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1. BASIC INFORMATION

1.1 Project Title

Castle Peak Cable Tunnel

1.2 Purpose and Nature of the Project

CLP Power Hong Kong Limited (CLPP) are planning to construct a cable tunnel ("the Castle Peak Cable Tunnel") to enhance the future cable outlets from Black Point and Castle Peak Power Stations, thereby improving the supply security to the existing network in Tuen Mun, Yuen Long and the airport.

The cable tunnel will be bored through the mountainous area of Castle Peak (beneath the Tsing Shan Firing Range). This method of construction is the preferred approach to reduce visual impacts associated with the power cables, avoid interface with the Tsing Shan Firing Range, and to increase the reliability of the system.

The proposed scheme design alignment and potential alignment envelope for the CLPP Castle Peak Cable Tunnel is presented in Appendix 1, Figure 1.1. The tunnel will be approximately 4.5km long with a 4.5m internal diameter to contain eight 132kV cable circuits. The preferred approach for construction will be the use of a tunnel boring machine (TBM), however, other methods may be considered by the design and build contractor, such as localised drill and blast methods.

This Project Profile includes an assessment of the potential environmental impacts associated with the construction and operation of the Castle Peak Cable Tunnel. The assessment has been based on information compiled by the Project Proponent and the Design Engineers.

1.3 Name of Project Proponent

CLP Power Hong Kong Limited

Engineering Projects Department

6/F Shamshuipo Centre

215 Fuk Wa Street

Kowloon

Hong Kong

Tel: 2678 6134 Fax: 2678 6210

1.4 Location and Scale of Project

The cable tunnel route traverses through a mountainous area from the western end of Castle Peak Power Station to a District Open Space (part of the Wu Shan Recreational Playground) located adjacent to the Sun Tuen Mun Centre in Tuen Mun. The majority of the tunnel alignment runs beneath the Tsing Shan Firing Range.

A shaft is proposed at the Tuen Mun end of the tunnel alignment (with an expected site area of approximately 2,510m^2) and a portal is proposed adjacent to the Castle Peak Power Station, to the east of Lung Fai Street (with an expected site area approximately 1,320m^2) with a works site to the west of Lung Fai Street (with an expected site area of approximately 11,040m^2). These locations will be the only areas of aboveground work and no other surface works will be required. The proposed works sites are shown in Appendix 1, Figure 1.2.

Upon completion of the construction work, there will be an access structure and ancillary facilities at the Castle Peak portal and a ventilation shaft and a ventilation / Electrical and Mechanical (E&M) building at Tuen Mun as part of the air intake for the tunnel. The shaft and ventilation building have been located in an area at the west end of the existing park based on discussions with Leisure & Cultural Services Department (LCSD). The permanent shaft has been located as far from the Sun Tuen Mun Centre as possible while ensuring there is sufficient space for a proposed Emergency Vehicle Access road to the ventilation building and a proposed access road to the LCSD storage area.

Initial discussions have been held with LCSD with regard to the temporary measures and permanent reinstatement and maintenance of the site and LCSD have been supportive with regard to the proposals developed so far. The proposals have been circulated to government departments and will be refined and agreed with LCSD prior to the works.

1.5 Environmental Impact Assessment Ordinance Status

The Castle Peak Site of Special Scientific Interest (SSSI) is located in the project area and has been designated SSSI status due to its flora. The tunnel alignment passes at a minimum depth of 300m below the surface of a section of this SSSI for a distance of about 250m and is shown, in relation to the tunnel alignment, in Appendix 1, Figure 1.3. The tunnel alignment will be significantly below the ground surface and will not impact the SSSI.

This Project Profile covers one classification of a Designated Project under the Environmental Impact Assessment Ordinance (EIAO), Schedule 2, Part I, Q – Miscellaneous, Q.1.

1.6 Name and Telephone Number of Contact Person

The Project Manager for CLPP for this project is:

Mr. Benson Hui Telephone: 2678 6134

2. OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 Implementation and Planning of the Proposed Project

CLPP have appointed Atkins China Limited (Atkins) as their consultant for the preparation of a scheme design, associated contract documents and environmental reporting for the Castle Peak Cable Tunnel.

2.2 Route Selection

The potential alignment envelope is considered to be the most appropriate route for this project. The underground portion of the alignment has been selected based on the shortest distance between the portal and shaft locations, taking into consideration the physical / engineering ground constraints and avoiding traversing beneath the Pillar Point Valley Landfill (PPVL). The portal locations have been selected based on the availability of non-environmentally sensitive land in the area and due to the proximity of the Castle Peak portal near the Castle Peak Power Station and the Tuen Mun shaft near the urban area of Tuen Mun.

During the detailed design, minor changes may occur to the underground alignment of the tunnel due to engineering considerations, however, such changes are not

expected to decrease the stated distance between the tunnel and the sensitive receivers identified and would be agreed with EPD in advance.

2.3 Project Time Table

The target completion date for the tunnel excavation is mid 2008 to facilitate cable installation by CLPP. Completion of the overall project is targeted for the third quarter of 2008.

The key project programme target dates are as follows:

Detailed Design and Land Approvals (See note 1)	October 2005 – October 2006
Construction	October 2006 – Third quarter 2008
Cable installation	Mid 2008 – Third quarter 2008
Completion	Third quarter 2008

Note 1: This will include a Section 16 application to Town Planning Board based on the Contractor's Detailed Design.

2.4 Interactions with Broader Programme or Other Projects

The Transport Department, Traffic Engineering (NTW) Division are currently planning a new turn around, taxi stand and bus stop arrangement in Tuen Tsing Lane adjacent to Sun Tuen Mun Centre. The target completion date for these roadworks is August 2006. For the Castle Peak Cable Tunnel, the works will initially commence at the Castle Peak Portal site. Construction work is currently programmed to commence for the Tuen Mun shaft site after the roadworks have been completed. As such, cumulative impacts arising from the projects are not anticipated.

At the Tuen Mun shaft, trenching works will be required to run the cables west and east along Tuen Tsing Lane. Whilst these trenching works are not part of this Works Contract, there is the potential for the trenching works to coincide with the end of the construction work at the Tuen Mun shaft site. There is also the potential for cable laying (by CLPP) to be undertaken at the same time as the E&M work is being undertaken in the shaft. The potential cumulative impacts from both the trenching and cable laying works of the other works contract have been considered in the construction noise assessment.

3. MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

3.1 Existing and Planned Sensitive Receivers and Sensitive Parts of the Natural Environment that might be affected by the Proposed Project

3.1.1 Noise

The closest noise sensitive receivers (NSRs) are indicated on Appendix 1, Figure 3.1 and are summarised in Table 3.1 below.

Table 3.1 Representative Noise Sensitive Receivers

NSR	Description	Approximate Distance from the Works Area (m)
NSR1	Village Houses on Lung Kwu Tan Road	> 400m
NSR2	Sun Tuen Mun Centre (Block 3)	28m
NSR3	Siu Shan Court	230m

At the Castle Peak portal, the closest noise sensitive receivers are village houses located over 400m away from the works site on the Lung Kwu Tan Road. Due to the distance from the site and topographic shielding from natural and man-made slopes, these houses will not be exposed to construction related noise and are therefore not considered further in this assessment.

At the Tuen Mun shaft, road traffic and KCRC light rail along Lung Mun Road dominate the background noise level. Block 3 of the Sun Tuen Mun Centre is the closest NSR to the site at about 28m from the works area boundary. The residential units in the development (i.e., the NSRs) are located on a podium structure of about 6 residential storeys high (approximately 17m above ground). Some units of Siu Shan Court also have line of sight to the shaft site but at a distance of about 230m from the site boundary.

With reference to Tuen Mun Outline Zoning Plan No. S/TM/20, there are no planned NSRs located near the works site and there are no rezoning applications (or Section 16 applications) under the Town Planning Ordinance in the vicinity of the works site that would become NSRs during the project construction.

3.1.2 Air Quality

The air sensitive receivers are the same as the NSRs discussed above. In addition, Wu Shan Recreation Playground located to the southeast of the Tuen Mun works site is also an air sensitive receiver. Currently the vehicular emissions from traffic on Lung Mun Road are the key air pollutant source in the area.

3.1.3 Water

There are no natural watercourses at either the Tuen Mun shaft or the Castle Peak portal works sites. At the Castle Peak portal, the site boundary is over 20m from the High Water Mark along the coast. The beach is not a Gazetted Beach and the project will not affect the beach area.

At the Tuen Mun shaft end of the tunnel, there is an existing single cell 2.5m x 2.5m sewer box culvert which crosses the tunnel alignment about 10m above. As the tunnel is expected to be in competent rock (which will be verified after detailed site investigation) at this intersection, likely settlements and associated impacts are considered to be minimal. However, the Contractor will be responsible for the monitoring of potential movements as required by DSD (Mainland North Division) and as specified in the Contract Documents. The method of monitoring of potential movements and the acceptance criteria will be agreed with DSD prior to the commencement of tunnelling work in the vicinity.

3.1.4 Ecology

Neither of the works sites are located in designated sites of conservation importance.

Tuen Mun Shaft Site

Literature Review

The proposed Tuen Mun Shaft Site is within a park area managed by LCSD. (Refer to Section 1.4.) There is no literature on any sensitive ecological resources existing within the proposed works area.

Site Survey

The proposed work site mainly comprises LCSD's playground and storage area within the park and is a man-made environment. The site is mostly concreted and sparsely

covered by vegetation, including the ornamental trees (*Cinnamomum burmanii, Caryota ochlandra* and *Chrysalidocarpus lutescens*), mostly planted in isolated planters. No natural ecological resources were found within this area.

To the west of the fence line, there is a small area of lawn and an area of hardstanding used for LCSD storage. Further west there is a small patch of roadside plantation (including the palm *Caryota ochlandra* and *Chrysalidocarpus lutescens*) adjacent to Lung Mun Road.

A patch of lowland secondary woodland was found on the southern side of the proposed Shaft Site beyond and outside of the proposed works area. It is bordered by a strip of lawn and will not be affected by the work.

Habitat Evaluation

The proposed shaft site is a heavily disturbed and modified man-made environment where natural ecological resources are virtually absent; and hence its ecological value is considered to be very poor. An evaluation of this site is shown below in Table 3.2.

Table 3.2 Evaluation of the Tuen Mun Shaft Site

Criteria	Remarks
Naturalness	The site is a man-made environment
Size	The site is small in size (0.25ha)
Diversity	The site is very poor in both habitat and species diversities
Rarity	None of the ecological resources found are considered to be rare
Re-creatability	The site is readily re-creatable
Fragmentation	The site is not fragmented
Ecological linkage	The site has no ecological linkage to any valuable habitat
Potential value	The site has very low potential value given its status
Nursery / Breeding ground	No known nursery / breeding ground exists and/or is in close proximity to the proposed site
Age	No information available
Abundance /Richness of wildlife	The site is very low in abundance/richness of wildlife

Castle Peak Portal Site

Literature Review

No previous EIA studies have been conducted to investigate the ecological condition of the proposed Castle Peak Portal Site and/or its surrounding area. There is no literature record indicating sensitive ecology within the works site area. However, outside the works site boundary, the beaches at Lung Kwu Sheung Tan and Lung Kwu Tan have been identified as potential breeding sites for the Chinese King Crab (horseshoe crab) *Tachypleus gigas* (Huang 1997), and both the *Tachypleus gigas* and *Tachypleus tridentatus* have been recorded from trawl surveys at Tap Shek Kok just south of Lung Kwu Tan (ERL 1992, ERM 1993, Planning Department 1993, SWK 1993). The Horseshoe crab is identified as a species of potential conservation concern in the HKSAR and its abundance and distribution range has been decreasing because of over-exploitation. This coastal area is outside the work site area and will not be directly or indirectly impacted by the project works.

Site Survey

The proposed Castle Peak portal is located in an area to the north of the Castle Peak Power Station which has been disturbed by the slope works for the formation of Lung Fai Street and comprises 2 patches of plantation woodland on both sides of the road. Both of the woodland patches have the same ecological and floristic characteristics.

The canopy of the plantation woodland is semi-open in nature and dominated by the fast-growing exotic trees *Casuarina equisetifolia, Acacia confusa* and *Leucaena leucocephala* accompanied by a few native trees such as *Ficus virens, Ficus microcarpus, Hibiscus tiliaceus, Macaranga tanarious, Bridelia tomentosa, Celtis chinensis and Sapium sebiferum.* The height of the trees range from 2m to 19m, with the girth width ranging from between about 5cm to 40cm.

The plantation woodland is simple in structure and the sub-storey and under-storey growth was found to be poor with little vegetative growth, especially saplings of native tree species. The ground floor of the woodland is covered by a thick layer (>3cm) of leaf litter. The plantation woodland habitat is influenced by road traffic along Lung Fai Street and the operations of the Castle Peak Power Station. The habitat is also fragmented from the natural vegetation on the slopes above Lung Mun Road.

A shrubland habitat was found on the steep slope on the southwest part of the portal site, facing the sea. It is composed of native shrub and tree species. Common species found in the shrubland include the trees *Cratoxylum cochinchinense* and *Scolopia saeva*, as well as the shrub *Litsea rotundifolia*. The sub-storey growth of the shrubland was also found to be simple and poor because of the thin soil profile and rocky substrate of the steep slope.

The project area will be limited to the headland and measures will be taken so that the works will not directly or indirectly affect the beach or coastal waters outside the works area.

Habitat Evaluation

The plantation woodlands found in the proposed Castle Peak Portal Site are poor in structural complexity and species diversity, and ecological resources provided by this habitat type are very limited with no species of conservation interest found within the works area. An evaluation is provided in Table 3.3 and the habitat found at the proposed portal site is considered to be low to moderate.

Table 3.3 Evaluation of the Castle Peak Portal Site

Criteria	Remarks
Naturalness	The site is a man-made habitat
Size	The sizes of the plantation woodland is relatively small in size (1.1ha and 0.13ha)
Diversity	The area is poor in both habitat and species diversities
Rarity	Neither the habitats or the species found are rare in Hong Kong
Re-creatability	The plantation woodland habitat are easy to re-create
Fragmentation	The plantation woodland is fragmented into 2 patches by a road
Ecological linkage	There is no ecological linkage between the two habitats and other sites and/or species of conservation interest
Potential value	The potential value of the habitats is considered moderate and constrained by the hard and rocky substratum which restricts the development of the vegetation

Criteria	Remarks
Nursery / Breeding ground	No nursery/breeding ground is found within the area, the potential breeding ground of horseshoe crab is outside the proposed works areas
Age	The age of the plantation woodland is considered less than 20 years old and in an early stage of development
Abundance /Richness of wildlife	The habitats are poor in abundance and richness of wildlife

Castle Peak SSSI

The Castle Peak SSSI consists of the summit and the ravines on the east and west faces of the Castle Peak and covers an area of about 76.4ha. It is designated for its botanical interest, as the summit is an important site for *Platycodon grandiflora*, a rare plant species protected under the Forests and Countryside Ordinance, and the rare plant *Uvaria hamiltonii* has also been reported to be present in the ravine forests.

The tunnel is expected to be wholly in rock when passing underneath the SSSI and will likely be undertaken using TBM construction methods for the main tunnel, with possibly tunnel niches being excavated using hand excavation methods or localised blasting, which will be determined by the design and build Contractor. The construction works within the tunnel will not have any impact within or near the SSSI as the tunnel is located some 300m below the ground surface. Due to the depth of the tunnel below ground level, vibration would not result at ground level. As such, the SSSI will not be affected either directly or indirectly by the project and no impacts will result to the flora.

3.1.5 Landscape and Visual

The site areas for construction are shown in Appendix 1, Figure 1.2. Plans and sections for the Castle Peak Portal and Tuen Mun shaft during the operation phase are presented in Figures 3.2 and 3.3 respectively with photographs of the existing Castle Peak Portal and Tuen Mun Shaft locations shown in Figures 3.4 and 3.5 respectively.

The landscape character of the Castle Peak site comprises primarily plantation species woodland adjacent to the power station, and this is considered to have a medium sensitivity to change as the landscape character is dominated by the close proximity of the power station. Based on a tree survey of the area (see the summary of results in Appendix 4), no trees in the Project Area are rare, protected by law or of significant amenity value. They are primarily exotic plantation species and of poor tree form and range between 2m and 19m in height and average about 4m in crown spread.

The Tuen Mun site is located in an urban setting with the landscape character dominated by the high-rise residential development of Sun Tuen Mun Centre as well as the Tuen Mun Golf Centre. The Tuen Mun shaft site would be located in an area managed by LCSD containing a fitness station and playground of predominantly hard–standing, with a low degree of landscape value. The landscape character of the site is considered to have a low sensitivity to change.

Neither site is considered to be in an area of high visual value.

The Castle Peak site is only partially visible from the sea with the landscape and vista dominated by the adjacent Castle Peak power station and Castle Peak behind. The visually sensitive receivers (VSRs) at the Castle Peak include CLPP employees (VSR1) and visitors using Lung Fai Street and the operators and passengers of

marine craft (VSR2) in western Hong Kong waters. Both of these VSRs are considered to have low sensitivity to change mainly due to the short and infrequent duration of view (VSR1) as well as the low degree of visibility and availability of alternative views (VSR2).

At the Tuen Mun site, the key VSRs are the residents of the Sun Tuen Mun Centre (Blocks 1-4 and 7-10) (VSR3) facing the existing playground and the residents on the upper floors of the three northern blocks of Siu Shan Court (VSR4). Other VSRs include the users of the remaining part of Wu Shan Recreational Playground (VSR5), and the users of Lung Mun Road (VSR6) and Tuen Tsing Lane (VSR7).

The residents of Sun Tuen Mun Centre are set back, elevated and have alternate views available. The foreground / middleground can also partially absorb views of the project and the existing quality of the view of the project site is low. Therefore VSR3 is considered to have medium sensitivity to change. Since the project is over 200m from VSR4, it is considered to have a low sensitivity to change. Since VSRs 5, 6 &7 are only in transit and/or have short and infrequent views of the site, they are also classified as having a low sensitivity to change.

3.1.6 Historical and Cultural

There are no declared monuments or historical structures within or in close proximity to either works site and the sites are relatively disturbed and no historical or cultural impacts are anticipated.

According to the Antiquities and Monuments Office (AMO) records, prehistoric archaeological remains have been found at sites within Lung Kwu Tan, a village north of the Castle Peak Portal Site. Excavations have been undertaken at these sites which are presently used for residential and horticultural uses. The project work area is outside the area identified and the local geology has been confirmed as primarily fill material and alluvium (potentially a former stream course that has been diverted) and has been extensively disturbed. Due to the disturbed nature of the site, archaeological remains are not expected to be present at this location.

3.2 Elements of Surrounding Environment Which Might Affect the Project

3.2.1 Landfill Sites

There is one strategic landfill, the West New Territories (WENT) Landfill, and two closed landfills, Siu Lang Shui Landfill (SLSL) and Pillar Point Valley Landfill (PPVL), in the Castle Peak area. The tunnel alignment has been specifically developed to avoid the tunnel alignment running directly beneath the landfill sites so as to avoid any direct or indirect construction or operational effects on these landfills.

The WENT landfill and Siu Lang Shui Landfill are over a kilometre away from the proposed works and hence will not have an impact on the proposed cable tunnel.

The existing landfill boundary of the closed landfill site, the PPVL, is situated about 225m away from the tunnel alignment at its closest point. In addition, the original landfill boundary abuts the tunnel alignment. However, the cable tunnel is expected to be at a depth of about 180m below ground at this location. The PPVL presently adopts a gas venting system. The PPVL is programmed to undergo restoration in 2006, at which time it is expected that a new gas control system and leachate management system will be implemented.

A preliminary landfill gas hazard (LGH) assessment has been undertaken (see Appendix 2) based on the EPD *Landfill Gas Hazard Assessment Guidance Note*. The assessment was undertaken to determine the potential sources and pathways for

landfill gas and leachate that could reach the cable tunnel and, based on a qualitative risk assessment matrix, to determine the degree of risk anticipated.

Based on the findings of this assessment, impacts from leachate are not expected to result due to the distance from the landfill.

With regard to landfill gas, the assessment concluded that the risk of landfill gas hazard to the tunnel is medium during construction and medium during the operational and maintenance phase due to the distance from the landfill site, the gas source and the expected pathways. As a prudent contingency measure, a ventilation system will be installed for the operational and maintenance phase. Normally the ventilation will be off. A daily timer will be installed to control the fans to run 2 hours per day to reduce humidity and any stale air inside the tunnel. Other than this the ventilation will only be activated during tunnel maintenance operations, or during auto operation mode when the tunnel temperature reaches 40°C or upon receiving an alarm signal from the gas detection system, however, this is not anticipated to occur on a regular basis.

As the present status of the qualitative risk assessment is medium, precautionary measures are required to be implemented for reducing the potential impacts to workers (listed in Section 5.1.6 of this Report). As part of the Contract Documents for this Project, a detailed quantitative LGH assessment will be required to be prepared by the Contractor based on the detailed method statement and design to further ensure that intrusion of landfill gas and leachate is prevented both during construction and operation of the tunnel.

3.2.2 Other Elements

Apart from the PPVL there are no other major elements of the surrounding environment that might affect the project area.

4. POSSIBLE IMPACTS ON THE ENVIRONMENT

4.1 Summary of Potential Environmental Impacts

The construction and operational impacts associated with the proposed Castle Peak Cable Tunnel are summarised in Table 4.1 and are described in further detail in the following Sections.

Table 4.1 Potential Sources of Environmental Impacts

Potential Impact	Cons.*	Ops.*
• Gaseous emissions	✓	x
• Dust	✓	x
• Odour	x	x
• Noise	✓	✓
• Night-time operations	✓	x
• Traffic generation	✓	x
• Liquid effluents, discharges, or contaminated runoff	✓	x
• Generation of waste or by-products	✓	x

• Manufacturing, storage, use, handling, transport, or disposal of Dangerous Goods, hazardous materials or wastes	✓	x
• Risk of accidents which result in pollution or hazard	✓	x
• Disposal of spoil materials	✓	x
• Disposal of potentially contaminated materials	x	x
• Disruption of water movement or bottom sediment	x	x
• Unsightly visual appearance	✓	✓
• Ecological impacts:		
- Terrestrial	✓	x
- Marine	x	x
- Fisheries	x	x
• Cultural heritage	x	x

Notes: ✓ = Potential to result in adverse impacts, **x** = Not expected to result in adverse impacts

*: Cons. = Construction phase Ops. = Operation phase

4.2 Process Involved, including Process Flow Diagrams, Site Plans, Storage Requirements, and Information on Emissions and Discharges

4.2.1 Tunnel Construction

The construction method for the cable tunnel will by Tunnel Boring Machine (TBM) which would be launched at the Castle Peak portal and the cutter head would be retrieved from the Tuen Mun shaft, whilst the remainder of the TBM would be pulled back through and extracted at the Castle Peak Portal. This will help minimise construction and spoil transportation impacts within the Tuen Mun urban area. Drill and localised blast methods may be undertaken for tunnel construction at the Castle Peak portal and Tuen Mun shaft areas as well as for joint bays and possibly niches. Blasting methods would require approval by the Mines Division, Geotechnical Engineering Office, Civil Engineering and Development Department and a license would be required for this work prior to being undertaken.

The internal diameter of the tunnel will be approximately 4.5m, with an excavation diameter of approximately 5.2m, to allow for space to construct the permanent lining (as necessary). The tunnel will be approximately 4.5km long. Various niches and joint bays will also be excavated at intervals of 500m and 600m respectively along the tunnel, possibly by hand and localised blasting.

Based on the preliminary interpretation of the ground conditions along the tunnel alignment, the tunnel is expected to be mainly excavated in rock except for possible local weathering zones along the Lung Mun Road at Tuen Mun and various geology structures such as faults, quartz veins and contacts between the different rock types.

Depending on the stability of the excavated profile and the degree of water ingress, the tunnel may be unlined along certain sections. The tunnel will be excavated and the lining will be installed as necessary in line with the exposed ground conditions. For sections of the tunnel where good competent rock is exposed and limited water seepage is evident no lining may be required. The section of the tunnel which passes through the PPVL Consultation Zone will be constructed to be ‘gas tight’. The details of the lining requirement will also be determined during the detailed quantitative LGH

assessment to be undertaken by the Contractor (as mentioned in section 3.2.1).

In other sections of the tunnel such as where poorer weathered rock or soil are exposed, temporary tunnel support and in-situ concrete, precast concrete segments or sprayed concrete permanent lining will be applied to provide both stability and water cut off. Drainage channels would be provided to intercept any water seepage into the tunnel.

CLPP will install 8 groups of 132kV cable circuits inside the tunnel. Three groups of cable circuits will be installed directly following completion of the tunnel and the remaining five groups will be installed in the future. For maintenance access and inspections, E&M services will also be provided.

4.2.2 Castle Peak Portal

At Castle Peak, a portal will be formed with temporary open cut slopes in soil and rock with a formation level that is approximately level with the Lung Fai Street. The site will disturb an area of about 1,320m^2. Soil nails, pattern or spot bolts with sprayed concrete will be used to provide temporary support for the temporary cut slopes. Alternatively, retaining walls may be used to form the works area required in the slope. The construction of the portal is likely to involve some temporary traffic measures along Lung Fai Street. The permanent portal structure will be backfilled and replanted following completion of the tunnel works.

4.2.3 Tuen Mun Shaft

The Tuen Mun shaft will be constructed to a depth of about 10m in soil and the remaining 10m in rock. The dimension of the shaft is anticipated to be around 15.3m by 8.4m. Depending on the geotechnical parameters to be confirmed following further site investigation, retaining structures using sheet pile walls, contiguous bored pile walls or diaphragm walls with a lateral supporting system would be required for the shaft excavation in the soft ground section. A curtain wall may be constructed by using permeation grouting method to ensure the water-tightness of the retaining structure. In the rock section, depending on the rock quality to be encountered, pattern or spot bolting with sprayed concrete would be used to provide adequate temporary support to the excavated shaft.

In order to minimise the shaft size and the footprint of the above ground ventilation building, the plant rooms will be stacked and the ventilation fans will be mounted vertically in the shaft. Upon completion, the grounds will be reinstated with landscaping around the permanent E&M / ventilation building. The ventilation building at this location will be used as an air intake for the tunnel with the exhaust located at the Castle Peak Portal.

4.3 Environmental Impacts During Construction Phase

4.3.1 Gaseous Emissions and Dust

There is the potential for fugitive dust emissions to be generated at both sites from the site clearance, excavation, blasting (should drill and blast techniques be adopted) and stockpiling of materials. Where blasting techniques are adopted, significant impacts are not anticipated at the ASRs as dust control measures will be applied at the portal and shaft, as required.

There will also be exhaust emissions (SO_2 and NO_X) from diesel powered construction plant. Through the application of standard dust control measures and the use of properly maintained equipment, however, adverse impacts on air quality are not anticipated.

4.3.2 Odour

No odour impacts are expected to result from the construction activities.

4.3.3 Noise

The Sun Tuen Mun Centre (NSR 2) is the closest NSR and will be the most affected NSR with regard to noise generated from the Tuen Mun Shaft construction. The key noise sources will be Powered Mechanical Equipment (PME) used during the removal of the hard standing, construction of the shaft, retrieval of the TBM, construction of the E&M plant room and ventilation shaft, backfilling, reinstatement and landscaping work. The anticipated equipment required for each activity and its sound power level are provided in Table 4.2. Quiet plant has been assumed for the air compressor and the generator and hand held breakers have been assumed for the shaft construction which are expected to be used at this location. This list of plant has been agreed by the scheme design consultants and CLPP as being appropriate to meet the works programme.

The Technical Memorandum for the Environmental Impact Assessment Ordinance (EIAO-TM) stipulates a noise standard of $L_{eq(30\ minutes)}$ 75 dB(A) for all domestic premises for daytime (0700 to 1900 hours on any days not being a Sunday or public holiday) construction activities. Thus, noise generated from the Tuen Mun Shaft construction activity is required to comply with this noise standard. It is not anticipated that there will be evening or night-time (1900 to 0700 hours) construction activities at the Tuen Mun Shaft works site, however, should there be any construction activities involving use of PME or Prescribed Construction Work (PCW) during these restricted hours, the Contractor shall be responsible for applying to EPD for a Construction Noise Permit (CNP) under the Noise Control Ordinance, Cap. 400 (NCO).

Trenching and cable laying works along Tuen Tsing Lane further to the north of the works site (also by CLPP) may be undertaken at the same time as the E&M work is being undertaken in the shaft. As such, the potential cumulative noise impacts from these works have been considered in the assessment. The anticipated equipment required for these activities and their sound power levels are provided in Table 4.3.

Table 4.2 Construction Equipment for Tuen Mun Shaft

Construction Activity	Equipment	GW-TM Code	Number of Plant	Sound Power Level, dB(A)
Removal of hard-standing	Air compressor < 10m^3 / min	CNP001	1	100
	Hand-held breaker, mass > 10kg and < 20kg	CNP024	1	108
Site clearance	Excavator / loader	CNP081	1	112
	Lorry	CNP141	1	112
	Crane, mobile (diesel)	CNP048	1	112
Shaft construction (in soil) - excavation	Excavator / loader	CNP081	1	112
	Crane, mobile (diesel)	CNP048	1	112
	Lorry	CNP141	1	112
	Water pump, submersible (electric)	CNP283	1	85
	Generator, super silenced (70dB(A) at 7m)	CNP103	1	95
Shaft construction (in soil) - diaphragm wall	Piling, diaphragm wall – bentonite filtering plant	CNP162	1	105
	Piling, diaphragm wall – hydraulic extractor	CNP163	1	105
	Crane, mobile (diesel)	CNP048	1	112
Shaft construction (in soil) - Concreting	Bar bender and cutter (electric)	CNP021	1	90
	Concrete lorry mixer	CNP044	1	109
	Concrete pump	CNP047	1	109
	Generator, super silenced (70dB(A) at 7m)	CNP103	1	95
	Piling, diaphragm wall – bentonite filtering plant	CNP162	1	105
	Lorry	CNP141	1	112
	Water pump, submersible (electric)	CNP283	1	85
Shaft construction (in rock) [In bottom of shaft at about minimum 10m below grade]	Breaker, hand-held, mass>35kg	CNP026	1	114
	Rock drill, hand-held (pneumatic)	CNP183	1	116
	Water pump, submersible (electric)	CNP283	1	85
Shaft construction (in rock) [at grade]	Generator, silenced (75dB(A) at 7m)	CNP102	1	100
	Ventilation fan	CNP241	1	108
	Concrete pump	CNP047	1	109
	Concrete lorry mixer	CNP044	1	109
	Crane, tower (electric) - mounted on gantry	CNP049	1	95
	Bar bender and cutter (electric)	CNP021	1	90
	Lorry	CNP141	1	112
TBM Retrieval [at grade]	Crane, tower (electric) - mounted on gantry	CNP049	1	95
	Lorry	CNP141	1	112
TBM Retrieval [In bottom of shaft at about 20m below grade]	Water pump, submersible (electric)	CNP283	1	85
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [at grade]	Concrete pump	CNP047	1	109
	Concrete lorry mixer	CNP044	1	109
	Lorry	CNP141	1	112
	Bar bender and cutter (electric)	CNP021	1	90
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [In bottom of shaft at about minimum 10m below grade]	Water pump, submersible (electric)	CNP283	1	85
Landscaping / reinstatement	Excavator / loader	CNP081	1	112
	Compactor, vibratory	CNP050	1	105
	Lorry	CNP141	1	112

GW-TM = Technical Memorandum on Noise from Construction Work Other than Percussive Piling.

Table 4.3 Construction Equipment for Other Works – Cable Laying

Cumulative Construction Activity due to Other Works (not under the subject application)	Equipment	GW-TM Code	Number of Plant	Sound Power Level, dB(A)
Trenching (another contract) - may overlap construction of permanent works inside shaft	Piling, large diameter bored, reverse circulation drill	CNP166	1	100
Trenching (another contract) - Excavation	Excavator / loader	CNP081	1	112
	Lorry	CNP141	1	112
Trenching (another contract) - Concreting	Concrete pump	CNP047	1	109
	Concrete lorry mixer	CNP044	1	109
Cable laying (another contract) - may overlap E&M works inside shaft	Lorry	CNP141	1	112
	Crane, mobile (diesel)	CNP048	1	112

The predicted noise levels due to construction activities have been calculated in accordance with the methodology prescribed in the Technical Memorandum on Noise from Construction Work Other than Percussive Piling (GW-TM) under the NCO. Generally, a notional source position has been assumed for general site works (i.e., removal of hard-standing, site clearance and landscaping and reinstatement works. For construction activities related to the shaft, TBM retrieval, permanent works and E&M works, the noise source location has been assumed at the centre of the shaft.

Two locations at Sun Tuen Mun Centre (Block 2 and Block 3) have been selected for the assessment as they are the closest to the works site boundary. Full operation of all plant has been assumed for the assessment but it is expected that this will rarely be the situation. The predicted construction noise levels at the two locations on the first residential floor (the worst affected) have been calculated according to the GW-TM and are tabulated below. Details of the calculations are provided in Appendix 3.

Table 4.4 Corrected Noise Levels Predicted at Sun Tuen Mun Centre (NSR2) – without Mitigation Measures

Construction Activity	Corrected Noise Level at NSR2 Sun Tuen Mun Centre, in dB(A)	
	Block 2	Block 3
Removal of hard-standing	69	69
Site clearance	**77**	**77**
Shaft construction (in soil) - excavation	**78**	**77**
Shaft construction (in soil) - diaphragm wall	74	74
Shaft construction (in soil) - concreting	**76**	**76**
Shaft construction (in rock)	**77**	**77**
TBM Retrieval	73	73
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft	**76**	**76**
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft with concurrent trenching works (another contract)	**77**	**78**
Landscaping / Reinstatement	**76**	**76**

Notes: Bold and underlined figures indicate noise levels exceeding the 75dB(A) noise standard for daytime construction activity.

From the results, noise exceedances over the 75dB(A) noise standard may occur. without mitigation, due to site specific and cumulative noise (Appendix 3 refers). In order to reduce the noise due to the site specific construction activities, noise mitigation measures will be required. The following has been shown to satisfactorily

reduce the noise to an acceptable levels:

- the use of top-bent 3m high movable noise barriers located adjacent to the excavator (maximum 3m away from the plant) so as to screen the view to its operation from the affected floors;
- movable noise barriers (3m high, top-bent) provided for the lorry loading / unloading area within the site (maximum 3m away from the plant); and
- partial enclosure provided for the concrete pump.

Further, cumulative noise levels would need to be reduced in addition to the above if the project works were undertaken concurrently during trenching and cable laying works. With the scheduling of works to avoid the following concurrent activities, the noise criteria will be achieved:

- Construction activities for the shaft permanent works shall be avoided during trenching works (during excavation); or
- Construction activities for the shaft permanent works shall be avoided during the cable laying works when they are less than 80m away (horizontal separation) from Block 3.

With the implementation of these measures, the construction noise levels will comply with the 75 dB(A) daytime noise standard. The maximum predicted construction noise levels at the two locations on the first residential floor (the worst affected sensitive receivers) after implementation of the proposed mitigation measures are tabulated below and the details of the calculations are provided in Appendix 3.

Table 4.5 Corrected Noise Levels Predicted at Sun Tuen Mun Centre (NSR2) – After Implementation of Proposed Mitigation Measures

Construction Activity	Corrected Noise Level at NSR2 Sun Tuen Mun Centre, in dB(A)	
	Block 2	Block 3
Removal of hard-standing	69	69
Site clearance	75	75
Shaft construction (in soil) - excavation	75	75
Shaft construction (in soil) - diaphragm wall	74	74
Shaft construction (in soil) - concreting	75	75
Shaft construction (in rock)	75	75
TBM Retrieval	73	73
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft, no concurrent cable trenching works	73	72
Landscaping / Reinstatement	75	74

The majority of the construction works, including TBM and potentially localised blasting would be undertaken below ground and would not be audible to the NSRs. At the Tuen Mun shaft, it will be feasible to excavate rock either by blasting or by hand methods without impacting upon the construction programme. The closest joint bay to the Tuen Mun shaft within the tunnel is at about 430m from the shaft so there will be no significant noise impact from blasting.

Due to the depth of the tunnel, the approximately 40m distance separation to the

nearest NSR structure, and the podium below the residential units, ground borne noise from the TBM is not anticipated to cause any adverse impact on the residents of Sun Tuen Mun Centre. Based on similar assessments for TBM tunnelling (e.g. the EIA for KCRC Kowloon Southern Link, EIA Register No.: AEIAR-083/2005) in similar ground conditions and at distances of less than 40m, ground borne noise impacts were not found to be significant. Although, based on other TBM projects in Hong Kong, ground borne noise is not expected to be a significant impact, once the project-specific TBM type is identified at the detailed design stage, a detailed quantitative ground borne noise assessment will be undertaken to confirm the specification and operational requirements. This assessment will be submitted for approval by EPD.

Where blasting methods are adopted, this is not administratively or procedurally controlled under the NCO or the EIAO-TM. The details and nature of works and method statement (determined by the Contractor) will be submitted to the Mines and Quarries Division of CEDD in application for a blasting permit. The submission will include an assessment of the potential impacts to nearby structures.

4.3.4 Night-time Operations

It is anticipated that the Contractor will maximise excavation, at the Castle Peak site which is remote from NSRs. Works may occur 24 hours per day and spoil extraction may also occur during restricted hours.

At the Tuen Mun shaft, restricted hours work, however, is likely to be limited only to the retrieval of excavation equipment.

Should the Contractor chose to use any PME during restricted hours at either site, they will be responsible for demonstrating the acceptability of the noise levels and for applying to EPD for a CNP.

4.3.5 Traffic Generation

The majority of the excavated material from the Castle Peak site will be temporarily stockpiled before being transported off-site to the disposal site to minimise traffic generation and associated noise and air quality impacts. Only construction worker movements will add to trips within the works site areas. The number of workers is anticipated to be small, however, and both sites are served well by public transport. The TBM is also likely to be delivered and retrieved by road, but these will only be single occurrences. Environmental impacts associated with traffic generation are therefore expected to be minimal.

4.3.6 Effluents, Discharges and Run Off

During the construction phase, there is the potential for adverse impacts to occur due to sediment loaded site run-off and potential wash-outs, fuel contaminated fluids and improper site housekeeping, especially during the rainy season. At the Castle Peak portal, measures will be undertaken to avoid untreated site discharges from inadvertently entering into the inshore waters of the North Western Water Control Zone, such as the implementation of temporary site drainage and treatment of effluent prior to discharge. At Tuen Mun, site run-off may be discharged into the local storm water drainage network upon receipt of the appropriate Discharge Licence.

The Contractors will either be required to connect site toilets and offices to the foul sewerage or provide chemical toilets on-site. Should any canteen or kitchen be provided on either site, wastewater will be discharge to a foul sewer via grease traps.

The site discharges will be required to achieve the discharge limits and measures will be taken to control any run-off from the site. As such, adverse impacts on water quality are not expected.

No marine works are proposed under the cable tunnel project and thus no impacts on marine water quality are anticipated.

4.3.7 Waste

A total of about 93,000m^3 of construction and demolition (C&D) material will be excavated during construction of the tunnel. Since the excavated material will be uncontaminated and inert, some can be stockpiled and reused for the formation works at the Castle Peak site and for backfilling at the Tuen Mun Shaft site. It is estimated that approximately 5% of the materials (4,650m^3) will be reused. For the surplus inert C&D material, which cannot be reused or recycled, it will be disposed of to public filling facilities or landfilled following the trip-ticket system.

The rate of extraction is anticipated to be in the region of about 6,000m^3 per month. Excavated materials will be temporarily stockpiled at Castle Peak before being transported off site to the nearest disposal sites (e.g., Tuen Mun Area 38 Fill Bank, Tsueng Kwan O Area 137 Fill Bank and WENT Landfill) to minimise the impact on the surrounding road network.

There will be a small quantity of demolition material generated at the Tuen Mun site that will mainly be from the removal of the hard-standing. It may be possible for LCSD to re-use the planters, equipment and landscape furniture within the remainder of the site or at other locations. The remainder of the equipment and furniture will be stored and re-used when the park is reinstated.

Small quantities of chemical waste will be generated at both sites along with municipal waste from construction workers. With the correct handling, storage and disposal of these waste streams (as mentioned below), adverse impacts on the environment are not anticipated.

4.3.8 Manufacture, Storage, Use, Handling, Transport, or Disposal of Dangerous Goods, Hazardous Materials or Wastes

All dangerous goods used during the construction process must be handled in accordance with the Dangerous Goods Ordinance. Impacts from dangerous goods are, therefore, not anticipated. All chemical wastes produced in the construction process must be handled in accordance with the Waste Disposal (Chemical Waste) Regulations. No adverse impacts during construction are therefore anticipated.

4.3.9 Risk of Accidents Resulting in Pollution or Hazard

No pollution or hazard generating accidents are expected to result from the construction of the tunnel works. Potential incidents involving dangerous goods or chemical waste will be managed under the controls of the relevant legislation as mentioned above.

4.3.10 Disposal of Spoil or Contaminated Material

Spoil will either be re-used as aggregate or used as public-fill, as mentioned above. No contaminated material will be excavated or generated from the construction work.

4.3.11 Disruption of Water Movement or Bottom Sediment

The project will not result in any impact on water movement or bottom sediment.

4.3.12 Landscape and Visual

Landscape Impacts

At the Castle Peak portal, landscape impacts will result from the temporary disturbance of topsoil and vegetation. A total of up to 1.23ha may be affected depending on the detailed design including the construction method and works site arrangements defined by the Contractor. As mentioned previously, a tree survey has been undertaken (summarised in Appendix 4) which indicates that no trees in the works areas are considered rare, protected by law or of significant amenity value. Given the above and in consideration of the characteristics of the existing landscape (abutting the Castle Peak Power Station), the reversibility of the change and the temporary nature of the change the magnitude of adverse landscape impact is considered to be small.

The landscape character at the Tuen Mun site is wholly man-made, consisting of a relatively low quality (by normal LCSD standards) recreational area dominated by a hard standing. The fitness station present within the works area will be relocated to another area of the park. This has been discussed with LCSD as part of an ongoing consultation process. At this site there would be negligible impact from this small area of construction work as the landscape resource is not considered to be subject to any discernable change. Only a small strip of grass and scrub would need to be cleared to allow the temporary construction access from Lung Mun Road.

Landscape Impact Assessment

Based on the sensitivity of the landscape to change and the magnitude of change, the significance of the landscape impact was determined and is presented below. Landscape mitigation measures have been proposed and included for the 'after mitigation' scenario (see Section 5).

Table 4.6 Significance of Landscape Impacts during Construction

Landscape character	Sensitivity to change	Magnitude of Change before Mitigation	Impact Significance before Mitigation	Impact Significance after Mitigation
Castle Peak – plantation woodland	Medium	Low	Moderate	Slight
Tuen Mun – mixed / high-rise urban	Low	Negligible	Insubstantial	Insubstantial

Only minor residual landscape impacts would result from project construction at the two sites with the implementation of the recommended mitigation measures.

Visual Impacts

There will be temporary visual impacts and intrusion to users of the Lung Fai Street accessing the Power Station (VSR1) from the construction works adjacent. Although only temporary in nature, due to the proximity of the views, the magnitude of change is considered to be high. At the Castle Peak portal, the site boundary has been set back from the shoreline and a buffer of trees and shrubs would be retained along the coast. This would partially screen the construction works from views looking at the portal from the sea from VSR2 and thus the magnitude of change is classified as negligible.

The construction works at Tuen Mun will be visible from the Sun Tuen Mun Centre (VSR3) but due to the small size of the site, the elevated viewpoints and the temporary nature of the construction activities, the magnitude of change is considered

to be moderate. Due to the distance to the site and the elevated views from Siu Shan Court, VSR4 has been classified as low. Although temporary, the magnitude of change for the users of the other areas of the park (VSR5) is considered to be high. The users of Lung Mun Road (VSR6) would only experience a low magnitude of change but users of Tuen Tsing Lane (VSR7) would experience a high magnitude of change due to the close proximity of the works site.

Visual Impact Assessment

Based on the sensitivity of the VSRs to change and the magnitude of change, the significance of the visual impact was determined and is presented below. Visual mitigation measures have been proposed and included for the 'after mitigation' scenario (see Section 5).

Table 4.7 Significance of Visual Impacts during Construction

Visually Sensitive Receiver	Sensitivity to change	Magnitude of Change before Mitigation	Impact Significance before Mitigation	Impact Significance after Mitigation
VSR1 – CLPP employees and visitors	Low	High	Moderate	Slight
VSR2 – Operators / passengers on ships	Low	Negligible	Insubstantial	Insubstantial
VSR3 – Residents at Sun Tuen Mun Centre	Medium	Moderate	Moderate	Slight
VSR4 – Residents at Siu Shan Court	Low	Low	Slight	Insubstantial
VSR5 – Users of playground	Low	High	Moderate	Slight
VSR6 – Users of Lung Mun Road	Low	Low	Slight	Insubstantial
VSR7 – Users of Tuen Tsing Lane	Low	High	Moderate	Slight

Only slight residual visual impacts would result from project construction at the two sites with the implementation of the recommended mitigation measures.

During the construction phase, there would be no landscape or visual impact to the SSSI which is the only element of the project which is considered to be Designated under the EIAO.

4.3.13 Ecology

Tuen Mun Shaft Site

During the construction phase of the project land-take would occur which would result in the direct lost of existing habitat in the area. A summary of the ecological impacts at the Tuen Mun shaft site is given in Table 4.8 below.

Table 4.8 Summary of the Ecological Impact at Tuen Mun Shaft Site

Criteria	Remarks
Habitat Quality	Very Low
Species	Very Poor
Size / Abundance	Very Poor
Duration	The impact is temporary, as the site would be reinstated after completion.
Magnitude	The magnitude is not considered substantial
Reversibility	The impact is reversible with the reinstatement

The site is a man-made habitat with very limited ecological resources and ecological impacts from construction would not result at this site. Only a small strip of grass / scrub would require clearance to allow for the temporary site access during construction.

Castle Peak Portal Site

During the construction phase of the project, land-take would require the direct loss of existing plantation woodlands present at the site. A summary of the ecological impacts is presented in Table 4.9 below.

Table 4.9 Summary of the Ecological Impact at Castle Peak Portal Site

Criteria	Remarks
Habitat Quality	Poor
Species	Low species diversity and no species of conservation interested recorded
Size / Abundance	The size is relatively small (total 1.2ha) for woodland habitat and the abundance and diversity of species are found to be poor
Duration	As the site will be re-instated after completion of the work, the impact is temporary only during the construction stage
Magnitude	The magnitude of the impact is not considered substantial during the construction period, and the planting of native tree species during re-instatement will enhance the ecological characteristics of the site
Reversibility	The impact is reversible

The ecological value of the habitats found in the works area is considered to be low to moderate because of the simplicity in both species and structural diversities as well as poor tree form, and hence the ecological impact from the loss of the plantation woodland habitat in the portal site is not considered to be significant. There would be no direct or indirect impact to shrubland habitat outside the works area. Measures have been provided to reinstate the site with native species (the Contractor will be required to submit a Tree Felling Application accompanied by a compensation planting plan, as described in Section 5.1.7 of this report) which may improve the quality of the present habitat.

Castle Peak SSSI

The proposed work includes the construction of an underground tunnel that will pass beneath the Castle Peak SSSI at a depth of about 300m below the surface. Only sub-surface construction work will be involved during the construction phase of the project, and no ecological resources within the SSSI will be affected by the work as discussed in Section 3.1.4.

4.3.14 Cultural Heritage

No historical or cultural impacts are anticipated during construction as described in Section 3.1.6.

4.4 Environmental Impacts During Operational Phase

Once the cable installation and the construction of the required structures at either end of the tunnel have been completed, environmental impacts during the operation phase are anticipated to be minimal.

Aerial emissions from the ventilation shaft will be minimal and will not have an impact on nearby sensitive receivers, such as the Sun Tuen Mun Centre, as the ventilation shaft at Tuen Mun will be the supply for the tunnel (the intake) and the exhaust point at the Castle Peak portal is over 400m from the nearest air quality sensitive receiver. In addition, the tunnel will be lined which will inhibit any landfill gas ingress from PPVL. Therefore, it is not anticipated that there will be any significant VOCs or odour impacts associated with landfill gas emissions resulted from the tunnel ventilation as the risk of landfill gas ingress is low (refers to Section 3.2.1).

The only potential for adverse environmental impacts may be due to noise from the ventilation fans and landscape and visual impacts during the operational phase, as discussed below. No other potential adverse impacts are expected from the operation of the cable tunnel.

4.4.1 Operational Noise

With regard to noise, the design and installation of the ventilation fans at the Tuen Mun shaft will be required to ensure that the operational noise levels are 5dB(A) below the appropriate Acceptable Noise Levels shown in the Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places of Construction Sites at the nearest noise sensitive receiver. Since the Sun Tuen Mun Centre is located in a developed urban area, and it is currently not affected by any Influencing Factor, its Area Sensitive Rating (ASR) is considered to be “B”. Therefore, the Acceptable Noise Levels for noise generated from the ventilation fans at the Tuen Mun shaft are as provided in Table 4.10.

Table 4.10 Noise Standard for Fixed Noise Sources at Tuen Mun Shaft

Time Period	Noise Standard*, in dB(A)
Day (0700 to 1900 hours) Evening (1900 to 2300 hours)	60
Night (2300 to 0700 hours)	50

Notes: * 5dB(A) below ANL described in IND-TM.

The horizontal separation from the nearest NSR (Sun Tuen Mun Centre Block 2) to the proposed shaft location is approximately 53m (which provides a distance attenuation of 43dB(A)). Therefore, the maximum sound pressure level at the ventilation building intake should not exceed 90dB(A) [50 – 3 + 43] in order to comply with the noise standards. These noise emission requirements shall be stipulated in the contract specifications for the ventilation system design. The Contractor shall ensure the noise standards are met through the incorporation of sound attenuation measures which will include avoiding locating and orientating the louvers for air intake/ inlet directly facing the Sun Tuen Mun Centre as well as other measures such as applying direct noise mitigation measures (e.g. silencers, acoustic louvers), and ensuring the façade of the shaft building has adequate sound insulation properties to minimise the noise emanating through the building structure.

4.4.2 Landscape and Visual

Landscape Impacts

At the Castle Peak portal, the site boundary is set back from the shoreline and a buffer of trees and shrubs are retained along the coast. The above ground structures that will remain after reinstatement are shown in Figure 3.2 and they will comprise an approx. 8m x 5.5m transformer room at the toe of the slope at a height of about 7m and, adjacent to the transformer room the portal entrance ramp (about 7m wide) to a security gate. Without mitigation, the magnitude of change at this site, however, as a result of the loss of vegetation is therefore considered to be medium.

At the Tuen Mun site, the above ground structure is shown in Figure 3.3 and will comprise a single fenced ventilation building with a total building footprint of about 7 x 8m. The building height will be approximately 6 m including the parapet. An EVA access will be also be designated across the park area. Without mitigation, the magnitude of change is considered to be low.

Landscape Impact Assessment

Based on the sensitivity of the landscape to change and the magnitude of change, the significance of the landscape impact was determined and is presented below. Landscape mitigation measures have been proposed and included for the 'after mitigation' scenario (see Section 5). The works site and slope adjacent to the portal will be replanted with native species appropriate to this coastal area and soil type, as far as possible, such as *Hibiscus tiliaceous, Ficus microcarpa, Microcos paniculatus*, which will also improve the landscape and habitat of the area.

At the Tuen Mun site, mitigation measures include the park reinstatement and landscaping. The relocated fitness station is illustrated in Figure 4.1 and the shaft structure will be blended in with the surrounding developments as indicated in Figure 4.2 (see viewpoints on Figure 1.2, Figure 4.2 does not indicate the Transport Department roundabout scheme as the details are not currently available.). Measures will be included for reinstatement of the site, such as landscaping and the colour scheme of the shaft structure, which will further blend the structure with the surroundings. These are presently being discussed with LCSD to ensure that they meet their standards.

Table 4.11 Significance of Landscape Impacts during Operation

Landscape character	Sensitivity to change	Magnitude of Change before Mitigation	Impact Significance before Mitigation	Impact Significance after Mitigation	
				Day 1	***Year 10***
Castle Peak – plantation woodland	Medium	Medium	Moderate	Slight	Insubstantial
Tuen Mun – mixed / high-rise urban	Low	Low	Insubstantial	Slight (beneficial)	Slight (beneficial)

The reinstatement measures provide an opportunity to provide local improvements to the landscape character of the Tuen Mun area after the establishment of the mitigation measures.

Visual Impacts

There will be permanent visual impacts and intrusion to users of the Lung Fai Street accessing the Power Station (VSR1) from the transformer room, ramp and entrance adjacent to the roadside. Due to the small size of the structures, the proximity of the views, and assuming that no mitigation is implemented, the magnitude of change is

considered to be moderate. The magnitude of change from VSR2 is considered to be negligible due to screening from the vegetative buffer.

The ventilation building at Tuen Mun will be visible from the Sun Tuen Mun Centre (VSR3) but due to the small size of the structure within the site, the elevated viewpoints, and the screening from the podium and footbridge the magnitude of change is considered to be low. Due to the distance to the site, the elevated views from Siu Shan Court, and screening from trees in the foreground, this VSR4 has been classified as negligible. The magnitude of change for the users of the other areas of the park is considered to be moderate without mitigation measures. Due to the small size of the structure the users of Lung Mun Road (VSR6) would experience a negligible magnitude of change and users of Tuen Tsing Lane (VSR7) would experience a moderate magnitude of change without mitigation.

Visual Impact Assessment

Based on the sensitivity of the VSRs to change and the magnitude of change, the significance of the visual impact was determined and is presented below. Visual mitigation measures have been proposed and included for the 'after mitigation' scenario (see Section 5).

Table 4.12 Significance of Visual Impacts during Operation

Visually Sensitive Receiver	Sensitivity to change	Magnitude of Change before Mitigation	Impact Significance before Mitigation	Impact Significance after Mitigation	
				Day 1	***Year 10***
VSR1 – CLPP employees and visitors	Low	Moderate	Moderate	Slight	Insubstantial
VSR2 – Operators / passengers on ships	Low	Negligible	Insubstantial	Insubstantial	Insubstantial
VSR3 – Residents at Sun Tuen Mun Centre	Medium	Low	Moderate	Slight	Insubstantial (beneficial)
VSR4 – Residents at Siu Shan Court	Low	Negligible	Insubstantial	Insubstantial	Insubstantial
VSR5 – Users of playground	Low	Moderate	Moderate	Slight	Insubstantial (beneficial)
VSR6 – Users of Lung Mun Road	Low	Negligible	Insubstantial	Insubstantial	Insubstantial
VSR7 – Users of Tuen Tsing Lane	Low	Moderate	Moderate	Slight	Insubstantial (beneficial)

Only slight to insubstantial residual visual impacts would result at the two sites at Day 1 of operation with the implementation of the recommended mitigation measures. Those impacts are anticipated to reduce to insubstantial after further maturing of the vegetation with potentially benefits to VSRs 3,5 and 7 from an improved landscape appearance within the playground.

For the operation of the project, there would be no landscape or visual impact to the SSSI which is the only element of the project which is considered to be Designated under the EIAO.

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

5.1 Measures to Minimise Environmental Impacts

5.1.1 General

Construction clauses will be included in the works contract to ensure the prevention and control of pollution related to water quality, noise nuisance, air quality and waste management. Further, CLPP will undertake on-site audits to verify that the works are being properly and fully implemented and monthly independent environmental audits will be undertaken and reported once a month to CLPP on the environmental performance of the works. In addition, the following will be implemented.

5.1.2 Air Quality

The following air quality measures will be implemented during construction of the project.

- The Contractor must comply with the control measures stipulated in the Air Pollution Control (Construction Dust) Regulation and implement all the required mitigation measures. In accordance with the requirements of the Regulation, sufficient dust control measures shall be implemented by the Contractor to ensure full protection of nearby Air Sensitive Receivers (including watering of the site, treating stockpiled materials and dust control measures on vehicles transporting materials as specified in the Regulation).
- Construction plant shall also be regularly maintained and kept in good working order to minimise gaseous and particulate emissions. Where possible, plant should be electrically rather than diesel powered.

Where blasting will be used, the following dust control measures shall be adopted:

- During any initial blasting for the tunnel portal construction, the blasting area shall be wetted with water prior to blasting. Blasting shall not be carried out when the strong wind signal or tropical cyclone warning signal No. 3 or higher is hoisted unless prior permission of the Commissioner of Mines is obtained.
- Wire mesh, gunny sacks and sandbags will be used on top of the blast area at each shot to prevent flying rock and dust
- When blasting is inside the tunnel, dust removal facilities such as water scrubber or water curtain shall be provided in the ventilation system or at the tunnel entrance to further control fugitive dust.

5.1.3 Noise

Construction Noise

Required Measures

In order to achieve the day-time noise criterion for the construction work, noise mitigation measures will be required at the Tuen Mun shaft site. These may include the following measures or other measures that will result in the equivalent reduction in noise levels.

- The provision of a 3m high, top-bent movable noise barriers for screening noise generated from the excavator and the lorry loading / unloading area within the site during site clearance, shaft construction activities, permanent works construction activities, and reinstatement activities. The barrier material will be required to have

a surface mass no less than 7kg/m^2;

- The provision of a partial enclosure (surface mass of no less than 7kg/m^2) for the concrete pump;
- The provision of quiet plant for the air compressor and generator; and
- The avoidance of construction activities for the permanent shaft works being undertaken concurrently with either the excavation activities associated with the cable trenching works or the cable laying works when they are less than 80m away (horizontal separation) from Block 3.

Further to the above measures, the Contractor shall undertake impact monitoring during construction of the Tuen Mun Shaft at a representative location (appropriate to ascertaining noise levels at the nearest sensitive receiver) within the Sun Tuen Mun Centre with clear line of sight to the works area to ensure that noise levels are within the acceptable criteria. One set of measurements of Leq(30 min) (as six consecutive Leq(5 min) readings) between 0700-1900 hours on normal weekdays at the selected location shall be conducted once a week when noise generating activities are underway.

Should noise levels be exceeded during the monitoring works, the Contractor shall undertake immediate measures (such as staggering of works or replacement of noisy plant) to reduce noise levels to acceptable levels.

Further Recommended Mitigation Measures

The following mitigation measures are also recommended for inclusion in the works contract to further attenuate construction noise levels:

- Noisy plant should be located as far from the NSR as possible to the south of the works site;
- Consideration shall be given to the location of any site offices inside the site to optimise the screening effect to the NSRs; and
- Careful scheduling of plant operations, such as avoiding the driving of the lorry during use of the concrete lorry mixer and pump, should be considered as far as practicable.

Blasting Mitigation Measures

The noise mitigation measures for any blasting work will be determined in the blasting assessment submission to CEDD for the blasting permit based on the Contractor's design and method statement. Likely measures that will be required may include noise barriers or enclosure at the Tuen Mun shaft.

Ground Borne Noise Mitigation Measures

Although, based on other TBM projects in Hong Kong, ground borne noise is not expected to be a significant impact, once the project-specific TBM type is identified at the detailed design stage, a detailed quantitative ground borne noise assessment will be undertaken to confirm the specification and operational requirements. This assessment will be submitted for approval by EPD.

Operational Noise

CLPP will be required to ensure that the noise levels from the ventilation fans at the Tuen Mun shaft are in accordance with the noise standards described in the EIAO-TM, i.e., 5dB(A) below the appropriate Acceptable Noise Levels (ANL) shown in the

Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places of Construction Sites (IND-TM) at the NSRs at Sun Tuen Mun Centre (50 dB(A)).

5.1.4 Water Quality

The Contractor shall fully comply with the Water Pollution Control Ordinance and during construction works, the best practice site drainage measures (e.g. ProPECC PN 1/94) shall be implemented at both work sites. In particular, temporary drainage shall be provided around the Castle Peak site to ensure that all run-off and ground water seepage is collected and passed though well-maintained sediment removal facilities and achieves the discharge limits before being discharged. During construction all C&D materials will be properly stockpiled and covered / contained to ensure that sediment-loaded surface runoff does not result from this material.

Any discharges from toilets or site offices provided will need to be connected to the foul sewerage. Alternatively, chemical toilets will be provided and will be regularly emptied and serviced by a licensed operator. Should any kitchen or canteen be provided on site, wastewater will be discharged to a foul sewer via grease traps capable of providing at least 20 minutes retention during peak flow.

5.1.5 Waste

Excavated materials and other wastes will be segregated, re-used or recycled as far as possible. Fill material will be retained for backfilling at the works sites. Excess fill will be re-used as aggregate, used on other projects or disposed of at designated public fill areas or landfills for disposal as a last resort. Disposal of the C&D Materials will be managed through the trip-ticket system following the guideline stipulated by the Environmental, Transport and Works Bureau Technical Circular (Works) No 31/2004 “Trip Ticket System for Disposal of Construction & Demolition Materials”. Potential public filling facilities / landfill have been identified for the disposal of the surplus inert C&D materials. These are Tuen Mun Area 38 Fill Bank, Tseung Kwan O Area 137 Fill Bank, and WENT Landfill. The proponent will be required to identify and agree with the Public Fill Committee and Facilities Management Group of EPD with respect to the final disposal sites.

Any Chemical Wastes from plant maintenance will be handled, stored and disposed of in accordance with the requirements of the Waste Disposal (Chemical Waste) Regulations.

5.1.6 Landfill Gas Hazard

As part of the Contract Documents for this Project, a quantitative LGH assessment will be required to be prepared by the Contractor based on the detailed method statement and design to further ensure that intrusion of landfill gas and leachate is prevented both during construction and operation of the tunnel. The detailed quantitative LGH assessment prepared by the Contractor shall be approved by the EPD. If the Contractor’s construction method involves blasting within the PPVL Consultation Zone, the quantitative LGH assessment will be further reviewed and updated and the Contractor shall seek approval from EPD on the revised assessment.

Should the findings of the more detailed ground investigation and detailed quantitative LGH assessment indicate that there is a risk of gas ingress, the Contractor will be required to implement measures to mitigate this risk (for example, the use of grouting of the ground, back grouting behind the lining segments or fully gasketted lining).

A preliminary landfill gas hazard assessment has been undertaken and is provided in Appendix 2 of this report. The assessment includes protection and precautionary

measures that are recommended to be implemented based on the expected construction method using TBM, as follows.

- A working method statement (safety plan) will be required under the contract which shall set out the measures and implementation strategies proposed to minimise risk and stipulates the gas monitoring requirements.
- All relevant workers should undergo training about the risks associated with landfill gas and should be thoroughly versed in first aid and emergency and evacuation techniques.
- A no smoking policy should be strictly applied.
- Provisions should be made to control water contamination that may arise if leachate infiltrates from the landfill, although this is not expected to occur. Further, procedures should be put in place for safe handling and disposal of tunnel excavation and boring spoil that may be contaminated.
- A mechanical ventilation system should be in use at all times when personnel are working in the tunnel. No work should be carried out in the absence of mechanical ventilation or without the presence of a suitably trained safety officer.
- All electrical equipment (including extension leads) should be fitted with spark arrestors or be intrinsically safe.
- As a minimum, no work should be undertaken during the absence of fire extinguishers or emergency breathing apparatus.
- Monitoring of methane, carbon dioxide and oxygen should be undertaken at all times during the works using suitable equipment. The range and detection action plan are stipulated in Section 6 and Table 6.1 Appendix 2 of this report.
- If blasting is to be used, all necessary precautions to prevent the ignition of flammable gas shall be undertaken by the Contractor. Approval from relevant Government Authorities shall be obtained. The Contractor shall prepare a Blasting Assessment Report in accordance with the requirements of Building Department, Geotechnical Engineering Office and the Commissioner of Mines as part of the Contract Documents.
- During operations, monitoring of methane, carbon dioxide and oxygen as recommended in Section 6 and Table 6.1 of Appendix 2 of this report is required.
- A methane gas detection system shall be provided and installed along the tunnel based on the findings of the detailed quantitative LGH assessment and to the approval of EPD. As a minimum requirement gas detectors shall be provided and installed at 50 metre centres, to cover the length of the tunnel within the 250m Consultation Zone of the PPVL and also at the tunnel alignment high point. Subject to the recommendations of the detailed quantitative LGH assessment, additional gas detectors may also be required.
- As a minimum, the gas detection system shall have two-level alarms. The low level alarm shall be used to switch on the ventilation system and the high level alarm shall be used to activate the evacuation alarm. The required spacing and frequency of the methane gas detectors shall be reviewed as part of the Contractor's detailed LGH assessment. The alarm levels shall be defined with reference to the Contractor's detailed LGH assessment.
- The tunnel ventilation system shall be automatically activated in high speed mode upon receiving an alarm signal from the methane gas detection system. The minimum air change rate at high speed mode shall not be less than 3 air changes

per hour.

With the implementation of the above measures, it is considered that the risk from landfill gas can be substantially reduced.

5.1.7 Landscape and Visual

The following measures are to be implemented either during construction or operation to reduce the potential for visual impacts resulting from the project. These measures are illustrated in Figures 3.2, 3.3, 4.1 and 4.2 where relevant but specific details of the measures would be determined by the Contractor at the detailed design stage.

- During construction, attractive site hoardings shall be installed around the sties.
- The works areas shall be kept tidy and construction waste shall be properly managed to reduce the visual impact of the construction sites to a minimum.
- The works area at the Castle Peak portal site should be kept to a minimum and where possible, the site boundary should maintain a wide vegetated buffer along the edge of the site facing the beach.
- The two works sites shall be reinstated after work has been completed. The Castle Peak portal backfilled area and works site shall be replanted with native species appropriate to this coastal area and soil type to enhance the habitat of the area. Proposed species to be planted include *Hibiscus tiliaceous, Ficus microcarpa, Microcos paniculatus.* At the Tuen Mun shaft the playground shall be reinstated, preferably with high quality hard and soft landscaping, to result in an improved visual appearance as agreed with LCSD.
- Landscape planting shall be provided to screen the above ground structures. Visually inobtrusive / sensitive architectural finishes and recessive chromatic treatments shall also be applied to all the above ground structures to ensure that they blend in with the surroundings.
- The Contractor will be required to submit a detailed Tree Survey of the Project Area, Tree Felling Application and compensation planting (replanting) plan and this requirement has been included in the Contract Document. Clearance of trees and shrubs and removal of top soil should be kept to the minimum required to safely and efficiently carry out the works.

According to the criteria stated in Annex 10 of the EIAO-TM, the residual landscape and visual impacts are considered to be acceptable with the recommended mitigation measures. There will be no landscape or visual impacts to the Castle Peak SSSI (the element of the project considered to the Designated under the EIAO) from the project work.

5.2 Comment on the Possible Severity, Distribution and Duration of Environmental Effects

The duration of the construction works will be approximately 2 years but will affect only a localised area in the vicinity of the two works sites. At the Tuen Mun shaft site, works will be present for approximately 18 months. With the implementation of the recommended mitigation measures, no adverse residual environmental impacts will result during the construction or operation of the proposed cable tunnel.

5.3 Comment on any Further Implications

None.

5.4 Use of Previous Approved EIA

KCRC Kowloon Southern Link, EIA Register No.: AEIAR-083/2005.

6. CONCLUSION

Based on the findings of this Project Profile, the environmental impacts resulting from the construction of the Castle Peak cable tunnel are considered to be minor. With the application of the recommended mitigation measures, no adverse residual environmental impacts are anticipated.

Since the impact of the cable tunnel is not expected to be adverse and the mitigation measures proposed meet the requirements of the Technical Memorandum on Environmental Impact Assessment Process, CLPP intends to directly apply for an Environmental Permit under Section 5(11) of the EIAO. In particular, although part of tunnel alignment traverses the Castle Peak SSSI, which causes this project to be classified as a Designated Project, it is unlikely to have any adverse impacts to the Castle Peak SSSI.

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中華電力
CLP Power

青山電纜隧道
Castle Peak Cable Tunnel

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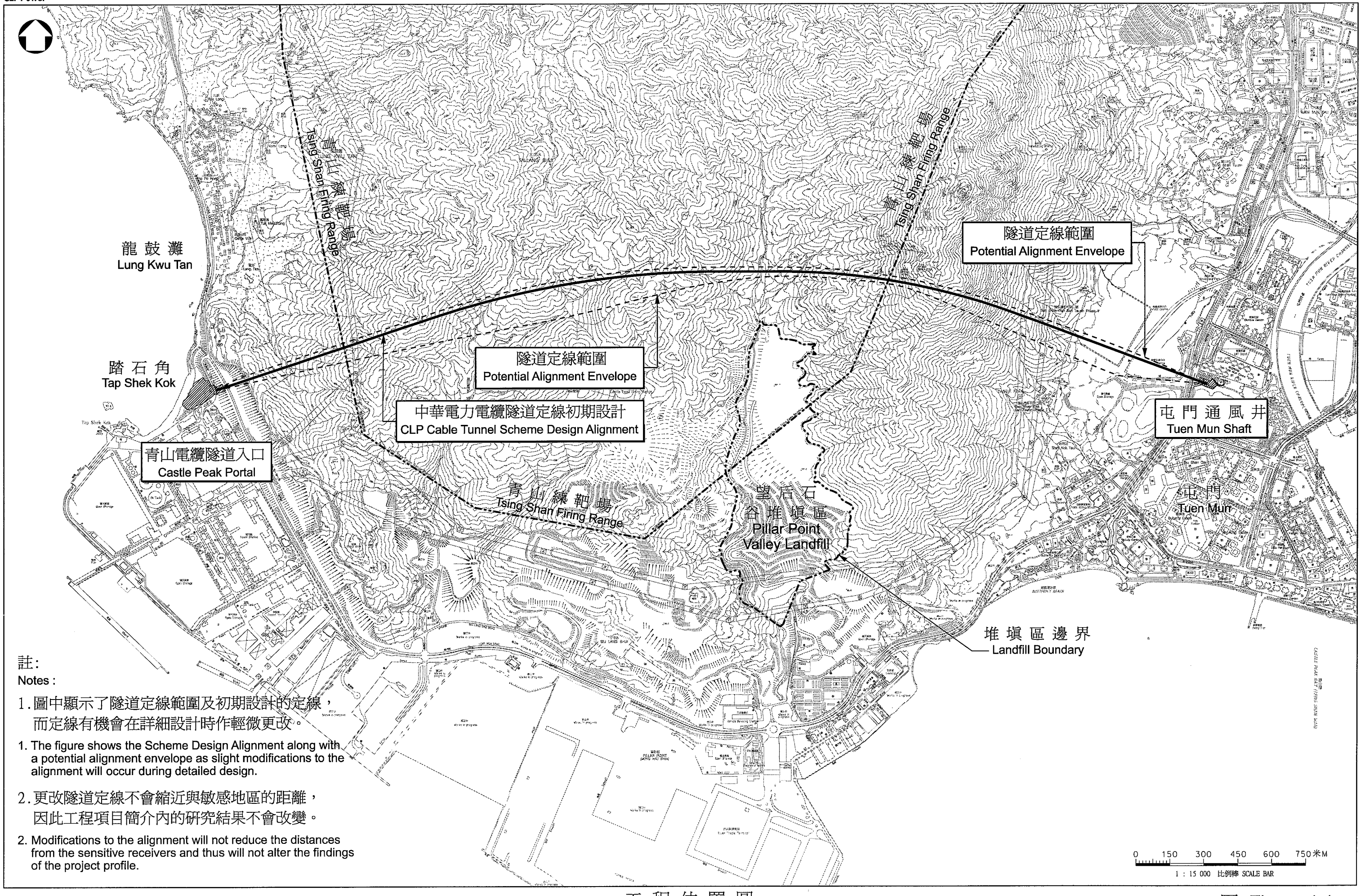

註:
Notes :

1. 圖中顯示了隧道定線範圍及初期設計的定線，而定線有機會在詳細設計時作輕微更改。

1. The figure shows the Scheme Design Alignment along with a potential alignment envelope as slight modifications to the alignment will occur during detailed design.

2. 更改隧道定線不會縮近與敏感地區的距離，因此工程項目簡介內的研究結果不會改變。

2. Modifications to the alignment will not reduce the distances from the sensitive receivers and thus will not alter the findings of the project profile.

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工程位置圖
Project Location Plan

圖 Figure 1.1

中華電力
CLP Power

青山電纜隧道
Castle Peak Cable Tunnel

ATKINS 阿特金斯顧問有限公司 Atkins China Ltd

中華電力電纜隧道定線初期設計
CLP Cable Tunnel
Scheme Design Alignment

隧道定線範圍
Potential Alignment Envelope

施工範圍
Site Area

龍門路 Lung Mun Road

龍輝街 Lung Fai Street

高水位標記
High Water Mark

青山電纜隧道入口
Castle Peak Portal

新屯門中心
Sun Tuen Mun Centre

視點
View Point
Locations

Fig. 4.2

Fig. 4.1

屯門通風井
Tuen Mun Shaft

0 50 100 米 M
1:2 000 比例尺 SCALE BAR

註:
Notes:

1. 圖中顯示了隧道定線範圍及初期設計的定線，而定線有機會在詳細設計時作輕微更改。
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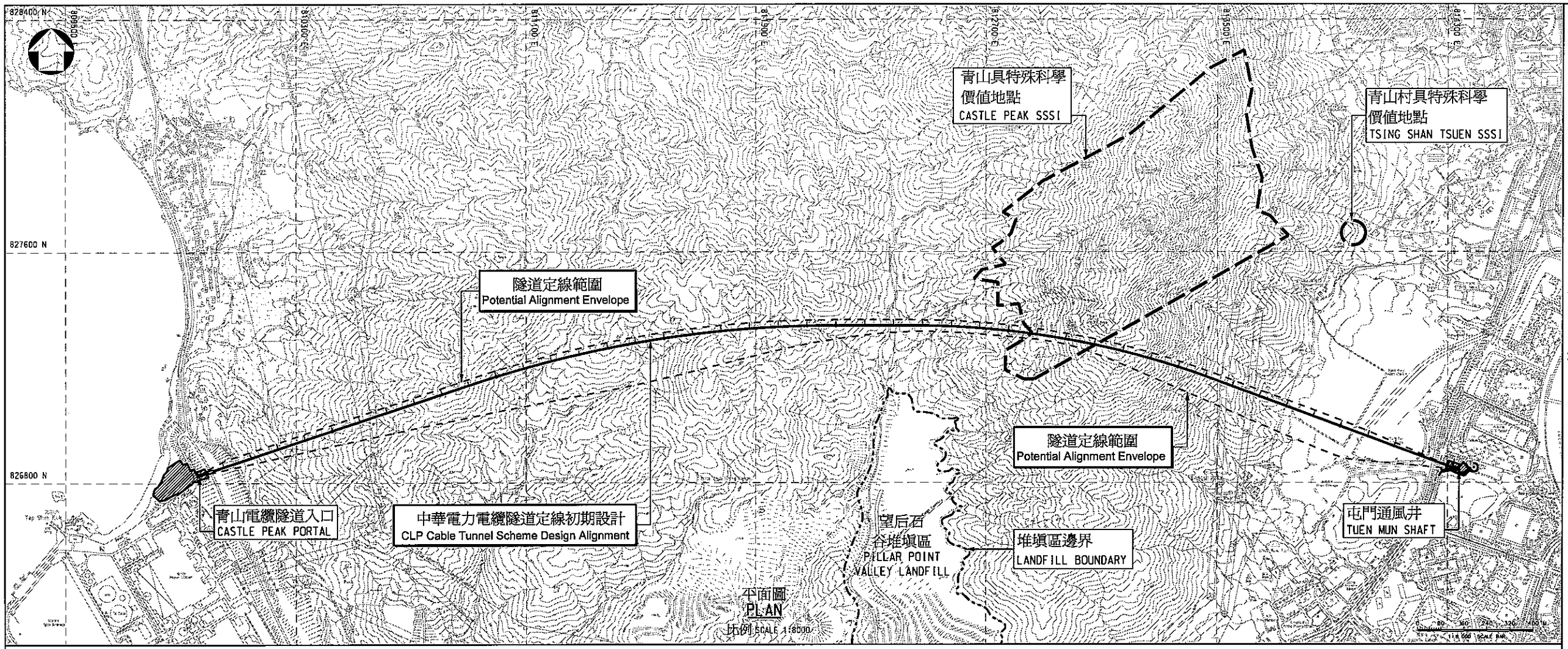
施工位置圖
Location of Works Areas

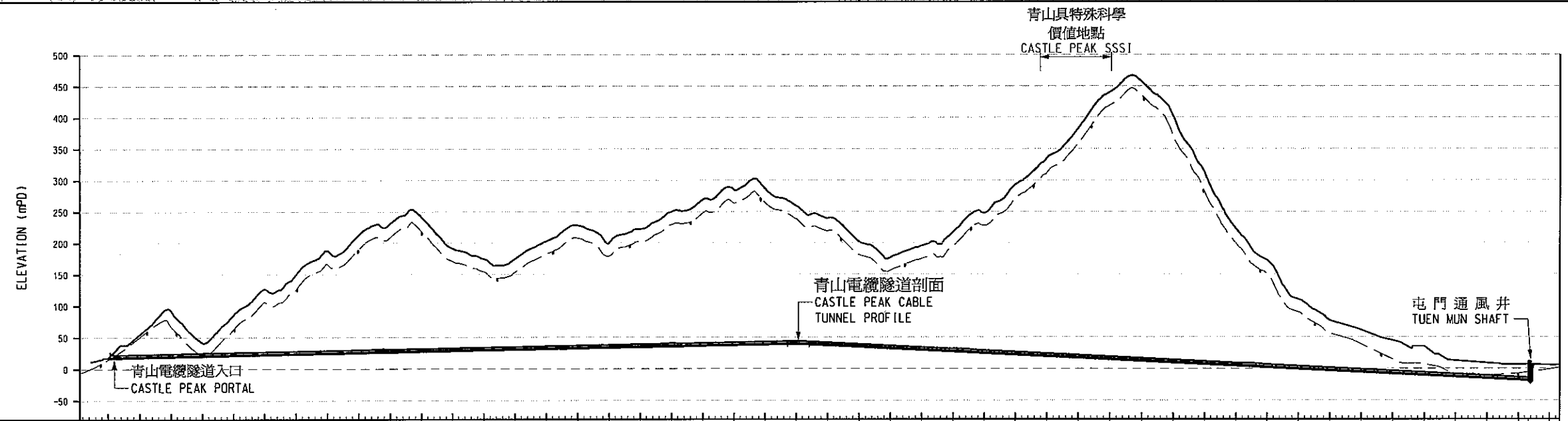
圖 Figure 1.2

中華電力
CLP Power

青山電纜隧道
Castle Peak Cable Tunnel

ATKINS 阿特金斯顧問有限公司 Atkins China Ltd





CHAINAGE (m)	0.000	100.000	200.000	300.000	400.000	500.000	600.000	700.000	800.000	900.000	1000.000	1100.000	1200.000	1300.000	1400.000	1500.000	1600.000	1700.000	1800.000	1900.000	2000.000	2100.000	2200.000	2300.000	2400.000	2500.000	2600.000	2700.000	2800.000	2900.000	3000.000	3100.000	3200.000	3300.000	3400.000	3500.000	3600.000	3700.000	3800.000	3900.000	4000.000	4100.000	4200.000	4300.000	4400.000	4500.000	4533.163	4600.000
EXISTING GROUND LEVEL (mPD)	+17.425	+55.037	+52.751	+41.838	+65.808	+126.407	+149.797	+187.512	+212.699	+231.161	+241.017	+191.280	+174.432	+174.912	+202.656	+227.757	+199.819	+222.077	+249.697	+268.797	+284.656	+285.652	+258.859	+239.276	+201.710	+176.835	+195.412	+217.205	+247.504	+293.047	+335.361	+383.160	+440.805	+455.959	+400.938	+311.439	+221.908	+172.405	+109.901	+76.269	+61.232	+44.741	+35.311	+12.628	+8.961	+6.500		
TUNNEL INVERT LEVEL (mPD)	+17.450	+18.150	+19.150	+20.150	+21.150	+22.150	+23.150	+24.150	+25.150	+26.150	+27.150	+28.150	+29.150	+30.150	+31.150	+32.150	+33.150	+34.150	+35.150	+36.150	+37.150	+38.150	+38.952	+36.891	+34.391	+31.891	+29.391	+26.891	+24.391	+21.891	+19.391	+16.891	+14.391	+11.891	+9.391	+6.891	+4.391	+1.891	-0.609	-3.109	-5.609	-8.109	-10.609	-13.109	-15.609	-18.109	-18.938	

剖面 PROFILE
比例 SCALE : HOR. = 1:8000
VER. = 1:4000

0 40 80 120 160 200米 M
1:4 000 比例棒 SCALE BAR

0 80 160 240 320 400米 M
1:8 000 比例棒 SCALE BAR

圖例說明
LEGEND:

SSSI 具特殊科學價值地點 SITE OF SPECIAL SCIENTIFIC INTEREST

註:
Notes :

1. 圖中顯示了隧道定線範圍及初期設計的定線，而定線有機會在詳細設計時作輕微更改。
1. The figure shows the Scheme Design Alignment along with a potential alignment envelope as slight modifications to the alignment will occur during detailed design.
2. 更改隧道定線不會縮近與敏感地區的距離，因此工程項目簡介內的研究結果不會改變。
2. Modifications to the alignment will not reduce the distances from the sensitive receivers and thus will not alter the findings of the project profile.

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具特殊科學價值地點位置圖
SSSI Location Plan

圖 Figure 1.3

中華電力
CLP Power

青山電纜隧道
Castle Peak Cable Tunnel

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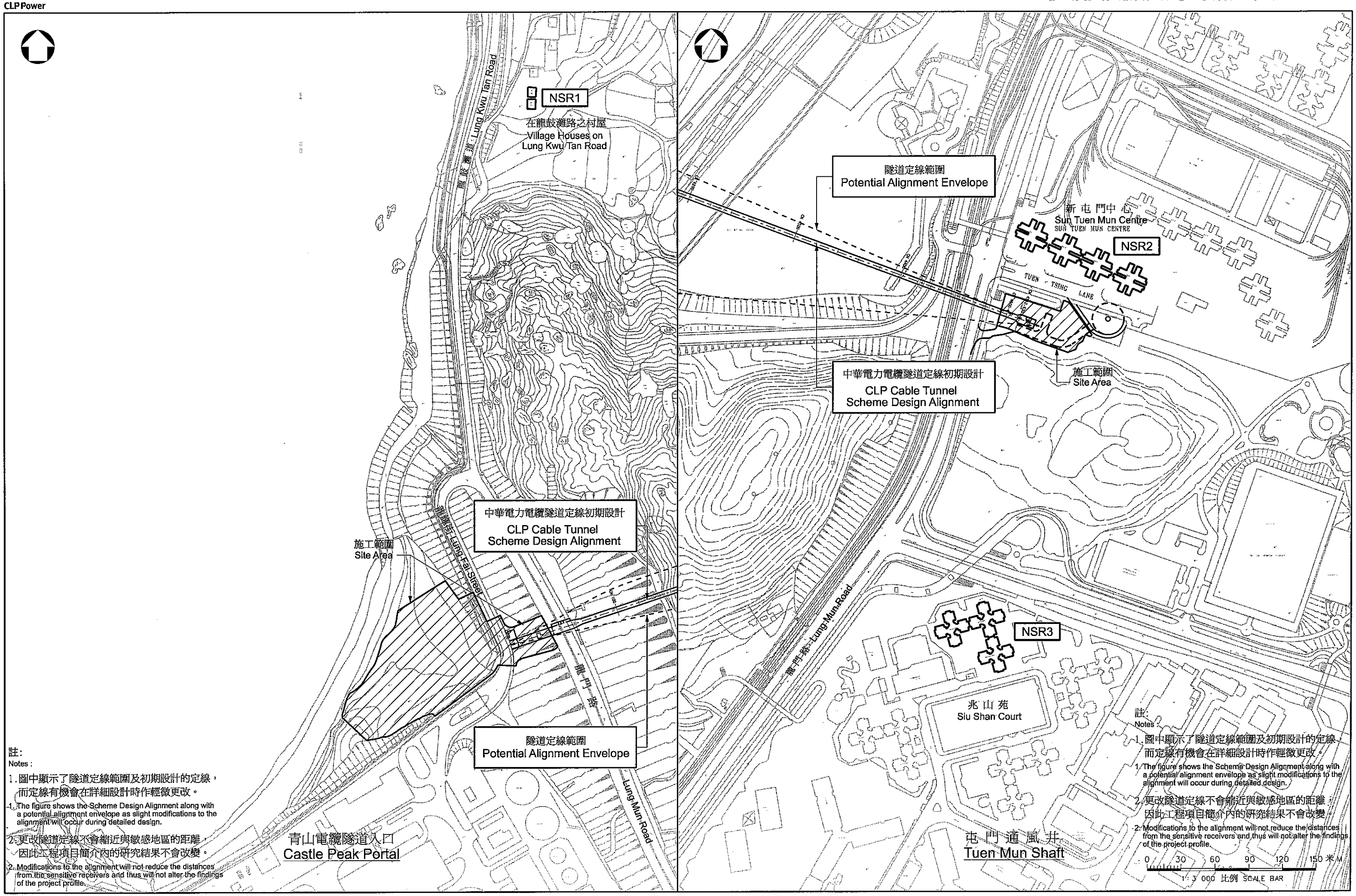

註:
Notes :

1. 圖中顯示了隧道定線範圍及初期設計的定線，而定線有機會在詳細設計時作輕微更改。
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2. Modifications to the alignment will not reduce the distances from the sensitive receivers and thus will not alter the findings of the project profile.

0 30 60 90 120 150 米 M
1 : 3 000 比例 SCALE BAR

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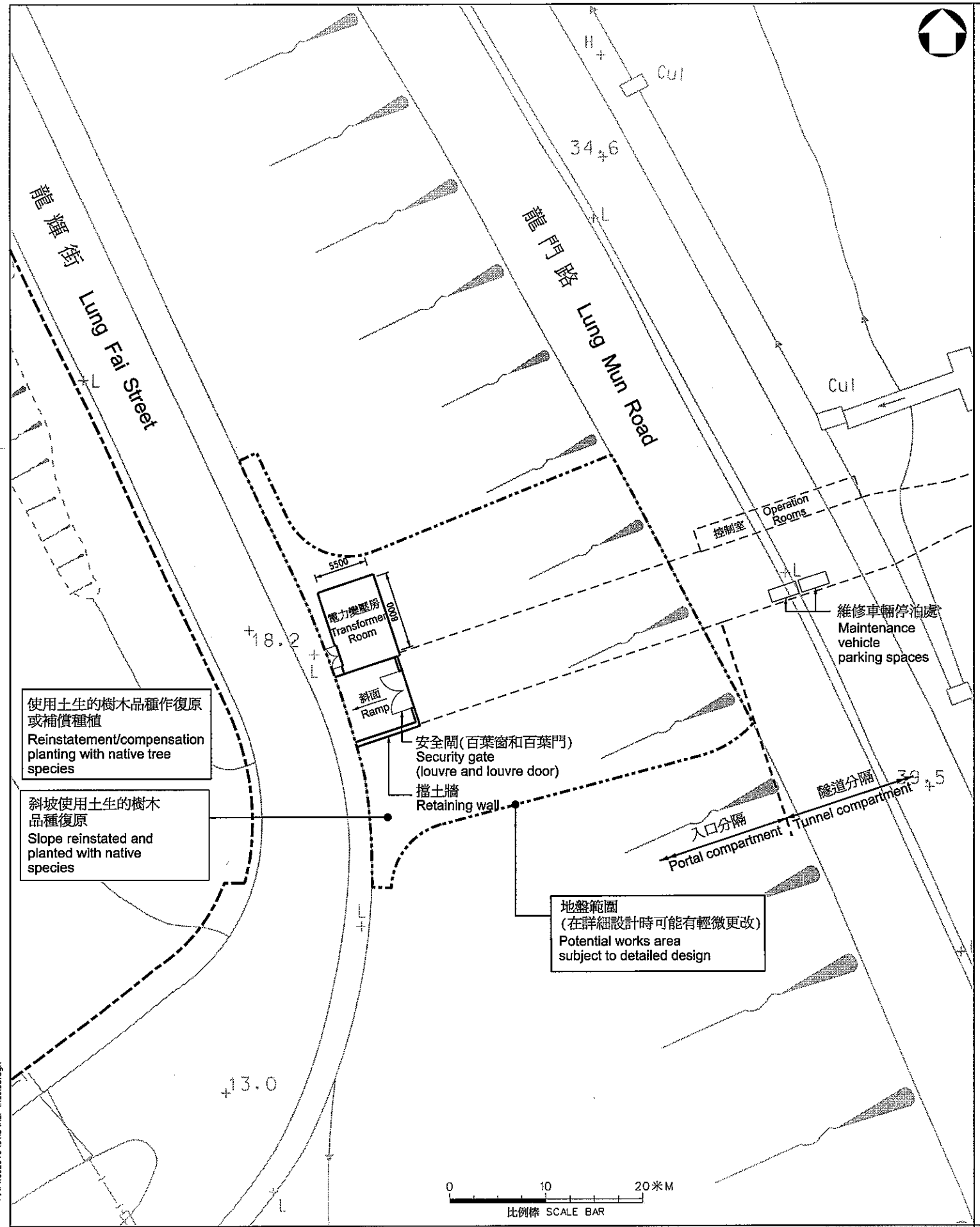
對噪音感應強的地方
Noise Sensitive Receivers

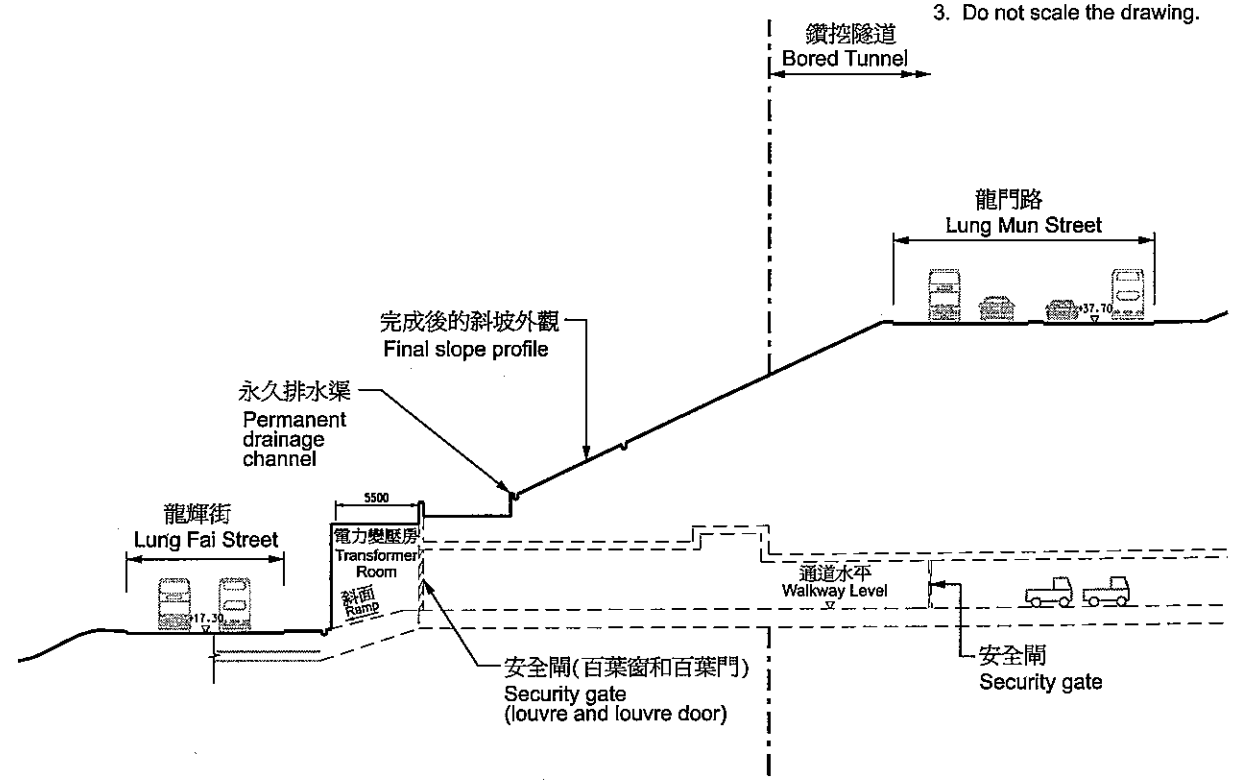
圖 Figure 3.1



平面圖 Plan

註：
Notes :

1. 除說明外,所有長度單位均爲毫米
1. All dimensions are in millimetres unless otherwise stated.
2. 除說明外,所有標高單位爲米以香港主水平基準(mPD)爲準
2. All levels are in metre relative to The Hong Kong Principle Datum (mPD) unless otherwise stated.
3. 圖並不合比例
3. Do not scale the drawing.



剖面圖 Section

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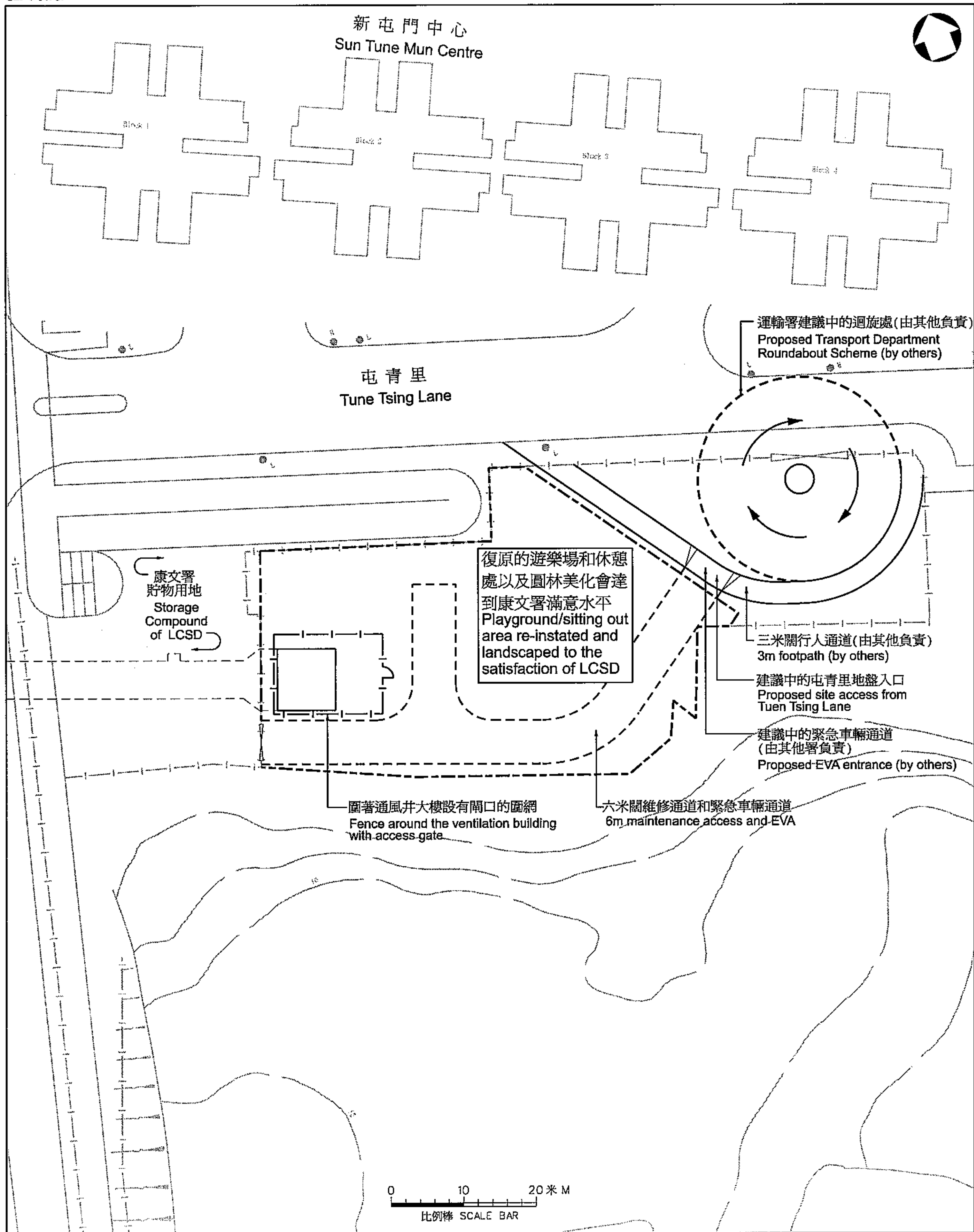
青山入口 - 使用階段的平面圖
Operation Phase Site Layout - Castle Peak Portal

圖 Figure 3.2

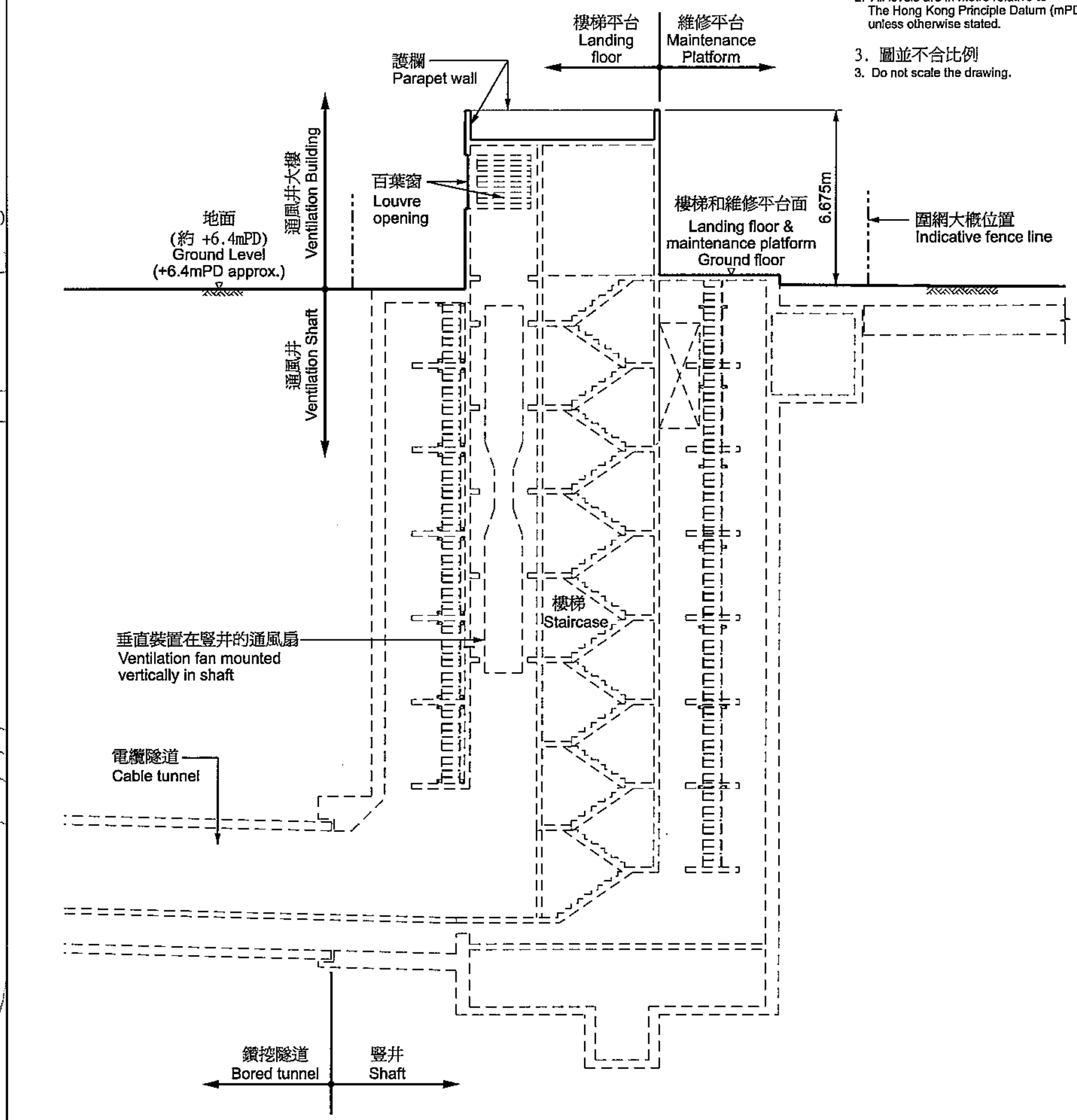
中華電力
CLP Power

青山電纜隧道
Castle Peak Cable Tunnel

ATKINS 阿特金斯顧問有限公司 Atkins China Ltd



平面圖 Plan



剖面圖 Section

註：
Notes:

1. 除說明外,所有長度單位均為毫米
1. All dimensions are in millimetres unless otherwise stated.
2. 除說明外,所有標高單位為米，以香港主水平基準(mPD)為準
2. All levels are in metre relative to The Hong Kong Principle Datum (mPD) unless otherwise stated.
3. 圖並不合比例
3. Do not scale the drawing.

屯門通風豎井 - 使用階段的平面圖
Operation Phase Site Layout - Tuen Mun Shaft

圖 Figure 3.3

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青山電纜隧道入口圖片
Photo of Castle Peak Portal

圖 Figure 3.4

屯門通風井工地圖片
Photo of Tuen Mun Shaft Site

圖 Figure 3.5

由新屯門中心平台望向遷移了的健身場
Relocated fitness station viewed from podium of Sun Tuen Mun Centre

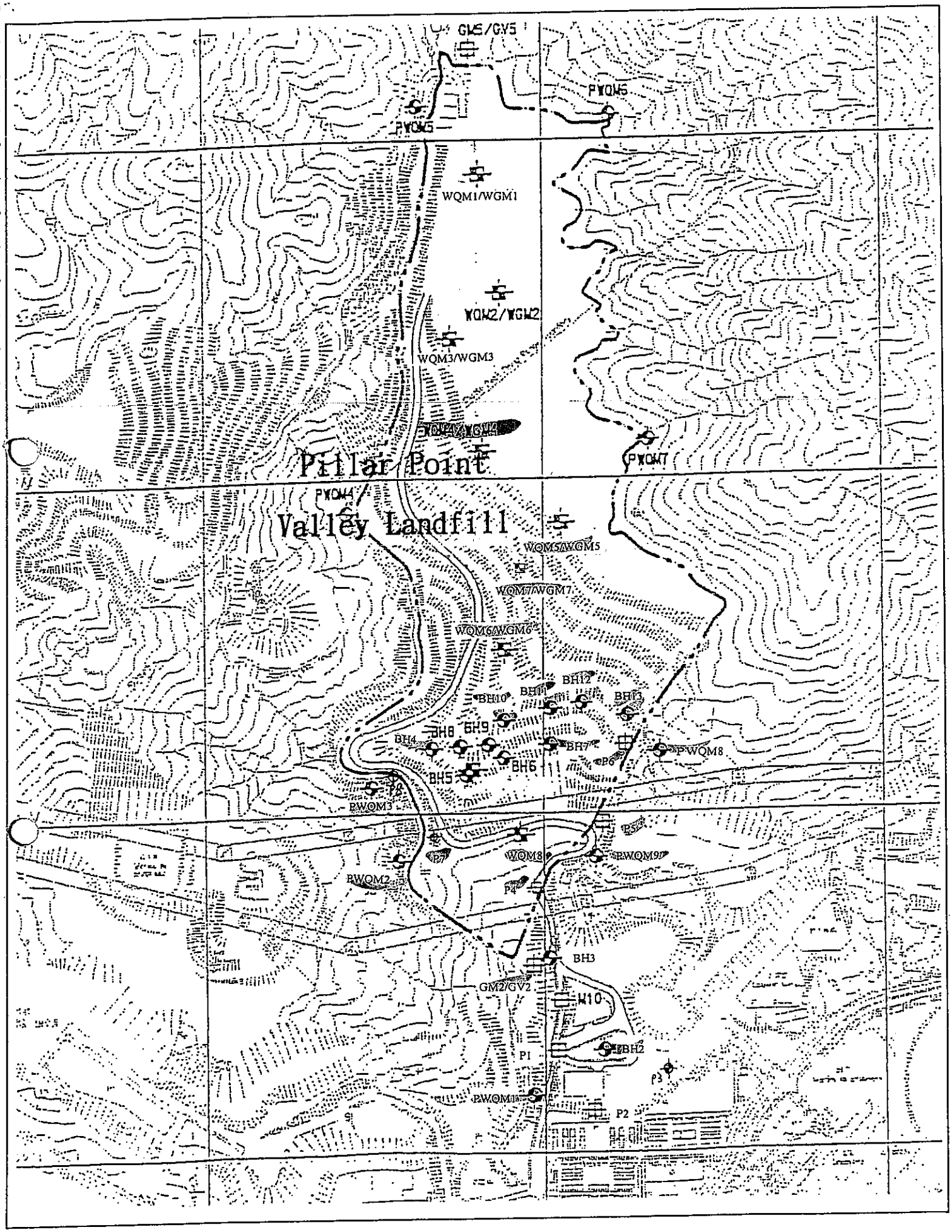
視點顯示在圖 1.2
For View Point location, see Figure 1.2

健身場擬遷位置的集成照片示意圖
Photomontage Illustration of the Fitness Station in the Proposed Relocation Area

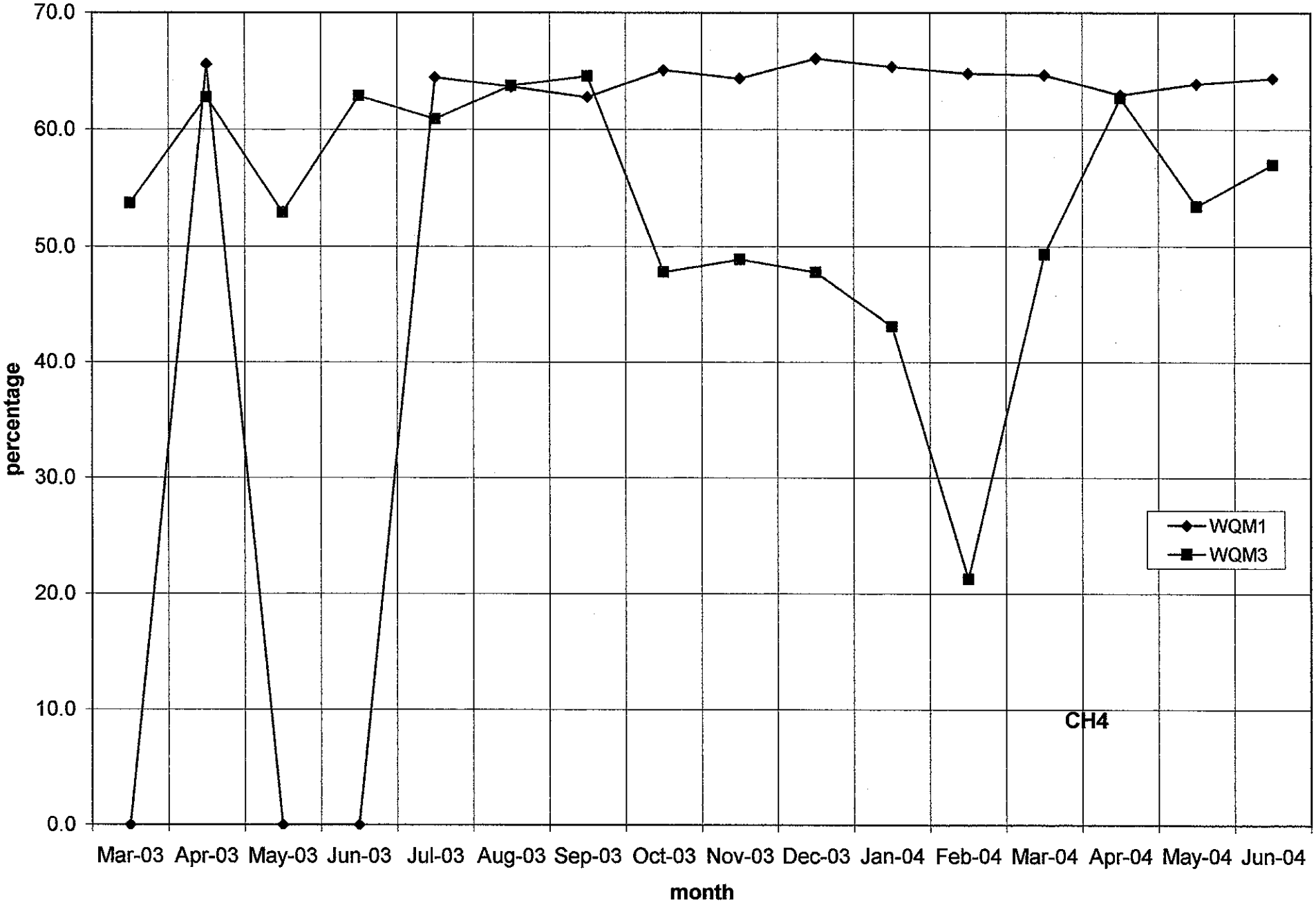
圖 Figure 4.1

工程完成後遊樂場 / 休憩處位置的集成照片示意圖
Photomontage Illustration of the Playground / Sitting Out Area Upon Completion of Construction

圖 Figure 4.2



Location Plan of Gas Monitoring Boreholes


70.0
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40.0
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percentage
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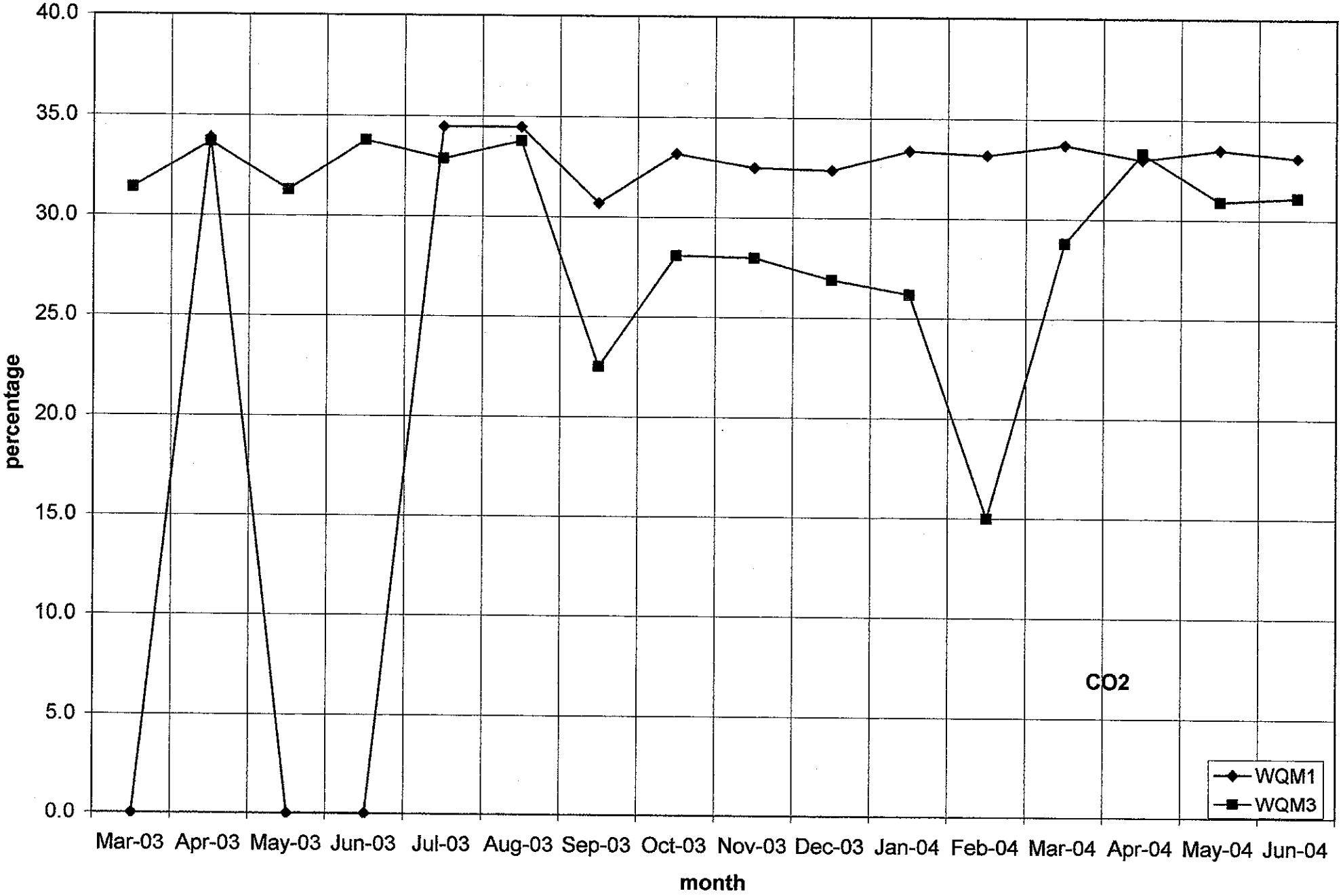
month
WQM1
WQM3
CH4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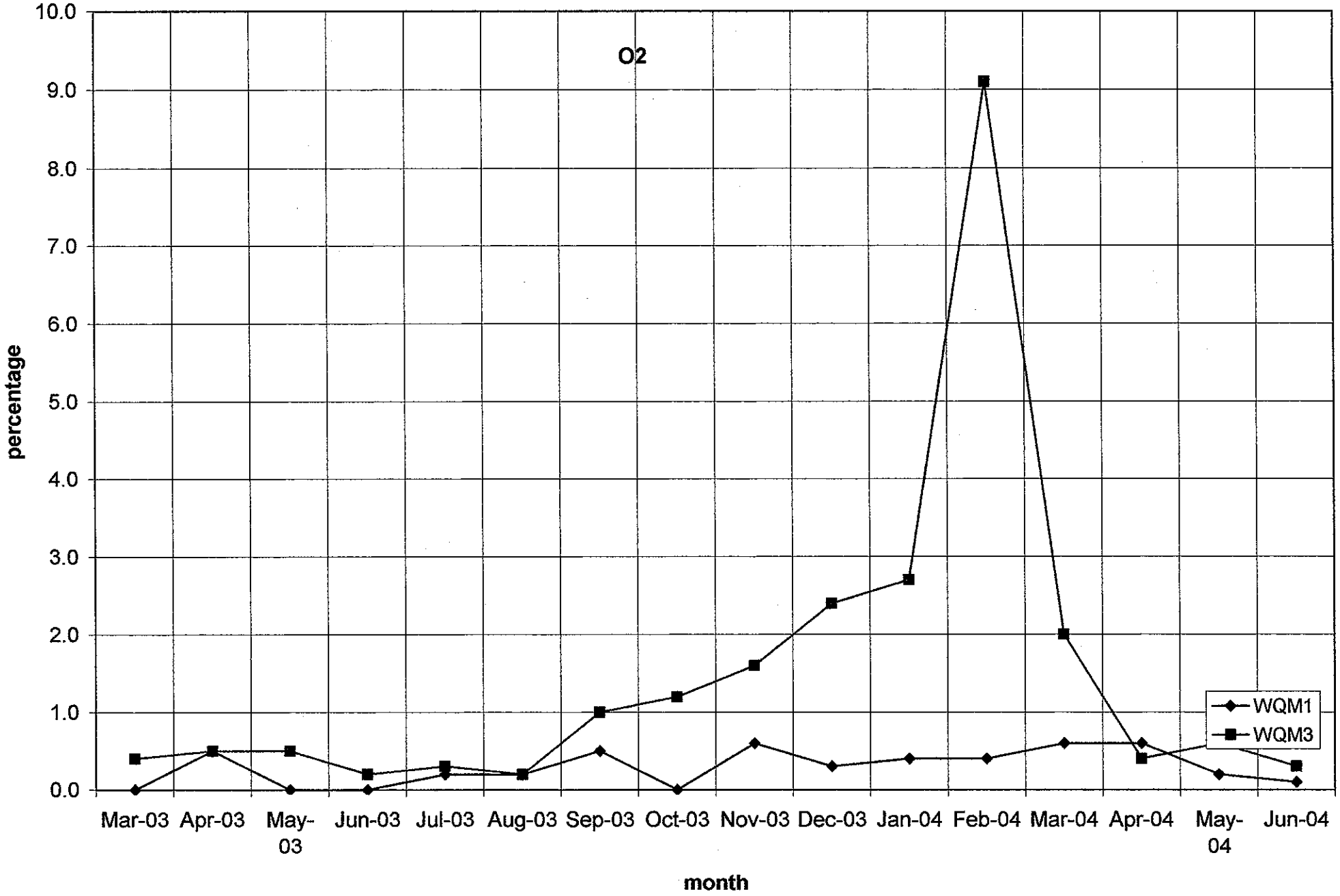
Jun-04
month
CO2
WQM1
WQM3


O2
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9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
percentage
Mar-03
Apr-03
May-03
Jun-03
Jul-03
Aug-03
Sep-03
Oct-03
Nov-03
Dec-03
Jan-04
Feb-04
Mar-04
Apr-04
May-04
Jun-04
month
WQM1
WQM3

Pillar Point Valley Landfill
Percentage of Methane

Borehole no.	Year 2003										Year 2004					
	Mar 03	Apr 03	May 03	Jun 03	Jul 03	Aug 03	Sep 03	Oct 03	Nov 03	Dec 03	Jan 04	Feb 04	Mar 04	Apr 04	May 04	Jun 04
PWQM1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PWQM2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PWQM3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PWQM8	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PWQM9	--	--	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P5	0.0	0.2	0.0	0.0	0.0	8.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P7	22.0	21.1	15.6	6.7	16.2	12.6	11.3	18.1	14.3	14.8	18.5	22.7	19.2	22.8	23.7	27.4
BH2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
BH3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BH4	66.4	64.2	63.1	61.2	62.5	61.7	61.0	64.3	63.8	64.6	65.0	64.0	64.1	62.0	62.7	61.4
BH7	59.1	60.3	59.9	60.1	61.1	60.4	58.2	62.5	61.8	62.8	62.8	62.2	61.5	60.2	60.6	58.9
BH10	--	64.1	64.8	63.6	63.4	64.8	62.5	65.4	64.7	65.6	65.9	65.7	65.0	63.3	64.0	62.9
BH11	60.9	62.5	62.6	60.1	61.7	62.0	60.7	64.0	64.2	65.0	65.4	64.6	45.4	45.4	52.8	61.1
BH12	58.7	60.8	60.1	61.5	61.8	62.1	61.5	66.0	64.2	61.4	64.1	63.5	62.2	60.7	59.6	60.0
BH13	38.6	31.0	46.7	54.0	53.0	59.1	53.8	43.5	41.0	39.0	0.0	28.8	24.5	34.2	38.2	45.4
GM2/GV2	--	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WQM1	--	65.6	--	--	64.5	63.7	62.8	65.1	64.4	66.1	65.4	64.8	64.7	63.0	63.9	64.4
WQM3	53.7	62.8	52.9	62.9	60.9	63.8	64.6	47.8	48.9	47.8	43.1	21.3	49.3	62.7	53.4	57.0
WQM5	61.0	65.3	64.9	41.1	64.5	64.5	63.5	66.2	65.1	66.8	66.0	64.0	63.8	63.3	63.6	63.2
WQM6	60.6	63.5	63.1	60.9	63.3	64.4	62.1	64.8	64.3	65.2	65.5	64.7	60.9	62.6	62.7	62.0
WQM7	--	64.4	63.6	61.7	49.0	62.9	63.3	68.0	67.4	67.6	66.0	64.9	63.5	62.6	62.7	62.2
WQM8	58.8	59.1	59.7	59.2	59.0	54.8	59.1	55.0	61.6	58.5	62.0	60.1	59.5	59.0	59.3	58.8

Remark: '--' represent the reading not taken

Pinar Point Valley Landfill
Percentage of Carbon Dioxide

Borehole no.	Year 2003										Year 2004					
	Mar 03	Apr 03	May 03	Jun 03	Jul 03	Aug 03	Sep 03	Oct 03	Nov 03	Dec 03	Jan 04	Feb 04	Mar 04	Apr 04	May 04	Jun 04
PWQM1	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
PWQM2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PWQM3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0
PWQM8	0.1	0.4	0.2	0.2	0.1	0.4	0.2	0.6	0.8	0.9	0.0	0.1	0.8	0.8	1.3	1.6
PWQM9	--	0.0	2.3	0.0	0.0	0.0	6.6	0.0	0.3	0.9	1.8	2.2	2.8	0.0	0.0	0.0
P1	3.7	3.0	3.3	0.6	3.3	0.3	4.0	5.0	5.2	6.4	3.0	2.6	0.2	0.3	2.4	4.8
P2	4.9	4.8	4.2	1.6	3.5	5.4	2.5	3.7	5.2	0.2	0.0	4.9	5.0	0.0	5.2	9.2
P4	0.0	--	2.7	0.0	0.0	0.0	0.0	4.1	1.4	3.6	2.8	2.6	3.1	6.0	0.7	0.0
P5	0.8	0.0	1.2	0.4	0.1	7.2	1.2	0.0	0.1	0.0	0.0	0.0	1.8	0.0	0.9	0.0
P6	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.0	0.3	0.0	0.0	0.0
P7	18.9	18.2	13.1	8.1	16.2	11.3	9.0	13.2	11.6	13.8	16.0	16.0	17.0	18.4	20.6	23.0
BH2	1.4	4.1	0.5	0.0	0.0	0.2	0.2	0.9	2.3	2.0	0.6	1.8	1.7	0.5	--	--
BH3	3.5	2.0	5.0	4.8	2.0	5.6	2.2	5.1	4.0	4.7	4.5	4.2	4.3	1.4	4.4	3.8
BH4	34.1	34.9	35.3	35.3	34.7	35.5	32.2	34.4	34.1	33.4	34.6	35.1	34.0	36.0	35.7	34.6
BH7	37.3	37.8	38.1	37.4	39.0	37.4	34.5	37.0	35.8	35.5	36.7	37.0	37.0	39.1	38.4	36.8
BH10	--	34.1	33.9	33.6	34.0	33.8	31.4	30.2	33.7	32.8	33.8	33.7	32.9	34.1	34.0	33.2
BH11	35.5	35.9	36.0	35.4	36.4	36.0	32.7	34.0	33.0	32.6	34.1	34.5	24.9	26.3	31.1	35.7
BH12	37.0	38.0	37.8	35.6	36.2	35.5	30.3	32.8	33.7	33.0	35.5	36.0	37.0	38.5	38.0	37.3
BH13	27.3	19.7	30.1	30.6	32.4	34.9	28.0	25.6	24.3	14.7	0.0	31.3	13.0	23.9	28.0	30.9
GM2/GV2	--	7.2	8.1	10.0	10.1	11.5	10.2	11.5	11.1	7.0	0.0	8.9	1.7	8.6	8.9	9.8
WQM1	--	33.9	--	--	34.5	34.5	30.7	33.2	32.5	32.4	33.4	33.2	33.7	33.0	33.5	33.1
WQM3	31.4	33.7	31.3	33.8	32.9	33.8	22.5	28.1	28.0	26.9	26.2	15.0	28.8	33.3	30.9	31.1
WQM5	34.4	34.1	35.2	26.9	33.5	33.8	30.2	31.7	31.8	32.3	33.1	33.2	33.1	34.1	34.4	33.7
WQM6	35.0	35.7	36.1	35.3	35.7	34.1	31.3	33.4	32.7	32.6	34.3	34.9	32.9	36.3	35.8	35.0
WQM7	--	35.1	36.1	35.8	29.7	35.4	30.6	31.9	32.1	32.3	33.2	34.8	34.8	35.8	35.7	34.9
WQM8	36.8	38.3	38.4	35.2	36.7	33.7	31.0	29.5	33.0	29.8	33.4	36.1	35.1	37.6	36.4	37.4

Remark: '--' represent the reading not taken

Pillar Point Valley Landfill

Percentage of Oxygen

Borehole no.	Year 2003										Year 2004					
	Mar 03	Apr 03	May 03	Jun 03	Jul 03	Aug 03	Sep 03	Oct 03	Nov 03	Dec 03	Jan 04	Feb 04	Mar 04	Apr 04	May 04	Jun 04
PWQM1	17.2	20.4	20.1	19.9	20.0	19.9	20.6	20.9	21.0	21.1	21.7	21.0	20.9	20.9	20.4	20.5
PWQM2	20.0	20.4	20.3	20.2	20.2	20.4	20.7	21.0	21.0	21.1	21.1	20.1	20.1	20.8	20.3	20.4
PWQM3	13.4	20.2	2.4	20.3	20.2	20.4	20.7	20.8	20.9	21.2	20.9	20.6	20.6	20.7	20.3	20.4
PWQM8	20.0	19.8	20.0	19.4	19.0	19.6	20.0	20.0	20.1	20.2	20.7	20.5	20.3	20.2	19.5	19.0
PWQM9	--	20.5	15.9	20.0	19.9	20.0	17.3	20.8	20.2	20.1	19.2	17.9	16.8	21.1	20.5	20.7
P1	17.2	18.1	17.1	18.6	16.6	19.6	15.4	15.8	16.2	20.1	18.7	18.6	20.6	20.5	18.4	16.0
P2	10.5	15.6	15.5	17.6	15.9	15.0	16.3	17.5	16.4	20.9	20.9	15.8	16.5	21.0	14.5	10.3
P4	19.9	--	17.4	19.9	20.1	19.9	20.4	19.2	19.4	18.9	19.2	20.0	18.7	14.0	19.6	20.7
P5	19.4	20.4	18.5	19.5	19.9	1.4	20.0	20.8	20.7	21.2	21.0	21.0	19.1	21.1	19.7	20.7
P6	20.3	20.4	20.2	19.1	19.9	19.9	20.7	20.6	20.9	20.5	14.5	20.7	20.5	20.7	20.3	20.5
P7	2.9	6.6	10.1	12.7	6.9	8.7	10.3	9.7	10.9	9.2	7.9	7.9	7.3	7.8	5.7	3.3
BH2	18.5	16.3	19.8	17.4	20.1	16.8	20.3	20.5	17.9	19.7	20.4	18.7	19.9	20.3	--	--
BH3	16.2	17.6	15.3	15.3	17.8	13.0	17.8	14.2	16.3	15.7	15.6	15.7	15.9	19.6	15.8	16.2
BH4	0.0	0.6	0.3	0.2	0.4	0.2	1.4	0.0	0.3	0.6	0.3	0.6	0.5	0.5	0.3	0.1
BH7	0.0	0.7	0.4	0.1	0.3	0.3	1.5	0.0	0.6	0.6	0.6	0.6	0.7	0.5	0.0	0.1
BH10	--	0.6	0.8	0.2	0.3	0.3	1.4	0.1	0.6	0.6	0.3	0.5	0.5	0.6	0.2	0.1
BH11	0.0	0.6	0.3	0.5	0.2	0.2	1.4	0.0	0.4	0.6	0.3	0.5	6.1	5.9	3.6	0.1
BH12	0.0	0.6	0.3	0.1	0.2	0.2	1.3	0.0	0.4	0.9	0.6	0.4	0.7	0.5	0.4	0.1
BH13	0.0	7.8	2.6	1.5	1.4	0.3	1.3	3.9	3.9	6.7	20.7	3.2	7.3	4.3	2.6	0.2
GM2/GV2	--	12.9	12.6	10.8	10.2	9.5	7.8	8.3	10.2	14.8	21.0	11.8	19.1	12.3	11.7	11.1
WQM1	--	0.5	--	--	0.2	0.2	0.5	0.0	0.6	0.3	0.4	0.4	0.6	0.6	0.2	0.1
WQM3	0.4	0.5	0.5	0.2	0.3	0.2	1.0	1.2	1.6	2.4	2.7	9.1	2.0	0.4	0.6	0.3
WQM5	0.0	0.5	0.9	0.0	0.2	0.2	1.0	0.0	0.4	0.4	0.3	0.5	0.8	0.7	0.2	0.2
WQM6	0.0	0.5	0.4	0.3	0.0	0.2	1.1	0.0	0.5	0.6	0.2	0.3	0.7	0.4	0.0	0.1
WQM7	--	0.5	0.4	0.2	0.1	0.2	1.6	0.0	0.6	0.4	0.3	0.2	0.7	0.4	0.3	0.2
WQM8	0.0	0.6	0.3	0.3	0.4	1.6	1.1	3.0	0.6	2.2	0.3	0.2	0.5	0.5	0.2	0.2

Remark: '--' represent the reading not taken

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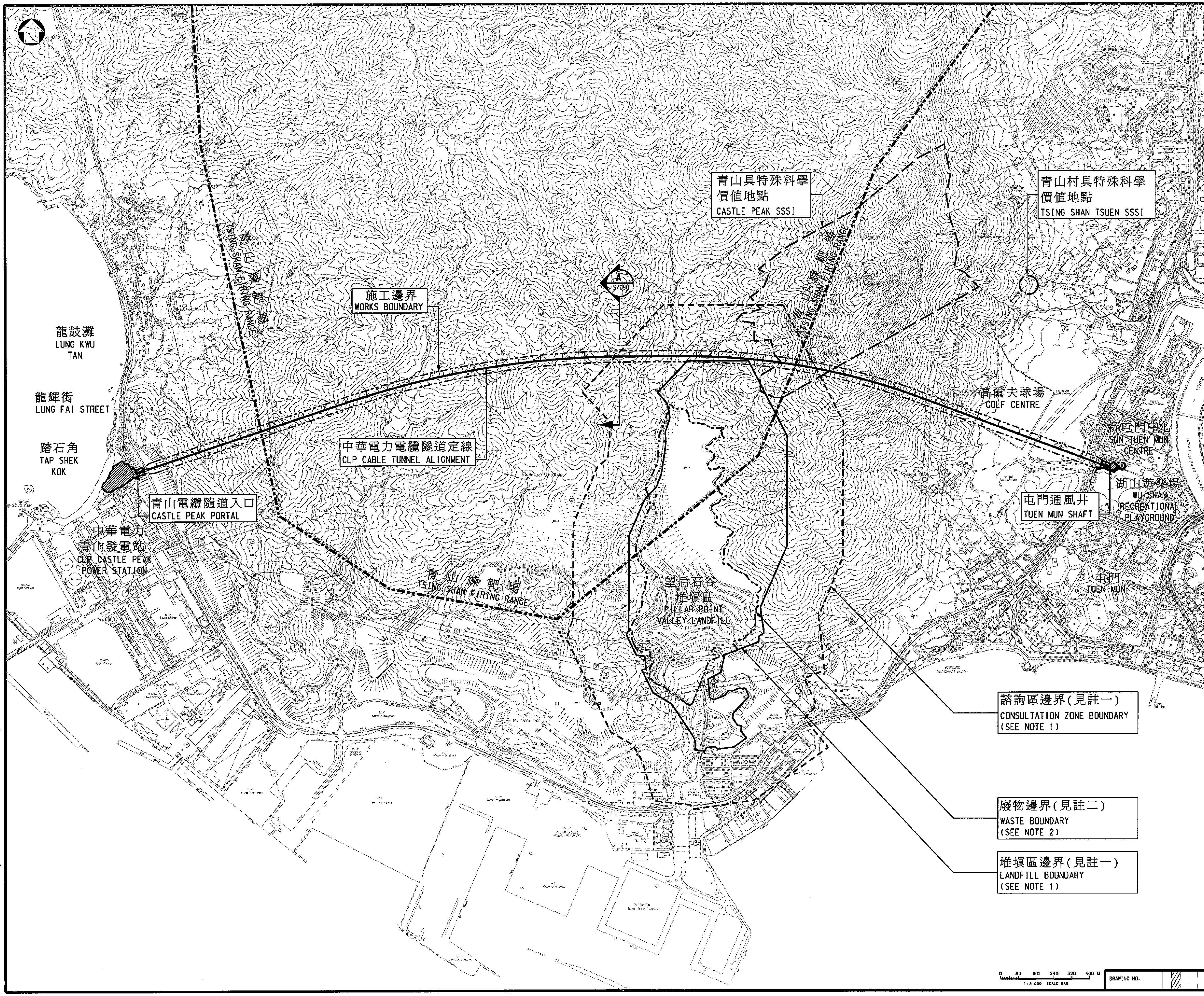

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註：
NOTE:

1. 從環境保護署刊物摘錄的資料中顯示望后石谷堆填區 / 諮詢區 （1997年）。
1. INFORMATION EXTRACTED FROM EPD PUBLICATION SHOWING PILLAR POINT LANDFILL BOUNDARY/CONSULTATION ZONE (IN 1997).
2. 從環境保護署獲取有關望后石谷堆填區現況的資料。
2. INFORMATION OBTAINED FROM EPD ON CURRENT STATUS OF PILLAR POINT LANDFILL.
3. 「SSSI」指具特殊科學價值地點，承包商應設計對SSSI不構成影響的隧道工程。
3. "SSSI" MEANS THE SITE OF SPECIAL SCIENTIFIC INTEREST. THE CONTRACTOR SHALL DESIGN THE TUNNELLING WORKS SUCH THAT THERE IS NO IMPACT ON THE SSSIs.
4. 圖中顯示的堆填區邊界及具特殊科學價值地點邊界僅是暫時性的。
4. THE LANDFILL AREA BOUNDARY AND THE SSSIs BOUNDARY SHOWN ARE TENTATIVE ONLY.

REV.	DESCRIPTION	DATE	CHK.
A	1st ISSUE		

RESPONSIBLE DEPT.	ENGINEERING PROJECTS
DESIGNED:	KW
DRAWN:	TH
CHECKED:	WHT
APPROVED:	AS
PROJECT NO.:	3713

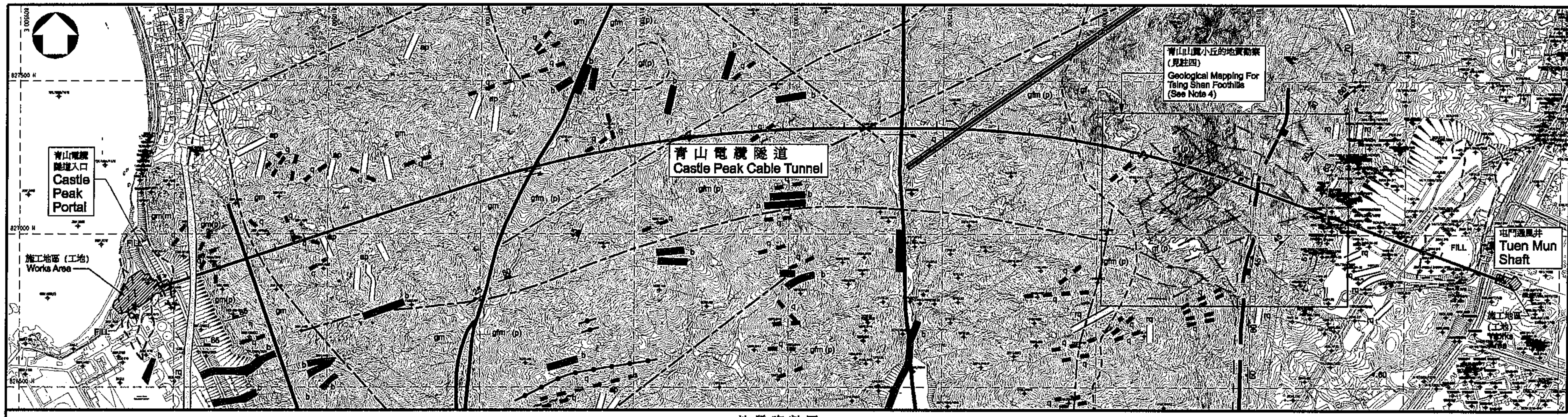
PROJECT TITLE: 工程名稱
青山電纜隧道
CASTLE PEAK CABLE TUNNEL

DRAWING TITLE 圖則名稱
工程位置圖
PROJECT LOCATION PLAN

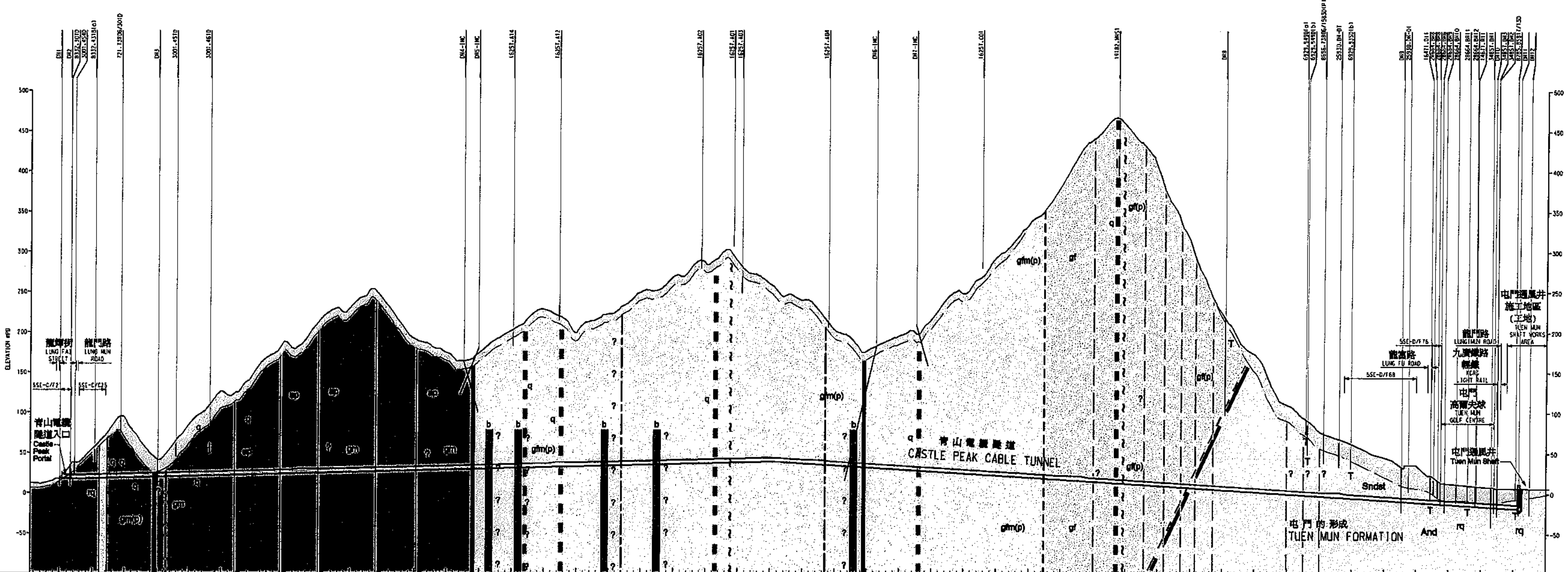
SHEETS IN SET: SHEET NO.:
SCALE AT A1: 1:8000

ATKINS 阿特金斯顧問有限公司 Atkins China Ltd

CONTRACT NO.:
CONTRACTORS/SUPPLIERS DRAWING NO.: 3713/ACL/CP/S/001
DRAWING NO.



地質資料圖
GEOLOGICAL DATA PLAN
比例 1:5000
SCALE 1:5000



DISTANCE (m)	EXISTING GROUND LEVEL (mPD)
0.000	+17.425
100.000	+55.037
200.000	+52.751
300.000	+41.838
400.000	+65.808
500.000	+126.407
600.000	+149.797
700.000	+187.612
800.000	+212.699
900.000	+231.161
1000.000	+241.017
1100.000	+151.280
1200.000	+174.432
1300.000	+174.912
1400.000	+202.656
1500.000	+227.757
1600.000	+199.819
1700.000	+222.077
1800.000	+249.697
1900.000	+268.797
2000.0000	+284.656
2100.000	+286.652
2200.000	+258.859
2300.000	+239.276
2400.000	+201.110
2500.000	+176.835
2600.000	+195.412
2700.000	+217.205
2800.000	+247.504
2900.000	+293.047
3000.0000	+335.361
3100.000	+383.160
3200.000	+448.885
3300.000	+455.959
3400.000	+400.938
3500.000	+311.439
3600.000	+221.908
3700.000	+172.405
3800.000	+109.901
3900.000	+76.269
4000.000	+61.232
4100.000	+44.741
4200.000	+35.311
4300.000	+12.628
4400.000	+6.961
4500.000	+6.500
4600.000	

縱向地質剖面
LONGITUDINAL GEOLOGICAL PROFILE
SCALE HORIZONTAL = 1:5000 VERTICAL = 1:2000

圖例說明
LEGEND :

- GIU NO.
- DRILLHOLE REFERENCE
- DRILLHOLE LOCATION
- DRILLHOLE
- SUPERFICIAL DEPOSITS, SAPROLITE & VEINS (UNDIFFERENTIATED)
- TUEN MUN FORMATION COMPRISING ANDESITES (And) / TUFFS (T) AND SANDSTONE (Sndst)
- gf — FINE-GRAINED GRANITE
- gfm — FINE-TO MEDIUM-GRAINED GRANITE
- gm — MEDIUM-GRAINED GRANITE
- (p) — PORPHYRITIC (ALSO REFERRED TO AS MEGACRYSTIC)
- q — QUARTZ
- ap — APLITE
- b — BASALT
- rq — QUARTZPHYRIC RHYOLITE
- rf — FELDSPARPHYRIC RHYOLITE
- ROCKHEAD
- MYLONITE
- SCHISTOSE
- OVERTURNED BEDDING
- BEDDING
- INCLINED JOINTING
- VERTICAL FOLIATION
- INCLINED FOLIATION
- ANTICLINE AXIAL TRACE (MAJOR)
- SYNCLINE AXIAL TRACE (MAJOR)
- GEOLOGICAL BOUNDARY
- FAULT WITH CROSSMARK ON DOWNTHROW SIDE (HKGS GEOLOGICAL MAP SHEET 5)
- QUARTZ VEINS (HKGS GEOLOGICAL MAP SHEET 5)
- GEOLOGICAL PHOTOLINEAMENT (GASP REPORT III)
- TRACE OF DYKE AND VEIN (GASP REPORT III)
- FAULTS (FLETCHER, 2002)
- ? — DENOTES UNCERTAINTY

中華電力
CLP Power

註：
(供地質資料圖之用)

NOTES :

(FOR GEOLOGICAL DATA PLAN)

1. CASTLE PEAK CABLE TUNNEL ALIGNMENT SHOWN IS THE SCHEME DESIGN ALIGNMENT AND IS SUBJECT TO CHANGE.
2. DRILLHOLE LOCATIONS HAVE BEEN DOWNLOADED DIRECTLY FROM THE GEOTECHNICAL DATABASE HELD AT THE GEOTECHNICAL INFORMATION UNIT OF THE GEOTECHNICAL ENGINEERING OFFICE. GROUND INVESTIGATION IMPLEMENTED BY CLP FOR THIS PROJECT IS ALSO SHOWN.
3. TRIAL PITS HAVE BEEN IDENTIFIED ALONG THE TUNNEL ALIGNMENT BUT ARE CONSIDERED NOT RELEVANT TO THIS PROJECT. THE TRIAL PIT LOCATIONS HAVE NOT BEEN SHOWN FOR CLARITY.
4. GEOLOGICAL FEATURES PRESENTED ON THIS DATA PLAN IS BASED ON THE 1:20,000 SCALE GEOLOGICAL MAP, SHEET 5 AND THE ENGINEERING GEOLOGY MAP PRESENTED GIVEN IN GASP REPORT III. FOR THE TSING SHAN FOOTHILLS AREA, THE GEOLOGICAL FEATURES SHOWN ARE BASED ON THE GEOLOGICAL MAPPING CARRIED OUT FOR THE NATURAL TERRAIN HAZARD STUDY FOR TSING SHAN FOOTHILLS, AGREEMENT NO. CE 47/2000 FOR THE GEOTECHNICAL ENGINEERING OFFICE.
5. SUPERFICIAL DEPOSITS AND SAPROLITE ARE GENERALLY AROUND 10 TO 20M THICK AND HAVE NOT BEEN SHOWN FOR CLARITY. HOWEVER FOR THE GEOLOGICAL PROFILES AT THE PROPOSED LOCATION OF CASTLE PEAK PORTAL AND TUEN MUN SHAFT, THE RELEVANT DRAWINGS SHOULD BE REFERRED TO FOR DETAILS.

(供地質剖面之用)
(FOR GEOLOGICAL PROFILE)

1. THE TUNNEL ALIGNMENT SHOWN IS THE SCHEME DESIGN ALIGNMENT.
2. GEOLOGICAL PROFILE HAS BEEN PRODUCED ALONG THE CENTRE LINE OF THE SCHEME DESIGN CASTLE PEAK CABLE TUNNEL ALIGNMENT. THE TUNNEL ALIGNMENT SUBJECT TO CHANGE.
3. THE INTERPRETATION OF THE SUBSURFACE GROUND CONDITIONS IS THAT WHICH CAN BE REASONABLY INTERPRETED FROM THE INFORMATION OBTAINED. DUE TO LIMITED SUBSURFACE GEOLOGICAL DATA, THE INTERPRETATION SHOWN IS CONCEPTUAL AND ACTUAL SUBSURFACE CONDITIONS CAN VARY CONSIDERABLY FROM THAT SHOWN.
4. THE GROUND SURFACE PROFILE HAS BEEN PRODUCED USING GEOGRAPHIC INFORMATION SYSTEM BY CUTTING A SECTION THROUGH THE 1:1000 SCALE TOPOGRAPHIC SURVEY MAPS PREPARED BY THE LANDS DEPARTMENT.
5. DRILLHOLES CLOSEST TO THE ALIGNMENT ARE PRESENTED AS A REFERENCE. THE INDIVIDUAL DRILLHOLE RECORDS SHOULD BE REFERRED TO FOR DETAILS.
6. DYKES, FAULTS, GEOLOGICAL PHOTOLINEAMENTS ARE SHOWN INDIVIDUAL VERTICAL FEATURES. HOWEVER IN REALITY THEY MAYBE SUBVERTICAL WITH SEVERAL OFFSHOOTS. THE WIDTH OF THESE FEATURES SHOWN IS SCHEMATIC.

REV.	DESCRIPTION	DATE	CHK.
A	首次發出 — 初步平面 1st ISSUE - PRELIMINARY ALIGNMENT		

RESPONSIBLE DEPT. 負責部門 工程項目 ENGINEERING PROJECTS

DESIGNED:	KL
DRAWN:	TP
CHECKED:	WT
APPROVED:	AS
PROJECT NO.:	3713

PROJECT TITLE: 工程名稱
青山電纜隧道
CASTLE PEAK CABLE TUNNEL

DRAWING TITLE 圖則名稱
地質資料圖及縱向地質剖面
GEOLOGICAL DATA PLAN AND LONGITUDINAL GEOLOGICAL PROFILE

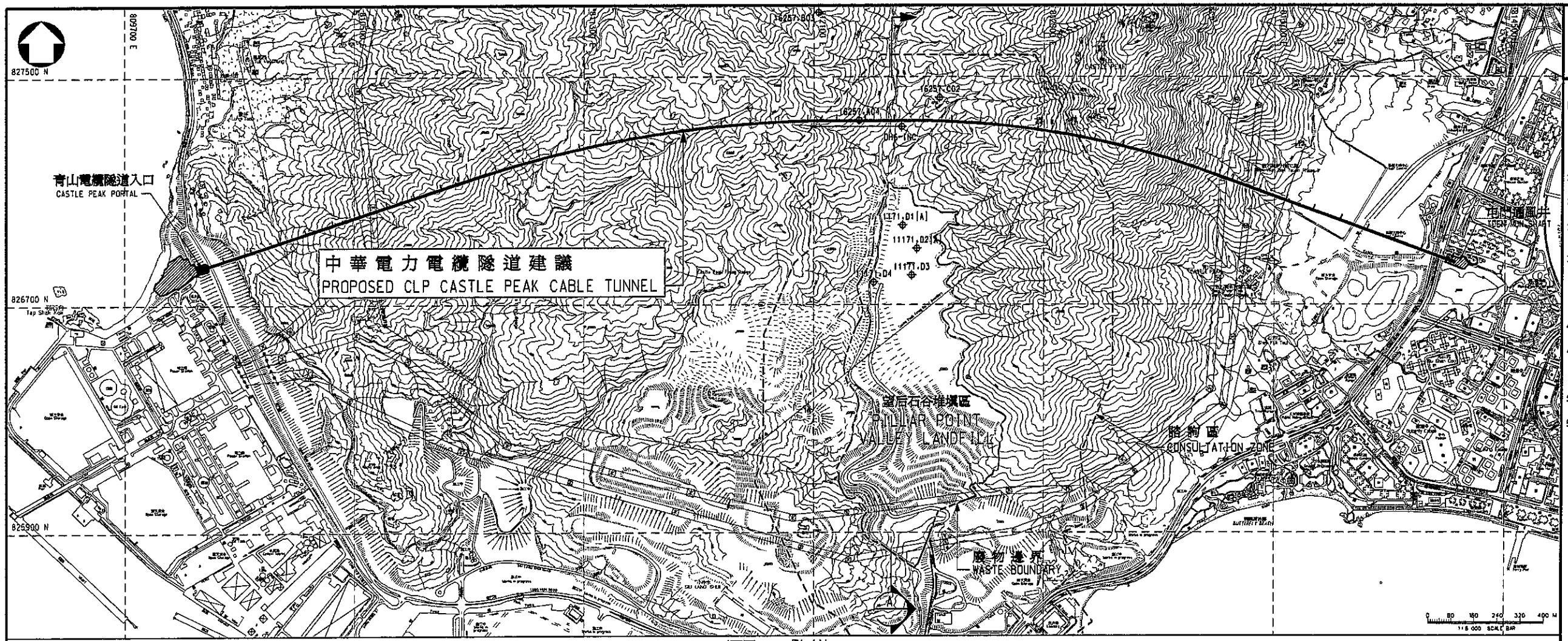
SHEETS IN SET: SHEET NO.:

SCALE AT A0: AS SHOWN

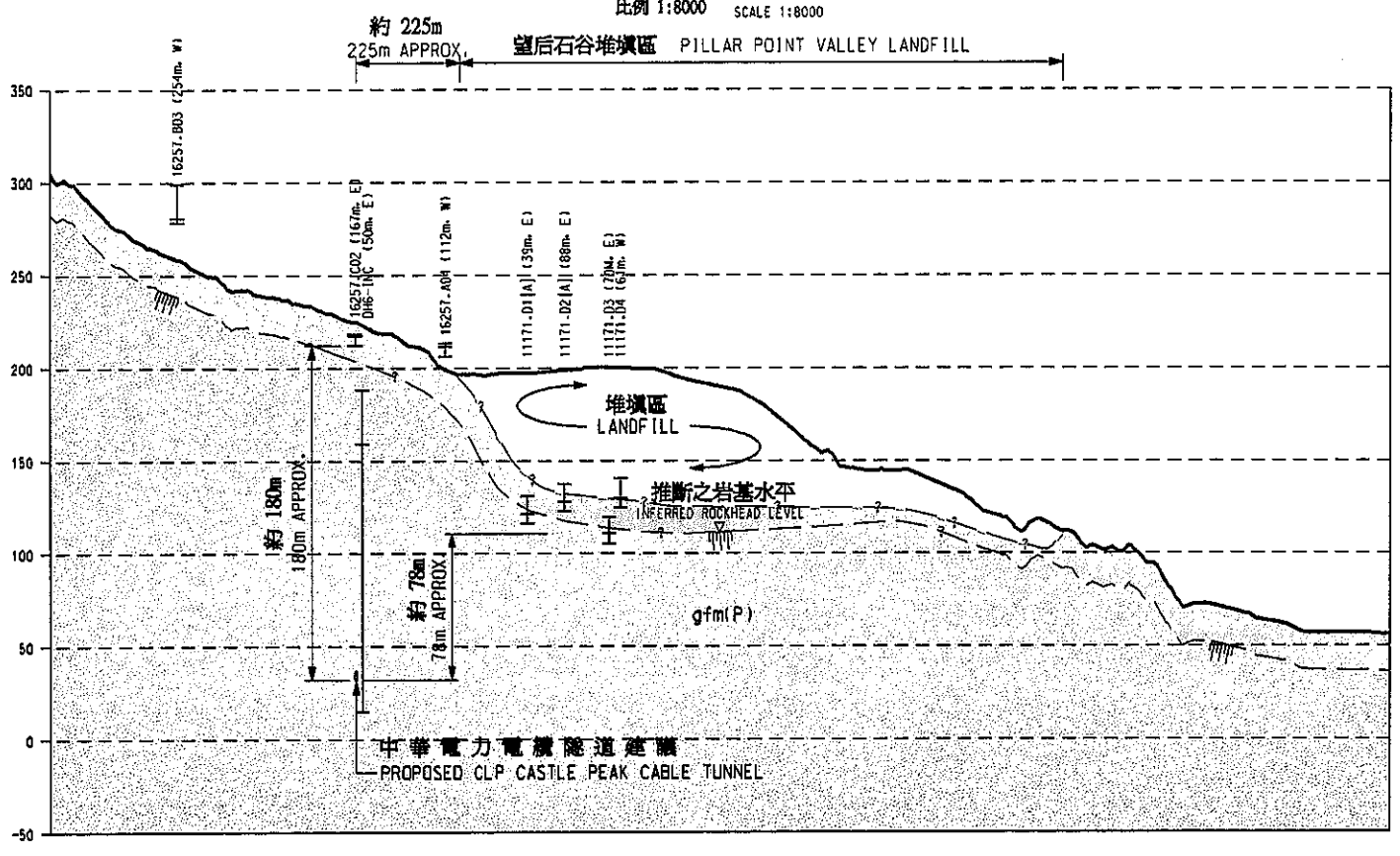
ATKINS 阿特金斯顧問有限公司 Atkins China Ltd

CONTRACT NO.:

CONTRACTORS/SUPPLIERS DRAWING NO.: 3713/ACL/CP/S/050



平面圖 PLAN
比例 1:8000 SCALE 1:8000



甲部 SECTION A
比例 SCALE 1:8000 (HOR)
1:2000 (VER)

圖例說明
LEGEND:

	GIU編號	GIU NO.
	鑽洞參考	DRILLHOLE REFERENCE
	鑽洞位置	DRILLHOLE LOCATION
	鑽洞	DRILLHOLE
	堆填區	LANDFILL
	表土沉積物、風化土及岩脈 (無差別 / 劃一)	SUPERFICIAL DEPOSITS, SAPROLITE & VEINS (UNDIFFERENTIATED)
	細粒至中粒花崗岩	FINE-TO MEDIUM-GRAINED GRANITE
	岩基	ROCKHEAD
?	表示不確定	DENOTES UNCERTAINITY

0 50 100 M 1:2 000 SCALE BAR
0 80 160 240 320 400 M 1:8 000 SCALE BAR

中華電力 CLP Power

註：
NOTES:

1. 鑽洞位置由土力工程處轄下之土木工程資訊單位的工程資料庫直接下載。
1. DRILLHOLE LOCATIONS HAVE BEEN DOWNLOADED DIRECTLY FROM THE GEOTECHNICAL DATABASE HELD AT THE GEOTECHNICAL INFORMATION UNIT OF THE GEOTECHNICAL ENGINEERING OFFICE.
2. 一般來說，表面沉積物及風化土的厚度大概是十至二十米 為求清晰，圖中未有顯示這些資料。
2. SUPERFICIAL DEPOSITS AND SAPROLITE ARE GENERALLY AROUND 10 TO 20m THICK AND HAVE NOT BEEN SHOWN FOR CLARITY.
3. 地下狀況的詮釋是根據所得資料而合理地解釋出來。 由於地下地質的資料有限，所示之詮釋屬概念性質， 實際的地下地質狀況中所示之情況或會有很大差別。
3. THE INTERPRETATION OF THE SUBSURFACE GROUND CONDITIONS IS THAT WHICH CAN BE REASONABLY INTERPRETED FROM THE INFORMATION OBTAINED. DUE TO LIMITED SUBSURFACE GEOLOGICAL DATA, THE INTERPRETATION SHOWN IS CONCEPTUAL AND ACTUAL SUBSURFACE CONDITIONS CAN VARY CONSIDERABLY FROM THAT SHOWN.
4. 地面剖面是由地理信息系統製造出來，經過地政總署制定的 地形數據圖（比例 1:1000）的橫切區段得來。
4. THE GROUND SURFACE PROFILE HAS BEEN PRODUCED USING GEOGRAPHIC INFORMATION SYSTEM, BY CUTTING A SECTION THROUGH THE 1:1000 SCALE TOPOGRAPHIC SURVEY MAPS PREPARED BY THE LANDS DEPARTMENT.
5. 最近鑽面線的鑽洞只供參考之用，欲知詳情， 請參考個別鑽洞之記錄。
5. DRILLHOLES CLOSEST TO SECTION LINE PRESENTED AS A REFERENCE. THE INDIVIDUAL DRILLHOLE RECORDS SHOULD BE REFERRED TO FOR DETAILS.

REV.	DESCRIPTION	DATE	CHK.
A	供諮詢之用 FOR CONSULTATION		

RESPONSIBLE DEPT. 負責部門 工程項目 ENGINEERING PROJECTS

DESIGNED:	KW
DRAWN:	TH
CHECKED:	JW
APPROVED:	AS
PROJECT NO.:	3713

PROJECT TITLE: 工程名稱
青山電纜隧道
CASTLE PEAK CABLE TUNNEL

DRAWING TITLE 圖則名稱
望后石谷堆填區
PILLAR POINT VALLEY LANDFILL

SHEETS IN SET: SHEET NO.:

SCALE AT A1:
AS SHOWN

ATKINS 阿特金斯顧問有限公司 Atkins China Ltd

CONTRACT NO.:

CONTRACTORS/SUPPLIERS DRAWING NO.:
3713/ACL/CP/S/060

DRAWING NO.

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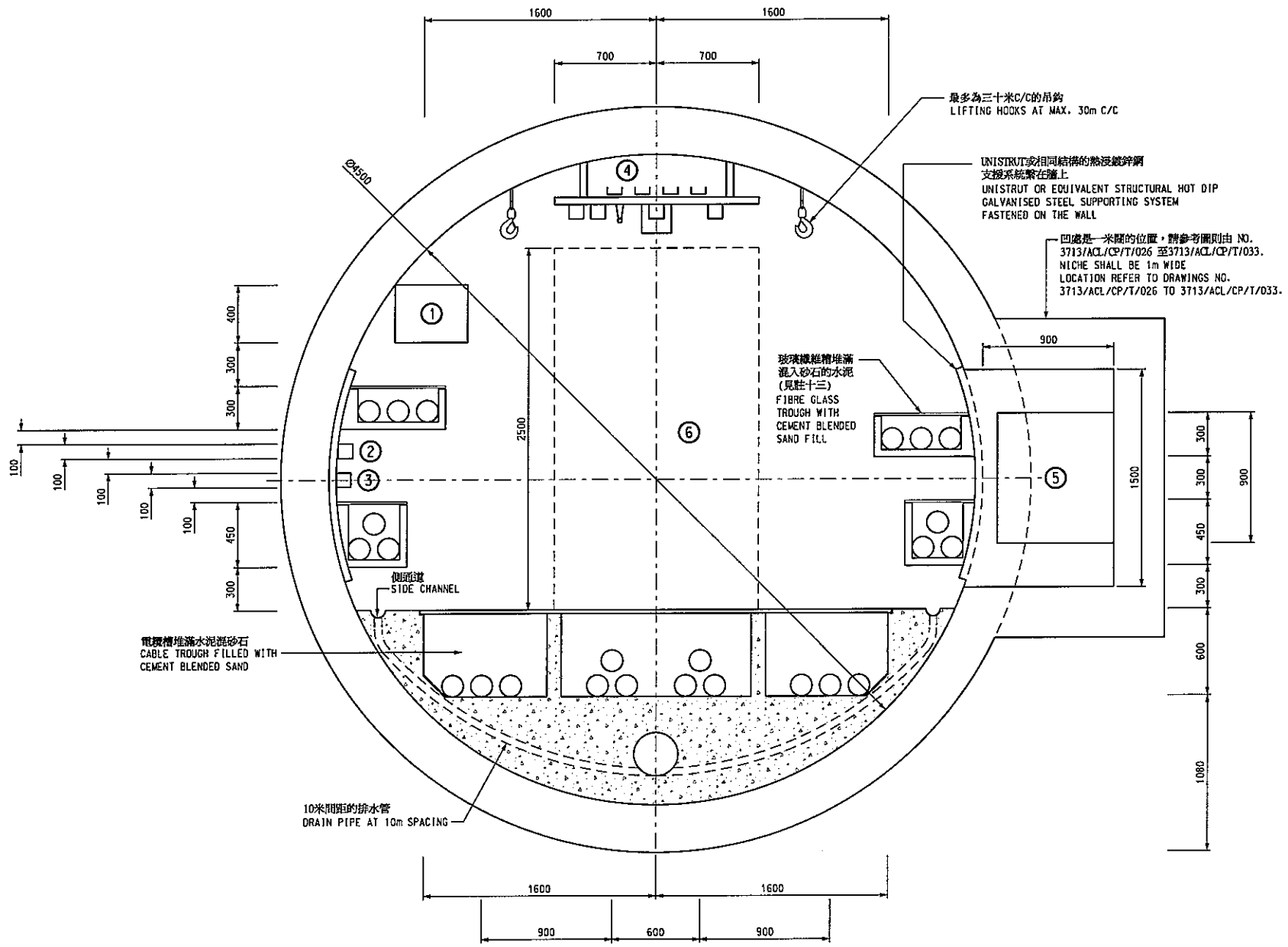
FILENAME: P:\PROJECTS\3713\REPVR\0029.dgn

①	電話及電話插座	TELEPHONE AND SOCKET OUTLET.
②	保養插座	MAINTENANCE SOCKET OUTLET.
③	警報電掣	PANIC ALARM PUSH BUTTON.
④	電纜梯連維修有裂縫電纜裝置、電纜托架、疏散警報、火警警報系統、線/點型高熱探測器、警報器、燈光設備、溫度感應器、甲烷氣體偵測器、煙霧探測器	CABLE LADDER WITH FIXINGS FOR LEAKY CABLE, CABLE TRAYS, EVACUATION ALARM, FIRM WARNING UNIT, LINEAR / POINT TYPE HEAT DETECTOR, LIGHT FITTING, TEMPERATURE SENSOR, METHANE GAS DETECTOR, SMOKE DETECTOR.
⑤	增額變壓器主要配電箱 次主要配電箱的燈光控制板	BOOSTER TRANSFORMERS MAIN DISTRIBUTION BOARD SUB MAIN DISTRIBUTION BOARD LIGHTING CONTROL PANEL.
⑥	保養外殼以電動車的最少尺碼(1400毫米闊 x 2500毫米高)爲基準	MAINTENANCE ENVELOPE BASED ON THE MINIMUM SIZE OF ELECTRIC VEHICLE WHICH IS 1400mm WIDTH x 2500mm HIGH.



甲部
SECTION A
比例 1:20 S/001
SCALE 1:20

中華電力
CLP Power

REV.	DESCRIPTION	DATE	CHK.
A	首次發出 1st ISSUE		

RESPONSIBLE DEPT. 負責部門 工程項目 ENGINEERING PROJECTS

DESIGNED:	KW
DRAWN:	TH
CHECKED:	WHT
APPROVED:	AS

PROJECT NO.: 3713

PROJECT TITLE: 工程名稱
青山電纜隧道
CASTLE PEAK CABLE TUNNEL

DRAWING TITLE
隧道典型剖面
TUNNEL TYPICAL CROSS SECTION

SHEETS IN SET: SHEET NO.:

SCALE AT A1: 1:20

ATKINS 阿特金斯顧問有限公司 Atkins China Ltd

CONTRACT NO.:

CONTRACTORS/SUPPLIERS DRAWING NO.:
3713/ACL/CP/S/090

DRAWING NO.

0 500 1000 mm
1:20 SCALE BAR

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APPENDIX 2: LANDFILL GAS HAZARD ASSESSMENT

1. INTRODUCTION

1.1 General

CLP Power (CLPP) have appointed Atkins China Limited (Atkins) as their consultant for the preparation of a scheme design and associated contract documents for a 4.5km long cable tunnel ("The Castle Peak Cable Tunnel" CPCT). The CPCT will allow future cable installation from Castle Peak Power Station to the Tuen Mun area. The tunnel is currently planned to run through a mountainous area from the western end of Castle Peak Power Station to a District Open Space located adjacent to the Sun Tuen Mun Centre in Tuen Mun.

The Pillar Point Valley Landfill (PPVL) is situated directly adjacent to the proposed tunnel alignment. The site plan showing the relationship between the tunnel alignment and the PPL area is detailed on Drawing 3713/ACL/CP/S/001. The indicative tunnel alignment is approximately 225m away from the existing waste boundary on plan, and is approximately 78m below the landfill.

Under Section 6.5, Chapter 9 of the *Hong Kong Planning Standards and Guidelines*, an evaluation of the risk posed by landfill gas is required for any development proposed within a Landfill Consultation Zone (LCZ), the area of land surrounding the landfill boundary as defined by a line running parallel to and 250 m away from the edge of the landfill site boundary.

In June 1997 the Environmental Protection Department (EPD) issued a *Guidance Note* (Landfill Gas Hazard Assessment Guidance Note) providing a risk assessment framework for developments proposed close to landfill sites. The *Guidance Note* must be followed when evaluating the risk related to qualifying developments. Generally, a qualitative landfill risk assessment is sufficient to ensure that appropriate levels of safety design features are incorporated within the development. All such assessments must be submitted to EPD for vetting.

This report constitutes a preliminary landfill gas hazard assessment based on the information available to the scheme design consultant. The report describes the preliminary tunnel design features, which can help mitigate landfill gas and groundwater ingress.

1.2 Scope of Assessment

This preliminary assessment has been undertaken in order to undertake an initial assessment of the landfill gas risk and to ascertain the need for mitigation measures. Necessary measures will be included within the contract to ensure the successful Design and Build (D&B) contractor makes full provision for any potential mitigation measures and controls during tunnel excavation and operation. A detailed landfill gas hazard assessment report will be required to be prepared at the detailed design stage by the D&B contractor. Mitigation measures will, in all cases, be implemented where required to ensure safe operation of the tunnel. A further objective has been to demonstrate that no insurmountable problems exist that would prevent the safe operation of the tunnel at the

proposed location.

It is highlighted that this preliminary report is based on limited site specific information regarding the ground conditions. As mentioned above, a detailed quantitative landfill gas hazard assessment will be required to be undertaken by the D&B Contractor following contract award. The detailed assessment prepared by the Contractor shall be approved by the EPD. If the Contractor's construction method involves blasting within the PPVL Consultation Zone, the assessment will be further reviewed and updated and the Contractor shall seek approval from EPD on the revised assessment.

This preliminary assessment has been undertaken with reference to the *Guidance Note* with the following tasks undertaken:

- a review of available background information and studies of relevance to the Pillar Point Valley Landfill;
- the identification of the sources, nature and likely quantities/concentrations of landfill gas emissions with the potential to affect the Castle Peak Cable Tunnel;
- the identification of viable pathways through the ground, underground cavities, utilities or groundwater and the conditions of these pathways through which the landfill gas emissions must pass if they are to reach the Castle Peak Cable Tunnel;
- as far as possible, the identification of elements of the Castle Peak Cable Tunnel that would be sensitive to the effects of the landfill gas emissions during construction and operational phases;
- a preliminary qualitative assessment of the degree of risk that the landfill gas emissions may pose to the Castle Peak Cable Tunnel for the identified source-pathway-target combination; and
- the proposal of appropriate measures to minimise landfill gas hazard during both the construction and operational phases.

The location of the Castle Peak Cable Tunnel relative to the landfill area is indicated in drawing 3713/ACL/CP/S/001.

2. POTENTIAL LANDFILL HAZARDS

2.1 Potential Hazards

Landfill gas can present a number of potential hazards if not adequately mitigated and /or controlled. The following properties of landfill gas are of particular concern in relation to developments proposed within a LCZ.

Methane

Methane, a key component of landfill gas, is flammable, burns when mixed with air between approximately 5% by volume and 15% by volume (the Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL) respectively). If a mixture of methane and air with a composition between the LEL and UEL is ignited in a confined space, the resulting

combustion may give rise to an explosion. Methane is also an asphyxiant, is odourless and colourless and its presence can only be confirmed through the use of a properly calibrated methane detector.

Carbon Dioxide

Carbon dioxide is the other main constituent of landfill gas, and is also an asphyxiant. It causes adverse health effects at relatively low concentrations. The long term Occupational Exposure Limit (OEL) is 0.5% by volume. Similar to methane, in its pure form the gas is odourless and colourless, and its presence may only be confirmed through the use of an appropriately calibrated carbon dioxide detector.

Landfill Gas Buoyancy

Methane is lighter than air, whilst carbon dioxide is heavier than air. Landfill gas mixtures are generally likely to have a density close to or equal that of air. However, it is known that site conditions may result in ratios of methane to carbon dioxide causing the landfill gas mixture to be either heavier, or lighter than, air. Consequently, landfill gas may collect at the bottom of trenches or, conversely, may rise up and accumulate beneath structures and foundations.

In certain circumstances landfill gas may be transported in solution in leachate, or may be generated as a byproduct of anaerobic metabolism of leachate. The crown of the entire tunnel alignment length within, and in proximity to, the LCZ is expected to be constructed and operated below the groundwater table. As such, the probability of landfill gas being transported in solution of leachate into the tunnel is therefore considered to be very low. However, ground conditions need to be confirmed following the detailed ground investigation.

2.2 Potential Hazards Associated with Landfill Leachate

Leachate is the contaminated effluent that drains from a landfill site. Although its composition can vary significantly with the type and age of the contained waste, it is typically highly polluting, has a high biological oxygen demand (BOD), and may contain high concentrations of compounds such as metal ions, chlorides, sulphates and ammonia compounds.

It is expected that no adverse affects to the tunnel will result due to leachate due to the distance from the landfill. The indicative tunnel alignment is approximately 225m away from the landfill on plan, and the tunnel alignment is approximately 78m below the landfill, as such, there is a large separation between the landfill site and the tunnel alignment. Further, it is also anticipated that the tunnel section within the LCZ will be waterproof to avoid leakage of ground water in the tunnel. Therefore, the landfill site leachate is considered not likely to exert any adverse affects on the tunnel section.

2.3 Landfill Gas Risk Assessment Methodology

The methodology set out in the *Landfill Gas Hazard Assessment Guidance Note* issued by EPD was adopted in this preliminary assessment. For ease of reference, the key points of the *Guidance Note* are reproduced in the following sections.

2.4 Landfill Gas Assessment Criteria

The risk due to landfill gas may be evaluated based upon the following three components:

- *Source* - the rate and concentration of gas generated by the landfill;
- *Pathway* - the nature and length of potential pathways through which landfill gas could migrate (such as geological features, utility services and leachate flow); and
- *Target* - the level of vulnerability of the development (i.e. the tunnels themselves).

These are discussed in the following sections.

Source

The source (i.e. the landfill) is evaluated with respect to the following classifications:

Minor - Landfill sites that gas controls have been installed and have demonstrated though monitoring that no migration of gas beyond the landfill boundary has occurred (or any specific control measures are required). The landfill must have measures to control gas that do not rely solely on an active gas extraction system or any other single control measure which is vulnerable to failure; or Old landfill sites where the maximum concentration of methane within the waste, as measured at several location across the landfill and on at least four occasions over a period of at least six months, is less than 5% by volume.

Moderate - Landfill sites at which some form of gas control has been installed (e.g. a lined site or one where vents or barriers have been retrospectively installed), but where there are only limited monitoring data to demonstrate prevention of off-site gas; or Landfill sites where comprehensive monitoring has demonstrated that there is no migration of gas beyond the landfill boundary but where the control of gas relies solely on an active gas extraction system or any other single control system that is vulnerable to failure.

Major - Recently filled landfill sites at which there is little or no control to prevent migration of gas or at which the efficacy of the gas control measures has not been assessed; or Any landfill site at which monitoring has demonstrated that there is significant migration of gas beyond the site boundary.

Pathway

The broad classification of the Pathway is as follows:

Very Short/Direct - Path length of less than 50 m for unsaturated permeable strata and fissured rock or less than 100 m for anthropogenic conduits.

Moderately Short/Direct - Path length of 50 - 100 m for unsaturated permeable soil or fissured rock or 100 - 250 m for anthropogenic conduits.

Long/Indirect - Path length of 100 - 250 m for unsaturated permeable soils and fissured rock.

In classifying the pathway, adjustment to the above general guidelines may be required to take account of other factors that can affect the extent of gas migration. Such factors include:

- the particular soil permeability;
- the spacing, tightness and direction of the fissures or joints;
- topography;
- depth and thickness of the medium through which the gas may migrate (this maybe affected by groundwater level);
- the nature of the strata over the potential pathway;
- the number of different pathway media involved; and
- the depth to groundwater table and groundwater flow patterns.

Target

Targets may be classified according to the following evaluation criteria:

High Sensitivity - Buildings and structures with ground level or below ground rooms/voids or into which services enter directly from the ground and to which members of the general public have unrestricted access or that contain sources of ignition. This would include developments where there is a possibility of additional structures being erected directly on the ground on an ad hoc basis and without regard to the potential risks.

Medium Sensitivity - Other buildings, structures or service voids where there is access only by authorised, well trained personnel, such as the staff of utility companies, who have been briefed on the potential hazards relating to landfill gas and the specific safety procedures to be followed. Deep excavations also fall into this category unless covered specifically elsewhere.

Low Sensitivity - Buildings/structures that are less prone to gas ingress by virtue of their design (such as those with a raised floor slab), shallow excavations or developments that involve essentially outdoor activities but where evolution of gas could pose potential problems.

These evaluation criteria should only be used as a general frame of reference, and particular aspects of a building or development may render it more or less sensitive than indicated. Account should be taken of any particular circumstances when assigning a target to any category.

2.5 Qualitative Assessment of Risk

Once the status of each of the source, pathway and target have been evaluated against the above criteria, a qualitative assessment of the overall risk may be made with reference to the matrix set out in Table 2.1.

Table 2.1 Qualitative Risk Assessment Matrix

Source	Pathway	Target Sensitivity	Risk Category
Major	Very Short / Direct	High	Very High
		Medium	High
		Low	Medium
	Moderately Short / Direct	High	High
		Medium	Medium
		Low	Low
	Long / Indirect	High	High
		Medium	Medium
		Low	Low
Moderate	Very Short / Direct	High	High
		Medium	Medium
		Low	Low
	Moderately Short / Direct	High	High
		Medium	Medium
		Low	Low
	Long / Indirect	High	Medium
		Medium	Low
		Low	Very Low
Minor	Very Short / Direct	High	High
		Medium	Medium
		Low	Low
	Moderately Short / Direct	High	Medium
		Medium	Low
		Low	Very Low
	Long / Indirect	High	Medium
		Medium	Low
		Low	Very Low

3. DESCRIPTION AND HISTORY OF PILLAR POINT VALLEY LANDFILL

3.1 Landfill History

PPVL covers an area of 38 hectares and was operated from 1983 to 1996. The landfill has received approximately 11 million tonnes of waste comprising mainly domestic, construction and industrial waste. The landfill was formed by infilling the natural valley to create a waste slope with a relatively flat platform. After completion of landfilling, it was covered with a soil capping, planted with vegetation in parts, and provided with a surface drainage system. The landfill is currently undergoing restoration and a new gas control system will be installed on site.

3.2 Landfill Gas Generation and Control

Results of landfill gas monitoring conducted monthly over the period from March 2003 to

June 2004 at PPVL have been provided by EPD (presented in Annex A). Monitoring wells along the northern side of the landfill (identified as WQM1 and WQM3) are the most relevant to the tunnel alignment, and indicate concentrations ranging from an average of 21.3 – 66.1 % for methane, 15.0 – 34.5 % for carbon dioxide and 0.0 – 9.1 % for oxygen. Apart from some of the exceptional data, the monitoring results show a steady concentration of methane, carbon dioxide and oxygen throughout the monitoring period. Results of monitoring stations WQM1 and WQM3 and the original monitoring data from EPD are presented in Annex A.

The landfill currently adopts a gas venting system; however, the landfill is programmed to undergo restoration in the following two years with a new gas control system as well as leachate management system. The restoration works are expected to be completely by mid-2006.

4. GROUND AND GROUNDWATER CONDITIONS BETWEEN LANDFILL AND TUNNEL ALIGNMENT

The assessment of the ground and groundwater conditions between PPVL and the proposed cable tunnel alignment is based on published geological literature, archival drillhole records obtained from the Geotechnical Information Unit (GIU) of the Geotechnical Engineering Office, Civil Engineering & Development Department and records from site-specific drillholes implemented by CLP as part of this project.

The drillhole locations, geological conditions and structures along the proposed cable tunnel alignment are shown on Drawing Nos. 3713/ACL/CP/S/050 and 3713/ACL/CP/S/060. The drillholes obtained from the GIU that were carried out in the area of interest were carried out before landfilling took place, and due to site formation activities associated with the landfill site, the ground conditions in the upper portion of these drillholes may not be representative of the current ground conditions. However, generally the ground conditions within the north part of the Consultation Zone that encompasses a section of the cable tunnel comprises fine to medium grained granites with rockhead varying from 2m to 17m below original ground level (which below PPVL can be assumed to be equivalent to the base of the landfill site). Minor igneous intrusions of basalt and dacite of Grade III decomposition and some quartz veining were also encountered in this area. Typically above the rockhead lies completely and highly decomposed granite and outside the PPVL area, colluvium was encountered.

The published geological map of the Castle Peak area indicates a north-south trending faultline bisecting PPVL and intersecting the proposed cable tunnel. Two drillholes, Drillholes DH6-INC and DH7-INC were implemented by CLP in order to determine the nature of the faultline that may intersect the cable tunnel. These drillholes have encountered evidence of faulting, i.e. brecciation, slickensides, mylonitisation, etc. however, no major fracture zones were encountered.

The NE-SW trending quartz vein identified on the published geological maps was not encountered in Drillhole DH7-INC that was intended to locate this feature. The archival drillholes in the PPVL area suggests that groundwater levels are generally around 10m below original ground level (assumed to be base of the landfill site). However, the hydrogeological regime may have been influenced by the PPVL site and hence this water level should be used with caution. The only recent groundwater monitoring readings in this area were from a standpipe installed in Drillhole DH6-INC implemented

by CLP. The water level readings from the standpipe indicates the groundwater level at this location in December 2004 (i.e. dry season) is around 10m below ground level, however, this groundwater level is expected to fluctuate slightly due to seasonal variations.

5. LANDFILL GAS RISK ASSESSMENT

5.1 General Information

The tunnel alignment is approximately 225m away from the landfill on plan, which is within the LCZ, and the tunnel alignment is approximately 78m below the landfill. The overall site Geotechnical Data Plan and Longitudinal Geological Profile are indicated in Drawing 3713/ACL/CP/S/050A. The tunnel section passes within the PPVL LCZ is shown in Drawing 3713/ACL/CP/S/060A.

5.2 Preliminary Design Stage Assumptions

A Tunnel Boring Machine (TBM) will be used for the tunnel and the preliminary general arrangement of the tunnel constructed by TBM methods is indicated in Drawing 3713/ACL/CP/S/090A. The 4.5km long cable tunnel will be designed as a fully waterproofed and 'gas tight' tunnel adjacent to the landfill and no groundwater will be allowed to drain into the tunnel. The tunnel vertical profile is designed with the highest point in the middle of alignment and dips gradually by 1- 2.5% to portals at both ends.

5.3 Gas Source

After completion of landfilling at Pillar Point Valley Landfill, it was covered with a soil capping, planted with vegetation in parts, and provided with a surface drainage system. The PPVL contains a substantial volume of waste and currently still generates a high concentration of methane gas. It is therefore assumed that the PPVL represents a major source of landfill gas.

The PPLV is currently subject to restoration works which commenced in 2004. It is anticipated that the restoration works will be finished by 2006, which include specific measures to control the off-site migration of both landfill gas and leachate. Following the successful completion of the restoration works and confirmation through on-going monitoring, the classification of the landfill should be minor to moderate; however, the present condition of the landfill site will be used as a conservative design approach.

5.4 Pathway

The potential pathways for migration of gas from the PPVL to the Castle Peak Tunnel are considered to comprise only natural features; no anthropogenic migration pathways (utility pipelines, channels, culvert etc) have been identified as connecting the subject site (i.e., the tunnel) to the landfill.

Following a preliminary desk study and site investigations, it is anticipated that there will be a fault line cutting through the tunnel within the consultation area. However, as discussed in section 4, groundwater level recorded at boreholes during drilling only is available and the tunnel is anticipated to be under the groundwater table. Moreover, the

tunnel alignment is approximately 225m away from the waste boundary on plan, and the tunnel alignment is approximately 78m below the level of the landfill. Therefore, the pathway for natural transmission is classified in accordance with the *Guidance Note* as long/indirect for the purposes of this assessment.

Drawing 3713/ACL/CP/S/060A indicates the geological profile for a cross section between the landfill and the nearest section of tunnel alignment and Drawing 3713/ACL/CP/S/050A indicates the geological profile along the length of tunnel alignment within, and in proximity to, the Land Consultation Zone. These figures also clearly indicate groundwater levels.

5.5 Targets

The tunnel section adjacent to the PPVL will be designed as a fully lined waterproof and 'gas tight' tunnel. During construction, the access of the TBM tunnel will be limited to authorised and well-trained staff only. Ventilation and full monitoring of hazardous gases will also be provided in the TBM during construction. It is considered, during tunnel construction, as having medium sensitivity to landfill gas according to the definition provided in the *Guidance Note*.

During tunnel operational and maintenance period, CLPP staff who undertake maintenance and inspections only will be allowed for the access of the tunnel. The inspections will probably be limited to once a year. Ventilation and gas monitoring will be provided within the tunnel to ensure a safe working environment for the personnel. It is considered, during operation, as having medium sensitivity to landfill gas according to the definition provided in the *Guidance Note.*

5.6 Assessment of Risk

A qualitative assessment of landfill gas risk posed by the PPVL to the Castle Peak Cable Tunnel, as described in this report, is set out in Table 5.1 below.

Table 5.1 Qualitative Risk Assessment

Source	Pathway	Target	Qualitative Risk
PPVL (major)	Natural, including faults and dykes (long/indirect)	During tunnel construction (medium)	Medium
PPVL (major)	Natural, including faults and dykes (long/indirect)	During tunnel maintenance period / operation phase (medium)	Medium

Based on the above, the construction and operation of the tunnel is classified as having a medium qualitative risk level. However, it should be noted that site restoration is being undertaken for the PPVL which is due to be completed in 2006, so the qualitative risk levels are expected to be reduced.

In accordance with Table 2.1 “Summary of General Categorisations of Risk” contained in the *Guidance Note* the implication of a landfill gas hazard risk categorisation of medium during tunnel construction is that mitigation measures will be required to reduce the potential impacts to workers. For a landfill gas hazard risk categorisation of medium during tunnel operation is that precautionary measures will be required to protect the proposed development is safe.

6. PROPOSED PROTECTION AND PRECAUTIONARY MEASURES

The protection and precautionary measures that should be reviewed and implemented as necessary by the contractor during construction and by CLPP during tunnel operation are indicated in the following sections.

6.1 Construction Phase

Should the findings of the more detailed ground investigation and detailed quantitative LGH assessment indicate that there is a risk of gas ingress, the Contractor will be required to implement measures to mitigate this risk (for example, the use of grouting of the ground, back grouting behind the lining segments or fully gasketted lining).

A working method statement (safety plan) will be required under the contract. This document should be submitted to EPD and other interested parties prior to commencement of tunnelling. The document should set out the measures and implementation strategies proposed to minimise the risk of fires, uncontrolled explosions and asphyxiation of workers during the construction phase. Amongst other issues, the safety plan should stipulate the gas monitoring required (in terms of frequency and location) prior to and during the use of all powered mechanical equipment. Further information such as responsible parties and timeframes for actions/responses to different monitoring scenarios, details of essential staff training requirements, and requirements for back-up monitoring equipment should also be provided. All work and staff training should be undertaken strictly in accordance with the safety plan.

All relevant workers should undergo training about the risks and indications of landfill gas and should be thoroughly versed in first aid and emergency and evacuation techniques.

A no smoking policy should be strictly applied.

The possibility of methane rich air being taken into diesel-engined plant should not be overlooked, although this is not likely to occur.

Provisions should be made to control water contamination that may arise if leachate infiltrates from the landfill, although this is not expected to occur. Procedures should also be put in place for the safe handling and disposal of tunnel excavation and boring spoil that may be contaminated.

A mechanical ventilation system should be in use at all times when personnel are working in the tunnel. No work should be carried out in the absence of mechanical ventilation or without the presence of a suitably trained safety officer.

All electrical equipment (including extension leads) should be fitted with spark arrestors or be intrinsically safe.

As a minimum, no work should be undertaken in the absence of fire extinguishers or emergency breathing apparatus (details should be provided in the safety plan).

Monitoring of methane, carbon dioxide and oxygen should be undertaken at all times during the works using suitable equipment. Specific details of measurement equipment, personnel, lines of responsibility and monitoring frequency should be set out in the safety plan to be prepared specifically for the TBM construction works. The actions set out in Table 6.1 below should be carried out in the event of gas trigger levels being breached.

Table 6.1 Landfill Gas Detection Action Plan

Parameter	Measurement	Required Action
O_2	< 19 %	Increase ventilation to restore O_2 to >19%
	< 18 %	Stop work
		Evacuate Personnel
		Increase ventilation to restore O_2 to >19%
CH_4	> 10 % LEL	Prohibit hot works
		Increase ventilation to restore CH_4 to < 10 % LEL
	> 20 % LEL	Stop work
		Evacuate Personnel
		Increase ventilation to restore CH_4 to < 10 % LEL
CO_2	> 0.5 %	Increase ventilation to restore CO_2 to < 0.5 %
	> 1.5 %	Stop work
		Evacuate Personnel
		Increase ventilation to restore CO_2 to < 0.5 %

Monitoring equipment should have, as a minimum, the indication ranges set out below.

Methane:	0 - 100 % LEL and 0 - 100 % by volume
Carbon-Dioxide:	0 - 20 % by volume
Oxygen:	0 - 21 % by volume

As a minimum, monitoring frequency should be undertaken on an hourly basis and should always be undertaken by suitably qualified personnel. All measurements should be recorded and included in the site diary. This should be reflected in the safety plan.

As a minimum, all measurements should be taken such that they include the highest and lowest elevations within the tunnel.

If blasting is to be used, all necessary precautions to prevent the ignition of flammable gas shall be undertaken by the Contractor. Approval from relevant Government Authorities shall be obtained. The Contractor shall prepare a Blasting Assessment

Report in accordance with the requirements of Building Department, Geotechnical Engineering Office and the Commissioner of Mines as part of the Contract Documents.

6.2 Operational Phase

A methane gas detection system shall be provided and installed along the tunnel based on the findings of the detailed quantitative LGH assessment and to the approval of EPD. As a minimum requirement gas detectors shall be provided and installed at 50 metre centres, to cover the length of the tunnel within the 250m Consultation Zone of the PPVL and also at the tunnel alignment high point. Subject to the recommendations of the detailed quantitative LGH assessment, additional gas detectors may also be required.

As a minimum, the gas detection system shall have two-level alarms. The low level alarm shall be used to switch on the ventilation system and the high level alarm shall be used to activate the evacuation alarm. The required spacing and frequency of the methane gas detectors shall be reviewed as part of the Contractor's detailed LGH assessment. The alarm levels shall be defined with reference to the Contractor's detailed LGH assessment.

A ventilation system will be installed for the operational and maintenance phase. Normally the ventilation will be off. A daily timer will be installed to control the fans to run 2 hours per day to reduce humidity and any stale air inside the tunnel. Other than this, the ventilation will only be activated during tunnel maintenance operations, or during auto operation mode when the tunnel temperature reaches 40°C or upon receiving an alarm signal from the methane gas detection system, however, this is not anticipated to occur on a regular basis.

The tunnel ventilation system shall be automatically activated in high speed mode upon receiving an alarm signal from the gas detection system. The minimum air change rate at high speed mode shall not be less than 3 air changes per hour.

Monitoring for methane, carbon dioxide and oxygen as recommended above should be conducted using equipment with the following indication ranges and the actions prescribed below taken in instances of exceedances of the criteria given in Table 6.1.

Methane	0-100% LEL and 0-100% by volume
Carbon dioxide	0-20%
Oxygen	0-21%

With the implementation of the above measures, it is considered that the risk from landfill gas can be substantially reduced.

7. CONCLUSION

A preliminary qualitative landfill gas hazard assessment has been undertaken with respect to the proposed Castle Peak Cable Tunnel during both construction and operational and maintenance phase. This assessment has been undertaken in

accordance with the *Landfill Gas Hazard Assessment Guidance Note* issued by EPD and on the basis of information available at the time of report production. This qualitative assessment has been carried out to identify the level of risk posed by the landfill on the project, and to recommend measures to reduce such risks.

The assessment has taken account of the source of gas (source), condition of intervening ground and topography (gas migration pathway), and the sensitivity of the proposed land uses (targets). Taking consideration of the specific nature of each of these factors the assessment has concluded that the risk of landfill gas hazard to the tunnel is medium during construction and medium during the operational and maintenance phase.

This preliminary assessment has indicated that measures such as some training and/or the development of appropriate operational procedures may be necessary with respect to the construction phase of the tunnel to reduce the risk of landfill gas hazard exposure to construction workers. This is also recommended for the operational phase of the tunnel, though the risk of landfill gas hazard is medium.

The early submission of a preliminary assessment has been undertaken in order to demonstrate to pertinent authorities that landfill gas issues are being duly considered and that necessary mitigation measures will, in all cases, be implemented where required to ensure safe operation of the cable tunnel. It is understood that in-principle approval is needed from EPD on the cable tunnel alignment prior to progress to the detailed design phase of the project. This assessment has also demonstrated that no insurmountable problems exist that would prevent the safe operation of the cable tunnel at the proposed location.

A further detailed quantitative landfill gas hazard assessment should be completed following design development in detailed design stage by the design and build contractor. The detailed quantitative landfill gas hazard assessment prepared by the Contractor shall be approved by the EPD. If the Contractor's construction method involves blasting within the PPVL Consultation Zone, the assessment will be further reviewed and updated and the Contractor shall seek approval from EPD on the revised assessment.

Annex A
Pillar Point Valley Landfill Gas Monitoring Data

CLP Power Castle Peak Cable Tunnel Project - Project Profile
Calculation of Construction Noise - Without Mitigation Measures

					Sun Tuen Mun Centre, Block 2									Sun Tuen Mun Centre, Block 3								
Construction Activity	**Equipment**	**GW-TM Code**	**Number of Plant**	**Sound Power Level, dB(A)**	**Horizontal Separation (m), Block 2**	**Vertical Separation (m), Block 2**	**Slant Distance (m), Block 2**	**Distance Attenuation dB(A), Block 2**	**Predicted Noise Level PNL at Block 2, dB(A)**	**Correction for barriers dB(A), Block 2**	**Corrected Noise Level CNL at Block 2, dB(A)**	**façade Correction dB(A)**	**CNL at Block 2 - Overall, dB(A)**	**Horizontal Separation (m), Block 3**	**Vertical Separation (m), Block 3**	**Slant Distance (m), Block 3**	**Distance Attenuation dB(A), Block 3**	**Predicted Noise Level PNL at Block 3, dB(A)**	**Correction for barriers dB(A), Block 3**	**Corrected Noise Level CNL AT Block 3, dB(A)**	**façade Correction dB(A)**	**CNL at Block 3 - Overall, dB(A)**
Removal of hard-standing	Air compressor ≤ 10m^3 / min	CNP001	1	100	46	24	52	-42	58	0	58	3	69	48	24	53	-43	57	0	57	3	69
	Hand-held breaker, mass > 10kg and < 20kg	CNP024	1	108	46	24	52	-42	66	0	66			48	24	53	-43	65	0	65		
Site clearance	Excavator / loader	CNP081	1	112	46	24	52	-42	70	0	70	3	77	48	24	53	-43	69	0	69	3	77
	Lorry	CNP141	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
	Crane, mobile (diesel)	CNP048	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
Shaft construction (in soil) - excavation	Excavator / loader	CNP081	1	112	46	24	52	-42	70	0	70	3	78	48	24	53	-43	69	0	69	3	77
	Crane, mobile (diesel)	CNP048	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
	Lorry	CNP141	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
	Water pump, submersible (electric)	CNP283	1	85	46	24	52	-42	43	0	43			48	24	53	-43	42	0	42		
	Generator, super silenced (70dB(A) at 7m)	CNP103	1	95	46	24	52	-42	53	0	53			48	24	53	-43	52	0	52		
Shaft construction (in soil) - diaphragm wall	Piling, diaphragm wall – bentonite filtering plant	CNP162	1	105	46	24	52	-42	63	0	63	3	74	48	24	53	-43	62	0	62	3	74
	Piling, diaphragm wall – hydraulic extractor	CNP163	1	105	46	24	52	-42	63	0	63			48	24	53	-43	62	0	62		
	Crane, mobile (diesel)	CNP048	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
Shaft construction (in soil) - Concreting	Bar bender and cutter (electric)	CNP021	1	90	46	24	52	-42	48	0	48	3	76	48	24	53	-43	47	0	47	3	76
	Concrete lorry mixer	CNP044	1	109	46	24	52	-42	67	0	67			48	24	53	-43	66	0	66		
	Concrete pump	CNP047	1	109	46	24	52	-42	67	0	67			48	24	53	-43	66	0	66		
	Generator, super silenced (70dB(A) at 7m)	CNP103	1	95	46	24	52	-42	53	0	53			48	24	53	-43	52	0	52		
	Piling, diaphragm wall – bentonite filtering plant	CNP162	1	105	46	24	52	-42	63	0	63			48	24	53	-43	62	0	62		
	Lorry	CNP141	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
	Water pump, submersible (electric)	CNP283	1	85	46	24	52	-42	43	0	43			48	24	53	-43	42	0	42		
Shaft construction (in rock) [In bottom of shaft at about minimum 10m below grade]	Breaker, hand-held, mass>35kg	CNP026	1	114	46	34	57	-43	71	-10	61	3	68	48	34	58	-43	71	-10	61	3	68
	Rock drill, hand-held (pneumatic)	CNP183	1	116	46	34	57	-43	73	-10	63			48	34	58	-43	73	-10	63		
	Water pump, submersible (electric)	CNP283	1	85	46	34	57	-43	42	-10	32			48	34	58	-43	42	-10	32		
Shaft construction (in rock) [at grade]	Generator, silenced (75dB(A) at 7m)	CNP102	1	100	46	24	52	-42	58	0	58	3	77	48	24	53	-43	57	0	57	3	76
	Ventilation fan	CNP241	1	108	46	24	52	-42	66	0	66			48	24	53	-43	65	0	65		
	Concrete pump	CNP047	1	109	46	24	52	-42	67	0	67			48	24	53	-43	66	0	66		
	Concrete lorry mixer	CNP044	1	109	46	24	52	-42	67	0	67			48	24	53	-43	66	0	66		
	Crane, tower (electric) - mounted on gantry	CNP049	1	95	46	24	52	-42	53	0	53			48	24	53	-43	52	0	52		
	Bar bender and cutter (electric)	CNP021	1	90	46	24	52	-42	48	0	48			48	24	53	-43	47	0	47		
	Lorry	CNP141	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
Shaft construction (in rock) [TOTAL]													77									77
TBM Retrieval [at grade]	Crane, tower (electric) - mounted on gantry	CNP049	1	95	46	24	52	-42	53	0	53	3	73	48	24	53	-43	52	0	52	3	73
	Lorry	CNP141	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
TBM Retrieval [In bottom of shaft at about 20m below grade]	Water pump, submersible (electric)	CNP283	1	85	46	44	64	-44	41	-10	31	3	34	48	44	65	-44	41	-10	31	3	34
TBM Retrieval [TOTAL]													73									73
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [at grade]	Concrete pump	CNP047	1	109	46	24	52	-42	67	0	67	3	76	48	24	53	-43	66	0	66	3	76
	Concrete lorry mixer	CNP044	1	109	46	24	52	-42	67	0	67			48	24	53	-43	66	0	66		
	Lorry	CNP141	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
	Bar bender and cutter (electric)	CNP021	1	90	46	24	52	-42	48	0	48			48	24	53	-43	47	0	47		
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [In bottom of shaft at about minimum 10m below grade]	Water pump, submersible (electric)	CNP283	1	85	46	34	57	-43	42	-10	32	3	35	48	34	58	-43	42	-10	32	3	35
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [TOTAL]													76									76
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [TOTAL] + Cumulative Noise from trenching works													77									78
Landscaping / reinstatement	Excavator / loader	CNP081	1	112	46	24	52	-42	70	0	70	3	76	48	24	53	-43	69	0	69	3	76
	Compactor, vibratory	CNP050	1	105	46	24	52	-42	63	0	63			48	24	53	-43	62	0	62		
	Lorry	CNP141	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		

					Sun Tuen Mun Centre, Block 2									Sun Tuen Mun Centre, Block 3								
Cumulative Construction Activity due to Other Works (not under the subject application)	**Equipment**	**GW-TM Code**	**Number of Plant**	**Sound Power Level, dB(A)**	**Horizontal Separation (m), Block 2**	**Vertical Separation (m), Block 2**	**Slant Distance (m), Block 2**	**Distance Attenuation dB(A), Block 2**	**Predicted Noise Level PNL at Block 2, dB(A)**	**Correction for barriers dB(A), Block 2**	**Corrected Noise Level CNL AT Block 2, dB(A)**	**façade Correction dB(A)**	**CNL at Block 2 - Overall, dB(A)**	**Horizontal Separation (m), Block 3**	**Vertical Separation (m), Block 3**	**Slant Distance (m), Block 3**	**Distance Attenuation dB(A), Block 3**	**Predicted Noise Level PNL at Block 3, dB(A)**	**Correction for barriers dB(A)**	**Corrected Noise Level CNL dB(A)**	**façade Correction dB(A)**	**CNL at Block 2 - Overall, dB(A)**
Trenching (another contract) - may overlap construction of permanent works inside shaft	Piling, large diameter bored, reverse circulation drill	CNP166	1	100	80	24	83	-46	54	0	54	3	57	58	24	62	-44	56	0	56	3	59
Trenching - Excavation	Excavator / loader	CNP081	1	112	80	24	83	-46	66	0	66	3	72	58	24	62	-44	68	0	68	3	74
	Lorry	CNP141	1	112	80	24	83	-46	66	0	66			58	24	62	-44	68	0	68		
Trenching - Concreting	Concrete pump	CNP047	1	109	80	24	83	-46	63	0	63	3	69	58	24	62	-44	65	0	65	3	71
	Concrete lorry mixer	CNP044	1	109	80	24	83	-46	63	0	63			58	24	62	-44	65	0	65		
Cable laying (another contract) - may overlap E&M works inside shaft	Lorry	CNP141	1	112	80	24	83	-46	66	0	66	3	72	58	24	62	-44	68	0	68	3	74
	Crane, mobile (diesel)	CNP048	1	112	80	24	83	-46	66	0	66			58	24	62	-44	68	0	68		

CLP Power Castle Peak Cable Tunnel Project - Project Profile
Calculation of Construction Noise - Without Mitigation Measures

					Sun Tuen Mun Centre, Block 2									Sun Tuen Mun Centre, Block 3								
Construction Activity	**Equipment**	**GW-TM Code**	**Number of Plant**	**Sound Power Level, dB(A)**	**Horizontal Separation (m), Block 2**	**Vertical Separation (m), Block 2**	**Slant Distance (m), Block 2**	**Distance Attenuation dB(A), Block 2**	**Predicted Noise Level PNL at Block 2, dB(A)**	**Correction for barriers dB(A), Block 2**	**Corrected Noise Level CNL at Block 2, dB(A)**	**façade Correction dB(A)**	**CNL at Block 2 - Overall, dB(A)**	**Horizontal Separation (m), Block 3**	**Vertical Separation (m), Block 3**	**Slant Distance (m), Block 3**	**Distance Attenuation dB(A), Block 3**	**Predicted Noise Level PNL at Block 3, dB(A)**	**Correction for barriers dB(A), Block 3**	**Corrected Noise Level CNL AT Block 3, dB(A)**	**façade Correction dB(A)**	**CNL at Block 3 - Overall, dB(A)**
Removal of hard-standing	Air compressor ≤ 10m^3 / min	CNP001	1	100	46	48	66	-44	56	0	56	3	67	48	48	67	-45	55	0	55	3	67
	Hand-held breaker, mass > 10kg and < 20kg	CNP024	1	108	46	48	66	-44	64	0	64			48	48	67	-45	63	0	63		
Site clearance	Excavator / loader	CNP081	1	112	46	48	66	-44	68	0	68	3	75	48	48	67	-45	67	0	67	3	75
	Lorry	CNP141	1	112	46	48	66	-44	68	0	68			48	48	67	-45	67	0	67		
	Crane, mobile (diesel)	CNP048	1	112	46	48	66	-44	68	0	68			48	48	67	-45	67	0	67		
Shaft construction (in soil) - excavation	Excavator / loader	CNP081	1	112	46	48	66	-44	68	0	68	3	75	48	48	67	-45	67	0	67	3	75
	Crane, mobile (diesel)	CNP048	1	112	46	48	66	-44	68	0	68			48	48	67	-45	67	0	67		
	Lorry	CNP141	1	112	46	48	66	-44	68	0	68			48	48	67	-45	67	0	67		
	Water pump, submersible (electric)	CNP283	1	85	46	48	66	-44	41	0	41			48	48	67	-45	40	0	40		
	Generator, super silenced (70dB(A) at 7m)	CNP103	1	95	46	48	66	-44	51	0	51			48	48	67	-45	50	0	50		
Shaft construction (in soil) - diaphragm wall	Piling, diaphragm wall – bentonite filtering plant	CNP162	1	105	46	48	66	-44	61	0	61	3	72	48	48	67	-45	60	0	60	3	72
	Piling, diaphragm wall – hydraulic extractor	CNP163	1	105	46	48	66	-44	61	0	61			48	48	67	-45	60	0	60		
	Crane, mobile (diesel)	CNP048	1	112	46	48	66	-44	68	0	68			48	48	67	-45	67	0	67		
Shaft construction (in soil) - Concreting	Bar bender and cutter (electric)	CNP021	1	90	46	48	66	-44	46	0	46	3	74	48	48	67	-45	45	0	45	3	74
	Concrete lorry mixer	CNP044	1	109	46	48	66	-44	65	0	65			48	48	67	-45	64	0	64		
	Concrete pump	CNP047	1	109	46	48	66	-44	65	0	65			48	48	67	-45	64	0	64		
	Generator, super silenced (70dB(A) at 7m)	CNP103	1	95	46	48	66	-44	51	0	51			48	48	67	-45	50	0	50		
	Piling, diaphragm wall – bentonite filtering plant	CNP162	1	105	46	48	66	-44	61	0	61			48	48	67	-45	60	0	60		
	Lorry	CNP141	1	112	46	48	66	-44	68	0	68			48	48	67	-45	67	0	67		
	Water pump, submersible (electric)	CNP283	1	85	46	48	66	-44	41	0	41			48	48	67	-45	40	0	40		
Shaft construction (in rock) [In bottom of shaft at about minimum 10m below grade]	Breaker, hand-held, mass>35kg	CNP026	1	114	46	58	74	-45	69	-10	59	3	66	48	58	75	-45	69	-10	59	3	66
	Rock drill, hand-held (pneumatic)	CNP183	1	116	46	58	74	-45	71	-10	61			48	58	75	-45	71	-10	61		
	Water pump, submersible (electric)	CNP283	1	85	46	58	74	-45	40	-10	30			48	58	75	-45	40	-10	30		
Shaft construction (in rock) [at grade]	Generator, silenced (75dB(A) at 7m)	CNP102	1	100	46	48	66	-44	56	0	56	3	75	48	48	67	-45	55	0	55	3	74
	Ventilation fan	CNP241	1	108	46	48	66	-44	64	0	64			48	48	67	-45	63	0	63		
	Concrete pump	CNP047	1	109	46	48	66	-44	65	0	65			48	48	67	-45	64	0	64		
	Concrete lorry mixer	CNP044	1	109	46	48	66	-44	65	0	65			48	48	67	-45	64	0	64		
	Crane, tower (electric) - mounted on gantry	CNP049	1	95	46	48	66	-44	51	0	51			48	48	67	-45	50	0	50		
	Bar bender and cutter (electric)	CNP021	1	90	46	48	66	-44	46	0	46			48	48	67	-45	45	0	45		
	Lorry	CNP141	1	112	46	48	66	-44	68	0	68			48	48	67	-45	67	0	67		
Shaft construction (in rock) [TOTAL]													75									75
TBM Retrieval [at grade]	Crane, tower (electric) - mounted on gantry	CNP049	1	95	46	48	66	-44	51	0	51	3	71	48	48	67	-45	50	0	50	3	71
	Lorry	CNP141	1	112	46	48	66	-44	68	0	68			48	48	67	-45	67	0	67		
TBM Retrieval [In bottom of shaft at about 20m below grade]	Water pump, submersible (electric)	CNP283	1	85	46	68	82	-46	39	-10	29	3	32	48	68	83	-46	39	-10	29	3	32
TBM Retrieval [TOTAL]													71									71
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [at grade]	Concrete pump	CNP047	1	109	46	48	66	-44	65	0	65	3	74	48	48	67	-45	64	0	64	3	73
	Concrete lorry mixer	CNP044	1	109	46	48	66	-44	65	0	65			48	48	67	-45	64	0	64		
	Lorry	CNP141	1	112	46	48	66	-44	68	0	68			48	48	67	-45	67	0	67		
	Bar bender and cutter (electric)	CNP021	1	90	46	48	66	-44	46	0	46			48	48	67	-45	45	0	45		
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [In bottom of shaft at about minimum 10m below grade]	Water pump, submersible (electric)	CNP283	1	85	46	58	74	-45	40	-10	30	3	33	48	58	75	-45	40	-10	30	3	33
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [TOTAL]													74									73
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [TOTAL] + Cumulative Noise from trenching works													75									76
Landscaping / reinstatement	Excavator / loader	CNP081	1	112	46	48	66	-44	68	0	68	3	74	48	48	67	-45	67	0	67	3	74
	Compactor, vibratory	CNP050	1	105	46	48	66	-44	61	0	61			48	48	67	-45	60	0	60		
	Lorry	CNP141	1	112	46	48	66	-44	68	0	68			48	48	67	-45	67	0	67		

					Sun Tuen Mun Centre, Block 2									Sun Tuen Mun Centre, Block 3								
Cumulative Construction Activity due to Other Works (not under the subject application)	**Equipment**	**GW-TM Code**	**Number of Plant**	**Sound Power Level, dB(A)**	**Horizontal Separation (m), Block 2**	**Vertical Separation (m), Block 2**	**Slant Distance (m), Block 2**	**Distance Attenuation dB(A), Block 2**	**Predicted Noise Level PNL at Block 2, dB(A)**	**Correction for barriers dB(A), Block 2**	**Corrected Noise Level CNL AT Block 2, dB(A)**	**façade Correction dB(A)**	**CNL at Block 2 - Overall, dB(A)**	**Horizontal Separation (m), Block 3**	**Vertical Separation (m), Block 3**	**Slant Distance (m), Block 3**	**Distance Attenuation dB(A), Block 3**	**Predicted Noise Level PNL at Block 3, dB(A)**	**Correction for barriers dB(A)**	**Corrected Noise Level CNL dB(A)**	**façade Correction dB(A)**	**CNL at Block 2 - Overall, dB(A)**
Trenching (another contract) - may overlap construction of permanent works inside shaft	Piling, large diameter bored, reverse circulation drill	CNP166	1	100	80	48	93	-47	53	0	53	3	56	58	48	75	-45	55	0	55	3	58
Trenching - Excavation	Excavator / loader	CNP081	1	112	80	48	93	-47	65	0	65	3	71	58	48	75	-45	67	0	67	3	73
	Lorry	CNP141	1	112	80	48	93	-47	65	0	65			58	48	75	-45	67	0	67		
Trenching - Concreting	Concrete pump	CNP047	1	109	80	48	93	-47	62	0	62	3	68	58	48	75	-45	64	0	64	3	70
	Concrete lorry mixer	CNP044	1	109	80	48	93	-47	62	0	62			58	48	75	-45	64	0	64		
Cable laying (another contract) - may overlap E&M works inside shaft	Lorry	CNP141	1	112	80	48	93	-47	65	0	65	3	71	58	48	75	-45	67	0	67	3	73
	Crane, mobile (diesel)	CNP048	1	112	80	48	93	-47	65	0	65			58	48	75	-45	67	0	67		

At an elevation of 48 m (and higher) above the source (for Block 2 and Block 3, approximately the 10/F), noise levels due to the project's construction activities comply with the 75 dB(A) noise standard.

CLP Power Castle Peak Cable Tunnel Project - Project Profile
Calculation of Construction Noise - With Mitigation Measures

					Sun Tuen Mun Centre, Block 2									Sun Tuen Mun Centre, Block 3								
Construction Activity	**Equipment**	**GW-TM Code**	**Number of Plant**	**Sound Power Level, dB(A)**	**Horizontal Separation (m), Block 2**	**Vertical Separation (m), Block 2**	**Slant Distance (m), Block 2**	**Distance Attenuation dB(A), Block 2**	**Predicted Noise Level PNL at Block 2, dB(A)**	**Correction for barriers dB(A), Block 2**	**Corrected Noise Level CNL at Block 2, dB(A)**	**façade Correction dB(A)**	**CNL at Block 2 - Overall, dB(A)**	**Horizontal Separation (m), Block 3**	**Vertical Separation (m), Block 3**	**Slant Distance (m), Block 3**	**Distance Attenuation dB(A), Block 3**	**Predicted Noise Level PNL at Block 3, dB(A)**	**Correction for barriers dB(A), Block 3**	**Corrected Noise Level CNL AT Block 3, dB(A)**	**façade Correction dB(A)**	**CNL at Block 3 - Overall, dB(A)**
Removal of hard-standing	Air compressor ≤ 10m^3 / min	CNP001	1	100	46	24	52	-42	58	0	58	3	69	48	24	53	-43	57	0	57	3	69
	Hand-held breaker, mass > 10kg and < 20kg	CNP024	1	108	46	24	52	-42	66	0	66			48	24	53	-43	65	0	65		
Site clearance	Excavator / loader	CNP081	1	112	46	24	52	-42	70	-5	65	3	75	48	24	53	-43	69	-5	64	3	75
	Lorry	CNP141	1	112	46	24	52	-42	70	-5	65			48	24	53	-43	69	-5	64		
	Crane, mobile (diesel)	CNP048	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
Shaft construction (in soil) - excavation	Excavator / loader	CNP081	1	112	46	24	52	-42	70	-5	65	3	75	48	24	53	-43	69	-5	64	3	75
	Crane, mobile (diesel)	CNP048	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
	Lorry	CNP141	1	112	46	24	52	-42	70	-5	65			48	24	53	-43	69	-5	64		
	Water pump, submersible (electric)	CNP283	1	85	46	24	52	-42	43	0	43			48	24	53	-43	42	0	42		
	Generator, super silenced (70dB(A) at 7m)	CNP103	1	95	46	24	52	-42	53	0	53			48	24	53	-43	52	0	52		
Shaft construction (in soil) - diaphragm wall	Piling, diaphragm wall – bentonite filtering plant	CNP162	1	105	46	24	52	-42	63	0	63	3	74	48	24	53	-43	62	0	62	3	74
	Piling, diaphragm wall – hydraulic extractor	CNP163	1	105	46	24	52	-42	63	0	63			48	24	53	-43	62	0	62		
	Crane, mobile (diesel)	CNP048	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
Shaft construction (in soil) - Concreting	Bar bender and cutter (electric)	CNP021	1	90	46	24	52	-42	48	0	48	3	75	48	24	53	-43	47	0	47	3	75
	Concrete lorry mixer	CNP044	1	109	46	24	52	-42	67	0	67			48	24	53	-43	66	0	66		
	Concrete pump	CNP047	1	109	46	24	52	-42	67	-5	62			48	24	53	-43	66	-5	61		
	Generator, super silenced (70dB(A) at 7m)	CNP103	1	95	46	24	52	-42	53	0	53			48	24	53	-43	52	0	52		
	Piling, diaphragm wall – bentonite filtering plant	CNP162	1	105	46	24	52	-42	63	0	63			48	24	53	-43	62	0	62		
	Lorry	CNP141	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
	Water pump, submersible (electric)	CNP283	1	85	46	24	52	-42	43	0	43			48	24	53	-43	42	0	42		
Shaft construction (in rock) [In bottom of shaft at about minimum 10m below grade]	Breaker, hand-held, mass>35kg	CNP026	1	114	46	34	57	-43	71	-10	61	3	68	48	34	58	-43	71	-10	61	3	68
	Rock drill, hand-held (pneumatic)	CNP183	1	116	46	34	57	-43	73	-10	63			48	34	58	-43	73	-10	63		
	Water pump, submersible (electric)	CNP283	1	85	46	34	57	-43	42	-10	32			48	34	58	-43	42	-10	32		
Shaft construction (in rock) [at grade]	Generator, silenced (75dB(A) at 7m)	CNP102	1	100	46	24	52	-42	58	0	58	3	74	48	24	53	-43	57	0	57	3	74
	Ventilation fan	CNP241	1	108	46	24	52	-42	66	0	66			48	24	53	-43	65	0	65		
	Concrete pump	CNP047	1	109	46	24	52	-42	67	-5	62			48	24	53	-43	66	-5	61		
	Concrete lorry mixer	CNP044	1	109	46	24	52	-42	67	0	67			48	24	53	-43	66	0	66		
	Crane, tower (electric) - mounted on gantry	CNP049	1	95	46	24	52	-42	53	0	53			48	24	53	-43	52	0	52		
	Bar bender and cutter (electric)	CNP021	1	90	46	24	52	-42	48	0	48			48	24	53	-43	47	0	47		
	Lorry	CNP141	1	112	46	24	52	-42	70	-5	65			48	24	53	-43	69	-5	64		
Shaft construction (in rock) [TOTAL]													75									75
TBM Retrieval [at grade]	Crane, tower (electric) - mounted on gantry	CNP049	1	95	46	24	52	-42	53	0	53	3	73	48	24	53	-43	52	0	52	3	73
	Lorry	CNP141	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		
TBM Retrieval [In bottom of shaft at about 20m below grade]	Water pump, submersible (electric)	CNP283	1	85	46	44	64	-44	41	-10	31	3	34	48	44	65	-44	41	-10	31	3	34
TBM Retrieval [TOTAL]													73									73
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [at grade]	Concrete pump	CNP047	1	109	46	24	52	-42	67	-5	62	3	73	48	24	53	-43	66	-5	61	3	72
	Concrete lorry mixer	CNP044	1	109	46	24	52	-42	67	0	67			48	24	53	-43	66	0	66		
	Lorry	CNP141	1	112	46	24	52	-42	70	-5	65			48	24	53	-43	69	-5	64		
	Bar bender and cutter (electric)	CNP021	1	90	46	24	52	-42	48	0	48			48	24	53	-43	47	0	47		
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [In bottom of shaft at about minimum 10m below grade]	Water pump, submersible (electric)	CNP283	1	85	46	34	57	-43	42	-10	32	3	35	48	34	58	-43	42	-10	32	3	35
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [TOTAL]													73									72
Construction of Permanent Works & E&M Plant Room / Ventilation Shaft [TOTAL] + Cumulative Noise from trenching works													75									75
Landscaping / reinstatement	Excavator / loader	CNP081	1	112	46	24	52	-42	70	-5	65	3	75	48	24	53	-43	69	-5	64	3	74
	Compactor, vibratory	CNP050	1	105	46	24	52	-42	63	0	63			48	24	53	-43	62	0	62		
	Lorry	CNP141	1	112	46	24	52	-42	70	0	70			48	24	53	-43	69	0	69		

					Sun Tuen Mun Centre, Block 2									Sun Tuen Mun Centre, Block 3								
Cumulative Construction Activity due to Other Works (not under the subject application)	**Equipment**	**GW-TM Code**	**Number of Plant**	**Sound Power Level, dB(A)**	**Horizontal Separation (m), Block 2**	**Vertical Separation (m), Block 2**	**Slant Distance (m), Block 2**	**Distance Attenuation dB(A), Block 2**	**Predicted Noise Level PNL at Block 2, dB(A)**	**Correction for barriers dB(A), Block 2**	**Corrected Noise Level CNL AT Block 2, dB(A)**	**façade Correction dB(A)**	**CNL at Block 2 - Overall, dB(A)**	**Horizontal Separation (m), Block 3**	**Vertical Separation (m), Block 3**	**Slant Distance (m), Block 3**	**Distance Attenuation dB(A), Block 3**	**Predicted Noise Level PNL at Block 3, dB(A)**	**Correction for barriers dB(A)**	**Corrected Noise Level CNL dB(A)**	**façade Correction dB(A)**	**CNL at Block 2 - Overall, dB(A)**
Trenching (another contract) - may overlap construction of permanent works inside shaft	Piling, large diameter bored, reverse circulation drill	CNP166	1	100	80	24	83	-46	54	0	54	3	57	80	24	83	-46	54	0	54	3	57
Trenching - Excavation	Excavator / loader	CNP081	1	112	80	24	83	-46	66	0	66	3	72	80	24	83	-46	66	0	66	3	72
	Lorry	CNP141	1	112	80	24	83	-46	66	0	66			80	24	83	-46	66	0	66		
Trenching - Concreting	Concrete pump	CNP047	1	109	80	24	83	-46	63	0	63	3	69	80	24	83	-46	63	0	63	3	69
	Concrete lorry mixer	CNP044	1	109	80	24	83	-46	63	0	63			80	24	83	-46	63	0	63		
Cable laying (another contract) - may overlap E&M works inside shaft	Lorry	CNP141	1	112	80	24	83	-46	66	0	66	3	72	80	24	83	-46	66	0	66	3	72
	Crane, mobile (diesel)	CNP048	1	112	80	24	83	-46	66	0	66			80	24	83	-46	66	0	66		

Mitigation Measures:
Partial enclosure for concrete pump.

1. INTRODUCTION

CLP Power (CLPP) intends to construct a 4.5 km long cable tunnel for the installation of 132kV circuits from the Castle Peak Power Station to Tuen Mun areas in order to secure the electricity supply and improve the supply reliability to Tuen Mun, Yuen Long as well as Lantau areas for the next 10 years. ERM –Hong Kong has been commissioned to conduct a tree survey at the cable tunnel portal and works areas (Project Area) at Castle Peak and to prepare the Tree Survey Report. This Appendix provides a summary of the findings from the Tree Summary Report.

2. SURVEY METHODOLOGIES

For the purpose of the Tree Survey, the guideline from Works Branch Technical Circulars No. 24/94 and No. 2/2004, and Nature Conservation Practice Note No. 02/2003 are referred. A plant is considered as a tree if its girth (circumference of the trunk) measures 300 mm (95 mm DBH) or more at a height of 1000 mm above ground level.

The tree survey identifies the following attributes of trees:

- Botanical name;
- Location;
- Level;
- Height;
- Crown spread;
- Trunk diameter and circumference (measured 1 metre from the ground);
- Tree form;
- Health condition;
- Amenity value; and
- Brief description and remarks.

3. RESULTS OF THE TREE SURVEYS

The tree survey within the Project Area was carried out during January 2005.

A total of 744 trees were recorded within the proposed Project Area. The tree species were dominated by exotic fast growing trees including *Acacia confusa*, *Leucaena leucocephala, Casuarina equisetifolia, Albizia lebbeck* and *Pinus elliottii,* and accompanied by a few native tree species such as *Ficus virens, Ficus microcarpus, Hibiscus tiliaceus, Macaranga tanarius, Bridelia tomentosa, Celtis chinensis* and *Sapium sebiferum.* The relative abundance of each tree species is summarized in *the table below.*

The Relative Abundance of Recorded Tree species

Species	Origin	Status	Total Number of Individuals
Casuarina equisetifolia	Exotic plantation	Very common	231
Acacia confusa	Exotic plantation	Very common	225
Leucaena leucocephala	Exotic plantation	Very common	206
Celtis chinensis	Native	Common	31
Hibiscus tiliaceus	Native	Common	14
Macaranga tanarius	Native	Very common	10
Sapium sebiferum	Native	Common	6
Bridelia tomentosa	Native	Very common	3
Ficus virens	Native	Common	3
Melaleuca leucadendron	Exotic plantation	Common	3
Pinus elliottii	Exotic plantation	Common	3
Albizia lebbeck	Exotic plantation	Very common	2
Ficus microcarpus	Native	Very common	2
Litsea glutinosa	Native	Very common	2
Sterculia lanceolata	Native	Common	2
Cinnamomum camphora	Native	Common	1

None of the trees recorded in the proposed Project Area are rare, protected by law or of significant amenity value. They are mostly exotic plantation species and of poor tree form. All of the trees are between 2 and 19 metres in height, of average 10 meters, whilst crown spread was on average 4 meters. Most of the tree species especially *Acacia confusa, Casuarina equisetifolia* and *Leucaena leucocephala* have reached maturity and their lower branches had either died back or were broken. Low abundance of understorey was recorded. The ground floor was generally bare with some native shrubs species including *Rhodomyrtus tomentosa, Litsea rotundifolia* and *Ficus microcarpus*.

4. SUMMARY

A tree survey has been conducted to record the abundance, species name, location, trunk diameters and circumference, height, crown spread, tree form, health condition and amenity value of the trees found within the Project Area. A total of 744 individual trees were found, most of which are fast growing exotic plants and dominated by a few exotic species including *Acacia confusa*, *Casuarina equisetifolia* and *Leucaena leucocephala.* Most of the trees were recorded in poor tree form with low amenity value. None of the recorded trees are rare or protected. This Tree Survey Report will form the basis for the proposed treatments of each tree if they are located in area conflicting with the construction work. The basic principle will be to where this is practical minimize the number of trees to be disturbed by the Project.