps and Plans in Terms of Engineering Geology. Quarterly Journal of Engineering Geology. Volume 5, p294-382.

[2] Anon (1982). Land Surface Evaluation for Engineering Practice. Quarterly Journal of Engineering Geology. Volume 15, p265-316.

[3] Davis, D.W., Sewell, R.J. & Campbell, S.D.G. (1997). U-Pb dating of Mesozoic Igneous Rocks from Hong Kong. Journal of the geological Society, Vol. 154, pp 1067-1076.

[4] Emery, K.A. (1998). Boulder Study of Hong Kong. Final Report to Maunsell Geotechnical Service Ltd. Water Resources Consulting Services, Australia.

[5] Geotechnical Control Office (GCO) (1987). Guide to Site Investigation (Geoguide 2). Geotechnical Control Office, Hong Kong, 359 p.

[6] Geotechnical Control Office (GCO) (1988). Geotechnical Area Studies Programme (GASP) – Clear Water Bay, GASP Report No. VII, Geotechnical Control Office, Hong Kong.

[7] Geotechnical Control Office (GCO) (1989). Clear Water Bay: Solid and Superficial Geology Sheet No. 12. Series HGM20. Scale 1:20,000. Hong Kong Geological Survey, Geotechnical Control Office, Hong Kong.

[8] Geotechnical Control Office (GCO) (1990). Geology of Sai Kung and Clear Water Bay, Hong Kong Geological Survey Memoir No.4, Geotechnical Control Office, Hong Kong, 111 p.

[9] Geotechnical Engineering Office (GEO) (1988). Guide to Rock and Soil Descriptions (Geoguide 3). Geotechnical Engineering Office, Hong Kong, 195 p.

[10] Geotechnical Engineering Office (GEO) (2003). Guide to Slope Maintenance (Geoguide 5 – 3rd Edition). Geotechnical Engineering Office, Hong Kong, 132 p.

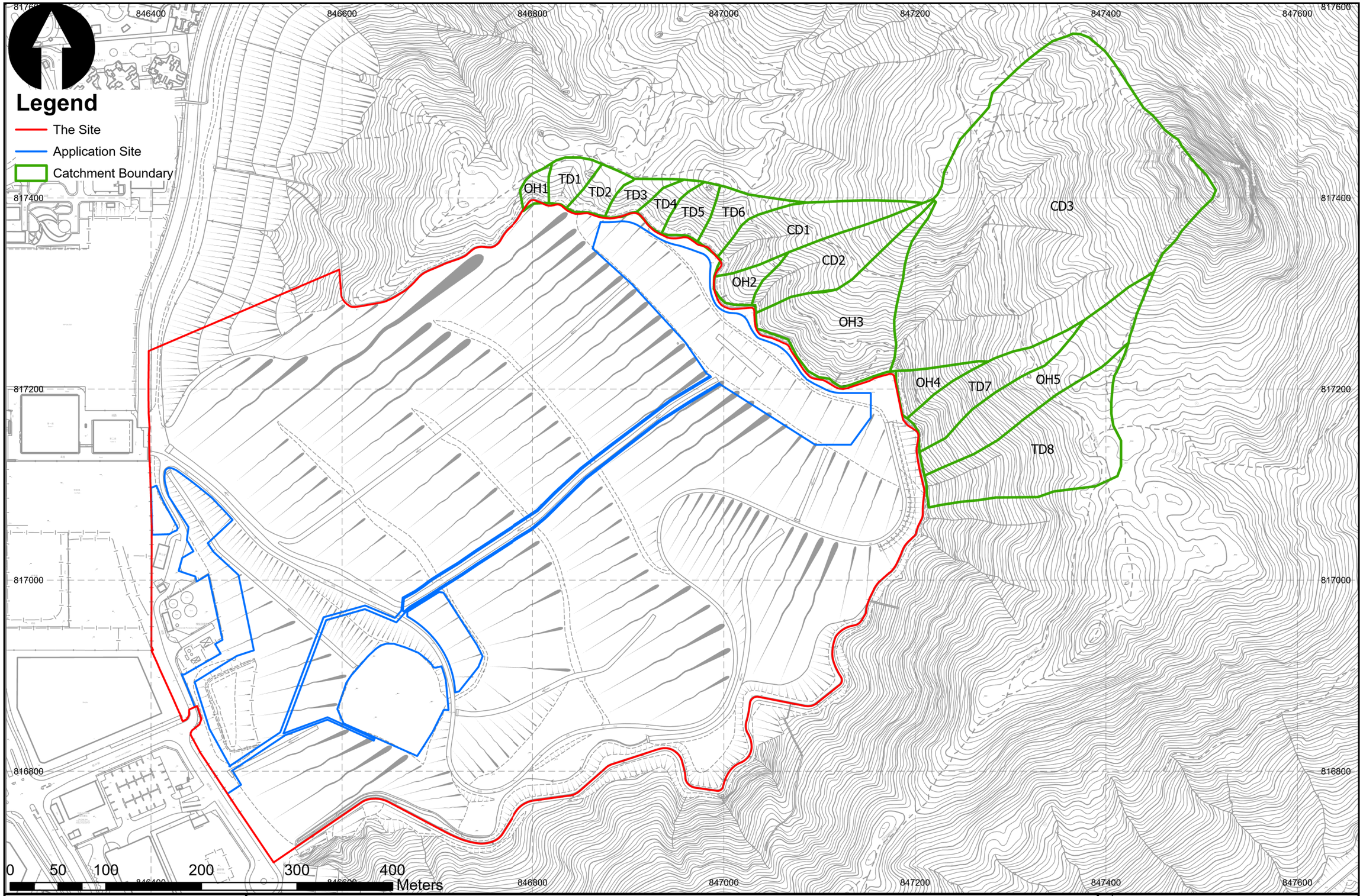
[11] Geotechnical Engineering Office (GEO) (2000). Geotechnical Manual for Slopes. Geotechnical Engineering Office, Hong Kong, 300 p.

[12] Ho, H.Y. and Roberts, K.J. (2016). Guidelines for Natural Terrain Hazard Studies. GEO Report No. 138 (Second Edition), Geotechnical Engineering Office, Hong Kong, 173 p.

[13] Kirk, P.A., Sewell, R.J., Campbell, S.G., Fletcher, C.N., Lai, K.W. & Li, X.C. (2000). Geological Map of Hong Kong, Series HGM100, Scale 1:100,000. Hong Kong Geological Survey, Geotechnical Engineering Office, Hong Kong.

[14] Lands Department (LandsD) (2000). Scale 1:1000 Topographic Maps.

[15] Sewell, R.J., Campbell, S.D.G., Fletcher, C.J.N., Lai, K.W. & Kirk, P.A. (2000). The Pre-Quaternary Geology of Hong Kong. Hong Kong Geological Survey, Geotechnical Engineering Office, Hong Kong, 181 p.



Job Title

Proposed Development of New Public Riding School at the Restored Tseung Kwan O Stage II/III Landfill (TKOL II/III)

Drawing Title

Location Plan of Natural Terrain Catchments

ARUP

Scale 1:1,000 (A3)

Drawn by: ML Date Mar 26 Checked: KC Approved: DL

Job No. **304521**

Figure No. **FIGURE 4.1**