



土木工程拓展署

Civil Engineering and Development Department

Agreement No. CE 28/2004 (GE)

Landslide Preventive Works at Po Shan, Mid-levels - Design and Construction

Project Profile

October 2005

Maunsell Geotechnical Services Ltd

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Agreement No. CE28/2004 (GE)

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Design and Construction

PROJECT PROFILE

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1. BASIC INFORMATION

Project Title

- 1.1 The title of this project is known as “Agreement No. CE28/2004 (GE) Landslide Preventive Works at Po Shan, Mid-levels – Design and Construction”.

Purpose and Nature of the Project

- 1.2 The objective of this Project is to carry out detailed design and supervision of landslide preventive works to improve the long-term stability of the Po Shan area against large-scale, deep-seated slope failure and to repair local parts of the hillside to minimize slope deterioration and shallow slope instabilities.
- 1.3 The Po Shan area is affected by high groundwater level and unfavourable geological conditions. In 1984-85, horizontal drains were installed in part of the area to lower the main groundwater table for improving the stability of the area against large-scale, deep-seated slope failure. However, the available monitoring data show increasing piezometric levels and that some of the horizontal drains, which are 20 years old, are exhibiting a decreasing trend of outflow in recent years. These are indicators of deteriorating drain performance. Therefore, more robust landslide preventive works are proposed to protect the occupants at the Po Shan Area.

Name of Project Proponent

- 1.4 The Project Proponent is the Planning Division of the Geotechnical Engineering Office, Civil Engineering and Development Department, Government of the Hong Kong Special Administrative Region (HKSAR).

Location and Scale of Project

- 1.5 The proposed landslide preventive works would be constructed to protect the existing residential developments at the toe of the project site. The location of the project is shown in **Figure 1.1**. **Figure 1.2** shows the general layout of the Project.
- 1.6 The major items of works are summarized as follows:

Underground Drainage Adits

- Two underground drainage adits, comprising the following elements (**Figure 1.2** refers), would be constructed to lower the main groundwater table
 - A m 7.7m (H) x 10m (W) tunnel portal would be constructed at the park adjacent to Po Shan Mansion
 - A 6.5m (H) x 8m (W) x 30m (L) portal chamber would be constructed for connection of the two proposed drainage adits (Tunnel No. 1 and No. 2)
 - 2 nos. of 3.5m diameter (i.e. outer diameter) underground drainage adits, Tunnel No. 1 and No. 2, with length 260m and 175m respectively, would be constructed at the upper and lower portion of the Po Shan Area
- About 200 nos. of sub-vertical drains with various lengths from 30m to 120m would be installed upwards from the drainage adits to a minimum length of 5m into completely decomposed volcanic rock. The drains will consist of an outer, 114mm outer diameter perforated casing; and a geotextile-wrap protected, 50mm outer diameter, slotted well-screen inner tube. (**Figure 1.3** refers)

Flexible Barriers

- A 4m high, approximately 130m long flexible barrier would be installed along the lower portion of the Po Shan Area to prevent loose debris falling down the hillside to the present development (**Figure 1.2** refers)

- 1.7 Operational phase activities associated with this Project would be limited to routine maintenance of the landslide preventive works (i.e. periodic clearance of accumulated debris in the flexible barrier).

Number and Types of Designated Project Covered by the Project Profile

- 1.8 In accordance with Category Q.1 (a) of Part 1, Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO), the proposed works at Po Shan Road would be partly fall within the boundary of the existing Pok Fu Lam Country Park, and as such should be regarded as a Designated Project. Therefore an Environmental Permit under the EIA Ordinance must be obtained prior to the commencement of any construction works. Location of Pok Fu Lam Country Park is illustrated in **Figure 1.1**.

Name and Telephone Number of Contact Person(s)

- 1.9 All queries regarding the Project can be addressed to the project proponent:
- | | |
|--------------------|--|
| Mr. Jerry L. P. Ho | Senior Geotechnical Engineer |
| | Geotechnical Engineering Office |
| | Civil Engineering and Development Department |
| | Tel : 2760 5700 |
| | Fax : 2714 0247 |
| | Email : lpheo@cedd.gov.hk |

2. OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

Implementation and Planning of the Proposed Project

- 2.1 The Agreement was awarded by the Civil Engineering and Development Department (CEDD) to Maunsell Geotechnical Services Ltd. (MGSL) as the engineering consultant in April 2005. MGSL is responsible for design and supervision of the landslide preventive works. The proposed works will be implemented by the Contractor(s) to be appointed by the Project Proponent at a subsequent stage.

Tentative Project Timetable

- 2.2 The contract for the landslide preventive works is scheduled for tendering in and is likely to commence in March 2006 with duration of 24 months. The preliminary construction programme for the Project is provided in **Appendix 2.1**.

Interactions with Other Projects

- 2.3 There are no known interactions with other definite projects on-going during the same period which need to be considered.
- 2.4 As advised by Drainage Services Department, construction of Hong Kong West Drainage Tunnel would commence in May 2007. With reference to the proposed alignment and the tentative construction programme of the Hong Kong West Drainage Tunnel provided by Drainage Services Department, it is noted that such works will be carried out after the completion of the drainage adit construction and away from the site of this project. Apparently, there are no interactions between the two projects.

3. MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

Description of Major Elements of the Surrounding Environment

- 3.1 The environmental assessments covering the areas in the vicinity of the Project site include noise, air quality, water quality, waste management, ecology, landscape and visual resources.

Noise

- 3.2 The areas surrounding the proposed project construction area are country park, namely Pok Fu Lam Country Park, and man-made slopes, with nearby high-rise residential areas to the south. Private residential developments *Po Shan Mansion* and *Hamilton Court* are located at about 10m and 120m to the northeast of the Project site. Part of the proposed works would encroach the boundary of Pok Fu Lam Country Park.
- 3.3 No major noise source was identified in the vicinity of the Study Area apart from the traffic along Po Shan Road. The ambient noise level is expected to be moderate.

Air Quality

- 3.4 The existing air quality near the proposed project site would be mainly contributed by emissions from vehicular traffic on nearby road networks. In the absence of in-situ monitoring data, reference is made to the annual average concentrations of major air pollutants measured at EPD's nearest monitoring stations (i.e. Central/Western Station) for the last 5 years. The 5-year annual average TSP levels at Central/Western station is $71\mu\text{g m}^{-3}$ according to *Air Quality 1999-2003*.

Water Quality

- 3.5 A drainage culvert lies within the works area of the landslide preventive works (**Figure 1.2**) on the hillslope between Po Shan Mansion and Hamilton Court. There are temporary streams outside the site boundary to the east and west (**Figure 3.1**).

Ecology

- 3.6 The works area for the landslide preventive works would fall partially within a recognised site of conservation importance: Pok Fu Lam Country Park. As such, an ecological assessment is required for the proposed works, as stipulated in Appendix A, *Annex 16* of the EIAO-TM.
- 3.7 Ecological baseline for the proposed works area and areas adjacent to the project site boundary (hereafter referred to as the Study Area) was determined through a review of relevant literature and field surveys. Ecological surveys of the Study Area were conducted from April to June 2005, comprising habitat/vegetation, avifauna, herpetofauna/mammals and terrestrial insects. Surveys were conducted by direct observation, listening for calling animals and searching potential micro-habitats.
- 3.8 A Habitat Map is presented in **Figure 3.1**. Representative photographs of habitats in the Study Area are given in **Appendix 3.1**. Photographs of species of conservation importance recorded in the Study Area are presented in **Appendix 3.2**. Plant species recorded in the Study Area are listed in **Appendix 3.3**. Faunal species recorded in the Study Area are listed in **Appendix 3.4**. Key findings of the ecological surveys were as follows:

Areas of Recognised Conservation Importance

- The works proposed for this Project would be conducted partially within Pok Fu Lam Country Park (**Figure 3.1** refers). Pok Fu Lam Country Park is approximately 270ha in size, and covers the catchment area of Pok Fu Lam Reservoir on the south side of Hong Kong Island, in addition to the hillside below the northern face of Victoria Peak. The Country Park supports extensive

areas of mature secondary woodland habitat, including several rare and protected plant species such as *Camellia hongkongensis*.

Habitats

- Mature secondary woodland habitat with a canopy height of 10-15m dominated the western portion of the works area, in addition to areas south and west of the Site Boundary. This habitat supported a moderate diversity of plants, with commonly encountered species including the trees *Acronychia pedunculata*, *Machilus chekiangensis* and *Schefflera heptaphylla*, shrubs such as *Psychotria rubra* and *Sarcandra glabra*, and the herb *Alpinia hainanensis*. Although largely natural, woodland habitat in the Study Area subject to disturbance in the mid-1980's when a network of small concrete drains was constructed on the surface of the hillside to improve slope stability. Additionally, some areas of the slope were found to be covered with chunan during recent ecological surveys.
- Two small streams were recorded along the eastern and western boundaries of the Study Area. The streams generally had a steep gradient, a well-defined riffle/pool sequence and a substrate consisting of bedrock and large boulders/cobbles. Close to Po Shan Road and Hatton Road, the substrate of both of these streams had been modified, with the channel beds lined with concrete. Riparian vegetation was well established and contiguous with surrounding areas of secondary woodland. Water flow in both streams (particularly the eastern stream) was found to be very low, even after heavy rains in May and June, and it is probable that these streams are temporary and have no surface flow in the dry season. Water quality in the streams appeared reasonable, with no obvious signs of pollution or disturbance.
- Drainage from the area inside the project site boundary is mostly directed to a small concrete culvert between Po Shan Mansion and Hamilton Court. No surface water flow was observed in this culvert during ecological surveys conducted for this Project, and it is likely that any substantial flow in the culvert is limited to the hours immediately following heavy rainfall. As such, this culvert is not considered further as a 'stream habitat' in this Report.
- Other habitats within the Study Area included engineered cut slopes, residential developments and landscaped amenity areas. Plant diversity in these habitats was low, with typical species recorded including trees such as *Acacia confusa*, shrubs including *Lagerstroemia speciosa*, and herbs/climbers such as *Alpinia hainanensis* and *Pueraria lobata* var. *montana*.

Vegetation

- Secondary woodland habitat within the Study Area was found to support seven plant species of conservation interest. The fern Lamb of Tartary (*Cibotium barometz*) is listed as a Wild plant under State Protection (Category II) under Mainland Legislation, and is scheduled under Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187). Hong Kong Pavetta (*Pavetta hongkongensis*), Bird's-nest Fern (*Neottopteris nidus*) and Rhododendron (*Rhododendron* spp.) are all listed under Forestry Regulation of Forests and Countryside Ordinance (Cap. 96). Chinese Pholidota (*Pholidota chinensis*) is listed under Forestry Regulation of Forests and Countryside Ordinance (Cap. 96) and scheduled under Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187). The locally common Small Persimmon (*Diospyros vaccinioides*) and Silver-back Artocarpus (*Artocarpus hypargyreus*) are not listed under any local or mainland legislation, but are classified as critically endangered and vulnerable respectively in the IUCN Red Data List (IUCN, 2004).

Fauna

- Six avifauna species of conservation importance were recorded from the Study Area. These included small groups of 5-10 Yellow-crested Cockatoo (*Cacatua sulphurea*) recorded from areas within and adjacent to the Study Area in April and June 2005. This species is listed as critically endangered in the IUCN Red Data List¹ due to trapping for pet trade, and is also listed

¹ BirdLife International 2004. *Cacatua sulphurea*. In: IUCN 2004. 2004 IUCN Red List of Threatened Species. www.redlist.org.

under CITES Appendix I². Hong Kong is outside of natural range of the Cockatoos, and the population established on the north of Hong Kong Island possibly originated from captive birds released from Flagstaff House in 1941³. The current population of this species in Hong Kong is estimated to be around 60-100 birds. The other five avifaunal species of conservation importance recorded in the Study Area comprised birds that are locally common and native to Hong Kong, but are protected under Mainland Chinese legislation. Lesser Coucal (*Centropus bengalensis*), Greater Coucal (*Centropus sinensis*) and Hwemei (*Garrulax canorus*) were recorded from woodland habitat in the Study Area. Peregrine Falcon (*Falco peregrinus*) and Black Kite (*Milvus migrans*) were recorded flying over the Study Area.

- Several Greater Short-nosed Fruit Bat (*Cynopterus sphinx sphinx*) were recorded flying in and around secondary woodland habitat. Although common and widespread across Hong Kong, all bat species in Hong Kong are protected under Cap. 170 Wild Animals Protection Ordinance.
- A snakeskin, probably belonging to an Indo-chinese Rat Snake (*Ptyas korros*), was recorded from the Study Area. Although Rat Snakes are common and widespread in Hong Kong⁴, this species is threatened by over-hunting elsewhere in the South China Region. The large, relatively secure population in Hong Kong is therefore considered important in a regional context⁵.
- One Mountain Crab (*Nanhaipotamon hongkongense*) was recorded from secondary woodland habitat in the Study Area. Although locally common in Hong Kong, Mountain Crabs have an extremely restricted regional and global distribution, and local populations in Hong Kong are therefore considered of potential global conservation concern⁵.
- Terrestrial insects including dragonflies and butterflies in the Study Area were all species that are common and widespread in Hong Kong, and none of the recorded species are considered of conservation importance.

Landscape & Visual

- 3.9 In terms of landscape and visual aspects, major elements are: the existing Leisure and Cultural Services Department (LCSD) rest garden (Open Space) to be occupied by the temporary works and the existing manmade slope (within Green Belt zoning) where the tunnel portal, the flexible barrier and the drainage adits will be constructed. No work will affect the Country Park. The rest garden is mostly turf with planted trees of common species on a relative flat area. The trees are mostly ornamental species such as *Bauhinia* spp., *Lagerstroemia speciosa*, *Melaleuca quinquenervia*, *Cratogeomys cochinchinense* and *Caryota ochlandra*. The slope is mostly woodland with mostly wildgrass and occasional trees of common species, *Celtis sinensis*, *Acacia confusa*, *Schefflera heptaphylla*, *Mallotus paniculatus*, *Cinnamomum camphora*, *Ficus microcarpa*, *Rhus succedanea*, *Leucaena leucocephala* and *Macaranga tanarius* etc. Both are of fair quality and of fair amenity value. Site Photo refer to Photo 1 - 7 of **Appendix 3.5**. Figure 3.4 shows the extent of proposed works and the existing Outline Zoning Plan zonings.

² UNEP-WCMC. June, 2005. *UNEP-WCMC Species Database: CITES-Listed Species* <http://www.cites.org/eng/resources/species.html>.

³ Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M., and Young, L. (2001): *The Avifauna of Hong Kong*. Hong Kong Bird Watching Society, Hong Kong.

⁴ Karsen, S., Lau, M. and Bogadek, A. (1998) *Hong Kong Amphibians and Reptiles*. 2nd edition. The Provisional Urban Council, Hong Kong.

⁵ Fellowes, J.R., Lau, M.W.N., Dudgeon, D., Reels, G.T., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. & Yu, Y.T. (2002) Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* **25**: 123-159

Existing and Planned Sensitive Receivers

Noise

- 3.10 For the purpose of noise impact assessment, representative noise sensitive receivers (NSRs) within 300 m from the Project site boundary were identified. Representative NSRs were selected in accordance with the criteria in the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM) to evaluate the potential noise impacts. **Table 3.1** presents details of the selected NSRs for noise impact assessment. Locations of representative NSRs and the proposed works areas are illustrated in **Figure 3.2**.
- 3.11 As shown in **Figure 3.2**, Pok Fu Lam Country Park lies to the south of the Project site and would be regarded as NSRs according to the EIAO-TM. Visitors to the country park would potentially be impacted by the proposed construction works. However, the EIAO-TM does not specify a limit for construction noise levels received at a country park, construction noise impact assessment at the Pok Fu Lam Country Park is thus addressed qualitatively in the **Section 4**.

Table 3.1 Representative Noise Sensitive Receivers

NSR	Location	Horizontal Separation from Site Boundary (m)	Use
N1	Po Shan Mansion	7	Residential
N2	Po Shan Mansion	20	Residential
N3	Hamilton Court	45	Residential
N4	Piccadilly Mansion	15	Residential
N5	No 21 Po Shan Road	40	Residential
N6	No 53 Conduit Road	45	Residential
N7	Pok Fu Lam Country Park	-(¹)	Country Park

Note: (1) The landslide preventive works fall partially within the Pok Fu Lam Country Park

Air Quality

- 3.12 Based on the criteria set out in *Annex 12* of the EIAO-TM, representative air sensitive receivers (ASRs) have been identified close to the Project site. A brief description of the representative ASRs is summarized in **Table 3.2** and the ASR locations are shown on **Figure 3.3**.

Table 3.2 Representative Air Sensitive Receivers

ASR	Location	Horizontal Separation from Site Boundary (m)	Use
A1	Po Shan Mansion	7	Residential
A2	Hamilton Court	45	Residential
A3	Piccadilly Mansion	15	Residential
A4	Ching Yuen Garden	110	Residential
A5	No 21 Po Shan Road	40	Residential
A6	No 53 Conduit Road	45	Residential
A7	Pok Fu Lam Country Park	-(¹)	Country Park

Note: (1) The landslide prevention works fall partially within the Pok Fu Lam Country Park

Water Quality

- 3.13 Water sensitive receivers have been identified and included a drainage culvert which lies within the works area of the landslide preventive works (**Figure 1.2**) on the hillslope between Po Shan Mansion and Hamilton Court.

Ecology

- 3.14 In accordance with the EIAO-TM Annex 8 criteria, the ecological importance of secondary woodland habitat and other habitats in the Study Area have been evaluated in **Tables 3.3a-3.3c** below.

Table 3.3a Ecological Value of Secondary Woodland Habitat in the Study Area

Criteria	Ecological Value
Naturalness	Although secondary in nature and subject to disturbance in the past, the habitat is largely natural.
Size	The habitat forms part of the extensive area of woodland covering the northern slopes of Hong Kong Island. Approximately 23ha of woodland habitat lies within the Study Area.
Diversity	Moderate
Rarity	Seven plant species of conservation interest (<i>Artocarpus hypargyreus</i> , <i>Cibotium barometz</i> , <i>Diospyros vacciniodes</i> , <i>Neottopteris nidus</i> , <i>Pavetta hongkongensis</i> , <i>Pholidota chinensis</i> , and <i>Rhododendron</i> spp.) recorded from woodland habitat. Seven faunal species of conservation interest (Yellow-crested Cockatoo, Lesser Coucal, Greater Coucal, Hwemei, Greater Short-nosed Fruit Bat, Indo-chinese Rat Snake, Mountain Crab) recorded from woodland habitat.
Recreatibility	Secondary woodland has moderate recreatibility, although would take several decades to mature.
Fragmentation	The habitat is not fragmented.
Ecological linkage	Habitat falls partially within Pok Fu Lam Country Park.
Potential value	Moderate.
Nursery ground	No significant records.
Age	N/a.
Abundance/ Richness of Wildlife	Moderate.
Ecological value	Moderate-High

Table 3.3b Ecological Value of Temporary Streams in the Study Area

Criteria	Ecological Value
Naturalness	Streams are largely natural, although the channel beds have been modified close to Po Shan Road and Hatton Road.
Size	The streams are small, approximately 1-2m in width.
Diversity	Moderate
Rarity	No significant records.
Recreatibility	Low.
Fragmentation	The habitat is not fragmented.
Ecological linkage	Habitat falls partially within Pok Fu Lam Country Park, and are structurally and functionally linked with moderate-high ecological value woodland habitat.
Potential value	Moderate.
Nursery ground	No significant records.
Age	N/a.
Abundance/ Richness of Wildlife	Moderate.
Ecological value	Low-Moderate

Table 3.3c Ecological Value of Other Habitats in the Study Area

Criteria	Ecological Value
Naturalness	Habitats are artificially created.
Size	Small.
Diversity	Low.
Rarity	No significant records.
Recreatability	High.
Fragmentation	The habitats are not fragmented.
Ecological linkage	Habitats do not fall within the boundary of recognised areas of conservation interest.
Potential value	Low.
Nursery ground	No significant records.
Age	N/a.
Abundance/ Richness of Wildlife	Low.
Ecological value	Low

- 3.15 Although subject to disturbance in the past, secondary woodland habitat in the Study Area is relatively mature, moderately diverse, and supports a number of floral and faunal species of conservation importance. As such secondary woodland habitat is considered of moderate-high ecological value.
- 3.16 Although the two streams in the Study Area retain many natural characteristics, both are small in size and it is probable that these streams are temporary and have no surface flow in the dry season. As such, the streams are considered of low-moderate ecological value only.
- 3.17 Other habitats in the Study Area (engineered cut slopes, residential developments and landscaped amenity areas) are largely man-made, support a low diversity of flora and fauna, and are not considered of ecological importance.

Landscape & Visual

- 3.18 Existing landscape and visual sensitive receivers are mostly residents of adjacent high-rises, especially Po Shan Mansion, users of the existing rest garden and road users of Po Shan Road. Their sensitivities do not change after the completion of the works.

4. POSSIBLE IMPACT ON THE ENVIRONMENT

Outline of Processes Involved

- 4.1 The drainage adits will be excavated mainly by Tunnel Boring Machine (TBM) except that the portal section of about 45m long will be excavated by drill and break method. Excavation by blasting is not allowed, and it is anticipated that non-explosive technique would be used for the rock excavation for the tunnel works. Concrete lining will be constructed along the excavated tunnels before sub-vertical drains to be installed from the tunnels. Flexible barriers will be fixed on concrete foundation or micro pile anchor. Ground plates and posts will then be installed on the footings. Ropes and wire mesh will be attached on the erected barriers. Landscape works will be carried out at the barriers and the portal.
- 4.2 The major construction tasks for the proposed landslide preventive works at Po Shan Road together with the envisaged duration of each task are shown in **Appendix 2.1**. The typical construction plant adopted for various construction activities can be referred to **Appendix 4.1**. The construction plants to be applied to this Project should be practical in completing the works within the schedule. Based on the preliminary design information, percussive piling would not be adopted for the proposed Project.
- 4.3 No construction works would be conducted during restricted hours (i.e. time between 1900 and 0700 hours and any time on a general holiday, including Sunday) according to the preliminary construction programme. In case of any construction works planned during restricted hours, it is the responsibility of the Contractor to ensure compliance with the *Noise Control Ordinance* (NCO) and the relevant TM. The Contractor will be required to submit Construction Noise Permit (CNP) application to the Noise Control Authority and abide by any conditions stated in the CNP, should one be issued. To minimise noise disturbance to the sensitive receivers in the vicinity, it is also intended that mobilisation of heavy machinery would be avoided as far as practicable from 0700 to 0900 hours and from 1800 to 1900 hours unless appropriate noise mitigation measures are in place.

Potential Environmental Impacts

Noise

Construction Phase

Potential Sources of Environmental Impacts

Airborne Construction Noise

- 4.4 The use of powered mechanical equipment (PME) for various above-ground construction activities would be the main source of airborne noise impact during the construction phase of the Project.
- 4.5 Above-ground construction activities proposed for the Project would include: site clearance, tunnel portal formation and installation of flexible barriers.
- 4.6 The remaining works such as construction of portal chamber, sub-vertical drains and tunnel excavation would be conducted inside underground tunnel, which would mainly be potential sources of groundborne construction noise, which are to be addressed in the sections below. These works would although be carried out underground, spoil arising from them would need to be handled by the PME outside the tunnel portal, and would thus be considered as one of the sources of airborne construction noise impact.
- 4.7 The construction plant inventory and their corresponding sound power levels (SWL) for all above-ground construction activities relevant to this Project are given in **Appendix 4.1A**. The assumptions of on-time percentage and the number of PME are expected to be practical in completing the works

within the schedule. The Engineering Consultant for this Project confirmed that the construction plant inventory would be reasonable, realistic and practicable with a view to meeting the construction programme. The project proponent had no objection on the proposed plant inventory.

- 4.8 The proposed construction activities would generally be small in scale. However, since NSRs were identified in proximity to the proposed works areas, adverse noise impacts due to the use of PME would likely be expected at these receivers if no noise control measures are implemented during the works period.

Groundborne Construction Noise

- 4.9 Vibration induced by the use of PME particularly associated with works in tunnels would be a source of groundborne construction noise. For this project, two drainage adits (i.e. Tunnels No. 1 and 2 as illustrated in **Figure 1.2**) would be constructed adopting a combination of mechanical excavation and tunnel boring machine (TBM) construction methods. A list of PME to be adopted for the construction of tunnels is provided in **Appendix 4.1**. Among the list, the major vibration generating equipment relevant to these works would be tunnel boring machine (TBM) and drill rig. These equipment would be operating in rock. The remaining PME are ancillary equipment, expected to have intermittent or transient modes of operations, and would thus be expected to be contributing minor groundborne construction noise impact. As the construction of sub-vertical drains would mainly involve the use of in-the-hole production drill, groundborne construction noise impact induced by these works would be considered not significant given the size of the drain would only be less than 120 mm in diameter (refer to Section 1.6 for dimension of sub-vertical drains) which is relatively small compared with the TBM and drill rig. The remaining PME proposed for sub-vertical drains construction including water pump and hydraulic jacks are ancillary equipment, and they would be considered to result in minor groundborne construction noise impact.
- 4.10 The noise control criteria and methodology for the assessment of groundborne construction noise impact of the Project are presented in **Appendix 4.1B**.

Project-induced Traffic Noise (Construction Phase)

- 4.11 The construction of the Project would induce additional traffic to the existing Po Shan Road. Based on the preliminary construction programme, it is envisaged that only about 24 construction vehicles per day (on average) would be induced by the proposed Project. No insurmountable noise impact due to project-induced traffic during construction phase would be expected.

Operation Phase

- 4.12 During the operation phase, only minor maintenance works such as removal of accumulated debris in the flexible barrier would be involved. No insurmountable operational noise impact is expected.

Prediction and Evaluation of Impacts

Airborne Construction Noise

- 4.13 Based on the proposed plant inventory as shown in **Appendix 4.1A**, noise impacts arising from various construction activities were predicted.
- 4.14 The unmitigated construction noise levels at representative residential NSRs are presented in **Table 4.1**. Detailed calculation of construction noise level for the unmitigated scenario is provided in **Appendix 4.2**.

Table 4.1 Ranges of Unmitigated Construction Noise Levels

NSR	Predicted Noise Levels, dB(A)	EIAO-TM Normal Daytime Construction Noise Criteria, dB(A)
N1	67 - 84	75
N2	63 - 74	75
N3	63 - 69	75
N4	62 - 68	75
N5	57 - 77	75
N6	61 - 75	75

- 4.15 The assessment results showed that predicted cumulative noise levels at representative residential NSRs would range from 57 to 84dB(A). The maximum level of exceedance predicted would be 9dB(A). Mitigation measures would thus be considered necessary to alleviate the construction noise impacts, as presented in **Section 5**.
- 4.16 Visitors to the Country Park (NSR N7) would potentially be impacted by the proposed construction works. Taking into account the transient nature of visitors to the Country Park, insurmountable construction noise impact on the NSR N7 would not be envisaged.

Groundborne Construction Noise

- 4.17 Based on the vibration source data and the existing geological profile available at the time of reporting, a worse case scenario for potential groundborne construction noise impact was assessed using methodology as presented in **Appendix 4.1B**. Unmitigated groundborne noise levels predicted at the NSR closest to the proposed works area (i.e. Block A, Po Shan Mansion) are shown in Table 4.2 below. Details of noise calculation and assumptions are provided in **Appendix 4.1B**.

Table 4.2 Unmitigated Groundborne Construction Noise Levels at Block A, Po Shan Mansion

Construction Activities	Predicted Groundborne Noise Level, dB(A)	Noise Criterion, dB(A)
TBM	23	65
Drill rig	33	65

Note: According to the preliminary construction programme available at the time of reporting, no simultaneous operations of the TBM and drill rig would be expected.

- 4.18 As shown in the table above, predicted groundborne noise levels would be well below the noise assessment criterion. Adverse groundborne noise impact associated with the construction of the Project would not be expected and mitigation measures would be considered not necessary.

Project-induced Traffic Noise (Construction Phase)

- 4.19 No insurmountable project-induced traffic noise impact would be expected during regard to the small number of construction vehicles involved from the proposed works (24 construction vehicles per day on average).

Air Quality

Construction Phase

Potential Sources of Impacts

- 4.20 Potential impacts arising from the construction of the proposed landslide preventive work would include dust nuisance and gaseous emissions from the construction plant and vehicles. The major construction activities for the Project would be potential sources of construction dust in the Study

Area include earthworks and tunnel formation. It is anticipated that dust would be generated from excavation, material handling and wind erosion from the site.

- 4.21 The construction of the Project would induce additional traffic to the existing Po Shan Road. However, as described above, it is envisaged that only about 24 construction vehicles per day (on average) would be induced by the proposed Project. Air quality impact due to project-induced traffic emissions would be expected to be minor.

Prediction and Evaluation of Impacts

- 4.22 The landslide preventive work at Po Shan would comprise the construction of two underground drainage adits, drainage adit portal and flexible barrier. Apart from site clearance, tunnel portal formation and installation of flexible barriers, the majority of construction works will be carried out inside tunnel. In addition, it would be considered unlikely that the construction of tunnel portal and flexible barrier as well as spoil handling would result in significant dust emissions given the scale of the proposed works would be small. In the light of the above, dust impact due to excavation, material handling and wind erosion is expected to be relatively minor with the implementation of mitigation measures as described in **Section 5**. It is also expected that there would be a limited number of plant for such and the small scale of the Project works would be carried out phase by phase. Hence, adverse impacts on air quality would not be expected.
- 4.23 A full implementation of dust suppression measures as stipulated in the *Air Pollution Control (Construction Dust) Regulation* by the Contractor would also be required during the construction phase of the Project. Adverse dust impact during the construction stage of the Project would not be envisaged.
- 4.24 Due to the limited traffic induced by the Project, no insurmountable air quality impact due to emissions from project-induced traffic would be envisaged.

Operation Phase

- 4.25 No operational phase air quality impact is expected.

Water Quality

Construction Phase

- 4.26 Water-bodies potentially affected by the proposed landslide preventive works include a drainage culvert within the works area and a hillside stream below the proposed flexible barrier (**Figure 1.2** refers). Site runoff and drainage from the works area, if uncontrolled, could enter the drainage culvert and stream.
- 4.27 During site clearance and tunnelling works, runoff and drainage from the works area would be the main sources of potential water quality impacts to the nearby water bodies. Site runoff and drainage may contain increased loads of suspended solids and contaminants. Potential sources of pollution from site drainage include: runoff and erosion from exposed soil surfaces and stockpiles; release of grouting and cement materials with rain wash; wash water from dust suppression sprays; and fuel and lubricants from maintenance of construction vehicles and mechanical equipment. Sewage arising from the on-site construction workforce would also have the potential to cause water pollution if it is discharged directly into the nearby water bodies without any appropriate treatment.
- 4.28 No adverse water quality impact would be expected during the operation phase of the proposed landslide preventive works. The proposed drainage adits will be constructed to replace the existing horizontal drainage system. The new system will be designed to regulate the groundwater table within its seasonal range and therefore the existing groundwater table will be maintained.

Waste Management

Construction Phase

- 4.29 Construction and demolition (C&D) material would be generated from excavation works for the construction of the proposed two drainage adits.
- 4.30 Estimated volumes of the C&D material are summarized in Table 4.3 below. The quantity of soil generated from installation of the flexible barriers would be insignificant and the total volume of C&D material given in Table 4.3 below would cover this works item. Approximately 50m³ of soft material and 100m³ of good quality rock will be reused in the Project as general fill and for construction of drainage layer, respectively. Provided that these waste materials are handled, transported and disposed of using the recommended methods in Section 5 and that good site practices are adhered to, no adverse environmental impacts and nuisance would be expected.

Table 4.3 Estimated Quantities of Waste Material Arisings

Construction works	Soil (m ³)	Rock (m ³)	Total (m ³)
Portal Formation	800		800
Portal Chamber	1200	2800	4000
TBM Tunnels		6200	6200
			11000

Operation Phase

- 4.31 No adverse impact would be expected during the operation phase of the proposed landslide preventive works.

Ecology

Potential Sources of Environmental Impacts

- 4.32 Several potential ecological impacts resulting from construction and operation phase activities have been identified. These would include:
- Limited impact to approximately 260m² secondary woodland habitat due to construction of concrete foundations of the flexible barrier. Impacts to the woodland habitat are considered limited as no tree-felling would be required. Also, these works would take place outside of Pok Fu Lam Country Park.
 - Impacts to approximately 77m² engineered cut slope, largely consisting of a hydroseeded area dominated sword grass (*Miscanthus* sp.) and occasional common trees (*Acacia confusa*, *Macaranga tanarius*), due to construction of drainage adit which would lie outside of the Pok Fu Lam Country Park boundary.
 - Temporary disturbance to landscaped amenity area (i.e. the rest garden) due to establishment of temporary works area.
 - Indirect disturbance to habitats and associated fauna adjacent to works areas resulting from increased human activity and noise-generating construction plant.
 - Indirect disturbance to habitats resulting from storage or dumping of construction material.

Prediction and Evaluation of Impacts

- 4.33 Using the basic design parameters described in **Section 1** and illustrated in **Figure 1.2** for reference, potential ecological impacts resulting from construction/operation phase activities have been evaluated according to *Table 1 of Annex 8* of the EIAO-TM, and are summarised in **Tables 4.4a-4.4c** below.

Table 4.4a Overall Impact Evaluation to Secondary Woodland Habitat in the Study Area

Evaluation Criteria	Overall Impact Evaluation
Habitat quality	Moderate-high.
Species	Seven floral and seven faunal species of conservation importance recorded from this habitat type. There would be potential direct impacts to individuals of plant species of conservation importance (<i>Artocarpus hypargyreus</i> , <i>Neottopteris nidus</i> and <i>Pavetta hongkongensis</i>) recorded close to alignment of the flexible barrier.
Size/Abundance	Approximately 260m ² of woodland habitat directly impacted by the proposed works.
Duration	Direct impacts would be permanent.
Reversibility	Direct impacts would be irreversible.
Magnitude	Very Minor.
Overall impact conclusion	Low.

Table 4.4b Overall Impact Evaluation to Temporary Stream Habitats in the Study Area

Evaluation Criteria	Overall Impact Evaluation
Habitat quality	Low-Moderate.
Species	No significant records
Size/Abundance	No direct or indirect impacts.
Duration	No direct or indirect impacts.
Reversibility	No direct or indirect impacts.
Magnitude	No direct or indirect impacts.
Overall impact conclusion	No Impact.

Table 4.4c Overall Impact Evaluation to Other Habitats in the Study Area

Evaluation Criteria	Overall Impact Evaluation
Habitat quality	Low.
Species	No significant records.
Size/Abundance	Approximately 77m ² engineered cut slope would be directly impacted by the proposed works.
Duration	Direct impacts engineered cut slope would be permanent. Impacts to landscaped amenity area would last for the duration of the construction phase and a period of re-establishment during operation phase.
Reversibility	Direct impacts to engineered cut slope would be irreversible. The landscaped amenity area would be reinstated following the completion of the construction phase, impacts to this habitat would therefore be reversible.
Magnitude	Very Minor.
Overall impact conclusion	Negligible.

- 4.34 Impacts to secondary woodland habitat would result from construction of concrete foundations of the flexible barrier. These impacts are considered relatively minor as only a small area of habitat would be directly affected. The concrete foundations would be approximately 1.5m in width, and would require a 2m wide footprint for installation. As the flexible barrier would total about 130m in length, the total footprint would therefore be approximately 260m². The alignment of the flexible barrier will be 'fine-tuned' based on the results of a tree survey, and therefore tree felling would be avoided.

Aside from these impacts, no other substantial woodland habitat loss is expected. Construction of the flexible barrier would require no heavy machinery, and all construction materials etc. will be transported to the site by hand. Therefore, no substantial vegetation clearance would be required, and no tree felling would be expected.

- 4.35 Subject to confirmation of the detailed design of landslide preventive works, three plant species of conservation importance (*Artocarpus hypargyreus*, *Neottopteris nidus* and *Pavetta hongkongensis*) recorded close to the alignment of the flexible barrier could be potentially impacted by construction phase activities. Potential impacts to these plant species would require mitigation.
- 4.36 Indirect disturbance impacts to fauna found in areas adjacent to the works area (including species of conservation importance) is expected to be relatively minor: Works would be limited in scale, temporary, and none of the species of conservation importance recorded from areas adjacent to the works areas are known to be particularly sensitive to disturbance. All of these species can be found in close proximity to urbanised areas and other sources of disturbance, indeed, the range of the Yellow-crested Cockatoo in Hong Kong is largely restricted to the urbanised and highly disturbed Mid-levels district of Hong Kong Island. No impacts to the two avifaunal species of conservation interest recorded flying over the Study Area (Black Kite and Peregrine Falcon) are expected. *Nanhaipotamon hongkongense* is amphibious in nature, and although is associated with stream banks (where it digs a burrow), it forages on land during rain, often at some distance from its burrow. Therefore the impact to woodland habitat resulting from flexible barrier construction would result in the loss of potential foraging habitat for this species. However, given the very small area of habitat affected (260m²), this impact is considered very minor.
- 4.37 No ecological impacts to the two streams lying to the east and west of the proposed works are expected. The nearest above ground works would be approximately 300m from the streams, which are located in different water catchments to the proposed works area.
- 4.38 Other impacts would be limited to the loss of very small areas of low ecological value habitats (engineered cut slope, landscaped amenity area) that supported no species of conservation importance. Ecological impacts to these habitats are considered negligible.

Landscape & Visual

Construction Phase

- 4.39 Landscape and visual impacts during the construction phase would be moderate. The existing Mid-level neighbourhood is pleasant and densely vegetated in comparison with other districts in Hong Kong. The temporary works area will occupy a small existing public rest garden (Open Space) with mostly turf and a few trees. There will be an immediate but temporary loss of greenery and recreational opportunity, affecting users from adjacent high-rises. As recently agreed onsite with representatives from LCSD, there should be no tree felling and all trees within the rest garden shall be transplanted. It was agreed that all trees proposed to be transplanted should involve only direct transplanting, i.e., without transplanting to an offsite temporary nursery, to maximize tree survival. Trees shall either be directly transplanted to new locations onsite or to another LCSD's park within the district. The tree transplanting scheme, together with the reinstatement proposal, was also presented and supported by District Council back on September 2005. A survey showing the existing trees to be affected is enclosed in Appendix 4.3.
- 4.40 The forecasted landscape impacts are quantified as follows:
- No. of existing trees to be transplanted to another LCSD's park = 6 nos
 - No. of existing trees to be transplanted within the site = 7 nos.
 - No. of existing trees to be felled = 0 nos.
 - Area of existing public Open Space (i.e., the rest garden) to be closed = 610 m²

- Area of existing slope wildgrass and shrubs within Green Belt to be removed (due to the tunnel portal) = 160 m²
- Area of existing slope wildgrass and shrubs within Green Belt to be removed (due to the flexible barrier) = 140 m²

Operation Phase

- 4.41 Visual impacts due to the proposed tunnel portal, which will permanently replace a small fraction of the exiting slope base (Green Belt), will be moderate. The proposed tunnel portal, though not uncommon in Hong Kong, may look exotic and unpleasant to the surrounding residents, especially to those in Po Shan Mansion. The massive surface area of the structure will be highly visible from the upper floors of Po Shan Mansion, as the portal will be constructed in adjacent to the relatively open rest garden. While vegetation may be planted to soften the edges of the portal, other 'hard' measures, such as a choice of subtle concrete tone or even the use of materials other than concrete, should be explored. A sketch design showing a landscape architectural design to soften the tunnel portal (refer to **Figure 4.1**) has been presented and supported by District Council.
- 4.42 The forecasted landscape impacts after reinstatement/ mitigation are quantified as follows:
- No. of existing trees to be transplanted to another LCSD's park = 6 nos.
 - No. of existing trees to be transplanted within the site = 7 nos.
 - No. of new trees to be planted to the site = 10 nos.
 - Net change in no. of trees found onsite = 4 nos. gain
 - Area of existing public Open Space permanently lost = 0 m²
 - Area of existing slope wildgrass and shrubs within Green Belt permanently lost (due to the tunnel portal) = 99 m²
 - Area of new shrub and groundcover planting within Green Belt permanently gain (due to the tunnel portal) = 97 m²
 - Area of existing slope wildgrass and shrubs within Green Belt permanently lost (due to the flexible barrier) = 140 m²
 - Area of reinstatement hydroseeding and climber mix within Green Belt permanently gain (due to the flexible barrier) = 70 m²
- 4.43 After all civil work completes, temporary works in the rest garden shall be removed/ demolished. As agreed with LCSD and supported by District Council, the rest garden (open space) will be reinstated to match the existing conditions. New trees with matching species shall be planted at the original locations where the existing trees have been transplanted away, Ornamental vegetation shall also be planted in front of the tunnel portal to help to soften it. A sketch plan presented and supported by District Council is shown in **Figure 4.2**.
- 4.44 The proposed flexible barrier, which will locate within Green Belt on the slope to the south of Po Shan Mansion, will create low impacts. It will require permanent removal of some existing wildgrass and shrubs on the slope, but it will not affect any existing trees. The alignment of the barrier is flexible and can be easily adjusted to suit site conditions. The barrier is also relatively low in comparison with the existing vegetation on the slope. Climber shall be also planted at the base of the barrier to crawl to the mesh. Together with the existing slope vegetation, the climber can effectively softened and screened the barrier. A generic landscape treatment for the flexible barrier is shown in **Figure 4.3**.

5. ENVIRONMENTAL PROTECTION MEASURES TO BE INCORPORATED IN THE DESIGN AND ANY FURTHER ENVIRONMENTAL IMPLICATIONS

Environmental Protection Measures to be incorporated in the Design

Airborne Construction Noise Control Measures

Good Site Practices

- 5.1 Although the noise mitigation effects are easily quantifiable and the benefits may vary with site conditions and operating conditions, good site practices are easy to implement and do not impact upon the works schedule. Good site practices listed below should be followed during each phase of construction:
- Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction program.
 - Silencers or mufflers on construction equipment should be utilized and should be properly maintained during the construction program.
 - Mobile plant, if any, should be sited as far from NSRs as possible.
 - Machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum.
 - Plant known to emit noise strongly in one direction should, wherever possible, be orientated so that the noise is directed away from the nearby NSRs.
 - Material stockpiles and other structures should be effectively utilised, wherever practicable, in screening noise from on-site construction activities.

Adoption of Quieter PME

- 5.2 Construction noise emissions would be minimised by adopting quieter PME. A list of quieter PME that were used in the prediction of construction noise is shown in **Table 5.1** and **Appendix 5.1A**. The quieter PME adopted in the assessment were taken from the BS5228: Part 1:1997. The proposed list of quieter PME has been confirmed to be practical in completing the works within the schedule. The type of quieter PME adopted in this assessment is not a must that the Contractors have to use specific items of plant for the construction operations. The Contractors are allowed to use other type of quieter PME, which have the same total SWL, to meet their needs.

Table 5.1 Quieter PME Recommended for Adoption during Construction Phase

Powered Mechanical Equipment (PME)	Reference	Sound Power Level (SWL)
Backhoe	BS C3/97	105
Dump Truck	BS C9/39	103
Generator	CNP102	100

Use of Movable Noise Barrier and Noise Enclosure

- 5.3 The use of movable barrier and noise enclosure for certain PME could further alleviate the construction noise impacts.
- 5.4 In general, 5dB(A) reduction for movable PME, 10dB(A) for stationary PME and about 15dB(A) for enclosed ones can be achieved depending on the actual design of movable noise barrier and enclosure.

- 5.5 For this assessment, the use of 3.5m high vertical barrier with a 1.5m long cantilevered upper portion inclined at 45° located within approximately 2m of the noise generating part of the PME, such that the line of sight to the NSR N1 at low floors (1-9/F) can be screened by movable barriers, would be expected to reduce the construction noise level by 5 or up to 10dB(A) for certain items of PME. A typical section showing the size and location of the proposed movable noise barrier is shown in **Figure 5.1**. **Appendix 5.1B** shows the assumed noise reduction effects achieved by the movable noise barrier for certain items of PME. The Contractor should be responsible for design the dimension of the movable noise barrier with due consideration given to the size of the PME and the requirement of intercepting the line of sight between the NSRs and PME. Barrier material of surface mass in excess of 7 kg/m² is recommended to achieve the predicted screening effect.
- 5.6 The use of noise enclosure for hand-held breaker and grout pump as shown in **Figure 5.2** would be considered a possible option for alleviating the construction noise impacts. It is envisaged that 10dB(A) reduction of noise from the hand-held breaker and grout pump could be achieved according to GW-TM.
- 5.7 The Engineer confirmed that the proposed movable barrier and noise enclosure would be feasible and practical as a noise mitigation measure for tunnel portal formation, and spoil handling for portal chamber formation, tunnel excavation and sub-vertical drains.

Mitigated Airborne Construction Noise Impacts

- 5.8 Mitigated construction noise levels were predicted at various NSRs (**Table 5.2** refers) taking into account the noise reduction provided by the above-mentioned mitigation measures. Detailed calculation of construction noise levels for the mitigated scenario is provided in **Appendix 5.2B**. Ranges of mitigated and unmitigated construction noise levels predicted at representative NSRs are both shown in **Table 5.2**.

Table 5.2 Ranges of Unmitigated and Mitigated Construction Noise Levels

NSR	Unmitigated Noise Levels, dB(A)	Mitigated Noise Levels, dB(A)	EIAO-TM Normal Daytime Construction Noise Criteria, dB(A)	Mitigation Measures Proposed
N1	67 - 84	65 - 73	75	Use of Quiet PME, Movable Noise Barrier ⁽¹⁾ and Noise Enclosure
N2	63 - 74	56 - 73	75	Use of Quiet PME
N3	63 - 69	54 - 67	75	Use of Quiet PME
N4	62 - 68	52 - 66	75	Use of Quiet PME
N5	57 - 77	57 - 71	75	Use of Quiet PME
N6	61 - 75	61 - 71	75	Use of Quiet PME

Notes: (1) For works at Area A, noise reduction effect achieved by the use of movable barriers at NSR N1 above 9/F was assumed to be negligible in the assessment.

- 5.9 As shown in **Table 5.2**, with the adoption of practicable noise mitigation measures, construction noise levels due to the proposed landslide preventive works at Po Shan Road would range from 52 to 73dB(A), which would be well within the EIAO-TM daytime construction noise criteria. Maximum construction noise level of 73 dB(A) was predicted at NSR N1 and N2 (which represent about 39 dwellings in total). According to the preliminary construction programme as shown in Appendix 2.1, maximum noise level would be predicted in the months of March to June 2006 at NSR N1 and December 2006 to March 2007 at NSR N2.
- 5.10 The proposed mitigation measures and PME have made reference to the projects of similar nature and conditions in Hong Kong, and are expected to be practical in completing the works within the schedule.

Residual Environmental Impacts

- 5.11 With the recommended mitigation measures in place, no adverse residual airborne construction noise impact would be expected.
- 5.12 For contingency planning, weekly construction noise monitoring at representative NSRs should be carried out to ensure the above noise mitigation measures would be implemented properly and to check on compliance with the assessment criteria.
- 5.13 In the unlikely event of non-compliance with the construction noise criteria, all noisy construction activities should be discontinued to identify sources of non-compliance. If the results of investigation reveal that the exceedance is due to the construction works of the Project, the Contractor should formulate and implement remedial measures such as carrying out maintenance for any defective equipment or re-scheduling of works such that any non-compliance can be rectified. The Engineer should conduct additional monitoring to confirm the effectiveness of the remedial measures. The additional monitoring should be continued until the recorded levels are rectified or proved to be irrelevant to the construction activities.
- 5.14 Although it would be considered unlikely that the construction of the Project would induce insurmountable traffic noise impact, a survey on the number of construction vehicles entering/leaving the proposed works areas would be carried out. The Engineer would make reference to the survey data to “fine-tune” the construction programme if necessary to ensure that project-induced traffic noise impact at the NSRs at Po Shan Road would be minimised as far as practicable.

Air Quality

Construction Dust

- 5.15 To ensure compliance with the AQOs and TSP criteria of EIAO-TM, dust suppression measures as stipulated in *Air Pollution Control (Construction Dust) Regulation* should be implemented and good site practices should be incorporated in the contract clauses to minimize construction dust impact. A number of practical dust control measures are listed below:
- Regular watering to reduce dust emissions from exposed site surfaces and unpaved road, with complete coverage, particularly during dry weather.
 - Frequent watering for particularly dusty static construction areas and areas close to ASRs.
 - Covering of all dusty vehicle loads transported to, from and between site locations with tarpaulin.
 - Establishment and use of vehicle wheel and body washing facilities at the exit points of the site.
 - Routing of vehicles and positioning of construction plant at the maximum possible distance from ASRs.
 - The belt conveyor used for spoil transfer should be enclosed on the top and the 2 sides.
 - The transfer point between any two belt conveyors should be totally enclosed.
 - An effective belt scraper or equivalent device should be installed at the head pulley of the belt conveyor to dislodge fine particles that may adhere to the belt surface and to reduce carry-back of fine particles on the return belt, and the belt scraper or equivalent should be equipped with bottom plates or other similar means to prevent falling of materials from the return belt.
 - The level of stockpiling belt conveyor should be adjusted such that the vertical distance between the belt conveyor outlet and the material landing point is maintained at not more than 1m.

- The area for the unloading of dusty materials from a belt conveyor outlet to any stockpile or trucks should be enclosed on the top and the 3 sides.

- 5.16 Weekly site inspections to inspect proper implementation of the above-recommended control measures should be conducted during construction phase of the Project.
- 5.17 Although it would be unlikely that traffic emissions induced by the Project would result in insurmountable air quality impact during construction phase, a survey on the number of construction vehicles entering/leaving the proposed works areas would be carried out. The Engineer and Contractor would make reference to the survey data to “fine-tune” the construction programme if necessary to ensure that air quality impact due to emissions from induced traffic at the ASRs at Po Shan Road would be minimised as far as practicable.

Residual Environmental Impacts

- 5.18 With the implementation of the proposed dust suppression measures, good site practices along with regular environmental audits, no adverse residual construction phase air quality impact would be expected.

Water Quality

- 5.19 The Contractor shall comply with the Water Pollution Control Ordinance (WPCO) and its subsidiary regulations.
- 5.20 The Contractor should ensure that all runoff arising from the works area are properly treated, e.g. by the use of sedimentation tank or silt trap, and that the discharge standards as stipulated in WPCO are met. Any trade effluent or foul or contaminated or cooling or hot water should not be discharged into any public sewer, stormwater drain, channel, stream course or the sea. If toilet facilities are erected, foul water effluent should be directed to the public foul sewer.
- 5.21 The Contractor should be responsible for the design, construction, operation and maintenance of all the mitigation measures and practices specified in the Professional Persons Environmental Consultative Committee Practice Note (ProPE0CC PN) 1/94 "Construction Site Drainage" issued by the Director of Environmental Protection.
- 5.22 Precautionary protection measures for the drainage culvert should be implemented by the contractor. Measures should include diversion of construction site effluent away from the drainage culvert, and placement of construction equipment and materials away from the drainage culvert.
- 5.23 Groundwater will be monitored by 29 nos. of automatic groundwater monitoring devices (AGMD) installed at the piezometers on the concerned natural hillsides. If abnormal groundwater drawdown is identified, groundwater table will be replenished by pumping water through a series of proposed recharge well. The monitoring will be conducted during construction phase of the Project. Following completion of the Project, post-construction monitoring will be carried out for two years. The need for carrying out further monitoring will be reviewed by making reference to monitoring data obtained during the construction and post-construction periods as appropriate.
- 5.24 No adverse water quality impact would be expected during operation phase of the Project.

Residual Environmental Impacts

- 5.25 With the implementation of the recommended mitigation measures, no adverse residual impact on water quality is anticipated.

Waste Management

- 5.26 The Contractor should comply with the Waste Disposal (Chemical Waste) (General) Regulation, the Waste Disposal Ordinance and its subsidiary regulations. A Waste Management Plan should be included by the Contractor in the construction contract.
- 5.27 The Contractor should not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the site onto any adjoining land or allow any waste matter which is not part of the final product from any waste processing plants to be deposited anywhere within any site or onto any adjoining land.
- 5.28 The construction and demolition material generated by the Contractor on-site should be transported to the public filling facility designated by CEDD. Monitoring of the Contractor's compliance with the requirements of the trip ticket system in accordance with ETWB TCW No. 31/2004 should be carried out to ensure that the correct procedures are being followed at all times.

Residual Environmental Impacts

- 5.29 With the implementation of the recommended mitigation measures for the handling, transportation and disposal of waste arisings, unacceptable residual impacts would not be expected during the construction of the proposed landslide preventive works.

Ecology

- 5.30 It is essential that landslide preventative works are carried out to alleviate severe potential risks posed by the unstable terrain in the Study Area. In this regard, some degree of disturbance and ecological impact within the Study Area would be inevitable. Nevertheless, the design of landslide preventive works has been carefully considered to avoid and minimise ecological impacts where possible, as summarised in the following points:
- The underground drainage system proposed under this Project would avoid direct impacts to moderate-high ecological value secondary woodland habitat in the Study Area.
 - Both the flexible barrier and drainage adit portal would be located outside of the Pok Fu Lam Country Park Boundary, thus minimising direct impacts to habitats inside the Country Park.
 - The precise alignment of the flexible barrier will take into account the findings of the tree survey and a future detailed vegetation survey conducted for the Project (described in the following section 5.27). The alignment would be 'fine-tuned' to avoid and minimise disturbance to mature trees and plant species of conservation importance where practicable. Tree felling would therefore be avoided.
- 5.31 Plant species of conservation importance were recorded within and adjacent to the proposed works areas. It is recommended that a detailed survey is conducted before the commencement of works to accurately map the location of these plant species of conservation importance within and adjacent to proposed works areas. The location of these plants would be taken into consideration during the detailed design of landslide preventive works (including the flexible barrier), and if practicable, they would be retained *in-situ*. If the proposed works would unavoidably affect the plants, as a last resort, it is recommended they be transplanted to suitable nearby locations prior to commencement of construction phase. A Report detailing measures to protect plant species of conservation importance found within and adjacent to works areas should be submitted to Environmental Protection Department (EPD)/ Agriculture, Fisheries and Conservation Department (AFCD) for discussion and agreement following the completion of detailed vegetation surveys, and prior to the commencement of construction phase activities.
- 5.32 Standard good site practice measures should be implemented throughout the construction phase. The measures should include:

- Placement of equipment or stockpile in designated works areas and access routes selected on existing disturbed land to minimise disturbance to woodland habitats.
- Construction activities should be restricted to works areas that should be clearly demarcated. The works areas should be reinstated after completion of the works.
- Waste skips should be provided to collect general refuse and construction wastes. The wastes should be disposed of timely and properly off-site.
- General drainage arrangements should include sediment and oil traps to collect and control construction site run-off.
- Open burning on works sites is illegal, and should be strictly prohibited.
- Temporary works areas would be re-instated following the completion of construction phase activities.
- Disturbance to existing vegetation should be minimised wherever possible. In particular, adequate protection should be provided for mature trees located within or adjacent to proposed works areas.

5.33 No tree felling is expected for the entire project.

Residual Environmental Impacts

- 5.34 Residual impacts would include limited impacts to approximately 260m² moderate-high ecological value secondary woodland habitat. Given the very small size of the affected area, and also that no tree felling is expected in woodland habitat, these impacts are considered minor. With the implementation of recommended mitigation measures, it is expected that there would be no significant residual impact to secondary woodland habitat.
- 5.35 Residual impacts to other habitats resulting from the proposed works would include the loss of a very small area of engineered cut slope habitat. Because this habitat is considered of low ecological value, these impacts are considered negligible.
- 5.36 Overall, it is expected that no substantial adverse residual ecological impacts would result from the proposed works, and that with the implementation of the proposed mitigation measures, the Project would comply with the requirements of *Annex 16* of the EIAO-TM.

Landscape & Visual

Design Stage

- 5.37 The construction contract shall designate 'no-intrusion zone' for the contractor throughout the entire site to maximize tree retention and to ensure tree protection during the construction phase.
- 5.38 All tree transplanting/ preservation and reinstatement scheme for the rest garden have already been confirmed with LCSD and supported by District Council. There will be no tree felling.

Construction Phase

- 5.39 All existing trees to be retained onsite shall be properly protected before the works start. Contractor's access to designated 'no-intrusion zone' should be prohibited.
- 5.40 The existing chainlink fence with climbers between the rest garden and Po Shan Road forms a reasonable screen. Until it is upgraded or reconstructed when the works are nearly completed, it shall be retained and protected during the construction phase.

Operational Phase

- 5.41 Rest garden shall be reinstated to meet LCSD's standards.
- 5.42 Any distributed slope shall be reinstated with matching woodland mix planting.

Residual Environmental Impacts

- 5.43 With the implementation of the proposed mitigation measures, good site practices along with regular environmental audits, the residual impact will be minimized.

Environmental Monitoring and Auditing Requirements

- 5.44 Regular environmental monitoring and site audits as described above should be carried out by a competent person with relevant professional qualifications and have sufficient relevant environmental monitoring and auditing (EM&A) experience subject to approval of the Engineer to check on compliance with relevant assessment criteria. The Project Proponent will also set up a Community Liaison Office with a telephone action hotline to enable the public to raise any matters of concern regarding the project such as complaints and comments.
- 5.45 An implementation schedule of environmental control measures is provided in **Appendix 5.3**.

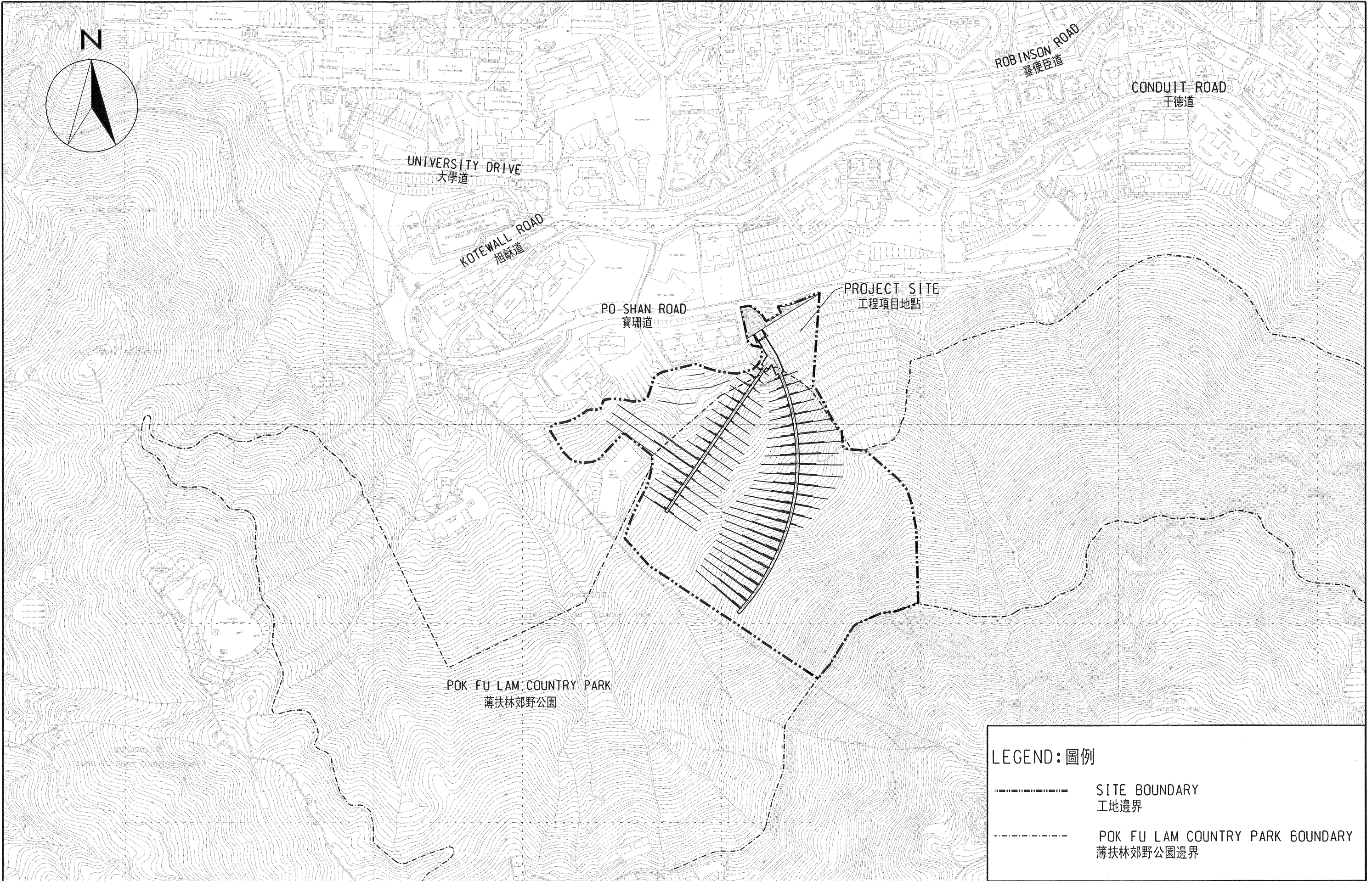
Further Implications

- 5.46 Public consultation through the Joint Action Group (JAG) of Po Shan Area has been conducting since the first meeting held in May 2005. In principle agreement has been sought from the JAG regarding the proposed Project. Besides, the proposed works have been presented to District Council Meetings under the Food, Environment, Hygiene and Works Committee and the Culture, Leisure & Social Affairs Committee in July and September 2005 respectively. Both committees have expressed their support to the proposed works including the temporary allocation of the amenity plot (i.e. rest garden) as the works area.

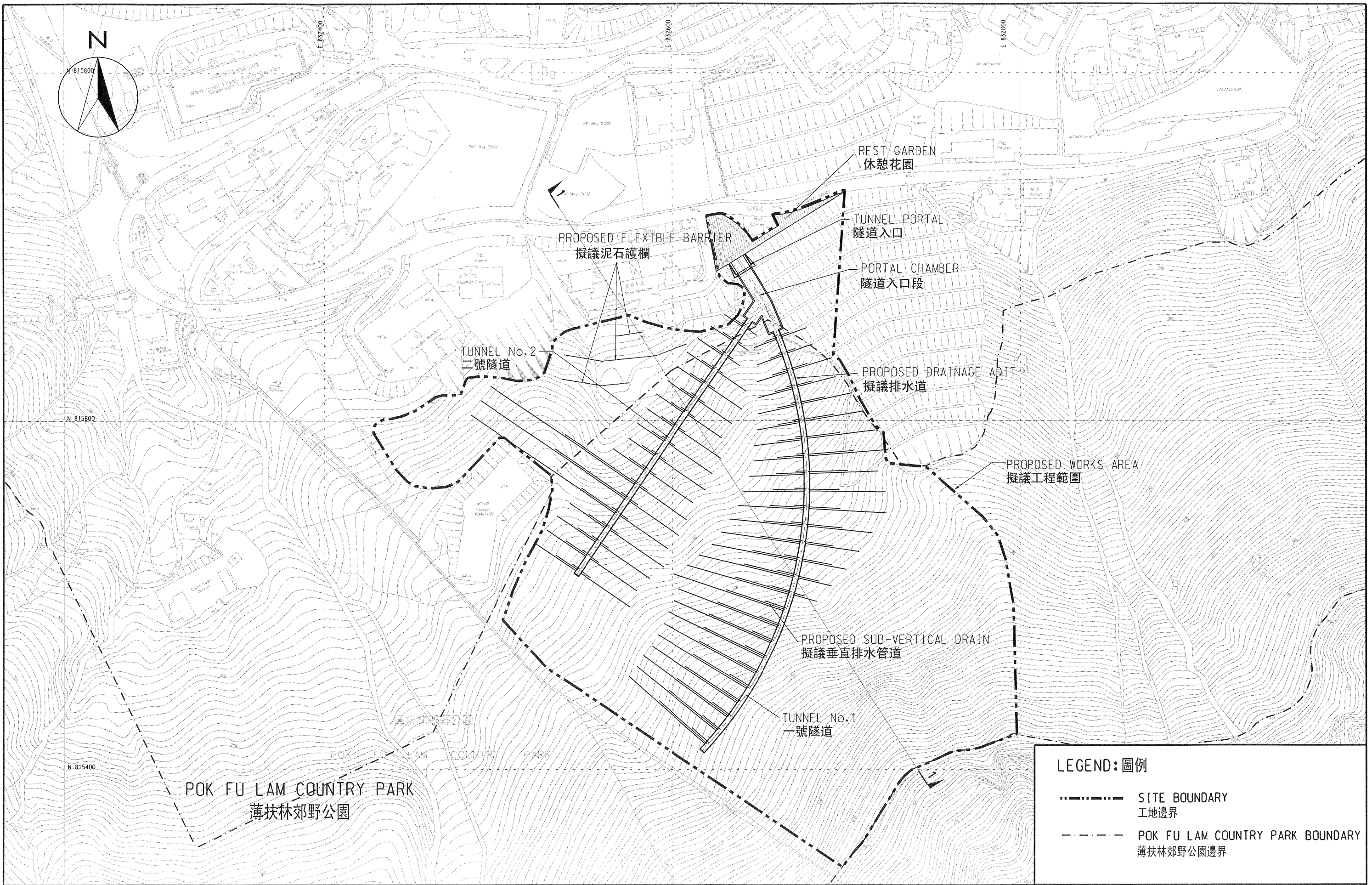
6. USE OF PREVIOUSLY APPROVED EIA REPORTS

- 6.1 No previously approved EIA reports were referenced for this project.

Figures



MAUNSELL AECOM Maunsell Environmental Management Consultants Ltd	LANDSLIDE PREVENTIVE WORKS AT PO SHAN, MID LEVEL - DESIGN AND CONSTRUCTION 半山區寶珊地段防止山泥傾瀉工程 - 設計及施工		SCALE	A3 1:3500	DATE	OCT 2005	
	LOCATION PLAN FOR THE PROJECT 工程項目位置圖		CHECK	LWYL	DRAWN	YPK	
			JOB No.	A02005	DRAWING No.	1.1	REV



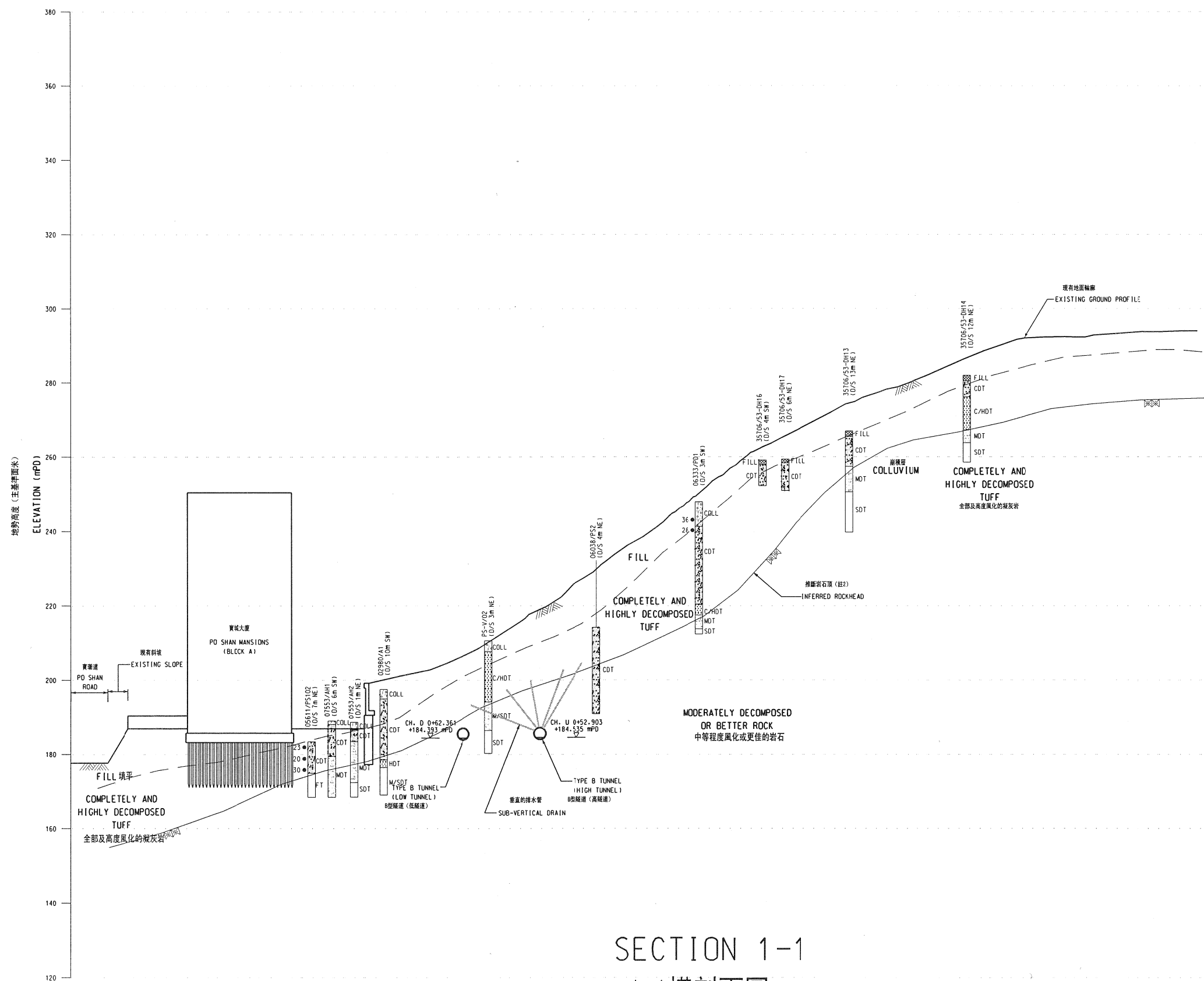
LEGEND: 圖例

.....

SITE BOUNDARY
工地邊界

POK FU LAM COUNTRY PARK BOUNDARY
薄扶林郊野公園邊界

MAUNSELL AECOM Maunsell Consultants Asia Ltd	LANDSLIDE PREVENTIVE WORKS AT PO SHAN, MID-LEVEL - DESIGN AND CONSTRUCTION 半山區寶珊地段防止山泥傾瀉工程 - 設計及施工			
	GENERAL LAYOUT PLAN 整體平面圖			
	SCALE	A3 1:2000	DATE	OCT 2005
	CHECK	LWYL	DRAWN	YPK
	JOB No.	A02005	DRAWING No.	1.2
			REV	-



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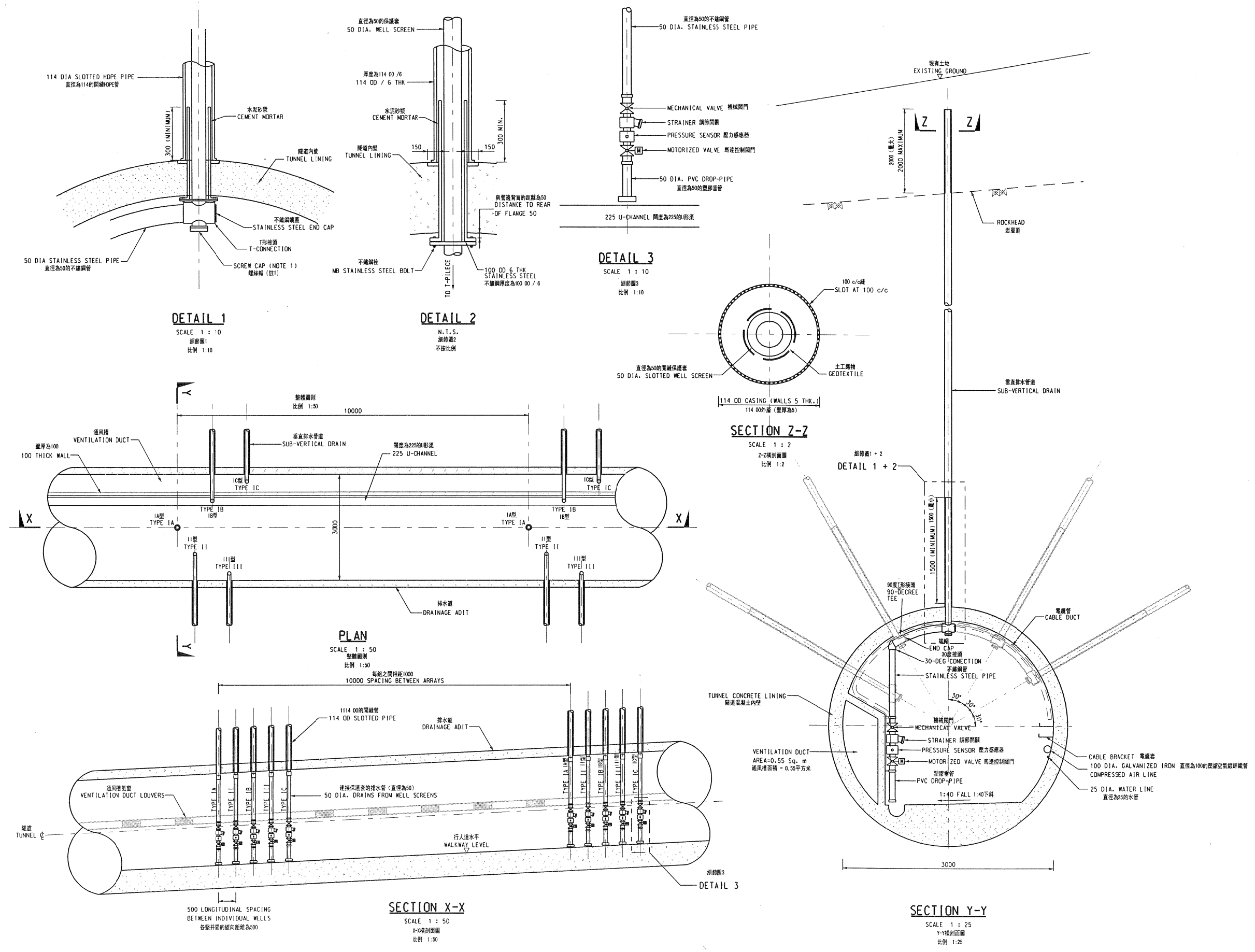
LANDSLIDE PREVENTIVE WORKS AT PO SHAN, MID-LEVELS-DESIGN AND CONSTRUCTION

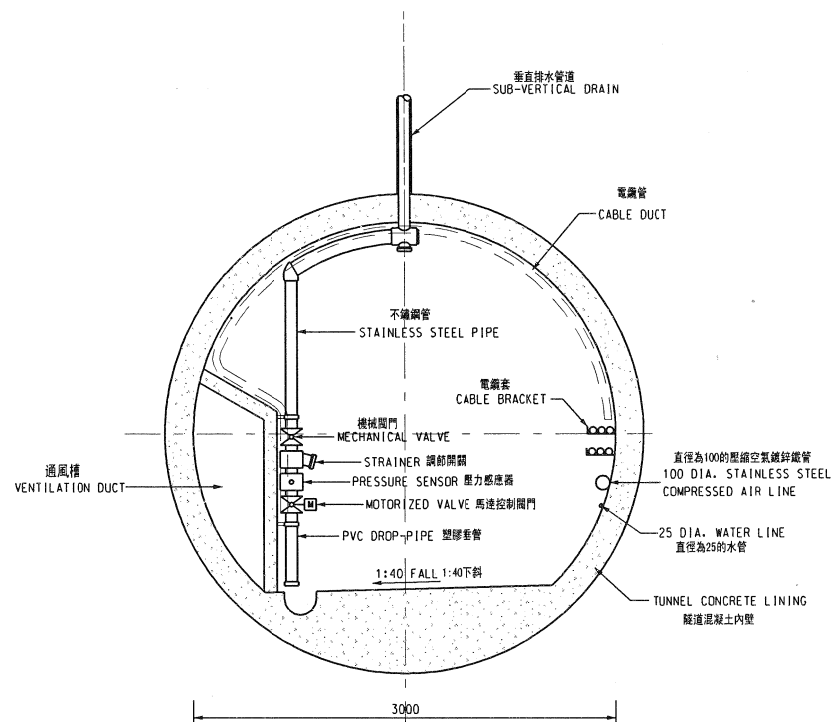
半山區寶珊地段防止山泥傾瀉工程 - 設計及施工

CROSS SECTION OF DRAINAGE ADITS

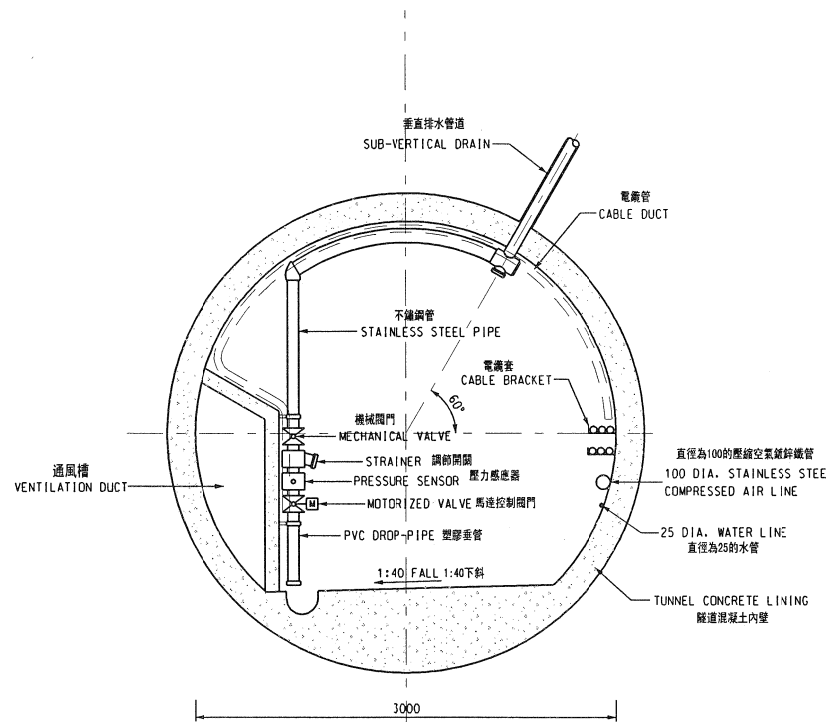
排水道橫剖面

SCALE	N.T.S	DATE	OCT 2005
CHECK	LWYL	DRAWN	YPK
JOB No.	A02005	DRAWING No.	1.3
		REV	—

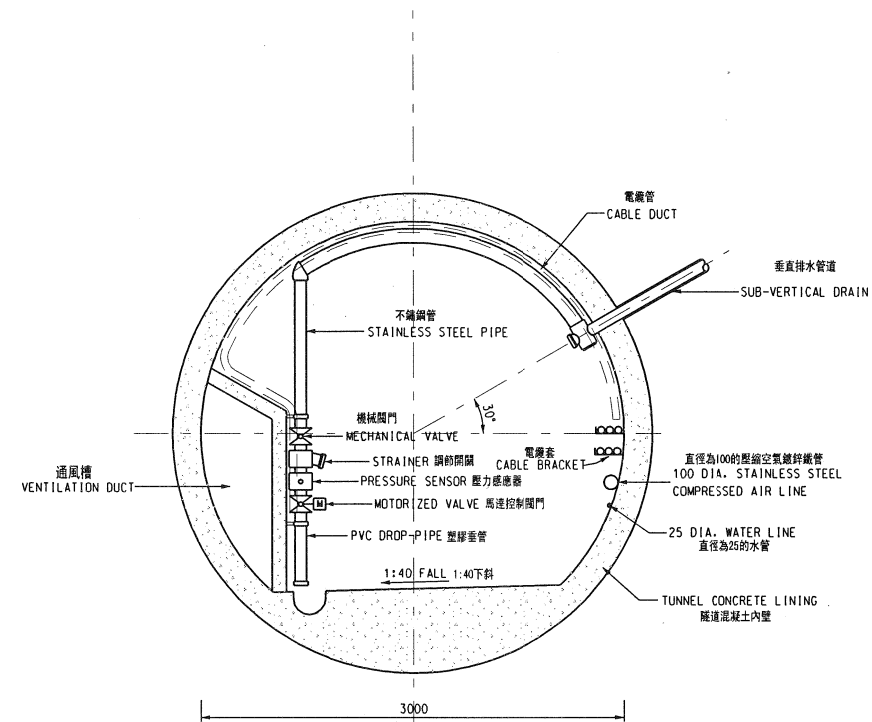




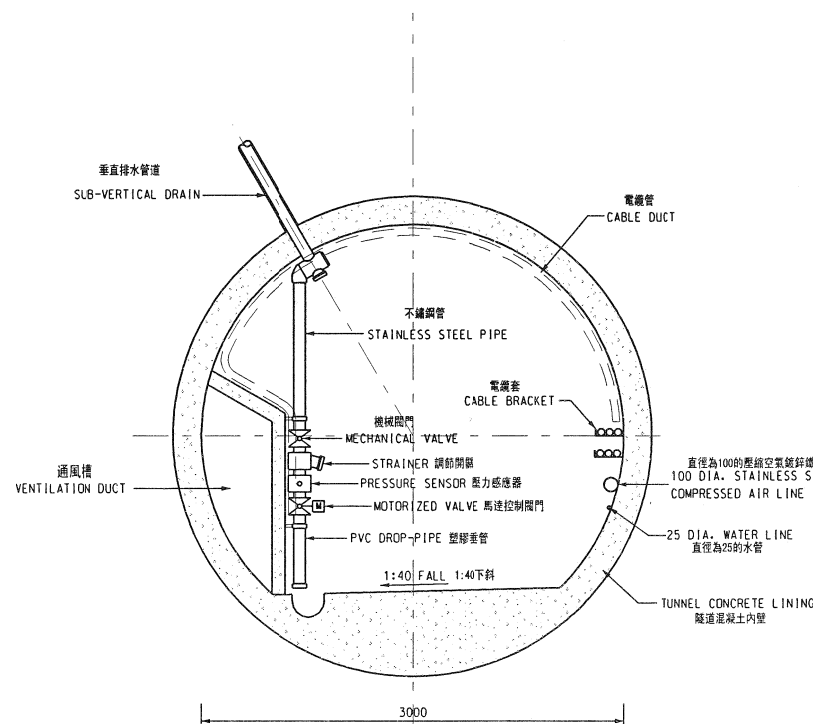
TYPE IA
SCALE 1 : 25
IA型
比例 1:25



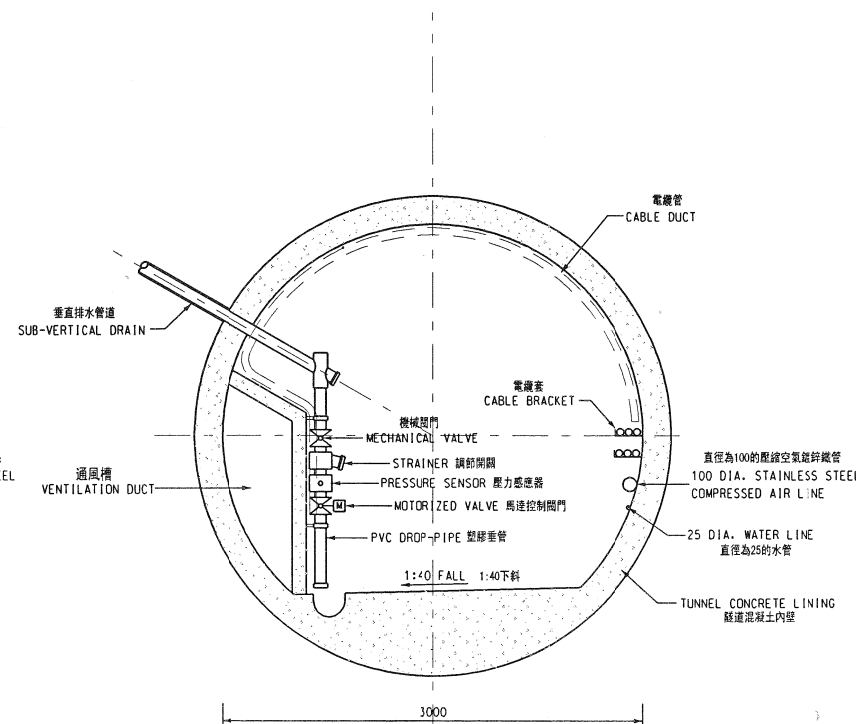
TYPE IB
SCALE 1 : 25
IB型
比例 1:25



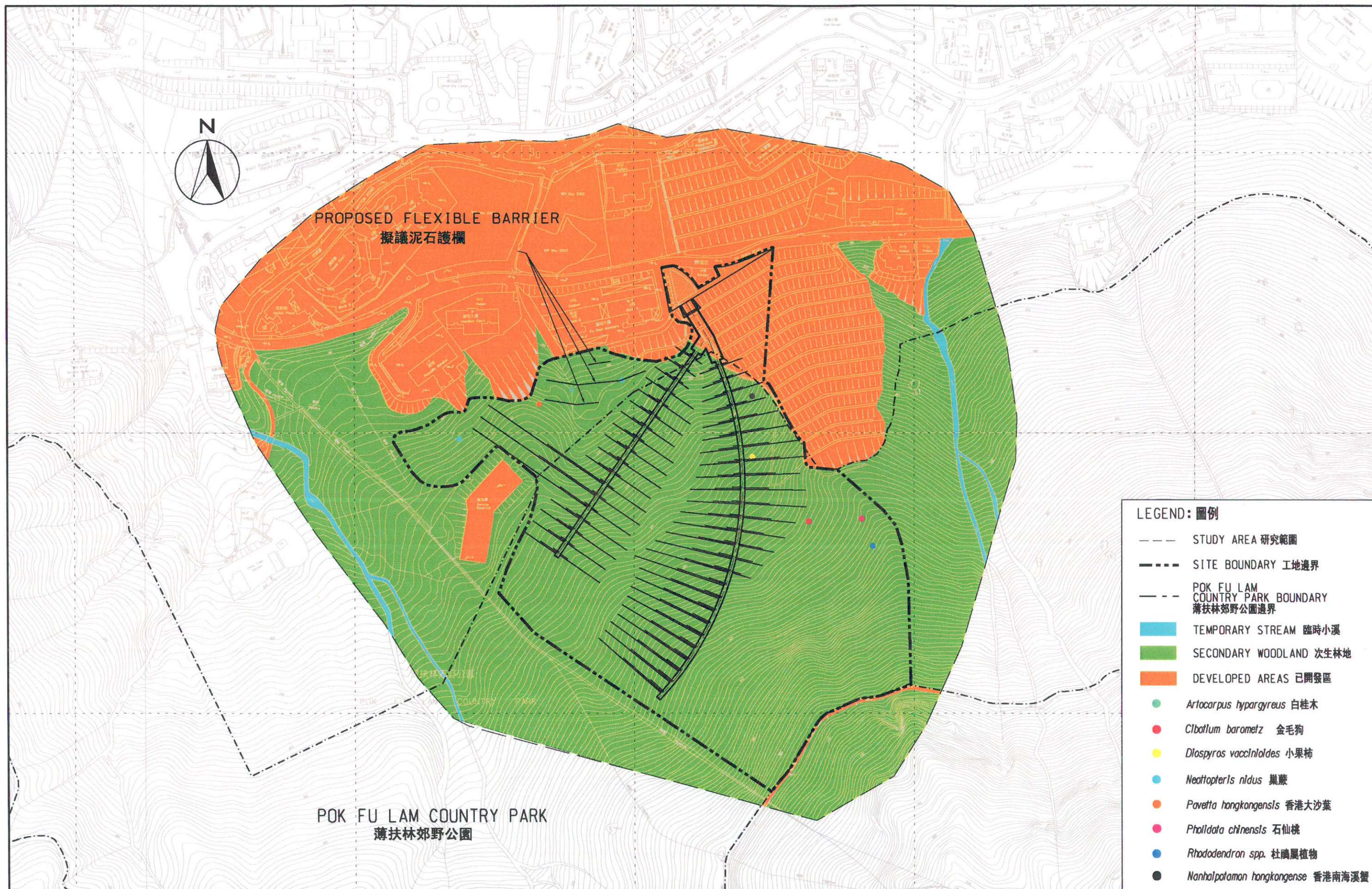
TYPE IC
SCALE 1 : 25
IC型
比例 1:25

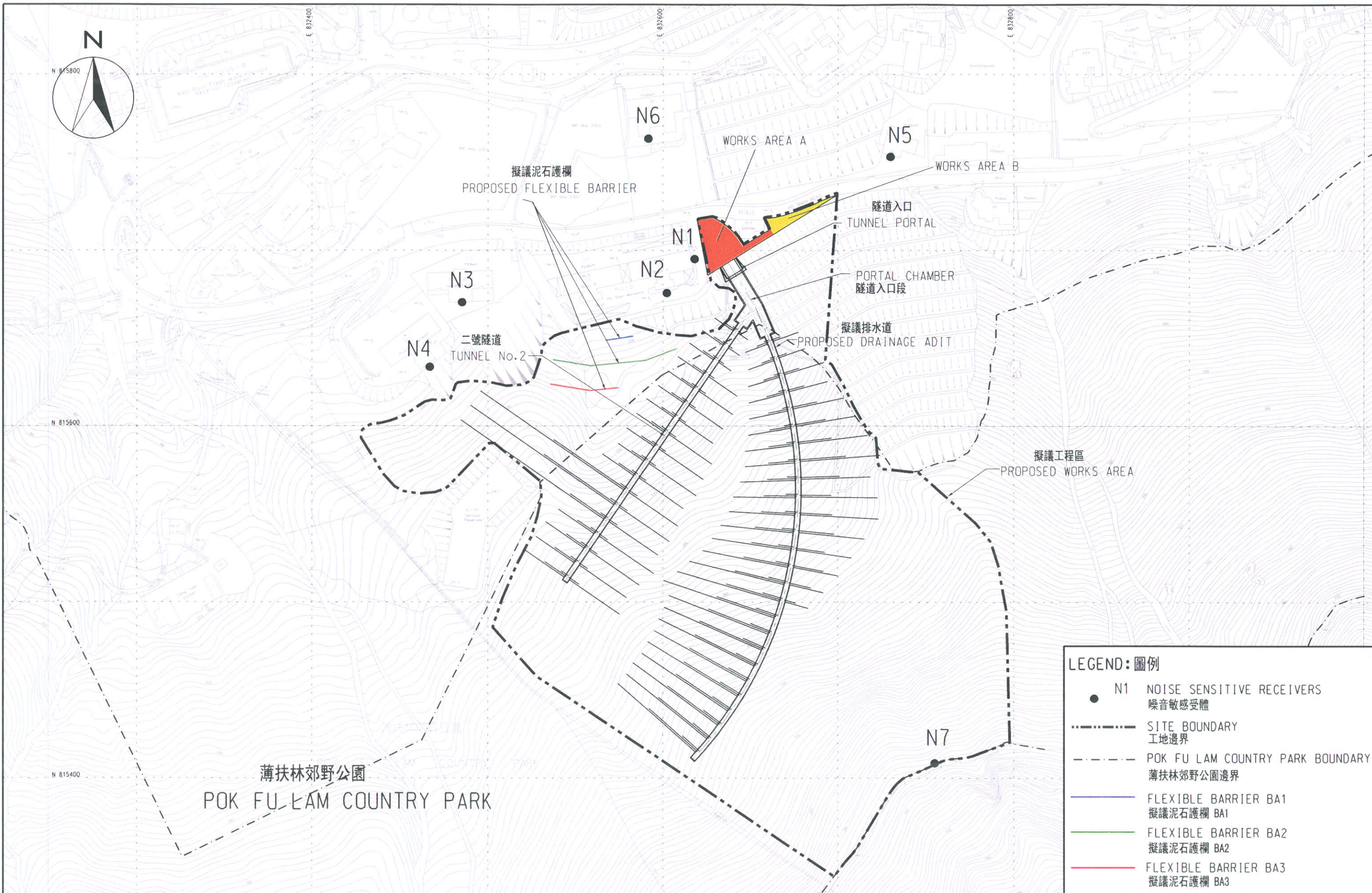


TYPE II
SCALE 1 : 25
II型
比例 1:25



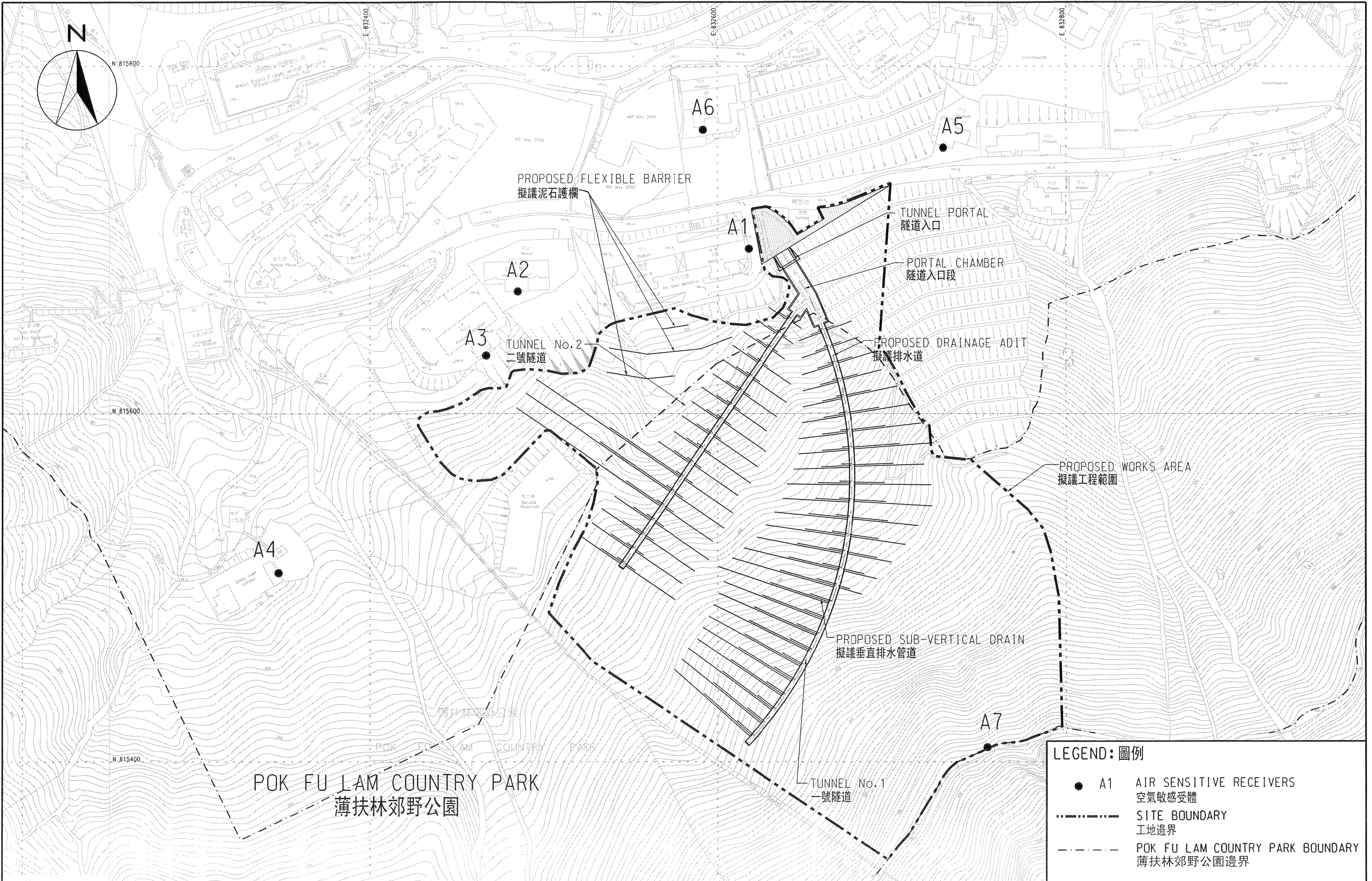
TYPE III
SCALE 1 : 25
III型
比例 1:25





LEGEND: 圖例

- N1 NOISE SENSITIVE RECEIVERS
噪音敏感受體
- SITE BOUNDARY
工地邊界
- - - POK FU LAM COUNTRY PARK BOUNDARY
薄扶林郊野公園邊界
- FLEXIBLE BARRIER BA1
擬議泥石護欄 BA1
- FLEXIBLE BARRIER BA2
擬議泥石護欄 BA2
- FLEXIBLE BARRIER BA3
擬議泥石護欄 BA3



LEGEND: 圖例

●

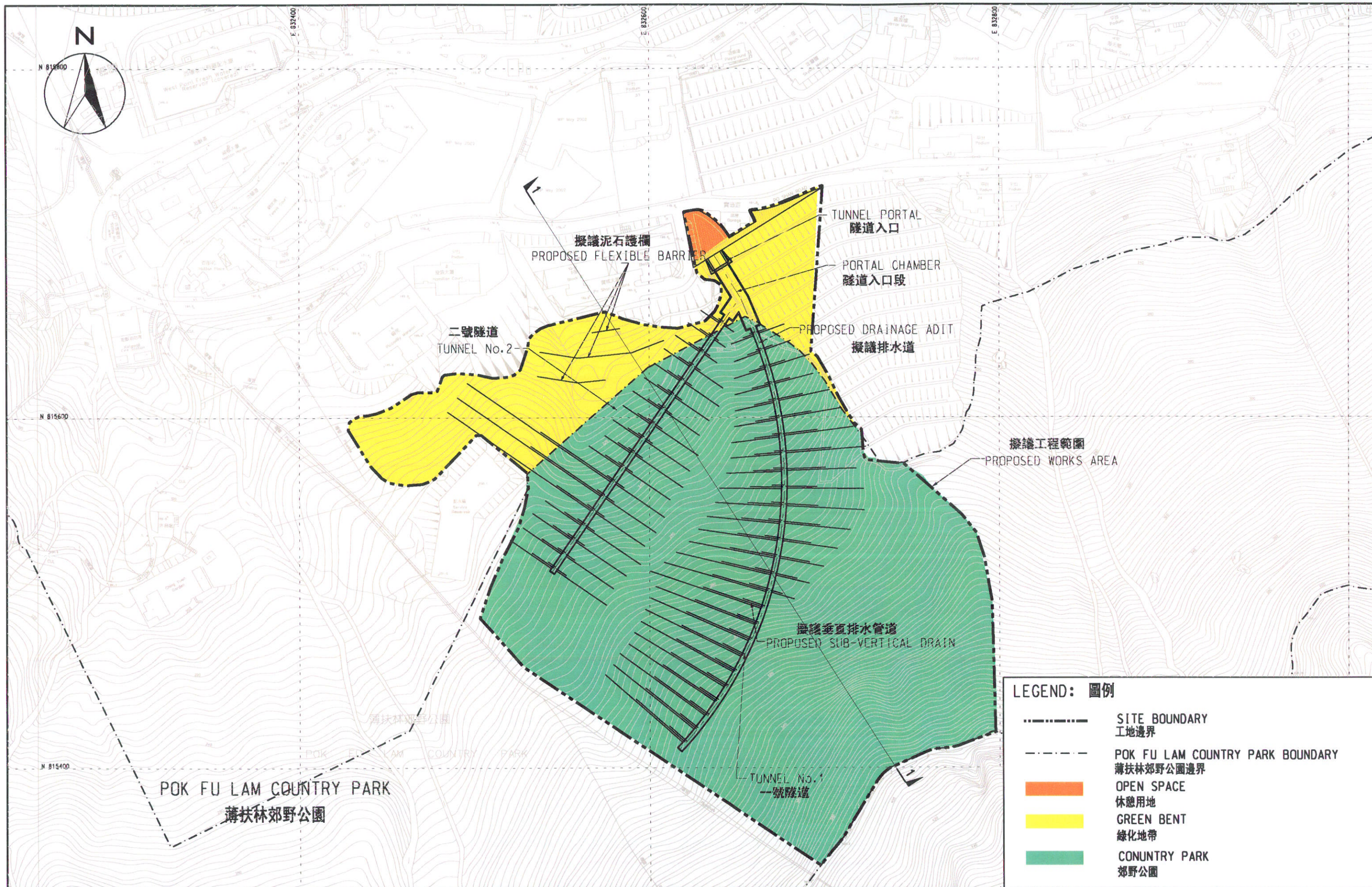
A1

AIR SENSITIVE RECEIVERS
空氣敏感受體

SITE BOUNDARY
工地邊界

POK FU LAM COUNTRY PARK BOUNDARY
薄扶林郊野公園邊界

MAUNSELL AECOM Maunsell Environmental Management Consultants Ltd	LANDSLIDE PREVENTIVE WORKS AT PO SHAN, MID-LEVELS- DESIGN AND CONSTRUCTION 半山區寶珊地段防止山泥傾瀉工程 - 設計及施工			
	LOCATIONS OF REPRESENTATIVE AIR SENSITIVE RECEIVERS 具代表性的空氣敏感受體位置圖			
	SCALE	A3 1:2000	DATE	OCT 2005
	CHECK	LWYL	DRAWN	YPK
	JOB No.	A02005	DRAWING No.	3.3
			REV	-



LEGEND: 圖例

- SITE BOUNDARY
工地邊界
- POK FU LAM COUNTRY PARK BOUNDARY
薄扶林郊野公園邊界
- OPEN SPACE
休憩用地
- GREEN BENT
綠化地帶
- CONUNTRY PARK
郊野公園

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LANDSLIDE PREVENTIVE WORKS AT PO SHAN, MID-LEVELS- DESIGN AND CONSTRUCTION
半山區寶珊地段防止山泥傾瀉工程 - 設計及施工

EXTENT OF WORKS VS. OUTLINE ZONING PLAN
工程範圍與發展大綱圖

SCALE	A3 1:2000	DATE	OCT 2005
CHECK	LWYL	DRAWN	YPK
JOB No.	A02005	DRAWING No.	3.4
		REV.	-

屋頂種植
山指甲
月橘
鵝掌藤
綠蘿

Rooftop Planting
Ligustrum sinense
Murraya paniculata
Schefflera arboricola
Scindapsus aureus

日式仿天然人造花崗石磚
混合 5 種淺棕色
(見說明圖 B)

**Japan-origin natural appearance
artificial granite tiles**
Mix of 5 tones of light brown
(See Illustration B)



Illustration A
說明圖 A



Illustration B
說明圖 B

層疊式種植
山指甲
月橘
棕竹
鵝掌
藤綠蘿

Cascaded Planting
Ligustrum sinense
Murraya paniculata
Rhapis excelsa
Schefflera arboricola
Scindapsus aureus

Climber on Metal Piano Wire
Ficus pumila
Parthenocissus himalayana
(See Illustration A)
金屬琴絃上的攀爬植物
薜荔爬牆虎
(見說明圖 A)

**Ornamental Planting in front
of Portal**
Chrysalidocarpus lutescens
Murraya paniculata
入口前裝飾種植
散尾
葵月橘

現有斜坡 - 植物未受滋擾
Existing slope
vegetation
undisturbed

Concrete structure
for slope stability
加固斜坡的混凝土結構

現有斜坡 - 植物未受滋擾
Existing slope
vegetation
undisturbed

現有斜坡 - 植物未受滋擾
Existing slope
vegetation
undisturbed

現有斜坡 - 植物未受滋擾
Existing slope
vegetation
undisturbed

Metal gate to access
tunnel
隧道金屬閘門

Chinese natural granite
(cleft finish) band
color: dark green
中國天然花崗石
(裂紋效果) 斑紋顏色:
深綠

Elevation 1:150
立視比例 1:150

Section 1:150
橫剖比例 1:150

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Landslide Preventive Works at Po Shan, Mid-levels Design and Construction
半山區寶珊地段防止山泥傾瀉工程 - 設計及施工
Mitigation to Tunnel Portal
隧道入口的緩解措施

SCALE	As shown	DATE	Aug-05
CHECK		DRAWN	
JOB NO	A02005	DRAWING No.	4.1
		Rev	



Existing view A
現有視野 A

Existing view E
現有視野 B



Item No.	Existing Item 現有項目		Reinstatement/ 復原 / 重置建議	Re-provision Proposal
項目編號	Description 說明	Quantity 數量		
1.0	Concrete bollards at entrance 入口處的混凝土柱	2 nos.	Re-provide with removable/ lockable painted GMS bollards 重新裝設，附有可移動 / 可上鎖的GMS柱，並噴上油漆。	
2.0	Warning sign to keep people off the turf 入口處的混凝土柱	1 no.	Remove, store and reuse the sign; new concrete footing (if any) to be re-provided 把標誌移走存放，然後再用，並重新裝設新的混凝土腳（若有需要）。	
3.0	Recycle plastic benches 再造塑膠椅	2 nos.	Remove, store and reuse 把長椅移走存放，然後再用。	
4.0	Refuse receptacle 垃圾箱	1 nos.	Remove, store and reuse 把垃圾箱移走存放，然後再用。	
5.0	Painted GMS metal railing 已噴上油漆的GMS金屬欄杆	22m 22米	Re-provide with painted GMS metal railing of matching style but with a lockable opening at the portal for accessing the tunnel 重新安裝適當風格並噴上油漆的GMS金屬欄杆，並需附有可上鎖的入口，以便進入隧道。	
6.0	Concrete paving 混凝土路面	270 sqm 270平方米	Re-provide concrete paving of a typical roadside pavement standard (i.e. to match HyD Std Drg No. B1102A) 重新安裝適當風格並噴上油漆的GMS金屬欄杆，並需附有可上鎖的入口，以便進入隧道。	
7.0	Turf area 草地	350 sqm 350平方米	Top 100mm existing soil to be removed and replace with topsoil or "Soil-mix" in accordance with ArchSD GS; apply hydroseeding over. 把頂層100毫米的現有泥土移走，並以表土或符合 ArchSD GS1的混合土，然後在上面噴草。	
	Bare soil area (behind private Garage 泥地（在私人車庫後）	50 sqm 50平方米	Change to concrete paving to match Item 6.0 改為混凝土路面，以配合第6.0項	
8.0	Trees 樹木	18 nos. 18株	A detail tree survey will be carried out by a qualified Landscape Architect. Either (a) transplant all to an offsite temporary nursery and then transplant back or (b) transplant all to other LCSD parks and rest gardens. Additional trees (tentatively 3 nos.) shall provided to screen off the proposed tunnel portal. 會由合資格的園藝工程師進行詳細樹木調查。 可以：(a) 把所有樹木移植於工地外的臨時苗圃，然後再移植回原地；或 (b) 把所有樹木移植於康樂文化事務署轄下的其他公園和休憩花園。 必須添加更多樹木（暫時是3株），以便掩蓋要建的隧道入口。	

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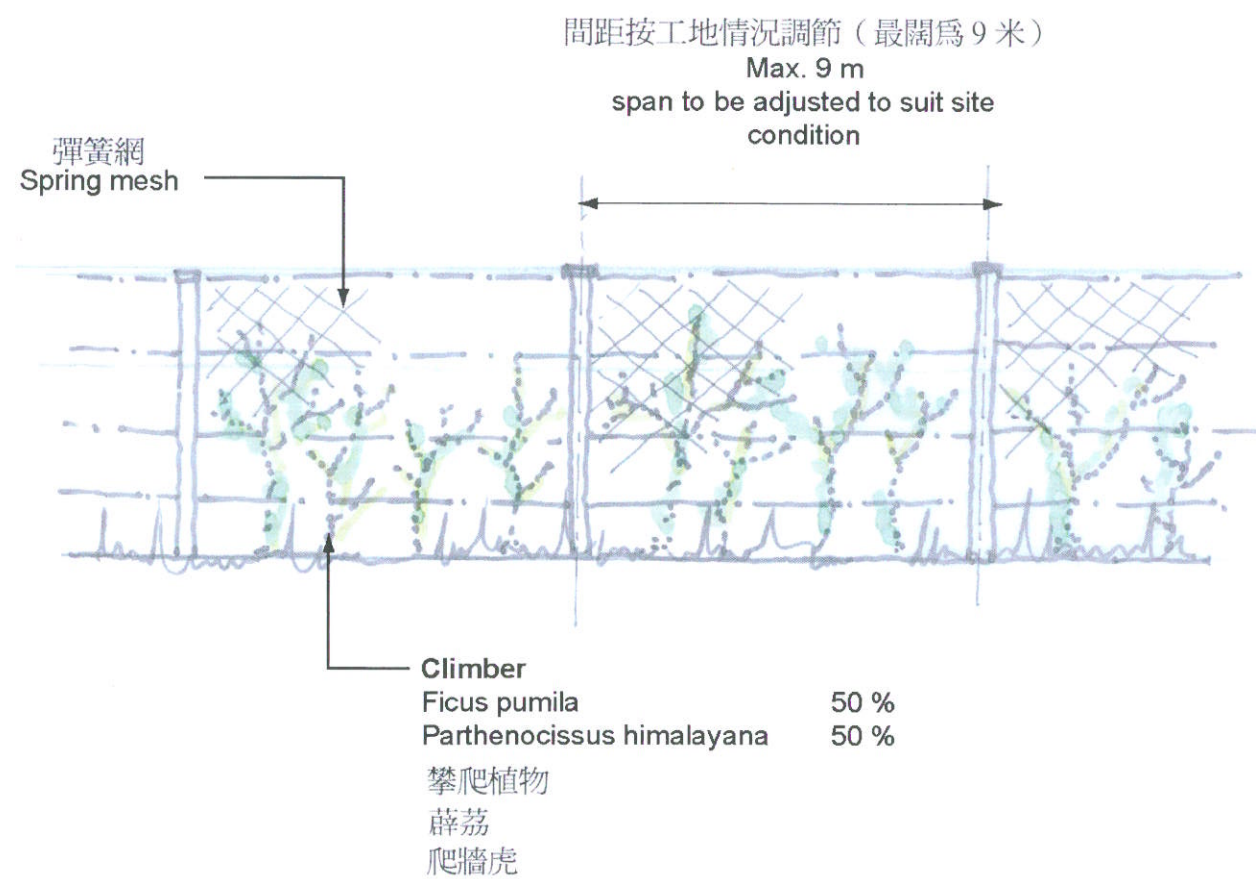
Landslide Preventive Works at Po Shan, Mid-levels Design and Construction

半山區寶珊地段防止山泥傾瀉工程－設計及施工

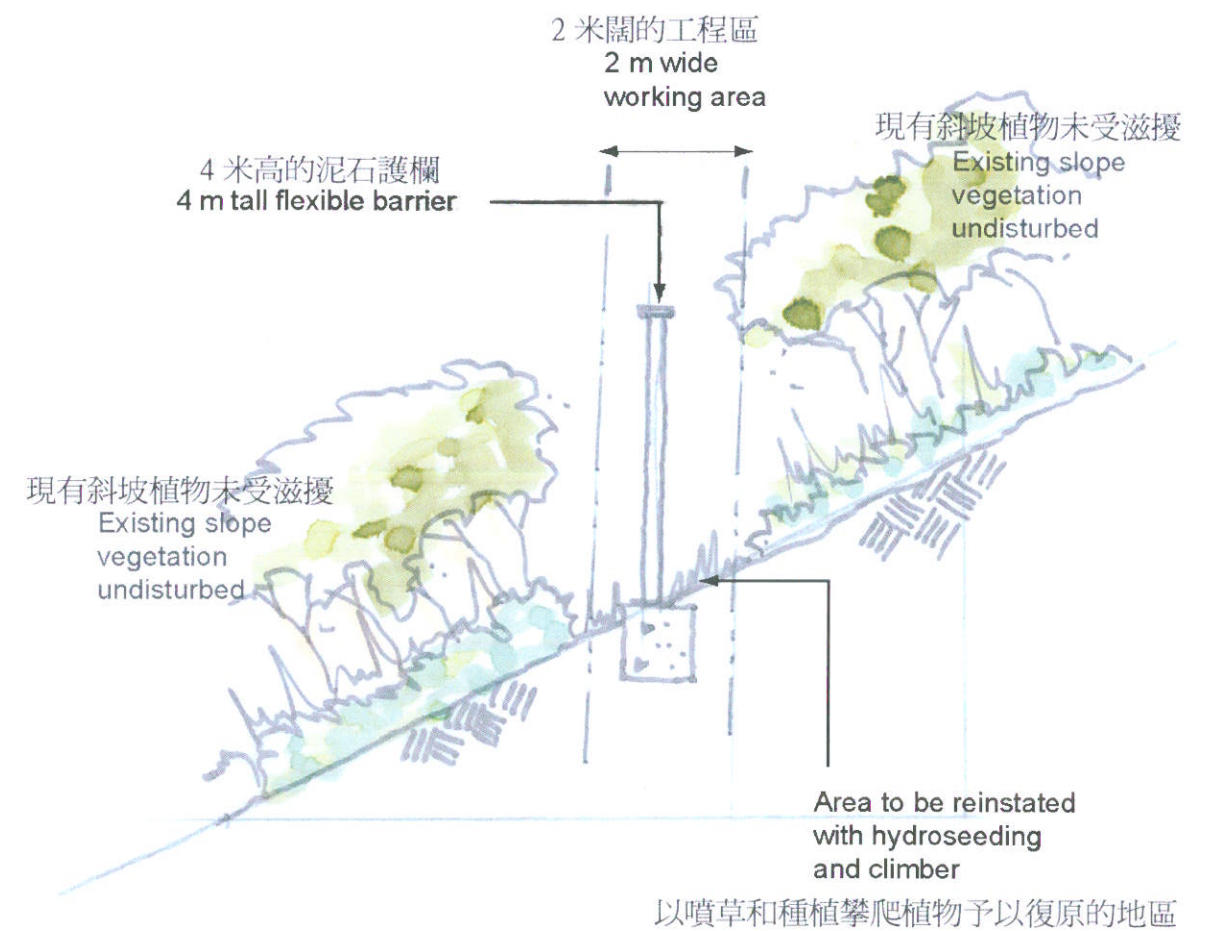
Rest Garden Reinstatement Design Intent

休憩花園復原設構圖

SCALE	1:500	DATE	Oct-05
CHECK		DRAWN	
JOB NO.	A02005	DRAWING No.	42
			Rev B



Elevation 1:100
立面比例 1:100



Section 1:100
橫剖比例 1:100

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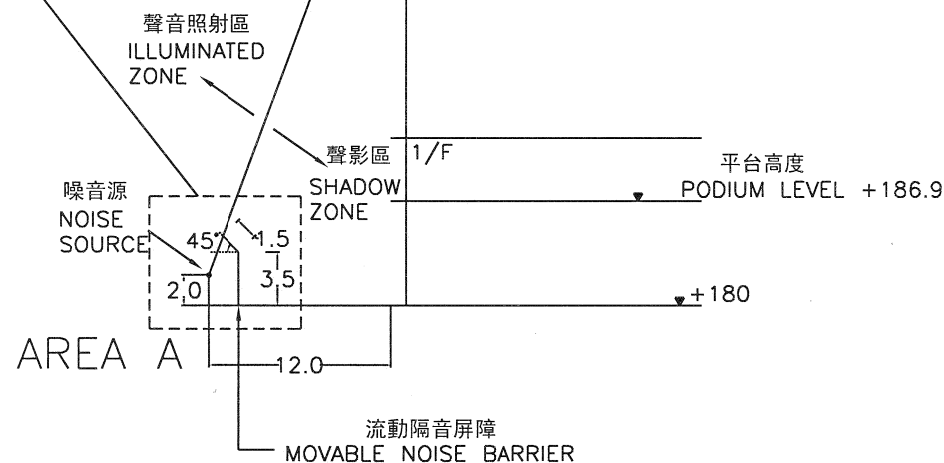
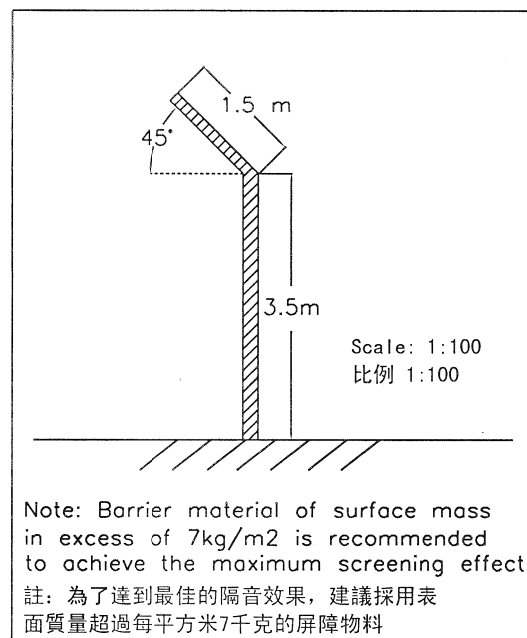
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Landslide Preventive Works at Po Shan, Mid-levels Design and Construction
半山區寶珊地段防止山泥傾瀉工程 - 設計及施工

Mitigation to Flexible Barrier
— 泥石護欄的緩解措施

SCALE	As shown	DATE	Aug-05
CHECK		DRAWN	
JOB NO	A02005	DRAWING No.	4.3
		Rev	-

NSR: N1 PO SHAN MANSION 噪音敏感受體: N1 寶城大廈



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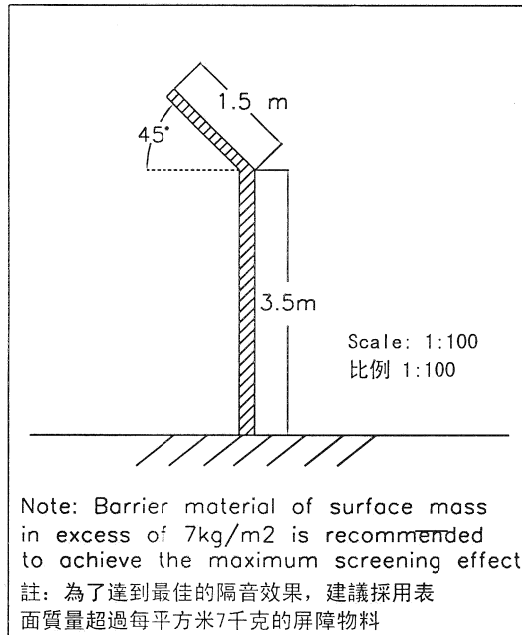
LANDSLIDE PREVENTIVE WORKS AT PO SHAN, MID-LEVELS- DESIGN & CONSTRUCTION
半山寶珊地段防止山泥傾瀉工程-設計及施工

TYPICAL SECTION OF MOVABLE NOISE BARRIER
(SHEET 1 OF 2)

流動隔音屏障的切面圖

SCALE	1:500	DATE	OCT 05
CHECK	MCTY	DRAWN	YPK
JOB No.	A02005	DRAWING No.	5.1
		REV	—

NSR: N1 PO SHAN MANSION 噪音敏感受體: N1 寶城大廈

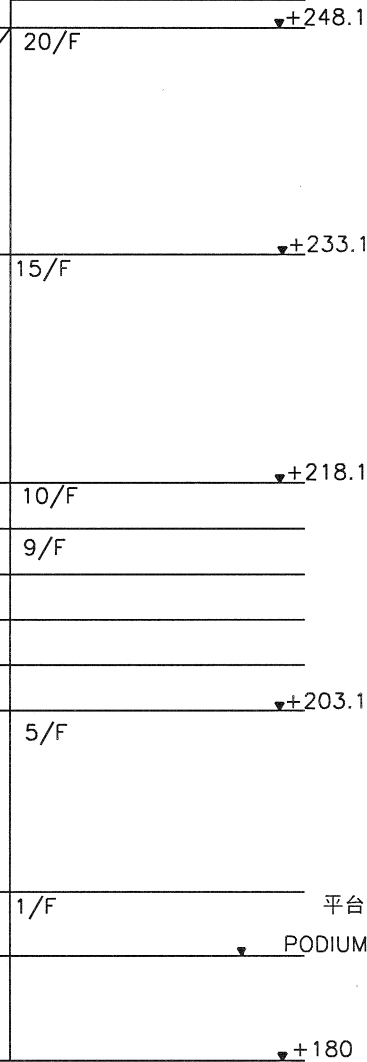


噪音源
NOISE SOURCE

AREA B

聲音照射區
ILLUMINATED
ZONE

聲影區
SHADOW
ZONE



50.0

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LANDSLIDE PREVENTIVE WORKS AT PO SHAN, MID-LEVELS- DESIGN & CONSTRUCTION
半山寶珊地段防止山泥傾瀉工程-設計及施工

TYPICAL SECTION OF MOVABLE NOISE BARRIER
(SHEET 2 OF 2)

流動隔音屏障的切面圖

SCALE	1:500	DATE	OCT 05
CHECK	MCTY	DRAWN	YPK
JOB No.	A02005	DRAWING No.	5.1
		REV	—



密封式隔音屏障
NOISE ENCLOSURE

Note: Barrier material of surface mass
in excess of 7kg/m² is recommended
to achieve the maximum screening effect

註：為了達到最佳的隔音效果，建議採用表
面質量超過每平方米7千克的屏障物料

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LANDSLIDE PREVENTIVE WORKS AT PO SHAN, MID-LEVELS- DESIGN & CONSTRUCTION

半山寶珊地段防止山泥傾瀉工程-設計及施工

TYPICAL SECTION OF NOISE ENCLOSURE

密封式隔音屏障的切面圖

SCALE	N.T.S.	DATE	OCT 2005
CHECK	LWYL	DRAWN	YPK
JOB No.	A02005	DRAWING No.	5.2
		REV	-

Appendix 2.1 Preliminary Construction Programme

Appendix 2.1 Preliminary Construction Programme

[illegible]

Appendix 3.1	Representative Photographs of Habitats Recorded in the Study Area
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Secondary Woodland



Engineered Slope



Residential Development



Landscaped Amenity Area



Temporary Stream

Appendix 3.2	Photographic Records of Species of Conservation Importance
--------------	--



Pholidota chinensis (石仙桃)



Rhododendron sp. (杜鵑花屬)

MAUNSELL AECOM Maunsell Environmental Management Consultants Ltd	Agreement No. CE 28/2004 (GE) Landslide Preventive Works at Po Shan, Mid-levels –Design and Construction Photographic Records of Species of Conservation Importance	SCALE	N.T.S.	DATE	Jul-05
		CHECK	DAVIDG	DRAWN	GCCL
		JOB NO.	A02005	DRAWING No.	App. 3.2
				Rev	-



Neottopteris nidus (巢蕨)



Pavetta hongkongensis (香港大沙葉)

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Agreement No. CE 28/2004 (GE) Landslide Preventive Works at
Po Shan, Mid-levels –Design and Construction

**Photographic Records of Species of
Conservation Importance**

SCALE	N.T.S.	DATE	Jul-05
CHECK	DAVIDG	DRAWN	GCCL
JOB NO.	A02005	DRAWING No.	App. 3.2
		Rev	-



Artocarpus hypargyreus (白桂木)



Cibotium barometz (金毛狗)

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Management Consultants Ltd

Agreement No. CE 28/2004 (GE) Landslide Preventive Works at
Po Shan, Mid-levels –Design and Construction

**Photographic Records of Species of
Conservation Importance**

SCALE	N.T.S.	DATE	Jul-05
CHECK	DAVIDG	DRAWN	GCCL
JOB NO.	A02005	DRAWING No.	App. 3.2
		Rev	-



Diospyros vaccinioides (小果柿)



Snakeskin

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Agreement No. CE 28/2004 (GE) Landslide Preventive Works at
Po Shan, Mid-levels –Design and Construction

**Photographic Records of Species of
Conservation Importance**

SCALE	N.T.S.	DATE	Jul-05
CHECK	DAVIDG	DRAWN	GCCL
JOB NO.	A02005	DRAWING No.	App. 3.2
		Rev	-



Mountain Crab (*Nanhaipotamon hongkongense*)

MAUNSELL AECOM Maunsell Environmental Management Consultants Ltd	Agreement No. CE 28/2004 (GE) Landslide Preventive Works at Po Shan, Mid-levels –Design and Construction Photographic Records of Species of Conservation Importance		SCALE	N.T.S.	DATE	Jul-05
			CHECK	DAVIDG	DRAWN	GCCL
			JOB NO.	A02005	DRAWING No.	App. 3.2
					Rev	-

Appendix 3.3 Plant Species Recorded in the
Study Area

Appendix 3.3 Plant Species Recorded in the Study Area

(Code for Abundance: xxx=abundant; xxx=frequent; xx=occasional; x=scarce)

Plant Species	Growth Form	Status in Hong Kong	Secondary Woodland	Other Habitats
<i>Acacia confusa</i>	tree	exotic, common	x	xx
<i>Acalypha australis</i>	herb	restricted		x
<i>Acrorychia pedunculata</i>	tree	common	xxx	
<i>Adiantum flabellulatum</i>	herb	common	xx	
<i>Adiantum malesianum</i>	herb	common	xx	
<i>Adinandra millettii</i>	shrub or small tree	common	xx	
<i>Ageratum conyzoides</i>	herb	exotic, common		xx
<i>Allamanda cathartica</i>	climbing shrub	exotic, cultivated		x
<i>Alocasia macrorrhiza</i>	perennial herb	common	xx	x
<i>Alpinia hainanensis</i>	perennial herb	common	xxxx	xxx
<i>Alpinia oblongifolia</i>	perennial herb	common	x	
<i>Alternanthera philoxeroides</i>	perennial herb	exotic, common		x
<i>Alyxia sinensis</i>	climber	common	x	
<i>Ampelopsis cantoniensis</i>	climber	very common	xx	
<i>Aporosa dioca</i>	tree	common	xxx	
<i>Archidendron clypearia</i>	tree	common	xx	
<i>Archidendron lucidum</i>	tree	common	xx	
<i>Ardisia crenata</i>	shrub	common	xx	x
<i>Ardisia quinqueгона</i>	shrub	common	xx	
<i>Artocarpus hypargyreus</i>	tree	common, Recorded in China Plant Red Data Book and Illustration of Rare & endangered plant in Guangdong Province	xx	
<i>Asparagus cochinchinensis</i>	climber	common	x	x
<i>Aster baccharoides</i>	herb	very common	xx	
<i>Bauhinia glauca</i>	climber	common	x	
<i>Bauhinia</i> spp.	tree			xx
<i>Berchemia racemosa</i> (<i>Berchemia floribunda</i>)	climbing shrub	common	xx	xx
<i>Blechnum orientale</i>	herb	very common		xx
<i>Boehmeria nivea</i>	shrub	restricted	x	
<i>Boehmeria penduliflora</i> var. <i>lochooensis</i>	shrub	restricted	xx	xx
<i>Bombax ceiba</i>	tree	common		x
<i>Borreria</i> spp.	herb	common		x
<i>Breynia fruticosa</i>	shrub	very common	xx	xx
<i>Bridelia tomentosa</i>	tree	common	x	xx
<i>Broussonetia papyrifera</i>	tree	common	xx	x
<i>Caesalpinia crista</i>	climber	very common	xx	
<i>Callicarpa formosana</i>	shrub	common	xx	
<i>Callicarpa nudiflora</i>	shrub	common	x	
<i>Callicarpa</i> spp.	shrub		xx	xx
<i>Caryota ochlandra</i>	shrub	common		xx
<i>Cayratia corniculata</i>	Herbaceous Vine	common	xx	xx
<i>Celastrus hindsii</i>	climber	very common	xx	
<i>Celastrus monospermus</i>	climber: vine	common	x	
<i>Celtis sinensis</i>	tree	very common	x	x
<i>Cibotium barometz</i>	tree-like Fern	common, Wild plant under State protection (category II); protected by the Animals and Plants (Protection of Endangered Species Ordinance (Cap. 187)	x	
<i>Cinnamomum camphora</i>	tree	very common	xx	xx
<i>Cinnamomum parthenoxylon</i>	large tree	common	xx	
<i>Clausena lansium</i>	tree	common	x	x
<i>Cocculus orbiculatus</i>	climber: vine	common		x
<i>Cratogeomys ligustrinum</i>	shrub	very common	x	x
<i>Cyclea</i> spp.	climber: vine	common	x	
<i>Daemonorops margaritae</i>	Climbing Palm	very common	x	
<i>Dalbergia benthami</i>	climber: vine	common	xx	xx
<i>Dalbergia millettii</i>	vine	common	x	
<i>Daphniphyllum calycinum</i>	shrub	common	xx	
<i>Dendropanax proteus</i>	shrub	common	x	
<i>Dendrotrophe frutescens</i>	Woody Vine	common	xx	

Appendix 3.3 Plant Species Recorded in the Study Area

(Code for Abundance: xxxx=abundant; xxx=frequent; xx=occasional; x=sparse)

Plant Species	Growth Form	Status in Hong Kong	Secondary Woodland	Other Habitats
<i>Desmodium heterocarpon</i>	herb	very common		xx
<i>Desmos chinensis</i>	woody climber	common	xx	
<i>Dicranopteris pedata</i> (<i>Dicranopteris dictotoma</i> ; <i>Dicranopteris linearis</i>)	herb	very common	xxx	
<i>Dimocarpus longan</i> (<i>Euphoria longan</i>)	tree	common and widely planted, wild plant under State protection (category II)		x
<i>Diospyros eriantha</i>	shrub or tree	very common	x	
<i>Diospyros morrisiana</i>	tree	very common	xx	
<i>Diospyros vaccinioides</i>	shrub	very common, critically endangered under 2001 IUCN Red List Categories and Criteria (Version 3.1)	xx	
<i>Diploclisia glaucescens</i>	Woody Vine	common	x	
<i>Diplospora dubia</i>	shrub or small tree	common	xx	
<i>Elaeocarpus sylvestris</i>	tree	very common	xx	
<i>Embelia laeta</i>	climber	very common		xx
<i>Embelia ribes</i>	climber	common	xx	xx
<i>Eriobotrya fragrans</i>	Shrub or Small Tree	common	x	
<i>Erythrina</i> spp.	tree	exotic	x	
<i>Eurya groffii</i>	shrub	common	x	
<i>Eurya nitida</i>	shrub	common	xx	
<i>Eurya</i> spp.	shrub			xx
<i>Ficus fistulosa</i>	tree	common	xx	
<i>Ficus hirta</i>	shrub	common	xx	xx
<i>Ficus hispida</i>	tree	common	xxx	
<i>Ficus pumila</i>	climber	very common	xx	xx
<i>Ficus variegata</i>	shrub	common	x	
<i>Ficus virens</i>	tree	common	xx	
<i>Fortunella hindsii</i>	shrub	common	x	
<i>Gahnia tristis</i>	herb	common	x	
<i>Gardenia jasminoides</i>	shrub	common	xx	
<i>Gelsemium elegans</i>	vine	restricted	xx	
<i>Glochidion eriocarpum</i>	shrub	common	xx	
<i>Glochidion wrightii</i>	shrub	common	x	
<i>Gnetum luofuense</i>	vine	common	xx	
<i>Graphistemma pictum</i>	Woody Vine	common	x	
<i>Hedyotis acutangula</i>	herb	very common	xx	
<i>Homalium cochinchinensis</i>	tree	common	xx	
<i>Hypserpa nitida</i>	Woody Vine	very common	x	
<i>Ilex asprella</i>	shrub	very common	xx	xx
<i>Ilex cinerea</i>	Shrub or Small Tree	common	x	
<i>Ilex pubescens</i>	shrub	very common	xx	
<i>Ilex viridis</i>	shrub	common	xx	
<i>Ipomoea cairica</i>	climber	exotic, common	x	
<i>Kyllinga monocephala</i>	herb	common		x
<i>Lagerstroemia speciosa</i>	shrub	exotic, common		xx
<i>Lantana camara</i>	shrub	exotic, common	x	xx
<i>Lasianthus</i> spp.	shrub		x	xx
<i>Lemnaphyllum microphyllum</i>	herb	common	x	
<i>Ligustrum sinense</i>	tree	common		xx
<i>Liquidambar formosana</i>	tree	very common		xx
<i>Liriope spicata</i>	herb	very common	xx	x
<i>Litsea cubeba</i>	tree	common	xx	
<i>Litsea glutinosa</i>	shrub	very common	x	xx
<i>Litsea monopetala</i>	tree	restricted		xx
<i>Litsea rotundifolia</i>	shrub	very common	xx	
<i>Livistona chinensis</i>	tree	cultivated	x	
<i>Lygodium japonicum</i>	climber	very common	xx	xxx
<i>Macaranga tanarius</i>	tree	very common	x	xx
<i>Machilus chekiangensis</i>	tree	common	xxx	
<i>Machilus</i> spp.	tree			xx
<i>Machilus velutina</i>	tree or large shrub	common	xx	
<i>Maesa perlaris</i>	climber: vine	common		xxx
<i>Mallotus paniculatus</i>	tree	very common	x	xx
<i>Melaleuca quinquenervia</i>	tree	exotic, common		x
<i>Melastoma candidum</i>	herb	common	xx	

Appendix 3.3 Plant Species Recorded in the Study Area

(Code for Abundance: xxx=abundant; xxx=frequent; xx=occasional; x=scarce)

Plant Species	Growth Form	Status in Hong Kong	Secondary Woodland	Other Habitats
<i>Melicope pteleifolia</i>	shrub	common	xx	
<i>Melodinus suaveolens</i>	woody vine	common	xx	
<i>Michelia figo</i>	shrub	exotic, common		xxx
<i>Mikania micrantha</i>	climber	exotic, common	x	xx
<i>Millettia speciosa</i>	climber: vine	common	xx	
<i>Millettia</i> spp.	climber		xx	
<i>Miscanthus floridulus</i>	perennial herb	common	xx	xx
<i>Morinda parvifolia</i>	climbing shrub	common	xx	xx
<i>Murraya paniculata</i>	shrub	exotic, common	x	xx
<i>Musa paradisiaca</i>	shrub	exotic, common	xx	xx
<i>Mussaenda erosa</i>	climbing shrub	common	xx	
<i>Mussaenda pubescens</i>	climber	very common	xx	xx
<i>Myrsine sequinii</i>	shrub	very common	x	
		restricted, Plant scheduled under Forestry Regulation of Forests and Countryside Ordinance (Cap 96)		
<i>Neottopteris nidus</i>	herb		xx	
<i>Oxalis corniculata</i>	herb	exotic, common		x
<i>Oxalis corymbosa</i>	herb	exotic, common	x	
<i>Paederia scandens</i>	climber: vine	common		x
<i>Pandanus forceps</i>	shrub or small tree	common	x	
		common, Plant scheduled under Forestry Regulation of Forests and Countryside Ordinance (Cap 96)		
<i>Pavetta hongkongensis</i>	tree or shrub		x	
<i>Pericampylus glaucus</i>	woody vine	restricted	x	
<i>Phoenix hanceana</i>	tree palm	common	x	
		very common, plant scheduled under Forestry Regulation of Forests and Countryside Ordinance (Cap 96); and the Animals and Plants (Protection of Endangered Species Ordinance (Cap. 187)		
<i>Pholidota chinensis</i>	Epiphytic Herb		x	
<i>Phyllanthus cochinchinensis</i>	shrub	very common	xx	x
<i>Piper</i> spp.			x	
<i>Polygonum chinense</i>	herb	very common	x	x
<i>Pothos chinensis</i>	climbing herb	very common	x	
<i>Pouzolzia zeylanica</i>	perennial herb	common		xx
<i>Psychotria rubra</i>	shrub	common	xxx	
<i>Psychotria serpens</i>	semi-woody climber	very common	xx	
<i>Pteris semipinnata</i>	herb	very common	xx	
<i>Pueraria lobata</i> var. <i>montana</i>	climber	common		xxx
<i>Pyrostegia venusta</i>	climber: vine	exotic, common		x
<i>Rhaphiolepis indica</i>	shrub	common	xx	
<i>Rhododendron simsii</i>	shrub	planted		x
		Plant scheduled under Forestry Regulation of Forests and Countryside Ordinance (Cap 96)		
<i>Rhododendron</i> spp.	shrub		x	
<i>Rhus chinensis</i>	shrub	very common	xx	xx
<i>Rubus reflexus</i>	climber	very common		xx
<i>Sageretia theezans</i>	shrub	very common	xx	x
<i>Sapium discolor</i>	tree	very common	x	xx
<i>Sarcandra glabra</i>	shrub	very common	xxx	xxx
<i>Scaevola sericea</i>	herb	very common	xx	
<i>Schefflera heptaphylla</i> (<i>Schefflera octophylla</i>)	tree	very common	xxx	
<i>Selaginella</i> spp.	herb		xx	
<i>Smilax china</i>	climbing shrub	very common	xx	
<i>Smilax corbularia</i>	climbing shrub	Common	xx	
<i>Smilax glabra</i>	climbing shrub	very common	x	
<i>Solanum americanum</i>	herb	exotic, common		x

Appendix 3.3 Plant Species Recorded in the Study Area

(Code for Abundance: xxxx=abundant; xxx=frequent; xx=occasional; x=scarce)

Plant Species	Growth Form	Status in Hong Kong	Secondary Woodland	Other Habitats
<i>Solanum nigrum</i>	herb	exotic, common		x
<i>Stachytarpheta jamaicensis</i>	herb	exotic, common		xx
<i>Stauntonia chinensis</i>	woody vine	restricted	xx	
<i>Stenoloma chusanum</i>	herb	common	xx	
<i>Stephania longa</i>	climber: vine	common	x	
<i>Sterculia lanceolata</i>	shrub	very common	xx	xxx
<i>Symplocos congesta</i>	Tree or Shrub	common	xxx	
<i>Symplocos lucida</i>	tree	common	xxx	
<i>Syzygium buxifolium</i>	shrub or small tree	native, common	x	
<i>Tetracera asiatica</i>	climber	very common	xx	
<i>Tetrastigma hemsleyanum</i>	herbaceous vine	restricted	xx	
<i>Thunbergia grandiflora</i>	herbaceous vine	common, cultivated or naturalised	x	
<i>Tinospora sinensis</i>	climber: vine	common	x	
<i>Toddalia asiatica</i>	shrub	restricted	xx	
<i>Tristania conferta</i> (<i>Lophostemon confertus</i>)	tree	exotic, common	x	
<i>Tylophora ovata</i>	woody vine	common	x	
<i>Typhonium blumei</i>	herb	restricted	x	xx
<i>Uvaria marcophylla</i>	vine	common	xx	
<i>Vernonia cinerea</i>	herb	exotic, common		x
<i>Viburnum odoratissimum</i>	shrub or small tree	very common		xx
<i>Viscum ovalifolium</i>	parasitic shrub	common	x	
<i>Wedelia trilobata</i>	herb	introduced, common	xx	xx
<i>Wikstroemia indica</i>	shrub	common		xx
<i>Wikstroemia nutans</i>	shrub	common	xx	
<i>Wollastonia biflora</i>	Perennial Herb	common		x
<i>Zanthoxylum avicennae</i>	shrub	common	xx	
<i>Zanthoxylum nitidum</i>	shrub	very common	x	
<i>Zanthoxylum scandens</i>	climbing shrub	common	x	x

Appendix 3.4 Fauna Recorded Within the Study Area
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Appendix 3.4- Fauna Recorded Within the Study Area

Avifauna

Common Name	Scientific Name	Occurrence in Hong Kong*
Black Kite	<i>Milvus lineatus</i>	1
Peregrine Falcon	<i>Falco peregrinus</i>	3
Domestic pigeon	<i>Columba sp.</i>	1
Spotted Dove	<i>Streptopelia chinensis</i>	1
Common Koel	<i>Eudynamys scolopacea</i>	1
Great Coucal	<i>Centropus sinensis</i>	1
Lesser Coucal	<i>Centropus bengalensis</i>	2
Yellow-crested Cockatoo	<i>Cacatua sulphurea</i>	2
Barn Swallow	<i>Hirundo rustica</i>	1
Tree Sparrow	<i>Passer montanus</i>	1
Chinese Bulbul	<i>Pycnonotus sinensis</i>	1
Crested bulbul	<i>Pycnonotus jocosus</i>	1
Magpie Robin	<i>Copsychus saularis</i>	1
Violet Whistling Thrush	<i>Myiophonus caeruleus</i>	1
Yellow-bellied Prinia	<i>Prinia flaviventris</i>	1
Common Tailorbird	<i>Orthotomus sutorius</i>	1
Yellow-browed Warbler	<i>Phylloscopus inornatus</i>	1
Silver Eared Mesia	<i>Leiothrix argentea</i>	2
Black faced Laughing Thrush	<i>Garrulax perspicillatus</i>	1
Black throated Laughing Thrush	<i>Garrulax chinensis</i>	3
Hwamei	<i>Garrulax canorus</i>	2
Fork-tailed Sunbird	<i>Aethopyga christinae</i>	2
Japanese White Eye	<i>Zosterops japonica(simplex)</i>	1
Great Tit	<i>Parus major</i>	1
Jungle Crow	<i>Corvus macrorhynchos</i>	1
Black-necked Starling	<i>Sturnus nigricollis</i>	1
Crested Myna	<i>Acridotheres cristatellus</i>	1
White-rumped Munia	<i>Lonchura striata</i>	2

* 1 - Widespread & Common, 2 - Local but not Uncommon, 3 - Very Local or Rare.

Herpetofauna & Mammals

Common Name	Scientific Name	Status
Amphibians		
Brown Tree Frog	<i>Polypedates leucomystax</i>	Common and widespread
Asian Common Toad	<i>Bufo melanostictus</i>	Common and widespread
Orante Pigmy Frog	<i>Microhyla ornata</i>	Common and widespread
Reptiles		
Indo Chinese Rat Snake	<i>Ptyas korros</i>	Common and widespread
Mammals		
Short-nosed Fruit Bat	<i>Cynopterus sphinx sphinx</i>	Common and widespread

Odonates

Scientific Name	Common Name	Status
Zygoptera		
<i>Copera marginipes</i>	-	Common & widespread
Anisoptera		
<i>Pantala flavescens</i>	-	Common & widespread

Butterflies

Scientific Name	Common Name	Status
<i>Abisara echerius</i>	Plum judy	Common & widespread
<i>Acytolepis puspa</i>	Common Hedge Blue	Common & widespread
<i>Athyma nefte</i>	Colour Sergeant	Common & widespread
<i>Pieris canidia</i>	Common white	Common & widespread
<i>Catopsilia pomona</i>	Lemon migrant	Fairly common & widespread
<i>Eurema hecabe</i>	Common Grass Yellow	Common & widespread
<i>Faunis eumeus</i>	Common faun	Common & widespread
<i>Graphium sarpedon</i>	Common Bluebottle	Common & widespread
<i>Ideopsis similis</i>	Blue Glassy Tiger	Common & widespread
<i>Lethe confusa</i>	Common white banded brown	Common & widespread
<i>Mycalesis mineus</i>	Dark brand bush brown	Common & widespread
<i>Notocrypta curvifascia</i>	Restricted Demon	Common & widespread
<i>Papilio paris</i>	Paris Peacock	Common & widespread
<i>Papilio polytes</i>	Common mormon	Common & widespread
<i>Parantica aglea</i>	Glassy Tiger	Common & widespread
<i>Ypthima lisandra</i>	Straight six ring	Common & widespread
<i>Zizeeria maha</i>	Pale Grass Blue	Common & widespread

Other Wildlife

Scientific Name	Common Name	Status
<i>Nanhaipotamon hongkongense</i>	Mountain Crab	Common & widespread

Appendix 3.5 Landscape and Visual Aspect- Site Photo



Overall View: Photo 1

Works area could be screened by existing chainlink fence with climbers



Overall View: Photo 2

Existing public leisure ground



Overall View: Photo 3
Existing public leisure ground



Overall View: Photo 4
Adjacent residential building - Po Shan Mansion

MAUNSELL AECOM Maunsell Environmental Management Consultants Ltd	Agreement No. CE 28/2004 (GE)		SCALE	N.T.S.	DATE	Jun-05
	Landslip Preventive Works at Po Shan, Mid-levels		CHECK	SHL	DRAWN	KNKY
	Landscape and Visual Aspect - Site Photo		JOB NO.	A02005	DRAWING No. App. 3.5	Rev -



Photo 5

View from the location of proposed Portal towards Po Shan Mansion



Photo 6

Existing vegetation of the man made slope

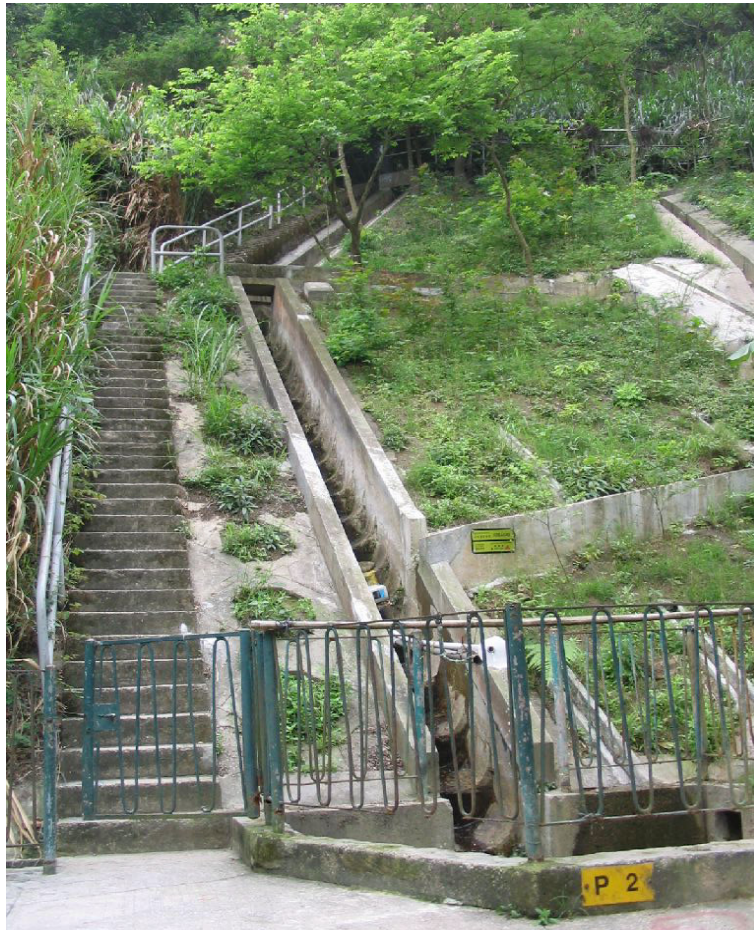


Photo 7

Existing vegetation and maintenance access for the man made slope

MAUNSELL AECOM Maunsell Environmental Management Consultants Ltd	Agreement No. CE 28/2004 (GE) Landslip Preventive Works at Po Shan, Mid-levels Landscape and Visual Aspect - Site Photo	SCALE	N.T.S.	DATE	Jun-05
		CHECK	SHL	DRAWN	KNKY
		JOB NO.	A02005	DRAWING No. App. 3.5	Rev -

Appendix 4.1	Construction Plant Inventory
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Appendix 4.1 Construction Plant Inventory

附件4.1 工程建築機器清單

	Remarks	No of PME used 機動設備數目		
		Works Area A	Works Area B	Works area for Flexible barrier BA1, 2&3
		工程範圍 A	工程範圍 B	泥石護欄 (Ba1, 2 &3) 的工程範圍
注意				
i Site Clearance and Setup 工地清理及準備工作				
2 nos. of backhoes (2部 挖土機)	L	1	1	
1 nos. of dump trucks (1部 卸土車)	L		1	
ii Tunnel Portal Formation 隧道入口建造工程				
3 nos. of backhoes (3部 挖土機)	L	1	2	
1 no. of breaker (1部 破碎機)	L	1		
1 nos. of dump trucks (1部 挖土機)	L		1	
1 no. of air compressor (1部 空氣壓縮機)	L	1		
1 no. of drillrig (1部 鑿岩機)	L	1		
1 no. of grouting plant (1部 灌漿機)	L	1		
1 no. of Conveyor Belt (1部 輸送帶)	L	1		
iii Portal Chamber Formation 隧道入口段建造工程				
2 nos. of backhoes (2部 挖土機)	L	1	1	
2 nos. of breakers (2部 破碎機)	U			
1 nos. of dump trucks (1部 卸土車)	L		1	
1 nos. of grouting plant (1部 灌漿機)	L	1		
1 no. of Conveyor Belt (1部 輸送帶)	L	1		
1 no. of jet fan (1部 抽氣扇)	U			
iv Tunnel Excavation 隧道挖掘工程				
1 no. of TBM (1部 隧道鑽挖機)	U			
2 nos. of backhoes (2部 挖土機)	L	1	1	
1 nos. of dump trucks (1部 挖土機)	L		1	
2 no. of drillrigs (2部 鑿岩機)	U			
1 no. of air compressor (1部 空氣壓縮機)	L	1		
3 nos. of vibrating rods (3部 混凝土震動機)	U			
1 no. of Conveyor Belt (1部 輸送帶)	L	1		
1 no. of Generator (1部 發電機)	L	1		
1 no. of jet fan (1部 抽氣扇)	U			
1 no. of shutter (1部 閘門)	U			
1 no. of grouting plant (1部 灌漿機)	L	1		
v Sub-vertical drains 裝設垂直排水管				
2 nos. of In-the-hole production drills (2部 洞穴鑿岩機)	U			
2 nos. of hydraulic jacks (2部 油壓起重機)	U			
1 nos. of water pumps (2部 水泵)	L	1		
1 no. of jet fan (1部 抽氣扇)	U			
2 no. of backhoe (2 部挖土機)	L	1	1	
1 no. of dump truck (3部 卸土車)	L		1	
1 no. of Conveyor Belt (1部 輸送帶)	L	1		
vi Installation of Flexible Noise Barrier 裝設泥石護欄				
1 no. of drillrigs (1部 鑿岩機)	U			1

Legend(說明):

(L) PME to be operated above-ground (在地面使用的機動設備)

(U) PME to be operated under-ground (在地下使用的機動設備)

Appendix 4.1A	Proposed Construction Plant Inventory for Airborne Construction Noise Assessment – Unmitigated
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Appendix 4.1A
Proposed Construction Plant Inventory for Airborne Noise Assessment -Unmitigated

Landslide Preventive Works at Po Shan Mid-Levels

Site Clearance

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)
Backhoe	CNP081	1	112	50%	0	109	109
Dump Truck	CNP067	1	117	30%	0		112
Total						109	114

Tunnel Portal Formation

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area A	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	CNP081	1	112	50%	0	109			
Backhoe	CNP081	2	112	50%	0				112
Hand-held breaker	CNP026	1	114	50%	0			111	
Drill rig	CNP072	1	110	70%	0		108		
Grout mixer	CNP105	1	90	100%	0		90		
Grout pump	CNP106	1	105	100%	0		105		
Air Compressor	CNP002	1	102	100%	0		102		
Conveyor belt	CNP041	1	90	100%	0	90	90		
Dump Truck	CNP067	1	117	30%	0				112
Total						109	111	111	115
						MAX for Area A		111	

Portal Chamber Formation

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)
Backhoe	CNP081	1	112	50%	0	109	
Backhoe	CNP081	1	112	50%	0		109
Grout mixer	CNP105	1	90	100%	0	90	
Grout pump	CNP106	1	105	100%	0	105	
Conveyor belt	CNP041	1	90	100%	0	90	
Dump Truck	CNP067	1	117	30%	0		112
Total						111	114

Tunnel Excavation

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	CNP081	1	112	50%	0		109	
Backhoe	CNP081	1	112	50%	0			109
Generator	CNP101	1	108	100%	0	108	108	
Grout mixer	CNP105	1	90	100%	0	90		
Grout pump	CNP106	1	105	100%	0	105		
Air Compressor	CNP002	1	102	100%	0	102		
Conveyor belt	CNP041	1	90	100%	0	90	90	
Dump Truck	CNP067	1	117	30%	0			112
Total						111	112	114
						MAX for Area A		112

Tunnel Excavation and Installation of Sub-Vertical Drains

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area A	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	CNP081	1	112	50%	0		109		
Backhoe	CNP081	1	112	50%	0				109
Generator	CNP101	1	108	100%	0	108	108		
Grout mixer	CNP105	1	90	100%	0	90			
Grout pump	CNP106	1	105	100%	0	105			
Air Compressor	CNP002	1	102	100%	0	102			
Conveyor belt	CNP041	1	90	100%	0	90	90	90	
Water pump (electric)	CNP281	1	88	100%	0			88	
Dump Truck	CNP067	1	117	30%	0				112
Total						111	112	109	114
						MAX for Area A		112	

Installation of Sub-Vertical Drains

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)
Backhoe	CNP081	1	112	50%	0	109	
Backhoe	CNP081	1	112	50%	0		109
Water pump (electric)	CNP281	1	88	100%	0	88	
Conveyor belt	CNP041	1	90	100%	0	90	
Dump Truck	CNP067	1	117	30%	0		112
Total						109	114

Installation of Flexible Barriers

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Drill rig	CNP072	1	110	50%	0	107
Total						107

Appendix 4.1B	Groundborne Construction Noise Assessment Criteria and Methodology
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Appendix 4.1B Groundborne Construction Noise Assessment Criteria and Methodology

1. ENVIRONMENTAL LEGISLATION, STANDARDS AND GUIDELINES

- 1.1 The Noise Control Ordinance (NCO) and the Environmental Impact Assessment Ordinance (EIAO) provide the statutory framework for noise control. Noise impacts were assessed in accordance with the standards, criteria and methodology provided in the various Technical Memoranda (TM) issued under the NCO and EIAO, as set out below:
- Technical Memorandum (TM) on Environmental Impact Assessment Process (EIAO-TM)
 - TM on Noise from Construction Work other than Percussive Piling (GW-TM)
 - TM on Noise from Construction Work in Designated Areas (DA-TM)
 - TM on Noise from Noise from Percussive Piling (PP-TM)
 - Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM).
- 1.2 The NCO defines evening, night-time, and any time on Sundays and general holidays to be restricted hours for construction work using powered mechanical equipment (PME). To work at these times, a contractor must obtain a construction noise permit (CNP).
- 1.3 Noise control on construction activities taking place at other times is subject to the “Criteria for Evaluating Noise Impact” stated in Table 1A of Annex 5 in the EIAO-TM. The noise limit (expressed as $L_{eq(30\text{ minutes})}$) is 75 dB(A) at the façades of dwellings. According to the preliminary construction programme for this Project available at the time of reporting, no works would be conducted during restricted hours.
- 1.4 According to the IND-TM under NCO, where the noise under investigation is transmitted primarily through the structural elements of the building or if the assessment point is at an internal location of a building, an adjustment of –10dB(A) should be made to relevant acceptable noise levels (ANLs).
- 1.5 Having regard to the above, the groundborne construction noise limit was determined to be 65dB(A), expressed as $L_{eq(30\text{ minutes})}$. Similar approach for derivation of groundborne construction noise criterion was adopted in the Environmental Impact Assessment (EIA) for ‘KCRC Kowloon Southern Link’ and Project Profile for ‘Development of the Former Marine Police Headquarter’ for direct application of Environmental Permit.

2. ASSESSMENT METHODOLOGY

Groundborne Noise Sources from Construction Activities

- 2.1 Vibration will be transmitted from the source via bedrock or soil to the nearby foundations of the noise sensitive receiver (NSR), and would then transmit primarily through the structural elements of the building, resulting in groundborne noise to the NSR.
- 2.2 As mentioned in Section 4.9 of the main text of the Project Profile for this Project, the major vibration generating equipment relevant to these works would be tunnel boring machine (TBM) and drill rig (for the construction of pipe pile wall). At the time of this report, there is no available information on the models and relevant vibration source levels of these two construction plants. The reference source levels for TBM and drill rig were derived by making reference to the vibration source data from the project of EIA for ‘KCRC Kowloon Southern Link’ (KSL Project). Assumptions on reference source levels and other correction items for TBM and drill rig are presented in **Appendices 4.1B1 and 4.1B2**.

- 2.3 It is expected that the size of the TBM to be adopted for this Project would be smaller than those for the KSL Project in which the reference source levels were derived from, and the drill rig to be adopted for this Project would be expected to be similar to that used for the KSL Project. It is envisaged that the prediction as provided in this report would be sufficiently conservative for the assessment of groundborne noise impact associated with this Project.

Groundborne Noise Prediction Methodology

- 2.4 Groundborne construction noise was predicted based on the methodology as described in US Department of Transportation “*High-speed Ground Transportation Noise and Vibration Impact Assessment*”.
- 2.5 Groundborne noise would be assessed by using the following formulae taking into account relevant source data, geological profile and foundation structure of the NSR. The geological profile for Po Shan Mansion for calculation are shown in Figure 1.
- 2.6 The predicted groundborne noise level L_p inside the noise sensitive rooms is given by the following equation.

$$L_p = L_{v,rms} + C_{dist} + C_{damping} + C_{building} + C_{floor} + C_{noise} + C_{multi} + C_{cum}$$

C_{dist} :	Distance attenuation
$C_{damping}$:	Soil damping loss across the geological media
$C_{building}$:	Coupling loss into building foundation
C_{floor} :	Coupling loss per floor
C_{noise} :	Conversion factor from floor vibration levels to noise levels
C_{multi} :	Noise level increase due to multiple sources
C_{cum} :	Cumulative effect due to neighbouring sites

Soil Damping

- 2.7 Internal losses of soil would cause the vibration amplitude to decay against the propagation distance and the decay relationship is based on the equation set out in the *Transportation Noise Reference Book*¹

$$V(R) = V(R_o) \times e^{-2\pi f \eta R/2c}$$

- 2.8 The velocity amplitude V is dependent on the frequency f in Hz, the soil loss factor η , the wave speed c in m/s, the distance R from the source to the NSR. The properties of soil materials are shown in Table 1.

Table 1 Wave Propagation Properties of Soil

Soil Type	Longitudinal Wave Speed c , m/s	Loss Factor, η	Density, g/cm^3
Soil	1500	0.5	1.7

- 2.9 No damping attenuation is applied for propagation in rocks.

Coupling Loss into Building Structures

- 2.10 The coupling loss into building structures represents the change in the incident ground-surface vibration due to the presence of the piled building foundation. The empirical values are given in Table 2.

¹ P. M. Nelson. Transportation Noise Reference Book. 1987.

Table 2 Loss factor for Coupling into Building Foundation

Frequency	Octave Band Frequencies, Hz					
	16	31.5	63	125	250	500
Loss factor for coupling into building foundation, dB	-7	-7	-10	-13	-14	-14

Coupling Loss Per Floor

- 2.11 The coupling loss per floor represents the floor-to-floor vibration transmission attenuation. For multi-storey buildings, a common value for the attenuation of vibration from floor-to-floor is approximately 1 dB attenuation in the upper floor regions and greater than 3 dB attenuation at lower floors. Coupling loss of 1 dB reduction per floor is assumed in this report for a conservative assessment to account for any possible amplification due to resonance effects.

Conversion from Floor Vibration to Noise Levels

- 2.12 Conversion from floor vibration levels to indoor reverberant noise levels is based on standard acoustic principles. The conversion factor is dependent on the surface area S of the room in m^2 , the radiation efficiency σ , the volume of the room V in m^3 and the room reverberation time RT in seconds. Conversion Factors from Floor Vibration Levels to Indoor Reverberant Noise Levels is 27 dB(A) for residential units.

Key Assumptions Made in the Calculation

- 2.13 Key assumptions made in the calculation of groundborne noise at the potentially worst affected noise sensitive receivers (NSRs) Po Shan Mansion are summarized in the table below.

Item	Assumptions
Source Term	<p>A list of PME to be adopted for the construction of tunnels is provided in Appendix 4.1A. Among the list, the major vibration generating equipment relevant to these works would be tunnel boring machine (TBM) and drill rig. These equipment would be operating in rock.</p> <p>The geology of the Project site would be similar to that of the Canton Road section of KSL Project as well as the Kwai Tsing Tunnel of the KCRC West Rail Project. The vibration source terms for TBM and drill rig adopted for the KSL Project EIA which were derived from the vibration measurement for TBM operation for the Kwai Tsing Tunnel were used in the present assessment. The size of the TBM to be used for this Project would be expected to be smaller than that for the KSL Project. For the purpose of the present assessment, the assumed vibration source terms would be considered sufficiently conservative.</p>
Soil Damping	<p>There is a soil layer between the bedrock and the foundation of the building. The loss factor (η) for clay and clayed soil could be assumed to be 0.5, however, caution in using so large a value of η needs to be exercised since very rapid attenuation of vibration with distance would be predicted².</p>

² P. M. Nelson. Transportation Noise Reference Book. 1987.

	The data available at the time of reporting would be considered not sufficient to determine the value of η to be applied in the assessment. In view of the likely uncertainty in the η value, no soil damping was assumed in the prediction of groundborne noise levels. The approach of not taking into account the soil damping factor would produce a more conservative estimation of the groundborne noise levels.
Floor to Floor Attenuation	<p>The residential towers of Po Shan Mansion sit on top of a podium structure of about 2-storey high, and the first residential floor are assumed to be at the third level above ground.</p> <p>Therefore, a -3dB(A) floor to floor attenuation was applied in the calculation.</p>
Distance Attenuation	Standard acoustic principle for determining distance attenuation was adopted in the present assessment.
Building Coupling Loss	Standard acoustic principle for determining building coupling loss was adopted in the present assessment.
Coupling Loss from Bedrock to Pile	Coupling loss from bedrock to pile was determined based on the Statistical Energy Analysis (SEA) calculation as presented in the EIA report for the KSL Project
Conversion from Vibration to Noise	Standard acoustic principle for converting vibration levels to noise levels was adopted in the present assessment.
Conversion to A-weighted Noise	Standard acoustic principle for converting vibration levels to noise levels was adopted in the present assessment.

2.14 Detailed calculations for groundborne noise levels are presented in **Appendix 4.1B1** and **4.1B2**.

Groundborne Noise Calculation

Appendix 4.1B1 Groundborne Noise Calculation for TBM

NSR Po Shan Mansion (Block A)

Item	Description	Quantity	Assumption
1	Vibration source	2.5 mm/s	Refer to EIA report* Section 7 and Appendix 7.1 Vibration Measurement for Construction TBM at DB320 Kwai Tsing Tunnel by Extrapolation, PPV at 5.5m
2	rms velocity	0.625 mm/s	Based on Crest factor of 4 Refer to Federal Transit Administration's manual for Transit Noise and Vibration Impact Assessment (FTA Guidance Manual)
3	Vibration Velocity, ref 10 ⁻⁶ mm/s	116 dB	Refer to EIA report* Section 7 and Appendix 7.2.3
4	Ro R Distance attenuation	5.5 m 46.3 m -19 dB	Reference distance mentioned in item 1 Distance between TBM to foundation of NSR, Refer to Figure 2
5	Soil Damping	0 dB	Refer to EIA report* Section 7 and Appendix 7.2.3 No soil damping was applied as vibration through rock
6	Building Coupling Loss	-10 dB	Refer to EIA report* Section 7 and Appendix 7.2.3
7	Coupling Loss from bed rock to pile	-18 dB	Refer to EIA report* Section 7 and Appendix 7.2.3 Statistical Energy Analysis (SEA) calculation in Ref F of Appendix 7.2.3 of EIA report*
8	Floor to floor attenuation	-3 dB	1 dB reduction per floor Residential units are located at 3rd level for Po Shan Mansion
9	Conversion from Vibration to noise	-23 dB	Refer to EIA report* Section 7 and Appendix 7.2.3
10	Conversion to A-weighted Noise	-20 dB	Refer to EIA report* Section 7 and Appendix 7.2.3 for a conservative measurement
11	Predicted Groundborne noise	23 dB(A)	Day time criteria (0700-1900) 65 dB(A)

* Kowloon Canton Railway Corporation KSL GSA 5100 Environmental Impact Assessment & Associated Services - Environmental Impact Assessment Report

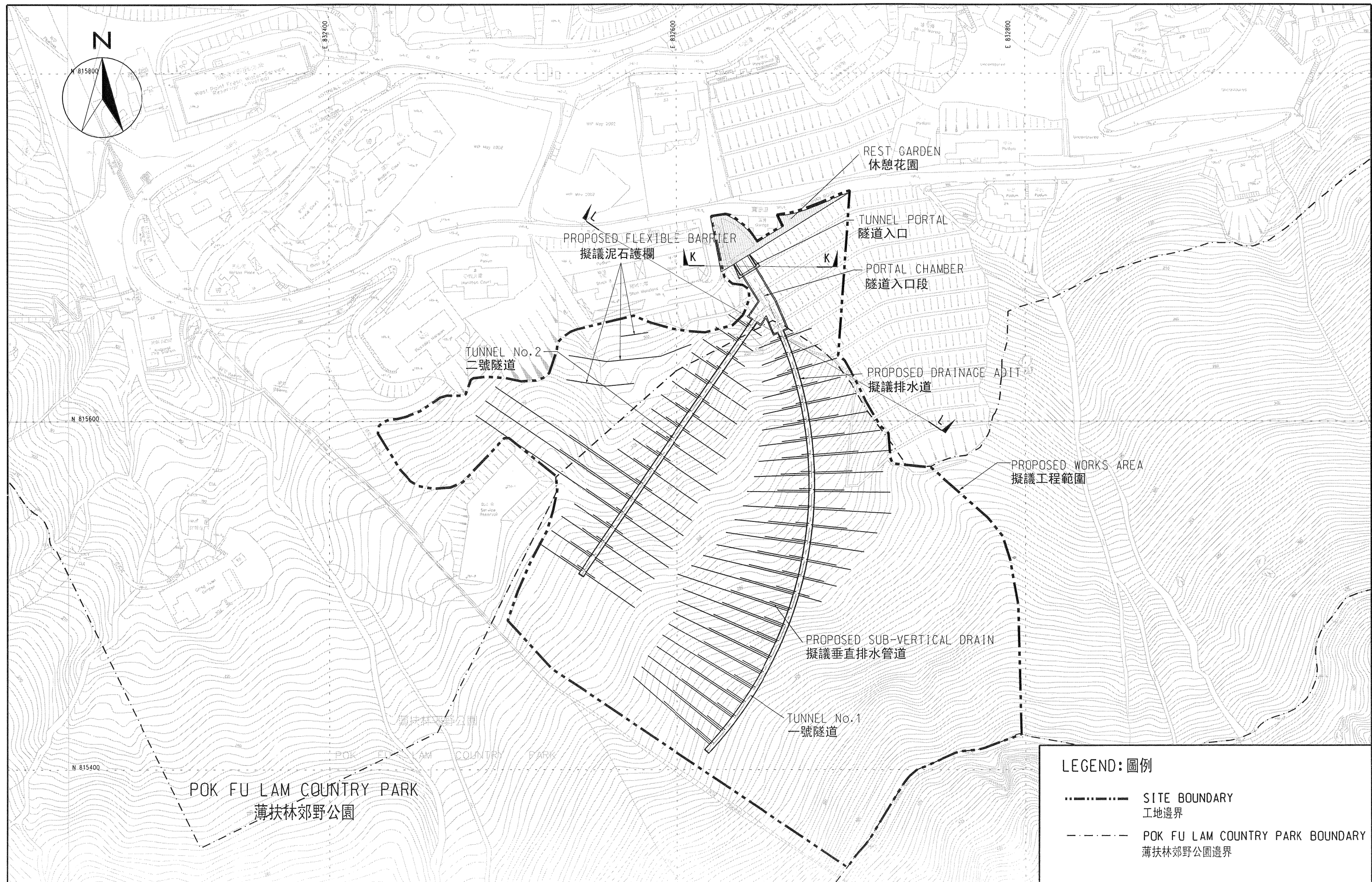
Groundborne Noise Calculation

Appendix 4.1B2 Groundborne Noise Calculation for Dril Rig (Construction of Pipe Pile Wall)

NSR Po Shan Mansion (Block A)

Item	Description	Quantity	Assumption
1	rms velocity	0.638 mm/s	Refer to EIA report* Appendix 7-2-4 Note 1
2	Vibration Velocity, ref 10 ⁻⁶ mm/s	116 dB	Refer to EIA report* Section 7 and Appendix 7.2.3
3	Ro R Distance attenuation	5.5 m 14.8 m -9 dB	Reference distance refer to EIA report* Appendix 7-2-4 Note 1 Distance between pipe pile to foundation of NSR, Refer to Figure 3
4	Soil Damping	0 dB	Refer to EIA report* Section 7 and Appendix 7.2.3 No soil damping was applied as vibration through rock
5	Building Coupling Loss	-10 dB	Refer to EIA report* Section 7 and Appendix 7.2.3
6	Coupling Loss from bed rock to pile	-18 dB	Refer to EIA report* Section 7 and Appendix 7.2.3 Statistical Energy Analysis (SEA) calculation in Ref F of Appendix 7.2.3 of EIA report*
7	Floor to floor attenuation	-3 dB	1 dB reduction per floor Residential units are located at 3rd level for Po Shan Mansion
8	Conversion from Vibration to noise	-23 dB	Refer to EIA report* Section 7 and Appendix 7.2.3
9	Conversion to A-weighted Noise	-20 dB	Refer to EIA report* Section 7 and Appendix 7.2.3 for a conservative measurement
10	Predicted Groundborne noise	33 dB(A)	Day time criteria (0700-1900) 65 dB(A)

*Kowloon Canton Railway Corporation KSL GSA 5100 Environmental Impact Assessment & Associated Services - Environmental Impact Assessment Report



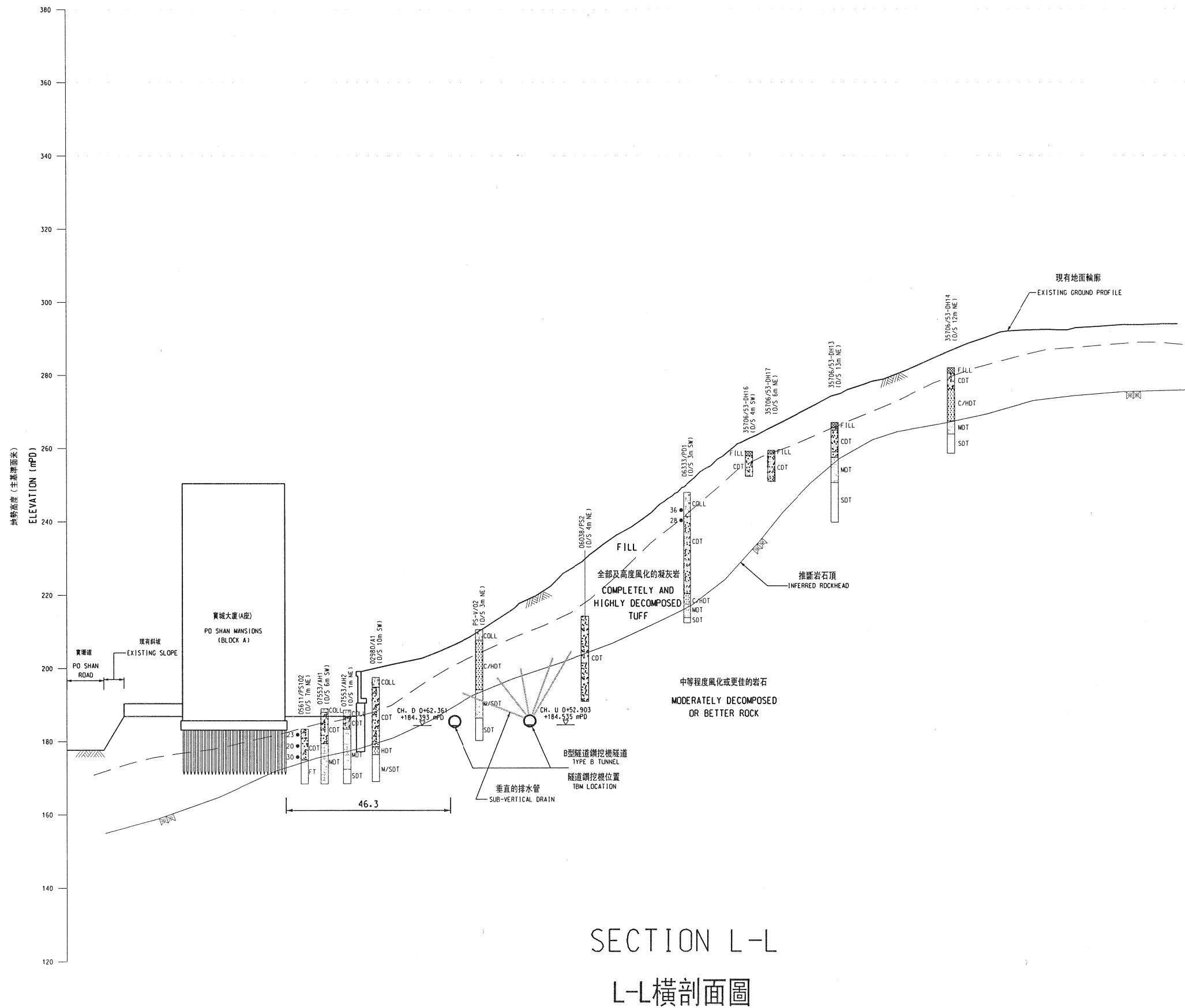
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Maunsell Consultants Asia Ltd

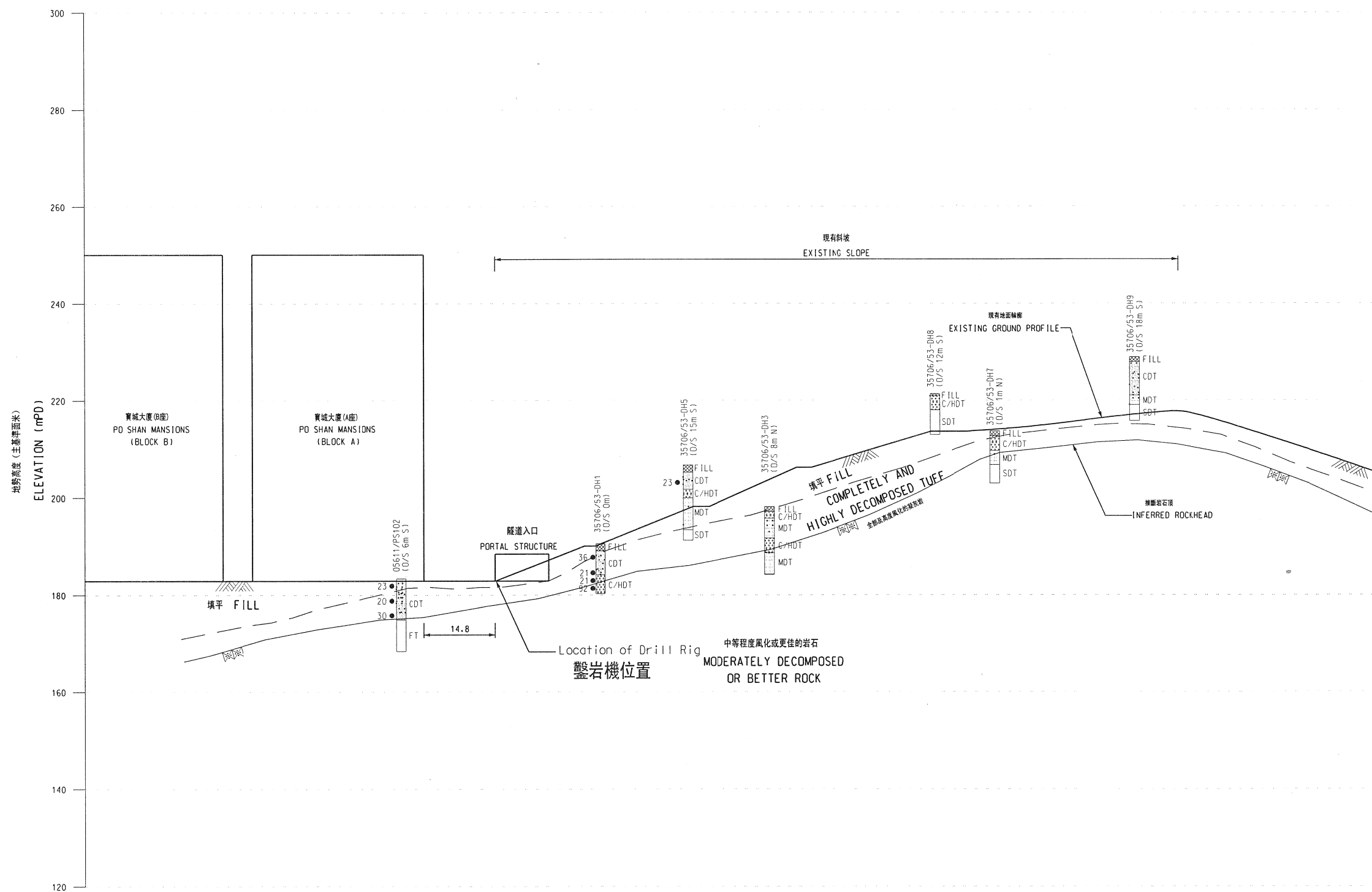
LANDSLIDE PREVENTIVE WORKS AT PO SHAN, MID-LEVEL - DESIGN AND CONSTRUCTION

半山區寶珊地段防止山泥傾瀉工程 - 設計及施工

GENERAL LAYOUT PLAN
整體平面圖

SCALE	A3 1:2000	DATE	OCT 2005
CHECK	LWYL	DRAWN	YPK
JOB No.	A02005	DRAWING No.	Figure 1
		REV	-





SECTION K-K

K-K橫剖面圖

Appendix 4.2	Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver – Unmitigated
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Appendix 4.2

Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Unmitigated Landslide Preventive Works at Po Shan Mid-Levels

NSR* : N1		1/F																													
Task No. #	Task Name	Work Area	SWL dB(A)	Distance (m)^	Barr.corr @ dB(A)	SPL dB(A)	2006												2007												2008
							Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	109	15		80			80																						
1b		B	114	51		74			74																						
2a	Tunnel Portal Formation	A	111	15		82				82	82	82																			
2b		B	115	51		76				76	76	76																			
3a	Portal Chamber Formation	A	111	15		82				82	82	82	82	82																	
3b		B	114	51		74				74	74	74	74	74																	
4a	Tunnel No. 1 Excavation	A	112	15		83									83	83	83	83	83												
4b		B	114	51		74									74	74	74	74	74												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	112	15		83															83	83	83	83							
5b		B	114	51		74															74	74	74	74							
6a	Installation of Vertical Drains	A	109	15		81																				81	81	81	81	81	81
6b		B	114	51		74																				74	74	74	74	74	74
7a	Installation of Flexible Barriers	BA1	107	58		67														67	67										
7b		BA2	107	54		67												67	67												
7c		BA3	107	82			64									64	64														
Total SPL, dB(A)							-	-	80	83	83	83	83	83	84	84	84	84	84	67	67	84	84	84	84	81	81	81	81	81	81

NSR* : N1		10/F																													
Task No. #	Task Name	Work Area	SWL dB(A)	Distance (m)^	Barr.corr @ dB(A)	SPL dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	109	38		72			72																						
1b		B	114	62		73			73																						
2a	Tunnel Portal Formation	A	111	38		74				74	74	74																			
2b		B	115	62		74				74	74	74																			
3a	Portal Chamber Formation	A	111	38		74				74	74	74	74	74																	
3b		B	114	62		73				73	73	73	73	73																	
4a	Tunnel No. 1 Excavation	A	112	38		75									75	75	75	75	75												
4b		B	114	62		73									73	73	73	73	73												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	112	38		75															75	75	75	75							
5b		B	114	62		73															73	73	73	73							
6a	Installation of Vertical Drains	A	109	38		72																				72	72	72	72	72	72
6b		B	114	62		73																				73	73	73	73	73	73
7a	Installation of Flexible Barriers	BA1	107	50		68														68	68										
7b		BA2	107	50		68																									
7c		BA3	107	80		64											64	64													
Total SPL, dB(A)							-	-	73	77	77	77	76	76	77	77	77	78	78	68	68	77	77	77	77	76	76	76	76	76	76

Appendix 4.2

Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Unmitigated

Landslide Preventive Works at Po Shan Mid-Levels

NSR* : N2

Task No. #	Task Name	Work	SWL	Distance	Barr.corr @	SPL	2006												2007												2008
		Area	dB(A)	(m)	dB(A)	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	109	35	10	63			63																						
1b		B	114	70	10	62			62																						
2a	Tunnel Portal Formation	A	111	35	10	65				65	65	65																			
2b		B	115	70	10	63				63	63	63																			
3a	Portal Chamber Formation	A	111	35	10	65				65	65	65	65	65																	
3b		B	114	70	10	62				62	62	62	62	62																	
4a	Tunnel No. 1 Excavation	A	112	35	10	66									66	66	66	66	66												
4b		B	114	70	10	62									62	62	62	62	62												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	112	35	10	66															66	66	66	66							
5b		B	114	70	10	62															62	62	62	62							
6a	Installation of Vertical Drains	A	109	35	10	63																			63	63	63	63	63	63	
6b		B	114	70	10	62																			62	62	62	62	62	62	
7a	Installation of Flexible Barriers	BA1	107	28	0	73													73	73											
7b		BA2	107	30	0	72												72	72												
7c		BA3	107	56	0	67										67	67														
Total SPL , dB(A)						-	-	63	67	67	67	66	66	67	70	70	74	74	73	73	67	67	67	67	66	66	66	66	66	66	

NSR* : N3

Task No. #	Task Name	Work	SWL	Distance	Barr.corr @	SPL	2006												2007												2008
		Area	dB(A)	(m)	dB(A)	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	109	145		61			61																						
1b		B	114	185		63			63																						
2a	Tunnel Portal Formation	A	111	145		63			63	63	63																				
2b		B	115	185		65			65	65	65																				
3a	Portal Chamber Formation	A	111	145		62			62	62	62	62	62																		
3b		B	114	185		63			63	63	63	63	63																		
4a	Tunnel No. 1 Excavation	A	112	145		63									63	63	63	63	63												
4b		B	114	185		63									63	63	63	63	63												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	112	145		63																63	63	63	63						
5b		B	114	185		63																	63	63	63	63					
6a	Installation of Vertical Drains	A	109	145		61																				61	61	61	61	61	61
6b		B	114	185		63																				63	63	63	63	63	63
7a	Installation of Flexible Barriers	BA1	107	80		64															64	64									
7b		BA2	107	60		66												66	66												
7c		BA3	107	64														66	66												
Total SPL, dB(A)						-	-	63	67	67	67	66	66	66	66	69	69	69	69	64	64	66	66	66	66	65	65	65	65	65	65

Appendix 4.2

Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Unmitigated

Landslide Preventive Works at Po Shan Mid-Levels

NSR* : N4

Task No. #	Task Name	Work	SWL	Distance	Barr.corr @	SPL	2006												2007												2008
		Area	dB(A)	(m)	dB(A)	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	109	175		59			59																						
1b		B	114	210		62			62																						
2a	Tunnel Portal Formation	A	111	175		61			61	61	61																				
2b		B	115	210		64			64	64	64																				
3a	Portal Chamber Formation	A	111	175		61			61	61	61	61	61																		
3b		B	114	210		62			62	62	62	62	62																		
4a	Tunnel No. 1 Excavation	A	112	175		62									62	62	62	62	62												
4b		B	114	210		62									62	62	62	62	62												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	112	175		62																62	62	62	62						
5b		B	114	210		62																62	62	62	62						
6a	Installation of Vertical Drains	A	109	175		59																				59	59	59	59	59	59
6b		B	114	210		62																				62	62	62	62	62	62
7a	Installation of Flexible Barriers	BA1	107	100		62													62	62											
7b		BA2	107	70		65											65	65													
7c		BA3	107	68		65										65	65														
Total SPL, dB(A)						-	-	62	66	66	66	64	64	65	68	68	68	68	62	62	65	65	65	65	64	64	64	64	64	64	64

NSR* : N5

Task No. #	Task Name	Work	SWL	Distance	Barr.corr @	SPL	2006												2007												2008
		Area	dB(A)	(m)	dB(A)	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	109	75		66			66																						
1b		B	114	50		75			75																						
2a	Tunnel Portal Formation	A	111	75		68			68	68	68																				
2b		B	115	50		76			76	76	76																				
3a	Portal Chamber Formation	A	111	75		68			68	68	68	68	68																		
3b		B	114	50		75			75	75	75	75	75																		
4a	Tunnel No. 1 Excavation	A	112	75		69								69	69	69	69	69													
4b		B	114	50		75								75	75	75	75	75													
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	112	75		69															69	69	69	69							
5b		B	114	50		75															75	75	75	75							
6a	Installation of Vertical Drains	A	109	75		67																			67	67	67	67	67	67	
6b		B	114	50		75																			75	75	75	75	75	75	75
7a	Installation of Flexible Barriers	BA1	107	176		57												57	57												
7b		BA2	107	160		58											58	58													
7c		BA3	107	200		56										56	56														
Total SPL, dB(A)						-	-	75	77	77	77	75	75	76	76	76	76	76	57	57	76	76	76	76	75	75	75	75	75	75	75

Appendix 4.2

Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Unmitigated Landslide Preventive Works at Po Shan Mid-Levels

NSR* : N6																															
Task	Task Name	Work	SWL	Distance	Barr.corr @	SPL	2006												2007												2008
No. #		Area	dB(A)	(m)	dB(A)	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	109	60		68			68																						
1b		B	114	75		71			71																						
2a	Tunnel Portal Formation	A	111	60		70				70	70	70																			
2b		B	115	75		73				73	73	73																			
3a	Portal Chamber Formation	A	111	60		70				70	70	70	70	70																	
3b		B	114	75		71				71	71	71	71	71																	
4a	Tunnel No. 1 Excavation	A	112	60		71									71	71	71	71	71												
4b		B	114	75		71									71	71	71	71	71												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	112	60		71																71	71	71	71						
5b		B	114	75		71																71	71	71	71						
6a	Installation of Vertical Drains	A	109	60		69																				69	69	69	69	69	69
6b		B	114	75		71																				71	71	71	71	71	71
7a	Installation of Flexible Barriers	BA1	107	112		61														61	61										
7b		BA2	107	120		60												60	60												
7c		BA3	107	140		59											59	59													
Total SPL, dB(A)							-	-	71	75	75	75	74	74	74	74	74	74	74	61	61	74	74	74	74	73	73	73	73	73	73

Note:

*Potentially worst affected floors were assessed.

^ Slant distance was used for calculating the noise levels at NSR N1

@ None of the PME item to be used in Area A and Area B would be visible when viewed from the assessment façade of NSR N2. NSR N2 is considered to be totally screened. According to GW-TM, a noise reduction of 10 dB(A) could be achieved.

1: According to the construction programme, site clearance and tunnel portal formation would not be carried out at the same time

2: For Site Clearance and Set Up, PME at Area A and Area B would not be operated concurrently

3: For month 2 to 4 (April to June 06), Tunnel Portal Formation (Task no. 2a and 2b) and Portal Chamber Formation (Task no.3a and 3b) share the same of group of equipment. Thus, the total SPL = Max SPL (2a&3a)+ Max SPL (2b &3b) as a worst case scenario.

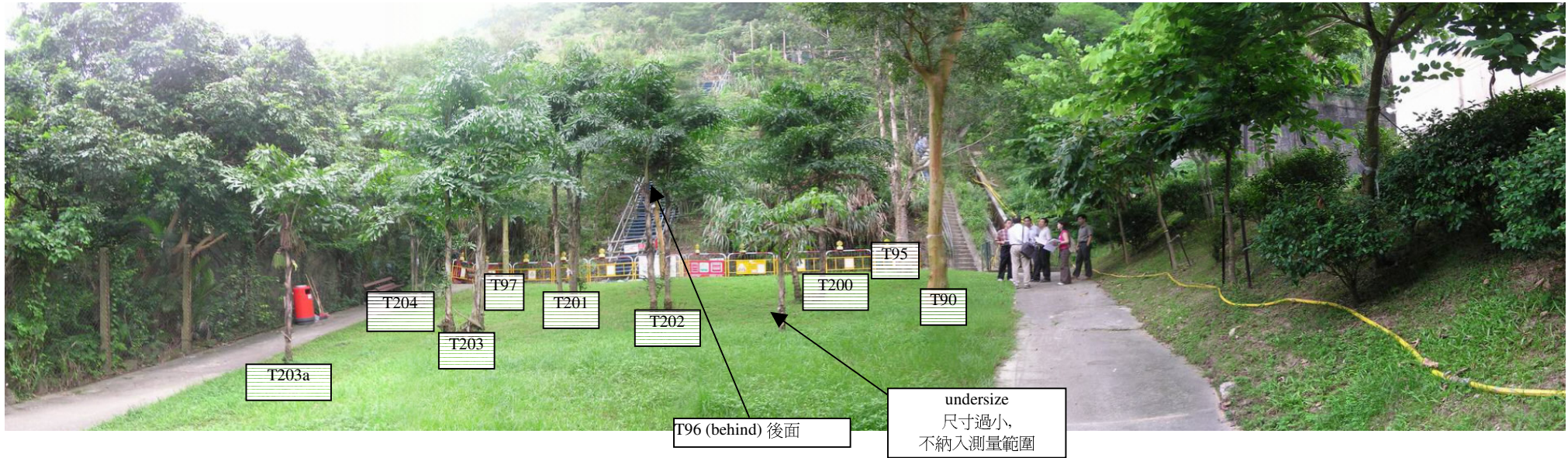
4: For month 18 to 19 (August to September 07), installation of vertical drains for Tunnel 1 and Tunnel 2 share the same of group of equipment.

Appendix 4.3 Tree Survey

Appendix 4.3 Tree Schedule

Tree No.	Species	Overall Height (m)	Girth (m)	Crown Spread (m)	Health (G/F/P)	Form (G/F/P)	Amenity Value (H/M/L)	Survival after Transplanting (H/M/L)	Recommendation	Justification	Jurisdiction	Status & Remarks
T01	<i>Acacia confusa</i>	10	1.25	8	F	F	M	L	R		LCSD	
T02	<i>Acacia confusa</i>	9	1.25	8	F	F	M	L	R		LCSD	
T03	<i>Macaranga tanarius</i>	4	0.4	4	F	F	M	L	T	Within temp work site	LCSD	Multi-trunk. To maximize root ball size and carry out advance root pruning before transplantation.
T90	<i>Cratoxylum ligustrinum</i>	6	0.7	3	F	F	M	M	T	Within temp work site	LCSD	
T91	<i>Bauhinia blakeana</i>	5	0.4	4	F	F	M	H	R		LCSD	On slope
T92	<i>Bauhinia blakeana</i>	5	0.4	3	F	F	M	H	R		LCSD	On slope
T93	<i>Bauhinia blakeana</i>	4	0.4	3	F	F	M	H	R		LCSD	On slope
T94	<i>Bauhinia blakeana</i>	5	0.45	5	F	F	M	H	R		LCSD	Leaning trunk, on slope
T95	<i>Melaleuca quinquenervia</i>	9	0.92	4	F	F	M	M	T	Within temp work site	LCSD	
T96	<i>Cratoxylum ligustrinum</i>	6	0.49	3	F	F	M	M	T	Within temp work site	LCSD	
T97	<i>Cratoxylum ligustrinum</i>	8	0.59	4	F	F	M	M	T	Within temp work site	LCSD	
T98	<i>Celtis sinensis</i>	5	0.35	3	F	P	M	M	R		Private	Partly encroached into metal railing
T99	<i>Celtis sinensis</i>	7	0.45	4	F	P	M	M	R		Private	Partly encroached into metal fence
T100	<i>Celtis sinensis</i>	8	1.8	6	F	F	M	M	R		Private	Partly encroached into metal fence
T101	<i>Celtis sinensis</i>	4	0.4	4	F	F	M	M	R		LandsD/ AFCD	On slope
T102	<i>Celtis sinensis</i>	4	0.3	3	F	F	M	M	T	Within works area	LandsD/ AFCD	On slope
T103	<i>Bridelia tomentosa</i>	3	0.35	2	F	P	M	L	R		LandsD/ AFCD	On slope, covered with climber
T104	<i>Celtis sinensis</i>	3	0.3	2	P	F	M	M	T	Within works area	LandsD/ AFCD	On slope, sparse crown
T110	<i>Dead Tree</i>	3	0.35	2								
T111	<i>Celtis sinensis</i>	4	0.35	3	F	P	M	M	R		LandsD/ AFCD	On slope, unbalance crown
T200	<i>Caryota ochlandra</i>	4	0.36	3	F	F	M	H	T	Within temp work site	LCSD	2-trunk
T201	<i>Caryota ochlandra</i>	6	0.4	4	F	F	M	H	T	Within temp work site	LCSD	3-trunk
T202	<i>Caryota ochlandra</i>	5	0.35	4	F	F	M	H	T	Within temp work site	LCSD	2-trunk
T203	<i>Caryota ochlandra</i>	5	0.35	4	F	F	M	H	T	Within temp work site	LCSD	3-trunk
T204	<i>Caryota ochlandra</i>	4	0.34	3	F	F	M	H	T	Within temp work site	LCSD	3-trunk
T203a	<i>Caryota ochlandra</i>	3	0.25	2	F	F	M	H	T	Within temp work site	LCSD	

Note: G: Good; F: Fair; P: Poor
H: High; M: Medium; L: Low
R: Retain; T: Transplant





MAUNSELL AECOM		LANDSLIDE PREVENTIVE WORKS AT PO SHAN MID-LEVELS 半山區寶珊地段防止山泥傾瀉工程 - 設計及施工		SCALE		A3 1:300		DATE		OCT 2005	
Maunsell Environmental Management Consultants Ltd		TREE SURVEY PLAN (REST GARDEN) 樹木調查圖 (休憩花園)		CHECK		KNKY		DRAWN		JNSC	
				JOB No.		A02005		DRAWING No.		APP 4.3	
								REV		B	

Appendix 5.1A	Proposed Construction Plant Inventory – Mitigated (Use of Quieter PME)
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Appendix 5.1A

Proposed Construction Plant Inventory -Mitigated (Use of Quieter PME)

Landslide Preventive Works at Po Shan Mid-Levels

Site Clearance

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0	102
Dump Truck	[1] -	BS C9/39	1	103	30%	0	98
Total						102	103

Tunnel Portal Formation

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area A	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0	102		
Backhoe	[1] -	BS C3/97	2	105	50%	0			105
Hand-held breaker	- -	CNP026	1	114	50%	0		111	
Drill rig	- -	CNP072	1	110	70%	0		108	
Grout mixer	- -	CNP105	1	90	100%	0		90	
Grout pump	- -	CNP106	1	105	100%	0		105	
Air Compressor	- -	CNP002	1	102	100%	0		102	
Conveyor belt	- -	CNP041	1	90	100%	0	90	90	
Dump Truck	[1] -	BS C9/39	1	103	30%	0			98
Total						102	111	111	106
MAX for Area A							111		

Portal Chamber Formation

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0	102
Backhoe	[1] -	BS C3/97	1	105	50%	0	102
Grout mixer	- -	CNP105	1	90	100%	0	90
Grout pump	- -	CNP106	1	105	100%	0	105
Conveyor belt	- -	CNP041	1	90	100%	0	90
Dump Truck	[1] -	BS C9/39	1	103	30%	0	98
Total						107	103

Tunnel Excavation

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0	102	
Backhoe	[1] -	BS C3/97	1	105	50%	0		102
Generator	[1] -	CNP102	1	100	100%	0	100	
Grout mixer	- -	CNP105	1	90	100%	0	90	
Grout pump	- -	CNP106	1	105	100%	0	105	
Air Compressor	- -	CNP002	1	102	100%	0	102	
Conveyor belt	- -	CNP041	1	90	100%	0	90	
Dump Truck	[1] -	BS C9/39	1	103	30%	0		98
Total						108	104	103
MAX for Area A							108	

Tunnel Excavation and Installation of Sub-Vertical Drains

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area A	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0		102	
Backhoe	[1] -	BS C3/97	1	105	50%	0			102
Generator	[1] -	CNP102	1	100	100%	0	100	100	
Grout mixer	- -	CNP105	1	90	100%	0	90		
Grout pump	- -	CNP106	1	105	100%	0	105		
Air Compressor	- -	CNP002	1	102	100%	0	102		
Conveyor belt	- -	CNP041	1	90	100%	0	90	90	
Water pump	- -	CNP281	1	88	100%	0			88
Dump Truck	[1] -	BS C9/39	1	103	30%	0			98
Total						108	104	102	103
MAX for Area A							108		

Installation of Sub-Vertical Drains

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Area A	Area B
						Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0	102
Backhoe	[1] -	BS C3/97	1	105	50%	0	102
Water pump (electric)	- -	CNP281	1	88	100%	0	88
Conveyor belt	- -	CNP041	1	90	100%	0	90
Dump Truck	[1] -	BS C9/39	1	103	30%	0	98
Total						102	103

Installation of Flexible Barriers

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Drill rig	- -	CNP072	1	110	50%	0
Total						107

Note:

[1] Use of Quiet PME

Appendix 5.1B	Proposed Construction Plant Inventory – Mitigated (Use of Quieter PME, Movable Noise Barrier and Noise Enclosure)
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Appendix 5.1B

Proposed Construction Plant Inventory -Mitigated (Use of Quieter PME, Movable Noise Barrier and Noise Enclosure)

Landslide Preventive Works at Po Shan Mid-Levels

For NSR N1 at low floor (1-9/F)*

Site Clearance

						Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0	102
Dump Truck	[1] -	BS C9/39	1	103	30%	0	98
Total							103

Tunnel Portal Formation

						Area A	Area A	Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] [2]	BS C3/97	1	105	50%	5	97		
Backhoe	[1] [2]	BS C3/97	2	105	50%	5			100
Hand-held breaker	- - [3]	CNP026	1	114	50%	10			101
Drill rig	- [2]	CNP072	1	110	70%	10		98	
Grout mixer	- [2]	CNP105	1	90	100%	5		85	
Grout pump	- - [3]	CNP106	1	105	100%	10		95	
Air Compressor	- [2]	CNP002	1	102	100%	10		92	
Conveyor belt	- -	CNP041	1	90	100%	0	90	90	
Dump Truck	[1] -	BS C9/39	1	103	30%	0			98
Total							98	101	102
MAX for Area A							101		

Portal Chamber Formation

						Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Backhoe	[1] [2]	BS C3/97	1	105	50%	5	97
Backhoe	[1] [2]	BS C3/97	1	105	50%	5	97
Grout mixer	- [2]	CNP105	1	90	100%	5	85
Grout pump	- - [3]	CNP106	1	105	100%	10	95
Conveyor belt	- -	CNP041	1	90	100%	0	90
Dump Truck	[1] -	BS C9/39	1	103	30%	0	98
Total							100

Tunnel Excavation

						Area A	Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] [2]	BS C3/97	1	105	50%	5	97	
Backhoe	[1] [2]	BS C3/97	1	105	50%	5		97
Generator	[1] [2]	CNP102	1	100	100%	10	90	90
Grout mixer	- [2]	CNP105	1	90	100%	5	85	
Grout pump	- - [3]	CNP106	1	105	100%	10	95	
Air Compressor	- [2]	CNP002	1	102	100%	10	92	
Conveyor belt	- -	CNP041	1	90	100%	0	90	90
Dump Truck	[1] -	BS C9/39	1	103	30%	0		98
Total							98	100
MAX for Area A							98	

Tunnel Excavation and Installation of Sub-Vertical Drains

						Area A	Area A	Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] [2]	BS C3/97	1	105	50%	5		97	
Backhoe	[1] [2]	BS C3/97	1	105	50%	5			97
Generator	[1] [2]	CNP102	1	100	100%	10	90	90	
Grout mixer	- [2]	CNP105	1	90	100%	5	85		
Grout pump	- - [3]	CNP106	1	105	100%	10	95		
Air Compressor	- [2]	CNP002	1	102	100%	10	92		
Conveyor belt	- -	CNP041	1	90	100%	0	90	90	
Water pump	- -	CNP281	1	88	100%	0			88
Dump Truck	[1] -	BS C9/39	1	103	30%	0			98
Total							98	98	100
MAX for Area A							98		

Installation of Sub-Vertical Drains

						Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Backhoe	[1] [2]	BS C3/97	1	105	50%	5	97
Backhoe	[1] [2]	BS C3/97	1	105	50%	5	97
Water pump (electric)	- -	CNP281	1	88	100%	0	88
Conveyor belt	- -	CNP041	1	90	100%	0	90
Dump Truck	[1] -	BS C9/39	1	103	30%	0	98
Total							100

Installation of Flexible Barriers

Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Drill rig	- -	CNP072	1	110	50%	0	107
Total							107

Note:

[1] Use of Quiet PME

[2] Use of Movable Barrier

[3] Use of Noise Enclosure

As shown in Figure 5.1, the line of sight to the NSR N1 at low floor (1-9/F) can be screened by movable barrier. Thus, noise reduction of 5dB(A) or up to 10dB(A) could be achieved for certain item of PMEs.

Appendix 5.1B

Proposed Construction Plant Inventory -Mitigated (Use of Quieter PME, Movable Noise Barrier and Noise Enclosure)

Landslide Preventive Works at Po Shan Mid-Levels

For NSR N1 at high floor (above 9/F)

Site Clearance

						Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0	102
Dump Truck	[1] -	BS C9/39	1	103	30%	0	98
Total							103

Tunnel Portal Formation

						Area A	Area A	Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0	102		
Backhoe	[1] [2]	BS C3/97	2	105	50%	5			100
Hand-held breaker	- - [3]	CNP026	1	114	50%	10			101
Drill rig	- -	CNP072	1	110	70%	0		108	
Grout mixer	- -	CNP105	1	90	100%	0		90	
Grout pump	- - [3]	CNP106	1	105	100%	10		95	
Air Compressor	- -	CNP002	1	102	100%	0		102	
Conveyor belt	- -	CNP041	1	90	100%	0	90	90	
Dump Truck	[1] -	BS C9/39	1	103	30%	0			98
Total							102	110	101
						MAX for Area A		110	

Portal Chamber Formation

						Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0	102
Backhoe	[1] [2]	BS C3/97	1	105	50%	5	97
Grout mixer	- -	CNP105	1	90	100%	0	90
Grout pump	- - [3]	CNP106	1	105	100%	10	95
Conveyor belt	- -	CNP041	1	90	100%	0	90
Dump Truck	[1] -	BS C9/39	1	103	30%	0	98
Total							103

Tunnel Excavation

Tunnel Excavation						Area A	Area A	Area B	
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0		102	
Backhoe	[1] [2]	BS C3/97	1	105	50%	5			97
Generator	[1] -	CNP102	1	100	100%	0	100	100	
Grout mixer	- -	CNP105	1	90	100%	0	90		
Grout pump	- - [3]	CNP106	1	105	100%	10	95		
Air Compressor	- -	CNP002	1	102	100%	0	102		
Conveyor belt	- -	CNP041	1	90	100%	0	90	90	
Dump Truck	[1] -	BS C9/39	1	103	30%	0			98
						Total	105	104	100
						MAX for Area A		105	

Tunnel Excavation and Installation of Sub-Vertical Drains

						Area A	Area A	Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0		102	102
Backhoe	[1] [2]	BS C3/97	1	105	50%	5			97
Generator	[1] -	CNP102	1	100	100%	0	100	100	
Grout mixer	- -	CNP105	1	90	100%	0	90		
Grout pump	- - [3]	CNP106	1	105	100%	10	95		
Air Compressor	- -	CNP002	1	102	100%	0	102		
Conveyor belt	- -	CNP041	1	90	100%	0	90	90	90
Water pump	- -	CNP281	1	88	100%	0			88
Dump Truck	[1] -	BS C9/39	1	103	30%	0			98
Total							105	104	100
						MAX for Area A		105	

Installation of Sub-Vertical Drains

						Area A	Area B
Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Backhoe	[1] -	BS C3/97	1	105	50%	0	102
Backhoe	[1] [2]	BS C3/97	1	105	50%	5	97
Water pump (electric)	- -	CNP281	1	88	100%	0	88
Conveyor belt	- -	CNP041	1	90	100%	0	90
Dump Truck	[1] -	BS C9/39	1	103	30%	0	98
Total							102

Installation of Flexible Barriers

Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Drill rig	- -	CNP072	1	110	50%	0	107
Total							107

Note:

[1] Use of Quiet PME

[2] Use of Movable Barrier

[3] Use of Noise Enclosure

As shown in Figure 5.1, the line of sight to the NSR N1 above 10/F can be screened by movable barrier used for backhoe in Area B. Thus, noise reduction of 5dB(A) could be achieved.

Appendix 5.2A	Calculation of Construction Noise Levels at Representative Noise Sensitive Receivers – Mitigated (Use of Quieter PME)
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Appendix 5.2 A

Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Mitigated (Use of Quieter PME)

Landslide Preventive Works at Po Shan Mid-Levels

NSR* : N1		1/F																															
Task No. #	Task Name	Work Area	SWL dB(A)	Distance (m)^	Barr.corr @ dB(A)	SPL dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan		
1a	Site Clearance and Set Up	A	102	15		73			73																								
1b		B	103	51		64			64																								
2a	Tunnel Portal Formation	A	111	15		82				82	82	82																					
2b		B	106	51		67				67	67	67																					
3a	Portal Chamber Formation	A	107	15		78				78	78	78	78	78																			
3b		B	103	51		64				64	64	64	64	64																			
4a	Tunnel No. 1 Excavation	A	108	15		79									79	79	79	79	79														
4b		B	103	51		64									64	64	64	64	64														
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	108	15		79																79	79	79	79								
5b		B	103	51		64																64	64	64	64								
6a	Installation of Vertical Drains	A	102	15		74																				74	74	74	74	74	74		
6b		B	103	51		64																				64	64	64	64	64	64		
7a	Installation of Flexible Barriers	BA1	107	58		67														67	67												
7b		BA2	107	54		67													67	67													
7c		BA3	107	82		64													64	64													
Total SPL, dB(A)							-	-	73	83	83	83	79	79	79	79	79	80	80	67	67	79	79	79	79	74	74	74	74	74	74		

NSR* : N1		10/F																														
Task No. #	Task Name	Work Area	SWL dB(A)	Distance (m)^	Barr.corr @ dB(A)	SPL dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	
1a	Site Clearance and Set Up	A	102	38		65			65																							
1b		B	103	62		63			63																							
2a	Tunnel Portal Formation	A	111	38		74				74	74	74																				
2b		B	106	62		65				65	65	65																				
3a	Portal Chamber Formation	A	107	38		70				70	70	70	70	70																		
3b		B	103	62		63				63	63	63	63	63																		
4a	Tunnel No. 1 Excavation	A	108	38		71									71	71	71	71	71													
4b		B	103	62		63										63	63	63	63	63												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	108	38		71																71	71	71	71							
5b		B	103	62		63																63	63	63	63							
6a	Installation of Vertical Drains	A	102	38		66																				66	66	66	66	66	66	
6b		B	103	62		63																				63	63	63	63	63	63	
7a	Installation of Flexible Barriers	BA1	107	50		68														68	68											
7b		BA2	107	50		68														68	68											
7c		BA3	107	80		64														64	64											
Total SPL, dB(A)							-	-	65	75	75	75	71	71	72	72	72	73	73	68	68	72	72	72	72	68	68	68	68	68	68	

Appendix 5.2 A

Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Mitigated (Use of Quieter PME)

Landslide Preventive Works at Po Shan Mid-Levels

NSR* : N2

Task No. #	Task Name	Work	SWL	Distance	Barr.corr @	SPL	2006												2007												2008
		Area	dB(A)	(m)	dB(A)	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	102	35	10	56			56																						
1b		B	103	70	10	51			51																						
2a	Tunnel Portal Formation	A	111	35	10	65				65	65	65																			
2b		B	106	70	10	54				54	54	54																			
3a	Portal Chamber Formation	A	107	35	10	61				61	61	61	61	61																	
3b		B	103	70	10	51				51	51	51	51	51																	
4a	Tunnel No. 1 Excavation	A	108	35	10	62								62	62	62	62	62													
4b		B	103	70	10	51								51	51	51	51	51													
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	108	35	10	62															62	62	62	62							
5b		B	103	70	10	51															51	51	51	51							
6a	Installation of Vertical Drains	A	102	35	10	57																			57	57	57	57	57	57	
6b		B	103	70	10	51																			51	51	51	51	51	51	
7a	Installation of Flexible Barriers	BA1	107	28	0	73													73	73											
7b		BA2	107	30	0	72																									
7c		BA3	107	56	0	67										67	67														
Total SPL , dB(A)						-	-	56	65	65	65	62	62	62	68	68	73	73	73	73	62	62	62	62	58	58	58	58	58	58	

NSR* : N3

Task No. #	Task Name	Work	SWL	Distance	Barr.corr @	SPL	2006												2007												2008
		Area	dB(A)	(m)	dB(A)	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	102	145		54			54																						
1b		B	103	185		53			53																						
2a	Tunnel Portal Formation	A	111	145		63			63	63	63																				
2b		B	106	185		55			55	55	55																				
3a	Portal Chamber Formation	A	107	145		59			59	59	59	59	59																		
3b		B	103	185		53			53	53	53	53	53																		
4a	Tunnel No. 1 Excavation	A	108	145		60									60	60	60	60	60												
4b		B	103	185		53									53	53	53	53	53												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	108	145		60															60	60	60	60							
5b		B	103	185		53															53	53	53	53							
6a	Installation of Vertical Drains	A	102	145		54																				54	54	54	54	54	54
6b		B	103	185		53																				53	53	53	53	53	53
7a	Installation of Flexible Barriers	BA1	107	80		64													64	64											
7b		BA2	107	60		66												66	66												
7c		BA3	107	64		66										66	66														
Total SPL, dB(A)						-	-	54	63	63	63	60	60	60	60	67	67	67	67	64	64	60	60	60	60	57	57	57	57	57	57

Appendix 5.2 A

Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Mitigated (Use of Quieter PME)

Landslide Preventive Works at Po Shan Mid-Levels

NSR* : N4

Task No. #	Task Name	Work	SWL	Distance	Barr.corr @	SPL	2006												2007												2008
		Area	dB(A)	(m)	dB(A)	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	102	175		52			52																						
1b		B	103	210		52			52																						
2a	Tunnel Portal Formation	A	111	175		61			61	61	61																				
2b		B	106	210		54			54	54	54																				
3a	Portal Chamber Formation	A	107	175		57			57	57	57	57	57																		
3b		B	103	210		52			52	52	52	52	52																		
4a	Tunnel No. 1 Excavation	A	108	175		58									58	58	58	58	58												
4b		B	103	210		52									52	52	52	52	52												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	108	175		58															58	58	58	58							
5b		B	103	210		52															52	52	52	52							
6a	Installation of Vertical Drains	A	102	175		53																				53	53	53	53	53	53
6b		B	103	210		52																				52	52	52	52	52	52
7a	Installation of Flexible Barriers	BA1	107	100		62													62	62											
7b		BA2	107	70		65												65	65												
7c		BA3	107	68		65											65	65													
Total SPL, dB(A)						-	-	52	62	62	62	58	58	59	66	66	66	66	62	62	59	59	59	59	55	55	55	55	55	55	55

NSR* : N5

Task No. #	Task Name	Work	SWL	Distance	Barr.corr @	SPL	2006												2007												2008
		Area	dB(A)	(m)	dB(A)	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	102	75		59			59																						
1b		B	103	50		64			64																						
2a	Tunnel Portal Formation	A	111	75		68			68	68	68																				
2b		B	106	50		67			67	67	67																				
3a	Portal Chamber Formation	A	107	75		64			64	64	64	64	64																		
3b		B	103	50		64			64	64	64	64	64	64																	
4a	Tunnel No. 1 Excavation	A	108	75		65									65	65	65	65	65												
4b		B	103	50		64									64	64	64	64	64												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	108	75		65															65	65	65	65							
5b		B	103	50		64															64	64	64	64							
6a	Installation of Vertical Drains	A	102	75		60																				60	60	60	60	60	60
6b		B	103	50		64																				64	64	64	64	64	64
7a	Installation of Flexible Barriers	BA1	107	176		57													57	57											
7b		BA2	107	160		58												58	58												
7c		BA3	107	200		56										56	56														
Total SPL, dB(A)						-	-	64	71	71	71	67	67	68	68	68	68	68	57	57	68	68	68	68	66	66	66	66	66	66	66

Appendix 5.2 A

Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Mitigated (Use of Quieter PME)

Landslide Preventive Works at Po Shan Mid-Levels

NSR* : N6																															
Task No. #	Task Name	Work	SWL	Distance	Barr.corr @	SPL	2006												2007												2008
		Area	dB(A)	(m)	dB(A)	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	102	60		61			61																						
1b		B	103	75		61			61																						
2a	Tunnel Portal Formation	A	111	60		70			70	70	70																				
2b		B	106	75		63			63	63	63																				
3a	Portal Chamber Formation	A	107	60		66			66	66	66	66	66																		
3b		B	103	75		61			61	61	61	61	61																		
4a	Tunnel No. 1 Excavation	A	108	60		67								67	67	67	67	67													
4b		B	103	75		61								61	61	61	61	61													
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	108	60		67															67	67	67	67							
5b		B	103	75		61															61	61	61	61							
6a	Installation of Vertical Drains	A	102	60		62																			62	62	62	62	62	62	62
6b		B	103	75		61																			61	61	61	61	61	61	61
7a	Installation of Flexible Barriers	BA1	107	112		61													61	61											
7b		BA2	107	120		60												60	60												
7c		BA3	107	140		59											59	59													
Total SPL, dB(A)							-	-	61	71	71	71	67	67	68	69	69	69	69	61	61	68	68	68	68	64	64	64	64	64	64

Note:

*Potentially worst affected floors were assessed.

^ Slant distance was used for calculating the noise levels at NSR N1

@ None of the PME item to be used in Area A and Area B would be visible when viewed from the assessment façade of NSR N2. NSR N2 is considered to be totally screened. According to GW-TM, a noise reduction of 10 dB(A) could be achieved.

1: According to the construction programme, site clearance and tunnel portal formation would not be carried out at the same time

2: For Site Clearance and Set Up, PME at Area A and Area B would not be operated concurrently

3: For month 2 to 4 (April to June 06), Tunnel Portal Formation (Task no. 2a and 2b) and Portal Chamber Formation (Task no.3a and 3b) share the same of group of equipment. Thus, the total SPL = Max SPL (2a&3a)+ Max SPL (2b &3b) as a worst case scenario.

4: For month 18 to 19 (August to September 07), installation of vertical drains for Tunnel 1 and Tunnel 2 share the same of group of equipment.

Appendix 5.2B	Calculation of Construction Noise Levels at Representative Noise Sensitive Receivers – Mitigated (Use of Quieter PME, Movable Noise Barrier and Noise Enclosure)
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Appendix 5.2 B

Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Mitigated (Use of Quieter PME , Movable Noise Barrier and Noise Enclosure) Landslide Preventive Works at Po Shan Mid-Levels

NSR* : N1		1/F																												
Task No. #	Task Name	Work	SWL	Distance	SPL	2006												2007												2008
		Area	dB(A)	(m)^	dB(A)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	102	15	73			73																						
1b		B	103	51	64			64																						
2a	Tunnel Portal Formation	A	101	15	73				73	73	73																			
2b		B	102	51	63				63	63	63																			
3a	Portal Chamber Formation	A	100	15	71				71	71	71	71	71																	
3b		B	100	51	61				61	61	61	61	61																	
4a	Tunnel No. 1 Excavation	A	98	15	70									70	70	70	70	70												
4b		B	100	51	61									61	61	61	61	61												
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	98	15	70															70	70	70	70							
5b		B	100	51	61															61	61	61	61							
6a	Installation of Vertical Drains	A	98	15	70																			70	70	70	70	70		
6b		B	100	51	61																			61	61	61	61	61		
7a	Installation of Flexible Barriers	BA1	107	58	67													67	67											
7b		BA2	107	54	67													67	67											
7c		BA3	107	82	64										64	64														
Total SPL, dB(A)					-	-	73	73	73	73	72	72	70	71	71	72	72	67	67	70	70	70	70	70	70	70	70	70		

NSR* : N1		10/F																												
Task No. #	Task Name	Work Area	SWL dB(A)	Distance (m)^	SPL dB(A)	2006												2007												2008
						Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1a	Site Clearance and Set Up	A	102	38	65			65																						
1b		B	103	62	63			63																						
2a	Tunnel Portal Formation	A	110	38	73				73	73	73																			
2b		B	102	62	61				61	61	61																			
3a	Portal Chamber Formation	A	103	38	67				67	67	67	67	67																	
3b		B	100	62	60				60	60	60	60	60																	
4a	Tunnel No. 1 Excavation	A	105	38	68										68	68	68	68	68											
4b		B	100	62	60										60	60	60	60	60											
5a	Tunnel No. 2 Excavation and Installation of Vertical Drains	A	105	38	68																68	68	68	68						
5b		B	100	62	60																60	60	60	60						
6a	Installation of Vertical Drains	A	102	38	66																				66	66	66	66	66	
6b		B	100	62	60																				60	60	60	60	60	
7a	Installation of Flexible Barriers	BA1	107	50	68														68	68										
7b		BA2	107	50	68																									
7c		BA3	107	80	64											64	64													
				Total SPL, dB(A)		-	-	65	73	73	73	67	67	69	70	70	71	71	68	68	69	69	69	69	67	67	67	67	67	

Note:

*Potentially worst affected floors were assessed.

^ Slant distance was used for calculating the noise levels at NSR N1

1: According to the construction programme, site clearance and tunnel portal formation would not be carried out at the same time

2: For Site Clearance and Set Up, PME at Area A and Area B would not be operated concurrently

3: For month 2 to 4 (April to June 06), Tunnel Portal Formation (Task no. 2a and 2b) and Portal Chamber Formation (Task no. 3a and 3b) share the same of group of equipment. Thus, the total SPL = Max SPL (2a&3a)+ Max SPL (2b &3b) as a worst case scenario.

4: For month 18 to 19 (August to September 07), installation of vertical drains for Tunnel 1 and Tunnel 2 share the same of group of equipment.

Appendix 5.3

Implementation Schedule of
the Proposed Mitigation
Measures

Appendix 5.3 IMPLEMENTATION SCHEDULE OF THE PROPOSED MITIGATION MEASURES

Project profile Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
S 5.1	Construction Noise Control Measures <ul style="list-style-type: none"> Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction program. Silencers or mufflers on construction equipment should be utilized and should be properly maintained during the construction program. Mobile plant, if any, should be sited as far from NSRs as possible. Machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. Plant known to emit noise strongly in one direction should, wherever possible, be orientated so that the noise is directed away from the nearby NSRs. Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening noise from on-site construction activities. 	To minimise construction noise emissions	Contractor	Work Site	Construction Stage	EIAO-TM
S 5.2	<ul style="list-style-type: none"> Use of quieter PME 	To minimise construction noise emissions	Contractor	Work Site	Construction Stage	EIAO-TM
S 5.3	<ul style="list-style-type: none"> Use of movable barrier and noise enclosure 	To minimise construction noise emissions	Contractor	Work Site	Construction Stage	EIAO-TM

Project profile Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
S 5.12-5.14	<p><i>Contingency Planning for Noise Control</i></p> <ul style="list-style-type: none"> Weekly construction noise monitoring at respectively NSRs should be carried out to ensure the above noise mitigation measures would be implemented properly and to check on compliance with the assessment criteria. In the unlikely event of non-compliance with the construction noise criteria, all noisy construction activities should be discontinued to identify sources of non-compliance. If the results of investigation reveal that the exceedance is due to the construction works of the Project, the Contractor should formulate and implement remedial measures such as carrying out maintenance for any defective equipment or re-scheduling of works such that any non-compliance can be rectified. The Engineer should conduct additional monitoring to confirm the effectiveness of the remedial measures. The additional monitoring should be continued until the recorded levels are rectified or proved to be irrelevant to the construction activities. A survey on the number of construction vehicles entering/leaving the proposed works areas would be carried out. The Engineer would make reference to the survey data to “fine-tune” the construction programme if necessary to ensure that project-induced traffic noise impact at the NSRs at Po Shan Road would be minimised as far as practicable. 	To monitor the construction noise emissions and traffic noise emissions	Design Team/Contractor	Work Site	Construction Stage	EIAO-TM

Project profile Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
S 5.15-5.16	<p><i>Construction Dust Control Measures</i></p> <ul style="list-style-type: none"> Regular watering to reduce dust emissions from exposed site surfaces and unpaved road, with complete coverage, particularly during dry weather. Frequent watering for particularly dusty static construction areas and areas close to ASRs. Covering of all dusty vehicle loads transported to, from and between site locations with tarpaulin. Establishment and use of vehicle wheel and body washing facilities at the exit points of the site. Routing of vehicles and positioning of construction plant at the maximum possible distance from ASRs. The belt conveyor used for spoil transfer should be enclosed on the top and the 2 sides. The transfer point between any two belt conveyors should be totally enclosed. An effective belt scraper or equivalent device should be installed at the head pulley of the belt conveyor to dislodge fine particles that may adhere to the belt surface and to reduce carry-back of fine particles on the return belt, and the belt scraper or equivalent should be equipped with bottom plates or other similar means to prevent falling of materials from the return belt. The level of stockpiling belt conveyor 	To minimise construction dust impacts.	Contractor	Work Site	Construction Stage	Air Pollution Control (Construction Dust) Regulation

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	<p>should be adjusted such that the vertical distance between the belt conveyor outlet and the material landing point is maintained at not more than 1m.</p> <ul style="list-style-type: none"> The area for the unloading of dusty materials from a belt conveyor outlet to any stockpile or trucks should be enclosed on the top and the 3 sides. Weekly site inspections to inspect proper implementation of the above-recommended control measures should be conducted during construction phase of the Project. 					
S 5.17	<p><i>Traffic Emission Control Measures</i></p> <ul style="list-style-type: none"> A survey on the number of construction vehicles entering/leaving the proposed works areas would be carried out. The Engineer and Contractor would make reference to the survey data to “fine-tune” the construction programme if necessary to ensure that air quality impact due to emissions from induced traffic at the ASRs at Po Shan Road would be minimised as far as practicable. 	To minimise air quality impact due to project-induced traffic emissions	Engineer/Contractor	Work Site	Construction Stage	-
S 5.19-5.23	<p><i>Construction Water Quality Impact Control Measures</i></p> <ul style="list-style-type: none"> The Contractor shall comply with the Water Pollution Control Ordinance (WPCO) and its subsidiary regulations. The Contractor should ensure that all runoff arising from the works area are properly treated, e.g. by the use of sedimentation 	To control construction phase water quality impact.	Contractor	Work Site	Construction Stage	ProPECC PN 1/94; WPCO

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	<p>tank or silt trap, and that the discharge standards as stipulated in WPCO are met. Any trade effluent or foul or contaminated or cooling or hot water should not be discharged into any public sewer, stormwater drain, channel, stream course or the sea. If toilet facilities are erected, foul water effluent should be directed to the public foul sewer.</p> <ul style="list-style-type: none"> • The Contractor should be responsible for the design, construction, operation and maintenance of all the mitigation measures and practices specified in the Professional Persons Environmental Consultative Committee Practice Note (ProPEOCC PN) 1/94 "Construction Site Drainage" issued by the Director of Environmental Protection. • Precautionary protection measures for the drainage culvert should be implemented by the contractor. Measures should include diversion of construction site effluent away from the drainage culvert, and placement of construction equipment and materials away from the drainage culvert. • Groundwater will be monitored by 29 nos. of automatic groundwater monitoring devices (AGMD) installed at the piezometers on the concerned natural hillsides. If abnormal groundwater drawdown is identified, groundwater table will be replenished by pumping water through a series of proposed recharge well. The monitoring will be conducted during construction phase of the Project. 					

Project profile Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
	Following completion of the Project, post-construction monitoring will be carried out for two years. The need for carrying out further monitoring will be reviewed by making reference to monitoring data obtained during the construction and post-construction periods as appropriate.					
S 5.26-5.28	<p>Construction Waste Management Measures</p> <ul style="list-style-type: none"> The Contractor shall comply with the Waste Disposal (Chemical Waste) (General) Regulation, the Waste Disposal Ordinance and its subsidiary regulations. A Waste Management Plan should be included by the Contractor in the construction contract. The Contractor should not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from site onto any adjoining land or allow any waste matter which is not part of the final product from waste processing plants to be deposited anywhere within any site or onto any adjoining land. The construction and demolition material generated by the Contractor on-site should be transported to the public filling facility designated by CEDD. Monitoring of the Contractor's compliance with the requirements of the trip ticket system in accordance with ETWB TCW No. 31/2004 should be carried out to ensure that the correct procedures are being followed at all times. 	To implement waste management.	Contractor	Work Site	Construction Stage	Waste Disposal Ordinance (Cap.54); Waste Disposal (Chemical Waste) (General) Regulation; ETWB TCW No. 31/2004

Project profile Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
S 5.32	<p><i>Ecological Impact Control Measures</i></p> <ul style="list-style-type: none"> The precise alignment of the flexible barrier should take into account the findings of the tree survey and a future detailed vegetation survey conducted for the Project to avoid and minimise disturbance to mature trees and plant species of conservation importance where practicable. There should be no tree felling. A detailed survey should be conducted before the commencement of works to accurately map the location of plant species of conservation importance within and adjacent to proposed works areas. The location of plant species should be taken into consideration during the detailed design of landslide preventive works (including the flexible barrier), and if practicable, they would be retained <i>in-situ</i>. If the proposed works would unavoidably affect the plants, as a last resort, it is recommended they be transplanted to suitable nearby locations prior to commencement of construction phase. A Report detailing measures to protect plant species of conservation importance found within and adjacent to works areas should be submitted to EPD/ AFCD for discussion and agreement following the completion of detailed vegetation surveys, and prior to the commencement of construction phase activities. 	To avoid and minimise ecological impacts	Engineer/ Contractor	Work Site	Design Stage	EIAO-TM

Project profile Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
	<ul style="list-style-type: none"> • Placement of equipment or stockpile in designated works areas and access routes selected on existing disturbed land to minimise disturbance to woodland habitats. • Construction activities should be restricted to works areas that should be clearly demarcated. The works areas should be reinstated after completion of the works. • Waste skips should be provided to collect general refuse and construction wastes. The wastes should be disposed of timely and properly off-site. • General drainage arrangements should include sediment and oil traps to collect and control construction site run-off. • Open burning on works sites is illegal, and should be strictly prohibited. • Temporary works areas would be reinstated following the completion of construction phase activities. • Disturbance to existing vegetation should be minimised wherever possible. In particular, adequate protection should be provided for mature trees located within or adjacent to proposed works areas. 					

Project profile Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
S 5.37-5.38	<i>Landscape Resources Preservation Measures</i>	To maximize tree retention and ensure tree protection	Design Team and Contractor	Work Site	Design Phase	EIAO-TM
S 5.39-5.40	<ul style="list-style-type: none"> The construction contract shall designate 'no-intrusion zone' for the contractor throughout the entire site to maximize tree retention and to ensure tree protection during the construction phase. There should be no tree felling. All existing trees to be retained onsite shall be properly protected before the works start. Contractor's access to designated 'no-intrusion zone' should be prohibited. The existing chainlink fence with climbers between the rest garden and Po Shan Road forms a reasonable screen. Until it is upgraded or reconstructed when the works are nearly completed, it shall be retained and protected during the construction phase. 	To maximize tree retention and ensure tree protection	Contractor	Work Site	Construction Phase	EIAO-TM
S 5.41-5.42	<i>Reinstatement of Rest Garden and Disturbed Slope</i> <ul style="list-style-type: none"> Rest garden shall be reinstated to meet LCSD's Standards. Any disturbed slope shall be reinstated with matching woodland mix planting 	To reinstate the affected areas	Contractor	Work Site	Operational Phase	LCSD's standards
S.5.45	<i>Management of Overall Construction Phase Environmental Impacts</i> <ul style="list-style-type: none"> The Project Proponent will set up a Community Liaison Office with a telephone action hotline to enable the public to raise any matters of concern regarding the project such as complaints and comments. 	To minimize overall construction phase environmental impacts	Project Proponent	-	Construction Phase	-