

Appendix 6.4A
Sediment Sampling and Testing
Plan (Issue 2)

Parsons Brinckerhoff (Asia) Ltd.

7/F One Kowloon
1 Wang Yuen Street
Kowloon Bay
Hong Kong
Tel: +852 2579 8899
Fax: +852 2856 9902
Email: info.hk@pbworld.com

16 April 2013

www.pbworld.com

Certified to ISO 9001, ISO 14001

Distribution List

Our ref. 2512043A-GN-00306/13

Dear Sirs/Madams,

By Post

Agreement No. CE 44/2011 (HY)
Proposed Road Improvement Works in West Kowloon Reclamation Development – Phase 1
Investigation, Design and Construction
Proposal for Sediment Sampling and Testing (Issue 2)

We enclose the Proposal for Sediment Sampling and Testing (Issue 2) for the captioned consultancy for your comments.

In view of the tight programme, we would be grateful if you would provide your comments by 30 April 2013 via email at chan.chungyan@pbworld.com.

If you have any enquiries, please contact our Alvin Yuen on 3900 2102.

Yours faithfully
PARSONS BRINCKERHOFF (ASIA) LTD.


Edmund Kwong
Project Manager

EKK/EW/AY/yc

Encl.

Agreement No.CE44/2011 (HY)

Proposed Road Improvement Works in West Kowloon Reclamation Development - Phase I - Investigation, Design and Construction
Distribution List

Department	Address	Name	Post	Tel	Fax	Email	Nos of copies
Environmental Protection Department Environmental Assessment Division Metro Assessment Group Kowloon Section (2)	27th Floor, Southorn Centre, 130 Hennessy Road, Wan Chai, Hong Kong	Ms. KWOK Wing Chi, Winnie	Env Protection Offr (Metro Assessment) 24	2835 1109	2591 0558	wcwkwok@epd.gov.hk	1
Environmental Protection Department Environmental Compliance Division Territorial Control Office Marine Dumping Section	25th floor, Southorn Centre, 130 Hennessy Road, Wan Chai, Hong Kong.	Dr. TSANG Chau Chiu, Sam	Sr Env Protection Offr (Territorial Control) 3	2835 1608	2305 0453	cctsang@epd.gov.hk	1
Civil Engineering and Development Department Civil Engineering Office Fill Management Division Strategy I Section	5/F, Civil Engineering and Development Building, 101 Princess Margaret Rd, Homantin, Kowloon	Mr. LAU Fuk Wing	Engr / Strategy 2	2762 5539	2714 0113	fwlau@cccd.gov.hk	1
Highways Department Major Works Project Management Office Major Works Office (1)	6th Floor, Ho Man Tin Government Offices, 88 Chung Hau Street, Ho Man Tin, Kowloon	Mr. LAM Kwok Fai	Sr Engr/Special Duties	2762 3583	2761 4864	sesd.mw@hyd.gov.hk	1

Agreement No. CE44/2011(HY)

Proposed Road Improvement Works in West Kowloon Reclamation Development (Phase 1)

– Investigation, Design and Construction



Proposal for Sediment Sampling and Testing
(Issue 2)

PROPOSAL FOR SEDIMENT SAMPLING AND TESTING (ISSUE 2)

CONTENTS

	Page
1. INTRODUCTION	1
1.1 Background	1
1.2 This Assignment	3
1.3 Objectives of this Assignment	3
2. PURPOSE OF THIS PROPOSAL	4
2.1 Management of Excavated Sediment in accordance with ETWB TC(W) No. 34/2002	4
2.2 Tier II Chemical Screening in accordance with ETWB TC(W) No. 34/2002	4
2.3 Excavated Marine Sediment from Piling Works	4
3. RATIONALE FOR SEDIMENT REMOVAL	4
4. DESK STUDY	5
4.1 Review on Published Geology	5
4.2 Review on Existing Ground Investigation	5
4.3 Conclusion from Desk Study	5
5. ESTIMATED QUANTITY OF MARINE SEDIMENT TO BE EXCAVATED	5
6. SEDIMENT SAMPLING PLAN	6
6.1 Sampling Locations	6
6.2 Sampling Method and Depth of Sampling	6
6.3 Strata Logging	6
6.4 Sample Size and Decontamination Procedures	7
6.5 QA/QC Requirements	7
7. LABORATORY ANALYSIS	8
7.1 Tier II Chemical Screening	8
7.2 Tier III Biological Screening	8
8. INTERPRETATION OF RESULTS	10

APPENDICES

- Appendix A FMC's Agreement to Rationale of Sediment Removal
- Appendix B Layout Plan of Proposed Works under the Project
- Appendix C Geological Map
- Appendix D Existing Ground Investigation Records (Extracts)
- Appendix E Proposed Ground Investigation Plan
(with drillholes for sampling of sediment)
- Appendix F Table of Tier II Chemical Screening
(from Table 1, Appendix B of ETWB TC (W) No. 34/2002)
- Appendix G Table of Tier III Biological Screening
(from Table 2, Appendix B of ETWB TC (W) No. 34/2002)
- Appendix H Sediment Quality Criteria for the Classification of Sediment
(from Appendix A of ETWB TC (W) No. 34/2002)
- Appendix I Response to Comments

1. INTRODUCTION

1.1 Background

There will be substantial developments in West Kowloon Reclamation Development (WKRd) including the West Kowloon Cultural District (WKCD), Austin Station of the Kowloon Southern Link (KSL) and West Kowloon Terminus (WKT) of the Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) and building developments above the two railway stations. With the completion of these developments and the commissioning of the new transport facilities, their traffic impacts to the road network of WKRd and its vicinity will be significant.

Apart from the additional traffic impacts arising from the major developments and transport facilities in WKRd, several major junctions in the area are currently operating with insufficient capacity causing serious congestion to some existing major road corridors including Jordan Road (JRD), Ferry Street (FST), Canton Road (CRD), Lin Cheung Road (LCR), Wui Cheung Road (WCR) and Austin Road (AUR). For example, the observed traffic queue on LCR southbound at its junction with JRD can be up to 340 metres (m) in the PM peak of Saturdays.

Against this background, Transport Department commissioned the “West Kowloon Reclamation Development Traffic Study” (the Traffic Study) in May 2008 to formulate comprehensive traffic and transport measures to address the traffic congestion problems and the additional traffic impacts arising from the various developments and transport infrastructures on the WKRd.

The Final Report of the Traffic Study was issued in September 2009. Findings of the study concluded that in design year 2031 the original road network in the WKRd previously planned in the late 1980s would be inadequate to support the demand of the local traffic as well as through traffic heading for other surrounding areas such as WKCD and Tsim Sha Tsui (TST). For instance, out of 41 key road junctions in the study area, 18 of them would be overloaded or approaching their capacity. The critical reserve capacity (RC) of these 18 junctions would range from -37% (junction of Austin Road West/Road D1) to +7% (junction of CRD/Kowloon Park Drive). Furthermore, there would be long traffic queues at five major junctions on JRD, FST, LCR, Austin Road West (AURW) and the future Road D1 causing blockage to the upstream junctions. Please refer to the Final Report of Agreement No. TD 54/2008 – West Kowloon Reclamation Traffic Study for the detailed junction analysis results within the study area.

To enhance the road network of the area, the Traffic Study identified and recommended, amongst others, the following Core and Additional Schemes together with the improvement works at the junction of CRD/FST/JRD. While the Core Schemes are being implemented by other agents, the Additional Schemes together with the improvement works at the said junction are going to be implemented under this Project.

Core Schemes (by other agents)

- (i) Scheme D – Extension of the previously planned LCR/AUR underpass to the west of the junction of CRD/AUR. This scheme will be implemented under the ‘Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link’ project by Railway Development Office of Highways Department;
- (ii) Scheme E – Provision of a new link road from the Kowloon exit of the Western Harbour Crossing (WHC) to the elevated JRD. This scheme will be implemented by a private developer led by the Mass Transit Railways Corporation Limited

Additional Schemes (under this Project)

- (iii) Scheme H - New road connection from Hoi Po Road to West Kowloon Highway (WKH) northbound plus widening of the elevated Nga Cheung Road (NCR);
- (iv) Scheme I - New link road from elevated NCR to WHC;
- (v) Scheme J - New link road from WKH southbound to NCR;
- (vi) Scheme Q - Provision of a local underpass along CRD at the junction of CRD/AUR;
- (vii) Improvement Works at the Junction of CRD/FST/JRD

Coupled with the Core Schemes, the Additional Schemes and the junction improvement works would enable most of the key road junctions in the study area to operate with spare capacity, and the traffic queue length would also be reduced avoiding blockage to the upstream junctions. To accommodate the increased traffic volume arising from XRL commissioning and WKCD (Phase 1) opening in 2015, it is desirable to complete the improvement works as early as possible.

A Feasibility Study (FS) consultancy (CE 65/2009 (HY)) was commissioned by the Highways Department (HyD) in May 2010 to study the technical feasibility of the proposed works. The Study concluded in June 2011 that the proposed Schemes H, I, J and Junction Improvement Works at CRD/FST/JRD were, prima facie, technically feasible. However, for Scheme Q (underpass) which would involve the construction of an underpass along Canton Road at the junction of CRD/AUR/AURW and the reconstruction of the associated pedestrian subway at the junction, its technical feasibility was still yet to be ascertained subject to the clarification of a number of site constraints and uncertainties. As such, it was decided that the proposed works would be divided into two phases for implementation. Phase 1 of works would include Schemes H, I, J, Q (interim road improvement only) and the Junction Improvement Works at CRD/FST/JRD. Meanwhile, if the Scheme Q (underpass) is subsequently found to be technical feasible, it will be put under Phase 2 of works for later implementation.

1.2 This Assignment

On 7 March 2012, the Government of Hong Kong Administration Region awarded Agreement No. CE44/2011 (HY) Proposed Road Improvement Works in West Kowloon Reclamation Development – Phase 1 – Investigation, Design and Construction to Parsons Brinckerhoff (Asia) Ltd. The major scope of the Project under this Assignment comprises:

- a) Scheme H (A) – New road connection from Hoi Po Road to WKH Northbound
- b) Scheme H (B) - Widening of elevated NCR
- c) Scheme I - New Link Road from Elevated NCR to WHC
- d) Scheme J - New Link Road from WKH Southbound to NCR
- e) Interim Scheme Q - Interim road widening works along Canton Road
- f) Improvement Works at the Junction of Canton Road/ Ferry Street/ Jordan Road

The corresponding layouts are shown in **Appendix B**.

1.3 Objectives of this Assignment

The objectives of the Assignment are:

- a) to affirm the engineering practicability of the project;
- b) to refine the Project Scope, layout and design requirements through review of previous studies, preliminary works, and the latest available information and carry out necessary further investigation and studies;
- c) to enhance aesthetic friendliness of the Project;
- d) to produce sound and cost-effective preliminary design and formulate an implementation strategy for the Project;
- e) to conduct and assist the Employer in conducting public consultation and engagement;
- f) to carry out the detailed design for the Project; and
- g) to provide supervision of construction including site investigation works for the Project.

2. PURPOSE OF THIS PROPOSAL

2.1 Management of Excavated Sediment in accordance with ETWB TC(W) No. 34/2002

This proposal is prepared in accordance with the Environment, Transport and Works Bureau Technical Circular (Works) No. 34/2002, proposing sampling and testing of marine sediment. It is anticipated that marine sediment will be encountered and excavated in the course of construction works under the Project.

2.2 Tier II Chemical Screening in accordance with ETWB TC(W) No. 34/2002

In accordance with the “Management Framework for Excavated Sediment” in Appendix C of ETWB TC (W) No. 34/2002, sediment sampling and testing are set out in this proposal for Tier II Chemical Screening (see Sections 6 to 8 below for details). Based on the testing results, the sediment will be assessed as Category L or Category M or Category H according to the classification stated in Appendix A of ETWB TC (W) No. 34/2002.

Both marine sediment or marine mud to be excavated should be properly handled and/or disposed of according to ETWB TC(W) No. 34/2002.

Sediment sampling and testing will be carried out to determine the sediment quality as set out in this Proposal, which will be in accordance with ETWB TC (W) No. 34/2002.

2.3 Excavated Marine Sediment from Piling Works

The marine sediment generated under this project is a result of the piling works for the viaducts. Among the improvement schemes as described above in Section 1, Scheme H and Scheme J are vehicular viaducts along the West Kowloon Highway. General layout of the viaducts is shown in **Appendix B**. Deep foundation in form of pre-bored H-piles has to be constructed to support the viaduct structures. As the viaducts are located in reclamation area, it is anticipated that approximately 1,000m³ of marine sediment will be excavated during the course of the piling works.

3. RATIONALE FOR SEDIMENT REMOVAL

The rationale for sediment removal was submitted separately in the form of a special paper to the Fill Management Division of the Civil Engineering and Development Department (CEDD) and the Environmental Protection Department (EPD) on 8 March 2013 as attached in **Appendix A**. Please refer to the letter in **Appendix A** for details of the rationale which will not be repeated here.

Subsequent to the above submission on rationale for sediment removal, Marine Fill Committee of CEDD had no further comment on 25 March 2013 (see **Appendix A**).

4. DESK STUDY

4.1 Review on Published Geology

According to the Hong Kong Geological Survey (Sheet 11, Series HGM20, 1:20,000), superficial deposits at locations of Scheme H(A), H(B), I and J are undivided, mainly dark grey marine mud. At locations of Scheme Q and Junction of CRD/FST/JRD, the superficial geology is marine sand and medium grained granite. All these locations are formed by reclamation to the current ground level. The relevant geological map is presented in **Appendix C**.

4.2 Review on Existing Ground Investigation

A review on existing GI records has been conducted for estimating the sediment quantity and for planning of further GI. Existing GI records in the vicinity of the works area were obtained from GIU of GEO, CEDD to explore the geological conditions. Extracts from previous GI records are included in **Appendix D**.

Reviews of the above GI records suggested that the works area in west Kowloon under concern is generally covered by a layer of fill material (approx. 15m to 30m thick) and is then followed by a layer of marine deposit (approx. 3m to 6m thick) before reaching the alluvium/ in situ soil/ decomposed granite. The marine deposit consisted of a layer of marine mud on top (approx. 2m to 3m thick) and a layer of marine sand underneath (approx. 1m to 3m thick).

4.3 Conclusion from Desk Study

The existing data are insufficient to assess the potential contamination level of the marine sediment. Sediment sampling and testing are proposed for Tier II Chemical Screening in accordance with ETWB TC (W) No. 34/2002.

5. ESTIMATED QUANTITY OF MARINE SEDIMENT TO BE EXCAVATED

5.1 Based on information including the existing ground investigation data and preliminary design of the pre-bored H-piles (of sizes only 610mm outer diameter) for the viaducts, the estimated maximum quantity of marine sediment to be excavated by the piling works is approximately 1,000m³.

5.2 Further ground investigation (GI) works will be undertaken to determine the thickness of the marine sediment at the piling locations. After the GI data is available, the estimated quantity of marine sediment will be refined and will be reported to EPD and the Secretary of Marine Fill Committee.

6. SEDIMENT SAMPLING PLAN

6.1 Sampling Locations

Samplings of sediments for chemical/biological testing are proposed at 5 numbers of drillholes, namely CB1 to CB5, at locations as shown on the proposed GI plans in **Appendix E**, along the alignments of the proposed viaducts. As shown on the proposed GI plans in **Appendix E**, the sediment samples will be taken at the excavation sites of sediment/mud.

The exact sampling locations will be determined on site and subject to fine adjustments due to site specific conditions (e.g. locations and presence of existing foundations, underground utilities, delivery pipes and services).

6.2 Sampling Method and Depth of Sampling

As the layers of marine sediment are approximately 15m to 30m below the existing ground level according to the existing GI data, the proposed drillholes for sampling should be advanced by means of rotary drilling method. For safety reason, an inspection pit of 1.5m deep below ground should be excavated to inspect the presence of underground utilities at each of the proposed drillhole location.

The boring using drill rigs should be performed from existing ground level to 5m into bedrock, as each of the drillhole (CB1 to CB5) serves the dual purposes of the following:

- (i) regular GI works to facilitate structural/geotechnical design, and
- (ii) sampling of sediment for chemical/biological testing.

Vertical profiles of samples should be taken according to Appendix B Section 2(a)(vi) of ETWB TC (W) No. 34/2002. Samples of sediment for chemical/biological testing will be taken once the layer of marine deposit is encountered. Samples should be continuous, and the top level of the sub-samples should be the top of the marine deposit, 0.9m down, 1.9m down, 2.9m down, and then every 3m to the bottom of the marine deposit.

The marine deposit consists of a stratum of marine mud and a subsequent stratum of marine sand according to the existing GI data. For marine mud, Piston samples should be taken. For marine sand, Mazier/U100/U76 samples should be taken depending on the actual soil properties of the marine sand encountered.

6.3 Strata Logging

Strata logging for drillholes should be taken during the course of drilling and sampling by a qualified geologist. The logs should include the general stratigraphic descriptions, depth of sampling, sample notation and level of groundwater (if encountered). The presence of rocks/boulders/cobbles and foreign materials such as metals, wood and plastics should be recorded.

6.4 Sample Size and Decontamination Procedures

All equipment in contact with the ground should be thoroughly decontaminated between each drilling and sampling event to minimize the potential for cross contamination. The equipment (including drilling bits and samplers) should be decontaminated by steam cleaning/high-pressure hot water jet, and then washed by phosphate-free detergent and finally rinsed by distilled/deionized water.

According to Appendix B Section 2(a)(vi) of ETWB TC (W) No. 34/2002, the recommended sample sizes for different testing parameters are tabulated below:

Parameters to be tested	Sample size*
Metals and metalloid	0.5 litre
Organic	0.5 litre
Biological response	6 litres

(*Quantity to be confirmed by testing laboratory. The quantity of reference sediment to be collected needs to be separately worked out for each case, especially if biological dilution tests are anticipated.)

Depending on the results of chemical screening, biological screening may be required and samples of reference sediment should also be taken. In that case, reference sediment required for the test should be collected from references sites in Hong Kong waters designated by EPD.

All sampling bottles should be labelled with the station number, sample length, diameter and depth, sampling date and time, together with full description of the sample. If the contents are hazardous, this should be clearly marked on the container and precautions taken during transport. The samples should be contained in laboratory cleaned high-density polyethylene bottles or wide mouth borosilicate glass bottles with Teflon lined lids in accordance with ETWB TC (W) No. 34/2002.

The samples should be kept at 4°C in the dark and should not be frozen. All samples should be promptly analysed. If this is impractical, the recommended maximum holding time is:

Sample type	Maximum holding time
Chemical test	2 weeks
Biological test	8 weeks

6.5 QA/QC Requirements

For chemical tests, all tests should be conducted by laboratories accredited by Hong Kong Laboratory Accreditation Scheme (HOKLAS) or, in case of overseas laboratories, by equivalent national accreditation for these tests.

For biological tests, all tests should be conducted by laboratories with appropriate accreditation. Reference should be made to the list of accredited laboratories capable of carrying out biological testing as kept and updated by EPD. In any case, the biological test shall include appropriate quality assurance/quality control such as:

- (i) Negative Control
- (ii) Positive Control

7. LABORATORY ANALYSIS

7.1 Tier II Chemical Screening

All samples should be tested for all the contaminants (except Tributyltin (TBT)) stated in Table 1 – Analytical Methodology in Appendix B of ETWB TC (W) No. 34/2002. The table is enclosed in **Appendix F**.

When requested by EPD, analysis for other contaminants such as TBT, Dichloro-diphenyl-trichloroethane (DDT), other organochlorine compounds, and other hazardous chemicals which arise from specific industrial discharge or spillage, will also be tested.

7.2 Tier III Biological Screening

Samples for biological testing will be taken as well under this proposal. When biological testing in laboratory under Tier III is necessary (which depends on the results of chemical screening), the samples will be used for biological testing in accordance with ETWB TC (W) No. 34/2002.

In accordance with ETWB TC (W) No. 34/2002, Tier III biological screening is necessary for all Category M and certain Category H sediment samples in which one or more contaminants exceed 10 times of the Lower Chemical Exceedance Level (LCEL). The methods will follow the requirements as stated in ETWB TC (W) No. 34/2002.

In general, all biological tests should be conducted on composite samples. Composite sample is prepared by mixing up to 5 samples of the same category (M or H) which are continuous in vertical profile.

The composite samples for biological testing should also be tested for moisture content, grain size (% <63µm), total organic carbon (TOC), and ammonia (as mgN/L) and salinity in porewater.

Sediment classified as Category M shall be subjected to the following three toxicity tests (to be considered as one set) on each composite sample:

- a 10-day burrowing amphipod toxicity test; and
- a 20-day burrowing polychaete toxicity test; and
- a 48-96 hour larvae (bivalve or echinoderm) toxicity test.

Sediment classified as Category H and with one or more contaminant levels exceeding 10 times LCEL shall also be subjected to the above three toxicity tests but in a diluted manner (dilution test). The samples shall be prepared prior to toxicity testing as follows:

Sediment characteristics	Preparation method
Category H sediment (> 10 x LCEL)	Sample to be mixed with 9 portions of reference sediment
Category M sediment or Category H sediment (>10 x LCEL) suspected of ammonia contamination	Additional set of sample (after dilution for Cat. H sediment) to be purged [#] for ammonia removal (for amphipod test only).

(# If the ammonia concentration in the overlying water of the test system is $\geq 20\text{mg/L}$, purging of sediment is required. This is performed by replacing the overlying water at a rate of 6 volume replacements/24 h for 24 hours, and repeated once only if the ammonia level still exceeds 20 mg/L.)

The test endpoints and decision criteria are summarized in Table 2 at the end of Appendix B of ETWB TC (W) No. 34/2002 (see **Appendix F**). The sediment is deemed to have failed the biological test if it fails in any one of the three toxicity tests.

Only ecologically relevant species should be used for carrying out the biological screening tests. The species to be used for each type of test can be selected from the following:

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

*Remarks:

U.S.EPA (U.S. Environmental Protection Agency) 1994. Methods for assessing the toxicity of sediment-associated contaminants with estuarine and marine amphipods. Office of Research and Development. U.S. Environmental Protection Agency, Cincinnati, OH. EPA/600/R94/025.

PSEP (Puget Sound Estuary Program) 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments.

8. INTERPRETATION OF RESULTS

- 8.1 Upon completion of the chemical testing, the sediment quality should be assessed according to sediment quality criteria in Appendix A of ETWB TC (W) No. 34/2002 (see **Appendix H**).

The sediment is classified into 3 categories based on its contamination levels, namely Category L, Category M and Category H. Details of the classification are included in **Appendix H**.

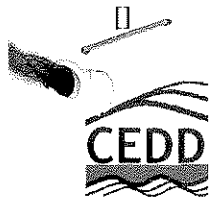
- 8.2 Biological screening is necessary for all Category M and certain Category H sediment samples in which one or more contaminants exceed 10 times of the LCEL. The test endpoints and decision criteria for biological screening should be in accordance with Table 2 of Appendix B of ETWB TC (W) No. 34/2002 (see **Appendix G**).

The sediment is deemed to have failed the biological test if it fails in any one of the three toxicity tests.

Appendix A

FMC's Agreement to Rationale of Sediment Removal

22



土木工程拓展署
Civil Engineering and
Development Department

Web site 網址 : http://www.cedd.gov.hk
E-mail 電子郵件 : fwlau@cedd.gov.hk
Telephone 電話 : 2762 5539
Facsimile 傳真 : 2714 0113
Our reference 本署檔號 : (0XEJ-01) in FM 4/1C/70A Pt. 96
Your reference 來函檔號 : 2512043A-GN-00283/13

土木工程處
Civil Engineering Office

香港九龍公主道 101 號
土木工程拓展署大樓
Civil Engineering and
Development Building,
101 Princess Margaret Road,
Kowloon, Hong Kong

Parsons Brinckerhoff (Asia) Ltd.
7/F One Kowloon
1 Wang Yuen Street
Kowloon Bay
Hong Kong
(Attention: Mr. Edmund Kwong

25 March 2013

BY FAX: 2856 9902

**FMC - No Further Comment
to Rationale of Sediment Removal**

Dear Sir,

Agreement No. CE 44/2011 (HY)

**Proposed Road Improvement Works in West Kowloon Reclamation Development – Phase 1
Investigation, Design and Construction
Management of Marine Sediment**

We refer to your letter of 8 March 2013.

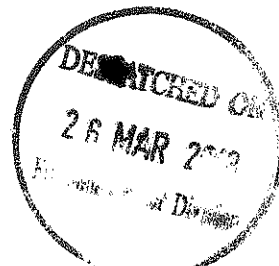
2. We have no further comment on the rationale for the sediment removal for the above project.

Yours faithfully,

(Derek Lau)

for Secretary, Marine Fill Committee
Civil Engineering and Development Department *Chia*

FWL/
File: 130325.PBA.WKRD.Rationale



Parsons Brinckerhoff (Asia) Ltd.

7/F One Kowloon
1 Wang Yuen Street
Kowloon Bay
Hong Kong
Tel: +852 2579 8899
Fax: +852 2856 9902
Email: info.hk@pbworld.com

8 March 2013

www.pbworld.com

Civil Engineering and Development Department
Civil Engineering Office
Fill Management Division
Strategy 1 Section
5/F, Civil Engineering and Development Building,
101 Princess Margaret Rd, Homantin, Kowloon

Certified to ISO 9001, ISO 14001

Our ref. 2512043A-GN-00283/13

By Post

Attn: Mr. LAU Fuk Wing

Dear Sir,

**Agreement No. CE 44/2011 (HY)
Proposed Road Improvement Works in West Kowloon Reclamation Development – Phase 1
Investigation, Design and Construction
Management of Marine Sediment**

We refer to your letter ref. (0X3T3-01) in FM 4/1C/70A dated 5 March 2013.

Based on your request, we enclose a special paper providing the justifications to demonstrate the need for removal of marine sediment generated by this project for your agreement.

In particular, your attention is also drawn to the fact that the marine sediment is generated as a result of the piling works for the viaducts.

According to WBTC (W) No. 34/2002, sampling and testing to determine the sediment quality may not be required subject to approval of DEP for small scale dredging works of less than 5,000m³ in situ. As the estimated maximum volume of marine sediment to be generated is approximately 1000m³, by copy of this letter, we would be grateful if EPD can advise whether the sediment sampling and testing requirements can be waived.

If you have any enquiries, please contact our Mr Joey Ho on 2579 7021 and ho.joey@pbworld.com.
or Alvin Yuen on 3900 2102 and yuen.alvin@pbworld.com.

Yours faithfully
PARSONS BRINCKERHOFF (ASIA) LTD.


Edmund Kwong
Project Manager

EKK/EW/wy

Encl.

cc. HyD/MWPMO
EPD
PB – Emeric Wan

(Attn: Mr. K F Lam)
(Attn: Miss FUNG Wing Sze, Sally)

(Fax: 2714 5198)
(Fax: 2591 0558)

Agreement No. CE44/2011 (HY)
**Proposed Road Improvement Works in West Kowloon Reclamation Development – Phase 1 –
Investigation, Design and Construction**

Special Paper – Rationale for Sediment Removal

1. PURPOSE

1.1 The purpose of this special paper is to demonstrate the need for removal of sediment to the Secretary of Marine Fill Committee in accordance with ETWB TC(W) No. 34/2002 (paragraph 8).

2. BACKGROUND

2.1 For the developments in WKRD including the West Kowloon Cultural District, West Kowloon Terminus of the Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link and residential developments above, a traffic study was commissioned by Transport Department and completed in 2009. The Traffic Study identified and recommended, amongst others, a series of improvements to enhance the existing road infrastructure thereat and enhance its accessibility.

3. SCOPE OF THE PROJECT

3.1 The Project will implement the following improvement schemes proposed by the aforementioned traffic study:

- (a) Scheme H – New road connection from elevated Nga Cheung Road (NCR) via Hoi Po Road to West Kowloon Highway (WKH) Northbound, consisting of part (A) and part (B)
- (b) Scheme I – New link road from elevated NCR to Western Harbour Crossing
- (c) Scheme J – New link road from WKH Southbound to NCR
- (d) Interim Scheme Q – Junction improvement works (involving local road widening) at Canton Road and Jordan Road (JRD)

3.2 The locations of these schemes are highlighted in the layout plan at **Appendix A**.

3.3 Amongst the various improvement schemes as described above, Scheme H and Scheme I are vehicular viaducts along the West Kowloon Highway. General layout of the viaducts is shown in **Appendix A**. Deep foundation in form of pre-bored H-piles has to be constructed to support the viaduct structures. As the viaducts are located in reclamation area, it is anticipated that approximately 1,000m³ of marine sediment will be excavated during the course of the piling works. Among the 1,000m³ of marine sediment, only 400m³ of which is expected to be marine mud. The remaining 600m³ is expected to be medium dense marine sand which is unlikely to be contaminated.

3.6 In accordance with ETWB TC(W) No. 34/2002 (paragraph 8), allocation of sediment disposal space at sea will not be considered until the need for removal of the sediment has first been satisfactorily demonstrated. The rationale for sediment removal must therefore be provided to the Secretary of Marine Fill Committee (MFC) for agreement. In the reply by MFC under their letter ref. (OX3T3-01) in FM 4/1C/70A Pt. 95 dated 5 March 2013, we are requested to provide detailed justifications to demonstrate the need for removal of sediment of such quantity and the considerations on possible reducing/reusing/treatment dredged/excavated sediment. It is also stated that FMC will scrutinise applications (for exemption), taking into account factors including the practicality of performance specifications, completeness of risk management strategies, and comprehensiveness of option assessments including consideration of new technology. The above advice by FMC is also consistent with paragraph 10 of ETWB TC(W) No. 34/2002. FMC further advised that only when there are cogent reasons for dredging will FMC consider allocating the necessary disposal space. The FMC's letter describing the above is enclosed in **Appendix B**.

3.7 Based on the requirement of ETWB TC(W) No. 34/2002 and the advice by FMC, the purpose of this special paper is to provide the rationale for sediment removal for agreement with the Secretary of FMC.

4. RATIONALE FOR SEDIMENT REMOVAL

4.1 Justification for Sediment Removal

4.1.1 The marine sediment generated under this project is a result of the piling works for the viaducts (i.e. not dredging).

4.1.2 In determining the pile type to be adopted, due cognisance has been taken to minimise the account of C&D materials (hence marine sediment) generated. As a result, pre-bored H-piles are adopted. As compared with large-diameter bored piles, the volume of C&D materials generated by pre-bored H-piles can be substantially minimised. Shallow foundation which does not involve excavation to the stratum of marine sediment has also been considered but is found to be not practical based on structural considerations. Therefore, elimination of any excavation of marine sediment would not be practical.

4.2 Estimated Quantity of Marine Sediment to be Excavated

4.2.1 Based on the information including the existing ground investigation data available, preliminary design of the location and quality of the pre-bored H-piles for the various viaducts, the estimated maximum quantity of marine sediment to be excavated by the piling works is approximately 1000m³.

4.2.2 Among the anticipated 1,000m³ of marine sediment, only 400m³ of which is expected to be marine mud as revealed from the existing borehole data. The remaining 600m³ will be medium dense marine sand, which is expected to have little or no contamination because of its stratum-position underneath the marine mud and the physical properties of marine sand.

4.2.3 Further ground investigation (GI) works will be undertaken to determine the thickness of the marine sediment at the piling locations. After the GI data is available, the estimated quantity of marine sediment will be refined and will be reported to EPD and Secretary of FMC.

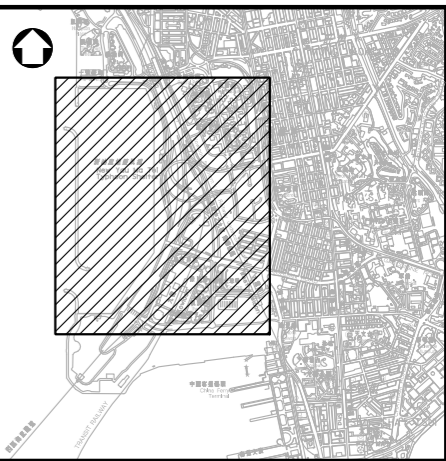
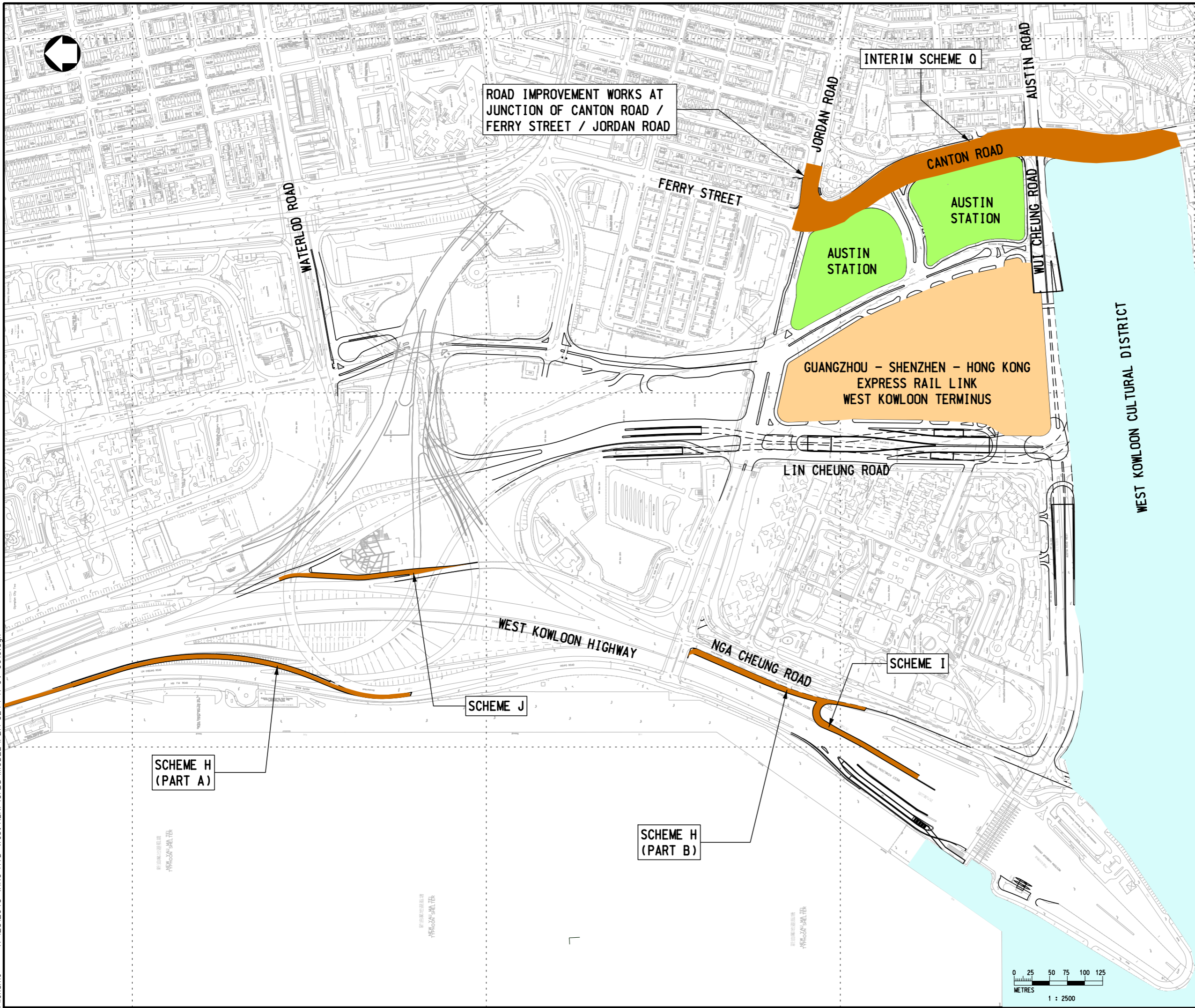
4.3 Treatment for Reuse of Excavated Sediment

4.3.1 In determining whether alternative options other than disposal are available, reference has been made to “Review of Options for Management of contaminated Sediment in Hong Kong Report on Assessment of Management Options” (i.e. hereinafter referred as the PAMP). However, it is found that the various ex-situ treatment options reviewed under the PAMP are revealed to be technical infeasible.

4.3.2 Reference has also been made to the local experience of reuse of the excavated marine sediment such as mixing cement with the marine sediment for backfilling has been considered. However, it is considered that application of this technology for this project is limited. Considerations are as follows.

- (a) Marine Sediment Generated from Piling Works: As the marine sediment produced is not as a result of dredging or excavation but piling works, the marine sediment will be mixed with the other excavated materials during the course of the pre-boring operation. It would be difficult if not impossible to extract the marine sediment from other excavated materials for mixing with the cement for reuse.
- (b) Shortage of works site: The various viaducts are located alongside West Kowloon Highway which is an expressway. In order to minimise the traffic impact during construction, the works site is reduced to the minimum required for construction. It would not be practical to undertake the mixing operation within the works site.
- (c) Shortage of works area: Off-site works area is extremely scarce in Hong Kong owing to the numerous mega-scale infrastructure projects, all the potential works areas identified under this project are substantially confirmed to be not available by the relevant authorities. The only works areas that can be secured under this project are all located in road verges which can only be used for parking of construction vehicles. Searching for works areas for Engineer’s and Contractor’s accommodation to facilitate contract administration is still in progress. Therefore, it is not anticipated that favourable works area can be identified for this project for undertaking cement & marine sediment mixing operation.
- (d) Shortage of space for backfilling: There is surplus C&D materials generated under this project based on the estimated volume of materials to be excavated and general filling material required. Therefore, the more marine sediment is mixed with cement for backfilled, the more surplus C&D materials are required to be disposed at the public fill. As disposal space at public fill is also extremely scarce in Hong Kong, cost-effectiveness of utilising the cement-mixed marine sediment for backfilling is in doubt.

Printed by : 20/8/2012
 Filename : X:\2512043 (HKG-HYD West KLN)\CADD\MODEL\PBA-CE44-K-CV-0010.dgn



LOCATION PLAN

- LEGEND:**
- ROAD IMPROVEMENT WORKS TO BE IMPLEMENTED UNDER THIS PROJECT
 - WEST KOWLOON TERMINUS (UNDER CONSTRUCTION BY OTHERS)
 - WEST KOWLOON CULTURAL DISTRICT
 - AUSTIN STATION

Rev	Description	By	Date

Consultant
PARSONS BRINCKERHOFF

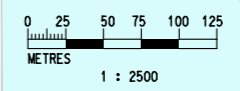
Project title
 AGREEMENT NO. CE 44/2011 (HY)
 PROPOSED ROAD IMPROVEMENT WORKS IN WEST KOWLOON RECLAMATION DEVELOPMENT - PHASE 1 INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title
KEY PLAN

Drawing no. CE44/K/CV/0010		Rev. -	
Drawn CAD	Date -	Checked -	Approved -
Scale 1:2500 @A1		Status PRELIMINARY DESIGN	

© COPYRIGHT RESERVED

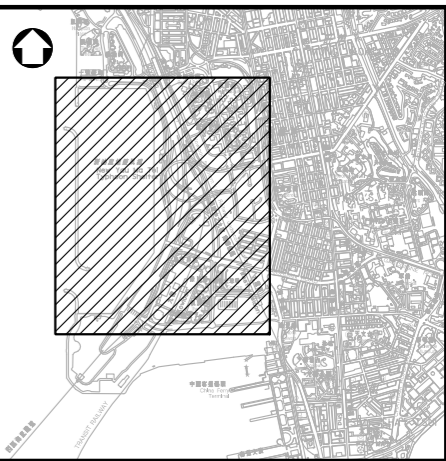
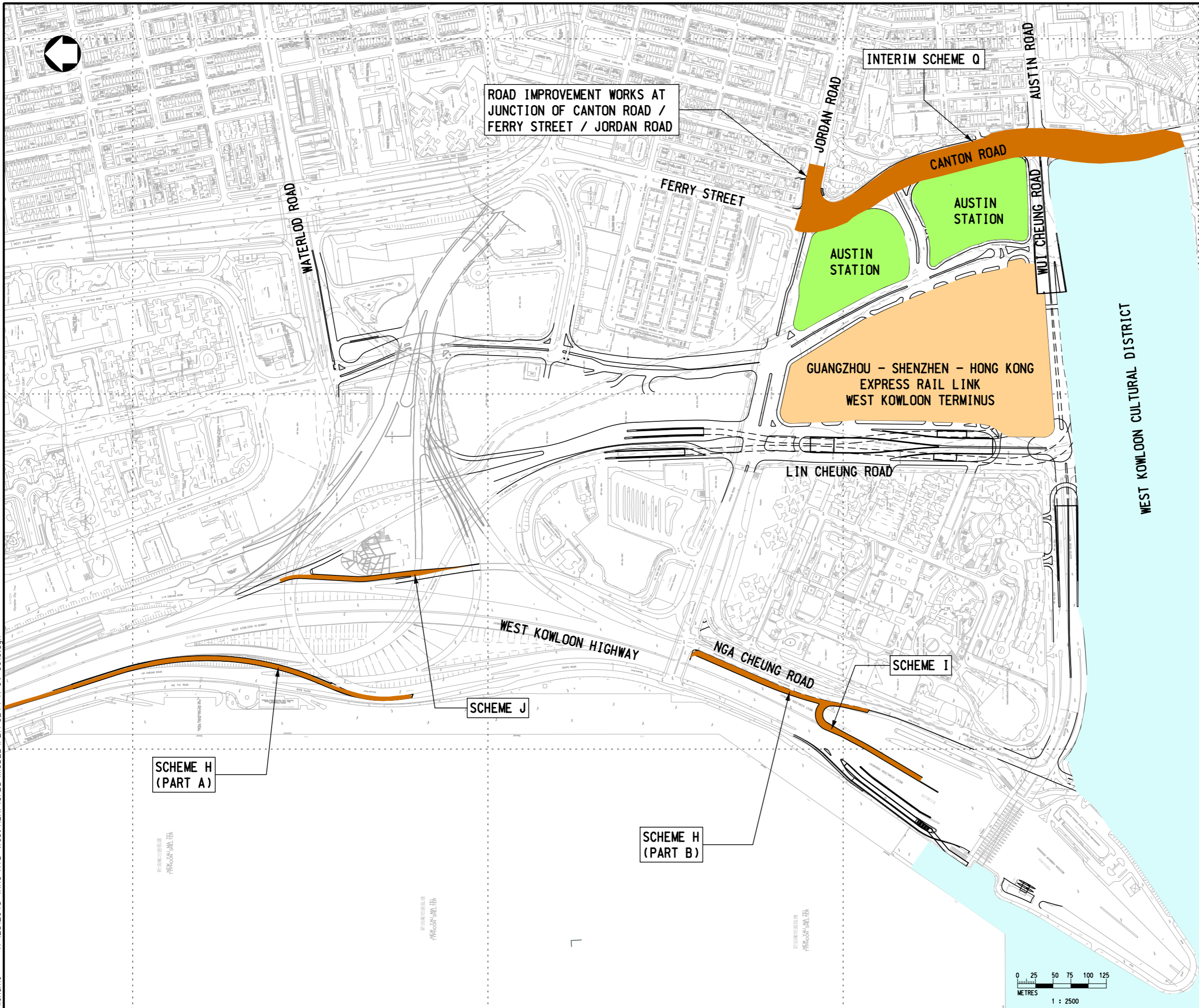
路政署
HIGHWAYS DEPARTMENT
 主要工程管理處
 MAJOR WORKS PROJECT MANAGEMENT OFFICE



Appendix B

Layout Plan of Proposed Works under the Project

Printed by : 20/8/2012
 Filename : X:\2512043 (HKG-HYD West KLN)\CADD\MODEL\PBA-CE44-K-CV-0010.dgn



LOCATION PLAN

- LEGEND:**
- ROAD IMPROVEMENT WORKS TO BE IMPLEMENTED UNDER THIS PROJECT
 - WEST KOWLOON TERMINUS (UNDER CONSTRUCTION BY OTHERS)
 - WEST KOWLOON CULTURAL DISTRICT
 - AUSTIN STATION

Rev	Description	By	Date

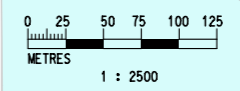
Consultant
PARSONS BRINCKERHOFF

Project title
 AGREEMENT NO. CE 44/2011 (HY)
 PROPOSED ROAD IMPROVEMENT WORKS IN WEST KOWLOON RECLAMATION DEVELOPMENT - PHASE 1 INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title
KEY PLAN

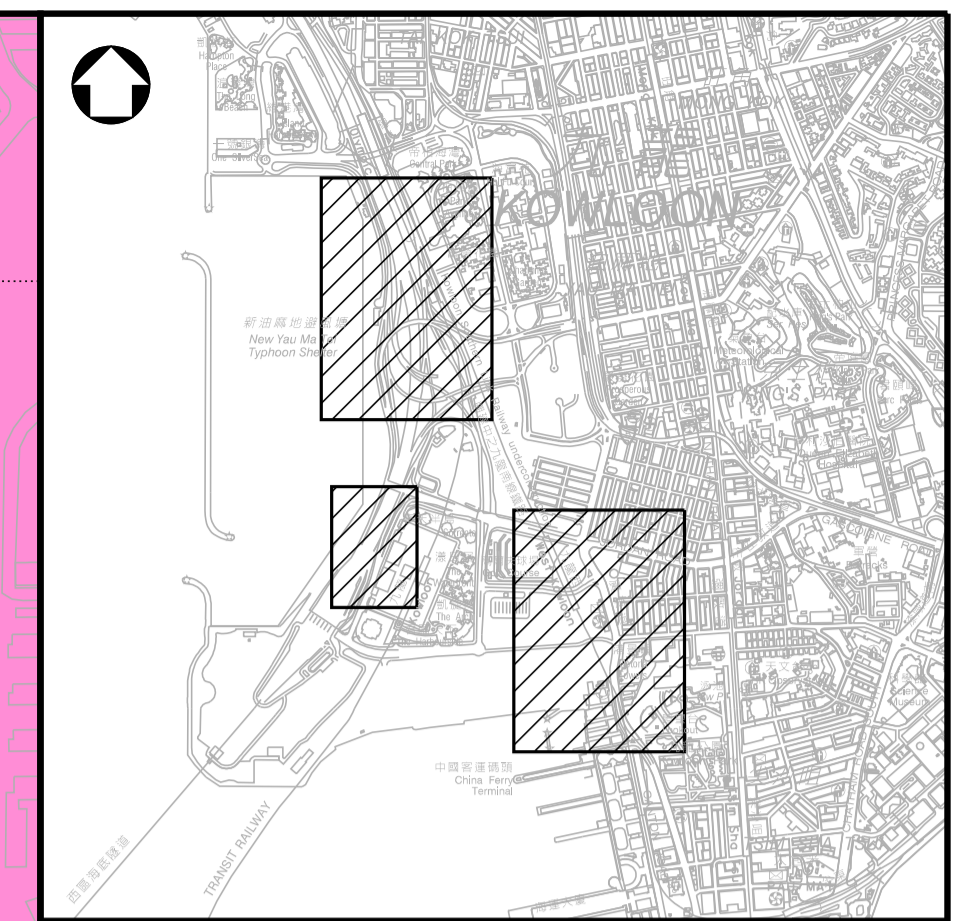
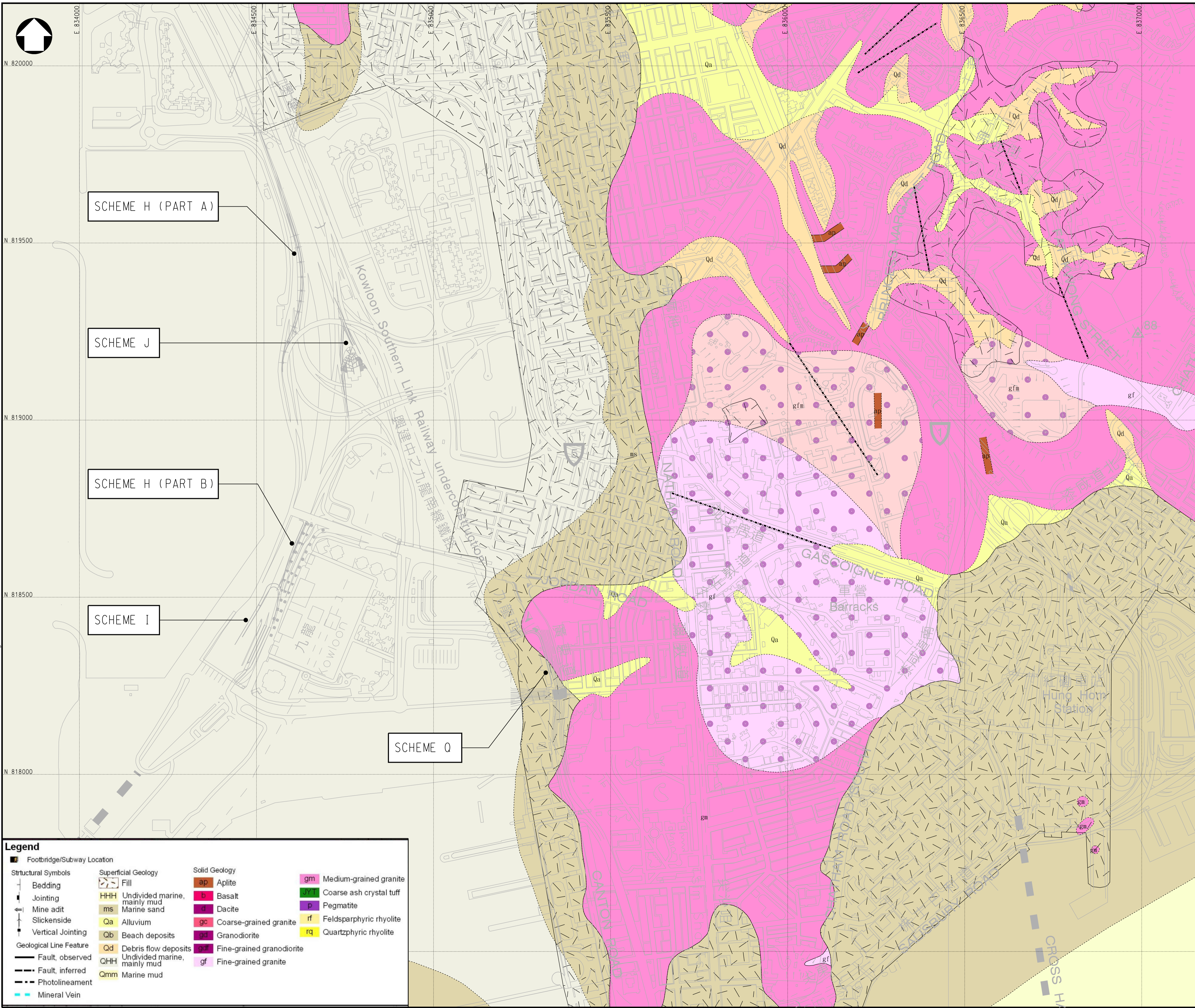
Drawing no. CE44/K/CV/0010		Rev. -	
Drawn CAD	Date -	Checked -	Approved -
Scale 1:2500 @A1		Status PRELIMINARY DESIGN	

© COPYRIGHT RESERVED



Appendix C
Geological Map

Printed by : 19/3/2012
 Filename : X:\2512043 (HKG-HYD West KLIN)\CADD\MODEL\PBBA-CE44-K-GE-001.dgn



LOCATION PLAN

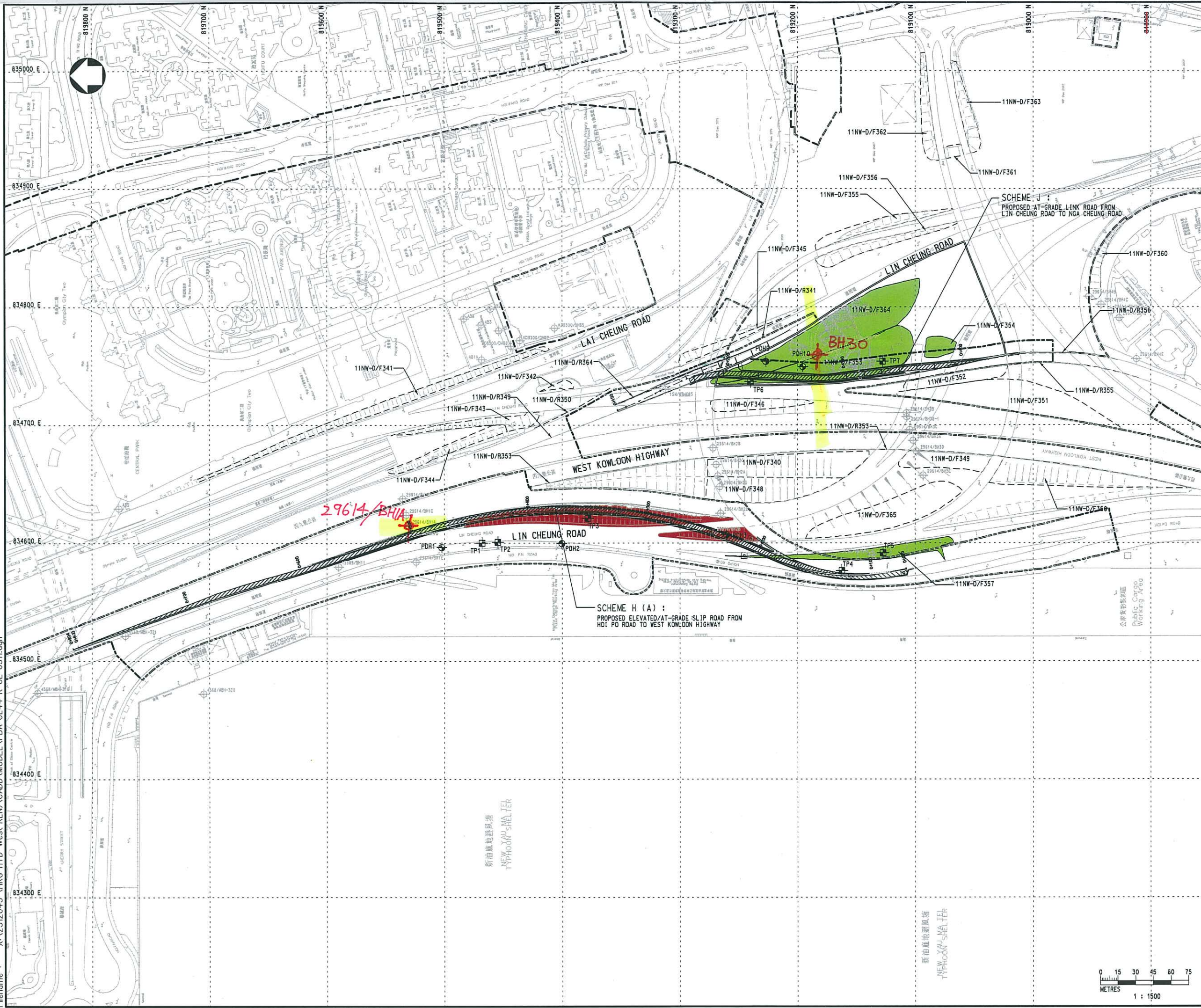
Legend

Structural Symbols		Superficial Geology		Solid Geology	
[Symbol]	Bedding	[Symbol]	Fill	[Symbol]	gm Medium-grained granite
[Symbol]	Jointing	[Symbol]	HHH Undivided marine, mainly mud	[Symbol]	ga Coarse ash crystal tuff
[Symbol]	Mine adit	[Symbol]	ms Marine sand	[Symbol]	p Pegmatite
[Symbol]	Slickenside	[Symbol]	Qa Alluvium	[Symbol]	rf Feldsparphyric rhyolite
[Symbol]	Vertical Jointing	[Symbol]	Qb Beach deposits	[Symbol]	gc Coarse-grained granite
[Symbol]	Geological Line Feature	[Symbol]	Qd Debris flow deposits	[Symbol]	gd Granodiorite
[Symbol]	Fault, observed	[Symbol]	QHH Undivided marine, mainly mud	[Symbol]	gf Fine-grained granodiorite
[Symbol]	Fault, inferred	[Symbol]	Qmm Marine mud	[Symbol]	gr Fine-grained granite
[Symbol]	Photolineament			[Symbol]	rq Quartzphyric rhyolite
[Symbol]	Mineral Vein				

Rev	Description	By	Date
Consultant			
PARSONS BRINCKERHOFF			
Project title			
AGREEMENT NO. CE 44/2011 (HY) PROPOSED ROAD IMPROVEMENT WOKS IN WEST KOWLOON RECLAMATION DEVELOPMENT - PHASE 1 INVESTIGATION, DESIGN AND CONSTRUCTION			
Drawing title			
GEOLOGICAL MAP			
Drawing no.		Rev.	
CE 44/K/GE/0001		-	
Drawn	Date	Checked	Approved
1:5000 (A1)	-	-	-
Scale	Status	TENDER DESIGN	
-	-	© COPYRIGHT RESERVED	
路政署 HIGHWAYS DEPARTMENT 主要工程管理處 MAJOR WORKS PROJECT MANAGEMENT OFFICE			

Appendix D
Existing Ground Investigation
Records (Extracts)

Printed by : 6/6/2012
 Filename : X:\2512043 (HKG-HYD West KLN)\CADD\MODEL\BPA-CE44-K-GE-0311.dgn



LOCATION PLAN

- LEGEND :
- EXISTING DRILLHOLE
 - PROPOSED DRILLHOLE
 - PROPOSED TRIAL PIT / TRIAL TRENCH
 - XRL SITE BOUNDARY LINE
 - CKR BOUNDARY
 - FEATURE BOUNDARY
 - FEATURES ALONG PROPOSED ROAD ALIGNMENT WHICH MAY BE EFFECTED BY THE PROPOSED WORKS
 - EXTENT OF UNREGISTERED SLOPE

Rev	Description	By	Date

Consultant
PARSONS BRINCKERHOFF

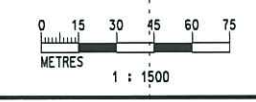
Project title
 AGREEMENT NO. CE 44/2011 (HY)
 PROPOSED ROAD IMPROVEMENT WORKS IN WEST KOWLOON RECLAMATION DEVELOPMENT - PHASE 1 INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title
GROUND INVESTIGATION AND FEATURE LOCATION PLAN (SHEET 1 OF 3)

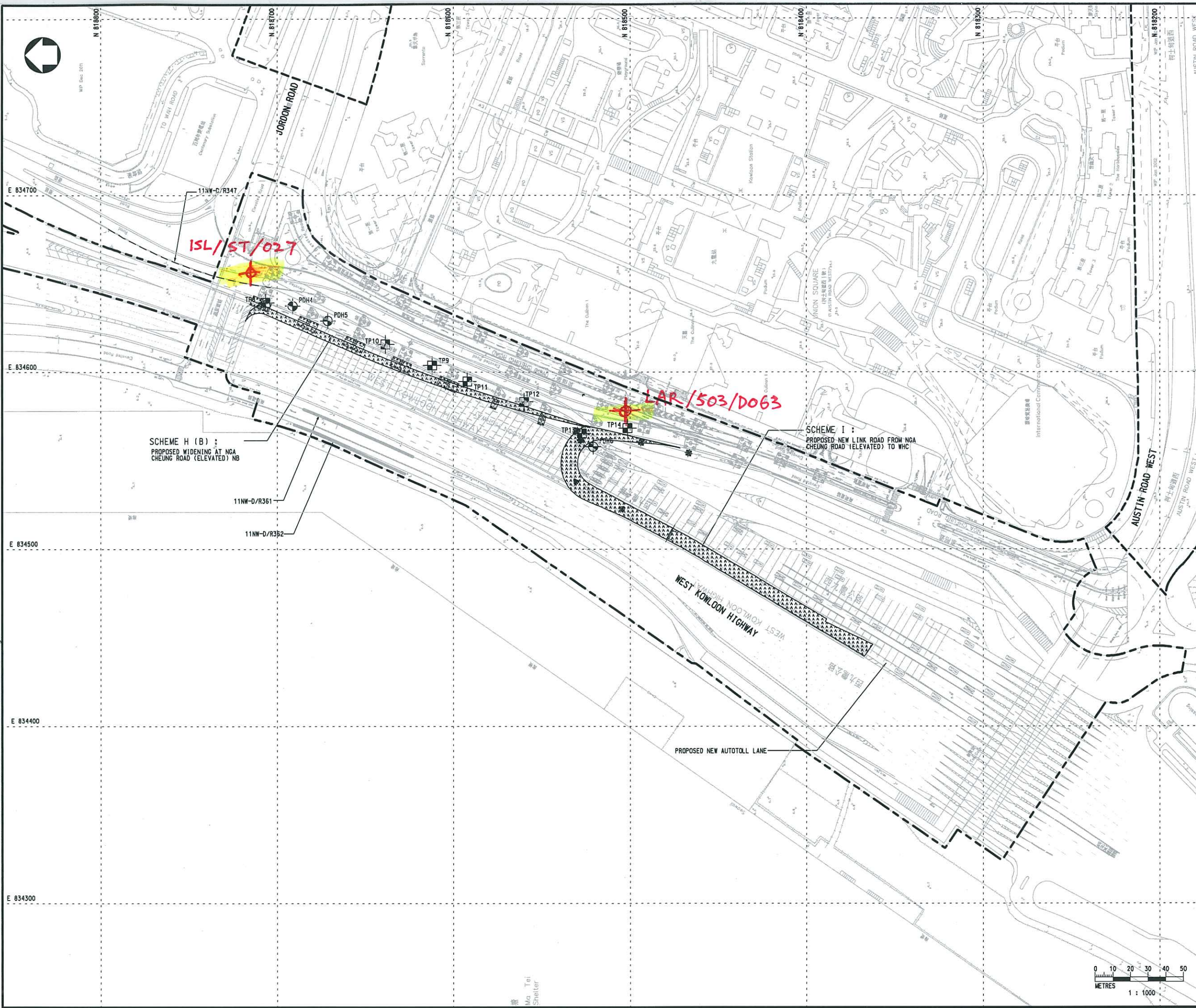
Drawing no. CE44/K/GE/0311		Rev. -	
Drawn CAD	Date -	Checked -	Approved -
Scale 1:1500 (A1)		Status PRELIMINARY DESIGN	

© COPYRIGHT RESERVED

路政署
 HIGHWAYS DEPARTMENT
 主要工程管理處
 MAJOR WORKS PROJECT MANAGEMENT OFFICE



Printed by : 9/25/2012
 Filename : X:\2512013 (HKC-HYD West KLN)\CADD\MODEL\PBA-CE44-K-GE-0312.dgn



LOCATION PLAN

- LEGEND :**
- EXISTING DRILLHOLE
 - PROPOSED DRILLHOLE
 - PROPOSED TRIAL PIT / TRIAL TRENCH
 - XRL SITE BOUNDARY LINE
 - FEATURE BOUNDARY

Rev	Description	By	Date

Consultant
PARSONS BRINCKERHOFF

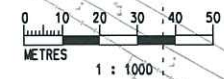
Project title
 AGREEMENT NO. CE 44/2011 (HY)
 PROPOSED ROAD IMPROVEMENT WORKS IN WEST KOWLOON RECLAMATION DEVELOPMENT - PHASE 1 INVESTIGATION, DESIGN AND CONSTRUCTION

Drawing title
GROUND INVESTIGATION AND FEATURE LOCATION PLAN (SHEET 2 OF 3)

Drawing no. CE44/K/GE/0312	Rev. -
Drawn CAD	Date -
Scale 1:1000 (A1)	Status PRELIMINARY DESIGN

© COPYRIGHT RESERVED

路政署
 HIGHWAYS DEPARTMENT
 主要工程管理處
 MAJOR WORKS PROJECT MANAGEMENT OFFICE



DRILLHOLE RECORD

JOB NO. WK14
 HOLE NO. BH1A
 SHEET 1 of 6
 DATE from 13.4.91 to 20.4.91

PROJECT West Kowloon Reclamation, Site Investigation
You Ma Tei Seawall

METHOD Rotary

CO-ORDINATES

ROCK COREBIT T2, TNW

MACHINE & No. Diamant Boart D7

E 834614.33
 N 819530.19

HOLE DIA. P to H to N
140mm to 114mm to 89mm

FLUSHING MEDIUM Water

ORIENTATION VERTICAL

GROUND-LEVEL 5.37 mPD

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description	
13/4	P		80	100	100	80	1			+4.77	0.50	T2			Cement concrete (FILL)	
				65	65	15	6			0.75	1.00					
				52	52	9	6			1.65	2.00					
				79	78	73	3			2.80	3.00					
13/4				77	68	46	3			4.00	4.20					
15/4				63	63	50	2			5.50	5.50					
	6.30 P H			60	57	57	1			6.30	6.30					
				65	63	63	1			7.80	8.00					
				43	43	39	3			9.30	9.30					
15/4	H		80							-4.63	10.00					

BOULDER and COBBLE sized fragment of slightly decomposed hardrock (FILL)

<ul style="list-style-type: none"> • Small disturbed sample • Large disturbed sample • SPT liner sample • U78 undisturbed sample • U100 undisturbed sample • Mazier sample • P/S Piston sample ▲ Water sample × Water level ↓ Standard penetration test ⊥ Permeability test ⊥ Piezometer tip ✓ In-situ vane shear test 	LOGGED <u>T.P. Wong</u> DATE <u>22.4.91</u> CHECKED <u>H.W. Chan</u> DATE <u>30.4.91</u>	REMARKS
---	---	---------

Lam Geotechnics Limited

- Office: 2/F, 332 Lockhart Rd., Kai Kwong Centre Bldg., Hong Kong
- Laboratory: 26/F, Unit 3, Honour Ind. Centre, No. 6, Sun Yip St., Chaiwan, Hong Kong
- Telex: 61840 LGEOL HX • Fax: 8340657 • Teles: 8910563, 5734365

DRILLHOLE RECORD

JOB NO. WK14
 HOLE NO. BH1A
 SHEET 2 of 6
 DATE from 13.4.91 to 20.4.91

PROJECT **West Kowloon Reclamation, Site Investigation
 You Ma Tei Seawall**

METHOD Rotary	CO-ORDINATES	ROCK COREBIT T2, TNW
MACHINE & No. Diamant Bort D7	E 834614.33 N 819530.19	HOLE DIA. P to H to N 140mm to 114mm to 89mm
FLUSHING MEDIUM Water	ORIENTATION VERTICAL	GROUND-LEVEL 5.37 mPD

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
15/4	H		80	43	43	39	3				10.30				BOULDER and COBBLE sized fragment of slightly decomposed hardrock (FILL)
				40	0	0	5				11.00				
15/4											11.80				
16/4				56	56	55	1		T2		12.00				
				78	34	17	N.I.				12.50				
				54	36	36	N.I.				13.00				
				54	36	36	N.I.				13.40				
				78	0	0	N.I.				14.00				
											14.60				
											15.00				
											15.63				
				100				22 bis	1		16.00				Soft to firm, greenish grey, CLAY with some shell fragment (MARINE DEPOSIT)
											17.00				
				100				43 bis	2		18.00				Medium dense, light greyish yellow, fine to coarse SAND with some shell fragment (MARINE DEPOSIT)
											19.00				
16/4	H		80					(1,1) 22,33 N=10	3		20.00				

<ul style="list-style-type: none"> * Small disturbed sample Large disturbed sample SPT liner sample U78 undisturbed sample U100 undisturbed sample Water sample P/S Pluton sample ▲ Water sample × Water level ↓ Standard penetration test ⊥ Permeability test ⊕ Piezometer tip ∨ In-situ vane shear test 	LOGGED <u>I.P. Wong</u> DATE <u>22.4.91</u> CHECKED <u>H.W. Chan</u> DATE <u>30.4.91</u>	REMARKS
--	---	---------

DRILLHOLE RECORD

JOB NO. WK14
 HOLE NO. BH1A
 SHEET 3 of 6
 DATE from 13.4.91 to 20.4.91

PROJECT **West Kowloon Reclamation, Site Investigation
 You Ma Tei Seawall**

METHOD **Rotary**

CO-ORDINATES

ROCK COREBIT **T2, TNW**

MACHINE & No. **Diamant Bort
 D7**

**E 834614.33
 N 819530.19**

HOLE DIA. **P to H to N
 140mm to 114mm to 89mm**

FLUSHING MEDIUM **Water**

ORIENTATION **VERTICAL**

GROUND-LEVEL **5.37 mPD**

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
16/4	H		80												See sheet 2 of 6
16/4				90					4	15.63	21.00				Firm to stiff, light yellowish brown, sandy CLAY with fine gravel <i>Silt</i>
17/4								(34) 55,15 N=19	5	16.63	22.00		V		Extremely weak, greenish green, completely decomposed fine grained GRANITE (Medium dense, clayey SILT with fine gravel)
				95				(34) 55,13 N=30	6		24.00		V		Extremely weak, pink, Completely decomposed medium grained GRANITE (Medium dense, silty fine SAND)
									7		25.00		V		
				70					8	22.63	26.00		V		Extremely weak, pink, Completely decomposed coarse grained GRANITE (Dense to very dense, fine to coarse SAND)
								(23) 55,12 N=30	9		27.00		V		
17/4	H		80							24.63	30.00				

<ul style="list-style-type: none"> • Small disturbed sample ▲ Water sample ↑ Large disturbed sample × Water level ▨ SPT liner sample ↓ Standard penetration test ▩ U76 undisturbed sample ⊥ Permeability test ■ U100 undisturbed sample ⊕ Piezometer tip ▧ Mazur sample ∨ In-situ vane shear test P/S Platon sample 	<p>LOGGED <u>I.P. Wong</u></p> <p>DATE <u>22.4.91</u></p> <p>CHECKED <u>H.W. Chan</u></p> <p>DATE <u>30.4.91</u></p>
--	--

REMARKS

Lam Geotechnics Limited

- Office 2/F 332 Lockhart Rd. Kai Kwong Comm. Bldg. Hong Kong.
- Laboratory 26/F, Unit 3, Honour Ind. Centre, No. 6 Sun Yip St., Chaiwan, Hong Kong.
- Telex 61840 LGEO LX • Fax 8340657 • Tels 8910563, 5734365

DRILLHOLE RECORD		JOB NO. <u>WK14</u>
		HOLE NO. <u>BH1A</u>
		SHEET <u>4</u> of <u>6</u>
		DATE from <u>13.4.91</u> to <u>20.4.91</u>
PROJECT <u>West Kowloon Reclamation, Site Investigation</u> <u>You Ma Tei Seawall</u>		
METHOD <u>Rotary</u>	CO-ORDINATES	ROCK COREBIT <u>T2, TNW</u>
MACHINE & No. <u>Diamant Bort D7</u>	<u>E 834614.33</u> <u>N 819530.19</u>	HOLE DIA. <u>P to H to N</u> <u>140mm to 114mm to 89mm</u>
FLUSHING MEDIUM <u>Water</u>	ORIENTATION <u>VERTICAL</u>	GROUND-LEVEL <u>5.37 mPD</u>

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
17/4	H		80	90							31.00				Extremely weak, pink, Completely decomposed coarse grained GRANITE (Dense to very dense, fine to coarse SAND)
								(4,6) (10,14,18) N=50			32.00				
				90							33.00				
								(7,8) (10,14,18) N=53			34.00				
17/4 18/4											35.00		V		
				95							36.00				
								(12,27) (10,14,18,18) N=216			37.00				
				90							38.00				
18/4	H		80							39.00					
										40.00					

<ul style="list-style-type: none"> • Small disturbed sample • Large disturbed sample • SPT liner sample • U76 undisturbed sample • U100 undisturbed sample • Mazur sample P/S Platon sample 	<ul style="list-style-type: none"> ▲ Water sample × Water level ↓ Standard penetration test ⊥ Permeability test ⊕ Piezometer tip ✓ In-situ vane shear test 	LOGGED <u>T.P. Wong</u> DATE <u>22.4.91</u> CHECKED <u>H.W. Chan</u> DATE <u>30.4.91</u>
--	--	---

REMARKS

DRILLHOLE RECORD

JOB NO. WK14
 HOLE NO. BH1A
 SHEET 5 of 6
 DATE from 13.4.91 to 20.4.91

PROJECT West Kowloon Reclamation, Site Investigation
Yau Ma Tei Seawall

METHOD Rotary

CO-ORDINATES

ROCK COREBIT T2, TNW

MACHINE & No. Diamant Boart
D7

E 834614.33
N 819530.19

HOLE DIA. P to H to N
140mm to 114mm to 89mm

FLUSHING MEDIUM Water

ORIENTATION VERTICAL

GROUND-LEVEL 5.37 mPD

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
18/4	H		80								41.00	V			Extremely weak, pink, Completely decomposed coarse grained GRANITE (Dense to very dense, fine to coarse SAND)
				90				(11,11) 20,20,35) N=134	17		42.00				
18/4 19/4									18		43.00				
								(10,16) 22,32,38,47) N=140	19		44.00				
				95					20		45.00				
19/4 20/4	46.00 H N							(12,11) 17,20,25,44) N=106	21		46.00				
								(10,13) 16,16,20,23) N=75	22		47.00				
	49.50 N										48.00				
											49.00				
20/4			80	100	100	90	4		TNW		49.50				Ch
											50.00		II		See sheet 6 of 6

<ul style="list-style-type: none"> • Small disturbed sample • Large disturbed sample • SPT liner sample • U78 undisturbed sample • U100 undisturbed sample • Maxier sample • P/S Piston sample 	<ul style="list-style-type: none"> ▲ Water sample ✕ Water level ⊥ Standard penetration test ⊥ Permeability test ⊥ Piezometer tip ✓ In-situ vane shear test 	LOGGED <u>T.P. Wong</u> DATE <u>22.4.91</u> CHECKED <u>H.W. Chan</u> DATE <u>30.4.91</u>	REMARKS
---	--	---	---------

Lam Geotechnics Limited

- Office: 2/F., 332 Lockhart Rd., Kai Kwong Conant Bldg., Hong Kong
- Laboratory: 26/F., Unit 3, Honour Ind. Centre, No. 5, Sun Yip St., Chaiwan, Hong Kong
- Telex: 61840 LGEOL HX • Fax: 8340657 • Tels: 8910563, 5734365

DRILLHOLE RECORD

JOB NO. WK14
 HOLE NO. BH1A
 SHEET 6 of 6
 DATE from 13.4.91 to 20.4.91

PROJECT West Kowloon Reclamation, Site Investigation
You Ma Tei Seawall

METHOD <u>Rotary</u>	CO-ORDINATES E <u>834614.33</u> N <u>819530.19</u>	ROCK COREBIT <u>T2, TNW</u>
MACHINE & No. <u>Diamant Boart D7</u>		HOLE DIA. <u>P to H to N</u> <u>140mm to 114mm to 89mm</u>
FLUSHING MEDIUM <u>Water</u>	ORIENTATION <u>VERTICAL</u>	GROUND-LEVEL <u>5.37 mPD</u>

Drilling Progress	Casing depth/size	Water level/time/data	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
20/4			80	100	100	90	4				50.55	+++			Strong, light pinkish green with dark green speckles, slightly decomposed coarse grained GRANITE medium spaced joint with limonite stained dip 10°-25° and 45°
				100	100	100	0				51.00	+++			
				100	100	100	2				51.35	+++			
				100	100	100	2				52.00	+++			
				100	100	93	3		TNW		52.30	+++			
				100	100	100	3				53.00	+++			
				100	100	100	3				53.45	+++			
20/4			80							49.58	54.95	+++			TD
											55.00				End of investigation hole at 54.95m
											57.00				
											58.00				
											59.00				
											60.00				

<ul style="list-style-type: none"> ▲ Small disturbed sample ▲ Large disturbed sample ▲ SPT liner sample ▲ U76 undisturbed sample ▲ U100 undisturbed sample ▲ Mazler sample ▲ P/S Platen sample ▲ Water sample ▲ Water level ▲ Standard penetration test ▲ Permeability test ▲ Piezometer tip ▲ In-situ vane shear test 	LOGGED <u>T.P. Wong</u> DATE <u>22.4.91</u> CHECKED <u>H.W. Chan</u> DATE <u>30.4.91</u>	REMARKS
---	---	---------



BACHY SOLETANCHE GROUP
SOIL & FOUNDATIONS SPECIALISTS

DRILLHOLE RECORD

W. O. PW7/2/33.105/S1
HOLE NO. ISL/ST/027
SHEET 1 of 5
DATE from 9/1/93 to 15/1/93

CONTRACT GC/91/05 OF C.E.D.

PROJECT **WEST KOWLOON EXPRESSWAY LAND SITE INVESTIGATION
(ADDITIONAL HOLES IN JORDAN AREA)**

METHOD **ROTARY**

CO-ORDINATES

ROCK CORE BIT **T2-101**

MACHINE & No. **CMC-40**

**E 834656.07
N 818712.02**

HOLE DIA. **0.00m-11.00m SX
11.00m-36.00m PX
36.00m-44.50m HX**

FLUSHING MEDIUM **WATER**

ORIENTATION **VERTICAL**

GROUND-LEVEL **8.29** mPD

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
1	SX			41							1.50	[Cross-hatched pattern]			Angular to subangular COBBLES with occasional boulder. Boulder at : 2.65m-3.00m. (FILL)
2	9/1/93			60											
3								(24 3,6,6,7) N=24	1	+5.29	3.00				Medium dense, yellow, fine to medium SAND with occasional shell fragments. (FILL)
4									2		3.45				
5								(35 4,6,7,7) N=24	3		4.00				
6									4		4.10				
7								(24 3,6,3,8) N=24	5		5.00				
8									6		5.45				
9									7		6.00				
10	SX							(35 6,7,6,8) N=27			6.10				
											7.00				
											7.45				
											8.00				
											8.10				
											9.00				
											9.45				
											10.00				
										-1.71					

- SMALL DISTURBED SAMPLE ▲ WATER SAMPLE
- ⬆ LARGE DISTURBED SAMPLE ⬇ PIEZOMETER TIP
- SPT LINER SAMPLE ⬇ STANDPIPE
- ▨ U76 UNDISTURBED SAMPLE ⬇ STANDARD PENETRATION TEST
- ▨ U100 UNDISTURBED SAMPLE ⬇ PERMEABILITY TEST
- ▨ MAZIER SAMPLE (76mm) ⊗ IN-SITU VANE SHEAR TEST
- PISTON SAMPLE

LOGGED H.C. Yeung
DATE 19/1/93
CHECKED D. Yuen
DATE 20/3/93

REMARKS

PROJECT **WEST KOWLOON EXPRESSWAY LAND SITE INVESTIGATION**
(ADDITIONAL HOLES IN JORDAN AREA)

METHOD **ROTARY**

CO-ORDINATES

ROCK COREBIT **T2-101**

MACHINE & No. **CMC-40**

E 834656.07

HOLE DIA. 0.00m-11.00m SX
11.00m-36.00m PX
36.00m-44.50m HX

N 818712.02

FLUSHING MEDIUM **WATER**

ORIENTATION **VERTICAL**

GROUND-LEVEL **8.29** mPD

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description	
11	SX 11.00m SX PX										10.10	[Cross-hatched pattern]			Medium dense, greyish yellow to yellowish grey fine to medium SAND with occasional shell fragments. (FILL)	
12								(22) (3,3,4) N=14		11.00 11.45						
13								(23) (4,3,3,4) N=14		12.00 12.10 13.00						
14										13.45 14.00						
15								(33) (3,4,4,3) N=14		14.10 15.00						
16										15.45 16.00 16.10						
17								(22) (3,2,3,5) N=13		17.00 17.45						
18										18.00 18.10						
19								(34) (6,4,5,7) N=22		16-9.71 -10.71 19.00						
20	PX									19.45 -11.71 20.00						

- SMALL DISTURBED SAMPLE
- ▲ WATER SAMPLE
- ▲ LARGE DISTURBED SAMPLE
- PIEZOMETER TIP
- SPT LINER SAMPLE
- STANDPIPE
- U76 UNDISTURBED SAMPLE
- ↓ STANDARD PENETRATION TEST
- U100 UNDISTURBED SAMPLE
- ↓ PERMEABILITY TEST
- MAZIER SAMPLE (76mm)
- IN-SITU VANE SHEAR TEST
- PISTON SAMPLE

LOGGED H.C. Yeung
DATE 19/1/93
CHECKED D. Yuen
DATE 20/3/93

REMARKS



BACHY SOLETANCHE GROUP
SOIL & FOUNDATIONS SPECIALISTS

DRILLHOLE RECORD

W. O. PW7/2/33.105/S1
HOLE NO. ISL/ST/027
SHEET 3 of 5
DATE from 9/1/93 to 15/1/93

CONTRACT GC/91/050F.C.E.D.

PROJECT WEST KOWLOON EXPRESSWAY LAND SITE INVESTIGATION
(ADDITIONAL HOLES IN JORDAN AREA)

METHOD ROTARY

CO-ORDINATES

ROCK COREBIT T2-101

MACHINE & No. CMC-40

E 834656.07
N 818712.02

HOLE DIA. 0.00m-11.00m SX
11.00m-36.00m PX
36.00m-44.50m HX

FLUSHING MEDIUM WATER

ORIENTATION VERTICAL

GROUND-LEVEL 8.29 mPD

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
21 11/1/93	PX								18		20.10				Medium dense, grey, slightly clayey fine to medium SAND with occasional shell fragments. (DISTURBED MARINE DEPOSIT)
								(3.3 5.4,4.5) N=18	19		21.00				
									20		21.45				
22		4.80m at 19:30							20		22.00				
		8.00m at 07:30							20		22.10				
23									21		23.00				
								(3.3 5.5,7.8) N=25	21		23.45				
24									22	15.71	24.00				
									22		24.10				
25									23	16.71	25.00				
								(4.6 7.8,9.14) N=38	23		25.45				
26									24		26.00				
									24		26.10				
27									25		27.00				
								(2.4 4.3,6.8) N=23	25		27.45				
28									26		28.00				
									26		28.10				
29									27	20.71	29.00				
								(2.3 3.4,4.5) N=18	27		29.45				
30	PX								27	21.71	30.00			Very stiff, greyish brown sandy CLAY. (ALLUVIUM)	

- ▲ SMALL DISTURBED SAMPLE
- ▲ WATER SAMPLE
- ⬇️ LARGE DISTURBED SAMPLE
- ⊕ PIEZOMETER TIP
- ▬ SPT LINER SAMPLE
- ⊕ STANDPIPE
- ▬ U76 UNDISTURBED SAMPLE
- ⬇️ STANDARD PENETRATION TEST
- ▬ U100 UNDISTURBED SAMPLE
- ⬇️ PERMEABILITY TEST
- ▬ MAZIER SAMPLE (76mm)
- ⊕ IN-SITU VANE SHEAR TEST
- ▬ PISTON SAMPLE

LOGGED H.C. Yeung
DATE 19/1/93
CHECKED D. Yuen
DATE 20/3/93

REMARKS

SSI - Chis



BACHY SOLETANCHE GROUP
SOIL & FOUNDATIONS SPECIALISTS

DRILLHOLE RECORD

W. O. PW7/2/33.105/S1
HOLE NO. ISL/ST/027
SHEET 4 of 5
DATE from 9/1/93 to 15/1/93

CONTRACT GC/91/050F.C.E.D.

DJWLOON EXPRESSWAY LAND SITE INVESTIGATION
(ANAL HOLES IN JORDAN AREA)

C-40	CO-ORDINATES	ROCK COREBIT T2-101
	E 834656.07 N 818712.02	HOLE DIA. 0.00m-11.00m SX 11.00m-36.00m PX 36.00m-44.50m HX
WATER	ORIENTATION VERTICAL	GROUND-LEVEL 8.29 mPD

Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
100					30 bls	28	30.45	30.45				Medium dense, greyish and reddish brown, clayey fine to medium SAND. (ALLUVIUM)
					(33, 34, 57) N=19	29	31.45	31.00				Medium dense, brownish yellow, fine to medium SAND. (ALLUVIUM)
100					40 bls	30	32.45	32.00				Medium dense, brown, silty fine to medium SAND. (ALLUVIUM)
					(22, 33, 67) N=19	31	33.45	33.00				Extremely weak, greyish brown & pinkish brown, completely decomposed medium grained GRANITE. (Silty fine to medium SAND) Becoming pinkish red at depth 35.00m to 38.00m.
100					38 bls	32	34.45	34.00				
100					(22, 34, 7, 10) N=24	34	36.45	36.00				
					(56, 7, 9, 11, 19) N=46	36	38.45	38.00				
					P.M.T.			39.00				
								40.00				

SAMPLE ▲ WATER SAMPLE SAMPLE □ PIEZOMETER TIP SAMPLE ∩ STANDPIPE SAMPLE ↓ STANDARD PENETRATION TEST SAMPLE ⊕ PERMEABILITY TEST SAMPLE ⊗ IN-SITU VANE SHEAR TEST	LOGGED <u>H.C. Yeung</u> DATE <u>19/1/93</u> CHECKED <u>D. Yuen</u> DATE <u>20/3/93</u>	REMARKS P.M.T. ↑ Pressuremeter Test carried out at 39.00m to 40.00m.
--	--	---



CHY SOLETANCHE GROUP
SOIL & FOUNDATIONS SPECIALISTS

DRILLHOLE RECORD

W. O. PW7/2/33.105/S1

HOLE NO. ISL/ST/027

SHEET 5 of 5

DATE from 9/1/93 to 15/1/93

CONTRACT GC/91/05 OF C.E.D.

WEST KOWLOON EXPRESSWAY LAND SITE INVESTIGATION
(ADDITIONAL HOLES IN JORDAN AREA)

ROTARY

CO-ORDINATES

ROCK CORE BIT T2-101

No. CMC-40

E 834656.07

HOLE DIA. 0.00m-11.00m SX
11.00m-36.00m PX
36.00m-44.50m HX

N 818712.02

MEDIUM WATER

ORIENTATION VERTICAL

GROUND-LEVEL 8.29 mPD

Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
		100					37		41.00				See sheet 4 of 5 (C.D.G.)
						(58) (9,12,14,17) N=52	38		41.45				
							39		42.00				Extremely weak to weak, pinkish brown, completely to highly decomposed medium grained GRANITE.
5.10m at 19:30							40		42.10				
11.50m at 07:30						(6,12) (13,19,24,36) N=90	41		43.00				(Silty fine to medium SAND with some subangular fine gravel sized rock fragments) RL
		100				RH	42		43.45				
5.00m at 19:30		100					43		44.00				Moderately strong to strong, brownish pink and greyish pink, mottled white & black, moderately to slightly decomposed medium grained GRANITE with medium to very closely spaced, rough to smooth & planar, kaolinite and limonite stained joints, dipping 20°-30°, 45°-60° and subvertical. Subvertical joints at : 45.33m-45.48m, 45.47m-45.60m, 45.86m-46.12m, 45.12m-46.30m, 46.18m-46.38m, 46.34m-46.48m, 46.70m-46.93m.
11.20m at 07:30		100	84	44			44		44.50				
							45		45.65				
		100	47	39	10.7		46		46.93				
		100	63	38			47		47.79				
		100	83	77			48		48.49				
							49		48.80				
		100	58	24	N.I.		50		48.73				
							51		49.42				
		100	38	0	9.0		52		49.84				

End of Investigation hole at 49.84 m.

- RBED SAMPLE ▲ WATER SAMPLE
- RBED SAMPLE ▬ PIEZOMETER TIP
- AMPLE ○ STANDPIPE
- IRBED SAMPLE ↓ STANDARD PENETRATION TEST
- URBED SAMPLE ⊥ PERMEABILITY TEST
- LE (76mm)
- LE ⊗ IN-SITU VANE SHEAR TEST

LOGGED H.C.Yeung

DATE 19/1/93

CHECKED D.Yuen

DATE 20/3/93

REMARKS

C.D.G. : Completely decomposed GRANITE

gm
cel
slightly altered



Drillhole Record

Drillhole No. BH30
 Sheet 1 of 8

PROJECT **Central Kowloon Route and Widening of Gascoigne Road Flyover (Investigation) - Ground Investigation**

METHOD Rotary Drilling	CO-ORDINATES	Contract No. HY/2008/14
Machine & No. BR-22	E 834757.01 N 819181.69	Date <u>29/04/09</u> to <u>13/05/09</u>
FLUSHING MEDIUM Water	ORIENTATION VERTICAL	GROUND LEVEL +10.77 mPD

Drilling Progress (dd/mm/yyyy)	Casing depth (m) / Size (mm)	Water level (m) / Time (hh:mm)	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D. %	Fracture Index	F.L. Test Depth (m)	Tests	Samples		Reduced Level	Depth (m)	Legend	Grade	Description
										No.	Type/Depth					
29/04/2009										1	0.40					Firm, reddish brown occasionally brown, sandy clayey SILT with some angular to subangular fine to coarse gravel sized rock fragments. (FILL)
										2	0.90					Medium dense, greyish brown, clayey silty fine to coarse SAND with some angular to subangular fine to coarse gravel sized rock fragments. (FILL)
										3	1.40	+9.27	1.50			
										4	1.90					Brownish grey occasionally grey, angular to subangular COBBLE with much medium to coarse gravel sized moderately strong to strong granite, tuff, brick, concrete fragments and wood pieces and firm, sandy silt matrix. (FILL)
										5	2.00					
										6	3.00					Firm to stiff, greyish brown, sandy clayey SILT with some angular to subangular fine to coarse gravel sized rock fragments. (FILL)
										7	3.20					
										8	3.60	+7.07	3.70			Very dense, brownish grey occasionally grey, slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized rock and shell fragments. (FILL from marine deposits)
										9	3.70					
29/04/2009		0.66m at 18:00		95						10	3.92					Firm to stiff, greyish brown, sandy clayey SILT with some angular to subangular fine to coarse gravel sized rock fragments. (FILL)
29/04/2009		Dry at 08:00		79						11	4.20					
				91						12	4.63					Firm to stiff, greyish brown, sandy clayey SILT with some angular to subangular fine to coarse gravel sized rock fragments. (FILL)
				70						13	5.10					
				50						14	5.50	+5.27	5.50			Very dense, brownish grey occasionally grey, slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized rock and shell fragments. (FILL from marine deposits)
				86						15	6.50					
										16	6.70					Very dense, brownish grey occasionally grey, slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized rock and shell fragments. (FILL from marine deposits)
										17	7.10					
										18	7.50					Very dense, brownish grey occasionally grey, slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized rock and shell fragments. (FILL from marine deposits)
										19	8.50	+3.17	8.60			
										20	8.60					Very dense, brownish grey occasionally grey, slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized rock and shell fragments. (FILL from marine deposits)
										21	9.05					
										22	9.20					Very dense, brownish grey occasionally grey, slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized rock and shell fragments. (FILL from marine deposits)
										23	9.60					
30/04/2009		3.03m at 18:00								24						Very dense, brownish grey occasionally grey, slightly silty fine to coarse SAND with some angular to subangular fine to medium gravel sized rock and shell fragments. (FILL from marine deposits)
04/05/2009		9.06m at								25						

● Small Disturbed Sample	⊗ Water Level	LOGGED <u>M.Chiu</u>
○ Large Disturbed Sample	⊥ Standard Penetration Test	DATE <u>18/05/2009</u>
▨ SPT Liner Sample	⊥ Permeability Test	CHECKED <u>P.C.Lee</u>
▨ U76 Undisturbed Sample	⊥ Piezometer Tip	DATE <u>19/05/2009</u>
▨ U100 Undisturbed Sample	⊥ Standpipe Tip	
▨ Mazier Sample	⊥ Pressuremeter Test	
□ Piston Sample	⊥ Impression Packer Test	
▲ Water Sample	⊥ Vane Shear Test	

REMARKS

- An inspection pit was excavated by hand to a depth of 2.00m.
- A falling head permeability test was carried out between depths of 31.20-32.70m.
- Constant head permeability tests were undertaken between depths of 10.10-11.60m and 43.40-44.90m.
- Packer test was carried out at the depths of 57.60-70.30m.
- Impression packer testing were undertaken from depths of 56.60-58.10m, 57.80-59.30m, 59.00-60.50m, 60.20-61.70m, 61.40-62.90m, 62.60-64.10m, 63.80-65.30m and 65.00-66.50m.



Drillhole Record

Drillhole No. BH30

Sheet 2 of 8

PROJECT **Central Kowloon Route and Widening of Gascoigne Road Flyover (Investigation) - Ground Investigation**

METHOD **Rotary Drilling**

CO-ORDINATES

Contract No. HY/2008/14

Machine & No. BR-22

E 834757.01

Date 29/04/09 to 13/05/09

N 819181.69

FLUSHING MEDIUM **Water**

ORIENTATION **VERTICAL**

GROUND LEVEL **+10.77 mPD**

Drilling Progress (dd/mm/yyyy)	Casing depth (m) / Size (mm)	Water level (m) / Time (hh:mm)	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D. %	Fracture Index	F.I. / Test Depths (m)	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
		08:00													See previous page
				89				10.10		B-142		18 10.60			
								11.20	8,9, 12, 14, 16, 18 N=60			19 11.05			
												20 11.20			
												21 11.60			
				73				13.20	8,11, 13, 15, 17, 18 N=58	B-120		22 12.60			
												23 13.05			
												24 13.20			
												25 13.60			
				93				15.20	9,12, 15, 17, 19, 22 N=73	B-146		26 14.60			
												27 15.05			
												28 15.20			
												29 15.60			
				91				17.20	16,19, 18,36,36/70mm (100/220mm)	B-282		30 16.60	-5.83	16.60	Very dense, grey, silty fine to coarse SAND with some angular to subangular fine to medium gravel sized rock and shell fragments. (FILL from marine deposits)
												31 17.05			
												32 17.20			
												33 17.52			
				96				19.20	6,9, 7, 4, 6, 7 N=30	B-79		34 18.60			19.20-19.65m: Medium dense.
												35 19.05			
												36 19.20			
												37 19.60			

<ul style="list-style-type: none"> ● Small Disturbed Sample ○ Large Disturbed Sample ▨ SPT Liner Sample ▩ U76 Undisturbed Sample ▩ U180 Undisturbed Sample ▨ Mazier Sample ▩ Piston Sample ▲ Water Sample 	<ul style="list-style-type: none"> ✕ Water Level ⊥ Standard Penetration Test ⊥ Permeability Test ⊥ Piezometer Tip ⊥ Standpipe Tip ⊥ Pressuremeter Test ⊥ Impression Packer Test ⊥ Vane Shear Test 	<p>LOGGED <u>M.Chiu</u></p> <p>DATE <u>18/05/2009</u></p> <p>CHECKED <u>P.C.Lee</u></p> <p>DATE <u>19/05/2009</u></p>
---	---	---

REMARKS



Drillhole Record

Drillhole No. BH30

Sheet 3 of 8

PROJECT **Central Kowloon Route and Widening of Gascoigne Road Flyover (Investigation) - Ground Investigation**

METHOD **Rotary Drilling**

CO-ORDINATES

Contract No. HY/2008/14

Machine & No. BR-22

E 834757.01

Date 29/04/09 to 13/05/09

N 819181.69

FLUSHING MEDIUM **Water**

ORIENTATION **VERTICAL**

GROUND LEVEL +10.77 mPD

Drilling Progress (dd/mm/yyyy)	Casing depth (m) /Size (mm)	Water level (m) /Time (hh:mm)	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D. %	Fracture Index	F.I./Test Depths (m)	Tests	Samples		Reduced Level	Depth (m)	Legend	Grade	Description
										No.	Type Depth					
																See previous page
21				89				21.20	B-131 3,7, 13,9,17,15 N=49	38 20.60 39 21.05 40 21.20 41 21.60	-9.83	20.60				Dense, grey occasionally brownish grey, slightly silty fine to coarse SAND with some angular to subangular fine gravel sized rock and shell fragments. (FILL from marine deposits)
22																
23		3.02m at 18:00 03/05/2009 7.39m at 08:00 06/05/2009		96				23.20	B-79 4,8, 10,9,10,12 N=41	42 22.60 43 23.05 44 23.20 45 23.60						
24																
25				73				25.20	B-111 6,7, 7,5,1,0 N=13	46 24.60 47 25.05 48 25.20 49 25.60	-14.43	25.20				Firm to stiff, dark greenish grey, sandy silty CLAY with some angular to subangular fine gravel sized rock and shell fragments. (MARINE DEPOSITS)
26																
27				87				27.20	B-91 8,6, 7,9,7,6 N=39	50 26.60 51 27.05 52 27.20 53 27.60	-16.43	27.20				Medium dense, grey, slightly silty fine to coarse SAND with some angular to subangular fine gravel sized rock and shell fragments. (MARINE DEPOSITS)
28																
29				100				29.20	B-49 3,4, 4,5,5,6 N=20	54 28.60 55 29.05 56 29.20 57 29.60	-17.83	28.60				Medium dense, pinkish brown, clayey silty fine to coarse SAND with some subangular to subrounded fine to medium gravel sized rock fragments. (ALLUVIUM)
30																

- Small Disturbed Sample
- Large Disturbed Sample
- SPT Liner Sample
- ▨ U76 Undisturbed Sample
- ▩ U100 Undisturbed Sample
- ▧ Mazier Sample
- ▦ Piston Sample
- ▤ Water Sample
- ⊕ Water Level
- ⊖ Standard Penetration Test
- ⊗ Permeability Test
- ⊕ Piezometer Tip
- ⊖ Standpipe Tip
- ⊕ Pressuremeter Test
- ⊖ Impression Packer Test
- ⊕ Vane Shear Test

LOGGED M.Chiu
 DATE 18/05/2009
 CHECKED P.C.Lee
 DATE 19/05/2009

REMARKS



Drillhole Record

Drillhole No. BH30
 Sheet 4 of 8

PROJECT **Central Kowloon Route and Widening of Gascoigne Road Flyover (Investigation) - Ground Investigation**

METHOD Rotary Drilling	CO-ORDINATES E 834757.01 N 819181.69	Contract No. HY/2008/14
Machine & No. BR-22		Date <u>29/04/09</u> to <u>13/05/09</u>
FLUSHING MEDIUM Water	ORIENTATION VERTICAL	GROUND LEVEL +10.77 mPD

Drilling Progress (dd/mm/yyyy)	Casing depth (m) / Size (mm)	Water level (m) / Time (hh:mm)	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D. %	Fracture Index	F.L./Test Depth (m)	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
06/05/2009	2.68m at 18:00							31.20		58 30.60	-19.83	30.60			See previous page
07/05/2009	7.32m at 08:00							31.80	3, 6, 7, 8 N=26	59 31.60 60 31.80 61 32.20					Medium dense, yellowish brown, clayey silty fine to coarse SAND with some subangular to subrounded fine to medium gravel sized rock fragments. (ALLUVIUM)
				30						62 32.60					
										63 33.60 64 33.70	-22.93	33.70			33.60-33.70m: With occasional clayey pocket.
07/05/2009	2.66m at 18:00									65 34.70					Medium dense, yellowish brown, silty fine to coarse SAND with some subangular to subrounded fine to medium gravel sized rock fragments. (ALLUVIUM)
08/05/2009	9.20m at 08:00							34.90	2, 3, 5, 4, 3, 4 N=14	66 34.90 67 35.30					
				0						68 35.70	-24.93	35.70		V	Extremely weak, reddish brown spotted white, grey and brown, completely decomposed medium grained GRANITE. (Firm to stiff, slightly sandy clayey SILT with some fine gravel sized rock fragments.)
										69 36.70 70 36.80					
	37.90 / 140mm									71 37.80 72 38.00					
								38.00	3, 4, 5, 5, 6 N=20	73 38.80 74 39.80					

<ul style="list-style-type: none"> • Small Disturbed Sample ▣ Large Disturbed Sample ▨ SPT Liner Sample ▩ U76 Undisturbed Sample ▧ U100 Undisturbed Sample ▦ Mazier Sample ▤ Piston Sample ▲ Water Sample 	<ul style="list-style-type: none"> z Water Level Standard Penetration Test Permeability Test Piezometer Tip Standpipe Tip Pressuremeter Test Impression Packer Test Vane Shear Test 	LOGGED <u>M.Chiu</u> DATE <u>18/05/2009</u> CHECKED <u>P.C.Lee</u> DATE <u>19/05/2009</u>	REMARKS
---	---	--	---------



Drillhole Record

Drillhole No. BH30

Sheet 5 of 8

PROJECT **Central Kowloon Route and Widening of Gascoigne Road Flyover (Investigation) - Ground Investigation**

METHOD **Rotary Drilling**

CO-ORDINATES

Contract No. **HY/2008/14**

E 834757.01

Machine & No. **BR-22**

N 819181.69

Date 29/04/09 to 13/05/09

FLUSHING MEDIUM **Water**

ORIENTATION **VERTICAL**

GROUND LEVEL **+10.77 mPD**

Drilling Progress (dd/mm/yyyy)	Casing depth (m) / Size (mm)	Water level (m) / Time (hh:mm)	Water Recovery %	Total core Recovery %	Split core Recovery %	R.Q.D. %	Fracture Index	F.L. / Test Depth (m)	Tests	Samples			Reduced Level	Depth (m)	Legend	Grade	Description
										No.	Type	Depth					
								40.00	3, 4, 5, 6, 7, 24	75	40.00				V	See previous page	
										76	40.40						
										77	40.80						
										78	41.80						
								42.00	3, 4, 5, 7, 10, 12, N-34	79	42.00	-31.23	42.00		V	Extremely weak, pinkish brown occasionally pink and greyish brown spotted white, grey and brown, completely decomposed medium grained GRANITE. (Stiff to very stiff, sandy clayey SILT with some fine gravel sized rock fragments.)	
08/05/2009		3.08m at 18:00								80	42.40						
09/05/2009		8.72m at 08:00								81	42.80						
								43.40		82	43.80						
								44.00	4, 5, 8, 11, 13, N-38	83	44.00						
										84	44.40						
										85	44.80						
								45.00	3, 4, 5, 10, 12, 15, N-45	86	45.80						
09/05/2009		3.09m at 18:00								87	46.00						
11/05/2009		8.33m at 08:00								88	46.40						
										89	46.80	-36.03	46.80		V	Extremely weak to very weak, greyish brown occasionally yellowish brown spotted grey and brown, completely decomposed medium grained GRANITE. (Slightly clayey silty fine to coarse SAND with some fine to medium gravel sized rock fragments.)	
										90	47.80						
								48.00	7, 10, 12, 21, 28, 34, N-97	91	48.00						
										92	48.40						
										93	48.80						
										94	49.90						

- Small Disturbed Sample
- Large Disturbed Sample
- ▨ SPT Liner Sample
- ▩ U76 Undisturbed Sample
- ▧ U100 Undisturbed Sample
- ▤ Mazier Sample
- ▥ Piston Sample
- ▲ Water Sample
- z Water Level
- ⊥ Standard Penetration Test
- ⊥ Permeability Test
- ⊥ Piezometer Tip
- ⊥ Standpipe Tip
- ⊥ Pressuremeter Test
- ⊥ Impression Packer Test
- ⊥ Vane Shear Test

LOGGED M.Chiu

DATE 18/05/2009

CHECKED P.C.Lee

DATE 19/05/2009

REMARKS



Drillhole Record

Drillhole No. BH30
 Sheet 6 of 8

PROJECT **Central Kowloon Route and Widening of Gascoigne Road Flyover (Investigation) - Ground Investigation**

METHOD **Rotary Drilling**

CO-ORDINATES

Contract No. HY/2008/14

Machine & No. BR-22

E 834757.01
 N 819181.69

Date 29/04/09 to 13/05/09

FLUSHING MEDIUM **Water**

ORIENTATION **VERTICAL**

GROUND LEVEL **+10.77 mPD**

Drilling Progress (dd/mm/yyyy)	Casing depth (m) / Size (mm)	Water level (m) / Time (hh:mm)	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D. %	Fracture Index	F.L. / Test Depths (m)	Tests	Samples		Reduced Level	Depth (m)	Legend	Grade	Description	
										No.	Type Depth						
				92						95	50.90					See previous page	
								51.10	18.27, 39.51, 18/20mm (100/170mm)	96	51.10						
										97	51.37						
				86						98	51.90						
								53.10	36, 24/25mm, 37, 43/25mm (200/100mm)	99	52.90						
										100	53.25						
				0													
				100						101	54.90						
	55.50 / 115mm									102	55.00						
								55.47		103	55.35	-44.70	-55.47				55.35-55.45m: Sandy fine to coarse gravel sized rock fragments.
								55.76									
				81	59	44		8.6		T2-101		-44.99	-55.76			Weak to moderately weak, brown spotted grey and brown, highly decomposed medium grained GRANITE.	
11/05/2009		3.07m at 18:00						5.1				-45.20	-55.97			No recovery, assumed to be completely decomposed GRANITE.	
12/05/2009		8.89m at 08:00						5.1				-56.60	-45.89	-56.66			Strong to very strong occasionally moderately strong, grey occasionally brown spotted pink, black and grey, slightly decomposed medium grained GRANITE with closely to medium occasionally very closely to closely spaced, rough stepped occasional undulating, limonite stained joints, dipping at 10°-20°, 20°-30° and 40°-50° occasional 0°-10° and 50°-60°.
				89	99	99		8.5	57.80		T2-101		-47.27	-58.04			55.97-56.66m: Moderately strong, moderately decomposed.
																	56.60m: Slickensided stepped joints, dipping at 0°-10°.
				89	99	99			58.76		T2-101		-47.64	-58.31			58.04-58.31m: Moderately strong, moderately decomposed.
								2.0									58.56-58.63m: Fine grained granite.
				100	100	97					T2-101						

● Small Disturbed Sample	⊕ Water Level	LOGGED <u>M.Chiu</u>
○ Large Disturbed Sample	⊖ Standard Penetration Test	
▨ SPT Liner Sample	⊗ Permeability Test	CHECKED <u>P.C.Lee</u>
▩ U76 Undisturbed Sample	⊙ Piezometer Tip	DATE <u>19/05/2009</u>
▧ U100 Undisturbed Sample	⊕ Standpipe Tip	
▦ Mazier Sample	⊖ Pressuremeter Test	
▤ Piston Sample	⊙ Impression Packer Test	
▣ Water Sample	⊖ Vane Shear Test	

REMARKS



Drillhole Record

Drillhole No. BH30

Sheet 7 of 8

PROJECT **Central Kowloon Route and Widening of Gascoigne Road Flyover (Investigation) - Ground Investigation**

METHOD **Rotary Drilling**

CO-ORDINATES

Contract No. HY/2008/14

Machine & No. BR-22

E 834757.01

Date 29/04/09 to 13/05/09

N 819181.69

FLUSHING MEDIUM **Water**

ORIENTATION **VERTICAL**

GROUND LEVEL +10.77 mPD

Drilling Progress (add/mm/yyyy)	Casing depth (m) / Size (mm)	Water level (m) / Time (hh:mm)	Water Recovery %	Total core Recovery %	Solid core Recovery %	R.Q.D. %	Fracture Index	F.L. / Test Depth (m)	Tests	Samples No. Type Depth	Reduced Level	Depth (m)	Legend	Grade	Description
				100	100	97	2.0	60.28			-49.49	60.26	+	II	See previous page
				100	100	97	16.7	60.50		T2-101			+	III	Moderately strong occasionally strong, brown occasionally grey and pink spotted pink, grey and brown, moderately decomposed medium grained GRANITE with closely to medium occasionally very closely spaced, rough stepped and undulating, limonite and manganese oxide stained joints, dipping at 20°-30°, 50°-60° and 70°-80° occasional 40°-50°.
				100	85	75	4.0	61.00		T2-101	-61.00		+	III	
				100	85	75	10.9	61.40					+	II	61.70-62.00m: Very strong, slightly decomposed.
				100	85	75	1.9	61.55		T2-101	-50.93	61.70	+	II	
				100	87	87	9.5	62.07					+	III	62.91-63.03m: Very strong, slightly decomposed.
				100	87	87	1.9	62.60		T2-101	-52.14	62.91	+	II	
				100	89	89	4.3	62.70					+	II	Strong to very strong occasionally moderately strong, grey occasionally pink and brown spotted pink, black and grey, slightly decomposed medium grained GRANITE with medium to widely occasionally closely spaced, rough stepped and undulating occasionally planar, limonite, manganese oxide and chlorite stained, calcite coated (up to 1mm) joints, dipping at 20°-30°, 40°-50° and 50°-60° occasional 10°-20°, 30°-40° and 70°-80°.
				100	100	89	7.1	63.22		T2-101	-52.26	63.03	+	II	
				100	92	88	7.1	63.45					+	II	63.97-64.11m: Moderately strong, moderately decomposed.
				100	92	88	1.2	63.80		T2-101	-53.20	63.97	+	III	
				100	92	88	8.5	63.87					+	II	64.76-65.04m: Subvertical joint.
				100	92	88	2.3	63.95		T2-101	-53.34	64.11	+	II	
				100	96	96	1.3	64.78					+	II	64.76-65.04m: Subvertical joint.
				100	96	96	8.3	65.00		T2-101			+	II	
				100	99	99	0.7	65.25					+	II	64.76-65.04m: Subvertical joint.
				100	99	99	2.3	65.69		T2-101			+	II	
				100	99	99	6.3	66.01					+	II	64.76-65.04m: Subvertical joint.
				100	99	99	1.3	66.79		T2-101			+	II	
				100	99	99	8.3	67.03					+	II	64.76-65.04m: Subvertical joint.
				100	99	99	0.7	67.47		T2-101			+	II	
				100	99	99	4.7	68.42					+	II	64.76-65.04m: Subvertical joint.
				100	99	99	1.7	68.85		T2-101			+	II	
				100	100	100	3.4	69.43					+	II	64.76-65.04m: Subvertical joint.
				100	100	100	3.4	69.43		T2-101			+	II	

- Small Disturbed Sample
- Large Disturbed Sample
- SPT Liner Sample
- ▨ U76 Undisturbed Sample
- ▩ U100 Undisturbed Sample
- ▧ Mazier Sample
- ▦ Piston Sample
- ▲ Water Sample

- z Water Level
- | Standard Penetration Test
- ┆ Permeability Test
- ⊕ Piezometer Tip
- Standpipe Tip
- ⊕ Pressuremeter Test
- ┆ Impression Packer Test
- ∨ Vane Shear Test

LOGGED M.Chiu

DATE 18/05/2009

CHECKED P.C.Lee

DATE 19/05/2009

REMARKS



BACHY SOLETANCHE GROUP
SOIL & FOUNDATIONS SPECIALISTS

DRILLHOLE RECORD

W. O. NO. 14
 DRILLHOLE NO. LAR/503/D063
 SHEET 1 of 5
 DATE from 19/5/94 to 23/5/94

CONTRACT 530E

CLIENT: MASS TRANSIT RAILWAY CORPORATION

PROJECT: LANTAU AND AIRPORT RAILWAY - GROUND INVESTIGATION

LOCATION: KOWLOON STATION AND WESTERN ELEVATED ROAD

METHOD ROTARY

CO-ORDINATES
E 834578.06
N 818500.11

MACHINE & No. CMC-40

FLUSHING MEDIUM WATER

ORIENTATION VERTICAL

ROCK COREBIT T2-101

HOLE DIA. 0.00m-6.00m C SX
6.00m-30.00m PX

GROUND-LEVEL +5.08 mPD

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
	SX										0.00				
1								15, 24, 38 71 bls	1	+4.08	1.00				WASH BORING
2				89				(4,4) (5,3,15) N=38	2		1.45				
3								6, 13, 67 86 bls	3		2.00				
4				100				(1,2) (2,3,24) N=11	4		2.45				
5								24, 24, 32 80 bls	5		3.00				
6	6.00m SX PX			89				(1,1) (3,4,32) N=12	6		3.45				
7								15, 20, 25 60 bls	7		4.00				
8								(1,2) (3,3,4,3) N=13	8		4.45				
9				100				12, 18, 26 56 bls	9		5.00				
10	PX			89							5.45				
											6.00				(FILL)
											6.45				
											7.00				
											7.45				
											8.00				
											8.45				
											9.00				
											9.45				
											10.00				
										-4.92					

- ▣ SMALL DISTURBED SAMPLE
- ▣ LARGE DISTURBED SAMPLE
- ▣ SPT UNER SAMPLE
- ▣ U76 UNDISTURBED SAMPLE
- ▣ U100 UNDISTURBED SAMPLE
- ▣ MAZIER SAMPLE (76mm)
- ▣ PISTON SAMPLE
- ▲ WATER SAMPLE
- ⊕ PIEZOMETER TIP
- ⊖ STANDPIPE
- ↓ STANDARD PENETRATION TEST
- ⊥ PERMEABILITY TEST
- ⊗ IN-SITU VANE SHEAR TEST

LOGGED TSAO HSU
 DATE 26/5/94
 CHECKED M. D.
 DATE 2/6/94

REMARKS



BACHY SOLETANCHE GROUP
SOIL & FOUNDATIONS SPECIALISTS

DRILLHOLE RECORD

W. O. NO. 14
 DRILLHOLE NO. LAR/503/D063
 SHEET 2 of 5
 DATE from 19/5/94 to 23/5/94

CONTRACT 530E

CLIENT: MASS TRANSIT RAILWAY CORPORATION

ROCK COREBIT T2-101

PROJECT: LANTAU AND AIRPORT RAILWAY - GROUND INVESTIGATION

LOCATION: KOWLOON STATION AND WESTERN ELEVATED ROAD

HOLE DIA. 0.00m-6.00m SX
6.00m-30.00m PX

METHOD ROTARY

CO-ORDINATES

MACHINE & No. CMC-40

E 834578.06
N 818500.11

GROUND-LEVEL +5.08 mPD

FLUSHING MEDIUM WATER

ORIENTATION VERTICAL

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
	PX							(2,3 2,2,3) N=9	10		10.00				
11				100				8, 10, 14 22 bls	11		11.00				
12								(2,2 4,3,3,4) N=14	12		12.00				
13				89				7, 11, 13 31 bls	13		13.00				
14								(3,3 2,3,3,4) N=12	14		14.00				
15				100				10, 8, 10 28 bls	15		15.00				
16								(5,6 6,5,5,8) N=24	16		16.00				
17				100				6, 9, 11 26 bls	17		17.00				
18								(4,4 3,3,3,5) N=14	18		18.00				
19				100				7, 8, 8 23 bls	19		19.00				
20	PX										-14.92				

(See sheet 1 of 5)

- SMALL DISTURBED SAMPLE ▲ WATER SAMPLE
- ↑ LARGE DISTURBED SAMPLE ↓ PIEZOMETER TIP
- ▨ SPT LINER SAMPLE ○ STANDPIPE
- ▤ U76 UNDISTURBED SAMPLE ↓ STANDARD PENETRATION TEST
- ▥ U100 UNDISTURBED SAMPLE ↓ PERMEABILITY TEST
- ▧ MAZIER SAMPLE (76mm) ⊗ IN-SITU VANE SHEAR TEST
- PISTON SAMPLE

LOGGED TSAO HSU
 DATE 26/5/94
 CHECKED M. D.
 DATE 2/6/94

REMARKS



BACHY SOLETANCHE GROUP
SOIL & FOUNDATIONS SPECIALISTS

DRILLHOLE RECORD

W. O. NO. 14
 DRILLHOLE NO. LAR/503/D063
 SHEET 3 of 5
 DATE from 19/5/94 to 23/5/94

CONTRACT 530E

CLIENT: MASS TRANSIT RAILWAY CORPORATION		ROCK COREBIT T2-101
PROJECT: LANTAU AND AIRPORT RAILWAY - GROUND INVESTIGATION		
LOCATION: KOWLOON STATION AND WESTERN ELEVATED ROAD		HOLE DIA 0.00m-6.00m SX 6.00m-30.00m PX
METHOD ROTARY	CO-ORDINATES	
MACHINE & No. CMC-40	E 834578.06 N 818500.11	
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND-LEVEL +5.08 mPD

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (F)	Legend	Grade	Zone	Description
20/5/94	PX							(3,3 3,4,5,6) N=18	20		20.00				
21				100				6, 6, 9 21 bis	21		20.45 21.00 21.45				
22								(4,5 6,5,6,6) N=23	22		22.00 22.45				
23				100				11, 18, 24 53 bis	23		23.00 23.45				(See sheet 1 of 5)
24								(4,7 7,7,5,6) N=25	24		24.00 24.45				
25				100				9, 13, 21 43 bis	25		25.00 25.45				
21/5/94								(3,3 3,2,2,3) N=10	26		26.00 26.45				Stiff, light grey, sandy silty CLAY with some gravel. (ALLUVIUM)
27				100				2, 2, 3 7 bis	27		27.00 27.45				
28								(3,2 3,5,4,5) N=17	28		28.00 28.45				
29				100				3, 4, 5 12 bis	29		29.00 29.45				(See sheet 4 of 5)
30	PX										24.92 30.00				

- SMALL DISTURBED SAMPLE ▲ WATER SAMPLE
- ↑ LARGE DISTURBED SAMPLE ◊ PIEZOMETER TIP
- ▨ SPT LINER SAMPLE ◊ STANDPIPE
- ▨ U78 UNDISTURBED SAMPLE ↓ STANDARD PENETRATION TEST
- ▨ U100 UNDISTURBED SAMPLE ↓ PERMEABILITY TEST
- ▨ MAZIER SAMPLE (76mm) ⊗ IN-SITU VANE SHEAR TEST
- PISTON SAMPLE

LOGGED TSAO HSU
 DATE 26/5/94
 CHECKED M. D.
 DATE 2/6/94

REMARKS



BACHY SOLETANCHE GROUP
SOIL & FOUNDATIONS SPECIALISTS

DRILLHOLE RECORD

W. O. NO. 14
DRILLHOLE NO. LAR/503/D063
SHEET 4 of 5
DATE from 19/5/94 to 23/5/94

CONTRACT 530E

CLIENT: MASS TRANSIT RAILWAY CORPORATION

ROCK COREBIT T2-101

PROJECT: LANTAU AND AIRPORT RAILWAY - GROUND INVESTIGATION

LOCATION: KOWLOON STATION AND WESTERN ELEVATED ROAD

HOLE DIA. 0.00m-6.00m SX
6.00m-30.00m PX

METHOD ROTARY

CO-ORDINATES

MACHINE & No. CMC-40

E 834578.06

N 818500.11

GROUND-LEVEL +5.08 mPD

FLUSHING MEDIUM WATER

ORIENTATION VERTICAL

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
31				100				(12 21,2,3) N=8 3, 3, 5 11 bla	30 31		30.00 30.45 31.00 31.45				Loose to medium dense, yellowish brown, very silty medium to coarse SAND with some gravels. (ALLUVIUM)
32								(22 2,3,3,2) N=10	32	-26.92	32.00				
33				100					33		33.00				Extremely weak, light pinkish grey spotted with white, completely decomposed medium to coarse grained GRANITE.
34								(44 4,5,6,8) N=23	34		34.00 34.45				(Medium dense, silty SAND with some gravel.) (C. D. G.)
35										-30.55	35.00 35.63				
36				100	100	100	4.9								
37											37.05				
38				100	100	93	4.6		T2-101					II	Strong to very strong, pinkish grey, spotted with green and pink, equigranular, slightly decomposed medium to coarse grained GRANITE. Joints are medium to widely spaced, rough and smooth planar, with limonite stained dip at : 10-20 deg, 35-45 deg & 65-75 deg. (S. D. G.)
39				100	100	100	2				38.55				
40											39.92 40.00				

- SMALL DISTURBED SAMPLE
- ▲ WATER SAMPLE
- ↑ LARGE DISTURBED SAMPLE
- PIEZOMETER TIP
- ▨ SPT LINER SAMPLE
- ∩ STANDPIPE
- ▩ U78 UNDISTURBED SAMPLE
- ↓ STANDARD PENETRATION TEST
- ▩ U100 UNDISTURBED SAMPLE
- ∩ PERMEABILITY TEST
- ▨ MAZIER SAMPLE (76mm)
- ∩ IN-SITU VANE SHEAR TEST
- PISTON SAMPLE

LOGGED TSAO HSU
DATE 26/5/94
CHECKED M. D.
DATE 2/6/94

REMARKS



BACHY SOLETANCHE GROUP
SOIL & FOUNDATIONS SPECIALISTS

DRILLHOLE RECORD

W. O. NO. 14
 DRILLHOLE NO. LAR/503/D063
 SHEET 5 of 5
 DATE from 19/5/94 to 23/5/94

CONTRACT 530E

CLIENT: MASS TRANSIT RAILWAY CORPORATION

PROJECT: LANTAU AND AIRPORT RAILWAY - GROUND INVESTIGATION

ROCK COREBIT T2-101

LOCATION: KOWLOON STATION AND WESTERN ELEVATED ROAD

METHOD ROTARY

CO-ORDINATES

HOLE DIA. 0.00m-6.00m SX
6.00m-30.00m PX

MACHINE & No. CMC-40

E 834578.06
N 818500.11

GROUND-LEVEL +5.08 mPD

FLUSHING MEDIUM WATER

ORIENTATION VERTICAL

Drilling Progress	Casing depth/size	Water level/time/date	Water Recovery %	Total core Recovery %	Solid core Recovery %	R. Q. D.	Fracture Index	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Zone	Description
23/5/94				100	100	100	1.7		T2-101		40.00 40.05 36.17 41.25	++ ++ ++ ++	II		(See sheet 4 of 5)
41															End of investigation hole at 41.25 m.
42															
43															
44															
45															
46															
47															
48															
49															
50															

- SMALL DISTURBED SAMPLE ▲ WATER SAMPLE
- ↑ LARGE DISTURBED SAMPLE □ PIEZOMETER TIP
- ▨ SPT LINER SAMPLE ∩ STANDPIPE
- ▩ U76 UNDISTURBED SAMPLE ↓ STANDARD PENETRATION TEST
- U100 UNDISTURBED SAMPLE ↓ PERMEABILITY TEST
- ▧ MAZIER SAMPLE (76mm) ⊗ IN-SITU VANE SHEAR TEST
- PISTON SAMPLE

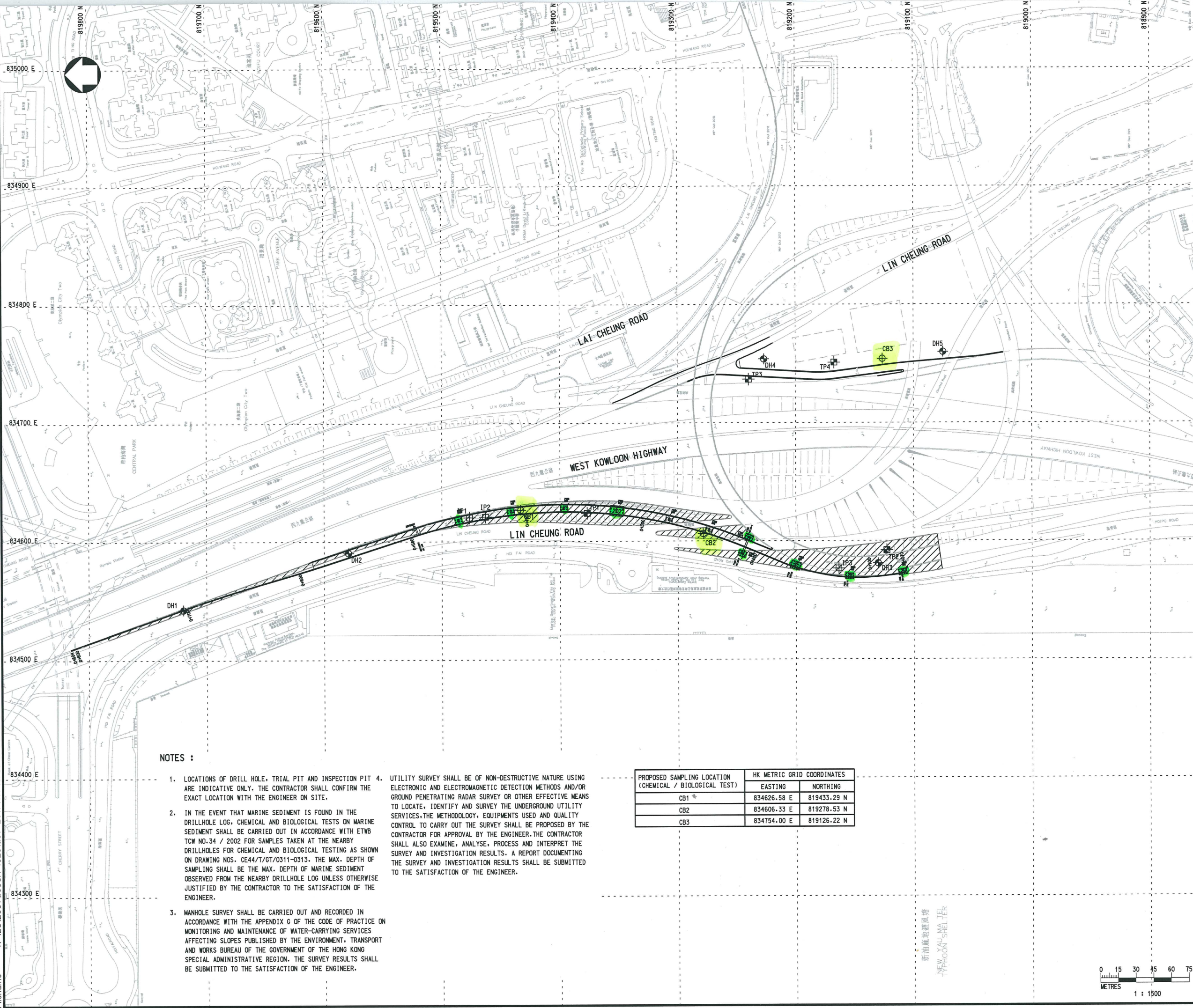
LOGGED TSAO HSU
 DATE 26/5/94
 CHECKED M. D.
 DATE 2/8/94

REMARKS

Appendix E

Proposed Ground Investigation Plan (with drillholes for sampling of sediment, and locations of excavation)

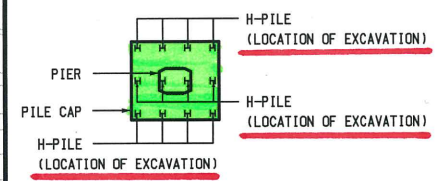
Printed by : 4/12/2013
 Filename : X:\2512037&038A (CE31837-2011-HY)\CADD\DRAWING\Tender Addendum_20130326 (Contract 1 VO)\PBA-CE44-W-GI-0311-A.dgn



LOCATION PLAN

- LEGEND :
- DRILLHOLE
 - DRILLHOLE FOR SAMPLING AND CHEMICAL / BIOLOGICAL TESTING (NOTE 2)
 - TRIAL PIT
 - INSPECTION PIT
 - AREAS REQUIRED MANHOLE SURVEY AND UTILITY SURVEY

PROPOSED ROCK SOCKETER H-PILE FOUNDATION



NOTES :

1. LOCATIONS OF DRILL HOLE, TRIAL PIT AND INSPECTION PIT ARE INDICATIVE ONLY. THE CONTRACTOR SHALL CONFIRM THE EXACT LOCATION WITH THE ENGINEER ON SITE.
2. IN THE EVENT THAT MARINE SEDIMENT IS FOUND IN THE DRILLHOLE LOG, CHEMICAL AND BIOLOGICAL TESTS ON MARINE SEDIMENT SHALL BE CARRIED OUT IN ACCORDANCE WITH ETWB TCW NO.34 / 2002 FOR SAMPLES TAKEN AT THE NEARBY DRILLHOLES FOR CHEMICAL AND BIOLOGICAL TESTING AS SHOWN ON DRAWING NOS. CE44/T/GT/0311-0313. THE MAX. DEPTH OF SAMPLING SHALL BE THE MAX. DEPTH OF MARINE SEDIMENT OBSERVED FROM THE NEARBY DRILLHOLE LOG UNLESS OTHERWISE JUSTIFIED BY THE CONTRACTOR TO THE SATISFACTION OF THE ENGINEER.
3. MANHOLE SURVEY SHALL BE CARRIED OUT AND RECORDED IN ACCORDANCE WITH THE APPENDIX G OF THE CODE OF PRACTICE ON MONITORING AND MAINTENANCE OF WATER-CARRYING SERVICES AFFECTING SLOPES PUBLISHED BY THE ENVIRONMENT, TRANSPORT AND WORKS BUREAU OF THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION. THE SURVEY RESULTS SHALL BE SUBMITTED TO THE SATISFACTION OF THE ENGINEER.

UTILITY SURVEY SHALL BE OF NON-DESTRUCTIVE NATURE USING ELECTRONIC AND ELECTROMAGNETIC DETECTION METHODS AND/OR GROUND PENETRATING RADAR SURVEY OR OTHER EFFECTIVE MEANS TO LOCATE, IDENTIFY AND SURVEY THE UNDERGROUND UTILITY SERVICES. THE METHODOLOGY, EQUIPMENTS USED AND QUALITY CONTROL TO CARRY OUT THE SURVEY SHALL BE PROPOSED BY THE CONTRACTOR FOR APPROVAL BY THE ENGINEER. THE CONTRACTOR SHALL ALSO EXAMINE, ANALYSE, PROCESS AND INTERPRET THE SURVEY AND INVESTIGATION RESULTS. A REPORT DOCUMENTING THE SURVEY AND INVESTIGATION RESULTS SHALL BE SUBMITTED TO THE SATISFACTION OF THE ENGINEER.

PROPOSED SAMPLING LOCATION (CHEMICAL / BIOLOGICAL TEST)	HK METRIC GRID COORDINATES	
	EASTING	NORTHING
CB1	834626.58 E	819433.29 N
CB2	834606.33 E	819278.53 N
CB3	834754.00 E	819126.22 N

Rev	Description	By	Date

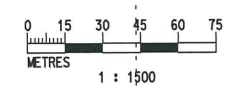
Consultant
PARSONS BRINCKERHOFF

Project title
 CONTRACT NO. HY/2012/11
 PROVISION OF BARRIER-FREE ACCESS FACILITIES FOR HIGHWAY STRUCTURES-PHASE 3 CONTRACT 1

Drawing title
GROUND INVESTIGATION PLAN (SHEET 1)

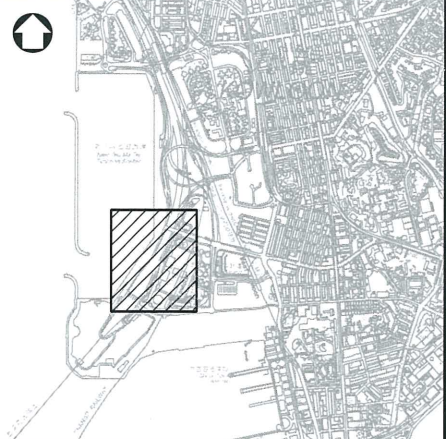
Drawing no. CE44/W/GI/0311		Rev. A	
Drawn CAD	Date NOV 2012	Checked - AT	Approved - EW
Scale 1:1500 (A1)		Status WORKING	

© COPYRIGHT RESERVED



新油麻地避風塘
 NEW YAU MA TELLER

Printed by : 4/12/2013
 Filename : X:\2512037&038A (CE31&37-2011-HY)\CADD\DRAWING\Tender Addendum\20130326 (Contract 1 VO)\PBA-CE44-W-GI-0312-A.dgn

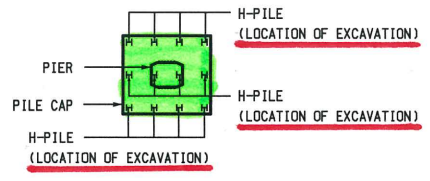


LOCATION PLAN

LEGEND :

- DRILLHOLE
- DRILLHOLE FOR SAMPLING AND CHEMICAL / BIOLOGICAL TESTING (NOTE 2)
- TRIAL PIT
- INSPECTION PIT
- AREAS REQUIRED MANHOLE SURVEY AND UTILITY SURVEY

PROPOSED ROCK SOCKETER H-PILE FOUNDATION



Rev	Description	By	Date

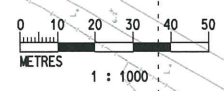
Consultant
PARSONS BRINCKERHOFF

Project title
 CONTRACT NO. HY/2012/11
 PROVISION OF BARRIER-FREE ACCESS FACILITIES FOR HIGHWAY STRUCTURES-PHASE 3 CONTRACT 1

Drawing title
GROUND INVESTIGATION PLAN (SHEET 2)

Drawing no. CE44/W/GI/0312		Rev. A	
Drawn CAD	Date NOV 2012	Checked AT	Approved EW
Scale 1:1000 (A1)		Status WORKING	

© COPYRIGHT RESERVED



NOTES :
 REFER TO DRAWING NO. CE44/GI/0311 FOR NOTES

PROPOSED SAMPLING LOCATION (CHEMICAL / BIOLOGICAL TEST)	HK METRIC GRID COORDINATES	
	EASTING	NORTHING
CB4	834573.27 E	818547.83 N
CB5	834530.71 E	818517.19 N

Ma Tei Shelter

路政署
HIGHWAYS DEPARTMENT
 主要工程管理處
 MAJOR WORKS PROJECT MANAGEMENT OFFICE

Appendix F

**Table of Tier II Chemical
Screening (from Table 1,
Appendix B of ETWB TC (W) No.
34/2002)**

Table 1 - Analytical Methodology

Parameters	Preparation Method <i>US EPA Method</i>	Determination Method <i>US EPA Method</i>	Reporting Limit
Metals <i>(mg/kg dry wt.)</i>			
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 <i>(mg/kg dry wt.)</i>			
Arsenic (As)	3050B	6020A or 7000A or 7061A	1
Organic-PAHs <i>(µg/kg dry wt.)</i>			
Low 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 <i>(µg/kg dry wt.)</i>			
Total PCBs+++	3550B or 3540C and 3665A	8082	3
Organometallics <i>(µg TBT/L in interstitial water)</i>			
Tributyltin	Krone et al. (1989)* - GC/MS UNEP/IOC/IAEA**	Krone et al. (1989)* - GC/MS UNEP/IOC/IAEA**	0.015

Appendix G

**Table of Tier III Biological
Screening (from Table 2,
Appendix B of ETWB TC (W)
No. 34/2002)**

Table 2 - Test Endpoints and Decision Criteria for Tier III Biological Screening

Toxicity test	Endpoints measured	Failure criteria
10-day amphipod	Survival	Mean survival in test sediment is significantly different ($p \leq 0.05$) ¹ from mean survival in reference sediment and mean survival in test sediment < 80% of mean survival in reference sediment.
20-day polychaete worm	Dry Weight ²	Mean dry weight in test sediment is significantly different ($p \leq 0.05$) ¹ from mean dry weight in reference sediment and mean dry weight in test sediment < 90% of mean dry weight in reference sediment.
48-96 hour larvae (bivalve or echinoderm)	Normality Survival ³	Mean normality survival in test sediment is significantly different ($p \leq 0.05$) ¹ from mean normality survival in reference sediment and mean normality survival in test sediment < 80% of mean normality survival in reference sediment.

¹ Statistically significant differences should be determined using appropriate two-sample comparisons (e.g., *t-tests*) at a probability of $p \leq 0.05$.

² Dry weight means total dry weight after deducting dead and missing worms.

³ Normality survival integrates the normality and survival end points, and measures survival of only the normal larvae relative to the starting number.

Appendix H

**Sediment Quality Criteria for the
Classification of Sediment (from
Appendix A of ETWB TC (W)
No. 34/2002)**

Sediment Quality Criteria for the Classification of Sediment

Contaminants	Lower Chemical Exceedance Level (LCEL)	Upper Chemical Exceedance Level (UCEL)
Metals (mg/kg dry wt.)		
Cadmium (Cd)	1.5	4
Chromium (Cr)	80	160
Copper (Cu)	65	110
Mercury (Hg)	0.5	1
Nickel (Ni)*	40	40
Lead (Pb)	75	110
Silver (Ag)	1	2
Zinc (Zn)	200	270
Metalloid (mg/kg dry wt.)		
Arsenic (As)	12	42
Organic-PAHs (µg/kg dry wt.)		
Low Molecular Weight PAHs	550	3160
High Molecular Weight PAHs	1700	9600
Organic-non-PAHs (µg/kg dry wt.)		
Total PCBs	23	180
Organometallics (µg TBT/L in Interstitial water)		
Tributyltin*	0.15	0.15

* *The contaminant level is considered to have exceeded the UCEL if it is greater than the value shown.*

The sediment is classified into 3 categories based on its contaminant levels :

Category L: Sediment with all contaminant levels not exceeding the Lower Chemical Exceedance Level (LCEL). The material must be dredged, transported and disposed of in a manner which minimizes the loss of contaminants either into solution or by resuspension.

Category M: Sediment with any one or more contaminant levels exceeding the Lower Chemical Exceedance Level (LCEL) and none exceeding the Upper Chemical Exceedance Level (UCEL). The material must be dredged and transported with care, and must be effectively isolated from the environment upon final disposal unless appropriate biological tests demonstrate that the material will not adversely affect the marine environment.

Category H: Sediment with any one or more contaminant levels exceeding the Upper Chemical Exceedance Level (UCEL). The material must be dredged and transported with great care, and must be effectively isolated from the environment upon final disposal.