# Project Profile for Installation of a 500mm NB Gas Pipeline inside the Existing Disused Tunnel (old Beacon Hill Tunnel)

# 工程項目簡介－於已停用隧道（舊畢架山隧道）內鋪設一條直徑 500 毫米燃氣管道

(Report No. 報告編號：243563/21/F)

May 2011

二零一一年五月

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# 1. Basic Information

## 1.1 Project Title

Installation of a 500mm NB Gas Pipeline inside the Existing Disused Tunnel (old Beacon Hill Tunnel).

## 1.2 Purpose and Nature of the Project

The Hong Kong and China Gas Company Limited (HKCG) is committed to continuous improvement in services for her customers by providing reliable and sufficient fuel gas supply. To enhance the natural gas utilization scheme, HKCG has commissioned the installation of a 500mm diameter steel pipeline with approximately 2.2km in length inside the disused tunnel running in parallel with the existing Beacon Hill Tunnel being used by MTR East Rail. There is already an existing 750mm diameter town gas pipeline running through the disused tunnel. On plan view, about 992m section of the pipeline falls within part of the Lion Rock Country Park boundary but the proposed work is at least 120m underneath the Country Park. No access to Country Park is needed. The proposed pipeline is part of the entire transmission system to carry natural gas from HKCG's Tai Po Production Plant to Ma Tau Kok Production Plant. The upstream and downstream pipelines of the entire natural gas transmission system were all ready for commissioning. The entire natural gas transmission system is pending to installation of pipeline inside the disused tunnel.

## 1.3 Name of Project Proponent

The Hong Kong and China Gas Company Limited (HKCG)

## 1.4 Contact Persons

**Project Proponent – The Hong Kong and China Gas Company Limited (HKCG)**

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## 1.5 Location of the Project

The proposed pipeline with total length of 2.2km will run parallel to the existing 750mm gas pipeline within the disused tunnel. The locations of the project and the existing disused tunnel are shown in **Figure 1.1**.

## 1.6 Scale of the Project

The proposed pipeline inside the disused tunnel is 500mm in diameter. It will be installed above ground, laying on aboveground support. Installation of pipeline and pipe supports would be carried out inside the disused tunnel. Site office and stockpile area will be sited at bare level ground underneath Cornwall Street outside south end of the disused tunnel. Access to site office, stockpile area and disused tunnel will be from nearby roads. No access to the Lion Rock Country Park is needed.

## 1.7 Site History and Existing Condition

The disused tunnel was built in the 1910s for railway purposes under the Lion Rock Country Park. Other than the openings at north and south ends of disused tunnel, there are no other openings at any location along the disused tunnel. The existing gas pipeline was installed in this disused tunnel in 1984 by the Hong Kong and China Gas Company Limited (HKCG) after the portion of railway tunnel was relined. Approximately 1,500m of the central portion of the disused tunnel was concrete lined at that time. Some auxiliary systems, such as lightings, gas detectors and etc., were also installed along the tunnel. The remaining sections were concrete lined in 2008. Isolation valves are installed outside the tunnel. There is no other utilities installation within the disused tunnel. Both ends of the disused tunnel are fenced by locked gates. Only HKCG staff has to enter the disused tunnel for carrying out routine operation and maintenance tasks. Operation and maintenance of the existing 750mm gas pipeline, the proposed 500mm gas pipeline and the disused tunnel itself do not require access to or through the Lion Rock Country Park. Three HKCG staff normally work for the operation and regular maintenance of existing 750mm gas pipelines and disused tunnel.

## 1.8 Number and Types of Designated Projects to be Covered by the Project Profile

The proposed installation of gas pipeline involves construction works within the disused tunnel which is at least 120m underneath the Lion Rock Country Park. The installation of proposed 500mm gas pipeline, operation and maintenance of the existing 750mm gas pipeline, the proposed 500mm gas pipeline and the disused tunnel itself do not require access through the Lion Rock Country Park but from the portal at both ends of the disused tunnel. Nevertheless, it is a designated project (DP) under Item Q.1 of Schedule 2, Part I of the EIA Ordinance (Cap. 499), by virtue of the fact that "*all projects including new access roads, railways, sewers, sewage treatment facilities, earthworks, dredging works and other building works partly or wholly in an existing or gazetted proposed country park or special area, a conservation area, an existing or gazetted proposed marine park or marine reserve, a site of cultural heritage, and a site of special scientific interest*", and any material change to the existing exempted designated project requires an environmental permit for the construction and operation.

# 2. Outline of Planning and Implementation Programme

## 2.1 Project Planning and Implementation

The project of installation and operation of the proposed gas steel pipeline is planned and designed by staff of HKCG. A Contractor will be commissioned by HKCG to install the pipeline in accordance with both statutory standards and other guidelines under the supervision of HKCG. The construction works for the project will be planned and constructed in an environmental friendly manner to minimise construction nuisance. Considerations had been given to the installation design of the pipeline. The preferred installation design of the pipeline is laid above the ground of the tunnel on aboveground pipe supports in about 16 m interval. Adoption of lean construction, such as reduced support foundation size, will minimize the amount of raw material being used and thus reduce the amount of waste.

The layout plan of the proposed installation of the proposed gas pipeline and associated works are shown in **Figures 2.1** and **2.2**.

The pipe is designed, constructed and operated to very stringent statutory safety ordinances and regulations to ensure the highest safety, maintenance and operational standards. The requirement of recognised international standard, such as IGE/TD/3, will also be made reference to.

HKCG operation has been certified to ISO 9001 Quality Management System since 1996, OHSAS 18001 Occupational Health & Safety Management System since 2005 and was the first gas utility in Asia to attain the PAS 55-1:2004 Asset Management Specifications global standard in 2007. All ISO 9001, OHSAS 18001 and PAS 55 are being continuously audited by external certification bodies annually to verify HKCG's continual compliance with these specifications.

Before commencement of the construction works, the existing pipeline as well as the 130m underground pipe section outside each end of the tunnel will be temporary decommissioned, free of town gas and filled with inert gas under nominal pressure. A fully sealed cross-sectional coverage of tunnel will be erected at north end of the tunnel as shown in **Figure 2.3** to separate the works area from the existing offtake station area at the north portal. Construction works will only involve installation of pipe supports and its concrete base and the laying of gas pipeline on the supports inside the tunnel.

The cross-sectional coverage mentioned above will be erected by the three HKCG operation and maintenance staff who have been responsible for the operation and regular maintenance of existing 750mm gas pipelines and disused tunnel. There will not be any other works at north portal or within disused tunnel at that time. Hence, there will not be any increase in working population during erection of the coverage.

The installation of proposed gas pipeline within the disused tunnel will be divided into 2 phases, Phase 1 – 0m to 650m from Tunnel north end and Phase 2 – 0m to 1550m from Tunnel south end. Installation works of Phase 1 will be firstly commenced and completed by January 2012, well before the commencement of Shatin to Central Link Project – Tai Wai Section and STWTW reprovisioning works. The construction workforce of Phase 1 would be around 3 to 9 during normal construction period (7am to 7pm). Not more than 4 workers will usually be working within tunnel for pipe installation work. 9 workers will be working within tunnel only for a transient period to deliver pipes to designated area.

Installation works of Phase 2 will be followed after completion of Phase 1 works. Upon completion of Phase 1 works, a temporary locked fence will be erected at interface of Phase 1 and Phase 2 works area, and no workers will be allowed to cross the fence at interface of Phase 1 and Phase 2 works area. Thus, workers activities will be confined to Phase 2 works area, 0m to 1550m from Tunnel south end. The expected total construction workforce of Phase 2 and at the south tunnel portal works area would be limited to below 30 during normal construction period (7am to 7pm).

During the construction period, sufficient forced ventilation will be provided. There will be continuous fresh air feeding and extraction of air throughout the tunnel by air supply/extraction units which will be provided and directed to the tunnel south end. Blasting, heavy excavation or drilling works will not be carried out in the project area. There is no works or any interference on the ground of Lion Rock Country Park.

## 2.2 Project Programme

The installation of additional gas pipeline within the disused tunnel will be divided into 2 phases, Phase 1 – 0m to 650m from Tunnel north end and Phase 2 – 0m to 1550m from Tunnel south end. Before commencement of pipe laying works, the cross-sectional coverage of tunnel will be erected at north end of tunnel. Phase 1 will be commenced in September 2011 and be completed by January 2012, well before the targeted commencement of Shatin to Central Link Project – Tai Wai Section and STWTW reprovisioning works in mid 2012. Upon completion of Phase 1 works, Phase 2 will then be commenced. The tentative works programme is shown in **Appendix A**. Should the targeted commencement of Shatin to Central Link Project – Tai Wai Section and STWTW reprovisioning works be advanced to late 2011, the number of workers usually working within the tunnel for pipe installation work of Phase 1 of the project would be increased to ensure Phase 1 will be completed in advance of them.

## 2.3 Interface with other Projects

Completion of the Project will tentatively be by July 2012, with Phase 1 works completed in January 2012 (i.e. before the targeted commencement of Shatin to Central Link Project – Tai Wai Section and STWTW reprovisioning works in mid 2012). There is no project identified to interface with the construction of the additional gas pipeline.

# 3. Major Elements of the Surrounding Environment

## 3.1 Introduction

The project locates within the disused tunnel underneath Beacon Hill in which about 992m section of the proposed gas pipeline falls within part of the Lion Rock Country Park as shown in **Figure 1.1**. The land use history of the project area and the vicinity does not indicate any potential land contamination.

## 3.2 Water Quality

There is no water course within or adjacent to the works area at the south portal of the tunnel.

Two small drainage channels are identified within the existing disused tunnel as indicated in **Figure 2.2**. The channels collect surface runoff and ground water seepage, if any from the concrete-lined tunnel, and are connected to the existing stormwater drainage system for discharge.

## 3.3 Hazard to Life

Site office and stockpile area will be sited at level ground outside south end of the disused tunnel.

There are an existing 750mm diameter gas pipeline inside the disused tunnel and a gas offtake station near the tunnel north portal.

Before commencement of the construction works, the existing pipeline as well as the 130m underground pipe section outside each end of the tunnel will be temporary decommissioned, free of town gas and filled with inert gas under nominal pressure. A fully sealed cross-sectional coverage of tunnel will be erected at north end of the tunnel to separate the works area from the existing offtake station area at the north portal.

Shatin Water Treatment Works (STWTW) is classified as a Potentially Hazardous Installation (PHI) on account of storage of hazardous chemical chlorine in one-tonne drums. The chlorination house with a storage capacity of 223 tonnes situates at about 370m to the northwest of the North Tunnel Portal of the project, and more than 500m from the north of the Lion Rock Country Park boundary. The project locates within the disused tunnel underneath Beacon Hill in which about 630m section also falls within the PHI Consultation Zone. The location of the chlorination house is shown in **Figure 1.1**.

The installation of proposed gas pipeline within the disused tunnel will be divided into 2 phases, Phase 1 – 0m to 650m from Tunnel north end and Phase 2 – 0m to 1550m from Tunnel south end. Phase 2 works area is entirely out of PHI Consultation Zone.

## 3.4 Ecology

Phase 1 and Phase 2 works area of the project is inside the disused tunnel. Site office and stockpile area will be sited at bare level ground underneath Cornwall Street outside south end of the disused tunnel. The area is surrounded by artificial sloping walls with some low-quality plantation. The area is accessible by the public. It has been disturbed by human activities and government's maintenance works of slope.

The disused tunnel where the gas pipeline is to be installed has been highly disturbed by operation and maintenance staff with lightings and noise generated by machineries since 1980s. It is identified through survey (refer to **Appendix D**) that the disused tunnel has not been inhabited by any bats.

Overall, there is no habitat or species of importance identified inside the disused tunnel and within the works area.

## 3.5 Noise

For construction works inside the disused tunnel, no noise sensitive receiver is anticipated. Residential building Oxford Garden is the nearest sensitive uses which may be subject to potential noise impact arising from powered mechanical equipment (PME) i.e. ventilation fan and generator operating outside the south tunnel portal of the project. Therefore, it has been identified as representative Noise Sensitive Receiver (NSR) and selected for prediction of the worst-case levels of noise impact. This representative NSR is described in **Table 3.1** and the location is shown in **Figure 3.1**.

Table 3.1: Representative NSR during Construction Phase

| NSR | Description | Type of Use | Remarks |
|---|---|---|---|
| N1 | Oxford Garden | Residential | - Horizontal distance between NSR and PME is 48 m<br>- NSR is screened by Cornwall Street and artificial slope from PME |

## 3.6 Air Quality

The Environmental Protection Department (EPD) operates a fixed air quality monitoring station in Sham Shui Po, which is the station situated nearest to the works area at the south tunnel portal of the project. The 5-year average concentrations of air pollutants were calculated from the annual average pollutant concentrations published in EPD's Air Quality in Hong Kong 2005 to 2009 at the Sham Shui Po air monitoring station. This is presented in **Table 3.2**.

Table 3.2: 5-year average pollutant concentrations monitored at Sham Shui Po air quality monitoring station

| Pollutants | 5-year Annual Average (µg/m³) | HKAQO Annual (µg/m³) |
|---|---|---|
| $SO_2$ | 21 | 80 |
| $NO_2$ | 67 | 80 |
| TSP | 80 | 80 |
| RSP | 54 | 55 |

The representative sensitive use associated with air quality and the Air Sensitive Receiver (ASR) is that situated closest to the works area. This representative ASR is tabulated in **Table 3.3** and its location is shown in **Figure 3.1**. It is the same as that identified for noise as described in Section 3.5.

Table 3.3: Representative ASR during Construction Phase

| ASR | Description | Type of Use | Horizontal Distance between ASR and works area (m) |
|---|---|---|---|
| A1 | Oxford Garden | Residential | 48 |

## 3.7 Cultural Heritage

The existing gas pipeline was installed in the disused tunnel in 1984 by HKCG after a portion of railway tunnel was relined. Concrete lining and some auxiliary systems, such as lightings, gas detectors, etc. were installed along the tunnel. The façade walls at both two tunnel portals were retained. The tunnel is now one of the government historic sites identified by the Antiquities and Monuments Office (AMO).

## 3.8 Landscape and Visual

Landscape resources identified within the study area is Lion Rock Country Park.

Potential visual sensitive receivers (VSRs) identified include the residents of Oxford Garden near the works area at south portal of the tunnel.

# 4. Potential Impact on the Environment

## 4.1 Introduction

Potential environmental impact arising from this project is limited to the construction phase as the additional pipeline is designed to minimize the maintenance requirements. Any environmental impact during the operation phase is therefore not anticipated.

## 4.2 Water Quality

### 4.2.1 Construction Phase

The project would involve installation of pipe supports and its concrete base and the laying of gas pipeline on the supports. Site runoff would be generated from site office and stockpiling area at the tunnel south portal during storm events. Wastewater would also be generated from the construction workforce. Standard pollution control measures detailed in Section 5.1.1 would be implemented as good site practices. Impacts of water quality on the existing drainage channels are not anticipated.

Hydrostatic testing of the gas pipelines would be required prior to commissioning of the gas pipeline system. For hydrostatic testing of gas pipelines, the gas pipelines would be filled with potable water (a nearly incompressible liquid) and examined for leaks with a specified test pressure. The test would be carried out at room temperature and dosing of chemicals into the water for testing is not required.

Hydrostatic test of the gas pipeline system may lead to effluent containing elevated concentrations of suspended solids. It was however expected that such potential water quality impact would be very temporary and localised. With the implementation of standard pollution control measures detailed in Section 5.1.1 to control water discharge from hydrostatic test, impact on water quality would be minimal.

### 4.2.2 Operation Phase

No operation phase water quality impact from the proposed project is anticipated.

## 4.3 Hazard to Life

### 4.3.1 Construction Phase

The pipe is designed, constructed and operated to very stringent statutory safety ordinances and regulations to ensure the highest safety, maintenance and operational standards. The requirement of recognised international standard, such as IGE/TD/3, will also be made reference to.

HKCG operation has been certified to ISO 9001 Quality Management System, OHSAS 18001 Occupational Health & Safety Management System. HKCG has attained the PAS 55-1:2004 Asset Management Specifications global standard. All ISO 9001, OHSAS 18001 and PAS 55 are being under yearly audit by external certification bodies.

The potential hazard due to the project is the potential gas leaks in the construction phase from the existing gas pipeline resulting from the installation works. Blasting, heavy excavation or drilling works will not be carried out in the project area. Therefore, no impact on the existing gas pipeline is expected.

As part of the project setting before commencement of the construction works, the existing pipeline as well as the 130m underground pipe section outside each end of the tunnel will be temporary decommissioned, free of town gas and filled with inert gas under nominal pressure. A fully sealed cross-sectional coverage of tunnel will also be erected at north end of the tunnel to separate the works area from the existing offtake station area at the north portal. The hazard due to potential gas leak has therefore been essentially eliminated before construction.

The impact on current societal levels of risk due to transient population of workers inside tunnel within consultation zone of STWTW is not expected because the tunnel is entirely isolated from the north tunnel portal by the cross-sectional coverage. Also the site office and stockpile area will be sited at level ground outside south end of the tunnel and is about 1.5km outside the consultation zone boundary.

The decommissioning of the existing pipeline and the erection of the cross-sectional coverage before the project commencement will be carried out by the three HKCG staff who have been responsible for the operation and regular maintenance of existing 750mm gas pipelines and disused tunnel. There will not be any other work arranged at north portal or within the tunnel at that time. Hence, there will not be any increase in working population and hence societal risk is same as current.

Sufficient forced ventilation will be provided during construction period. There will be continuous fresh air feeding and extraction of air throughout the tunnel by air supply/extraction units which will be provided and directed to the tunnel south end.

As precautionary measures, chlorine detectors will be installed in the disused tunnel near the Tunnel north end. Alarm will be triggered upon detection of any chlorine ingress. Communication channel will also be established with the STWTW operation staff during construction phase. Masks for workers within the tunnel will also be provided to prevent harm from chlorine leakage. Details of the emergency procedures will be formulated in the safety management plan which should be prepared by Contractor to ensure evacuation procedures are in place in case of chlorine leakage of the STWTW.

According to the project programme, the installation of proposed gas pipeline within the disused tunnel will be divided into 2 phases, Phase 1 – 0m to 650m from Tunnel north end and Phase 2 – 0m to 1550m from Tunnel south end. Phase 2 works area is entirely out of PHI Consultation Zone. Installation works of Phase 1 will be firstly commenced and completed by January 2012, well before the commencement of Shatin to Central Link Project – Tai Wai Section and STWTW reprovisioning works.

The construction workforce of Phase 1 would be around 3 to 9 during normal construction period (7am to 7pm). Not more than 4 workers will usually be working within tunnel for pipe installation work. 9 workers will be working within tunnel only for a transient period to deliver pipes to designated area. An estimate on the potential fatalities of the Project due to its proximity to STWTW based on a worst case scenario had be conducted and detailed in **Appendix F**. The results showed that even in an extremely unlikely worst case, assuming that the cross-sectional isolation and all precautionary measures of the project have failed to function, the contribution of the Project to affect the existing societal risk of the area is negligible.

In summary, adverse impact from hazard point of view is not anticipated for the construction of the project.

### 4.3.2 Operation Phase

For the operation phase, no hazard to life impact from the installation of additional gas pipeline inside the existing disused tunnel is anticipated as the pipes are designed, constructed and operated to very stringent statutory safety ordinances and regulations to ensure the highest safety, maintenance and operational standards. The requirement of recognised international standard, such as IGE/TD/3, will also be made reference to. HKCG operation has been certified to ISO 9001 Quality Management System since 1996, OHSAS 18001 Occupational Health & Safety Management System since 2005 and was the first gas utility in Asia to attain the PAS 55-1:2004 Asset Management Specifications global standard in 2007. All ISO 9001, OHSAS 18001 and PAS 55 are being continuously audited by external certification bodies annually to verify HKCG's continual compliance with these specifications. Practices adopted are highlighted below:

- grade of pipe material selected can stand for 35 barg operating pressure while the pipe will only be worked at 7 barg or below;
- the pipe is well protected with internal and external coatings;
- design factor f=0.3 is adopted in pipe wall thickness calculation;
- welds are 100% radiographic checked;
- the pipe is equipped with 2 isolation valves outside tunnel and hence the valves are accessible at all times;
- the pipes can be isolated from the entire system immediately in case of any mishap;
- Tunnel is equipped with gas sensors and signal is relayed to HKCG Grid Control Centre for 24-hour monitoring;
- leakage survey to this pipe will be conducted once per annum; and
- Both ends of the disused tunnel are fenced by locked gates. Only HKCG staff has to enter the disused tunnel for carrying out routine operation and maintenance tasks.

The above practices had also been adopted for the existing pipeline. Current routine operation and maintenance program for the existing pipeline will continue and therefore the safety of the existing pipeline will not be affected after construction of the project.

## 4.4 Ecology

### 4.4.1 Construction Phase

There is no potential direct ecological impact anticipated since the construction works is carried out mainly within the existing disused tunnel where no flora or fauna has been identified. The small portion of works area at south tunnel portal is of low ecological value due to its highly modified nature, low quality and low species diversity. The small-scale construction work would not cause any significant ecological impact at the south tunnel portal. Summary of evaluation of potential ecological impact is described in **Table 4.1**.

Table 4.1: Evaluation of Potential Ecological Impact

| Criteria | Remarks |
|---|---|
| Habitat quality | The disused tunnel was completely concrete-lined without any flora or fauna inhabited. The habitat of the works area at the south tunnel portal is a bare ground with low quality. |
| Species | Species diversity, richness and abundance are very low. |
| Size/Abundance | The works area is small and no felling of trees would be required. |

| Criteria | Remarks |
|---|---|
| Duration | Construction period for the proposed pipeline is about 10 months. |
| Reversibility | 100% |
| Magnitude | No direct ecological impact, and insignificant indirect impact. |

### 4.4.2 Operation Phase

No operation phase ecological impact from the proposed project is anticipated.

## 4.5 Noise

### 4.5.1 Construction Phase

Installation of pipeline and pipe supports would be carried out inside the disused tunnel. Site office and stockpile area for pipes and powered mechanical equipment (PME) will be sited at bare level ground underneath Cornwall Street outside south portal of the disused tunnel. For the construction works inside the disused tunnel, no noise impact on any NSR is expected. Construction noise impact would be limited due to the Site office and stockpile area at the south portal and the limited use of powered mechanical equipment (PME).

Noise impact due to the construction activities within Site office and stockpile area at the south portal has been assessed. The type and number of PMEs, and the corresponding sound power level (SWL) are given in **Appendix B**.

It is envisaged that construction activities will last for approximately 10 months for the installation of pipe supports and laying of additional gas pipeline as shown in **Appendix A**. The predicted construction noise impact for the unmitigated scenario is summarised in **Table 4.2**. Calculation worksheet is presented in **Appendix C**.

Table 4.2: Unmitigated Construction Noise Impact, dB(A)

| NSR | Description | Type of Use | Predicted Construction Noise Level, dB(A) | Construction Noise Criteria, dB(A) (1) |
|---|---|---|---|---|
| N1 | Oxford Garden | Residential | 65 | 75 |

Note(1): Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM), Annex 5, Table 1B - Noise Standards for Daytime construction activities

The predicted construction noise level is 65 dB(A), which is anticipated to have insignificant impact on the NSRs locating in urban area next to Cornwall Street. No exceedances of the daytime noise criteria are predicted at the representative NSR, and hence no specific noise mitigation measure is required for the construction works. Nevertheless, good site practices as detailed in Section 5.1.4 to further reduce the construction noise level would be implemented. Adverse construction noise impact is therefore not anticipated. There will be no construction activities during the restricted hours.

### 4.5.2 Operation Phase

No operation phase noise impact from the proposed project is anticipated.

## 4.6 Waste Management

### 4.6.1 Construction Phase

#### 4.6.1.1 Introduction

The construction activities to be carried out for construction of the project would generate a variety of wastes that can be divided into distinct categories based on their composition and ultimate method of disposal. The identified waste types include construction waste and chemical waste, and are not expected to have adverse impact if good site practices are adopted.

Each type of waste arising is described below, together with an evaluation of the potential environmental impacts associated with generation, handling, storage, transport and disposal for each waste type.

#### 4.6.1.2 Construction waste

Construction waste generated will be minimal. The construction works involve only pipe welding and pipe supports installation, only small amount of excavated soil would be resulted. Any excavated soil will be reused inside the tunnel. Any pipe material will be collected and returned to HKCG store and will not be disposed of.

#### 4.6.1.3 Chemical Waste

The maintenance and servicing of construction plant and equipment may generate some chemical wastes such as cleaning fluids, solvents, lubrication oil and fuel. Maintenance of vehicles may also involve the use of a variety of chemicals, oil and lubricants including heavy duty cleaners, organic solvents, degreasers, brake fluids, battery acid and soldering fluids. It is difficult to quantify the amount of chemical waste that would arise from the construction activities since it would be dependent on the Contractor's on-site maintenance requirements and the amount of plant utilised. However, it is anticipated that as there is no parking area at works area and good site practices are adopted, the quantity of chemical waste (such as lubricating oil and solvent produced from plant maintenance) would be as small as in the order of no more than a few cubic metres per month ,.

Chemical wastes arising during the construction phase might pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner as stipulated in the Waste Disposal (Chemical Waste) (General) Regulations. The potential hazards include:

- Toxic effects to workers;
- Impacts on water quality from spills; and
- Fire hazards.

Materials classified as chemical wastes would require special handling and storage arrangements before removal for appropriate treatment at the licensed Chemical Waste Treatment Facility. The handling, storage and disposal of chemical wastes are in accordance with the requirements under the Waste Disposal (Chemical Waste) (General) Regulations and adverse environmental impacts are not expected.

### 4.6.2 Operation Phase

No operation phase waste management impact from the proposed project is anticipated.

## 4.7 Air Quality

### 4.7.1 Construction Phase

Temporary stockpiling of construction materials may generate fugitive dust. Construction vehicle and plant may also cause potential dust nuisance.

As the construction works involve only pipe supports installation and pipe welding, only small amount of construction stockpile and the associated potential dust generation would be resulted. Potential dust nuisance from construction vehicles and plants is expected to be minimal due to the limited number to be used on-site. Standard dust control measures as detailed in Section 5.1.6 would be implemented. Adverse impact on air quality is not anticipated.

### 4.7.2 Operation Phase

No operation phase air quality impact from the proposed project is anticipated.

## 4.8 Cultural Heritage

### 4.8.1 Construction Phase

Within or in the vicinity of the project boundary, there was no declared monument, proposed monument, graded historic sites and buildings, or sites of archaeological interest identified by AMO. The disused tunnel is now identified by AMO as a government historic site, for which the internal walls had already been concrete lined and attention should be drawn to the façade walls at both portals of the tunnel which were kept unaltered. According to the project scope, these façade walls will not be affected by the project. The details are described below.

The works would only involve pipe supports installation and pipe welding within the tunnel. No blasting, heavy excavation or drilling works would be involved. Installation of pipeline and pipe supports would be carried out inside the disused tunnel. Site office and stockpile area will be sited only at bare level ground outside south end of the disused tunnel. The temporary cross-sectional coverage of tunnel during construction phase will be erected by waterproofing sealant on the concrete lining inside the tunnel and will not touch the facade walls at the tunnel portals. The coverage and associated lateral support will be erected as deep inside the tunnel as indicated in **Figure 2.3**. Also, the steel plate coverage and the lateral support will be painted in colour abstracted from the existing visual context for better integration with the tunnel in order to avoid any potential visual impact. Other than this, the lined tunnel internal walls need not be touched throughout the project construction.

As the project has no works altering or touching the façade walls, or involving potential structural vibration, adverse impact on these façade walls is not anticipated.

### 4.8.2 Operation Phase

No operation phase cultural heritage impact from the proposed project is anticipated.

## 4.9 Landscape and Visual

### 4.9.1 Construction Phase

Most of the construction works of the project would be carried out within the existing disused tunnel. No impact on landscape resources, i.e. Lion Rock Country Park, is expected.

The works area at the south tunnel portal would be used for stockpiling and accommodation of site office only and would be temporarily occupied for less than a year. As it is surrounded by artificial sloping walls with some plantation and underneath an existing road (refer to Plate 1 in **Appendix E**), the works area would be screened from the residents in the nearby residential buildings. Therefore, adverse visual impact to the potential VSRs is not anticipated.

### 4.9.2 Operation Phase

No operation phase landscape and visual impact from the proposed project is anticipated.

# 5. Environmental Protection Measures and Any Further Environmental Implications

## 5.1 Measures to Minimize Environmental Impacts

### 5.1.1 Water Quality

#### 5.1.1.1 Construction Phase

With the implementation of general pollution control measures as good site practice during construction phase, adverse water quality impact is not anticipated.

***Construction Site Runoff and Drainage***

Adequate construction site drainage management measures should be implemented and maintained by the Contractor to control site runoff and drainage.

The site practices outlined in ProPECC PN 1/94 Construction Site Drainage should be followed during construction works to minimise, if any, surface runoff and reduce any suspended solids prior to discharge. Where appropriate, these practices include the following items and should be properly implemented to control site discharges so as to avoid water quality impacts during the construction phase:

- Surface runoff from construction sites should be discharged into the two small channels within the tunnel or storm drains outside the tunnel via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels or earth bunds or sandbag barriers should be provided on site to properly direct stormwater to such silt removal facilities;
- Sand/silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly;
- Open stockpiles of construction materials on site should be covered with tarpaulin or similar fabric during rainstorms;
- Manholes should always be adequately covered and temporarily sealed to prevent silt, construction materials or debris from getting into the drainage system, and to prevent storm run-off from getting into foul sewers.

***General Construction Activities***

Construction waste generated will be minimal. The construction works involve only pipe welding and pipe supports installation, only small amount of excavated soil would be resulted. The excavated soil will be reused inside the tunnel. Any pipe material will be collected and returned to HKCG store and will not be disposed of.

Construction waste, debris and refuse generated on site should be collected, handled and disposed properly. Stockpiles of cement and other construction materials should be kept covered when not being used.

Fuel, oil, solvents and lubricants should only be used and stored in designated areas which have pollution prevention facilities. To prevent spillage of fuel, oil, solvents and lubricants to nearby water bodies, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas within bunds of a

capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.

***Sewage Effluent***

Temporary sanitary facilities, such as portable chemical toilets, should be provided on site to handle sewage from the workforce. A licensed contractor should be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.

***Effluent from Hydrostatic/Commissioning Tests of the Gas Pipeline System***

Dosing of chemicals into the water for testing should be prohibited. A discharge licence under the WPCO should be applied by the Contractor from EPD for discharging effluent from the construction site. Sedimentation tanks with sufficient capacity (determining factors on capacity include retention time, actual design and operation etc.), constructed from pre-formed individual cells of approximately 6 to 8 $m^3$ capacities, should be adopted for settling the effluent prior to disposal. The system capacity should be flexible and able to handle multiple inputs from a variety of sources and particularly suited to applications where the influent is pumped. The effluent discharge will be ensured to comply with the Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS) standards, and no unacceptable residual water quality impact due to effluent arising from hydrostatic test is expected.

#### 5.1.1.2 Operation Phase

No mitigation measure is required.

### 5.1.2 Hazard to Life

#### 5.1.2.1 Construction Phase

As expressed in Section 4.3.1, with the project scope and setting as described below, no hazard impact is anticipated. Even assuming an extremely unlikely worst case scenario that all precautionary measures and the cross-sectional tunnel coverage have failed to function, the contribution of the project to affect the existing societal risk of STWTW is negligible.

As part of the project setting before commencement of the works, the existing pipeline within the tunnel as well as the 130m underground pipe section outside each end of the tunnel will be temporary decommissioned, free of town gas and filled with nitrogen or other inert gases under nominal pressure. A fully sealed cross-sectional coverage of tunnel will also be erected at north end of the tunnel to separate the works area from the existing offtake station area at the north portal.

The decommissioning of the existing pipeline and the erection of the cross-sectional coverage before the project commencement will be carried out by the three HKCG staff who have been responsible for the operation and regular maintenance of existing 750mm gas pipelines and disused tunnel. There will not be any other work arranged at north portal or within the tunnel at that time.

Site office and stockpile area will be sited at level ground outside south end of the disused tunnel. The installation of proposed gas pipeline within the disused tunnel will be divided into 2 phases, Phase 1 – 0m to 650m from Tunnel north end and Phase 2 – 0m to 1550m from Tunnel south end. Phase 2 works area is entirely out of PHI Consultation Zone and will be separated from the Phase 1 works area by a locked fence. Installation works of Phase 1 will be firstly commenced and completed by January 2012 tentatively, well before the commencement of Shatin to Central Link Project – Tai Wai Section and STWTW reprovisioning works. The construction workforce of Phase 1 would be around 3 to 9 during normal construction period (7am to 7pm). Not more than 4 workers will usually be working within tunnel for pipe installation work. 9 workers will be working within tunnel only for a transient period to deliver pipes to designated area. Masks for workers within tunnel will be provided to prevent harm from chlorine leakage.

Should Shatin to Central Link Project – Tai Wai Section and STWTW reprovisioning works are to advance their dates of commencement of construction works, the number of workers usually working within tunnel for pipe installation work of Phase 1 of the project would be increased to not more than 7 workers to ensure Phase 1 of the Project is completed well before the commencement of Shatin to Central Link Project – Tai Wai Section and STWTW reprovisioning works.

Sufficient forced ventilation will be provided during construction period. There will be continuous fresh air feeding and extraction of air throughout the tunnel by air supply/extraction units which will be provided at the tunnel south end.

As precautionary measures, chlorine detectors will be installed in the disused tunnel near the Tunnel north end. Alarm will be triggered upon detection of any chlorine ingress. Communication channel will also be established with the STWTW operation staff during construction phase. Details of the emergency procedures should be formulated in the safety management plan which should be prepared by Contractor to ensure evacuation procedures are in place in case of chlorine leakage.

#### 5.1.2.2 Operation Phase

The practices adopted to meet the relevant safety ordinances, regulations and standards for the gas pipe have been highlighted in Section 4.3.2 above. Apart from this, no further mitigation measures is required.

### 5.1.3 Ecology

#### 5.1.3.1 Construction Phase

No specific mitigation measure for ecological impact is required as the project would not encroach within any ecological sensitive receiver. General good construction practices and management would minimize disturbance to off-site habitats and associated wildlife.

#### 5.1.3.2 Operation Phase

No mitigation measure is required.

### 5.1.4 Noise

#### 5.1.4.1 Construction Phase

No exceedance of noise criteria is predicted for the construction works, however, it is recommended that the Contractor should adopt good site practices to minimise construction noise as far as practicable. Good site practices measures include the following:

- The Contractor should adopt the Code of Practice on Good Management Practice to Prevent Violation of the Noise Control Ordinance (Chapter 400) (for Construction Industry) published by EPD;
- The Contractor should observe and comply with the statutory and non-statutory requirements and guidelines;
- Before commencing any work, the Contractor should submit to the Engineer's Representative for approval the method of working and equipment intended to be used at the site;
- The Contractor should devise and execute working methods to minimise the noise impact on the surrounding sensitive uses, and provide experienced personnel with suitable training to ensure that those methods are implemented;
- Noisy equipment and noisy activities should be located as far away from the NSRs as practical;
- Unused equipment should be turned off; number of operating PME should be kept to a minimum and the parallel use of noisy equipment / machinery should be avoided as far as practicable;
- Regular maintenance of all plant and equipment; and
- Material stockpiles and other structures may be effectively utilised as noise barriers, where practicable.

#### 5.1.4.2 Operation Phase

No mitigation measure is required.

### 5.1.5 Waste Management

#### 5.1.5.1 Construction Phase

Adverse impacts related to waste management are not expected to arise, provided that good site practices are followed. Recommendations for good site practices during the construction activities include:

- Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site;
- Training of site personnel in proper waste management and chemical handling procedures;
- Provision of sufficient waste disposal points and regular collection of waste;
- Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers; and
- Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors.

Good management and control could prevent the generation of a significant amount of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:

- Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal;

- Encourage collection of aluminium cans by providing separate labelled bins to enable this waste to be segregated from other general refuse generated by the workforce;
- Proper storage and site practices to minimise the potential for damage or contamination of construction materials; and
- Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste.

In addition to the above measures, specific pollution control measures are recommended below for the identified waste arising to minimise environmental impacts during handling, transportation and disposal of these wastes.

Construction waste generated will be minimal. The construction works involve only pipe welding and pipe supports installation, only small amount of excavated soil would be resulted. The excavated soil will be reused inside the tunnel. Any pipe material will be collected and returned to HKCG store and will not be disposed of.

General refuse should be stored in enclosed bins or compaction units separate from C&D material. A reputable waste collector should be employed by the Contractor to remove general refuse from the site. Preferably an enclosed and covered area should be provided to reduce the occurrence of 'wind blown' light material.

If chemical wastes are produced at the construction site, the Contractor would be required to register with the EPD as a chemical waste producer and to follow the guidelines stated in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as flammable, oxidizing, irritant, toxic, harmful, corrosive, etc. The Contractor should use a licensed collector to transport and dispose of the chemical wastes, to either the approved Chemical Waste Treatment Centre, or another licensed facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

#### 5.1.5.2 Operation Phase

No mitigation measure is required.

### 5.1.6 Air Quality

#### 5.1.6.1 Construction Phase

Dust control measures should be adopted as required under the Air Pollution Control (Construction Dust) Regulation. A control programme can be instigated to monitor the construction process in order to enforce dust controls and modify methods of works to reduce dust emissions down to acceptable levels. Dust control measures as stipulated in the Air Pollution Control (Construction Dust) Regulation should be implemented throughout the construction period.

Good site management is important to minimise potential air quality impact. As a general guidance, the Contractor should maintain high standard of housekeeping to prevent emissions of fugitive dust. Loading,

unloading, handling and storage of raw materials, wastes or by-products should be carried out in a manner so as to minimize the release of visible dust. Any piles of materials accumulated on or around the work areas should be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas should be carried out in a manner without generating fugitive dust emissions. The material should be handled properly to prevent fugitive dust emissions before cleaning.

#### 5.1.6.2 Operation Phase

No mitigation measure is required.

### 5.1.7 Cultural Heritage

No mitigation measure is required for construction and operation phases of the project. Care will be taken to avoid touching the facade walls at the two tunnel portals.

### 5.1.8 Landscape and Visual

No mitigation measure is required for construction and operation phases of the project.

## 5.2 Monitoring and Auditing

Adverse environmental impact is not anticipated and thus is not expected to require monitoring and auditing.

## 5.3 Possible Severity, Distribution and Duration of Environmental Effects

The duration of the works would be short given that the project installation is expected to be completed within 10 months and the installation will be completed before the commencement of construction of Shatin to Central Link Project – Tai Wai Section. Construction works would only affect a localized area inside the tunnel. In addition, the works area of the project locates on a bare ground with no ecologically sensitive area in the immediate vicinity. With the proposed project scope and the implementation of good site practices, adverse environmental impact is not anticipated.

## 5.4 Further Implications

Operation of the additional gas pipeline will follow relevant safety ordinances, regulations and standards. Further implication of project is not anticipated.

# 6. Previously Approved EIA Reports

There was no relevant EIA report for the proposed project.

# 目錄

附表



附圖

# 1. 基本資料

## 1.1 工程項目名稱

於已停用隧道（舊畢架山隧道）內鋪設一條直徑 500 毫米燃氣管道

## 1.2 工程項目的目的和性質

香港中華煤氣有限公司（簡稱「煤氣公司」）不斷致力於改善服務，爲她的客戶提供可靠和充足穩定的燃氣供應。爲提高天然氣的利用，煤氣公司已決定於跟現有港鐵東鐵線正在使用的畢架山隧道並排的已停用隧道內，鋪設一條長約 2.2 公里、直徑 500 毫米的燃氣鋼管道。在已停用隧道內，現有一條直徑 750 毫米的煤氣管道。從平面圖看，燃氣管道約有 992 米在獅子山郊野公園範圍內，但燃氣管道實則存在於郊野公園最少 120 米垂直距離下，因此並不須進入郊野公園內。擬設燃氣管道是整個輸氣系統的一部分，將天然氣由大埔製氣廠輸送到馬頭角製氣廠。整個天然氣輸氣系統的上行及下行管道均準備就緒，正等待在已停用隧道內安裝擬設燃氣管道後投入運作。

## 1.3 工程項目倡議者名稱

香港中華煤氣有限公司

## 1.4 聯絡人姓名及電話號碼

**工程項目倡議者－香港中華煤氣有限公司**

聯絡人姓名：沈全衍先生（工程系統經理）

電話：2963 1010

傳真：2561 6313

## 1.5 工程項目的地點

擬設燃氣管道的總長度爲 2.2 公里，與已停用隧道內現有的直徑 750 毫米煤氣管道並排而建。本項目及已停用隧道的位置在**圖 1.1** 展示。

## 1.6 工程項目的規模

擬於已停用隧道內設置燃氣管道的直徑爲 500 毫米，將安裝在地面支托上面。燃氣管道及其支托的設置工程將會在已停用隧道內進行，工地辦事處及物料貯存區將置於歌和老街底下南面隧道口外的空地，將從附近的道路進入工地辦事處、物料貯存區及已停用隧道，毋須進入任何獅子山郊野公園範圍內。

## 1.7 項目工地的歷史及現況

已停用隧道於一九一零年代在獅子山郊野公園底下興建，作鐵路用途。除了南北兩端的隧道口，已停用隧道內並無其他開口。現有煤氣管道是煤氣公司於一九八四年鐵路隧道改道後設置的，當時在已停用隧道中間部分約 1,500 米鋪了混凝土內層，沿隧道內安裝了一些輔助系統如照明設備、氣體探測器等。已停用隧道的其餘部分也於二零零八年鋪了混凝土內層。燃氣管道於隧道外裝設了切斷閥。已停用隧道內並無其他公共設施裝置，隧道兩面出入口均有鎖上的閘門，只有煤氣公司員工會進入隧道進行日常運作和維修工作。在進行現有的直徑 750 毫米煤氣管道、擬設的直徑 500 毫米燃氣管道及已停用隧道本身的運作及維修工作，煤氣公司

員工均不須進入或經過獅子山郊野公園。通常只有三名煤氣公司員工爲現有煤氣管道和隧道進行定期維護及運作。

## 1.8 工程項目簡介涵蓋的指定工程項目數量和種類

擬設燃氣管道之工程只在已停用隧道內進行，位於獅子山郊野公園下面垂直距離至少 120 米的地底。進行燃氣管道的設置、運作及維修時，會使用已停用隧道南面及北面的隧道口，而不須進入獅子山郊野公園。按照環境影響評估條例（第 499 章）附表 2 第 I 部種類 Q.1 所載「包括下述項目在內的全部工程項目：新通路、鐵路、下水道、污水處理設施、土木工事、挖泥工程及其他建築工程，而該等項目部分或全部位於現有的郊野公園或特別地區或經憲報刊登的建議中的郊野公園或特別地區、自然保育區、現有的海岸公園或海岸保護區或經憲報刊登的建議中的海岸公園或海岸保護區、文化遺產地點和具有特別科學價值的地點」，本項目屬於指定工程項目，以及對現有獲豁免指定工程項目作出實質改變，施工及營運均須環境許可證。

# 2. 規劃大綱及實施計劃

## 2.1 工程項目的規劃及實施

本項目之設置及營運燃氣鋼管由煤氣公司負責計劃和設計。煤氣公司將會委託承建商依照法定標準及其他指引，在煤氣公司的監督下設置燃氣管道。本項目的施工將以環保的方式計劃及設置以減少擾民；在設計燃氣管道的設置工程時，安裝設計已作出多項考慮。較可取之設計方案爲在已停用隧道地面上每隔約 16 米設置柱基以安裝燃氣管道。通過精簡的建築方法，例如減少柱基尺寸，減低了原材料的使用及所產生的廢物。

擬鋪設燃氣管道及相關工程的概覽圖於**圖 2.1** 及 **2.2** 展示。

擬設燃氣管道的設計、裝置及運作是嚴格遵照安全法例及守則，確保達至最高的安全、維護及運作標準。擬設的燃氣管道也將參考國際標準例如 IGE/TD/3 所載的要求。

煤氣公司已獲得多項國際認證，包括在一九九六年取得 ISO 9001 質量管理體系標準，在二零零五年取得 OHSAS 18001 職業健康安全管理體系規範，在二零零七年成爲亞洲第一間燃氣公司採用 PAS 55 資產管理認證系統，並持續每年由外部認證機構審查煤氣公司以核實繼續符合所有 ISO 9001、OHSAS 18001 及 PAS 55 認證要求。

在開始管道設置工程之前，現有煤氣管道及兩面隧道口外 130 米的地底管道將會暫時解除運作、切斷煤氣輸送及以低壓隋性氣體填充管道。於隧道北端將會豎立全面的密封蓋板，如**圖 2.3** 所示，使工程範圍與北面隧道口外的煤氣調壓站完全分隔。工程只包括設置管道支托及其混凝土柱基，以及在支托上鋪設燃氣管道。

上文所述的全面密封蓋板將由三名煤氣公司一向負責運作及維護現有煤氣管道和已停用隧道的員工豎立，屆時不會有其他工程在北面隧道口或隧道內進行，因此在豎立蓋板期間並不會增加該範圍的工作人口。

於已停用隧道內鋪設燃氣管道的工程將分爲兩個階段，第一階段是從北面隧道口起計 0 米至 650 米的範圍，而第二階段是從南面隧道口起計 0 米至 1550 米的範圍。第一階段的設置工程將首先展開，在二零一二年一月完成，會在沙田至中環綫－大圍段工程及沙田濾水廠重置工程開始之前完工。在正常施工時間（上午七時至下午七時），第一階段的建築工人人數將爲 3 至 9 人。經常在已停用隧道內進行管道設置工程的建築工人人數將不超過 4 人，僅在間中會有 9 名工人在隧道內負責搬運管道到指定地方。

第一階段工程完成後，將接著開展第二階段的設置工程，屆時將會在第一階段及第二階段之間豎立一道上鎖鐵欄，工人將不准橫過鐵欄。因此，建築工人的活動將限制在第二階段工地，即南面隧道口 0 米至 1550 米的範圍。在正常施工時間（上午七時至下午七時）於第二階段及南面隧道口工地的預計建築工人人數會限制爲少於 30。

施工期間將有充足的通風；在隧道內配備供風及抽風設備，把新鮮空氣送入隧道及抽向南面隧道口。本項目範圍內並不會進行爆破、大量挖掘或鑽鑿工程，不會有任何工程在獅子山郊野公園地面上進行或對其構成干擾。

## 2.2 工程項目時間表

鋪設燃氣管道的施工將分爲兩個階段，第一階段是從北面隧道口起計 0 米至 650 米的範圍，而第二階段是從南面隧道口起計 0 米至 1550 米的範圍。開始管道鋪設工程之前，將於隧道北端豎立上文提及的蓋板。第一階段擬於二零一一年九月展開，於二零一二年一月完成，在沙田至中環綫－大圍段工程及沙田濾水廠重置工程於二零一二年年中開展之前完工。第一階段工程完成後，第二階段工程便會展開。暫定的工程時間表於附錄 A 顯示。若沙田至中環綫－大圍段工程及沙田濾水廠重置工程提前於二零一一年年底開始，項目將增加第一階段經常在隧道內進行管道設置工程的建築工人人數，確保第一階段工程於上述兩項工程開始之前完工。

## 2.3 與其他項目的相接

項目將暫定於二零一二年七月完工，而第一階段將於二零一二年一月（在沙田至中環綫－大圍段工程及沙田濾水廠重置工程於二零一二年年中開展之前）完工。擬設燃氣管道的設置工程並沒有與任何確認的項目相接。

# 3. 周圍環境的主要元素

## 3.1 簡介

本項目位於畢架山地底下的已停用隧道內，如**圖 1.1** 所示，從平面圖看，擬設的燃氣管道約有 992 米在獅子山郊野公園範圍內。本項目工地及附近的土地用途歷史顯示並沒有潛在的土地污染。

## 3.2 水質

本項目南面隧道口工地範圍內及近鄰並沒有水道。

如**圖 2.2** 所示，於已停用隧道內有兩條小排水溝，收集地面徑流及任何從隧道混凝土內層滲出的地下水，連接到現有的雨水排放系統。

## 3.3 生命危害

工地辦事處及物料貯存區將置於南面隧道口外的空地。

現時在已停用隧道內有一條直徑 750 毫米的煤氣管道，另在北面隧道口外有一個煤氣調壓站。

開始管道設置工程之前，現有煤氣管道及兩面隧道口外 130 米的地底管道將會暫時解除運作、切斷煤氣輸送及以低壓隋性氣體填充管道。於隧道北端將會豎立全面的密封蓋板，使工程範圍與北面隧道口外的煤氣調壓站完全分隔。

沙田濾水廠由於貯存以公噸計的化學氯危險品，故爲一潛在危險設施。沙田濾水廠內的 223 公噸貯存量加氯房位於本項目北面隧道口的西北方約 370 米，於獅子山郊野公園邊界北面多於 500 米外。項目位於畢架山下的已停用隧道內，而擬設的燃氣管道有約 630 米落在潛在危險設施諮詢區內。沙田濾水廠加氯房的位置已於**圖 1.1** 顯示。

於已停用隧道內鋪設燃氣管道的工程將分爲兩個階段，第一階段是從北面隧道口起計 0 米至 650 米的範圍，而第二階段是從南面隧道口起計 0 米至 1550 米的範圍。第二階段的工程範圍是完全在潛在危險設施諮詢區之外。

## 3.4 生態

本項目的第一及第二階段的工程範圍在已停用隧道之內。工地辦事處及物料貯存區將置於歌和老街底下南面隧道口外的光禿地面，而該地面範圍被斜坡牆圍住，只有一些低質素的人工種植。該範圍是公眾可以進入的地方，因此已受人爲活動及政府的斜坡維修工程活動滋擾。

擬設燃氣管道的已停用隧道早在一九八零年代開始已受維修工人、照明系統及機器噪音的滋擾，並已透過調查（參考**附錄 D**）確認已停用隧道內並沒有蝙蝠棲息。

總括而言，於已停用隧道及工地範圍內，確認並沒有重要的生境或物種。

## 3.5 噪音

於已停用隧道內的設置工程並不會影響任何「噪音感應強的地方」。最接近本項目南面隧道口的噪音敏感用途爲晉利花園住宅大廈，可能受到機動設備（亦即通風扇和發電機）運作引致的潛在噪音影響，故已識別此

大廈爲最接近的「噪音感應強的地方」，作爲預測最壞情況下受噪音影響水平的對象。具代表性的「噪音感應強的地方」於**表 3.1** 說明，位置如**圖 3.1** 所示。

表 3.1: 施工期具代表性的「噪音感應強的地方」

| 「噪音感應強的地方」 | 說明 | 用途分類 | 備註 |
|---|---|---|---|
| N1 | 晉利花園 | 住宅 | -「噪音感應強的地方」與機動設備的距離爲 48 米<br>- 歌和老街及人工斜坡把機動設備從「噪音感應強的地方」掩蔽了 |

## 3.6 空氣質素

最接近本項目南面隧道口工地的環境保護署（環保署）空氣質素監測站位於深水埗。根據環保署出版的 2005 至 2009 年《香港空氣質素報告》在深水埗空氣質素監測站錄得的空氣污染物全年平均濃度，計出污染物的五年平均濃度，結果列於**表 3.2**。

表 3.2: 深水埗空氣質素監測站錄得的污染物五年平均濃度

| 污染物 | 全年平均值（微克/立方米） | 香港空氣質素指標一年平均值（微克/立方米） |
|---|---|---|
| 二氧化硫 | 21 | 80 |
| 二氧化氮 | 67 | 80 |
| 總懸浮粒子 | 80 | 80 |
| 可吸入懸浮粒子 | 54 | 55 |

易受空氣污染影響的代表受體爲最接近工地的空氣敏感受體。具代表性的空氣敏感受體於**表 3.1** 說明，位置如**圖 3.1** 所示，與第 3.5 章節的「噪音感應強的地方」相同。

表 3.3: 施工期具代表性的空氣敏感受體

| 空氣敏感受體 | 說明 | 用途分類 | 空氣敏感受體與工地的距離（米） |
|---|---|---|---|
| A1 | 晉利花園 | 住宅 | 48 |

## 3.7 文化遺產

在鐵路隧道有部分路段被改道後，已停用隧道內現有的煤氣管道是於一九八四年由煤氣公司設置。已停用隧道內鋪了混凝土內層，沿隧道內也安裝了一些輔助系統如照明設備、氣體探測器等。南北隧道口的外牆已被保存。此隧道現時被古物古蹟辦事處界定爲其中一個政府文物地點。

## 3.8 景觀及視覺

研究範圍內確認的景觀資源爲獅子山郊野公園。

確認的視覺敏感受體爲鄰近本項目南面隧道口外工地的晉利花園住宅大廈的居民。

# 4. 潛在環境影響

## 4.1 簡介

由於擬鋪設燃氣管道的設計已將維修的需要減至最低，故本項目引起的潛在環境影響局限於施工期間，預計本項目的運作期間並沒有構成任何環境影響。

## 4.2 水質

### 4.2.1 施工期

本項目的工程包括設置管道支托及其混凝土柱基，以及在支托上鋪設燃氣管道。在暴雨期間，於南面隧道口外的工地辦公室及存料堆可能會引起工地徑流。地盤工人於施工期時也可能會產生污水。本項目將會實施詳列於第 5.1.1 章節的標準污染管制措施作爲良好工地作業守則，預計並不會對現有排水渠道的水質有任何影響。

在鋪設的燃氣管道系統投入運作之前，須爲燃氣管道進行水壓測試。燃氣管道將被注入食水，於特定的測試壓力下，檢驗管道有否泄漏。水壓測試將在室溫下進行，並不須在測試水中加進化學物質。

燃氣管道系統的水壓測試可能會產生含有懸浮固體濃度的廢水，但是此水質影響只是非常暫時性及局部地於施工期發生。若適當地實施列於章節 5.1.1 的標準污染管制措施以控制水壓測試的廢水排放，對水質的影響將會十分輕微。

### 4.2.2 營運期

預計本項目於營運期並沒有水質影響。

## 4.3 生命危害

### 4.3.1 施工期

擬設管道的設計、裝置及運作是嚴格遵照法定的安全條例及守則，確保達到最高安全、維護及運作標準。擬設的燃氣管道也將參考國際認可標準，例如 IGE/TD/3 所載的要求。

煤氣公司已獲得 ISO 9001 質量管理體系標準認證及 OHSAS 18001 職業健康安全管理體系認證。煤氣公司已採用 PAS 55 資產管理認證系統。每年由外部認證機構對煤氣公司所有 ISO 9001、OHSAS 18001 及 PAS 55 認證進行審查。

本項目的潛在危害是於施工期間因工程引致現有煤氣管道有潛在的氣體洩漏。工程範圍內並不會進行爆破、大量挖掘或鑽鑿工程，所以預計不會對現有煤氣管道構成任何影響。

作爲項目設置的一部分，現有煤氣管道及南北隧道口外 130 米的地底管道在開始工程之前將會暫時解除運作、切斷煤氣輸送及以低壓隋性氣體填充管道。於隧道北端將會豎立全面的密封蓋板，使工程範圍與北面隧道口外的煤氣調壓站完全分隔。故此，工程開展前潛在氣體洩漏的危害已根本上消除。

因有全面的密封蓋板，整條已停用隧道將與北面隧道口完全隔離，所以即使本項目的工人在已停用隧道內施工會增加於沙田濾水廠諮詢區內的流動人口，也預計不會影響現時群體風險水平。而且，工地辦事處及物料貯存區將置於南面隧道口外的空地，距離潛在危險設施諮詢區界線約有 1.5 公里。

開始管道設置工程之前，解除現有煤氣管道的運作及豎立全面密封蓋板的工作將由三名一向負責運作及維修現有煤氣管道和隧道的煤氣公司員工進行，屆時不會有其他工程在北面隧道口或隧道內進行，因此並沒有增加該範圍的工作人口，而群體風險也與現時一樣。

施工期間將有充足的通風，隧道內配備的供風及抽風設備會把新鮮空氣送入隧道及抽向南面隧道口。

作爲預防措施，已停用隧道北端將會設置氯氣探測器，當探測到有氯氣進入隧道便會啓動警報器。施工期間，項目倡議者將與沙田濾水廠的職員設立溝通渠道。項目將爲在已停用隧道內施工的工人提供面罩，以防止氯氣洩漏的危害。承建商將備有安全管理計劃，制定詳盡的緊急應變程序，確保已準備撤離程序以應付沙田濾水廠的氯氣洩漏。

根據項目時間表，於已停用隧道內鋪設燃氣管道的工程將分爲兩個階段，第一階段是從北面隧道口起計 0 米至 650 米的範圍，而第二階段是從南面隧道口起計 0 米至 1550 米的範圍。第二階段的工程範圍是完全在潛在危險設施諮詢區之外。第一階段的設置工程將首先展開，在二零一二年一月完成，會在沙田至中環綫－大圍段工程及沙田濾水廠重置工程開始之前完工。

在正常施工時間（上午七時至下午七時），第一階段的建築工人人數將爲 3 至 9 人。經常在隧道內進行管道設置工程的建築工人人數將不超過 4 人，僅在間中會有 9 名工人在已停用隧道內負責搬運管道到指定地方。因鄰近沙田濾水廠而構成本項目有潛在的死亡事故已基於可能出現的最壞情況作出估算，於附錄 F 詳述。估算結果顯示即使在可能性爲微乎其微的最壞情況下，假設全面密封蓋板及項目所有預防措施皆未能發揮作用，本項目也不會對該區現時群體風險水平構成影響。

總括來說，從風險的角度，預計本項目的施工並沒有不良影響。

### 4.3.2 營運期

預計本項目於營運期並沒有生命危害影響，因爲管道的設計、裝置及運作是嚴格遵照法定的安全條例及規則，確保達到最高安全、維護及運作標準。項目也將參考國際認可標準，例如 IGE/TD/3 所載的要求。煤氣公司已於一九九六年獲得 ISO9001 質量管理體系標準認證及於二零零五年獲得 OHSAS18001 職業健康安全管理體系認證，也是亞洲第一間燃氣公司在二零零七年採用 PAS 55 資產管理認證系統。每年有外部認證機構審查煤氣公司以核實繼續符合所有 ISO 9001、OHSAS 18001 及 PAS 55 認證要求。本項目採用的燃氣管道運作常規之要點如下：

- 所選管道物料的質量等級可承受 35 巴的操作壓力，而管道的操作壓力只爲 7 巴；
- 管道有內塗層及外塗層，有良好的保護；
- 管壁厚度計算採用的設計因數爲 0.3；
- 百分之百檢查焊接處；
- 管道在已停用隧道外的部分設置了切斷閥，故此在任何時間皆可以使用切斷閥；
- 若有任何意外事故，隧道管道可以立即從整個系統隔離；
- 隧道已設置氣體探測器，進行 24 小時監測，信號傳送至煤氣公司的 24 小時運作的調度中心；以及
- 每年一次對管道進行泄漏檢查；以及
- 已停用的隧道的南北隧道口均裝有上鎖的鐵欄，只有煤氣公司的員工才能進入隧道內進行日常運作及維護工作。

以上的常規也已用於現有煤氣管道的運作，現有煤氣管道目前的日常運作及維護計劃會繼續進行，故此現有煤氣管道的安全並不會在本項目施工之後受影響。

## 4.4 生態

### 4.4.1 施工期

由於設置工程主要在現有停用隧道內，而確認於隧道內並沒有任何植物或動物，因此預計沒有潛在的直接生態影響。小部分的工地位於南面隧道口外，基於該地已高度受人爲活動改造的性質、低質素及低生物多樣性，所以生態價值爲低，而本項目的小規模設置工程並不會引致任何顯著的生態影響。潛在生態影響評估的總結於**表 4.1** 說明。

表 4.1: 潛在生態影響的評估

| 準則 | 備註 |
|---|---|
| 生境質素 | 已停用隧道完全鋪上混凝土內層，沒有任何植物或動物在內；南面隧道口工地的生境爲一低質素的光禿地面 |
| 物種 | 物種多樣性、豐盛程度及數量均十分低 |
| 生境面積／物種數量 | 工地面積小，不須砍伐任何樹木 |
| 影響期 | 擬鋪設管道的施工期約爲十個月 |
| 可逆轉性 | 100% |
| 環境改變的大小 | 沒有直接的生態影響；間接影響爲不顯著 |

### 4.4.2 營運期

預計本項目於營運期並沒有生態影響。

## 4.5 噪音

### 4.5.1 施工期

燃氣管道及其支托的設置工程將會在已停用隧道內進行，工地辦事處、物料貯存區及機動設備將置於歌和老街底下南面隧道口外的空地。在已停用隧道內進行的工程預計對任何「噪音感應強的地方」均不會構成噪音影響，只有工地辦事處、物料貯存區位於南面隧道口外，而設置工程只會有限地使用機動設備，所以本項目構成的建築噪音影響將會有限。

於隧道口工地範圍內的施工所構成的噪音影響已被評估。而施工所使用的機動設備之種類和數量，以及相關聲功率級已在附錄 B 中列出。

如附錄 A 所示，整個設置管道支托與鋪設燃氣管道工程的施工預計歷時大約十個月。**表 4.2** 列出了在沒有緩解措施的情況下預測的建築噪音影響。附錄 C 則列出計算工作表。

表 4.2: 未經緩解的建築噪音影響(分貝(A))

| 「噪音感應強的地方」 | 說明 | 用途分類 | 預計的建築噪音程度，分貝(A) | 建築噪音標準(1) |
|---|---|---|---|---|
| N1 | 晉利花園 | 住宅 | 65 | 75 |

註(1): 環境影響評估程序的技術備忘錄中附件五的表 1B – 日間建築活動噪音標準

預測的建築噪音程度爲 65 分貝，預計對於歌和老街兩旁市區「噪音感應強的地方」的影響爲不顯著。預測於具代表性「噪音感應強的地方」的噪音水平將不會超出日間噪音標準，所以施工並不須特別的噪音緩解措

施。儘管如此，項目仍會實施列於章節 5.1.4 的良好工地作業守則，以盡量減低建築噪音水平，所以預計不會構成不良的建築噪音影響。於限制時間內，並不會有設置工程進行。

### 4.5.2 營運期

預計本項目於營運期並沒有噪音影響。

## 4.6 廢物管理

### 4.6.1 施工期

#### 4.6.1.1 引言

本項目的施工將會產生各種廢物，可以根據廢物的成份及最終棄置方案而作出分類。已確認的廢物種類包括建築廢物及化學廢物，若採用良好工地作業守則，這些廢物並不會構成不良的環境影響。

工程產生的每一種廢物，以及廢物的產生、處理、貯存、運輸及棄置對環境潛在的影響，已在下文詳述。

#### 4.6.1.2 建築廢物

本項目所產生的建築廢物會很少。焊接管道和安裝管道支托只會挖掘出少量的土壤，而所有挖掘土壤將重用於隧道內。任何剩餘管道材料將被收集並存放在煤氣公司的貯存區，不會棄掉。

#### 4.6.1.3 化學廢物

建築設備和工具的維修和使用或會產生化學廢物，如清潔液、溶劑、潤滑油和燃料。維修汽車會涉及多種化學物、汽油和潤滑劑，包括重型清潔劑、有機溶劑、去油劑、制動液、電池酸性溶液和焊接用溶液。施工所產生的化學廢物較難予以定量，因爲這取決於承建商的維修要求和使用設備的數量。然而，由於工地沒有停車處，並會實施良好工地作業守則，所以化學廢物（如維修設備時所產生的潤滑油和溶劑）的數量預計少至每月只有數立方米。

於施工期間產生的化學廢物如不按照《廢物處置(化學廢物)(一般)規例》 所訂的規則去貯存和棄置，或會引起環境、健康和安全的危害。這些危害包括：

- 對工人的毒害影響；
- 洩漏對水質造成影響；及
- 火災

所有被分類爲化學廢物的物料，須在運送到持牌的化學廢物處理設施進行適當處理及棄置之前，作出特定的處理和貯存安排。化學廢物的處理、貯存和棄置會符合廢物處置（化學廢物）（一般）規例的要求，預計項目並不會產生不良環境影響。

### 4.6.2 營運期

預計本項目於營運期並沒有廢物管理影響。

## 4.7 空氣質素

### 4.7.1 施工期

臨時貯存建築物料時或會產生揚塵，工地車輛及設備也可能會產生潛在塵埃滋擾。

由於工程只涉及設置管道支托及管道焊接，所以只會產生少量物料堆存及相關潛在的塵埃飛揚。因爲工地使用的車輛及設備數目有限，所以預計潛在產生的塵埃滋擾只會十分輕微。實施在章節 5.1.6 所列的標準塵埃管制措施後，預計不會對空氣質素構成不良的影響。

### 4.7.2 營運期

預計本項目於營運期並沒有空氣質素影響。

## 4.8 文化遺產

### 4.8.1 施工期

本項目範圍內及附近並沒有古物古蹟辦事處界定的法定古蹟、提議的古蹟、已評級歷史文物地點和建築、或具考古價值的地點。已停用隧道現時是古物古蹟辦事處界定的「政府文物地點」，因爲內牆已經鋪上混凝土，所以關注點在於南北隧道口被保留不變的外牆。根據本項目的施工範圍，南北隧道口外牆不會受本項目影響，詳細說明如下：

管道鋪設工程只包括在已停用隧道內設置管道支托及管道焊接，並不會進行爆破、大量挖掘或鑽鑿工程。管道及管道支托的安裝將在已停用隧道內進行。工地辦公室和物料貯存區將置於南面的隧道口外的空地。施工期間於隧道的臨時密封蓋板將以防水密封膠把蓋板豎立在隧道內，並不會接觸到南北隧道口的外牆。蓋板及其支托將豎立於隧道內，見**圖 2.3** 所示。此外，蓋板及其支托將塗上與現有視覺環境相似的顏色，與隧道配合，避免任何潛在的視覺影響。除此以外，項目的施工不會接觸隧道的混凝土內牆。

由於本項目不會改動或接觸南北隧道口的外牆，或涉及潛在的結構振動，故沒有對外牆構成不良影響。

### 4.8.2 營運期

預計本項目於營運期並沒有文化遺產影響。

## 4.9 景觀及視覺

### 4.9.1 施工期

大部分設置工程將會在現有的已停用隧道內進行，因此預計不會對景觀資源，即獅子山郊野公園構成影響。

位於南面隧道口的擬設工地將會只作貯存及工地辦公室之用，臨時佔用時間將不超過一年。由於擬設工地範圍是在一條現有道路下面，被人工斜坡牆及植樹包圍（參考**附錄 E** 內插圖 1），工地範圍與鄰近居民之間有此作遮隔，因此預計本項目並不會對潛在的視覺敏感受體有不良視覺影響。

### 4.9.2 營運期

預計本項目於營運期並沒有景觀及視覺影響。

# 5. 環境保護措施及其他環境影響

## 5.1 減少環境影響的措施

### 5.1.1 水質

#### 5.1.1.1 施工期

在施工期間會實施一般性的污染控制措施作爲良好工地作業守則，預計本項目並不會對水質造成任何影響。

***工地徑流及排水***

承建商應實施充足的工地排水管理措施，以控制工地徑流及排水。

施工期間應遵守《環保署專業人士環保事務諮詢委員會專業守則 1/94 建築地盤排水》內列出的工地作業守則，以減少任何地面徑流，及在排放前減少任何懸浮固體。這些作業守則包括下列措施，應按需要於施工期適當實施，以控制工地排放及預防水質影響：

- 工地的地面徑流應經由備有如隔沙池、沙泥收集器或集泥池等能清除沙泥的設施，排放到已停用隧道內的兩條小渠或隧道外的雨水渠；工地內應提供溝渠、土堤或沙包，以適當地引導雨水至清除沙泥設施；
- 定期維修清除沙泥設施、水道及沙井，以及清理沉積淤泥及砂礫；
- 暴雨期間，建築物料的露天庫存應用防水布之類作遮蓋；
- 沙井應經常蓋好及暫時密封，以防止淤泥、建築物料或碎料流入排放系統及防止雨水徑流流入污水渠。

***一般建築活動***

本項目所產生的建築廢物會很少。焊接管道和安裝管道支托只會挖掘出少量的土壤，而所有挖掘土壤將重用於隧道內。任何剩餘管道材料將被收集並存放在煤氣公司的倉庫，不會棄掉。

工地產生的建築物料、碎料或垃圾應妥善收集、處理及棄置。備用中的混凝土及其他建築物料庫存應蓋好。

燃料、油類、熔劑及潤滑劑只可在備有防止污染設施的指定範圍內使用及貯放。防止燃料、油類、熔劑及潤滑劑流入附近的水體，所有燃料缸及貯存地方應鎖上及設置在相等於最大容器 110%的容量的密封堤內，並在雨後妥善排放雨水。

***污水***

應在工地內設置如流動化學洗手間的臨時衛生設施，以處理源來自工人的污水。應聘請持牌承建商以提供適當及足夠的流動洗手間及負責適當的棄置及維修。

***燃氣管道系統水壓測試產生的污水***

應禁止在測試水中加進化學物質。承建商應根據《水污染管制條例》向環保署申請排放牌照，以排放工地廢水。應採用足夠容量（容量決定因素包括滯水時間、實際設計及運作等等）及以容量大約 6 至 8 立方米預製個別組件建造的沉積池，將污水先沉澱後排放。系統容量應有靈活性，能以處理多個各種來源的輸水口，也特別適合應用於污水泵。會確保排放的廢水符合《技術備忘錄：排入去水渠及污水渠系統、內陸及海岸水域的污水標準》，預計水壓測試的廢水不會引致不良的水質影響。

5.1.1.2 營運期

不須實施任何緩解措施。

**5.1.2** 生命危害

5.1.2.1 施工期

在 4.3.1 章節已經提及，透過本項目的施工範圍和下面所述的設置，預計本項目的施工沒有構成生命危害的影響。即使假設全面密封蓋板及項目所有預防措施皆未能發揮作用，本項目也不會對沙田濾水廠現時的群體風險水平造成影響。

作爲工程開始前項目佈置的一部分，煤氣管道及兩面隧道口外 130 米的地底管道將會暫時解除運作、切斷煤氣輸送及以低壓隋性氣體填充管道。於隧道北端將會豎立全面的密封蓋板，使工程範圍與北面隧道口外的煤氣調壓站完全分隔。

開始項目工程之前，解除現有煤氣管道運作及豎立全面的密封蓋板的工序將由三名一向運作及維護現有煤氣管道和隧道的煤氣公司員工負責，屆時不會有其他工程在北面隧道口或隧道內進行。

工地辦事處及物料貯存區將置於南面隧道口外的空地。於已停用隧道內鋪設燃氣管道的工程將分爲兩個階段，第一階段是從北面隧道口起計 0 米至 650 米的範圍，而第二階段是從南面隧道口起計 0 米至 1550 米的範圍。第二階段的工程範圍是完全在潛在危險設施諮詢區之外，將以一道上鎖鐵欄與第一階段的工地分隔。第一階段的設置工程將首先展開，暫定在二零一二年一月完成，會在沙田至中環綫－大圍段工程及沙田濾水廠重置工程開始之前完工。在正常施工時間（上午七時至下午七時），第一階段的建築工人人數將爲 3 至 9 人。經常在隧道內進行管道設置工程的建築工人人數將不超過 4 人，僅在間中會有 9 名工人在隧道內負責搬運管道到指定地方。項目將爲在隧道內施工的工人提供面罩，以防止氯氣洩漏的危害。

若沙田至中環綫－大圍段工程及沙田濾水廠重置工程提前開始，本項目於第一階段的建築工人人數將增加至最多 7 人，以確保第一階段工程於上述兩項工程開始之前完工。

施工期間將有充足的通風，隧道內配備的供風及抽風設備會把新鮮空氣送入隧道及把空氣抽向南面隧道口。

作爲預防措施，已停用隧道北端將會設置氯氣探測器，當探測到有氯氣進入隧道便會啓動警報器。施工期間，項目倡議者將與沙田濾水廠的職員設立溝通渠道。承建商將備有安全管理計劃，制定詳盡的緊急應變程序，確保已準備撤離程序以應付氯氣洩漏。

5.1.2.2 營運期

營運燃氣管道採取的常規做法符合有關安全條例、規例和標準，已經於 4.3.2 章節中提及。除此之外，不須實施其他緩解措施。

**5.1.3** 生態

5.1.3.1 施工期

由於本項目並不會擾害任何生態敏感受體，故不須實施針對性的生態緩解措施。一般的良好建築作業及管理守則將會減少對工地外生境及相關野生生物的滋擾。

5.1.3.2 營運期

不須實施緩解措施。

### 5.1.4 噪音

5.1.4.1 施工期

建築活動沒有超出噪音準則標準，故不須實施特別的緩解措施。然而，建議承建商應實施良好工地作業守則以盡量減低建築噪音。良好工地作業守則包括以下各項：

- 承建商應採用由環境保護署所發表的“防止違反《噪音管制條例》(第 400 章)良好管理業務守則(供建造業界使用)”；
- 承建商應遵守法定和非法定的要求和指引；
- 在任何工作開始前，承建商應提交會在工地使用的工作方法和機器，以取得工程師代表的認可；
- 承建商應策劃和實行工作方法以減少對周圍「噪音感應強的地方」的噪音影響，以及提供有經驗及曾受訓練的人員，確保這些方法得以實施；
- 高噪音機器和活動應盡可能遠離「噪音感應強的地方」；
- 關掉閒置的設備、減少運作中的機動設備數量及盡可能避免共同使用高噪音設備或機器；
- 定期維修全部機器和設備；及
- 可行的情況下，有效地利用貯存物料和其他結構作隔音屏障。

5.1.4.2 營運期

不須實施緩解措施。

### 5.1.5 廢物管理

5.1.5.1 施工期

***良好作業守則***

只要執行良好的工地作業守則，預計本項目並不會引起關於廢物管理的不良影響。施工期內的良好工地作業守則建議如下：

- 提名合資格人員，如工地經理，負責執行良好的工地作業守則，安排工地廢物的收集及棄置至適當設施；
- 爲工地工作人員提供正確的廢物管理及化學品處理程序的訓練；
- 準備足夠的廢物棄置地點及定期收集廢物
- 實施適當措施，如以遮蓋貨車或密封貨櫃運送廢物，以減少在運送途中被風吹起的垃圾及塵埃；及
- 定期清洗及維修排水系統、污水坑及油污截流器。

***減少廢物措施***

良好管理及控制可以避免大量廢物的產生。在計劃及設計階段確保良好工地作業守則的實施，最能夠減少廢物。建議減少廢物的措施包括：

- 在不同的容器、箕斗或堆存分類及貯存不同種類的廢物，以提高再用或再造物料的質量及適當地棄置；
- 提供分別的標籤收集箱以鼓勵鋁罐的收集，並與其他一般垃圾分開；
- 適當地貯存及遵守工作守則，以把建築物料的破壞或污染減至最少；及
- 小心計劃及貯存建築物料，以減少廢物數量及避免不必要的廢物產生。

除了以上各項減廢守則，下列建議的針對性的管制措施亦能減少在處理、運送的棄置期間所造成的環境影響。

***建築廢物***

將盡量減少產生建築廢物，而工程只包括管道和安裝管道支托，只會挖掘出少量的土壤，而所有挖掘土壤將重用於隧道內。任何剩餘管道材料將收集並存放在煤氣公司的貯存區，不會棄置。

***一般垃圾***

一般垃圾應貯存在有蓋的垃圾箱或壓縮裝置內，並跟拆建廢料分開。承建商應聘用合資格的廢物收集商清理工地的一般垃圾。最好也提供一個圍住及有蓋的範圍以減少較輕物料被風吹影響的情況。

***化學廢物***

如工地內有化學廢物產生，承建商應向環保署申請爲化學廢物生產者及根據《包裝、標籤及存放化學廢物的工作守則》內列明的指引。應使用高質素並可相互兼容化學廢物容器，不可相互兼容的化學品應分開貯存。正確的標籤應穩固地貼在每個化學廢物容器上，並列明相應的化學特性，如：易燃、助燃、刺激性、有毒、有害、腐蝕性等等。根據《廢物處置（化學廢物）（一般）規例》，承建商應聘用持牌的收集商負責運送及棄置化學廢物至認可的化學廢物處理中心或其他持牌設施。

5.1.5.2 營運期

不須實施任何緩解措施。

### 5.1.6 空氣質素

5.1.6.1 施工期

應根據《空氣污染管制(建造工程塵埃)規例》的要求，實施塵埃管制措施。訂下管制計劃監測建築過程，以加強塵埃管制並調整施工方法，使塵埃排放減至可接受的水平。按照《空氣污染管制(建造工程塵埃)規例》的規定，於施工期實施塵埃管制措施。

良好工地作業守則可將潛在空氣質素影響減至最低。作爲一般指引，承建商應保持高水準的工程管理，以可防止塵土飛揚。裝卸、處理和貯存原料、廢物或副產品時，應把可見的塵埃釋放減至最低。在工程範圍堆積的物料應定期清理。在工程範圍清潔及維修所有設施時，應避免塵土飛場。在清理之前，物料應妥善處理，防止塵土飛場。

5.1.6.2 營運期

不須緩解措施。

### 5.1.7 文化遺產

項目施工期及營運期均不須實施任何緩解措施。倡議人及承建商會注意避免觸及南北隧道口的外牆。

### 5.1.8 景觀及視覺

項目施工期及營運期均不須實施任何緩解措施。

## 5.2 監察及審核

預計本項目不會構成構成不良的環境影響，因此不須進行監察和審核。

## 5.3 有關環境影響的嚴重性、可能分布及持續時間

由於本項目預計會分階段設置，並於十個月內竣工，所以工程的持續時間爲短。設置工程將於沙田至中環綫－大圍段工程開始前完工，而且設置工程只會影響一個局部範圍。此外，本項目的工地位於一處光禿的地面，四周並非生態易受破壞地區。因此，在擬設項目的範圍內以及實施良好工地作業守則後，預計並不會構成不良的環境影響。

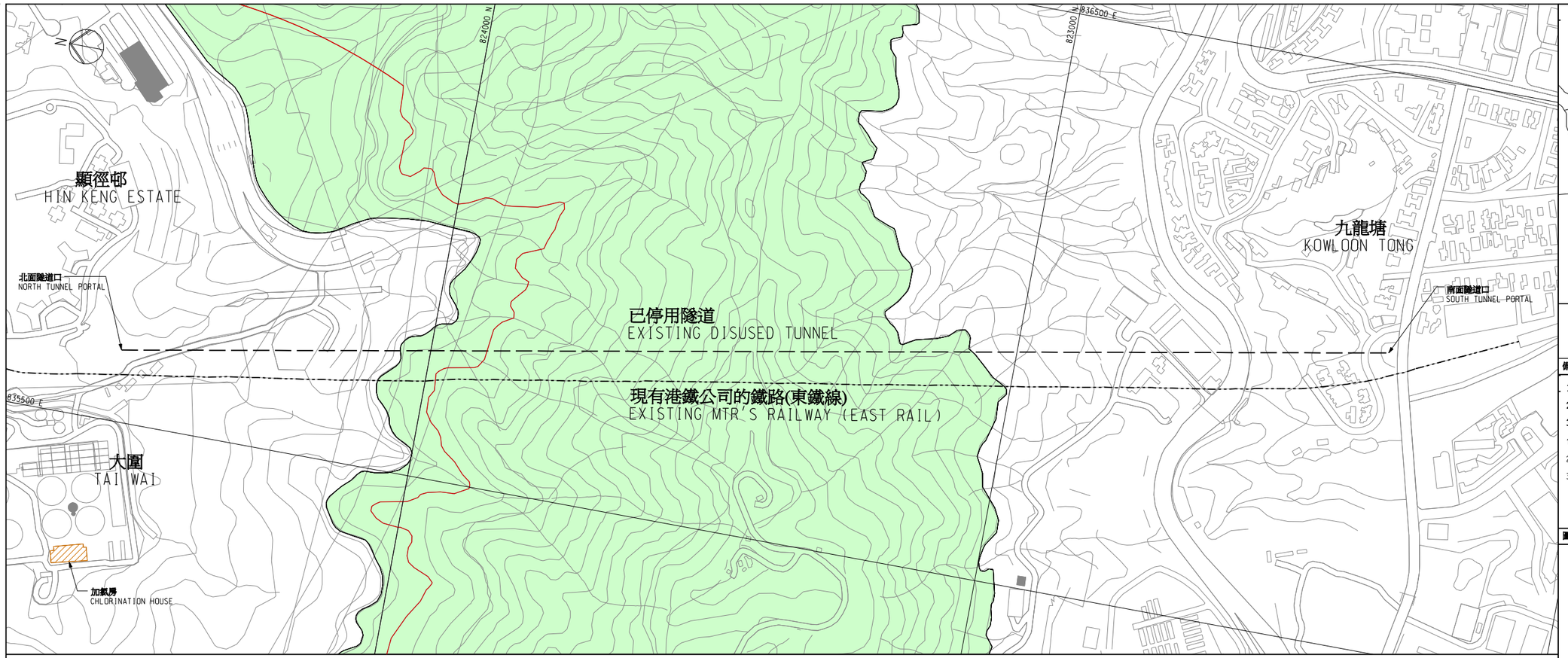
## 5.4 進一步的結果

額外燃氣管道的營運將遵守有關安全條例、規例和標準進行，預計項目不會有任何久遠的影響。

# 6. 先前通過的環評報告

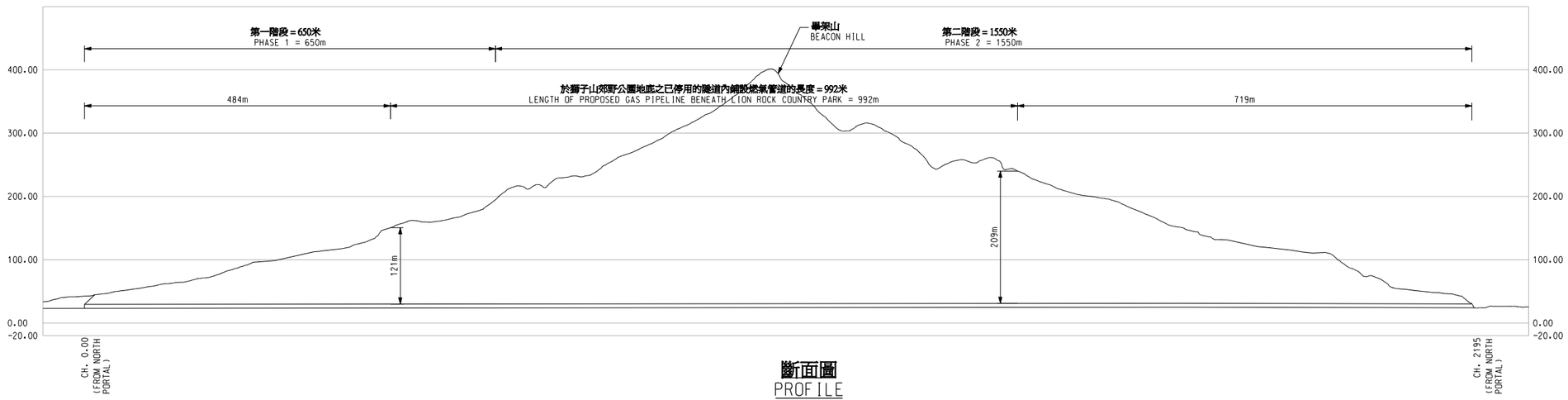
項目沒有相關的環境影響評估報告。

# Figures 附圖




## 規劃圖
PLAN

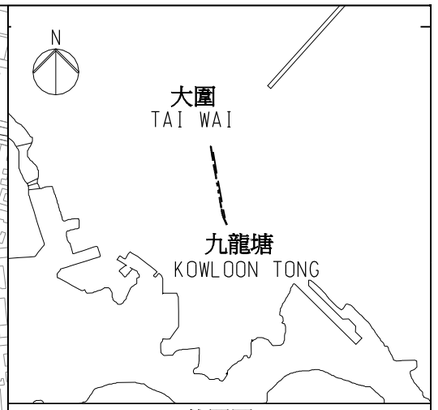
比例 1:4000
SCALE 1:4000




## 斷面圖
PROFILE

比例 1:4000
SCALE 1 : 4000






## 位置圖
KEY PLAN

SCALE 1:40000

**備註:**

**1. 除特別註明外, 所有量度單位均爲米.**

**2. 所有高度單位爲米, 並基於香港主水平基準上.**

**3. 鏈距單位爲米.**

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (mPD).
3. CHAINAGES ARE IN METERS.

**圖例:**

**獅子山郊野公園範圍**
AREA OF LION ROCK COUNTRY PARK

**潛在危險設施諮詢區**
POTENTIALLY HAZARDOUS INSTALLATION (PHI) CONSULTATION ZONE

| Rev | Date | Drawn | Description | Ch'k'd | App'd |
|---|---|---|---|---|---|
| P8 | MAY 11 | JL | REVISED DRAFT | SL | TI |
| P7 | MAY 11 | JL | REVISED DRAFT | SL | TI |
| P6 | APR 11 | JL | REVISED DRAFT | SL | TI |
| P5 | APR 11 | JL | REVISED DRAFT | SL | TI |
| P4 | MAR 11 | JL | REVISED DRAFT | SL | TI |
| P3 | MAY 10 | JL | REVISED DRAFT | SL | TI |
| P2 | MAR 10 | LN | REVISED DRAFT | SL | TI |
| P1 | JUN 09 | TF | DRAFT TO HKCG | SL | TI |

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**工程名稱**

**工程項目簡介 - 於已停用隧道(舊擎架山隧道)內鋪設一條直徑500毫米燃氣管道**

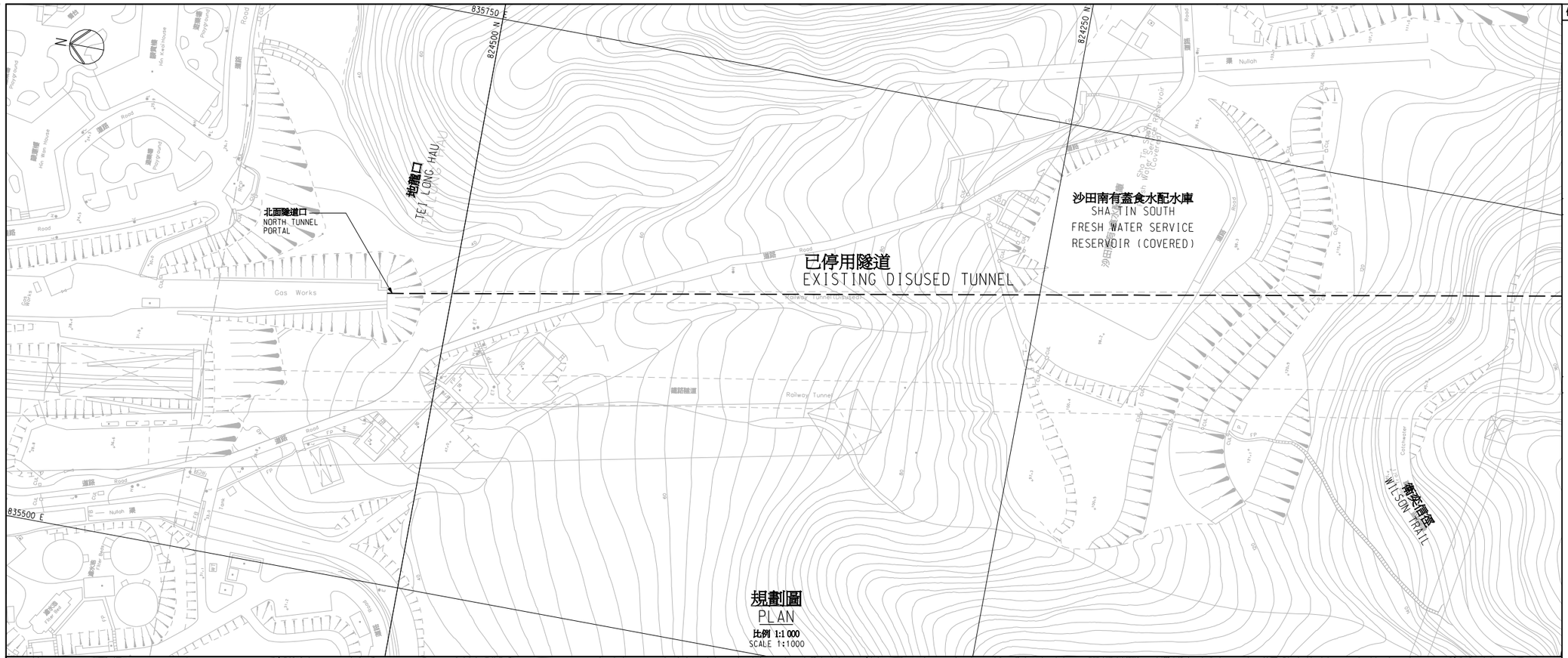
PROJECT PROFILE FOR INSTALLATION OF A 500mm NB GAS PIPELINE INSIDE THE EXISTING DISUSED TUNNEL (OLD BEACON HILL TUNNEL)

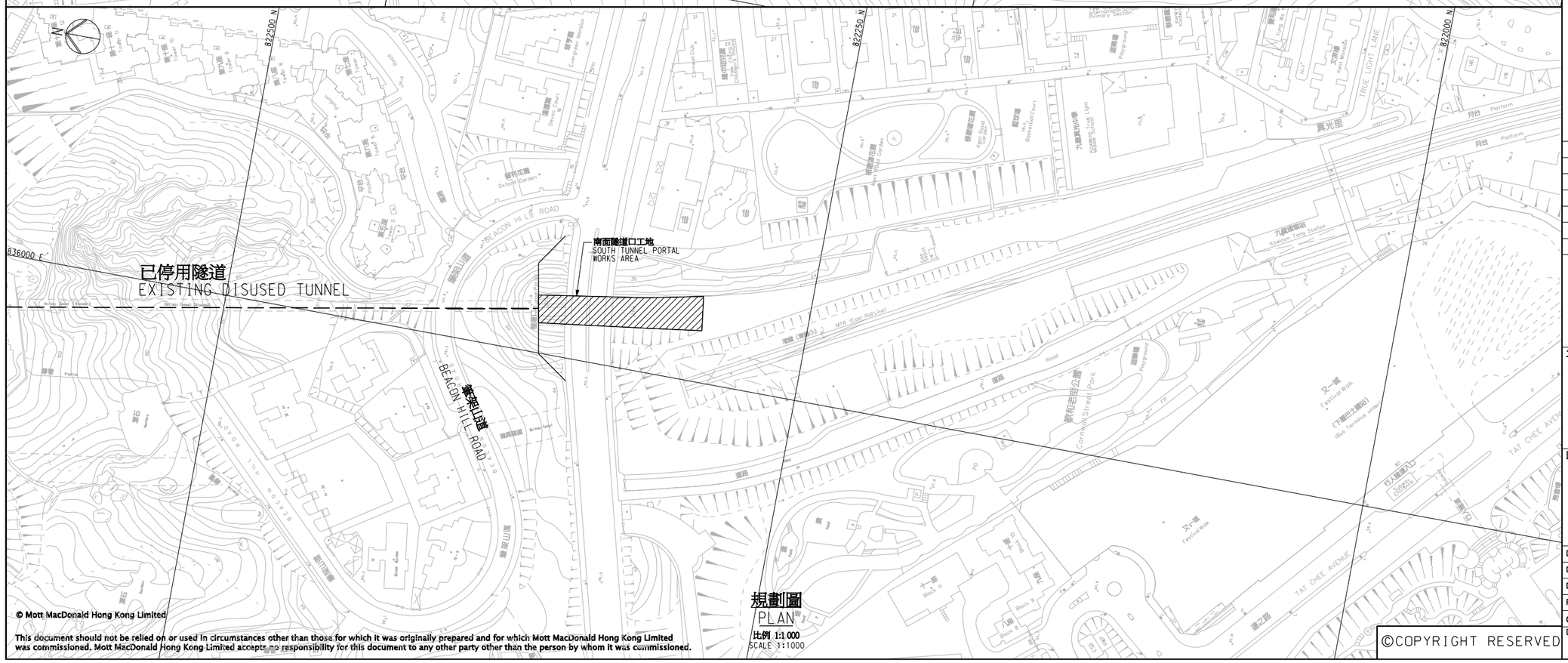
**圖則名稱**

**工程位置圖**

LOCATION OF WORKS

| | | | | | |
|---|---|---|---|---|---|
| Designed | PC | | Eng.Chk. | SL | |
| Drawn | TF | | Approved | TI | |
| Dwg.Chk. | DL | | Scale | 1:4000 | |
| Project | 243563 | | | | Status PRE |
| CAD file | J:\243563\Report\ENV\PRO_REPORT-110526\Figure 1.1-P8.dgn | | | | |
| Drawing No. | FIGURE 圖 1.1 | | | | Rev P8 |






**備註:**

**1. 除特別註明外, 所有量度單位均爲米.**

**2. 所有高度單位爲米, 並基於香港主水平基準上.**

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (mPD).

| Rev | Date | Drawn | Description | Ch'k'd | App'd |
|---|---|---|---|---|---|
| P6 | MAY 11 | JL | REVISED DRAFT | SL | TI |
| P5 | MAY 11 | JL | REVISED DRAFT | SL | TI |
| P4 | MAR 11 | JL | REVISED DRAFT | SL | TI |
| P3 | JAN 11 | JL | REVISED DRAFT | SL | TI |
| P2 | MAR 10 | GYZ | REVISED DRAFT | SL | TI |
| P1 | JUN 09 | TF | DRAFT TO HKCG | SL | TI |

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**工程名稱**

**工程項目簡介 - 於已停用隧道(舊畢架山隧道)內鋪設一條直徑500毫米燃氣管道**

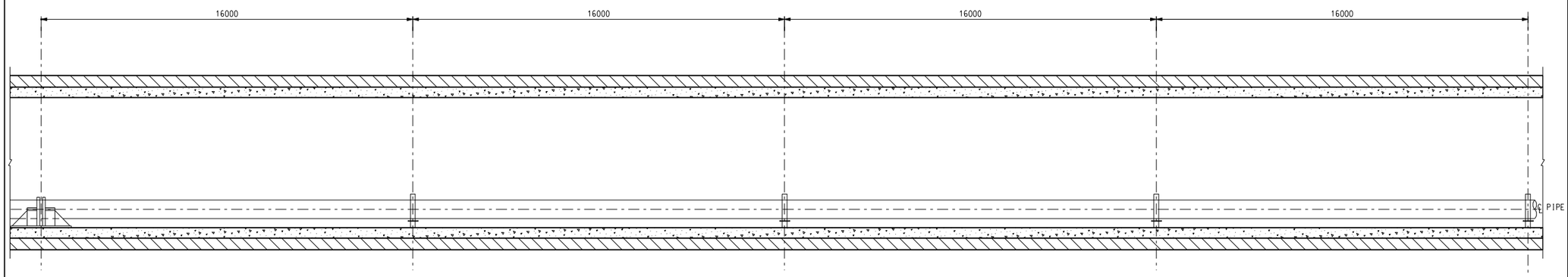
PROJECT PROFILE FOR INSTALLATION OF A 500mm NB GAS PIPELINE INSIDE THE EXISTING DISUSED TUNNEL (OLD BEACON HILL TUNNEL)

**圖則名稱**

**概覽圖**

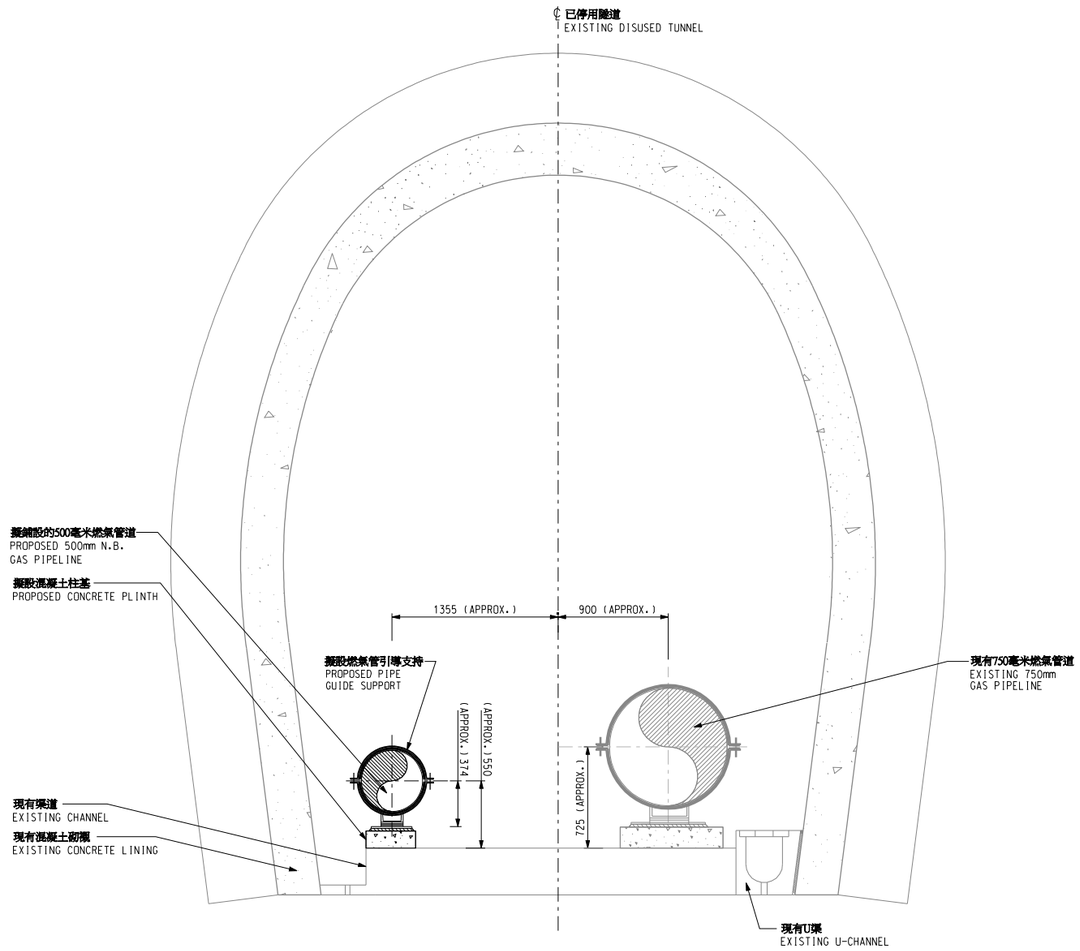
LAYOUT PLAN

| | | | | | |
|---|---|---|---|---|---|
| Designed | JC | | Eng.Chk. | SL | |
| Drawn | TF | | Approved | TI | |
| Dwg.Chk. | DL | | Scale | 1:1000 | |
| Project | 243563 | | | | Status PRE |
| CAD file | J:\243563\Report\ENV\PRO_REPORT-110526\Figure 2.1-P6.dgn | | | | |
| Drawing No. | FIGURE 圖 2.1 | | | | Rev P6 |




## 擬設直徑500毫米燃氣管道的標準正視圖
## ELEVATION VIEW OF PROPOSED 500mm N.B. GAS PIPELINE

**比例** SCALE 1:100




## 擬設直徑500毫米燃氣管道的總體佈置
## PROPOSED 500mm N.B. GAS PIPELINE GENERAL ARRANGEMENT

**比例** SCALE 1:25
**註: 由北向南望**
NOTE : VIEW FROM NORTH TO SOUTH.



**備註:**

1. **除特別註明外, 所有尺寸以毫米爲單位.**
   **所有相對於現有建築物的標示尺寸僅作參考.**
2. **所有工程需符合《土木工程一般規格》(2006年版).**

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL DIMENSIONS RELATING TO THE EXISTING STRUCTURE ARE INDICATIVE ONLY.
2. ALL WORKS SHALL BE COMPLIED WITH GENERAL SPECIFICATION FOR CIVIL ENGINEERING WORKS 2006.

| Rev | Date | Drawn | Description | Ch'k'd | App'd |
|---|---|---|---|---|---|
| P7 | MAY 11 | JL | REVISED DRAFT | SL | TI |
| P6 | MAY 11 | JL | REVISED DRAFT | SL | TI |
| P5 | APR 11 | JL | REVISED DRAFT | SL | TI |
| P4 | MAR 11 | JL | REVISED DRAFT | SL | TI |
| P3 | JAN 11 | JL | REVISED DRAFT | SL | TI |
| P2 | MAR 10 | JL | DRAFT TO HKCG | SL | TI |
| P1 | APR 10 | VN | DRAFT TO HKCG | SL | TI |

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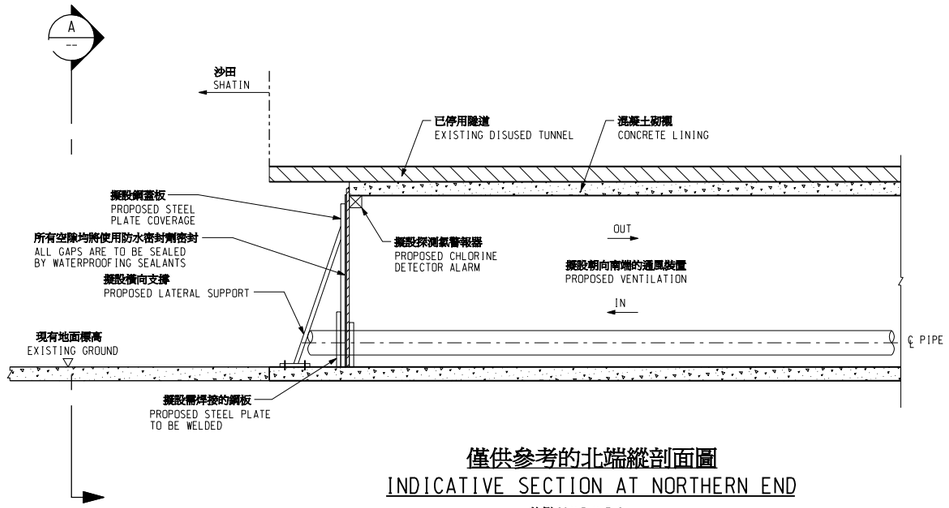
**工程名稱**
**工程項目簡介 - 於已停用隧道(舊畢架山隧道)內鋪設一條直徑500毫米燃氣管道**
PROJECT PROFILE FOR INSTALLATION OF A 500mm NB GAS PIPELINE INSIDE THE EXISTING DISUSED TUNNEL (OLD BEACON HILL TUNNEL)

**圖則名稱**
**擬設直徑500毫米燃氣管道的總體佈置**
GENERAL ARRANGEMENT OF PROPOSED 500mm N.B. GAS PIPELINE

0 25 50 75 100 125
MILLIMETRES
1 : 25

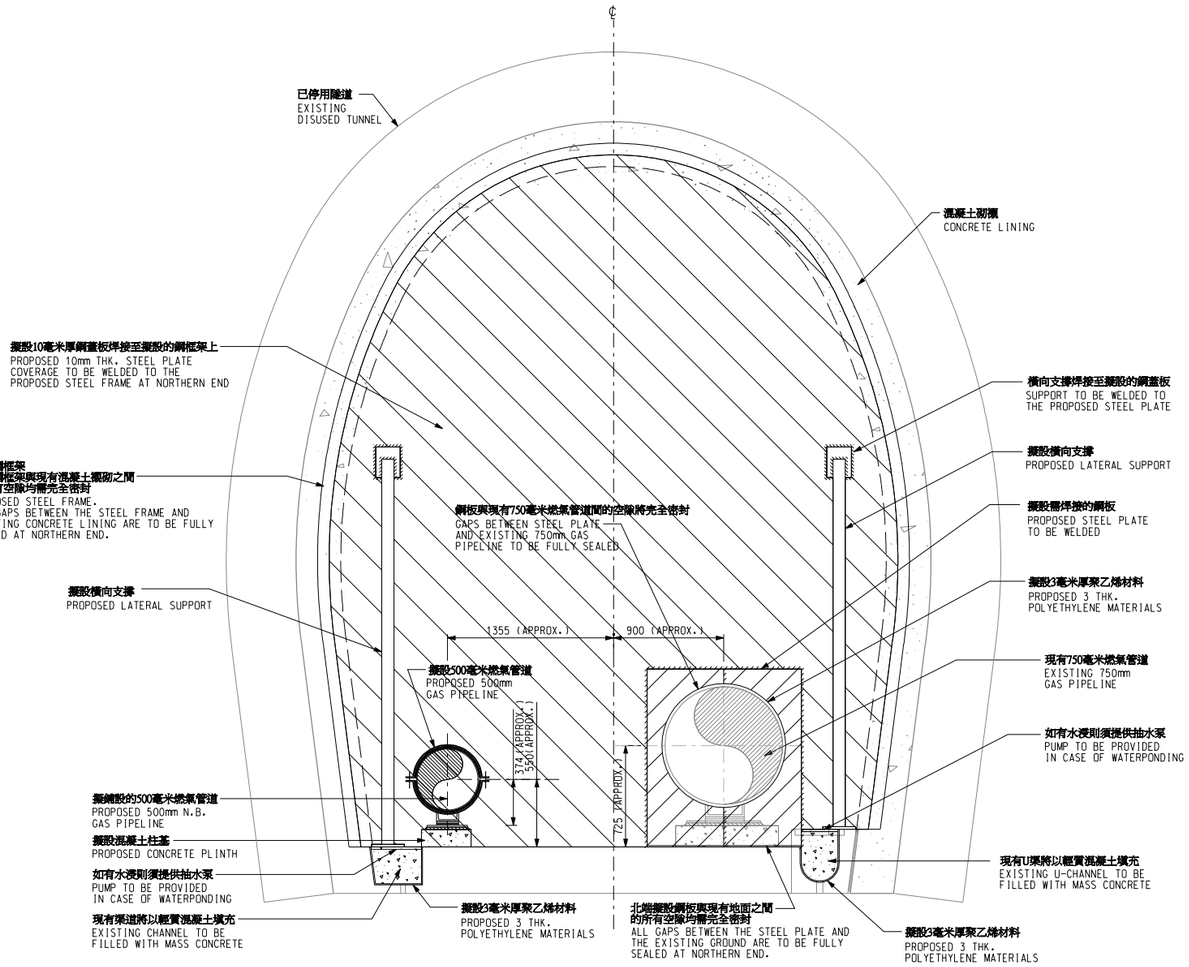


| | | | | | |
|---|---|---|---|---|---|
| Designed | JC | | Eng.Chk. | DL | |
| Drawn | JL | | Approved | JK | |
| Dwg.Chk. | DL | | Scale | AS SHOWN @A1 | |
| Project | 243563 | | | | Status PRE |
| CAD file | J:\243563\Report\ENV\PRO_REPORT-110526\Figure 2.2-P7.dgn | | | | |
| Drawing No. | FIGURE 圖 2.2 | | | | Rev P7 |




## 僅供參考的北端縱剖面圖
## INDICATIVE SECTION AT NORTHERN END

比例 SCALE N.T.S.




## 立面圖 ELEVATION A

比例 SCALE 1:25

## 擬設北端全密封方案
## PROPOSED FULLY SEALED OPTION AT THE NORTHERN END

註: 由北向南望
NOTE : VIEW FROM NORTH TO SOUTH.



**備註:**

1. 除特別註明外, 所有尺寸以毫米爲單位.
   所有相對於現有建築物的標示尺寸僅作參考.
2. 所有工程需符合《土木工程一般規格》(2006年版).

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL DIMENSIONS RELATING TO THE EXISTING STRUCTURE ARE INDICATIVE ONLY.
2. ALL WORKS SHALL BE COMPLIED WITH GENERAL SPECIFICATION FOR CIVIL ENGINEERING WORKS 2006.

| Rev | Date | Drawn | Description | Ch'k'd | App'd |
|---|---|---|---|---|---|
| P8 | MAY 11 | VN | DRAFT TO HKCG | SL | TI |
| P7 | MAY 11 | VN | DRAFT TO HKCG | SL | TI |
| P6 | APR 11 | VN | DRAFT TO HKCG | SL | TI |
| P5 | APR 11 | VN | DRAFT TO HKCG | SL | TI |
| P4 | APR 11 | VN | DRAFT TO HKCG | SL | TI |
| P3 | MAR 11 | VN | DRAFT TO HKCG | SL | TI |
| P2 | MAR 11 | VN | DRAFT TO HKCG | SL | TI |
| P1 | FEB 11 | VN | DRAFT TO HKCG | SL | TI |

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工程名稱

**工程項目簡介 - 於已停用隧道(舊畢架山隧道)內鋪設一條直徑500毫米燃氣管道**

PROJECT PROFILE FOR INSTALLATION OF A 500mm NB GAS PIPELINE INSIDE THE EXISTING DISUSED TUNNEL (OLD BEACON HILL TUNNEL)

圖則名稱

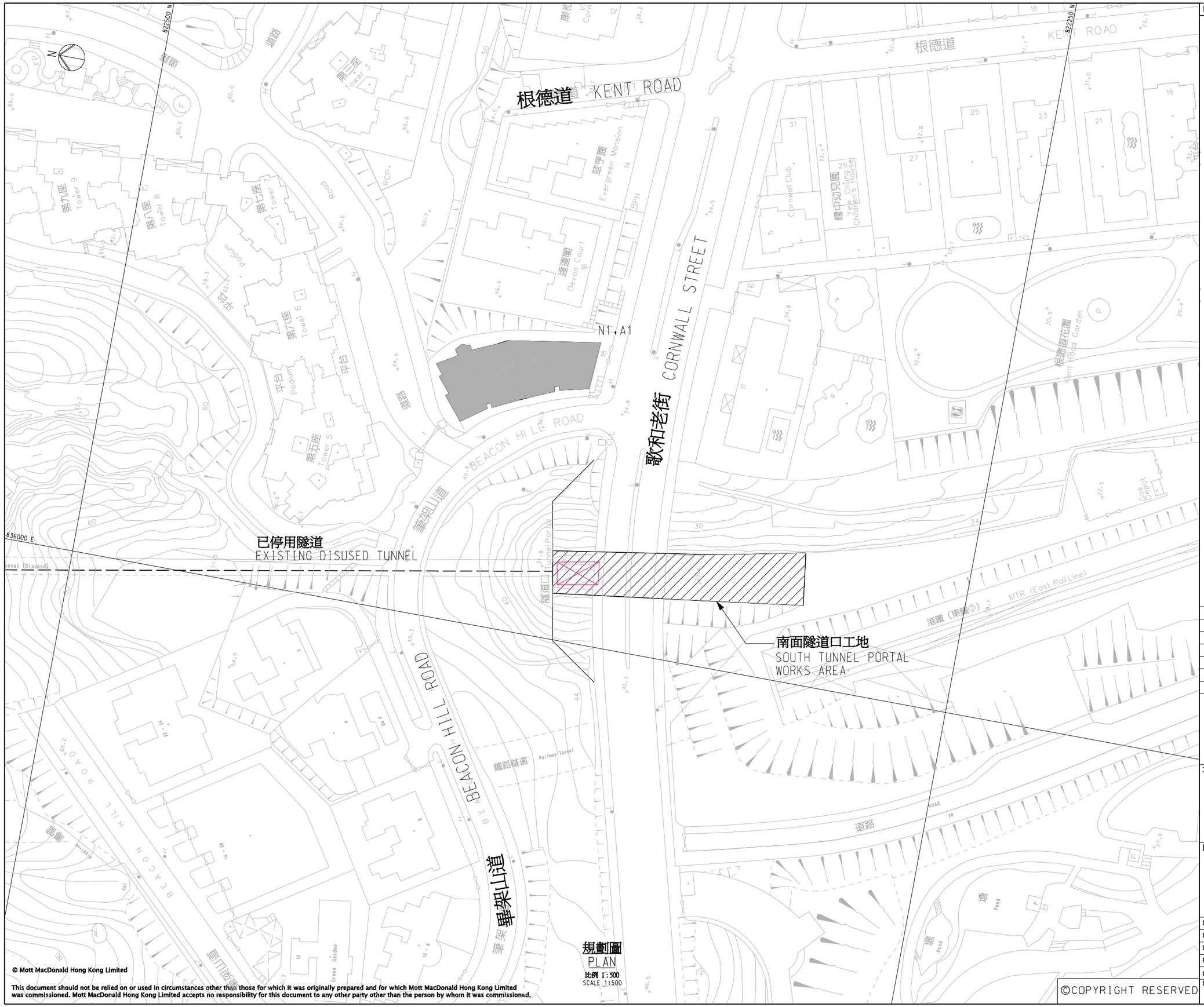
**擬設北端全密封方案**

PROPOSED FULLY SEALED OPTION AT THE NORTHERN END

0 25 50 75 100 125
MILLIMETRES
1 : 25



| | | | | | |
|---|---|---|---|---|---|
| Designed | JC | | Eng.Chk. | DL | |
| Drawn | JL | | Approved | JK | |
| Dwg.Chk. | DL | | Scale | AS SHOWN @A1 | |
| Project | 243563 | | | | Status PRE |
| CAD file | J:\243563\Report\ENV\PRO_REPORT-110526\Figure 2.3-p8.dgn | | | | |
| Drawing No. | FIGURE 圖 2.3 | | | | Rev P8 |






**圖例:**

N1 **具代表性的「噪音感應強的地方」位置**
LOCATION OF REPRESENTATIVE NOISE SENSITIVE RECEIVER

A1 **具代表性的空氣敏感受體位置**
LOCATION OF REPORESENTATIVE AIR SENSITIVE RECEIVER

**機動設備位置**
LOCATION OF POWERED MECHANICAL EQUIPMENT (PME)

| Rev | Date | Drawn | Description | Ch'k'd | App'd |
|---|---|---|---|---|---|
| P6 | MAY 11 | JL | FINAL TO HKCG | SL | TI |
| P5 | MAY 11 | JL | FINAL TO HKCG | SL | TI |
| P4 | MAY 11 | JL | FINAL TO HKCG | SL | TI |
| P3 | MAR 11 | JL | DRAFT TO HKCG | SL | TI |
| P2 | JAN 11 | JL | DRAFT TO HKCG | SL | TI |
| P1 | APR 10 | VN | DRAFT TO HKCG | SL | TI |

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**工程名稱**
**工程項目簡介 - 於已停用隧道(舊畢架山隧道)內鋪設一條直徑500毫米燃氣管道**
PROJECT PROFILE FOR INSTALLATION OF A 500mm NB GAS PIPELINE INSIDE THE EXISTING DISUSED TUNNEL (OLD BEACON HILL TUNNEL)

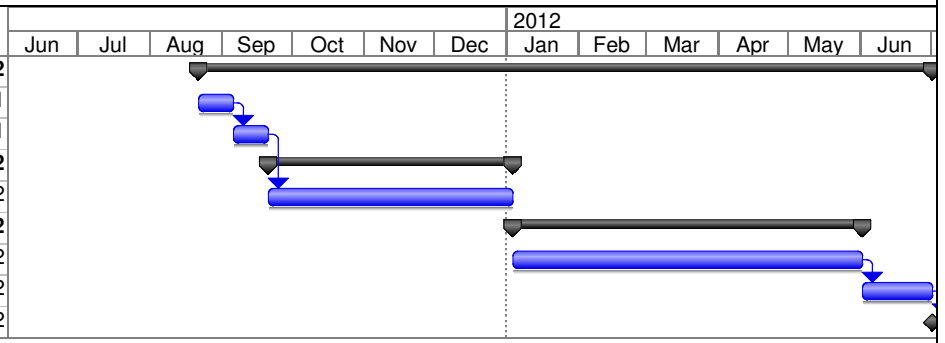
**圖則名稱**
**具代表性「噪音感應強的地方」及空氣敏感受體位置圖**
LOCATION OF REPRESENTATIVE AIR AND NOISE SENSITIVE RECEIVER

| | | | | | |
|---|---|---|---|---|---|
| Designed | PC | | Eng.Chk. | SL | |
| Drawn | TF | | Approved | TI | |
| Dwg.Chk. | DL | | Scale | 1:500 | |
| Project | 243563 | | | | Status PRE |
| CAD file | J:\243563\Report\ENV\PRO_REPORT-110526\Figure 3.1-P6.dgn | | | | |
| Drawing No. | FIGURE 圖 3.1 | | | | Rev P6 |

# Appendix A Tentative Construction Programme

Installation of a 500mm NB Gas Pipeline inside the Existing Disused Tunnel (Old Beacon Hill Tunnel)

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **Installation of a 500mm dia. Pipeline** | **315 days** | **Mon 22/08/11** | **Sun 01/07/12** |
| 2 | Commencement of Contract | 15 days | Mon 22/08/11 | Mon 05/09/11 |
| 3 | Initial Survey & Temporary Works Setup | 15 days | Tue 06/09/11 | Tue 20/09/11 |
| 4 | **Phase 1 - 0m to 650m from Tunnel North End** | **105 days** | **Wed 21/09/11** | **Tue 03/01/12** |
| 5 | Pipe Welding & Associated Installation | 105 days | Wed 21/09/11 | Tue 03/01/12 |
| 6 | **Phase 2 - 0m to 1550m from Tunnel South End** | **150 days** | **Wed 04/01/12** | **Fri 01/06/12** |
| 7 | Pipe Welding & Associated Installation | 150 days | Wed 04/01/12 | Fri 01/06/12 |
| 8 | Testing & Commissioning | 30 days | Sat 02/06/12 | Sun 01/07/12 |
| 9 | Completion of Works | 0 days | Sun 01/07/12 | Sun 01/07/12 |




Date: Mon 30/05/11

Task Milestone Summary

# Appendix B Construction Plant Inventory

| PME | TM or other reference | No. of PME | SWL, dB(A)/ unit | Screening Effect, dB(A) | % on time | Total SWL, dB(A) |
|---|---|---|---|---|---|---|
| **Activity 1 Anchor Installation** | | | | | | |
| Generator, silenced, 75 dB(A) at 7 m | CNP 102 | 1 | 100 | -5 | 100% | 95 |
| Ventilation fan | CNP 241 | 1 | 108 | -5 | 100% | 103 |
| | | | | | **Total** | **104** |
| | | | | | | |
| **Activity 2 Pipe Laying** | | | | | | |
| Generator, silenced, 75 dB(A) at 7 m | CNP 102 | 1 | 100 | -5 | 100% | 95 |
| Ventilation fan | CNP 241 | 1 | 108 | -5 | 100% | 103 |
| | | | | | **Total** | **104** |
| | | | | | | |

# Appendix C Construction Noise Impact

| Construction Noise Impact on N1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Noise Criterion, Leq (30 min) =** | **75 dB(A)** | | | | | | | | | |
| **PME** | **TM or other reference** | **No. of PME** | **SWL, dB(A)/ unit** | **Screening Effect, dB(A)** | **% on time** | **Total SWL, dB(A)** | **Horizontal dist. from NSR, m** | **Dist. Corr., dB(A)** | **Façade Corr., dB(A)** | **CNL, dB(A)** |
| **Activity 1 Anchor Installation** | | | | | | | | | | |
| Generator, silenced, 75 dB(A) at 7 m | CNP 102 | 1 | 100 | -5 | 100% | 95 | 48.0 | -41.6 | 3.0 | 56.4 |
| Ventilation fan | CNP 241 | 1 | 108 | -5 | 100% | 103 | 48.0 | -41.6 | 3.0 | 64.4 |
| | | | | | **Total** | 104 | | | **Total** | **65.0** |
| | | | | | | | | | | |
| **Activity 2 Pipe Laying** | | | | | | | | | | |
| Generator, silenced, 75 dB(A) at 7 m | CNP 102 | 1 | 100 | -5 | 100% | 95 | 48.0 | -41.6 | 3.0 | 56.4 |
| Ventilation fan | CNP 241 | 1 | 108 | -5 | 100% | 103 | 48.0 | -41.6 | 3.0 | 64.4 |
| | | | | | **Total** | 104 | | | **Total** | **65.0** |
| | | | | | | | | | | |

# Appendix D Cave Dwelling Bat Survey

# Cave Dwelling Bat Survey

## 1. Introduction

Abandoned tunnel, cave, mines, drainage culverts and air raid shelters with less human disturbance could be used for bat roosting. The Project Area Beacon Hill Tunnel is maintained and regularly checked by the Hong Kong and China Gas Company Limited (HKCG) for the maintenance of the steel pipeline inside the disused tunnel. Although field worker reported no sighting of bats during their regular maintenance work, a cave dwelling bat survey was conducted to check if any bat colony is present.

## 2. Method

Field survey was conducted on 22 April 2010 a.m., by an ecologist and an assistant accompanied by a HKCG staff. The whole tunnel has been walked through from northern portal to southern portal. Direct observation at the roof of the tunnel and active searching of the crevice was made throughout the whole survey period with an aid of binocular and torch.

## 3. Result

In order to provide a safe working environment for the staff working inside the tunnel, the tunnel was illuminated and a ventilation fan was kept operating at the northern portal during the whole survey period. The whole tunnel was surveyed thoroughly but no bat or its dropping was found. Site photos taken are presented in **Photos 1** and **2**.

## 4. Reference

Shek, C.T and Chan, C.S.M. (2005) Roost Censuses of Cave Dwelling Bats of Hong Kong. *Hong Kong Biodiversity*, Issue No. 10. Agriculture, Fisheries and Conservation Department.

**Photo 1**: Site photo taken on 22 April, 2010 at the mid section of the tunnel indicating the absence of bat colony.

**Photo 2**: Southern portal of the tunnel.

# Appendix E Plates

Plate 1 View of South Tunnel Portal

Plate 2 View of North Tunnel Portal

# Appendix F Analysis on Potential Fatalities

# Analysis on Potential Fatalities

Before considering the potential fatalities of the Project due to its proximity to STWTW, it is worth to note the following project settings and precautionary measures:

1. Site office and stockpile area will be sited at level ground outside south end of the disused tunnel, which is not affected by accidental chlorine release.

2. Before commencement of the works, the existing pipeline as well as the 130m underground pipe section outside each end of the tunnel will be temporary decommissioned, free of town gas and filled with inert gases under nominal pressure. A fully sealed cross-sectional coverage of tunnel will be erected at north end of tunnel. As this only opening at north end of disused tunnel is to be sealed, the disused tunnel is entirely isolated from the north tunnel portal.

3. The installation of proposed gas pipeline within the disused tunnel will be divided into 2 phases, Phase 1 – 0m to 650m from Tunnel north end and Phase 2 – 0m to 1550m from Tunnel south end. Phase 2 works area is entirely out of PHI Consultation Zone. The construction workforce of Phase 1 would be around 3 to 9 during normal construction period (7am to 7pm). 9 workers will be working within tunnel only for a transient period to deliver pipes to designated area. Masks for workers within tunnel will be provided to prevent harm from chlorine leakage.

4. Installation works of Phase 2 will be followed after completion of Phase 1 works. Upon completion of Phase 1 works, a temporary locked fence will be erected at interface of Phase 1 and Phase 2 works area. Thus, workers activities will be confined to Phase 2 works area, 0m to 1550m from Tunnel south end. No workers will be allowed to cross the fence at interface of Phase 1 and Phase 2 works area. Thus, workers activities will be confined to Phase 2 works area, 0m to 1550m from Tunnel south end.

5. During the construction period, sufficient forced ventilation will be provided. Fresh air will be fed into the tunnel by blowers located at the Tunnel south end and continuously extracted from the tunnel by exhaust fans at the Tunnel south end.

6. Chlorine detectors will be installed near the North tunnel end inside the tunnel. Alarm will be triggered upon detection of any chlorine ingress, and all workers will be evacuated towards the south portal of the tunnel.

7. Communication channel will be established with the STWTW operation staff during construction phase.

A worst scenario is considered to estimate the potential fatalities of the Project due to its proximity to STWTW. This scenario requires simultaneous occurrence of the following cases:

1. Damage (roof collapse) to the chlorine storage room occurs due to a remote catastrophe, i.e. aircraft crash or high-intensity earthquake, leading to rupture of multiple chlorine storage drums. In this case, LD90 contour might reach the north portal of the Tunnel.

2. Damage to the fully sealed cross-sectional coverage of tunnel erected at north end of the Tunnel.

3. Installation works of Phase 1 is in progress, i.e., no more than 4 workers are inside Phase 1 tunnel for pipe installation work. For a transient period to deliver pipes to designated works area, maximum 9 workers will be working within the Tunnel.

4. Failure of STWTW operation staff to notify the project workers to dismiss from the tunnel to south portal of the tunnel.

5. Failure of chlorine detectors to detect chlorine ingress and alert the workers to leave the tunnel towards Kowloon Tong.

6. Failure of forced ventilation to dilute the chlorine infiltrated into the tunnel.

7. Failure of workers inside the tunnel to wear masks against the chlorine hazard.

For the above extremely worst scenario, the same protection factor for persons inside buildings are taken, i.e., 10% of that for a person remaining out of doors. Thus, the probability of fatality of workers inside the tunnel is taken as 0.9 x 10% = 0.09. The anticipated fatality is calculated to be 0.09 x 4 = 0.36 for normal working hours, 0.09 x 7 = 0.63 under accelerated programme, and 0.09 x 9 = 0.81 for a transient period for pipe delivery. In any cases, less than 1 fatality is expected due to inhalation of chlorine vapour.

Meanwhile, it is worth to note that likelihood of such worst scenario is extremely low because it requires simultaneous occurrence of a remote serious accident and failure of a series of precautionary measures. Therefore, it can be concluded the contribution of the Project to the overall risk of STWTW is negligible.