Mott MacDonald

Appendix K

Key Assessment Assumptions and Methodologies

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15 June 2009

Urgent By Fax : 25167979

The Hong Kong and China Gas Company Limited,
Gas Supply Planning Department, 17th floor,
363 Java Road, North Point,
Hong Kong
(Attn: Mr. SHUM Chuen Kui, Sam / Gas Supply Planning Manager)

→ Florence Yuen. 袁

Ming

Dear Mr. Shum,

Environmental Impact Assessment Ordinance (EIAO)
Project Title: Installation of Submarine Gas Pipelines from Ma Tau Kok to North Point for Former Kai Tak Airport Development
(EIA Study Brief No. ESB-171/2007)

Water Quality Methodology Paper

I refer to a letter from your consultant, Mott Connell (ref: PEJ/TI/TT/FY/T237926/30.03/L-0319) dated 27 May 2009 submitting the captioned revised Water Quality Methodology Paper for our agreement under Sections 3.4.1.4 and Appendix A of the EIA Study Brief No. ESB-171/2007.

Please be informed that after taking into the advice from our water assessment team, the submitted proposal is considered as acceptable. As such, agreement is hereby given under the following requirement of the captioned EIA Study Brief:

Reference in the Study Brief Stipulating the Requirements	Key Description
Section 3.4.1.4	The Applicant shall predict, quantify and assess any water quality impacts arising from the Project on the water system(s) and the sensitive receivers by appropriate mathematical modelling and/or other techniques proposed by the Applicant and agreed by the Director. The mathematical modelling requirements are set out in Appendix A to this study brief. The impacts shall include any significant changes in hydrology, flow regime, sediment erosion and deposition patterns, water and sediment quality and marine organisms/community due to the dredging and backfilling for the laying of the submarine pipeline and any marine works; any hydrostatic/commissioning tests of the gas pipeline system; sewage, wastewater and surface runoff from construction activities. The prediction shall include different implementation stages or sequences.
Appendix A	Model details – Simulation 2. The sediment transport module for assessing impacts of sediment loss due to marine works shall include the processes of settling, deposition and re-erosion. The values of the modelling parameters shall be

	agreed with EPD. Contaminants release and DO depletion during dredging and dumping shall be simulated by the model. 3. The models shall at least cover the Hong Kong waters, the Pearl Estuary and the Dangan Channel to incorporate all major influences on hydrodynamic and water quality. A fine grid model may be used for detailed assessment of this study. It shall either be linked to a far field model or form part of a larger model by gradual grid refinement. The coverage of the fine grid model shall be properly designed such that it is remote enough so that the boundary conditions would not be affected by the waterway and the proposed disposal ground. The model coverage area shall be agreed with EPD. 4. In general, grid size at the area affected by the project shall be less than 400 m in open waters and less than 75 m around sensitive receivers. The Kai Tak Approach Channel shall have at least 4 grids across it to better resolve transverse variations of the Channel. The grid schematization shall be agreed with EPD. <u>Modelling assessment</u> 5. Cumulative impacts due to other projects, activities or pollution sources within a boundary to the agreement of EPD shall also be predicted and quantified.

Nevertheless, your company and the consultant should note that according to Section 3.4 of the EIAO-Technical Memorandum, the assessment shall be based on the best available information at the time of the assessment. The above agreement is only for the concerned requirements under the EIA Study Brief to facilitate the EIA study. It shall not prejudice the Director of Environmental Protection's future decisions on any application for approval of the EIA report under the EIAO. If there is any significant change in circumstances, project design/details or assessment methodology/assumptions, etc. your company and the consultant should review the situations; carry out necessary updating/revisions; and seek our advice whether further agreements under the EIA Study Brief are necessary.

You are also reminded that the requirements on documentations of key assessment assumptions, limitations of assessment methodologies and related prior agreement(s) with the Director of Environmental Protection as stipulated under Section 3.4.11 of the EIA Study Brief shall be followed.

Yours sincerely,

(Victor YEUNG)
Senior Environmental Protection Officer
for Director of Environmental Protection

c.c.:
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Installation of Submarine Gas Pipelines and Associated Facilities from To Kwa Wan to North Point for Former Kai Tak Airport Development

Water Quality Modelling Methodology Paper

Document No. 237926/19/D

January 2009

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Issue and Revision Record

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A	February 2008	Isaac Chu	Florence Yuen	Dr Anne F Kerr	Draft
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C	October 2008	Isaac Chu	Florence Yuen	Dr Anne F Kerr	Revised Draft
D	January 2009	Isaac Chu	Florence Yuen	Dr Anne F Kerr	Revised Draft

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1 INTRODUCTION

1.1 Overview

1.1.1 Mott Connell was appointed by the Hong Kong and China Gas Company Limited to carry out the Feasibility Study and Detailed Design including the Environmental Impact Assessment for the Installation of Submarine Gas Pipelines and Associated Facilities from To Kwa Wan to North Point for the Former Kai Tak Airport Development (hereinafter called "the Project").

1.1.2 As part of the project scope, a twin submarine gas pipeline from To Kwa Wan to North Point is required to be laid to make way for the Cruise Terminal Development at the future South East Kowloon Development and for the Central Kowloon Route Project. It is anticipated that pipe pulling by bottom pull and lay-barge methods will likely be used to construct the submarine gas pipeline and a trench would need to be dredged likely by grab dredger in Victoria Harbour before laying the pipeline during construction. The location of the proposed submarine gas pipelines alignment is shown in **Figure 1.1**.

1.1.3 With reference to the EIA Study Brief No. ESB-171/2007, the Study Area for water quality assessment shall cover the Victoria Harbour, Western Buffer and Eastern Buffer Water Control Zones (WCZs). It is however considered that the potential water quality impact upon the distant receivers in Western Buffer WCZ would be minimal. The water quality impact assessment would focus on the area that would be likely affected by the Project including the Victoria Harbour and Eastern Buffer WCZs.

1.1.4 From the preliminary findings, it has been considered that grab dredging of seabed and pipe-pulling by bottom pull and lay-barge methods will be chosen as the preferred construction method.

1.1.5 In the bottom pull method for pipe pulling, pipes are joined to form pipe strings which are progressively pulled from a landfall site into a pre-dredged trench underwater by a winch set up at the landfall site at the other side of the waters until the crossing is complete. In the lay barge method for pipe pulling, while the work barge moves along the pipeline, the pipes are progressively added to form a string, which are hung in a catenary form at the back of the barge, additional marine plants are required to transport pipes from the shore to the work barge throughout the mainlaying operation. Water quality impact is not anticipated from works associated with bottom pull and lay barge methods for pipe pulling.

1.1.6 As a result, the modelling methodology described in the sessions below will be based on the assumption that closed grab dredgers will be used during construction.

2 CONSTRUCTION PROGRAMME

2.1 Overview

2.1.1 Construction of the proposed submarine gas pipelines from To Kwa Wan to North Point for Former Kai Tak Airport Development is scheduled to commence in April 2010 for completion by December 2011. Major marine works includes trench dredging and

backfilling by placement of rockfill. Dredging is scheduled to take place from July 2010 to December 2010 while backfilling by placement of rockfill is scheduled to take place from February 2011 to July 2011.

3 WATER SENSITIVE RECEIVERS

3.1 Overview

3.1.1 Water sensitive receivers have been identified in accordance with the Hong Kong Planning Standards and Guidelines (HKPSG) and the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM). Water sensitive receivers in Victoria Harbour and its adjacent waters within the designated WCZs were considered and identified. They include:

WSD Salt Water Intakes

- Tsing Yi Salt Water Pumping Station and Intake;
- Cheung Sha Wan Salt Water Pumping Station and Intake;
- Kowloon South Salt Water Pumping Station and Intake;
- Yau Ma Tei Salt Water Pumping Station and Intake.
- Tai Wan Salt Water Pumping Station and Intake;
- Cha Kwo Ling Salt Water Pumping Station and Intake;
- Yau Tong Salt Water Pumping Station and Intake;
- Siu Sai Wan Salt Water Pumping Station and Intake;
- Heng Fa Chuen Salt Water Pumping Station and Intake;
- Sai Wan Ho Salt Water Pumping Station and Intake;
- Quarry Bay Salt Water Pumping Station and Intake;
- Wan Chai Salt Water Pumping Station and Intake;
- Sheung Wan Salt Water Pumping Station and Intake;
- Kennedy Town Salt Water Pumping Station and Intake;

Cooling Water Intakes

- MTRC Tsing Yi Station;
- MTRC Kowloon Station;
- China H.K. City;
- Harbour City;
- Ocean Centre;
- Ocean Terminal;
- Government Premises;
- New World Centre;
- East Rail Extension;
- Yau Tong Bay Ice Plant;
- Pamela Youde Nethersole Eastern Hospital;
- Provident Centre;
- City Garden;
- Windsor House;
- Excelsior Hotel and World Trade Centre;
- Sun Hung Kai Centre;
- Great Eagle Centre / China Resources Building;
- Wan Chai Tower / Revenue Tower / Immigration Tower;

- Telecom House / Hong Kong Academy for Performing Arts (HKAPA) / Shun On Centre;
- Hong Kong Convention and Exhibition Centre Phase I;
- Hong Kong Convention and Exhibition Centre Extension;
- Queensway Government Offices;
- Hong Kong and Shanghai Bank (HSBC) Pumping Station Intake;
- Prince's Building Group, Mandarin Hotel Intakes;
- MTRC South Intake;
- Sha Wan Drive;
- Queen Mary Hospital;
- North Point Government Offices;
- Taikoo Place.

Corals

- Cape Collinson
- Green Island
- Sandy Bay

Fish Culture Zone

- Tung Lung Chau
- Ma Wan

3.1.2 The locations of the Water Quality Sensitive Receivers and EPD's Routine Water Quality Monitoring Stations are shown in **Figure 2**. The water quality sensitive receivers identified in the WCZs would be addressed in the water quality assessment. The assessment area would be extended to include other areas if the water quality sensitive receivers are found also being impacted during the course of the EIA study and have a bearing on the environmental acceptability of the Project.

3.1.3 All the sensitive receivers would be defined as water quality monitoring points in the model to obtain the key water quality parameters for determination of water quality changes as a result of the construction activities.

4 ASSESSMENT METHODOLOGY

4.1 General

4.1.1 The assessment of the water quality impact arising from the construction follows relevant criteria and guidelines for evaluating and assessing water pollution, including Annex 6 and Annex 14 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) issued by EPD under Section 16 of the EIAO which specifies the assessment method and criteria that are relevant to water quality assessment.

4.1.2 As no maintenance dredging is required for the operation phase, there would be no anticipated water quality impact during the operation of the submarine gas pipelines and therefore the modelling for operation phase is not necessary.

4.2 Hydrodynamic Models

Set-up of Hydrodynamic Model

4.2.1 Computer modelling was employed to assess the potential impact on water quality in Victoria Harbour, Western Buffer and Eastern Buffer WCZs associated with the construction of the proposed submarine gas pipelines for different tidal conditions. The hydrodynamic and water quality models were developed by Delft Hydraulics, namely Delft3D-FLOW and Delft3D-WAQ respectively.

4.2.2 In this study, it is proposed that the basis for modelling of the harbour waters is the existing, validated Western Harbour Model (**Figure 3**). This model would cover the relevant part of the Hong Kong waters, including the Pearl Estuary and the Dangan (Lema) Channel. To ensure that an accurate coastline profile is used in the modelling, the existing model would be refined with the most recently available information of the proposed developments, from sources such as designated projects under EIAO.

4.2.3 The resolution of the grid of model is between 100 and 200m in the project area. A locally refined domain in the project area would be inserted to obtain the above-said resolution. The grid mesh would be further modified to generate higher resolution (about 50 m x 100 m) in the vicinity of the proposed submarine gas pipelines (**Figure 5**).

Simulation Periods

4.2.4 The simulated periods cover a complete spring-neap tidal cycle. The actual simulation period is preceded by a spin-up period. The simulation periods are specified below:

Spin-up dry season:	2 February 12:00 – 9 February 12:00
Dry season:	9 February 12:00 – 23 February 12:00
Spin-up wet season:	19 July 04:00 – 26 July 04:00
Wet season:	26 July 04:00 – 9 August 04:00

4.2.5 In order to determine if spin-up period is sufficient for the simulation, the model is run for one more spring-neap cycle (Run 2, Appendix A). The results for water levels and salinity during wet and dry seasons show no significant difference in the values and pattern/phase between the first spring-neap-cycle (Run 1, Appendix A) and Run 2, which suggesting the spin-up period for Run 1 is sufficient.

Boundary Conditions for Water Quality Models

4.2.6 The initial and boundary conditions are set to zero suspended solids concentrations for the modelling exercise and the sediment release from the proposed dredging for the submarine gas pipeline and marine works from concurrent projects will be added to the background manually.

Verification of new model

4.2.7 The appropriateness of the new model is checked against the original Sai Ying Pun Model.

Four locations and one cross-section is included in the verification. Various parameters including Salinity, Water Level, Current Speeds, Temperature, Momentary and Accumulated Fluxes of the spin-up period have been checked and the results have been plotted in Appendix A.

4.3 Sediment Plume Modelling

General

4.3.1 Water quality impacts would arise from dredging activities of the proposed submarine gas pipelines that would disturb the marine bottom sediment, elevate the SS concentrations of the water column and generate sediment plume along the tidal flows. The impact of sediment plume dispersion during the marine works was simulated by a three-dimensional Delft3D-WAQ Model. The WAQ model simulated suspended solids (SS, in mg/L), optionally subdivided over different fractions representing different sediment sources. The simulated SS represented the project related discharges only. The calculated concentrations were interpreted as excess concentrations on top of the background concentrations.

4.3.2 The Delft3D-WAQ model takes into account the sedimentation process by means of a settling velocity, while erosion of bed sediment, causing resuspension of sediment, is governed by a function of the bed shear stress. The parameters adopted in the model are summarised in **Table 4-1**.

Table 4-1 Summary of Parameters for Sediment Plume Model (Delft3D-WAQ)

Model Parameters	
Settling velocity	0.5mm/s
Critical shear stress for deposition	0.2N/m^2
Critical shear stress for erosion	0.3N/m^2
Minimum depth where deposition allowed	0.1m
Resuspension rate	30g/m^2/d

Reference: EIA Report for Laying of Western Cross Harbour Main and Associated Land Mains from West Kowloon to Sai Ying Pun (EIAO Register No. AEIAR-109/2007)

4.3.3 The impacts in terms of DO depletion, unionised ammonia (NH_3-N) and total inorganic nitrogen (TIN) would not be modelled explicitly, but will be estimated on the basis of the calculated sediment concentrations. This would lead to an estimated increase relative to the background of the concentrations of different contaminants, dependent on the quality of the released sediments.

4.3.4 For TIN, it is assumed that the total nitrogen content, being ammonia content and Kjedahl-N of the sediment is transformed to TIN. For NH_3-N, it is assumed that the entire nitrogen content of the bottom is transformed to ammonium and unionised ammonia. The percentage unionised ammonia is estimated on the basis of temperature, salinity and pH on the basis of the formulations used in Delft3D-WAQ (Delft3D-WAQ Technical Reference Manual, September 2005, WL | Delft Hydraulics). The estimation of the factor is worst case and different for wet and dry season. Analogously, this would lead to an estimated decrease relative to the background of the concentrations of DO, dependent on the quality of the released sediments. For DO it is assumed that the entire SOD content of the sediment is transformed to DO decrease. This can be expressed as follows:

$$\Delta TIN(x, y, z, t) = \Delta SS(x, y, z, t) \times (C_{SS,NH4} + C_{SS,Kj-N})$$

$$\Delta NH3(x, y, z, t) = \Delta SS(x, y, z, t) \times (C_{SS,NH4} + C_{SS,Kj-N}) \times f(sal, T, pH)$$

$$\Delta DO(x, y, z, t) = -\Delta SS(x, y, z, t) \times C_{SS,SOD}$$

where

TIN	concentration of Total Inorganic Nitrogen (mgN/L)
SS	concentration of suspended solids (mg/L)
$C_{SS,NH4}$	concentration of ammonium in suspended matter (gN/gSS)
$C_{SS,Kj-N}$	concentration of Kjedahl-N in suspended matter (gN/gSS)
f(sal,temp,pH)	factor unionised ammonia (gNH3/(gNH4+gNH3)
sal	Salinity (ppt)
T	Temperature (Celsius)
pH	pH
DO	concentration of dissolved oxygen (mg/L)
$C_{SS,SOD}$	concentration of SOD in suspended matter (gO/gSS)

4.3.5 This approach relies on worst case assumptions. Any removal of pollutants from the water phase with the sedimentation of SS and any replenishment of DO from the atmosphere is neglected.

4.3.6 The values used in this assessment are based on the highest EPD routine marine sediment quality monitoring data recorded at VS3 in 2006 near the dredging area and are summarised in **Table 4-2**. $C_{SS,SOD}$ is extracted from the laboratory analysis data of sediment samples during Ground Investigation of the Project.

Table 4-2 Sediment Quality near the Dredging Area

Parameters	Dry season	Wet season
$C_{SS,NH4}$	6.1E-6	11E-6
$C_{SS,Kj-N}$	1200E-6	510E-6
f(sal,temp,pH)	0.1	0.05
sal	33	30
T	21	26
pH	8.0	7.9

Modelling Scenario

4.3.7 With reference to the construction programme and likely concurrent projects, representative worst case scenarios has been selected for modelling, including all the potentially concurrent dredging activities envisaged during the proposed dredging works for installation of submarine gas pipelines.

Scenario 1 – Installation of Submarine Gas Pipeline Only

4.3.8 This scenario assumes no marine works is taking place concurrently with the dredging for the Installation of the Submarine Gas Pipelines for Former Kai Tak Airport Development.

Scenario 2 – Installation of Submarine Gas Pipeline with Concurrent Projects

4.3.9 This scenario assumes the following marine works would take place concurrently in the Year 2010 and 2011:

- Dredging of the trench for Installation of the Submarine Gas Pipelines for Former Kai Tak Airport Development

- Dredging at and near the existing seawall of the former Kai Tak Airport runway for construction of the Phase I Berth for Proposed Cruise Terminal at Kai Tak

- Dredging in the Harbour area for cruise vessel approach to the Phase I Berth for Proposed Cruise Terminal at Kai Tak

- Dredging for seawall foundation at the former Kai Tak Airport runway for the new public landing steps cum fireboat berth for Proposed Cruise Terminal at Kai Tak

- Dredging for seawall foundation at TCBR Stage 1 West for Wan Chai Development Phase II and Central-Wan Chai Bypass

- Dredging along the proposed alignment of the submarine sewage pipeline of the Wan Chai East Sewage Screening Plant for Wan Chai Development Phase II and Central-Wan Chai Bypass

4.3.10 The sediment source locations near the proposed submarine gas pipelines are shown in **Figure 4**.

4.3.11 The sediment source locations for Dredging Works for Proposed Cruise Terminal at Kai Tak and Wan Chai Development Phase II were based on information available from the approved Environmental Impact Assessment (EIA) Report and the EIA Report available for public inspection respectively.

Sediment Loss Rates

4.3.12 The following assumptions are made in the sediment plume modelling simulations:

- Closed grab dredger with 8 m^3 capacity would be used for the proposed dredging activities to be included in the sediment plume modelling.

- With respect to the rate of sediment loss during dredging, the Contaminated Spoil Management Study reviewed relevant literature and concluded that losses from closed grab dredgers were estimated at 11 to 20 kg m^{-3} of mud removed. Taking the upper figure of 20 kg m^{-3} to be conservative, the loss rate in kg s^{-1} was calculated based on the daily volume rate of dredging (Assuming a dry density for marine sediment of 1,300 kg m^{-3}, the sediment loss during dredging is equivalent to a spill amount of 1.54%)

- Sediment loss rates during dredging and filling activities for Proposed Cruise Terminal at Kai Tak and Wan Chai Development Phase II would be based on the values adopted in approved EIA Report and the EIA report available for public inspection respectively.

4.3.13 The production rates for different construction activities were identified and the calculated sediment loss rates for Scenarios 1 and 2 are shown in **Table 4-3** and **Table 4-4**.

Table 4-3 Maximum Production Rate for Scenario 1

Source	Construction Activity	Production Rate (m^3 per day)	Loss Rate (kg per s)	Working Hours Per Day	Construction Duration (months)
Installation of Submarine Gas Pipelines from Ma Tau Kok to North Point – Trench Dredging					
A or B	Dredging (1 closed grab dredger with 8 m^3 capacity)	4000	1.39	16	6

Table 4-4 Maximum Production Rates for Scenario 2

Source	Construction Activity	Production Rate (m^3 per day)	Loss Rate (kg per s)	Working Hours Per Day	Construction Duration (months)
Installation of Submarine Gas Pipelines from Ma Tau Kok to North Point – Trench Dredging					
A or B	Dredging (1 closed grab dredger with 8 m^3 capacity)	4000	1.39	16	6
Proposed Cruise Terminal at Kai Tak – Dredging at and near the Seawall (Under Mitigation Scenario)					
C	Dredging (1 closed grab dredger with 8 m^3 capacity)	2000	0.23	12	12
D	Dredging (1 closed grab dredger with 8 m^3 capacity)	2000	0.23	12	12
Proposed Cruise Terminal at Kai Tak – Dredging in the Manoeuvring Area for the Phase I Berth					
E	Dredging (1 closed grab dredger with 8 m^3 capacity)	2000	0.93	12	12
F	Dredging (1 closed grab dredger with 8 m^3 capacity)	2000	0.93	12	12
Proposed Cruise Terminal at Kai Tak – Public Landing Steps cum Fireboat Berth (Under Mitigation Scenario)					
G	Dredging (1 closed grab dredger with 8 m^3 capacity)	1000	0.12	12	6
Wan Chai Development Phase II (Under Mitigation Scenario)					
H	Dredging (1 closed grab dredger with 8 m^3 capacity)	1500	0.13	16	1
I	Dredging (1 closed grab dredger with 8 m^3 capacity)	6000	0.52	16	0.5

Contaminant Release during Dredging

4.3.14 The loss of sediment to suspension during dredging may have chemical effects on the receiving waters. This is because the sediment would contain organic and chemical pollutants. As part of the marine site investigation works for this Project, laboratory testing of sediment samples will be undertaken. Laboratory tests such as elutriate tests will be performed on the sediment samples to simulate and quantify the degree of mobilization of various contaminants such as metals, ammonia, trace organic contaminants (including PCBs, PAHs, TBT and chlorinated pesticides) into the water column during dredging.

4.3.15 An indication of the likelihood of release of heavy metals from the sediment during dredging can be given by the results of the elutriate tests from the marine site investigation works. If the contaminant levels are higher in the elutriates in comparison with the blanks (marine water from the same site), it can be concluded that the contaminants are likely to be released into the marine waters during dredging activities. As there is no existing legislative standard or guideline for individual heavy metal contents in marine waters, the UK Water Quality Standards for Coastal Surface Water, Australian and New Zealand Guidelines for Fresh and Marine Waters, Environmental Economic and BPEO Assessment Principals for Integrated Pollution Control and USEPA Salt Water Criterion' were adopted as the assessment criteria.

4.3.16 Should there be exceedance of the assessment criteria, conservative tracers would be introduced into the model for Scenario 2 model runs to estimate the dilution that could be generated by the tidal flows. The release rate of tracers will follow the sediment release rate in Table 4.4 at the source (discharge location) and a concentration of 0 g/m^3 would be defined at all the boundaries. Since there is no decay of the tracer, the changes in concentration of the tracer at different grid cells would be due to the advection and dispersion of tidal flows. Comparing the concentration at the grid cell of the source (C0) and the concentration at a selected grid cell located away from the source (C1), the dilution rate would be obtained (C0:C1).

4.4 Assessment Criteria for Water Quality Impact

4.4.1 The modelling results would be assessed for compliance of Water Quality Objectives (WQOs). With reference to the EIA Study Brief No. ESB-171/2007, the Study Area for water quality assessment should cover the Victoria Harbour, Western Buffer and Eastern Buffer Water Control Zones (WCZs). **Table 4-5** to **Table 4-7** below summaries the WQOs for the three WCZs.

Table 4-5 Summary of Water Quality Objectives for the Victoria Harbour WCZ

Parameters	Objectives	Sub-Zone
Offensive Odour, Tints	Not to be present	Whole zone
Colour	Not to exceed 50 Hazen units, due to human activity	Inland waters

Parameters	Objectives	Sub-Zone
Visible foam, oil scum, litter	Not to be present	Whole zone
E. coli	Not to exceed 1000 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals between 7 and 21 days	Inland waters
Dissolved Oxygen (DO) within 2 m of the seabed	Not less than 2.0 mg L^{-1} for 90% of samples	Marine waters
Depth-averaged DO	Not less than 4.0 mg L^{-1} for 90% of samples	Marine waters
Dissolved Oxygen	Not less than 4.0 mg L^{-1}	Inland waters
pH	To be in the range of 6.5 - 8.5, change due to human activity not to exceed 0.2	Marine waters
	Not to exceed the range of 6.0 - 9.0 due to human activity	Inland waters
Salinity	Change due to human activity not to exceed 10% of ambient	Whole zone
Temperature	Change due to human activity not to exceed 2 ^{o}C	Whole zone
Suspended solids	Not to raise the ambient level by 30% caused by human activity	Marine waters
	Annual median not to exceed 25 mg L^{-1} due to human activity	Inland waters
Ammonia	Annual mean not to exceed 0.021 mg L^{-1} as unionised form	Whole zone
Nutrients	Shall not cause excessive algal growth	Marine waters
	Annual mean depth-averaged inorganic nitrogen not to exceed 0.4 mg L^{-1}	Marine waters
BOD_5	Not to exceed 5 mg L^{-1}	Inland waters
Chemical Oxygen Demand	Not to exceed 30 mg L^{-1}	Inland waters
Toxic substances	Should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone
	Human activity should not cause a risk to any beneficial use of the aquatic environment.	Whole zone

Source: Statement of Water Quality Objectives (Victoria Harbour (Phases One, Two and Three) Water Control Zone)

Table 4-6 Summary of Water Quality Objectives for the Western Buffer WCZ

Parameters	Objectives	Sub-Zone
Offensive Odour, Tints	Not to be present	Whole zone
Colour	Not to exceed 30 Hazen units, due to human activity	Water gathering ground subzones
	Not to exceed 50 Hazen units, due to human activity	Inland waters
Visible foam, oil scum, litter	Not to be present	Whole zone
E. coli	Not to exceed 610 per 100 mL, calculated as the geometric mean of all samples collected in a calendar year	Secondary contact recreation subzones and Fish culture subzones
	Not to exceed 180 per 100 mL, calculated as the geometric mean of all samples collected from March to October inclusive in 1 calendar year. Samples should be taken at least 3 times in 1 calendar month at intervals of between 3 and 14 days.	Recreation subzones
	Less than 1 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals between 7 and 21 days	Water gathering ground subzones
	Not to exceed 1000 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals between 7 and 21 days	Other Inland waters
Depth-averaged DO	Not less than 4.0 mg L^{-1} for 90% of samples	Marine waters except Fish culture subzones
Dissolved Oxygen (DO) within 2 m of the seabed	Not less than 2.0 mg L^{-1} for 90% of samples	Marine waters except Fish culture subzones
Depth-averaged DO	Not less than 5.0 mg L^{-1} for 90% of samples	Fish culture subzones
Dissolved Oxygen (DO) within 2 m of the seabed	Not less than 2.0 mg L^{-1} for 90% of samples	Fish culture subzones
Dissolved Oxygen	Not less than 4.0 mg L^{-1}	Water gathering ground subzones and other inland waters

Parameters	Objectives	Sub-Zone
pH	To be in the range of 6.5 - 8.5, change due to human activity not to exceed 0.2	Marine waters
	Not to exceed the range of 6.0 – 8.5 due to human activity	Water gathering ground subzones
	Not to exceed the range of 6.0 - 9.0 due to human activity	Inland waters
Salinity	Change due to human activity not to exceed 10% of ambient	Whole zone
Temperature	Change due to human activity not to exceed 2 ^{o}C	Whole zone
Suspended solids	Not to raise the ambient level by 30% caused by human activity	Marine waters
	Annual median not to exceed 20 mg L^{-1} due to human activity	Water gathering ground subzones
	Annual median not to exceed 25 mg L^{-1} due to human activity	Inland waters
Ammonia	Annual mean not to exceed 0.021 mg L^{-1} as unionised form	Whole zone
Nutrients	Shall not cause excessive algal growth	Marine waters
	Annual mean depth-averaged inorganic nitrogen not to exceed 0.4 mg L^{-1}	Marine waters
BOD_5	Not to exceed 3 mg L^{-1}	Water gathering ground subzones
	Not to exceed 5 mg L^{-1}	Inland waters
Chemical Oxygen Demand	Not to exceed 15 mg L^{-1}	Water gathering ground subzones
	Not to exceed 30 mg L^{-1}	Inland waters
Toxic substances	Should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone
	Human activity should not cause a risk to any beneficial use of the aquatic environment.	Whole zone

Source: Statement of Water Quality Objectives (Western Buffer Water Control Zone).

Table 4-7 Summary of Water Quality Objectives for the Eastern Buffer WCZ

Parameters	Objectives	Sub-Zone
Offensive odour, tints	Not to be present	Whole zone
Visible foam, oil scum, litter	Not to be present	Whole zone
Dissolved oxygen (DO) within 2m of the seabed	Not less than 2.0mg/l for 90% of samples	Marine waters

Parameters	Objectives	Sub-Zone
Depth-averaged DO	Not less than 4.0mg/l for 90% of samples	Marine waters excepting fish culture subzones
	Not less than 5.0mg/l for 90% of samples	Fish culture subzones
	Not less than 4.0mg/l	Water gathering ground subzone and other Inland waters
5-Bay biochemical oxygen demand (BOD5)	Change due to waste discharges not to exceed 3mg/l	Water gathering ground subzones
	Change due to waste discharges not to exceed 5mg/l	Inland waters
Chemical oxygen demand (COD)	Change due to waste discharges not to exceed 15mg/l	Water gathering ground subzones
	Change due to waste discharges not to exceed 30mg/l	Inland waters
pH	To be in the range of 6.5 – 8.5, change due to waste discharges not to exceed 0.2	Marine waters
	To be in the range of 6.5 – 8.5	Water gathering ground subzones
	To be in the range of 6.0 – 9.0	Inland waters
Salinity	Change due to waste discharges not to exceed 10% of ambient	Whole zone
Temperature	Change due to waste discharges not to exceed 2 ^{o}C	Whole zone
Suspended solids (SS)	Not to raise the ambient level by 30% caused by waste discharges and shall not affect aquatic communities	Marine waters
	Change due to waste discharges not to exceed 20mg/l of annual median	Water gathering ground subzones
	Change due to waste discharges not to exceed 25mg/l of annual median	Inland waters
Unionized ammonia (UIA)	Annual mean not to exceed 0.021mg/l as unionized form	Whole zone
Nutrients	Shall not cause excessive algal growth	Marine waters
Total inorganic nitrogen (TIN)	Annual mean depth-averaged inorganic nitrogen not to exceed 0.4mg/l	Marine waters

Parameters	Objectives	Sub-Zone
Dangerous substances	Should not attain such levels as to produce significant toxic effects in humans, fish or any other aquatic organisms	Whole zone
	Waste discharges should not cause a risk to any beneficial use of the aquatic environment	Whole zone
Bacteria	Not exceed 610 per 100ml, calculated as the geometric mean of all samples collected in one calendar year	Fish culture subzones
	Less than 1 per 100ml, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days	Water gathering ground subzones
	Not exceed 1000 per 100ml, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days	Inland waters
Colour	Change due to waste discharges not to exceed 30 Hazen units	Water gathering ground
	Change due to waste discharges not to exceed 50 Hazen units	Inland waters

Source: Statement of Water Quality Objectives (Eastern Buffer Water Control Zone)

WSD's Water Quality Criteria for Flushing Water at Sea Water Intakes

4.4.2 Besides the WQOs set under the WPCO, WSD have also specified a set of water quality criteria for flushing water at seawater intakes shown in Table 4-8.

Table 4-8 WSD's Water Quality Criteria for Flushing Water at Sea Water Intakes

Parameter (in mg/L unless otherwise stated)	Target Limit
Colour (HU)	< 20
Turbidity (NTU)	< 10
Threshold Odour Number (odour unit)	< 100
Ammonia Nitrogen (NH_3-N)	< 1
Suspended Solids (SS)	< 10
Dissolved Oxygen (DO)	> 2
5-day Biochemical Oxygen Demand (BOD_5)	< 10
Synthetic Detergents	< 5
E. coli (no. per 100 mL)	< 20,000

Suspended Solids Criterion for Benthic Organisms

4.4.3 Benthic organisms, including corals, may be damaged by sediment deposition that blocks the respiratory and feeding organs of the corals. According to Hawker and Connell[(2)], the sedimentation rate higher than 0.1 kg m^{-2} per day would introduce moderate to severe impact

upon corals. This was adopted as the assessment criterion for protecting the marine ecological sensitive receivers in this study. There are no established legislative criteria for water quality for corals. An elevation criterion of 10 mgL^{-1} in SS has been adopted as the critical value above which impacts to the habitat may occur, same as the previous approved EIA [3].

Suspended Solids Criterion for Fish Culture Zone

4.4.4 A general water quality protection guideline for suspended solids (SS) has been proposed by AFCD[4]. The guideline requires maximum SS levels remain below $50mgL^{-1}$. This criterion has been adopted in the previous approved EIA[5].

Output of Modelling Results

4.4.5 The modelling results would be presented in terms of contour plot, time series plot and table for both the dry and wet seasons in water quality section of the EIA report.

References:

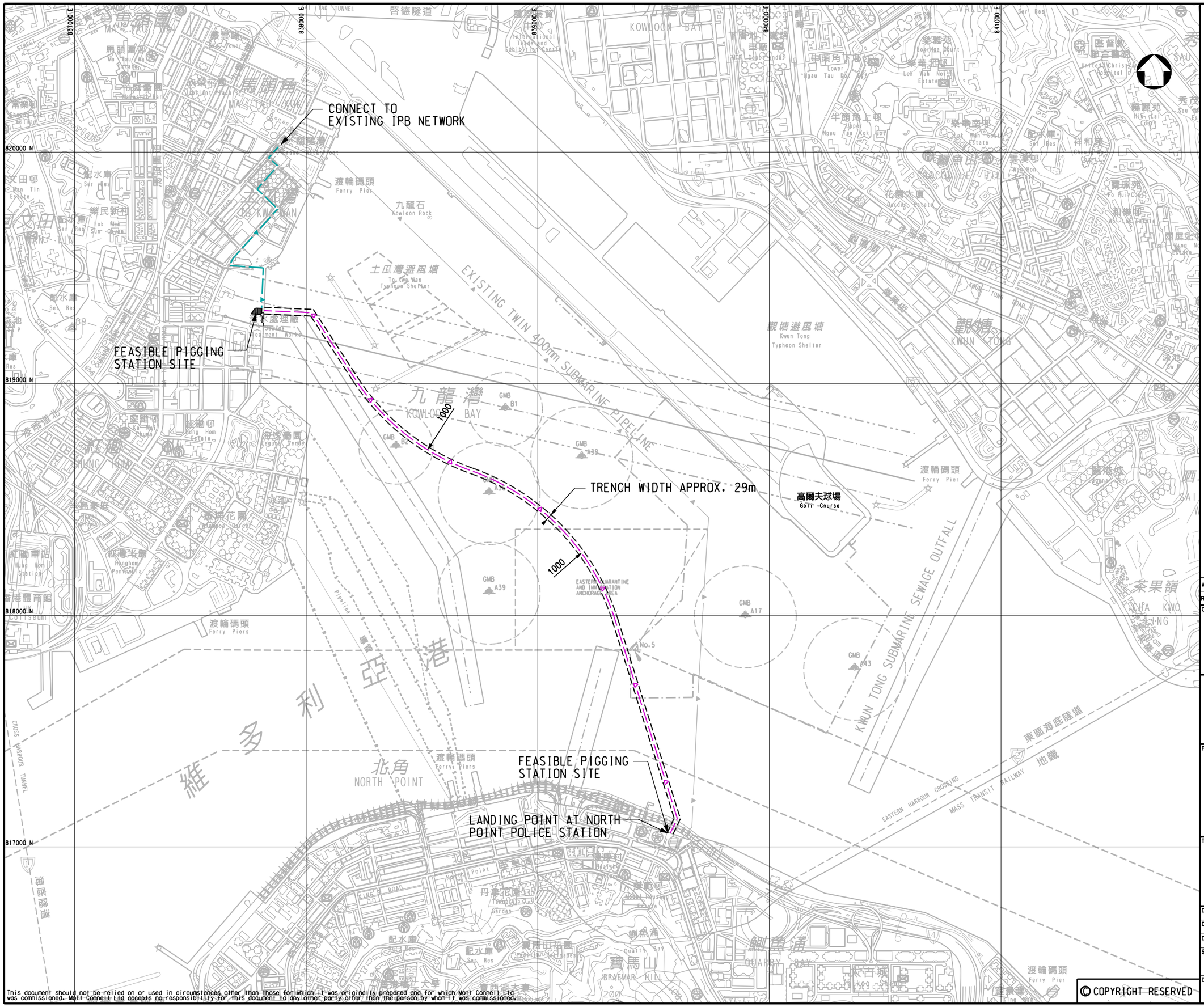
([1]) Environmental Quality Standards and Assessment Levels for Coastal Surface Water (from HMIP (1994) Environmental Economic and BPEO Assessment Principals for Integrated Pollution Control). *(Source: Environmental Impact Assessment Study for Disposal of Contaminated Mud in the East Sha Chau Marine Borrow Pit, by ERM, January 1997).*

([2]) Hawker, D. W. and Connell, D. W. (1992). "Standards and Criteria for Pollution Control in Coral Reef Areas" in Connell, D. W and Hawker, D. W. (eds.), *Pollution in Tropical Aquatic Systems*, CRC Press, Inc.

([3]) ERM Hong Kong Ltd. (2001), Environmental Impact Assessment for the Proposed submarine Gas Pipeline from Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal, Shenzhen to Tai Po Gas Production Plant, Hong Kong, Final EIA Report, For the Hong Kong and China Gas Co., Ltd.

([4]) City University of Hong Kong (2001), *Consultancy Study on Fisheries and Marine Ecological Criteria for Impact Assessment, Final Report*, For Agriculture, Fisheries and Conservation Department, Hong Kong SAR Government.

([5]) Maunsell Consultants Asia Ltd. (2001), *Environmental Impact Assessment for Tai Po Sewage Treatment Works – Stage V, Final EIA Report*, For Drainage Services Department, Hong Kong SAR Government.



LEGEND:

- PROPOSED TWIN 450 SUBMARINE GAS MAIN
- PROPOSED 600 LAND GAS MAIN

Rev	Date	Drawn	Description	Ch'k'd	App'd
A	OCT 08	CCH	FIRST ISSUE	MT	TI

Client

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Project

INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM TO KWA WAN TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

GENERAL LAYOUT OF THE PROJECT

Designed	DL		Eng.Chk.	TT	
Drawn	CCH		Coordination	DL	
Dwg.Chk.	DL		Approved	TI	

Scale 1:7500@A1

Project 237926

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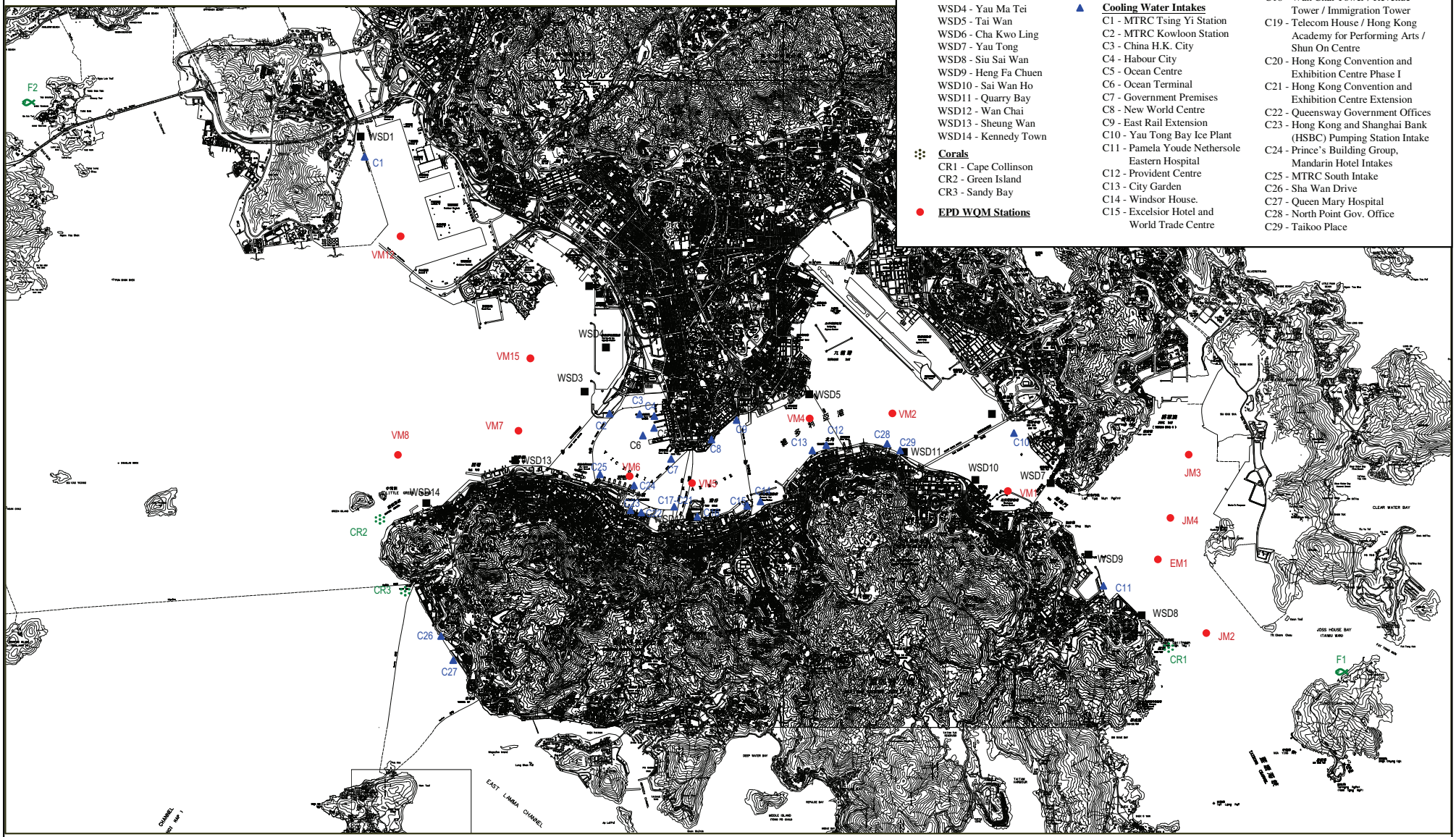
Status

Drawing No. FIGURE 1

Rev A



LEGEND:

WSD Salt Water Intakes
- WSD1 - Tsing Yi
- WSD2 - Cheung Sha Wan
- WSD3 - Kowloon South
- WSD4 - Yau Ma Tei
- WSD5 - Tai Wan
- WSD6 - Cha Kwo Ling
- WSD7 - Yau Tong
- WSD8 - Siu Sai Wan
- WSD9 - Heng Fa Chuen
- WSD10 - Sai Wan Ho
- WSD11 - Quarry Bay
- WSD12 - Wan Chai
- WSD13 - Sheung Wan
- WSD14 - Kennedy Town

Corals
- CR1 - Cape Collinson
- CR2 - Green Island
- CR3 - Sandy Bay

EPD WQM Stations

Fish Culture Zone
- F1 - Tung Lung Chau
- F2 - Ma Wan

Cooling Water Intakes
- C1 - MTRC Tsing Yi Station
- C2 - MTRC Kowloon Station
- C3 - China H.K. City
- C4 - Habour City
- C5 - Ocean Centre
- C6 - Ocean Terminal
- C7 - Government Premises
- C8 - New World Centre
- C9 - East Rail Extension
- C10 - Yau Tong Bay Ice Plant
- C11 - Pamela Youde Nethersole Eastern Hospital
- C12 - Provident Centre
- C13 - City Garden
- C14 - Windsor House.
- C15 - Excelsior Hotel and World Trade Centre
- C16 - Sun Hung Kai Centre
- C17 - Great Eagle Centre / China Resources Building
- C18 - Wan Chai Tower / Revenue Tower / Immigration Tower
- C19 - Telecom House / Hong Kong Academy for Performing Arts / Shun On Centre
- C20 - Hong Kong Convention and Exhibition Centre Phase I
- C21 - Hong Kong Convention and Exhibition Centre Extension
- C22 - Queensway Government Offices
- C23 - Hong Kong and Shanghai Bank (HSBC) Pumping Station Intake
- C24 - Prince's Building Group, Mandarin Hotel Intakes
- C25 - MTRC South Intake
- C26 - Sha Wan Drive
- C27 - Queen Mary Hospital
- C28 - North Point Gov. Office
- C29 - Taikoo Place

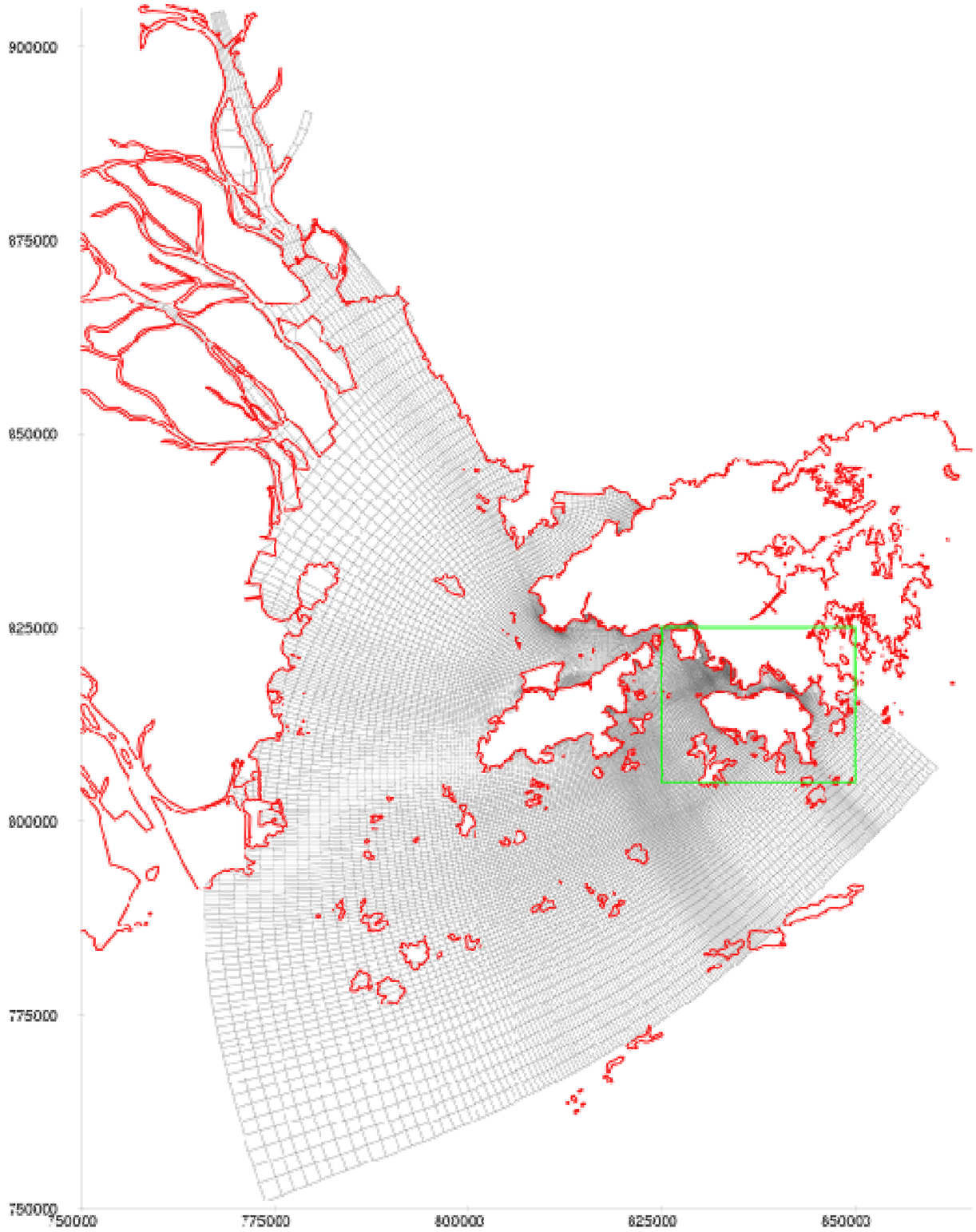
Consultant: Mott MacDonald

Client: Hong Kong and China Gas Company Limited

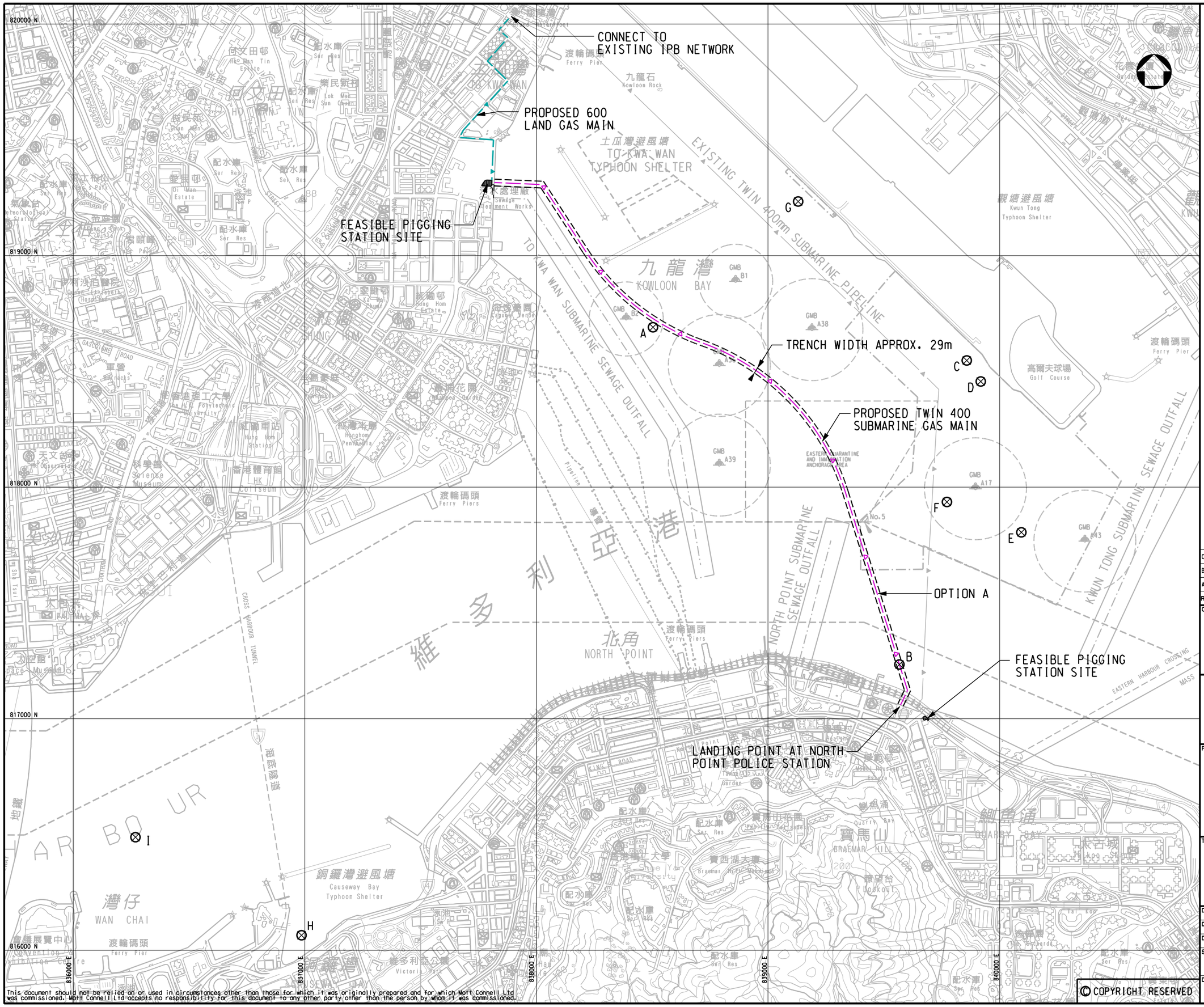
Project: Installation of Submarine Gas Pipelines and Associated Facilities from To Kwa Wan to North Point for Former Kai Tak Airport Development

Title: Locations of Water Quality Sensitive Receivers

Figure 2	Rev. -	Dec 08



Consultant: Mott Connell	**Client:** Hong Kong and China Gas Company Limited	**Project:** Installation of Submarine Gas Pipelines and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development	**Title:** Extent of the Western Harbour Model Grid
			Figure 3 | **Rev. A** | **Mar 08**



LEGEND:

- PROPOSED TWIN 400 SUBMARINE GAS MAIN
- PROPOSED 600 LAND GAS MAIN
- A — SEDIMENT SOURCE

Rev	Date	Drawn	Description	Ch'k'd	App'd
C	OCT 08	YKL	REVISED ALIGNMENT	MT	TI
B	JUL 08	YKL		MT	TI
A	MAR 08	YKL	FIRST ISSUE	MT	TI

Client

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Project

INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM TO KWA WAN TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

LOCATION OF SEDIMENT SOURCE

Designed	KL		Eng.Chk.	MT	
Drawn	YKL		Coordination	KL	
Dwg.Chk.	KL		Approved	TI	

Scale 1:7500@A1

Project 237926

Status

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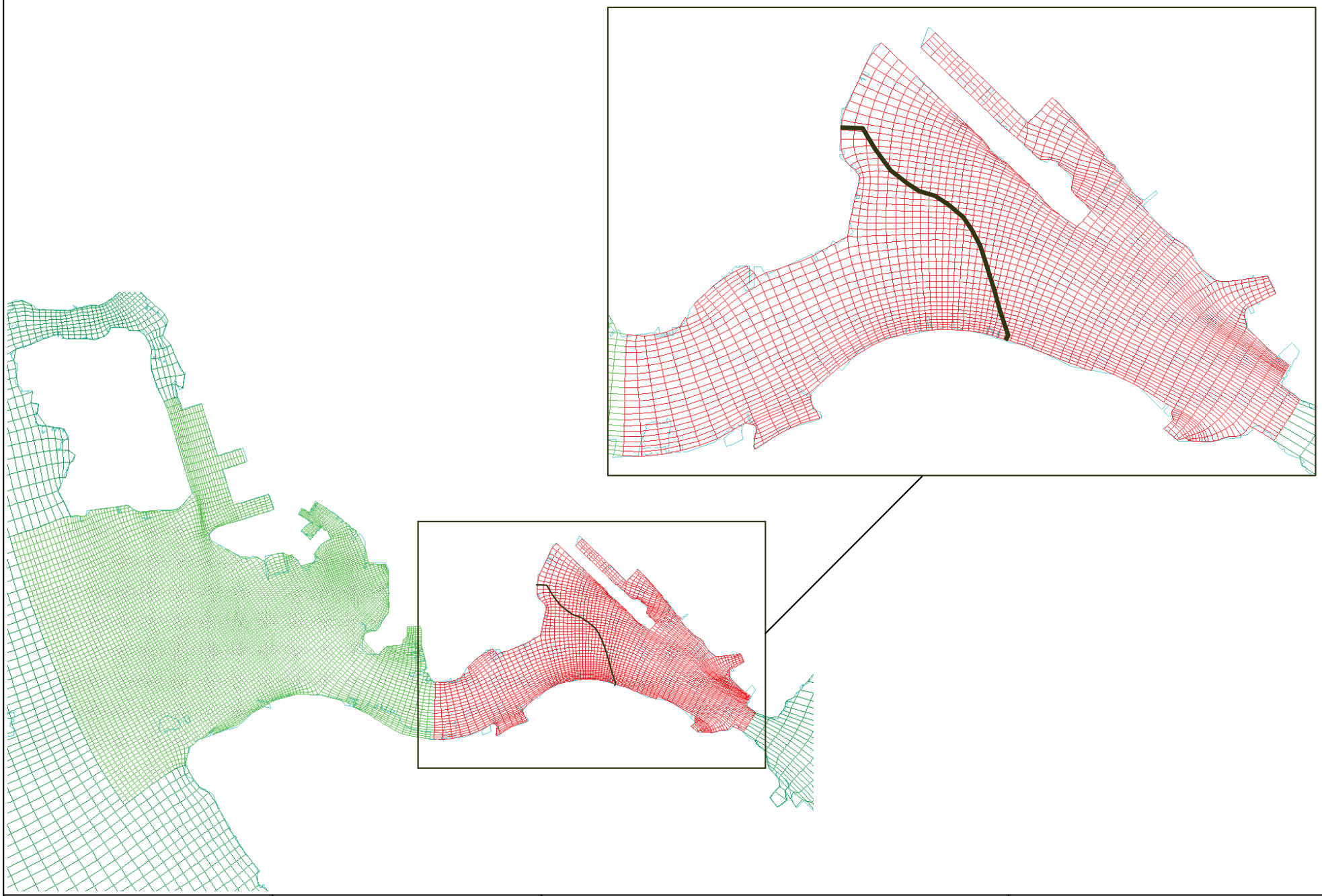
Drawing No. FIGURE 4

Rev C



Consultant:	Client:	Project:	Title:		
Mott Connell	Hong Kong and China Gas Company Limited	Installation of Submarine Gas Pipelines and Associated Facilities from To Kwa Wan to North Point for Former Kai Tak Airport Development	Refined Grid Model		
			Figure 5	Rev. 1	Oct 08

+852 2147 0894
本署檔號 OUR REF: EP2/G/H/145
來函檔號 YOUR REF:
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環境保護署分處
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軒尼詩道
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修頓中心廿八樓

24 June 2008

Urgent By Fax : 25167979

The Hong Kong and China Gas Company Limited,
Gas Supply Planning Department, 17th floor,
363 Java Road, North Point,
Hong Kong
(Attn: Mr. SHUM Chuen Kui, Sam / Gas Supply Planning Manager)

Dear Mr. Shum,

Environmental Impact Assessment Ordinance (EIAO)
Project Title: Installation of Submarine Gas Pipelines from Ma Tau Kok to North Point for Former Kai Tak Airport Development
(EIA Study Brief No. ESB-171/2007)
Sediment Sampling Plan

I refer to a letter from your consultant, Mott Connel (ref: KMY/PEJ/TI/TT/DL/FY/T237926/30.03/L-0171) dated 5 June 2008 submitting the captioned Sediment Sampling Plan for our agreement/approval under Sections 3.4.1.5(ix) and 3.4.2.2(iii)(a) of the EIA Study Brief No. ESB-171/2007.

Please be informed that after taking into the advice from our water quality and waste assessment teams, the submitted proposal is considered as acceptable. As such, agreement/approval are hereby given under the following requirements of the captioned EIA Study Brief:

Reference in the Study Brief Stipulating the Requirements	Key Description
Section 3.4.1.5(ix)	Water Quality Impact The ranges of parameters to be analyzed; the number, location, depth of sediment, type and methods of sampling; sample preservation; and chemical and biological laboratory test methods to be used shall be subject to the agreement of the Director.
i 母 Section 3.4.2.2(iii)(a)	Waste Management Implications The ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test method; and the laboratory to be used shall be subject to the approval of the Director.

Nevertheless, your company and the consultant should note that according to Section 3.4 of the EIAO-Technical Memorandum, the assessment shall be based on the best available information at the time of the assessment. The above agreement is only for the concerned requirements under the EIA Study Brief to facilitate the EIA study. It shall not prejudice the Director of Environmental Protection's future decisions on any application for approval of the EIA report under the EIAO. If there is any significant change in circumstances, project design/details or assessment methodology/assumptions, etc. your company and the consultant should review the situations; carry out necessary updating/revisions; and seek our advice whether further agreements under the EIA Study Brief are necessary.

You are also reminded that the requirements on documentations of key assessment assumptions, limitations of assessment methodologies and related prior agreement(s) with the Director of Environmental Protection as stipulated under Section 3.4.11 of the EIA Study Brief shall be followed.

Yours sincerely,

(Victor YEUNG)
Senior Environmental Protection Officer
for Director of Environmental Protection

c.c.:
Mott Connell (Attn: Mr. Tony Tang) Fax: 28271823

c.c. internal: S(MA)5, S(RA)4, E(MA)31

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Our ref: KMY/PEJ/TI/TT/DL/FY/T237926/30.03/L-0171
Your ref: (39) EP2/G/H/145

The EIA Ordinance Register Office
Environmental Protection Department
27th Floor, Southorn Centre,
130 Hennessy Road,
Wan Chai, Hong Kong.

Attn: The EIAO Register Office

5th June 2008

By Hand

Dear Sirs / Madams

Installation of Submarine Gas Pipelines and Associated Facilities
From Ma Tau Kok to North Point for Former Kai Tak Airport Development
ESB-171/2007 - Clauses 3.4.1.5 (ix) and 3.4.2.2 (iii)(a)
Sediment Sampling Plan

We refer to your letter ref. (39) EP2/G/H/145 dated 7 March 2008 regarding comments on our captioned submission. Please find enclosed 3 hard copies of the Revised Sediment Sampling Plan with our response to your comments in Appendix A for your agreement. We would be grateful if you can provide your comments if any, by Thursday, 19 June 2008.

Should you have any queries or require any further information, please contact Ms. Florence Yuen at 2828 5768.

Yours faithfully
for MOTT CONNELL LIMITED

Tony Tang

Encl.
c.c: HKCG/GSPD Mr. Sam Shum (1 hard copy)

FIFTY YEARS OF ENGINEERING SUCCESS IN HONG KONG 50th

The Hong Kong and China Gas Company Limited

17th Floor,

363 Java Road

North Point

Hong Kong

Installation of Submarine Gas Pipelines and Associated Facilities from Ma Tau Kok to North Point for Former Kai Tak Airport Development

Sediment Sampling Plan

June 2008

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APPENDICES

1 INTRODUCTION

Mott Connell was appointed by the Hong Kong and China Gas Company Limited to carry out the Feasibility Study and Detailed Design including the Environmental Impact Assessment for the Installation of Submarine Gas Pipelines and Associated Facilities from Ma Tau Kok to North Point for the Former Kai Tak Airport Development (hereinafter called "the Project").

As part of the project scope, a twin submarine gas pipeline from Ma Tau Kok to North Point is required to be laid to make way for the Cruise Terminal Development at the future South East Kowloon Development and for the Central Kowloon Route Project. It is anticipated that bottom pull and lay-barge methods will likely be used to construct the submarine gas pipeline and a trench would need to be dredged in Victoria Harbour before laying the pipeline during construction.

The general layout of the Project Corridor and the areas requiring marine dredging are shown in **Figures 1.1a** and **1.1b**. As a protection measure against anchor drop, the proposed pipeline would be laid approximately 3m below the existing seabed along the trench backfilled with suitable rockfills on top. Based on our initial study, this pre-dredged trench would be approximately 4m deep, and in trapezoidal shape with 5m bottom width and side slope at a gradient of 1:3 (V:H) (see **Figure 1.2**). The estimated quantity of the dredged material arising from the trenching work would be approximately 201,280 m^3 (exclusive of any bulking factor). Based on the existing marine ground investigation (G.I.) records, it is anticipated that the dredged material would mainly be marine mud and potentially a mixture of contaminated and uncontaminated deposits. The proposed dredging is planned to commence in June 2010.

As part of the study, we would undertake a Sediment Quality Assessment for the dredged material for the submarine gas pipeline. To facilitate the assessment, G.I. such as marine drillholes and vibrocores would be undertaken to determine the properties of the dredged material. A *Proposal for Sampling and Testing of Sediment* was prepared and submitted to the Territorial Control Office in accordance with the Technical Circular *ETWB TCW No. 34/2002 Management of Dredge/Excavated Sediment* in which the sampling and testing results would be used to support future dumping permit application for the dredged spoil.

As the submarine gas pipeline component of the Project is classified as Designated Project under item H.2 of Part I of Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) (Cap.499), an Environmental Impact Assessment Report is required to be submitted and approved by the Director of Environmental Protection under the EIAO before an Environmental Permit can be issued. To meet the requirements of the EIA Study Brief of the Project (ESB-171/2007), the scope of the G.I. works should also cover the requirements of Water Quality Impact and Waste Management Implications as stipulated in Sections 3.4.1.5 (ix) and 3.4.2.2 (iii)(a) of the EIA Study Brief.

The purpose of this Sediment Sampling Plan is to seek the agreement of EPD on the following:

- the range of parameters to be analyzed; the number, location, depth of sediment, type and methods of sampling; sample preservation; and chemical and biological laboratory test methods to be used for elutriate tests as specified in Section 3.4.1.5 (ix) of the EIA Study Brief (ESB-171/2007)

- the range of parameters to be analyzed, the number, type and methods of sampling; sample preservation; chemical and biological laboratory test method; and the laboratory to be used for dredged sediment sampling and testing as specified in Section 3.4.2.2 (iii)(a) of the EIA Study Brief (ESB-171/2007)

Details of the above are outlined in *Sections 3 and 4* of this Sediment Sampling Plan.

2 REVIEW OF HISTORICAL DATA

The Quaternary Geology of Hong Kong (CED, May 2000), 1:100 000 Seabed Sediments Map indicates that mud and sandy mud deposits are present over the proposed alignment. This is supported by the related 1:20 000 Hong Kong Geological Survey Geology Map (Sheet 11, Hong Kong & Kowloon, 1986) which identifies that the superficial geology along the proposed alignment comprises Holocene marine mud.

The Marine Water Quality in Hong Kong in 2006 (EPD 2007) indicated that there is only one EPD reference marine sampling point (VC3) in the vicinity of the alignment. The most recent available test results from recovered sediments from this location indicate that a number of heavy metals such as Copper, Silver and Zinc exceeded the Lower and Upper Chemical Exceedence Limits (LCEL & UCEL) as per PNAP 252. The high levels of Copper were attributed to discharges from printed circuit board, electroplating, metal and textile industries between the 1960's and 1980's, while the elevated Silver levels were stated to originate possibly from pollution due to electroplating industries, photo-processing business and dental clinics in the Harbour area. From the above quoted results, it is believed that a proportion of the proposed dredged marine clay volumes may be considered as Category M or H sediment that require chemical and biological screening.

An existing North Point Sewage Outfall, located at Java Road next to K. Wah Centre as shown in Figures 1.1a and 1.1b is used to discharge the screened sewage from the North Point Sewage Screening Plant to Victoria Harbour as confirmed by Drainage Services Department (DSD). The as-built records of the outfall suggested that it was approximate 600m long. There is no decommissioning programme for the outfall even when HATS Stage 2A project comes into operation in 2014, the aforementioned discharge arrangement will continue and the outfall would still be maintained in serviceable conditions to serve as an emergency bypass outfall so as to facilitate future maintenance of the facilities of the North Point PTW as well as to cope with any mishaps in the HATS Sewage Conveyance System.

The minimum distance between the outfall and the dredging area of the proposed submarine gas pipeline is approx. 100m apart and the dredging area would not fall into 50m protection boundary of the North Point Sewage Outfall.

3 SEDIMENT SAMPLING AND TESTING

Based on the results of the previous studies discussed above, the sediment of the Project Corridor could be contaminated with high levels of copper and possibly other heavy metals. According to *ETWB TCW No. 34/2002 Management of Dredged/Excavated Sediment*, Tier II Chemical Screening would be required. The proposed marine ground investigation works is presented in **Figure 3.1**. For this project, a new bathymetric survey would be undertaken. As detailed in Section 2, the chemical characteristics of the proposed dredged material along the alignment may be contaminated. In this respect, and with reference to PNAP 252, the

proposed marine ground investigation would be vibrocore sampling on an approximately 100m by 100m grid spacing with 100mm subsamples taken at seabed, 0.9m down, 1.9m down, 2.9m down, 5.9m down and 8.9m down, where appropriate. Grab samples from Sai Kung Port Shelter would also be obtained as a Reference Sediment for laboratory testing.

In view of the possibility of changing the landing sites on the Hong Kong Island of submarine pipeline, ground investigation stations are proposed along the two possible alignments. The locations of the vibrocores are presented in Table 3-1.

Table 3-1 Proposed Vibrocore Sampling Locations

Vibrocore/Grab Sample No.	Easting	Northing	Proposed Depth
VC1a/b*	837890	819432	6m**
VC2a/b*	837969	819371	6m**
VC3a/b*	838033	819295	6m**
VC4a/b*	838087	819211	6m**
VC5a/b*	838142	819127	6m**
VC6a/b*	838196	819043	6m**
VC7a/b*	838253	818961	6m**
VC8a/*	838317	818885	6m**
VC9a/b*	838387	818817	6m**
VC10a/b*	838464	818755	6m**
VC11a/b*	838546	818702	6m**
VC12a/b*	838633	818657	6m**
VC13a/b*	838726	818619	6m**
VC14a/b*	838820	818579	6m**
VC15a/b*	838904	818533	6m**
VC16a/b*	838982	818479	6m**
VC17a/b*	839055	818419	6m**
VC18a/b*	839121	818353	6m**
VC19a/b*	839180	818281	6m**
VC20a/b*	839232	818204	6m**
VC21a/b*	839277	818122	6m**
VC22a/b*	839314	818037	9m**
VC23a/b*	839343	817948	9m**
VC24a/b*	839372	817857	9m**
VC25a/b*	839374	817760	9m**
VC26a/b*	839367	817660	9m**
VC27a/b*	839359	817561	9m**
VC28a/b*	839352	817461	9m**
VC29a/b*	839345	817361	9m**
VC30a/b*	839338	817261	9m**
VC31a/b*	839403	817759	9m**
VC32a/b*	839433	817663	9m**
VC33a/b*	839463	817568	9m**
VC34a/b*	839493	817472	9m**
VC35a/b*	839523	817377	9m**
VC36a/b*	839552	817281	9m**
VC37a/b*	839582	817186	9m**
Ref. Sediment 1	*	*	*

Notes :-

1. * Vibrocores denoted 'a' & 'b' are to be carried out in close proximity to each other, where 'a' vibrocores are for laboratory testing samples while 'b' vibrocores are to be split for logging purposes.
2. ** refers to provisional depth of vibrocore which is subject to final design of trench depth.

On recovery of the vibrocores and grab samples, the required subsamples would be taken, bagged, labelled and stored as set out in PNAP 252. Geological logging would be undertaken as per GeoGuide 3. All soil subsamples would be tested for the suites of tests again following the conditions and procedures set out in PNAP 252. Tier II Chemical Screening would be undertaken for the parameters using the analytical methods and reporting limits described in Table 3-2.

Table 3-2 Parameters Proposed for Chemical Screening for Sediment Samples

Parameter	Preparation Method US EPA method	Determination Method US EPA Method	Reporting Limit (mg/kg)
Metals (mg/kg dry wt.)			
Cadmium (Cd)	3050B	6020A or 7000A or 7131A	0.2
Chromium (Cr)	3050B	6010C or 7000A or 7190	8
Copper (Cu)	3050B	6010C or 7000A or 7210	7
Mercury (Hg)	7471A	7471A	0.05
Nickel (Ni)	3050B	6010C or 7000A or 7520	4
Lead (Pb)	3050B	6010C or 7000A or 7420	8
Silver (Ag)	3050B	6020A or 7000A or 7761	0.1
Zinc (Zn)	3050B	6010C or 7000A or 7950	20
Metalloid (mg/kg dry wt.)			
Arsenic (As)	3050B	6020A or 7000A or 7061A	1
Organic-PAHs (µg/kg dry wt.)			
Lower Molecular Weight PAHs+	3550B or 3540C and 3630C	8260B or 8270C	55
High Molecular Weight PAHs++	3550B or 3540C and 3630C	8260B or 8270C	170
Organic-non-PAHs (µg/kg dry wt.)			
Total PCBs+++	3550B or 3540C and 3665A	8082	3
Organometallics (µg TBT/L in interstitial water)			
Tributyltin*	Krone et al. (1989)* - GC/MS UNEP/IOC/IAEA**	Krone et al. (1989)* - GC/MS UNEP/IOC/IAEA**	0.015

*Krone et al. (1989), A method for analysis of butyltin species and measurement of butyltins in sediment and English Sole livers from Puget Sound, Marine Environmental Research 27 (1989) 1-18. Interstitial water to be obtained by centrifuging the sediment and collecting the overlying water.
** UNEP/ICO/IAEA refers to IAEA's Marine Environment Laboratory reference methods. These methods are available free of charge from UNEP/Water or Marine Environmental Studies Laboratory at

IAEA's Marine Environment Laboratory. Interstitial water to be obtained by centrifuging the sediment and collecting the overlying water.

As Category M material is expected, Tier III Biological Screening could be required after the chemical screening to determine the disposal option under *ETWB TCW No. 34/2002 Management of Dredged/Excavated Sediment.* The technical circular recommends all samples should be promptly analysed although, under proper storage (4°C in dark but not frozen), a maximum holding time of 2 weeks and 8 weeks for chemical test and biological test, respectively, is considered valid. The species to be used for each type of test would be selected from species listed in Table 3-3.

Table 3-3 Species Proposed for Biological Screening for Sediment Samples

Test Types	Species	Reference Test Conditions
10-day borrowing amphipod toxicity test	*Ampelisca abdita* *Leptocheirus plumulosus* *Eohaustorius estuarius*	U.S. EPA (1994) / PSEP (1995) U.S. EPA (1994) U.S. EPA (1994) / PSEP (1995)
20-day burrowing polychaete toxicity test	*Neanthes arenaceodentata*	PSEP (1995)
48-96 hour larvae (bivalve or echinoderm) toxicity test	Bivalve: *Mytilus spp.* *Crassostrea gigas* Echinoderm: *Dendraster excentricus* *Strongylocentrotus spp.*	 PSEP (1995) PSEP (1995) PSEP (1995) PSEP (1995)

If Biological Screening is required, reference sediment will be collected from Sai Kung Port Shelter using surface grab sampler.

4 ADVANCE WORKS FOR EIA STUDY BRIEF

4.1 Background

As discussed in Section 1, the G.I. and laboratory testing proposed in this Sediment Sampling Plan should cover the requirements of Technical Circular *ETWB TCW No. 34/2002 Management of Dredge/Excavated Sediment.* However, it should also cover the requirements of the Water Quality Impact and Waste Management Implications specified in Sections 3.4.1.5 and 3.4.2.2 (iii) of the EIA Study Brief No. ESB-171/2007 so as to enhance the cost effectiveness of the Project as the sample collection process itself accounted the majority of the cost compared to the laboratory testing cost.

4.2 Sediment Samples and Interstitial Water Tests

For each sediment sample, the Sediment Sampling Plan included the testing of 9 heavy metals and metalloids, low and high molecular weight PAH, total PCBs as listed in Table 3-2. For interstitial water, as the Study Area partially covered the Eastern Quarantine and Immigration Anchorage (EQIA), the testing for organometallics TBT was also included as listed in Table 3-2 along the proposed pipeline routes.

Testing of the following additional parameters in 15 or 16 sediment samples along the proposed gas pipeline alignment spaced at 200m intervals as shown in **Figure 4.1** are

proposed to allow evaluation of contamination by chlorinated pesticides and nutrient of the sediment as listed in Table 4-1.

Table 4-1 Parameters Proposed for Chlorinated Pesticides and Nutrient for Sediment Samples

Parameter	Analytical Method	Reporting Limit (mg/kg)
Chlorinated Pesticides		
Aldrin	S/O/Pesticide	0.5
Alpha-BHC		0.5
Beta-BHC		0.5
Delta-BHC		0.5
Gamma-BHC		0.5
Heptachlor		0.5
Heptachlor epoxide		0.5
Endosulfan 1		0.5
Endosulfan sulphate		0.5
p, p'-DDT		0.5
p, p'-DDD		0.5
p, p'-DDE		0.5
Nutrient		
Ammonia Nitrogen (NH_3N)	APHA 4500-NH_3:G	0.1
Total Kjeldahl Nitrogen (TKN)	APHA 4500 N_{org}:B	50
Nitrate Nitrogen (NO_3-N)	APHA 4500-NO_3:F/NO_2:B	1.0
Nitrite Nitrogen (NO_2-N)	APHA 4500-NO_2:B	1.0
Total Phosphorus (TP)	APHA 4500 P:B4,F	10
Sediment Oxygen Demand (SOD, 20 Days)	In house method	5

4.3 Elutriate Tests

To facilitate the assessment of likelihood of release of contaminants from the marine mud during dredging, it has been specified in the EIA Study Brief to perform elutriate tests on sediment samples to simulate and quantify the degree of mobilization of various contaminants.

The sediment sub-samples from vibrocore sampling taken at seabed, 0.9m down, 1.9m down, 2.9m down, 5.9m down and 8.9m down, where appropriate at the 15 or 16 stations along the proposed gas pipeline alignment spaced at 200m intervals as shown in **Figure 4.1** will also be used for elutriate test where sections of vibrocore tube are cut, sealed and capped, labelled, stored in a dark environment in a cool box below 4°C immediately after collection on site. On transfer from site to laboratory, samples are kept at below 4°C, by regularly replacing the ice packs. The elutriate test is a procedure developed to simulate the release of dissolved contaminants from a dredged disposal operation in open waters, and may be considered a laboratory simulation of release of dissolved contaminants from a mechanical dredged disposal operation (USEPA and USACE 1998). The *in situ* composite water and sediment samples of the same station will be mixed in a ratio of 1:4 sediment:water. The mixture is mechanically shaken vigorously for 30 minutes and allowed to settled undisturbed for 1 hour. The liquid filtrate phase is then centrifuged or filtered through a 45 μm filter to remove all

suspended particulate matter. The extracted liquid filtrate is the elutriate to be used for further test.

The elutriate samples discussed above would be tested for a suite of contaminants as presented in Table 4-2 which are similar to the sediment samples. The test will also be performed on a blank sample (marine waters) for comparison.

Table 4-2 Parameters Proposed for Elutriate Samples

Parameter	Analytical Method	Reporting Limit
Heavy Metals		
Silver (Ag)	USEPA 6020A / ICPMS	1.0 µg/L
Cadmium (Cd)		0.2 µg/L
Copper (Cu)		1.0 µg/L
Nickel (Ni)		1.0 µg/L
Lead (Pb)		1.0 µg/L
Zinc (Zn)		4.0 µg/L
Chromium (Cr)		1.0 µg/L
Mercury (Hg)		0.1 µg/L
Metalloid		
Arsenic (As)	USEPA 6020A / ICPMS	2.0 µg/L
Nutrient		
Nitrogen-Ammonia (NH_3N)	APHA 17ed 4500-NH_3	0.10 mg NH_3-N/L
Nitrogen-Nitrate (NO_3-N)	APHA 17ed 4500-NO_3-	0.05 mg NO_3-N/L
Nitrogen Nitrite (NO_2-N)	APHA 17ed 4500-NO_2-	0.05 mg NO_2-N/L
Total Kjeldahl Nitrogen (TKN)	ASTM D 3590-89	1.0 mg-N/L
Total Phosphorus (TP)	APHA 19e 4500-P B & E	0.1 mg-P/L
Trace Organic Contaminants		
Polychlorinated Biphenyls (PCBs)	USEPA 8080 / GC/ECD or USEPA 8270 / GC/MS	0.01µg/L
Polynuclear Aromatic Hydrocarbons (PAHs)	USEPA 8310 / HPLC or USEPA 8270 / GC/MS	0.20µg/L
TBT	Solvent extraction then GC/MS Quantification	0.015µg/L
Chlorinated Pesticides		
Aldrin	W/O/Pesticide	0.10µg/L
Alpha-BHC		0.10µg/L
Beta-BHC		0.10µg/L
Delta-BHC		0.10µg/L
Gamma-BHC		0.10µg/L
Heptachlor		0.10µg/L

Heptachlor epoxide		0.10µg/L
Endosulfan 1		0.10µg/L
Endosulfan sulphate		0.10µg/L
p, p'-DDT		0.10µg/L
p, p'-DDD		0.10µg/L
p, p'-DDE		0.10µg/L

The laboratory testing of samples collected will be carried out by an appropriate laboratory which is HOKLAS (Hong Kong Laboratory Accreditation Scheme) accredited. The Laboratory will conduct the required analyses which falls under her accredited test categories according to standard method and technique used as specified in her scope of accreditation under HOKLAS while the remaining required analyses will be conducted according to in-house or other approved international standard methods.

Standard elutriate preparation will be in accordance with USEPA 823/B-98-004 Dredged Material – Inland Testing Manual.

Prior to use, all lab-ware would be thoroughly cleaned as appropriate for the contaminant analysis. At a minimum, lab-ware would be washed with detergent, rinsed with acetone, five times with tap water, placed in a clean 10% HCl acid bath for a minimum of 4 h, rinsed five times with tap water, and then thoroughly flushed with either distilled or deionised water.

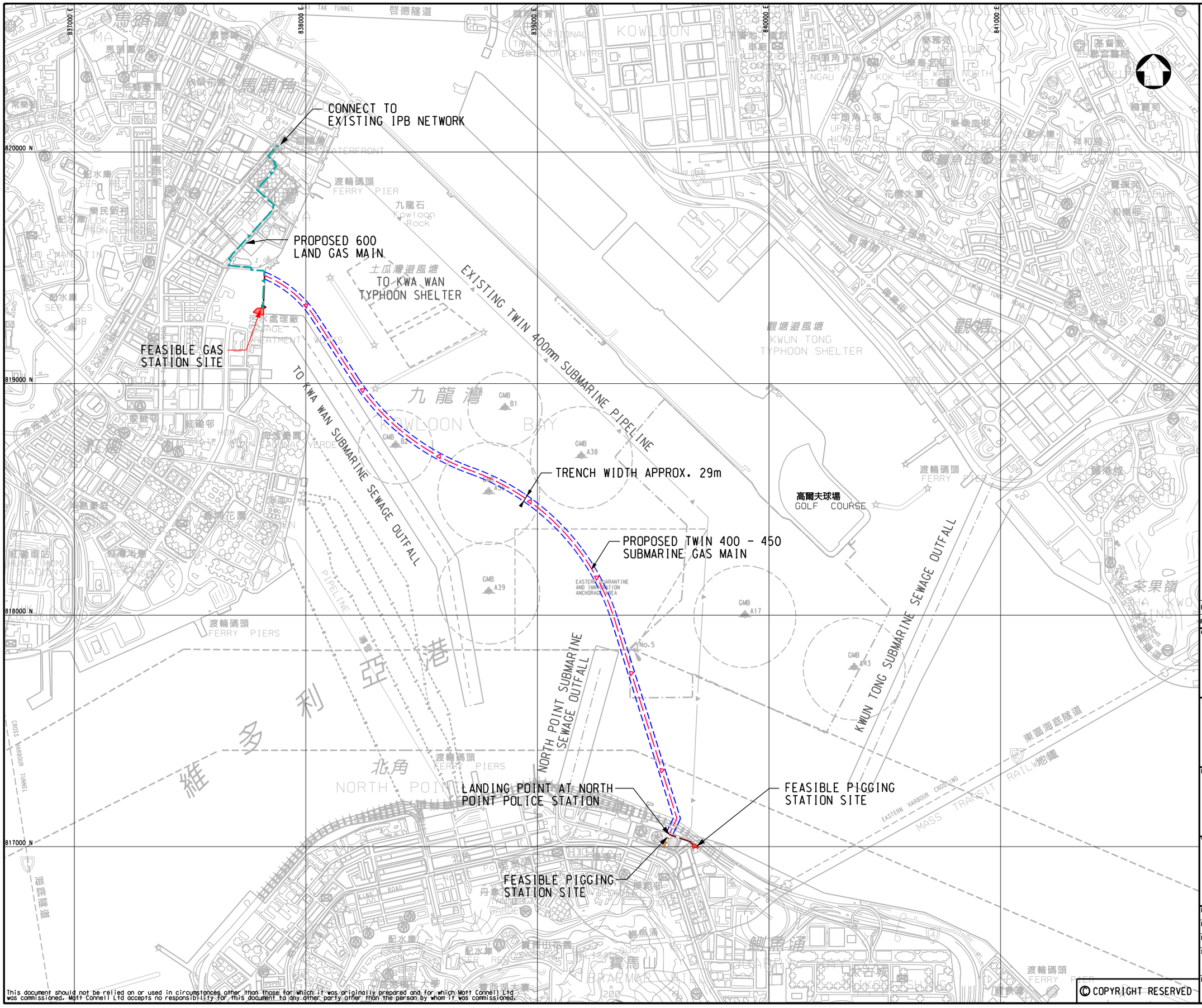
The elutriate are to be prepared by using marine water from the dredging site. Enough elutriate would be prepared for the chemical analyses and for the water column toxicity tests in Tier III.

The elutriate is prepared by sub-sampling approximately 1 L of the dredged material from the well-mixed original sample. The dredged material and unfiltered water are then combined in a sediment-to-water ratio of 1:4 on a volume basis at room temperature (22 ± 2°C). This is best accomplished by volumetric displacement. After the correct ratio is achieved, the mixture is stirred vigorously for 30 min with a mechanical or magnetic stirrer. At 10 min intervals, the mixture is also stirred manually to ensure complete mixing. After the 30 min mixing period, the mixture is allowed to settle for 1 hour. The supernatant is then siphoned off without disturbing the settled material, and centrifuged to remove particulates prior to chemical analysis (approximately 2,000 rpm for 30 min, until visually clear).

5 GEOLOGICAL PROFILE

The geological profile of the proposed twin 400mm submarine gas pipeline is presented in **Figure 5.1**. As shown in **Figure 5.1**, the seabed material which would be affected by the installation of the proposed twin 400mm submarine gas pipeline in general consist of marine deposit, fill and alluvium.

FIGURES



LEGENDS:

- PROPOSED TWIN 400 - 450 SUBMARINE GAS MAIN
- PROPOSED TWIN 400 LAND GAS MAIN
- PROPOSED 600 LAND GAS MAIN
- PROPOSED 600 LAND GAS MAIN

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	AUG 07	YKL	STAGE 1 REPORT	MT	TI

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Project

INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM MA TAU KOK TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

GENERAL LAYOUT OF THE PROJECT (OPTION A)

Designed	KL		Eng.Chk.	MT	
Drawn	YKL		Coordination	KL	
Dwg.Chk.	KL		Approved	TI	

Scale 1:7500@A1

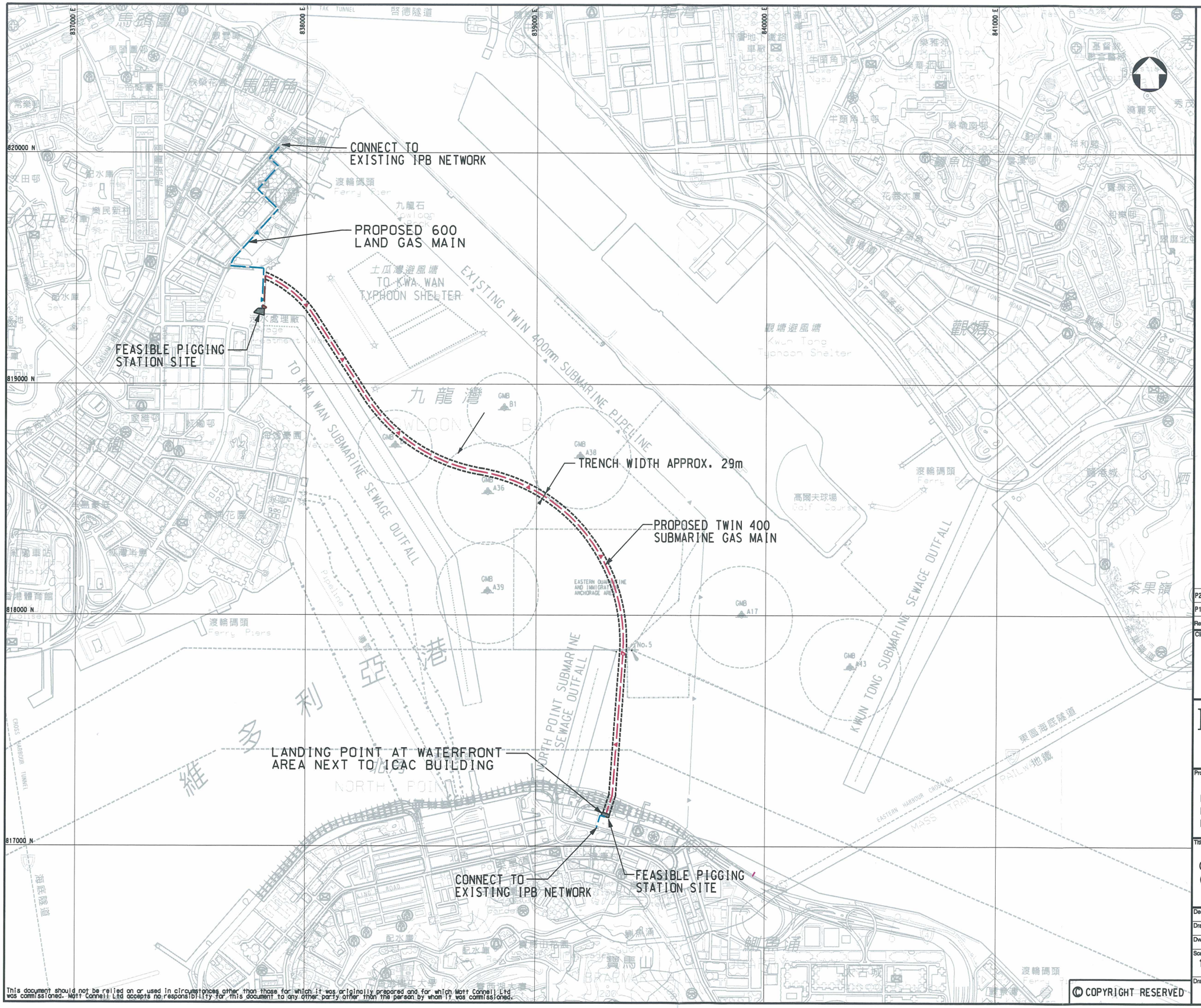
Project 237926

Status PRE

CAD File J:\237926\REPORT\CIV\SEDIMENT SAMPLING APR 2008\FIGURE 1.1a.dwg

Drawing No. FIGURE 1.1a

Rev P1



LEGENDS:

- PROPOSED TWIN 400 SUBMARINE GAS MAIN
- PROPOSED TWIN 400 LAND GAS MAIN
- PROPOSED 600 LAND GAS MAIN

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	SEP 07	YKL	REVISE PIGGING STATION LAYOUT	MT	TI
P1	AUG 07	YKL	STAGE 1 REPORT	MT	TI

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INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM MA TAU KOK TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

GENERAL LAYOUT OF THE PROJECT (OPTION B)

Designed	KL		Eng.Chk.	MT	
Drawn	YKL		Coordination	KL	
Dwg.Chk.	KL		Approved	TI	

Scale 1:7500@A1

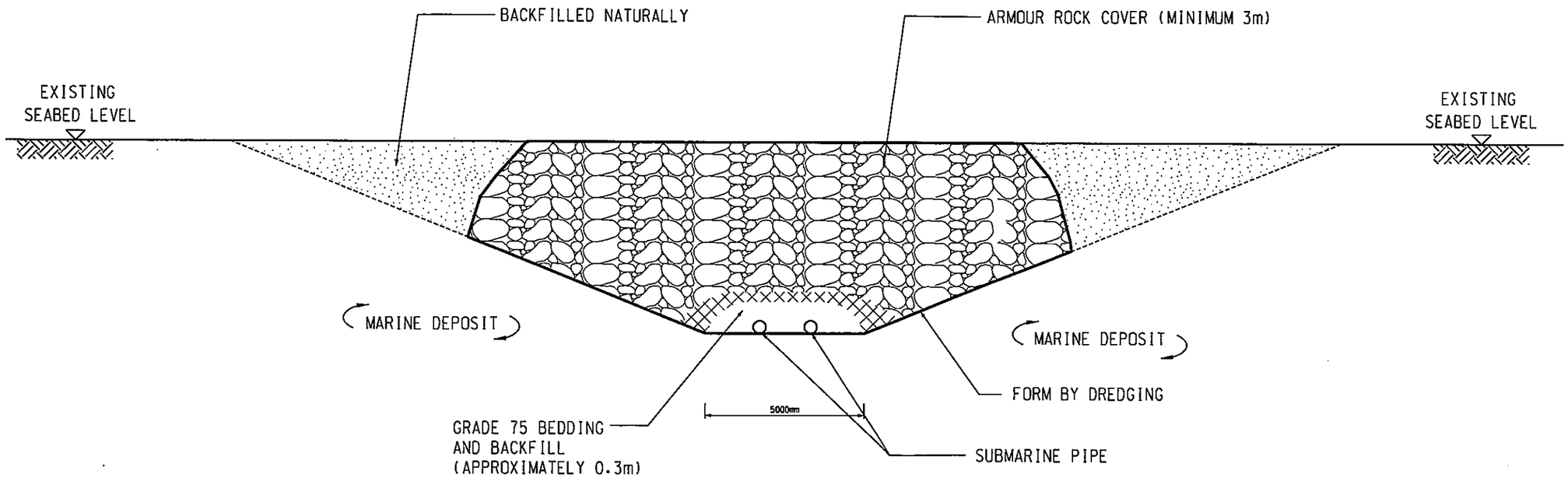
Project 237926

CAD File J:\237926\report\civ\SEDIMENT SAMPLING JAN 2008\FIGURE -1b.dgn

Status PRE

Drawing No. FIGURE 1.1b

Rev P3



Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	AUG 07	YKL	STAGE 1 REPORT	MT	TI

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Project

INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM MA TAU KOK TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

TYPICAL CROSS SECTION OF PIPELINE TRENCH

Designed	KL		Eng.Chk.	MT	
Drawn	YKL		Coordination	KL	
Dwg.Chk.	KL		Approved	TI	

Scale: AS SHOWN@A1

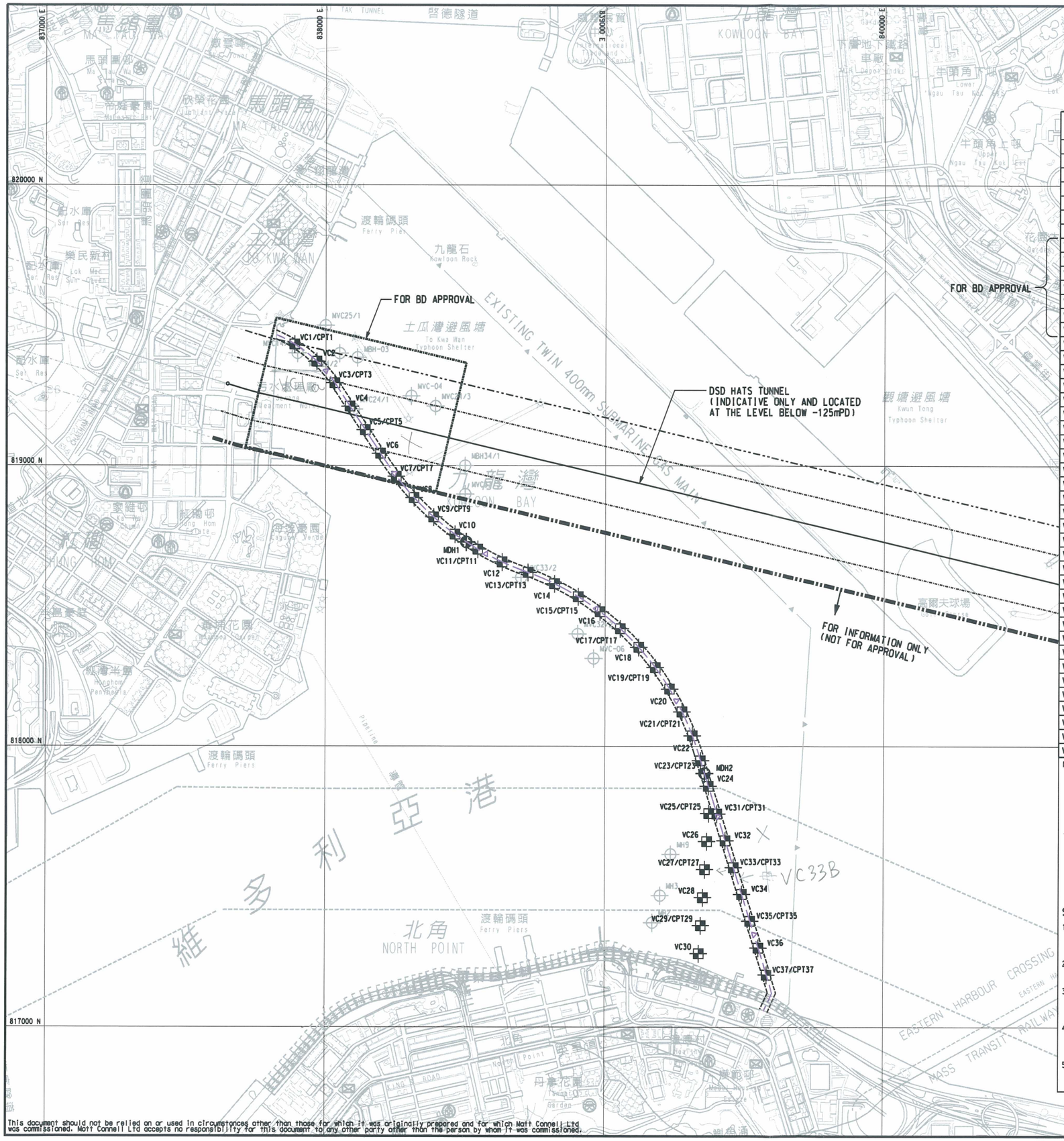
Project: 237926

CAD File: h:\237926\report\civ\sediment sampling fig 2008\FIGURE

Status: PRE

Drawing No.: FIGURE 1.2

Rev: P1



MDH/VC/CTP NO.	GI LOCATIONS		
	EASTING (m)	NORTHING (m)	TENTATIVE DEPTH++
~~MDH1~~ DELETED	~~837936~~ DELETED	~~819402~~ DELETED	~~15m#~~ DELETED
~~MDH2~~ DELETED	~~838169~~ DELETED	~~819085~~ DELETED	~~5m#~~ DELETED
MDH1	838504	818728	15m#
~~MDH4~~ DELETED	~~839054~~ DELETED	~~818060~~ DELETED	~~DELETED~~
MDH2	839358	817903	15m#
~~MDH6~~ DELETED	~~839341~~ DELETED	~~817314~~ DELETED	~~15m#~~ DELETED
~~MDH7~~ DELETED	~~839540~~ DELETED	~~817530~~ DELETED	~~5m#~~ DELETED
VC1/CPT1*+	837889	819432	6m
VC2	837968	819371	6m
VC3/CPT3*+	838032	819295	6m
VC4	838087	819210	6m
VC5/CPT5*+	838141	819127	6m
VC6	838196	819043	6m
VC7/CPT7*+	838251	818959	6m
VC8	838317	818885	6m
VC9/CPT9*+	838387	818817	6m
VC10	838464	818755	6m
VC11/CPT11*+	838546	818702	6m
VC12	838633	818657	6m
VC13/CPT13*+	838726	818619	6m
VC14	838820	818579	6m
VC15/CPT15*+	838904	818533	6m
VC16	838982	818479	6m
VC17/CPT17*+	839055	818419	6m
VC18	839121	818353	6m
VC19/CPT19*+	839180	818281	6m
VC20	839232	818204	6m
VC21/CPT21*+	839277	818122	6m
VC22	839314	818037	9m
VC23/CPT23*+	839343	817948	9m
VC24	839372	817857	9m
VC25/CPT25*o+	839374	817760	9m
VC26o	839367	817660	9m
VC27/CPT27*o+	839359	817561	9m
VC28o	839352	817461	9m
VC29/CPT29*o+	839345	817361	9m
VC30o	839338	817261	9m
VC31/CPT31*+	839403	817759	9m
VC32	839433	817663	9m
VC33/CPT33*+	839463	817568	9m
VC34	839493	817472	9m
VC35/CPT35*+	839523	817377	9m
VC36	839552	817281	9m
VC37/CPT37*+	839582	817186	9m

NOTE: ONE VIBROCORE WILL BE TAKEN AT EACH OF THE INDICATED VIBROCORE POSITION, THE JAR SAMPLE SHELL LOGGED.

* - THE PROVIDED COORDINATES ARE FOR VIBROCORE (VC), THE CPT SHALL BE CARRIED OUT AT 2m OFFSET THE VIBROCORE LOCATION.

o - UNLESS INSTRUCTED BY THE ENGINEER, THE PROPOSED MARINE DRILLHOLE AND VIBROCORE ARE PROVISIONAL ONLY .

\+ - SAMPLES FOR ELUTRIATE TEST SHALL BE TAKEN AS PER THE SPECIFICATIONS.

++ - REFERS TO PROVISIONAL DEPTH AND THE END OF EACH MDH/VC SHALL BE SUBJECTED TO THE ENGINEER'S APPROVAL.

- 5m OF ALLUVIUM SOIL MUST BE IDENTIFIED AND AGREED BY THE ENGINEER FOR TERMINATION OF DRILLING HOLE.

SAMPLING, FIELD TEST AND INSTRUMENTATION

1. ALL HOLES SHALL BE FORMED BY ROTATARY DRILLING WITH WATER AS FLUSHING MEDIUM. ALL HOLES SHALL BE H SIZE IN SOIL, ARTIFICIAL HARD MATERIAL, BOULDER, AND IN MATERIAL OTHER THAN ROCK.
2. OBTAIN PISTON SAMPLES IN VERY SOFT TO SOFT MARINE/ALLUVIAL CLAY AT 2m INTERVALS COMMENCING AT 0.5m BELOW SEABED LEVEL.
3. OBTAIN MAZIER AT 2m INTERVALS IN SUPERFICIAL & IN-SITU SOIL OR BY U76 AS AN ALTERNATIVE TO IMPROVE RECOVERY FOR LESS COHESIVE GRANULAR SOILS.
4. CARRY OUT SPT INCLUDING UNER SAMPLE AT 0.5m BELOW EACH MAZIER SAMPLE AND 1.0m BELOW EACH U76 SAMPLE AND IN-SITU VANE SHEAR TEST IMMEDIATELY BELOW EACH PISTON SAMPLE.
5. PERMEABILITY TEST TO BE CARRIED OUT AT ALL DRILLHOLES AND LOCATION TO BE DETERMINTED BY THE ENGINNER.

NOTE:

1. THE EXACT LOCATIONS OF DRILL HOLES AND VICROCORES ARE TO BE DETERMINED ON SITE BY THE ENGINEER.

LEGEND:

- SSDS 100m PROTECTION ZONE
- SSDS 200m PROTECTION ZONE
- EXISTING TWIN 400 SUBMARINE GAS MAIN
- PROPOSED SUBMARINE GAS MAIN
- MVC24/3 — PREVIOUS GROUND INVESTIGATION
- MDH1 — PROPOSED MARINE DRILLHOLE
- VC3/CPT3 — PROPOSED VIBROCORE AND CPT

MDH/VC/CTP NO.	RELATIVE HORIZONTAL DISTANCE BETWEEN BOREHOLES AND DSD HATS(m)*	TETATIVE BOTTOM LEVEL (mPD)
VC1/CPT1	197m	-16
VC2	155m	-16
VC3/CPT3	96m	-17
VC4	27m	-18
VC5/CPT5	41m	-18
VC6	110m	-19
VC7/CPT7	179m	-19

* REMARK: MEASURED FROM CENTRE LINE

G.I. WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH PNAP 165

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	JUN 08	YKL	STAGE 1 REPORT	MT	TI

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Project

INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM TO KWA WAN TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

GROUND INVESTIGATION
FOR SUBMARINE GAS MAIN ALIGNMENT

Designed	KL		Eng.Chk.	MT	
Drawn	YKL		Coordination	KL	
Dwg.Chk.	KL		Approved	TI	

Scale 1:7000@A1

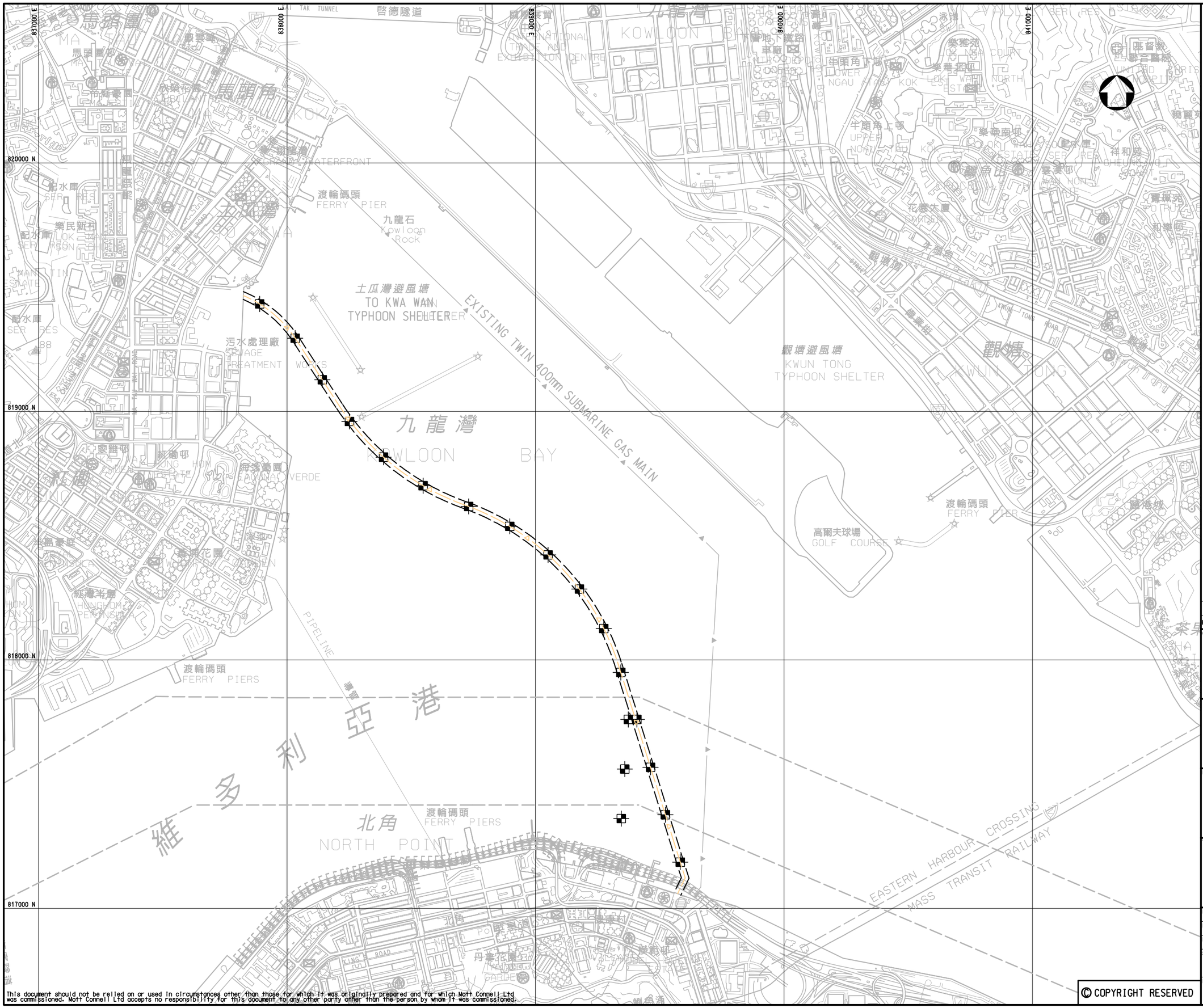
Project 237926

Status PRE

CAD File J:\237926\report\civ\sediment sampling Jun 2008\FIGURE 3-1.dgn

Drawing No. FIGURE 3.1

Rev P1



LEGENDS:

- EXISTING TWIN 400 SUBMARINE GAS MAIN
- PROPOSED SUBMARINE GAS MAIN
- MVC24/3 — PREVIOUS GROUND INVESTIGATION
- VC3/CPT3 — PROPOSED VIBROCORE FOR ELUTRIATION TESTS AT 200m INTERVAL

Rev	Date	Drawn	Description	Ch'k'd	App'd

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Project

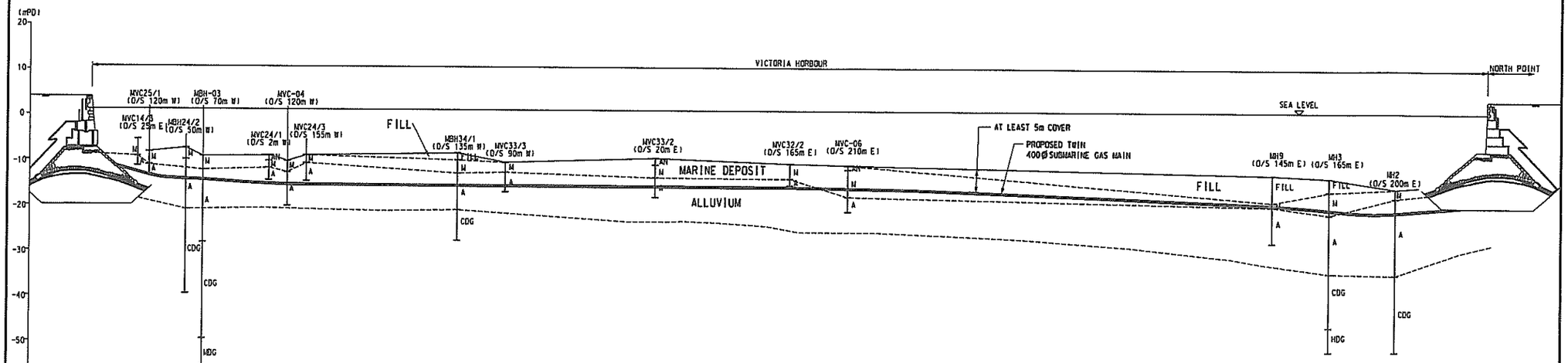
INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM MA TAU KOK TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

PROPOSED VIBROCORES FOR ELUTIRATE TESTS

Designed			Eng.Chk.		
Drawn			Coordination		
Dwg.Chk.			Approved		

Scale 1:7000@A1	Project 237926 CAD File J:\237926\REPORT\CIV\SEDIMENT SAMPLING JAN 2008\FIGURE	Status INF
Drawing No. FIGURE 4.1		Rev P1



SCALE: 1:5000 (HOR.)
1:500 (VER.)

LEGENDS:

AN	- ANTHROPOGENIC DEPOSIT
M	- MARINE DEPOSIT
A	- ALLUVIUM
HDG	- HIGHLY DECOMPOSED GRANITE
CDG	- COMPLETELY DECOMPOSED GRANITE
MDG	- MODERATELY DECOMPOSED GRANITE
I	DRILLHOLE OR VIBROCORE
O/S 2m N	OFFSET 2m NORTH FROM PROPOSED MAIN ALIGNMENT CENTRAL LINE

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	AUG 07	YKL	STAGE 1 REPORT	MT	TJ

Client

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Project

INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM MA TAU KOK TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

GEOLOGICAL PROFILE OF PROPOSED SUBMARINE GAS PIPELINE

Designed			Eng.Chk.		
Drawn			Coordination		
Dwg.Chk.			Approved		

Scale: AS SHOWN@A1	Project: 237926	Status: PRE
	CAD File: j\237926\report\civ\SEDIMENT SAMPLING JAN 2008\FIGURE 5.1.dgn	
Drawing No.: FIGURE 5.1		Rev: P1

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Branch Office
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Wan Chai, Hong Kong.

環境保護署分處
香港灣仔
軒尼詩道
一百三十號
修頓中心廿八樓

4 July 2008

Urgent By Fax : 25167979

	To	Action	Inform	Copy	Sign	Date
1	TI		✓			5/7
2	TT					9/7
Rec'd	DL WKC	07 JUL 2008				8/7
3	FY					8/7
4	PEJ					
File No. T237926/30.04					Mott Connell	

The Hong Kong and China Gas Company Limited,
Gas Supply Planning Department, 17th floor,
363 Java Road, North Point,
Hong Kong
(Attn: Mr. SHUM Chuen Kui, Sam / Gas Supply Planning Manager)

Dear Mr. Shum,

Environmental Impact Assessment Ordinance (EIAO)
Project Title: Installation of Submarine Gas Pipelines from Ma Tau Kok to North Point for Former Kai Tak Airport Development
(EIA Study Brief No. ESB-171/2007)

Noise Assessment Points

I refer to a letter from your consultant, Mott Connell (ref: KMY/PEJ/TI/TT/DL/FY/T237926/30.03/L-0179) dated 24 June 2008 submitting the captioned Noise Assessment Points for our agreement under Sections 3.4.8.2(iii)(b) of the EIA Study Brief No. ESB-171/2007.

Please be informed that after taking into the advice from our noise assessment team, the submitted proposal is considered as acceptable. As such, agreement is hereby given under the following requirement of the captioned EIA Study Brief:

Reference in the Study Brief Stipulating the Requirements	Key Description
Section 3.4.8.2(iii)(b)	Assessment points to represent all identified noise sensitive receivers (NSRs) for carrying out quantitative noise assessment

Nevertheless, your company and the consultant should note that as stated in Section 3.4.8.2(iii)(b) of the EIA Study Brief, the noise assessment points could be varied subject to the best and latest information available during the course of the EIA study. The above agreement is only for the concerned requirements under the EIA Study Brief to facilitate the EIA study. It shall not prejudice the Director of Environmental Protection's future decisions on any application for approval of the EIA report under the EIAO. If there is any significant change in circumstances, project design/details or assessment methodology/ assumptions, etc. your company and the consultant should review the situations; carry out necessary updating/revisions; and seek our advice whether further agreements under the EIA Study Brief are necessary.

You are also reminded that the requirements on documentations of key assessment assumptions, limitations of assessment methodologies and related prior agreement(s) with the Director of Environmental Protection as stipulated under Section 3.4.11 of the EIA Study Brief shall be followed.

Yours sincerely,

(Victor YEUNG)
Senior Environmental Protection Officer
for Director of Environmental Protection

c.c.:
Mott Connell (Attn: Mr. Tony Tang) Fax: 28271823

c.c. internal: S(MA)4, E(MA)31

Mott Connell

17

Our ref: KMY/PEJ/TI/TT/DL/FY/T237926/30.03/L-0179

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The EIA Ordinance Register Office
Environmental Protection Department
27th Floor, Southorn Centre,
130 Hennessy Road,
Wan Chai, Hong Kong.

Attn: The EIAO Register Office

24th June 2008

By Post

Dear Sirs / Madams

Installation of Submarine Gas Pipelines and Associated Facilities
From Ma Tau Kok to North Point for Former Kai Tak Airport Development
ESB-171/2007 - Clause 3.4.8.2 (iii)(b)
Noise Assessment Points

We refer to Clause 3.4.8.2(iii)(b) of the EIA Study Brief No. ESB-171/2007, agreement with EPD is required on assessment points prior to the quantitative noise assessment.

Please find below a list of noise assessment points to represent all identified noise sensitive receivers (NSRs) for carrying out quantitative noise assessment for your agreement. The location of the noise assessment points are also shown in the figures attached.

Please note that representative NSRs have included the existing ones and committed noise sensitive developments/uses recently approved under the Town Planning Ordinance that are likely to be occupied during the construction phase of the Project.

NSR ID	Description	Usage	OZP
Ma Tau Kok			
SCH01	Po Leung Kuk Ngan Po Ling College (Existing)	Institutional	Hung Hum OZP (S/K9/21) gazetted on Feb 08
SCH02	CCC Kei To Secondary School (Existing)	Institutional	Hung Hum OZP (S/K9/21) gazetted on Feb 08
SCH03	Oblate Father's Primary School (Existing)	Institutional	Kai Tak OZP (S/K22/2) gazetted on Nov 07
SCH04	Holy Carpenter Primary School (Existing)	Institutional	Kai Tak OZP (S/K22/2) gazetted on Nov 07
SCH05	School (Planned)	Institutional	Hung Hum OZP (S/K9/21) gazetted on Feb 08
WFM	Wing Fai Mansion (Existing)	Residential	Hung Hum OZP (S/K9/21) gazetted on Feb 08
SUV	Sunrise Villa (Existing)	Residential	Ma Tau Kok OZP (S/K10/19) gazetted on Jan 08
WCT	Block B, Wei Chien Court (Existing)	Residential	Ma Tau Kok OZP (S/K10/19) gazetted on Jan 08

NSR ID	Description	Usage	OZP
North Point			
SCH06	Canossa College (Existing)	Institutional	Quarry Bay OZP (S/H21/24) gazetted on Oct 07
LPV	La Place de Victoria (Existing)	Residential	North Point OZP (S/H8/21) gazetted on Jul 07
MHE	Model Housing Estate (Existing)	Residential	North Point OZP (S/H8/21) gazetted on Jul 07
KCM	Kut Cheong Mansion (Existing)	Residential	North Point OZP (S/H8/21) gazetted on Jul 07
LKB	Lai King Building (Existing)	Commercial/ Residential	Quarry Bay OZP (S/H21/24) gazetted on Oct 07
FSQ	North Point Fire Services Married Quarters (Existing)	G/IC	North Point OZP (S/H8/21) gazetted on Jul 07
HG	Healthy Garden (Existing)	Residential	North Point OZP (S/H8/21) gazetted on Jul 07
HP	Harbour Plaza, North Point (Existing)	Hotel	North Point OZP (S/H8/21) gazetted on Jul 07

We shall be grateful to receive your agreement on or before Tuesday, 1 July 2008.

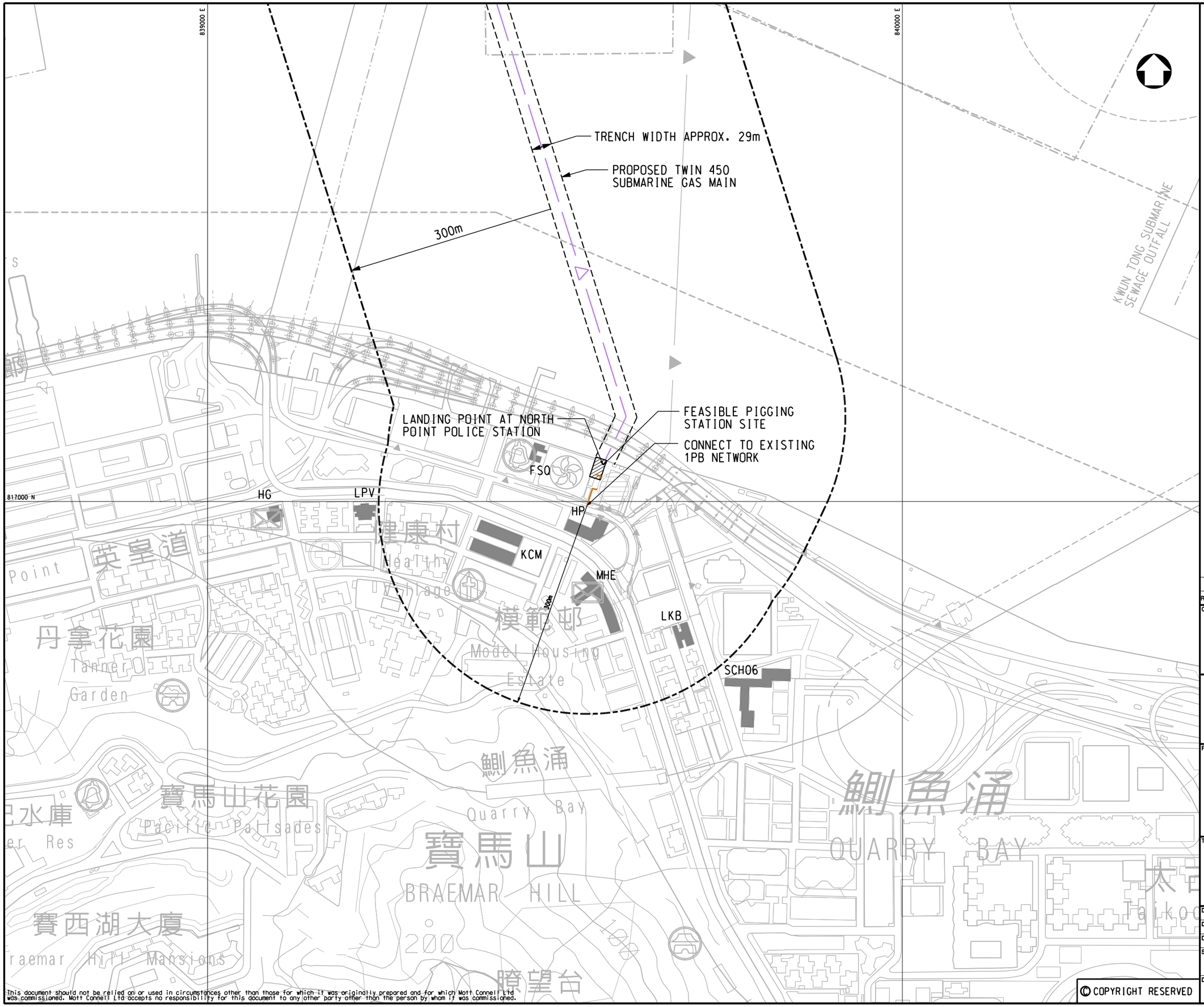
Should you have any queries or require any further information, please contact our Florence Yuen at 2828 5768.

Yours faithfully
for MOTT CONNELL LIMITED

Tony Tang

Encl.
c.c: HKCG/GSPD Mr. Sam Shum

Mott Connell



LEGENDS:

- PROPOSED TWIN 450 SUBMARINE GAS MAIN
- PROPOSED TWIN 400 LAND GAS MAIN
- PROPOSED 600 LAND GAS MAIN
- 300m ASSESSMENT AREA

Rev	Date	Drawn	Description	Ch'k'd	App'd

Client

THE HONG KONG AND CHINA GAS COMPANY LIMITED.

Mott Connell

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Tel 2828 5757
Fax 2827 1823
Web www.mottconnell.com.hk

Project

INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM TO KWA WAN TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

REPRESENTATIVE
NOISE SENSITIVE RECEIVERS (NSRS)
(SHEET 1 OF 3)

Designed	CWK		Eng.Chk.	MT	
Drawn	YKL		Coordination	FY	
Dwg.Chk.	CWK		Approved	TI	

Scale 1:2500@A1

Project 237926

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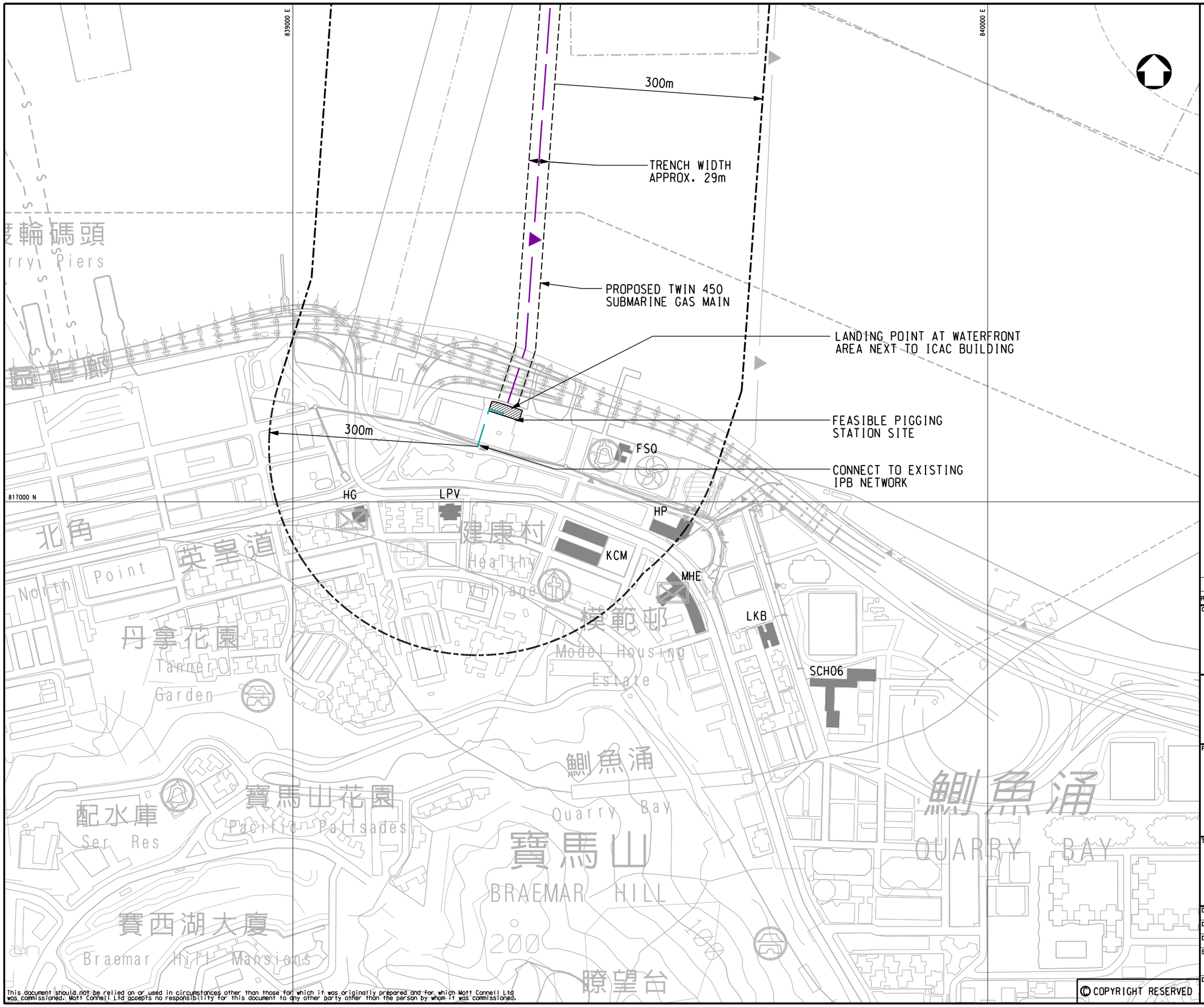
Status PRE

Drawing No. FIGURE 10.2a

Rev P1



LEGENDS:

- PROPOSED TWIN 450 SUBMARINE GAS MAIN
- PROPOSED 600 LAND GAS MAIN
- 300m ASSESSMENT AREA

Rev	Date	Drawn	Description	Ch'k'd	App'd

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Project

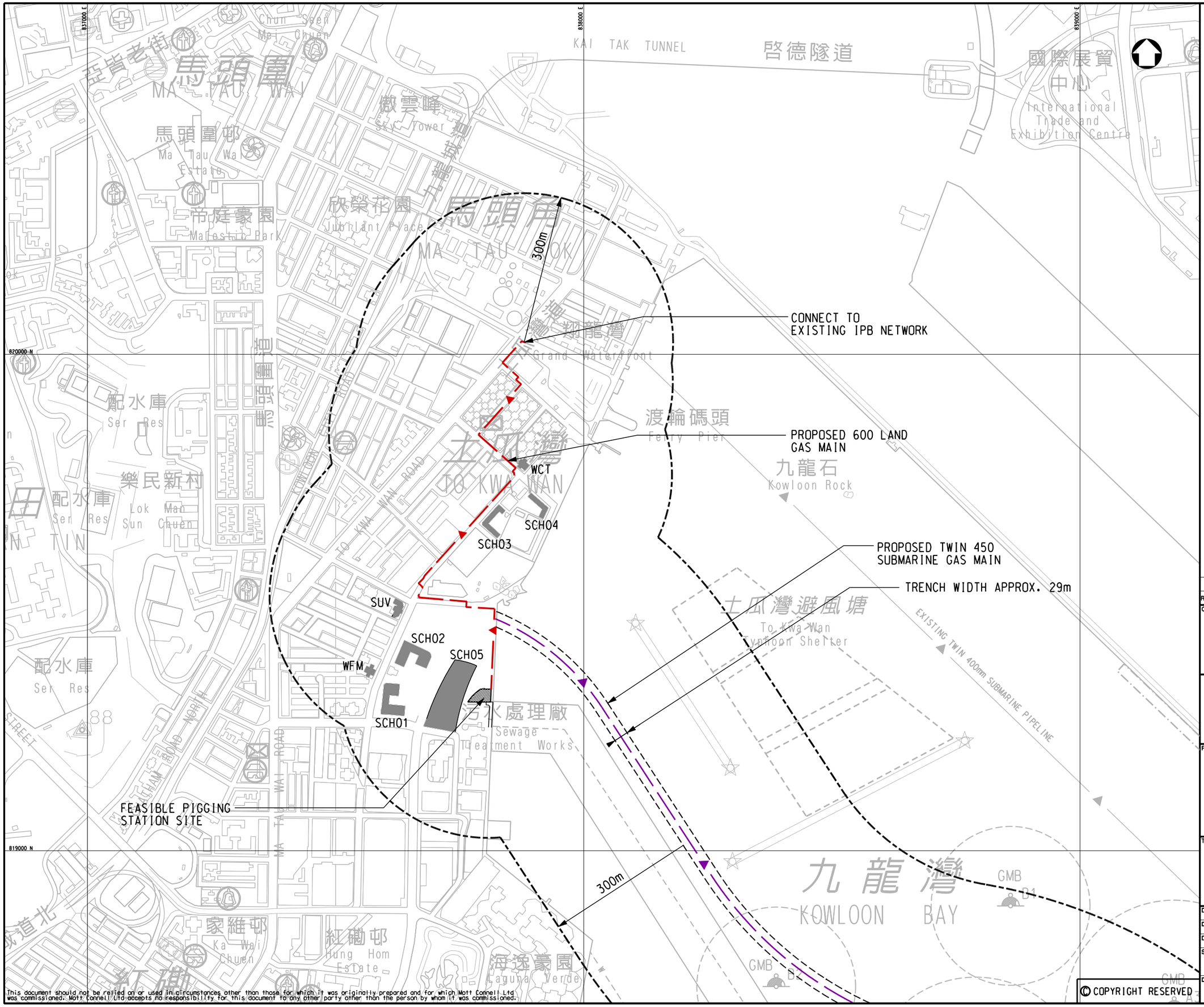
INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM TO KWA WAN TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

REPRESENTATIVE
NOISE SENSITIVE RECEIVERS (NSRS)
(SHEET 2 OF 3)

Designed	CWK		Eng.Chk.	MT	
Drawn	YKL		Coordination	FY	
Dwg.Chk.	CWK		Approved	TI	

Scale 1:2500@A1	Project 237926 CAD File J:\237926\REPORT\ENV\EIA\080523\FIGURE 10-2b.dgn	Status PRE
Drawing No. FIGURE 10.2b		Rev P1



LEGENDS:

- PROPOSED TWIN 450 SUBMARINE GAS MAIN
- PROPOSED TWIN 400 LAND GAS MAIN
- 300m ASSESSMENT AREA

Rev	Date	Drawn	Description	Ch'k'd	App'd

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Project

INSTALLATION OF SUBMARINE GAS PIPELINES AND ASSOCIATED FACILITIES FROM TO KWA WAN TO NORTH POINT FOR FORMER KAI TAK AIRPORT DEVELOPMENT

Title

REPRESENTATIVE
NOISE SENSITIVE RECEIVERS (NSRS)
(SHEET 3 OF 3)

Designed	CWK		Eng.Chk.	MT	
Drawn	YKL		Coordination	FY	
Dwg.Chk.	CWK		Approved	TI	

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Project 237926

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Status PRE

Drawing No. FIGURE 10.2c

Rev P1