Appendix A

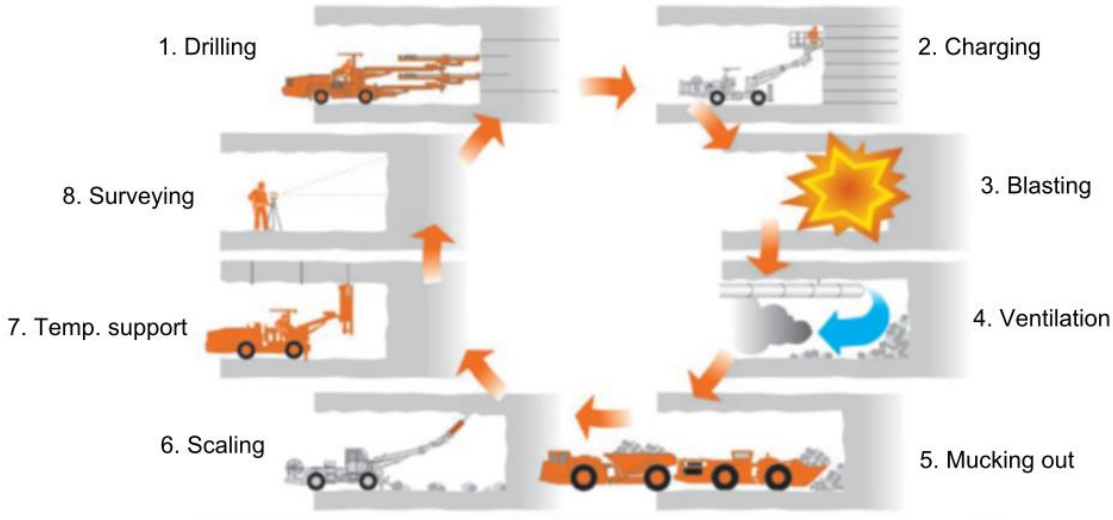
Extract of Geotechnical Assessment Report

8 Preliminary Blasting Assessment

8.1 General

8.1.1 The underground quarry is proposed to be excavated by drill and blast method, which follows a cyclic procedure. Each cycle commences with drilling the blastholes, charging the face with explosives, firing the blast, ventilating the fumes, scaling and mucking out the blasted rock, and installing any necessary temporary support. The cycle is then repeated. The time required to complete one full cycle will be largely dependent on the size of the tunnel/cavern and advance length. The typical blasting cycle is shown in **Plate 8.1**.

Plate 8.1 Typical Blasting Cycle



8.1.2 A project-specific blasting assessment report (BAR) will be submitted as part of the geotechnical submission to the GEO for comments and agreement. The BAR will further identify the constraints affecting the storage, explore transportation and use of explosives and confirm the feasibility of the proposed blasting works in detail.

8.2 Overview of Sensitive Receivers

8.2.1 The blasting influence zone is defined as the area subject to vibration, measured in Peak Particle Velocity (PPV) larger than 5 mm/s. This value corresponds with the vibration limit typically applied to historic buildings, buildings in poor condition, or of unknown design quality. It has therefore been determined that any sensitive receivers subjected to less than 5 mm/s do not require detailed assessment unless the preliminary inspection suggests the feature may be unusually sensitive to blasting vibrations.

8.2.2 The assessment has included a general review of all sensitive receivers within 169.6 m true distance of the blasting area. This is in accordance with 10 kg per delay MIC for the MAT, CT and PC, which gives an initial blasting influence zone with 169.6 m true distance, beyond which the ground vibrations will be less than 5 mm/s. A review of all historic buildings within 300 m of the blast area has also been carried out.

8.2.3 The sensitive receivers identified within the blasting influence zone includes:

- Existing man-made features;
- Existing natural terrain slopes and boulders;
- Newly formed man-made features at tunnel portals;
- CLP - Substation, transformer and underground cables;
- DSD - Water Pipes
- MTR - Tung Chung Line and Airport Express Line railway structures and ventilation building;

- WSD - Salt and fresh water pipes
- HyD - Tsing Yi North Coastal Road Foundation, Northwest Tsing Yi Interchange Foundation, Tsing Sha Highway Foundation, Ting Kau Bridge Foundation, Tsing Yi Administration Building, Storage Building and Garage;
- Hong Kong Shipyard Limited - Existing Building and Structure at TYTL Lot 102;
- Tsing Yi Nature Trails Pavilion;
- Tsing Yi - Lantau Link – Construction site, tunnel, newly formed slopes and permanent structures; and
- Underground cables of i-Cable Communication Limited, TraxComm Limited, SmarTone Mobile Communications Limited, Hong Kong Broadband Network Limited, PCCW – HKT Telephone Limited and Hutchison Global Communications Limited.

8.3 Blasting Risk Analysis

8.3.1 The use of blasting can cause three main environmental effects: ground vibration, air overpressure and flyrock.

Ground Vibration

8.3.2 Ground vibration induced by blasting generally occurs as a cyclic wave motion within the ground. This creates movement of the ground that can be measured as velocity, acceleration or displacement, and these will be related depending on the frequency of the motion.

8.3.3 The magnitude of vibration induced by blasting is generally dependent on the maximum instantaneous explosive charge rate per delay and the distance from the blast. The induced vibration, in terms of peak particle velocity (PPV), is estimated by the following equation:

$$PPV = K\left(\frac{R}{\sqrt{W}}\right)^{-B} \qquad \textbf{Equation (1)}$$

Where

PPV	-	Peak Particle Velocity (mm/s)
K	-	rock transmission constant
R	-	distance between blasting point and measuring point (m)
W	-	maximum charge weight per delay (kg)
B	-	attenuation exponent

8.3.4 Studies carried out by Mines Division of the CEDD (Li and Ng, 1992), have identified typical values for the constants K and B. The constants at the 84 % confidence level for blasting induced ground vibrations recommended by Li and Ng are:

K = 644 B = 1.22

8.3.5 The allowable charge weight per delay is calculated considering the allowable PPVs of the various sensitive receivers within the blasting zone of influence. The controlling charge weight per delay is the allowable charge weight due to limitations from all controlling sensitive receivers and is called the maximum instantaneous charge (MIC).

8.3.6 According to preliminary blasting impact assessment under the Pilot Study, underground quarry blasting operations at the maximum MIC of 10kg/ delay are generally feasible in TYNUQ. Reduction in the maximum MIC may be required near the portal areas or near sensitive receivers for blasting works, subject to detailed assessment. The preliminary blasting influence zone is presented in **Figure 9.1**.

Air Overpressure

8.3.7 Air overpressure is a product of all blasting operations, and is the term used to describe the dynamic atmospheric pressure fluctuations created in the air due to blasting. This term is used in preference to "noise" since it also includes frequencies of disturbance which are inaudible. For higher frequencies above 20Hz, this will be audible as noise, but below 20Hz is typically inaudible to humans.

8.3.8 The level of air overpressure depends on the charge weight and distance from the blast source.

$$P = K(d/\sqrt[3]{W})^a$$ **Equation (2)**

Where P - Pressure (kPa)
d - Distance between blasting point and measuring point (m)
w - Explosives charge weight per delay (kg)
K - Site constant
a - Site exponent

8.3.9 With reference to the GEO Report No. 232, GEO suggested that a site exponent of -1.2 and a site constant of 3.17 would be applied to a fully confined charge. The modified equation is listed as follow:

$$dBL = 164 - 24 \log d/(\sqrt[3]{w})$$ **Equation (3)**

Where d - distance between blasting point and measuring point (m)
w - maximum charge weight per delay (kg)

8.3.10 These constants have been used in many recent similar blasting projects in the initial blasting assessment. They may be modified during operation phase to obtain more accurate site-specific ground condition to then optimize the blasting design.

8.4 Protective and Mitigation Measures

8.4.1 Several examples of protective and mitigation measures are listed as follows. It will be further reviewed and confirmed in the blasting method statement.

Air Overpressure

8.4.2 The pressure wave generated by explosion propagates through air as an airborne vibration in the form of concussion or air overpressure. Blast doors with sound proofing shall be provided at each tunnel portal as a noise mitigation measure. The details of the blast doors will be presented in the contractor's Blasting Method Statement. Air overpressure can also be reduced by stemming blast holes with cartridges of stemming materials.

Flyrock

8.4.3 Flyrock is the uncontrolled throwing of rock through the air as a result of blasting. This can be very hazardous for surface blasting, but for underground blasting the tunnel walls provide natural protection. Provision of steel blast doors at any tunnel portal will effectively confine any possible flyrock within the blast area. By evacuating underground works in the vicinity of the blast, all potential risk from flyrock for underground blasting can be effectively managed. As the MAT is advanced and blasting moves further from the portal, it may be possible to relocate the blast doors to a position inside the MAT or even CT.

8.4.4 A no-blasting zone adjacent to any blast doors has been adopted and the length of the no-blasting zone shall be subjected to the appropriate assessment.

Dust

8.4.5 General dust control measures are identical to site formation works by other excavation methods – wetting down of roads, covering offloads and maintenance of vegetative cover where possible. Due to the blasting being carried out within a tunnel environment, dust can be effectively controlled with the use of adequate ventilation systems which include dust filters. To control the dust generated from the shot itself, the blasthole stemming should consist of appropriate granular material and not the fine drill chips from the drilling of the holes. A fine mist of water will be sprayed after blasting to settle dust and fumes and the blasted rock will also be sprayed with water prior mucking.

Fumes

8.4.6 Blasting creates various noxious gases as part of the chemical reactions which take place, including carbon monoxide and the various oxides of nitrogen. Adequate ventilation of the working area would be provided before workmen re-enter after blasting. A procedure for checking that the air is respirable by the use of a gas detector shall be proposed in the contractor's Blasting Method Statement. Watering down of the muckpile will also mitigate the effect of blast fumes.

8.5 Instrumentation and Monitoring

8.5.1 In order to eliminate any uncertainties and to justify suitability and validity of the parameters adopted in estimating blasting-induced vibrations, blast monitoring will be carried out.

8.5.2 A vibrograph (velocity seismograph) is normally proposed for each vibration monitoring station to measure and record PPVs and amplitudes of ground motion in three mutually perpendicular directions. The purpose of vibration monitoring is to validate the design assumptions, and to ensure that the permitted PPVs are not exceeded. Vibration monitoring should be conducted throughout the influence zone as required and not necessarily limited to the critical or particularly sensitive receivers. In general, for each blast, a minimum of six sensor locations (including the three highest ranked controlling sensitive receivers for that blast, with the locations of the other three monitoring points to be agreed with the Supervising Officer's Representative) shall be carried out for each blast.

8.5.3 Air overpressure monitoring will be carried out at locations around the perimeter of the site close to the portal, in order to ensure that air overpressure does not exceed the limits as specified by Mines Division. In addition, air overpressure experienced by the sensitive receivers adjacent to the blasting sites should also be monitored.

8.5.4 Monitoring will be required for every blast carried out. The monitoring plans shall be agreed with Mines Division. Alert, Action and Alarm (AAA) levels should be assigned to all monitoring locations.

8.5.5 For ground vibration, levels will be related to a proportion of the actual limit for the sensor location as tabulated in **Table 8.1.**

Table 8.1 Alert, Action and Alarm (AAA) Levels for Ground Vibration

Control Level	Vibration Level	Procedures/Requirements
Alert	90% of the specified limit	- Inform the Supervising Officer's Representative, Blasting Engineer, BCS of occurrence. - Review monitoring data and recording equipment for accuracy. - Check secure placement of transducers. - Review blast pattern and parameters. - Inspect sensitive receivers affected. - Prepare action plan. - Continue blasting.
Action	95% of the specified limit	- Inform the Supervising Officer's Representative, Blasting Engineer, BCS, GEO Mines Division immediately. - Review / modify blast pattern and blast parameters - Review and implement action plan if necessary.

Control Level	Vibration Level	Procedures/Requirements
		- Detailed inspection of all affected sensitive receivers. - Plan and prepare remedial works if necessary. - Seek approval from the Supervising Officer's Representative to resume blasting.
Alarm	100% of the specified limit	- Blasting work shall cease. - Inform the RSS, the Engineer and Mines Division. - Detailed investigation of the cause of the occurrence. - Detailed Inspection of affected sensitive receivers. - Geological inspection of blast area to determine if there was unexpected influence due to geological conditions. - Implement remedial works if required. - Modify blast design and vibration assessment parameters to reduce PPV. - Blasting to continue only after approval from the Engineer and Mines Division.

For air overpressure, the AAA levels are tabulated in **Table 8.2.**

Table 8.2 - Alert, Action and Alarm (AAA) Levels for Air Overpressure

Control Level	Air Overpressure Level	Procedures/Requirements
Alert	118dBL	- Inform the Supervising Officer's Representative, Blasting Engineer, BCS of the occurrence. - Review monitoring data and recording equipment for accuracy. - Check placement of microphone. - Check microphone is wind shielded. - Measure background wind dBL level. - Continue blasting.
Action	119 dBL	- Report occurrence to the Supervising Officer's Representative, Blasting Engineer, BCS and GEO Mines Division immediately - Carry out all alert actions. - Review / modify blast pattern and blast direction. - Prepare action plan. - Resume blasting.
Alarm	120dBL	- Blasting work shall cease. - Inform the RSS, the Engineer and Mines Division. - Geological inspection of blast area to determine if there was unexpected influence due to geological conditions. - Stop blasting if public complaints are received. - Implement Action Plan if required. - Modify blast design and direction. - Prepare plan of trial blasting for approval to resume blasting, if required.

8.6 Arrangement for Explosives Delivery

8.6.1 Excavation by drill and blast requires delivery of explosives that are classified as Schedule 1 Dangerous Goods. Explosives are currently anticipated to be delivered to TYNUQ by GEO Mines Division, with one daytime delivery each day, except for Sundays, public holidays, whenever typhoon Signal No. 3 or higher is hoisted and whenever the Red or Black Rainstorm is in force.

8.6.2 All explosives will be taken to the blast face and loaded into the blastholes immediately after arriving on site. Any unused explosives shall be destroyed immediately upon the completion of blasting. It shall be destroyed in a proper place and a safe manner recommended by the manufacturer of the explosive product. The details shall be provided in the contractor's Blasting Method Statement. No on-site storage shall be allowed.

8.6.3 As blasting is anticipated to be once per day, no explosive magazine is necessary. The explosives will be transported overland by the government vehicle normally once a day, subjected to the available resources, arriving on site between 12.00 pm and 3.00 pm, allowing for a blast time in the afternoon. The exact arrangement will require further liaison between GEO Mines Division and the contractor.

8.7 Site Evacuation and Clearance Requirements

8.7.1 It is envisaged that all personnel would be evacuated from the underground quarry, prior to firing the blast.

8.7.2 The typical evacuation procedures for tunnel blasting are listed below:

- Initially, all workers within the Main Access Tunnel, Connection Tunnel and Production Cavern shall be evacuated prior to firing the blast.
- Before the initiation of a tunnel blast, affected underground and portal site personnel will be relocated to a designated safe location. The exact designated safe location will be indicated in the contractor's Blasting Method Statement.
- After each blast, the Shotfirer(s) shall check the blast faces and confirm the blasts are successful. Ventilation shall be carried out until air monitoring indicates that the blast fumes have been cleared and it is safe to re-enter the Main Access Tunnel, Connection Tunnel and Production Cavern. Personnel may then be allowed to enter the evacuated portion of the Main Access Tunnel, Connection Tunnel and Production Cavern.
- As the Main Access Tunnel, Connection Tunnel and Production Cavern are advanced, and if a suitable blast screen / shelter is installed within the Main Access Tunnel, Connection Tunnel and Production Cavern, personnel may remain within the protected portion of the Main Access Tunnel, Connection Tunnel and Production Cavern during blasting, subject to approval by Mines Division and the Blasting Competent Supervisor (BCS).

8.8 Impacts on Tsing Yi Coastal Road Structures

8.8.1 The allowable PPV of the Tsing Ma Control Area is set as 25mm/s, and this has been agreed with the Highways Department in April 2025.

8.8.2 During the operation phase of the underground quarry, careful blast design by controlling the maximum instantaneous chargeweight (MIC) will be implemented. Necessary monitoring for every blast, as described in **Section 8.5**, will be planned for all nearby sensitive receivers to ensure the actual vibration does not exceed the allowable vibration limit. By implementing these measures, the structural integrity of the highway structures is not anticipated to be adversely affected by the blasting works.

9 Review on the Existing Man-made Slopes

9.1 General

9.1.1 Preliminary stability assessment shall be carried out for all existing and new man-made slopes and retaining walls which may affect or be affected by the proposed development in accordance with ETWB TC(W) Nos. 29/2002.

9.1.2 If there are any newly proposed water-carrying services close to the man-made slopes, measures to prevent water leakage with reference to "Code of Practice on Monitoring and Maintenance of Water-carrying Services Affecting Slopes" shall be considered and provided, where necessary.

9.2 Existing Registered Man-Made Slopes and Retaining Walls

9.2.1 A total of 57 existing registered man-made features, including 34 cut slopes, 1 cut slope with retaining structures, 15 fill slopes and 7 retaining walls were registered within or in the vicinity of the TYNUQ as presented in **Figure 9.1**. All registered man-made features that may affect or be affected by the TYNUQ have been classified by considering either the debris travel distance and angle in accordance with GEO TGN No. 15, or their location within the blasting influence zone. The existing slope features can be classified into the following three types:

Feature to be removed or modified

9.2.2 Seven features will be modified or removed by the proposed works and the feature boundary will be updated in the Slope Information System upon completion of works.

9.2.3 The existing features no. 6SE-D/C 544, 6SE-D/C 554, 6SE-D/F252 and 6SE-D/F253 will be modified by the proposed site formation works at the Tam Kon Shan Portal and Ngau Kok Wan Portal. For the remaining parts of these features, further assessment on the features will be conducted and submitted separately, if necessary, with due consideration of the extent of Tam Kon Shan Portal and Ngau Kok Wan Portal formation works. Upgrading works may be required to ensure that the features are up to current geotechnical standard.

9.2.4 The existing features no. 6SE-D/C 485, 6SE-D/C 192 and 6SE-D/F88 will be removed by the proposed site formation works at Tam Kon Shan Portal, Ngau Kok Wan Portal and surface land.

Feature to be further assessed

9.2.5 There are 48 existing features located inside the blasting influence zone or where the proposed development falls within the crest/toe influence zone of the feature in the event of failure. The existing features would affect or be affected by the surface development and underground blasting.

9.2.6 According to memo ref. GCMW 2/E1/6SE-D/C552 issued by the Mainland West Division, GEO to LandsD, on 22 June 2010, unauthorized slope cutting was reported at Sub-division No. 3 of slope no. 6SE-D/C552. The principal cut was approximately 20 m in length and 5 m in height with a depth of 1 m. An additional cut was identified immediately east of this location, extending about 20 m in length and up to 1.5 m in height. Given the presence of these unauthorized works, particular attention will need to be paid to slope stability and potential impacts during the detailed design and construction phases.

Feature not affecting or being affected

9.2.7 The existing features nos. 6SE-D/C 188 and 6SE-D/F 87 are located outside the blasting influence zone. In addition, the access road lies beyond both the anticipated travel distance of potential landslide debris and the expected crest influence zone in the event of failure. Therefore, this feature will neither affect nor be affected by TYNUQ.

Summary

9.2.8 The screening result of these features are summarized in the following table. Detailed assessment is provided in **Table D1** of **Appendix D** and the location of these features are shown in **Figure 9.1**.

Table 9.1 – Summary of Action on Existing Features

Action on Existing Feature	Number of Feature
Feature to be removed or modified	7
Feature to be further assessed	48
Feature not affecting or being affected	2

9.3 Existing Unregistered Man-Made Slopes

9.3.1 There are five unregistered slopes located within the blasting influence zone. The locations of these unregistered man-made slopes are shown in **Figure 9.1**. The existing features U1, U3 and U5 would affect or be affected by surface development or underground blasting. The slopes U2 and U4 will be modified by the proposed site formation works at the Ngau Kok Wan Portal and Tam Kon Shan Portal respectively. The screening result of these features is summarized in **Table D2** of **Appendix D**.

10 Preliminary Natural Terrain Hazard Assessment

10.1 Approach to Natural Terrain Hazard Study (NTHS)

10.1.1 Design Event Approach (DEA) has been adopted in accordance with GEO Report No. 138 (2nd Edition) (GEO, 2016) for the natural terrain hazard assessment under this study. According to the guidelines, the design requirements for the hillside catchments are based on a 'Design Event', which is a sufficiently conservative estimate of the credible failure volume at a notional return period of 100 years. As there are no recent landslides recorded and observed within the natural terrain hillside catchments, the credible failure volume is estimated based on the verified relict landslides that occurred within the study catchments or in the relevant vicinity.

10.1.2 Within hillside catchments, three relict landslides, i.e. RL1, RL2, and RL3 (**Figure 10.1**), have been verified with estimated source volumes ranging from approximately 23.6m^3 to 71.4m^3, which all belong to Class B1 ENTLI. RL1 has the largest estimated source volume of 71.4 m^3 with an estimated 1.5 m depth within catchment TY-NT1.

10.1.3 According to GEO Report No. 138 (2nd Edition) Section 4.7.4 "Concurrent occurrence of failures at different landslide source locations should be considered, where there is evidence of such occurrence in the catchment in past rainstorm(s) within the aerial photograph record or based on obvious field evidence". Based on aerial photograph interpretation and field mapping, there is no evidence for the occurrence of concurrent failures.

10.1.4 Hence, using the largest past landslide volume with a moderate degree of certainty in the validated database as the design event source volume would be sufficiently conservative. A design source volume of 72 m^3 is, thus, adopted.

10.1.5 A sensitivity analysis is carried out to evaluate the influence of key input parameters. The depth of the design source volume has been assumed as 2 m, and the largest design source volume is calculated to be 95.2 m^3, which is rounded up to 100 m^3 for assessment.

10.2 Open Hillslope Landslide (OHL)

10.2.1 For the OH catchment TY-NT1, a minor relict landslide has been verified and no failure occurred during the 1-in-500 historic rainstorm event in September 2023. It indicates that the catchment may not be active, but the possibility of relict landslide reactivation cannot be ruled out. Therefore, the landslide susceptibility of this terrain unit is considered to be moderate.

10.2.2 Based on the gradient distribution map in **Figure 3.2**, most of the hillside catchment is inclined at 25 to 35° and locally over 40°. The verified ENTLI feature is located at terrain above 40°, therefore, the steep terrain of the catchment may pose a higher chance to initiate open hillside failure.

10.3 Channelised Debris Flow (CDF)

10.3.1 Catchments TY-NT2, TY-NT4, and TY-NT4a are considered CD catchments, where open hillslope failures initiated from the catchments would run into the distinct drainage lines DL2, DL4, DL4a, and DL5 (**Figure 10.1**), and discharge at the mouth of the incised drainage lines. These three catchments contain continuous and well-developed drainage lines with two minor relict landslide features RL2 and RL3 verified at the flanks of the drainage lines, but no failure occurred during the 1-in-500 historic rainstorm event in September 2023. It indicates that the hillside catchment may be susceptible to failure and generation of CDF hazards if relict landslide reactivation occurs at the flanks of drainage lines as an active erosion front. The sharp convex break-in-slope at the flanks of the drainage lines is considered to act as a potential active erosion front, where failure is likely to occur and become channelised.

10.4 Debris Flow (DF)

10.4.1 Catchment TY-NT3 consists of obvious depressions at the toe and is considered a TD catchment, where open hillslope failures initiated from this catchment would run into the drainage lines and converge at the mouth of the drainage lines DL3, DL3a and DL3b. No landslide features are identified and verified within the catchment. Given the similarity of the terrain unit TU3 as in catchments TY-NT2 and TY-NT4, the sharp convex break-in-slope at the flanks of drainage lines may be an active erosion front if relict landslide reactivation occurs. Any failure from the catchment is likely to become confined in the TD catchment.

10.5 Rock Fall/ Boulder Fall

10.5.1 Based on the desk study, no records of rock fall or boulder fall incidents are found. Rock outcrops are mainly observed along the drainage lines. No extensive rock outcrop/ cliff is located within the catchments. Therefore, the potential for initiation of rock fall is considered to be low.

10.5.2 Boulders observed from detailed API and field mapping are mostly embedded in the ground or deposited at valley floors with no signs of distress or hazardous movement. It is confirmed that no immediate and obvious signs of danger near the natural terrain hillslope toe. Therefore, the hillside catchments is considered to have low susceptibility for boulder fall hazard.

10.5.3 Thus, in accordance with GEO Report No. 138 (2nd Edition) (Ho and Roberts, 2016), no preventive action is required and no detailed systematic evaluation of boulder instability is undertaken.

10.6 Deep-seated Failure

10.6.1 Evidence for deep-seated failure, such as tension cracking and bulging of the hillside, is not identified in detailed API or during the field mapping. The hillside catchments also do not contain prominent topographic depression which may indicate previous deep-seated failure. Therefore, the susceptibility for deep-seated failure occurring within the hillside catchments is considered to be low.

10.7 Run-out Analysis

10.7.1 DAN-W (Release 10) has been used to predict the extent of debris runout and mitigation design parameters for potential CDF, DF and OHL hazards.

10.7.2 The debris parameters used in the analysis are based on the recommendation in GEO Technical Guidance Note No. 29 (TGN 29) (GEO, 2011) and GEO Technical Guidance Note No. 38 (TGN 38) (GEO, 2013). The parameters adopted are listed below:

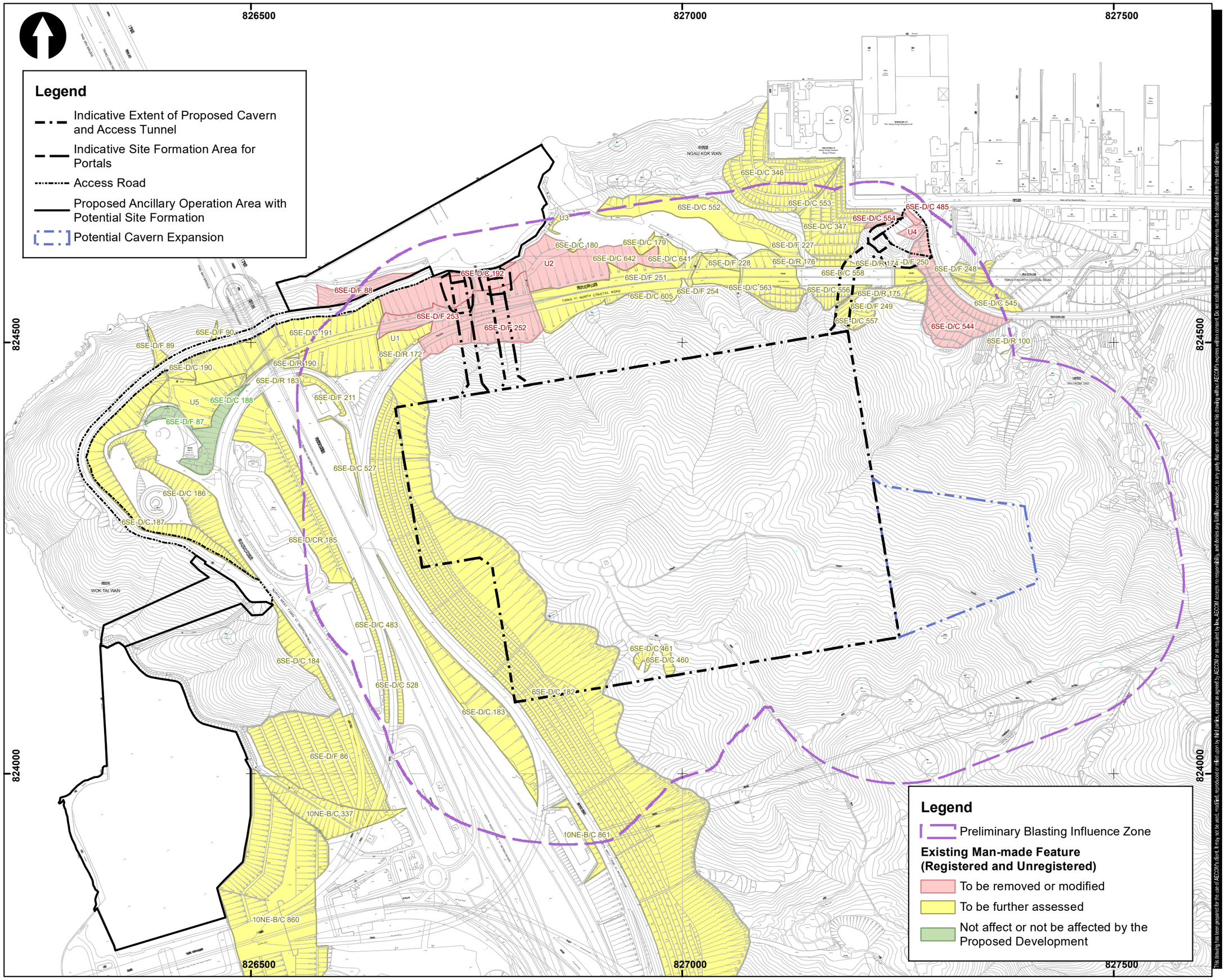
Hazard Type	Debris Flow Path	Rheological Model	Apparent friction (Φ_a)	Turbulence coefficient (ξ)
CDF	FP2, FP4, FP5	Voellmy	11°	500 m/s^2
DF	FP3	Voellmy	18°	1000 m/s^2
OHL	FP1	Frictional	25°	-

10.7.3 Five debris flow paths (FP1 to FP5) have been assessed for the run-out analysis. These flow paths and assessment results are shown in **Figure 10.1**.

10.8 Hazard Mitigation Approach

10.8.1 As a preliminary design, a passive mitigation strategy will be proposed as a conceptual mitigation measure. A 10 m buffer zone measured from the surface land boundary at Ngau Kok Wan will be designated as a no-manned facility zone during the Amber rainstorm signal or above is in force. The schematic configuration of the proposed mitigation measure is shown in **Figure 10.2**.

Figures



AECOM

PROJECT
項目

UNDERGROUND QUARRYING AT TSING YI NORTH - INVESTIGATION, DESIGN AND CONSTRUCTION

CLIENT
業主

土木工程拓展署
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ISSUE/REVISION
修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核核

STATUS
種類

SCALE 比例
A3 1:4,000

DIMENSION UNIT 尺寸單位
METERS

KEY PLAN
索引圖

PROJECT NO. 項目編號
60733229

CONTRACT NO. 合約編號
CE 79/2023 (GE)

SHEET TITLE
圖紙名稱

Categorization of Existing Man-made Features

SHEET NUMBER
圖紙編號

60733229/B15/FIGURE 9.1

826750

827000

824500

824250

青衣北岸公路

TSING YI NORTH COASTAL ROAD

Elevated Road

Nullah

FP1 FP2 FP3 FP4 FP5

DL1 DL2 DL3 DL3a DL3b DL4 DL5

RL1 RL2 RL3

Legend

- Indicative Extent of Proposed Cavern and Access Tunnel (Underground)
- Indicative Site Formation Area for Portals
- Access Road
- Proposed Ancillary Operation Area with Potential Site Formation
- Study Area
- Hillside Catchments
- Convex Break-in-slope
- Concave Break-in-slope
- Incised Drainage Line
- Verified Relict Landslide
- Design Event Source Area
- Design Flow Path
- Design Flow Path Chainage
- Debris Front (Source volume 72 m³)
- Debris Front (Source volume 100 m³)

Landslide Susceptibility

- Moderate

AECOM

PROJECT
項目

UNDERGROUND QUARRYING AT TSING YI NORTH - INVESTIGATION, DESIGN AND CONSTRUCTION

CLIENT
業主

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ISSUE/REVISION
修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核對

STATUS
階段

SCALE 比例: A3 1:1,500

DIMENSION UNIT 尺寸單位: METERS

KEY PLAN
索引圖

PROJECT NO. 項目編號: 60733229

CONTRACT NO. 合約編號: CE 79/2023 (GE)

SHEET TITLE
圖紙名稱

Natural Terrain Hazard Plan

SHEET NUMBER
圖紙編號

60733229/B15/FIGURE 10.1

826750

827000

824500

824250

青衣北岸公路

TSING YI NORTH COASTAL ROAD

Elevated Road

Nullah

FP1

FP2

FP3

FP4

FP5

DI.1

DI.2

DI.3

DI.3a

DI.3b

DI.4

DI.5

Legend

- Indicative Extent of Proposed Cavern and Access Tunnel (Underground)
- Indicative Site Formation Area for Portals
- Access Road
- Proposed Ancillary Operation Area with Potential Site Formation
- Study Area
- Hillside Catchments
- Convex Break-in-slope
- Concave Break-in-slope
- Incised Drainage Line
- Design Event Source Area
- Design Flow Path
- Design Flow Path Chainage
- Debris Front (Source volume 72 m³)
- Debris Front (Source volume 100 m³)
- 10m No-manned Facility Zone when the Amber rainstorm signal or above is in force

AECOM

PROJECT
項目

UNDERGROUND QUARRYING AT TSING YI NORTH - INVESTIGATION, DESIGN AND CONSTRUCTION

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ISSUE/REVISION
修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK 核查

STATUS
階段

SCALE 比例: A3 1:1,500

DIMENSION UNIT 尺寸單位: METERS

KEY PLAN
索引圖

PROJECT NO. 項目編號: 60733229

CONTRACT NO. 合約編號: CE 79/2023 (GE)

SHEET TITLE
圖紙名稱

Proposed Mitigation Measures

SHEET NUMBER
圖紙編號

60733229/B15/FIGURE 10.2

Appendices

Appendix D1 - Summary of Existing Registered Geotechnical Features

Feature No.	Feature Type	Coordinates		Location	Crest Facility	Toe Facility	Existing Consequence - to - Life	Geometry			Maintenance Responsibility	Within Blasting Influence Zone*	Evaluation [according to GEO TGN No.15]					Risk or impact on the proposed development (1) Feature to be removed or modified (2) Feature to be further assessed* (3) Feature not affect or not be affected	Remarks
		Easting	Northing					Max. Height H (m)	Length L (m)	Gradient (deg.)			Total slope height greater than 10 m?	Assumed Travel Angle (deg.)	Extreme travel Angle Reach / Crest Influence Zone (m)	Distance of proposed facility from Existing Features (m)	Projected travel distance reaches proposed development?		
10NE-B/C 861	Soil & Rock Cut Slope	826891	823927	Behind Mtr Ventilation Building, Cheung Tsing Road, Tsing Yi.	Road/footpath with moderate traffic density	Manned substation	1	10	147	75	MTRL2	Y	N	30	17	398.5	N	(2)	-
6SE-D/F 211	Fill Slope	826584	824447	Tsing Ma Control Area (Tmca) - Northwest Tsing Yi Interchange	Other non-crowded built-up facilities	Road/footpath with low traffic density	2	4	71	30	HyD (TMCA)	Y	N	20	11	73.6	N	(2)	-
6SE-D/C 527	Soil & Rock Cut Slope	826619	824367	Tsing Ma Control Area (Tmca) - Northwest Tsing Yi Intercharge	Lightly-used open area/facilities	Road/footpath with moderate traffic density	2	3	124	40	HyD (TMCA)	Y	N	30	5	125.4	N	(2)	-
6SE-D/C 528	Soil & Rock Cut Slope	826672	824107	Tsing Ma Control Area (Tmca) - Northwest Tsing Yi Interchange	Road/footpath with low traffic density	Road/footpath with heavy traffic density	2	7	110	65	HyD (TMCA)	Y	N	30	12	129.9	N	(2)	-
6SE-D/C 563	Soil Cut Slope	827116	824550	Tsing Yi North Coastal Road, Kts	Undeveloped green belt	Flyover	2	22	75	40	HyD (TMCA)	Y	Y	20	60	110.3	N	(2)	-
6SE-D/C 179	Soil Cut Slope	826957	824616	East Of Ting Kau Bridge Abutment Near Ngau Kok Wan, Tsing Yi.	Undeveloped green belt	Remote area or abandoned facilities	3	5	27	40	LandsD	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/C 460	Soil Cut Slope	826984	824136	East Of Junction Of Tsing Ma & Ting Kau Bridges, Tsing Yi	Undeveloped green belt	Undeveloped green belt	3	5	30	30	LandsD	Y	N	30	9	453.0	N	(2)	-
6SE-D/C 461	Soil Cut Slope	826958	824142	East Of Junction Of Tsing Ma / Ting Kau Bridges, Tsing Yi	Undeveloped green belt	Undeveloped green belt	3	3	30	25	LandsD	Y	N	30	5	423.6	N	(2)	-
6SE-D/C 556	Soil Cut Slope	827173	824555	Westbound Of Tsing Yi North Coastal Road, Yau Kom Tau, Tsing Yi	Undeveloped green belt	Road/footpath with moderate traffic density	2	20	53	43	HyD (TMCA)	Y	Y	20	55	52.5	Y	(2)	-
6SE-D/R 172	Retaining wall	826675	824488	Westbound Of Tsing Yi North Coastal Road, Ngau Kok Wan, Tsing Yi	Road/footpath with moderate traffic density	Undeveloped green belt	2	6	41	89	HyD	Y	N	30	10	73.8	N	(2)	-
6SE-D/R 174	Retaining wall	827224	824589	Eastbound Of Tsing Yi North Coastal Road, Yau Kom Tau, Tsing Yi	Road/footpath with moderate traffic density	Undeveloped green belt	2	4	13	89	HyD (TMCA)	Y	N	30	7	28.0	N	(2)	-
6SE-D/R 175	Retaining wall	827227	824564	Westbound Of Tsing Yi North Coastal Road, Yau Kom Tau, Tsing Yi	Road/footpath with moderate traffic density	Road/footpath with low traffic density	2	5.5	15	89	HyD (TMCA)	Y	N	30	10	49.1	N	(2)	-
6SE-D/R 176	Retaining wall	827148	824587	Eastbound Of Tsing Yi North Coastal Road, Ngau Kok Wan, Tsing Yi	Road/footpath with moderate traffic density	Remote area or abandoned facilities	2	5	10	89	HyD (TMCA)	Y	N	30	9	91.5	N	(2)	-
6SE-D/C 347	Soil & Rock Cut Slope	827185	824644	Nr. Hong Kong Cement Company, Tam Kon Shan Road, Tsing Yi	Road/footpath with very heavy traffic density	Factory	1	46.3	110	49	LandsD	Y	Y	20	127	19.3	Y	(2)	-
6SE-D/C 553	Soil Cut Slope	827167	824683	Hong Kong Cement Company, Tam Kon Shan Road, Tsing Yi	Undeveloped green belt	Other crowded built-up area	1	21	75	30	TYTL119	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/C 558	Soil Cut Slope	827173	824589	Tsing Yi North Coastal Road	Remote area or abandoned facilities	Road/footpath with moderate traffic density	2	6	50	38	HyD (TMCA)	Y	N	30	10	44.7	N	(2)	-
6SE-D/R 183	Retaining wall	826512	824470	Eastbound Of Tsing Yi North Coastal Road, Underneath Ting Kau Bridge, Ngau Kok Wan, Tsing Yi	Road/footpath with moderate traffic density	Lightly-used open area/facilities	2	8.5	52	89	HyD (TMCA)	Y	N	30	15	60.8	N	(2)	-
6SE-D/R 100	Retaining wall	827381	824494	Yau Kom Tau, Tsing Yi	Remote area or abandoned facilities	Remote area or abandoned facilities	3	3.1	30	75	DD438 Lot13RP, LandsD	Y	N	30	5	135.8	N	(2)	-
6SE-D/C 346	Soil & Rock Cut Slope	827105	824694	Inside Hong Kong Cement Co. Ngau Kok Wan, Tsing Yi	Undeveloped green belt	Factory	1	45	150	37	LandsD	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/C 182	Soil & Rock Cut Slope	826772	824209	Junction Of Tsing Ma Bridge And Ting Kau Bridge	Undeveloped green belt	Road/footpath with heavy traffic density	2	90	760	45	HyD (TMCA)	Y	Y	20	247	90.2	Y	(2)	-
6SE-D/C 184	Soil Cut Slope	826564	824134	Tsing Ma/Ting Kau Bridges Intersection, Tsing Yi	Undeveloped green belt	Road/footpath with moderate traffic density	2	12	140	30	HyD (TMCA)	Y	Y	20	33	0.0	Y	(2)	-
6SE-D/C 483	Rock Cut Slope	826648	824166	Tsing Ma & Ting Kau Bridge Intersection, Tsing Yi	Road/footpath with heavy traffic density	Other crowded built-up area	1	7	170	70	HyD (TMCA)	Y	N	30	12	94.3	N	(2)	-
6SE-D/C 183	Soil Cut Slope	826748	824105	Tsing Ma/Ting Kau Bridges Intersection, Tsing Yi	Road/footpath with moderate traffic density	Road/footpath with heavy traffic density	2	11	350	30	HyD (TMCA)	Y	Y	20	30	133.0	N	(2)	-
6SE-D/C 180	Soil Cut Slope	826874	824608	East Of Ting Kau Bridge Abutment Near Ngau Kok Wan, Tsing Yi	Undeveloped green belt	Remote area or abandoned facilities	3	4.5	20	35	LandsD	Y	N	30	8	39.0	N	(2)	-
6SE-D/C 191	Soil & Rock Cut Slope	826546	824493	Tsing Yi North Coastal Road, Kwai Tsing	Road/footpath with moderate traffic density	Road/footpath with very low traffic density	2	42	226	32	HyD (TMCA)	Y	Y	20	157	0.0	Y	(2)	-
6SE-D/C 545	Soil Cut Slope	827355	824557	Adjacent To Link Road Of Tsing Yi North Coastal Road, Yau Kom Tau, Tsing Yi	Flyover	Road/footpath with moderate traffic density	2	15	100	33	HyD (TMCA)	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/F 248	Fill Slope	827336	824576	Yau Kom Tau, Tsing Yi	Lightly-used open area/facilities	Road/footpath with moderate traffic density	2	10.5	20	24	HyD (TMCA)	Y	Y	10	60	38.7	Y	(2)	-
6SE-D/F 250	Fill Slope	827262	824577	Yau Kom Tau, Tsing Yi	Flyover	Road/footpath with moderate traffic density	2	16	35	25	HyD (TMCA)	Y	Y	10	91	27.9	Y	(2)	-
6SE-D/F 251	Fill Slope	826925	824562	Ngau Kok Wan, Tsing Yi	Undeveloped green belt	Undeveloped green belt	3	30	240	24	HyD (TMCA)	Y	Y	10	170	50.1	Y	(2)	-
6SE-D/F 227	Fill Slope	827098	824588	Tsing Yi North Coastal Road, Kts	Flyover	District open space	2	18	60	30	HyD (TMCA)	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/F 228	Fill Slope	827048	824591	Ngau Kok Wan, Tsing Yi	Flyover	Catchwater-Group 5 facilities	2	12	50	30	HyD (TMCA)	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/C 557	Soil Cut Slope	827196	824532	Westbound Of Tsing Yi North Coastal Road, Yau Kom Tau, Tsing Yi	Undeveloped green belt	Road/footpath with moderate traffic density	2	26	40	40	HyD (TMCA)	Y	Y	20	71	56.5	Y	(2)	-
6SE-D/F 254	Fill Slope	827037	824577	Ngau Kok Wan, Tsing Yi	Flyover	Road/footpath with very low traffic density	2	19	50	28	HyD (TMCA)	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/R 190	Retaining wall	826546	824476	Underneath Ting Kau Bridge, Ngau Kok Wan, Tsing Yi	Road/footpath with moderate traffic density	Remote area or abandoned facilities	2	7	20	63	HyD (TMCA)	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/F 249	Fill Slope	827251	824560	Yau Kom Tau, Tsing Yi	Undeveloped green belt	Flyover	2	24	65	25	HyD (TMCA)	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/C 605	Soil Cut Slope	826944	824556	Natural Slope Immediate Above Slope No. 6SE-D/F251	Undeveloped green belt	Lightly-used open area/facilities	3	3	12	50	LandsD	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/CR 185	Soil Cut Slope and Retaining wall	826553	824334	Adjoining To Toilet Block At The Viewing Platform Near Tsing Ma Bridge	Road/footpath with heavy traffic density	Other thinly populated buildings	1	12	240	30	HyD (TMCA)	Y	Y	20	33	71.4	N	(2)	-
6SE-D/C 552	Soil Cut Slope	827042	824657	Near Hong Kong Cement Company, Ngau Kok Wan, Tsing Yi	Undeveloped green belt	Construction sites	2	15	240	40	DD438 LOT46	Y	Y	20	41	50.6	N	(2)	According to memo ref. GCMW 2/E1/6SE-D/C552 issued by the Mainland West Division, GEO to LandsD, on 22 June 2010, unauthorized slope cutting was reported at Sub-division No. 3 of slope no. 6SE-D/C552.
6SE-D/C 641	Soil Cut Slope	826986	824603	Adjoining Tsing Yi North Coastal Road, Tmc	Undeveloped green belt	Road/footpath with very low traffic density	3	12	45	30	HyD (TMCA)	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/C 642	Soil Cut Slope	826959	824611	Tsing Yi North Coastal Road, Tmc	Remote area or abandoned facilities	Remote area or abandoned facilities	3	9	30	25	LandsD	Y	-	-	-	-	N	(2)	In the event of a failure, landslide debris is not expected to travel toward the proposed facilities, and therefore will not impact the proposed development.
6SE-D/C 186	Soil & Rock Cut Slope	826422	824331	Junction of Tsing Ma/Ting Kau Bridges Construction Site	Road/footpath with low traffic density	Road/footpath with moderate traffic density	2	15	200	30	HAD	N	-	-	6	0.0	Y	(2)	The expected crest influence zone is conservatively assumed be 0.4 times the slope height.
6SE-D/C 187	Soil Cut Slope	826328	824340	Lantau Link Visitors Centre, Tsing Yi	Other densely populated buildings	Road/footpath with low traffic density	1	15	390	40	ArchSD, DSD	N	Y	20	41	0.0	Y	(2)	-

Appendix D1 - Summary of Existing Registered Geotechnical Features

Feature No.	Feature Type	Coordinates		Location	Crest Facility	Toe Facility	Existing Consequence - to - Life	Geometry			Maintenance Responsibility	Within Blasting Influence Zone*	Evaluation [according to GEO TGN No.15]					Risk or impact on the proposed development (1) Feature to be removed or modified (2) Feature to be further assessed* (3) Feature not affect or not be affected	Remarks
		Easting	Northing					Max. Height H (m)	Length L (m)	Gradient (deg.)			Total slope height greater than 10 m?	Assumed Travel Angle (deg.)	Extreme travel Angle Reach / Crest Influence Zone (m)	Distance of proposed facility from Existing Features (m)	Projected travel distance reaches proposed development?		
6SE-D/F 90	Fill Slope	826457	824505	Tsing Ma/Ting Kau Bridges Intersection, Tsing Yi	Road/footpath with very low traffic density	Undeveloped green belt	3	11	24	35	LandsD	N	-	-	4	0.0	Y	(2)	The expected crest influence zone is conservatively assumed be 0.4 times the slope height.
6SE-D/F 89	Fill Slope	826392	824488	To the North of GLA-TKT1716	Road/footpath with low traffic density	Remote area or abandoned facilities	3	24	10	40	DSD	N	-	-	10	0.0	Y	(2)	
6SE-D/C 190	Soil & Rock Cut Slope	826422	824462	To the North of GLA-TKT1716	Remote area or abandoned facilities	Road/footpath with low traffic density	3	10	35	37	DSD	N	N	30	17	0.0	Y	(2)	-
6SE-D/F 86	Fill Slope	826572	824028	Near End of Tsing Ma Bridge, Tsing Yi	Road/footpath with moderate traffic density	District open space	2	53	120	30	HyD (TMCA)	N	Y	10	301	12.4	Y	(2)	-
10NE-B/C 337	Soil & Rock Cut Slope	826595	823961	Tsing Ma Bridge exit, near administration building, Tsing Yi	Lightly-used open area/facilities	Remote area or abandoned facilities	3	52	140	25	HyD (TMCA)	N	-	-	21	11.0	Y	(2)	The expected crest influence zone is conservatively assumed be 0.4 times the slope height.
10NE-B/C 860	Soil & Rock Cut Slope	826532	823836	Under the Beginning of Tsing Ma Bridge, Tsing Yi	Flyover	Remote area or abandoned facilities	2	52	300	30	HyD (TMCA)	N	Y	20	143	0.0	Y	(2)	-

Remarks: * Those features within the blasting influence zone will be assessed in deliverable B17 - Blasting Assessment Report and the features outside the blasting influence zone will be assessed in another deliverable B28 - Report on Review of Preliminary Design.

Appendix D2 - Summary of Existing Unregistered Geotechnical Features

Feature No.	Feature Type	Coordinates		Location	Crest Facility	Toe Facility	Existing Consequence to - Life	Geometry			Maintenance Responsibility	Within Blasting Influence Zone*	Evaluation [according to GEO TGN No.15]					Risk or impact on the proposed development (1) Feature to be removed or modified (2) Feature to be further assessed* (3) Feature not affect or not be affected	Remarks
		Easting	Northing					Max. Height H (m)	Length L (m)	Grad. (deg)			Total slope height greater than 10 m?	Assumed Travel Angle (°)	Extreme travel Angle Reach (m)	Distance of proposed facility from Existing Features (m)	Projected travel distance reaches proposed development?		
U1	Slope	826670	824500	Ngau Kok Wan, Tsing Yi	Road/footpath with moderate traffic density	Remote area or abandoned facilities	2	18	70	26	N/A	Y	Y	10	102	53.0	Y	(2)	-
U2	Slope	826700	824560	Ngau Kok Wan, Tsing Yi	Undeveloped green belt	Road/footpath with very low traffic density	3	25	370	35	N/A	Y	-	-	-	-	-	(1)	To be modified by proposed Ngau Kok Wan Portal Formation works
U3	Slope	826850	824640	Ngau Kok Wan, Tsing Yi	Remote area or abandoned facilities	Construction sites	3	4	35	40	N/A	Y	N	20	11	8.0	Y	(2)	-
U4	Slope	827270	824630	Adjoining Tam Kon Shan Road, Tsing Yi.	Undeveloped green belt	Road/footpath with moderate traffic density	2	9	16	20	N/A	Y	-	-	-	-	-	(1)	To be modified by proposed Tam Kon Shan Portal Formation works
U5	Slope	826420	824440	Lantau Link Visitors Centre, Tsing Yi	Road/footpath with moderate traffic density	Road/footpath with low traffic density	2	14	140	20	N/A	N	Y	20	38	10.0	Y	(2)	-

Remarks: * Those features within the blasting influence zone will be assessed in deliverable B17 - Blasting Assessment Report and the features outside the blasting influence zone will be assessed in another deliverable B28 - Report on Review of Preliminary Design.