

MTR Corporation Limited

Shatin to Central Link –
 Consultancy Agreement No. NEX/2213

**Environmental Impact Assessment
 (EIA) for Protection Works at
 Causeway Bay Typhoon Shelter**

Sediment Sampling and Testing Plan

Jul 2010

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1. INTRODUCTION

- 1.1 The Shatin to Central Link (SCL) is one of the priority railways recommended for implementation in the Railway Development Strategy 2000. It is also one of the ten large-scale infrastructure projects announced by the Chief Executive in his 2007-2008 Policy Address. MTR Corporation Limited (MTR Corporation) has been entrusted to plan and design for this project. The overview of SCL Alignment is shown in **NEX2213/C/331/ENS/M58/510**.
- 1.2 A key aspect of constructing the SCL inside the Causeway Bay Typhoon Shelter (CBTS) will be the coordination of interfaces with the Central-Wan Chai Bypass and Island Eastern Corridor (CWB) project of the Highways Department, which involves the construction of cut-and-cover tunnel from temporary reclamation in the CBTS. Since this will overlap with the target construction period of SCL, there is a need to address how the SCL can be integrated with the CWB tunnel works to minimize the extent and duration of temporary reclamation for both projects in the CBTS. Eventually, tunnel protection works for the SCL at CBTS is proposed to be undertaken by Highways Department together with the main CWB works.
- 1.3 The SCL Protection Works and associated works at CBTS (hereinafter known as “the Project”) involve the construction of a 160m tunnel box by cut-and-cover method at the crossing above the CWB tunnels. Temporary reclamation is required and will be authorized under the Foreshore and Sea-bed (reclamations) Ordinance. With the presence of the Protection Works, future construction of the SCL on both sides of the CWB tunnels is protected and ensured feasible without damaging or unduly affecting the CWB tunnels which could be operational by then. This arrangement will also minimize public nuisance and impact to the surrounding environment as it can reduce the reclamation area for subsequent construction of the SCL after CWB is completed. Nevertheless, the Protection Works cannot serve to function for any railway service or operation.
- 1.4 In addition to the above, the Project will also include a temporary mooring area located at the southeast corner of CBTS (offshore of Tung Lo Wan Fire Station). The mooring area is shown in **NEX2213/C/331/ENS/M58/512**.
- 1.5 The Project is a Designated Project (DP) under Item C.12 (b), Part I of Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) – “A dredging operation which is less than 100m from a seawater intake point”. The implementation of the Project therefore requires an Environmental Permit (EP) under the EIAO. An Environmental Impact Assessment (EIA) Study Brief (No. ESB-213/2010) (the Study Brief) was issued by the Environmental Protection Department (EPD). AECOM Asia Company Limited (AECOM) was commissioned by MTR Corporation to undertake the Environmental Impact Assessment (EIA) studies for the Project.

Rationale for Sediment Dredging

- 1.6 A report summarizing the rationale for sediment removal for SCL has been submitted to Marine Fill Committee (MFC) in accordance with the requirements outlined in the *Environment, Transport and Works Bureau Technical Circular (Works) No.34/2002 Management of Dredged/Excavated Sediment*. The report demonstrates the genuine need for sediment removal for disposal and explains the constraints of leaving the sediment in its place and the impracticability of application of treatment options. Possible measures that have been explored or implemented to negate or minimize the need for sediment removal are also described. The rationale for sediment removal has been approved by MFC on 13 April 2010.
- 1.7 The Approval Letter from MFC is attached in **Appendix A**

Purpose of this Sediment Sampling and Testing Plan

- 1.8 In accordance with Clause 3.4.2.2(i) and 3.4.2.2(iii)(a) of the Study Brief for the Project, it is necessary to identify and quantify the dredging / excavation, transportation, disposal arrangements and impact due to dredging for sediment / mud. Field investigation, including sampling and laboratory testing, would be conducted with details agreed by EPD. This Sediment Sampling and

Testing Plan (SSTP) is thus to present the procedures of the sediment sampling and testing for agreement with EPD.

- 1.9 This SSTP is prepared generally in accordance with the *Practice Note for Authorized Persons and Registered Structural Engineers No. 252 – Management Framework for Disposal of Dredged / Excavated Sediment (PNAP 252)*. Findings from the sediment sampling and testing exercise would be used to assess the waste implications and water quality impacts associated with dredging and excavating the sediment / mud.
- 1.10 In addition, this SSTP will specify the sampling and testing plan for water quality impact assessment to fulfil the requirements of Clause 3.4.1.6(g) of the Study Brief for the Project.

2. PROJECT AREA AND POTENTIAL AREA OF ENCOUNTERING SEDIMENT

- 2.1 The Project Area to be assessed includes the area for temporary reclamation offshore to the existing Police Officers' Club (POC) and the temporary mooring area at the southeast corner of CBTS and offshore to the Tong Lo Wan Fire Station.
- 2.2 Sediments would be removed from parts of the Project Area as dredging would be required for the area for temporary reclamation and the temporary mooring area. Dredging in the latter area would be carried out in order to lower the existing seabed level. According to MTR Corporation's latest construction design, parts of the dredging area offshore to POC overlaps with dredging area already assessed/approved under the CWB project, which is highlighted yellow in **NEX2213/C/331/ENS/M58/511**. Thus, the overlapped area does not require further sediment quality assessment under the Project. The Project Area and the proposed extent of dredging are shown in **NEX2213/C/331/ENS/M58/511-512**.

Sampling Locations

- 2.3 A total of **ten (10)** sediment sampling locations are proposed for the Project. The sampling locations are shown in **NEX2213/C/331/ENS/M58/511-512**.
- 2.4 Shallower sediments (i.e. generally to depths just below the marine deposit) will be taken using vibrocore / grab method. As the Project may require deep level dredging, drillhole is also proposed in the vicinity to collect marine sediments at deeper depths and, if necessary, to supplement the sediment quality results obtained from the vibrocore samples.
- 2.5 For the area for temporary reclamation, as the underlying sediments of the typhoon shelter are subject to heavy pollution over the years, sediment contamination level is likely to be very high and a 50 x 50m sampling grid arrangement is proposed.
- 2.6 For the temporary mooring area, based on the sediment quality data collected under the EIA Study for the *Wan Chai Development Phase II Project*¹, Category H sediment were found at location just west of the proposed mooring area. No Type 3 sediments were however encountered. Nevertheless, based on the Wan Chai Development Phase II EIA Study, an abandoned shipyard (A King Shipyard) is located east of the off-site area. Therefore, roughly 50 x 50m sampling grid arrangement is recommended.
- 2.7 In addition to the proposed sampling locations within the dredging area under this Project, two more sampling locations (2211/SCL/EDH-VC-021 and EDH-VC026) are proposed outside the dredging area to cater for potential design changes and assess quality of sediment close to the boundary of the dredging extent, especially where the SCL alignments shall be constructed.
- 2.8 The sampling locations, with Hong Kong metric grid coordinates and as far as practical at 50 x 50m grid arrangement, are shown in **NEX2213/C/331/ENS/M58/511-512** and **Table 2.1** below.
- 2.9 In addition to the above, a grab sample will also be collected from EPD's routine marine sediment monitoring station PS6 at Port Shelter as the reference sediment sample.
- 2.10 The exact sampling locations shall be determined on site and subject to fine adjustment due to site specific conditions (e.g. locations, presence of foundations, underground utilities, delivery pipes and services). The location shall be agreed with MTRC's representatives prior to drilling/excavation and sampling.

¹ Supplemental Agreement No. 1 to Agreement No. CE 54/2001 (CE) Wan Chai Development Phase II – Planning and Engineering Review: Environmental Impact Assessment Report for Wan Chai Development Phase II and Central – Wan Chai Bypass, 2007

Table 2.1 Proposed Sediment Sampling Locations

| Sampling ID | Coordinate* | | Drawing Number |
|--------------------|-------------|-----------|---------------------------|
| | Easting | Northing | |
| 2211/SCL/EDH-VC018 | 836987.44 | 816181.47 | NEX2213/C/331/ENS/M58/511 |
| 2211/SCL/EDH-VC019 | 837023.00 | 816165.00 | NEX2213/C/331/ENS/M58/511 |
| 2211/SCL/EDH-VC021 | 837004.00 | 816124.00 | NEX2213/C/331/ENS/M58/511 |
| 2211/SCL/EDH-VC026 | 836943.17 | 816050.56 | NEX2213/C/331/ENS/M58/511 |
| 2211/SCL/EDH-VC027 | 836966.04 | 816031.15 | NEX2213/C/331/ENS/M58/511 |
| 2211/SCL/VC028 | 836932.01 | 815992.18 | NEX2213/C/331/ENS/M58/511 |
| 2211/SCL/MS001 | 837573.45 | 816305.24 | NEX2213/C/331/ENS/M58/512 |
| 2211/SCL/MS002 | 837573.21 | 816259.08 | NEX2213/C/331/ENS/M58/512 |
| 2211/SCL/MS003 | 837522.53 | 816304.06 | NEX2213/C/331/ENS/M58/512 |
| 2211/SCL/MS004 | 837505.88 | 816255.95 | NEX2213/C/331/ENS/M58/512 |

Note:

* Actual locations are subject to fine adjustments on-site.

Sampling Procedure

- 2.11 Prior to sampling at each location, the sampling location shall be set out with the aid of a differential global positioning system (DGPS) or equivalent device with similar accuracy. After the setting out, the depth of water, in metres below the Principal Datum (mPD), shall be measured.
- 2.12 Surface sediment shall then be taken by a closed grab sampler at the following all sampling locations. The grab sampler shall be thoroughly washed with seawater prior to each sampling attempt. Laboratory testing will be carried out on the grab samples in case insufficient amount of samples were collected from the vibrocore subsamples.
- 2.13 The surface sediment samples shall be recovered on site and placed in laboratory-provided clean high density polyethylene containers, wide mouth borosilicate glass bottles with Teflon lined lids or other appropriate containers and sealed to prevent leakage. Only new or pre-cleaned sample containers shall be used to hold the sediment samples. The containers shall be labeled with station number, sample depth, sampling date and time, together with full description of the sample. If the contents are hazardous, this shall be clearly marked on the container and precautions taken during transport.

Vibrocoring

- 2.14 A total of **nine (9)** sampling locations (namely 2211/SCL/ EDH-VC018, EDH-VC019, EDH-VC021, EDH-VC026, EDH-VC027 and MS001 to MS004) shall collect sediment samples using vibrocoring. The vibrocoring shall be continuous and shall terminate at about 1 to 2 m below the alluvium layer or at depth as specified by the MTR Corporation's representatives. The minimum sample recovery shall be at least 80% of the vibrocore length for each sampling attempt.
- 2.15 The vibrocore sample shall be sub-sampled and cut on-site into 1m sections except the first sub-sample which should be 0.0-0.9m. The top levels of these sub-samples shall be seabed (0m), 0.9m down, 1.9m down, 2.9m down and every 3m down. Both cut ends of each vibrocore sub-sample shall then be sealed up with tightly fitting rubber caps and duct-taped in place. Each vibrocore sub-sample shall be clearly labeled 'top' and 'bottom' and with sample identify (e.g. station number, sample depth, sampling date and time, together with full description of the sample).

Drillhole

- 2.16 Sediment sample from **one (1)** sampling location (namely 2211/SCL/VC028) shall be collected using rotary drilling method. The drillhole shall be continuous and shall terminate below the alluvium layer, or at depth as instructed by the MTR Corporation's Representative on-site. Piston, mazier or other sampling techniques as agreed by MTR Corporation will be used to collect the sediment samples.

- 2.17 Continuous undisturbed sample shall be taken and the top levels of the samples should be the seabed, 0.9m down, 1.9m down, 2.9m down and then every 3m down to the end of the alluvium layer. Both ends of the samples shall be sealed up with tightly fitting rubber caps and duct-taped in place. Samples shall be clearly labeled 'top' and 'bottom' and with sample identify (e.g. station number, sample depth, sampling date and time, together with full description of the sample).

Sample Handling

- 2.18 All samples shall be stored, transported and maintained at 4°C or lower without being frozen in the dark prior to any laboratory testing. All samples shall be packed and transported in such a manner as to avoid shock, vibration or any other disturbance of the samples. Samples shall be delivered to laboratory within 24 hours after collection and analyzed within 14 days of delivery for chemical testing. The chain-of-custody procedure shall be followed to record the flow of sample handling, from collection of samples to delivery of samples to the designated Laboratory.

Sample Size

- 2.19 Prior to sampling, the laboratory responsible for analysis should be consulted for the particular sample size for chemical / biological testing. According to the *PNAP 252*, the recommended sample sizes for each parameter and test are as follows:

Table 2.2 Recommended Sample Size

| Parameters to be tested | Sample Size |
|-------------------------|-------------|
| Metals and metalloid | 0.5 L |
| Others | 0.5 L |
| Biological response | 6 L |

Sediment Sampling at Port Shelter

- 2.20 Prior to sampling, the laboratory responsible for analysis shall be consulted for the sample size for both chemical and biological testing as well as the required preservation procedures.
- 2.21 Prior to sampling at each location, the sampling location should also be set out with the aid of a differential global positioning system (DGPS) or equivalent device. After the setting out, the depth of water or the ground surfaces level, in metres below the Principal datum (mPD), should be measured.
- 2.22 Surface sediment shall be taken by closed grab sampler from EPD's routine marine sediment monitoring station PS6 at Port Shelter as the reference sample. The grab sampler shall be thoroughly washed with seawater prior to each sampling attempt.
- 2.23 The surface sediment samples shall be recovered on site and placed in laboratory-provided clean high density polyethylene containers, wide mouth borosilicate glass bottles with Teflon lined lids or other appropriate containers and sealed to prevent leakage. Only new or pre-cleaned sample containers shall be used to hold the sediment samples. The containers shall be labeled with station number, sample depth, sampling date and time, together with full description of the sample. If the contents are hazardous, this shall be clearly marked on the container and precautions taken during transport.
- 2.24 The samples shall be stored, transported and maintained at 4°C or lower without being frozen in the dark prior to any laboratory testing. All samples shall be packed and transported in such a manner as to avoid shock, vibration or any other disturbance of the samples. Samples shall be delivered to laboratory within 24 hours after collection and analyzed within 14 days of delivery for chemical testing. The chain-of-custody procedure shall be followed to record the flow of sample handling, from collection of samples to delivery of samples to the designated Laboratory.

QA/QC Requirements

- 2.25 All tests will 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.
- 2.26 For chemical screening, the following QC plan will be implemented for the laboratory testing:
- Method Blank
 - Duplicate (at 5% level i.e. one for every 20 samples)
 - Matrix Spike (at 5% level i.e. one for every 20 samples)
- 2.27 The proposed data quality objectives are shown in **Table 2.3**.

Table 2.3 Data Quality Objectives for Chemical Screening

| Quality Controls | Acceptance Criteria |
|------------------|--|
| Method Blank | Less than method detection limit (MDL) |
| Duplicate | Agree within $\pm 25\%$ of the mean of duplicate results |
| Matrix Spike | Agree within $\pm 25\%$ of the recovery of spike concentration |

- 2.28 For biological screening, negative and positive control should be included as appropriate quality assurance/quality control.

3. LABORATORY ANALYSIS

Chemical Testing (Tier II)

3.1 Samples collected, including reference samples, from both land-based and marine-based ground investigation works, will be tested for parameters stated in Table 1 – Analytical Methodology in Appendix B of *PNAP252*. The parameters to be analyzed, methodology used and detection limits are presented in **Table 3.1**.

Table 3.1 Chemical Testing Parameters

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

Note:

- + Low molecular weight PAHs include acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene.
- ++ High molecular weight PAHs include benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene and benzo(g,h,i)perylene.
- +++ The reporting limit is for individual PCB congeners. Total PCBs include 2,4' diCB, 2,2',5' triCB, 2,4,4' triCB, 2,2',3,5' tetraCB, 2,2',5,5' tetraCB, 2,3',4,4' tetraCB, 3,3',4,4' tetraCB, 2,2',4,5,5' pentaCB, 2,3,3',4,4' pentaCB, 2,3',4,4',5' pentaCB, 3,3',4,4',5' pentaCB, 2,2',3,3',4,4' hexaCB, 2,2',3,4,4',5' hexaCB, 2,2',4,4',5,5' hexaCB, 3,3',4,4',5,5' hexaCB, 2,2',3,3',4,4',5' heptaCB, 2,2',3,4,4',5,5' heptaCB, 2,2',3,4',5,5',6 heptaCB (ref: the "summation" column of Table 9.3 of Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (The Inland Testing Manual) published by USEPA).
- * Krone et al. (1989), A method for analysis of butyltin species and measurement of butyltins in sediment and English Sole livers from Puget Sound, Marine Environmental Research 27 (1989) 1-18. Interstitial water to be obtained by centrifuging the sediment and collecting the overlying water.
- ** UNEP/IOC/IAEA refers to IAEA's Marine Environment Laboratory reference methods. Interstitial water to be obtained by centrifuging the sediment and collecting the overlying water.

Biological Testing (Tier III)

3.2 Subject to the chemical test results and EPD approval of the biological testing proposal, the following toxicity test will be carried out on the composite and reference samples. Composite sample is prepared by mixing up to 5 samples of the same category (M or H) which are continuous in vertical or horizontal profile.

- 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.

3.3 For sediment sample that were classified in the chemical screening as Category H with one or more contaminant levels exceeding 10 times the Lower Chemical Exceedance Level (LCEL), the toxicity tests for that particular composite sample will be conducted in a diluted manner (dilution test) in accordance with *PNAP 252*.

3.4 The species to be used for each type of biological test will be selected from **Table 3.2** below.

Table 3.2 Testing Parameters for Biological Screening (Tier III) for Composite Samples

| Test Type | Species | Reference Test Condition* |
|---|--|----------------------------|
| 10-day burrowing amphipod toxicity test | <i>Ampelisca abdita</i> | USEPA (1994) / PSEP (1995) |
| | <i>Leptocheirus plumulosus</i> | USEPA (1994) |
| | <i>Eohaustorius estuaries</i> | USEPA (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 spp.</i> <i>Crassostrea gigas</i> | PSEP (1995) |
| | Echinoderm: <i>Dendraster excentricus</i> <i>Strongylocentrotus spp.</i> | |

* Note:

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

3.5 Ancillary test, including porewater salinity, ammonia, TOC, grain size and moisture content will also be tested on the composite and reference samples. The ancillary test will provide necessary information on the general characteristics of the sediment. Test organisms will be selected based on their application limits for sediment grain size and porewater salinity. When ammonia level is found to be higher than the tolerance limit (i.e. > 20 mg/L), sediment samples will be flushed (purged) by frequent renewal of the overlying water, after test set-up, until the ammonia level drops below the tolerance limit.

3.6 The test endpoints and decision criteria are summarized in Table 2 in Appendix B of *PNAP 252* and shown in **Table 3.3** below. The sediment is deemed to have failed the biological test if it fails in any one of the three toxicity tests.

Table 3.3 Test Endpoints and Decision Criteria for Tier III Biological Testing

| Toxicity test | Endpoints measured | Failure criteria |
|-----------------|--------------------|--|
| 10-day amphipod | Survival | Mean survival in test sediment is significantly different ($p < 0.05$) ¹ from mean survival in reference sediment and mean survival in test sediment < 80% of mean survival in reference sediment. |

| Toxicity test | Endpoints measured | Failure criteria |
|---------------------------|---------------------------------|---|
| 20-day polychaete | Dry Weight ² | Mean dry weight in test sediment is significantly different ($p < 0.05$) 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 bivalve larvae | Normality Survival ³ | Mean normality survival in test sediment is significantly different ($p < 0.05$) 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 $p < 0.05$.

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.

Laboratory Testing for Sediment-Water Quality Assessment

3.7 For the purpose of performing sediment-water quality assessment under the EIA Study, additional chemical and elutriate tests will be conducted for the marine-based sediment / composite water samples collected at the following 5 sampling locations. The sampling locations are selected based on an approximately interval of 100 m apart.

- I. 2211/SCL/EDH-VC019;
- II. 2211/SCL/VC024;
- III. 2211/SCL/VC028;
- IV. 2211/SCL/MS001; and,
- V. 2211/SCL/MS004.

3.8 Among the above, no sediment sampling is proposed for the sampling location 2211/SCL/VC024 (837003.00E, 816074.00N) under this EIA study. Details of the additional chemical and elutriate testing are discussed below.

Additional Chemical Testing on Sediments

3.9 Additional chemical testing on the sediments samples from the above sampling locations will be conducted for the parameters as shown in **Table 3.4** and shown in **NEX2213/C/331/ENS/M58/511-512**. The purpose of the additional chemical testing is to allow for the evaluation of sediment contamination by chlorinated pesticides, nutrient, bioavailability and physicochemical properties. The associated analytical testing methods and reporting limits are attached in **Appendix B**.

Table 3.4 Additional Chemical Testing Parameters (Nutrients and Chlorinated Pesticides)

| Type of Contaminant | Parameters |
|-------------------------------|-------------------------|
| Nutrient | Total Kjeldahl Nitrogen |
| | Ammonia Nitrogen |
| | Nitrate Nitrogen |
| | Nitrite Nitrogen |
| | Total Phosphorus |
| Chlorinated Pesticides | Aldrin |
| | Alpha-BHC |
| | Beta BHC |
| | Delta-BHC |
| | Gamma BHC |

| Type of Contaminant | Parameters |
|---|--------------------------------------|
| | Heptachlor |
| | Heptachlor epoxide |
| | Endosulfan 1 |
| | Endosulfan sulphate |
| | p, p'-DDT |
| | p, p'-DDD |
| Bioavailability / Physicochemical Properties | p, p'-DDE |
| | Sediment Oxygen Demand (SOD, 5 days) |
| | Acid Volatile Sulphide (AVS) |
| | Moisture Content |

Ambient Marine Water and Elutriate Testing

- 3.10 *In-situ* marine water samples will be collected at the above 5 sampling locations from 1m below the surface, mid-depth and 1m above seabed, and pooled to form a composite water samples. Another set of reference marine water sample shall be collected at Lei Yue Mun (842400E, 816500N) within the Victoria Harbour Water Control Zone.
- 3.11 Elutriate test shall also be carried out for sediment samples collected at the above 5 sampling locations. The sampling and testing procedure are discussed below.

Water Sampling Procedure for Elutriate Testing

- 3.12 Prior to commencement, the laboratory responsible for the analysis shall be consulted for the sample size. Water sample collection shall commence prior to sediment collection to avoid seabed disturbance.
- 3.13 Prior to sampling at each location, the sampling location shall be set out with the aid of a differential global positioning system (DGPS) or equivalent device with similar accuracy. After the setting out, the depth of water, in metres below the Principal Datum (mPD), shall be measured.
- 3.14 Samples shall then be taken using Niskin sampler and the sampler shall need to be thoroughly washed with seawater prior to each sampling attempt. Water samples shall be taken at 1m below the surface, mid-depth and 1m above seabed. The three samples shall then be pooled to form a composite water sample.
- 3.15 The composite water samples shall then be poured into the pre-labelled and laboratory provided sample storage containers and maintained in a chilled (around 4°C) condition in the dark. The sample shall be delivered to the laboratory in an expedient manner and shall be chilled (at about 4 °C) but not frozen and stored in the dark prior to chemical analysis.

Elutriate Testing Procedure

- 3.16 The *in-situ* composite waters will be mixed with the sediment sample collected in the same station in a sediment-to-water ratio of 1:4 on a volume basis. The mixture is mechanically shaken vigorously for 30 minutes and then settled undisturbed for 1 hour. The liquid phase is then centrifuged or filtered through a 45 µm filter to remove all suspended particulate matter. The extracted liquid filtrate is the elutriate to be used for further test.
- 3.17 All the *in-situ* composite water samples and elutriate discussed above shall be tested for a suite of contaminants as shown in **Table 3.1** as well as the nutrient and chlorinated pesticide parameters as shown in **Table 3.4** above. The associated analytical testing methods and reporting limits are attached in **Appendix B**. All the samples not analyzed immediately shall be maintained in a chilled but not frozen (~4°C) condition in the dark in the laboratory.
- 3.18 There are possibilities that the *in-situ* composite water was already contaminated rendering the

elutriate test and as such, the testing results may not be reflective to the actual dredging operation. In such case, a second elutriate test of the sediments using reference water collected from Lei Yue Mun (842400E, 816500N) within the Victoria Harbour Water Control Zone shall be conducted.

- 3.19 Prior to the commencement of the second elutriate test, the water quality of the 5 *in-situ* composite water samples shall firstly be ascertained to be contaminated. However, there are currently no defined marine water quality objectives (WQO) for metals and metalloid in Hong Kong and the European Union Environmental Quality Standards (EQS), prescribed for the protection of marine life for metals and the metalloid arsenic, shall be used as the assessment criteria for the *in-situ* composite water quality. The EQS criteria are presented in **Table 3.5** below.

Table 3.5 The European Union Environmental Quality Standard (EQS) Values to Protect Marine Life

| Metals and Metalloid | Water Quality Standard (as dissolved metal) (µg/L) |
|----------------------|--|
| Arsenic | 25 |
| Cadmium | 2.5 |
| Chromium | 15 |
| Copper | 5 |
| Lead | 25 |
| Mercury | 0.3 |
| Nickel | 30 |
| Silver | 2.3* |
| Zinc | 40 |

* Based on the UK Water Quality Standard.

4. INTERPRETATION OF RESULTS AND WAY FORWARD

4.1 The sediment quality should be assessed according to *PNAP 252*. As specified in the *PNAP 252*, sediments are classified into three categories based on their contaminant levels. The classification is as follows:

Category L: Sediment with all contaminant levels not exceeding the Lower Chemical Exceedance Level (LCEL). The materials 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.

4.2 Tier III biological screening will be conducted for further analysis of Category M and Category H sediment with one or more contaminant levels exceeding 10 times the LCEL. The methods will follow the requirements of *PNAP 252*.

4.3 The sediment quality criteria for the classification of sediment are shown in **Table 4.1** below.

Table 4.1 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 | 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.

4.4 Tier III biological screening will be conducted for further analysis of Category M and Category H sediment with one or more contaminant levels exceeding 10 times the LCEL. If Tier III biological

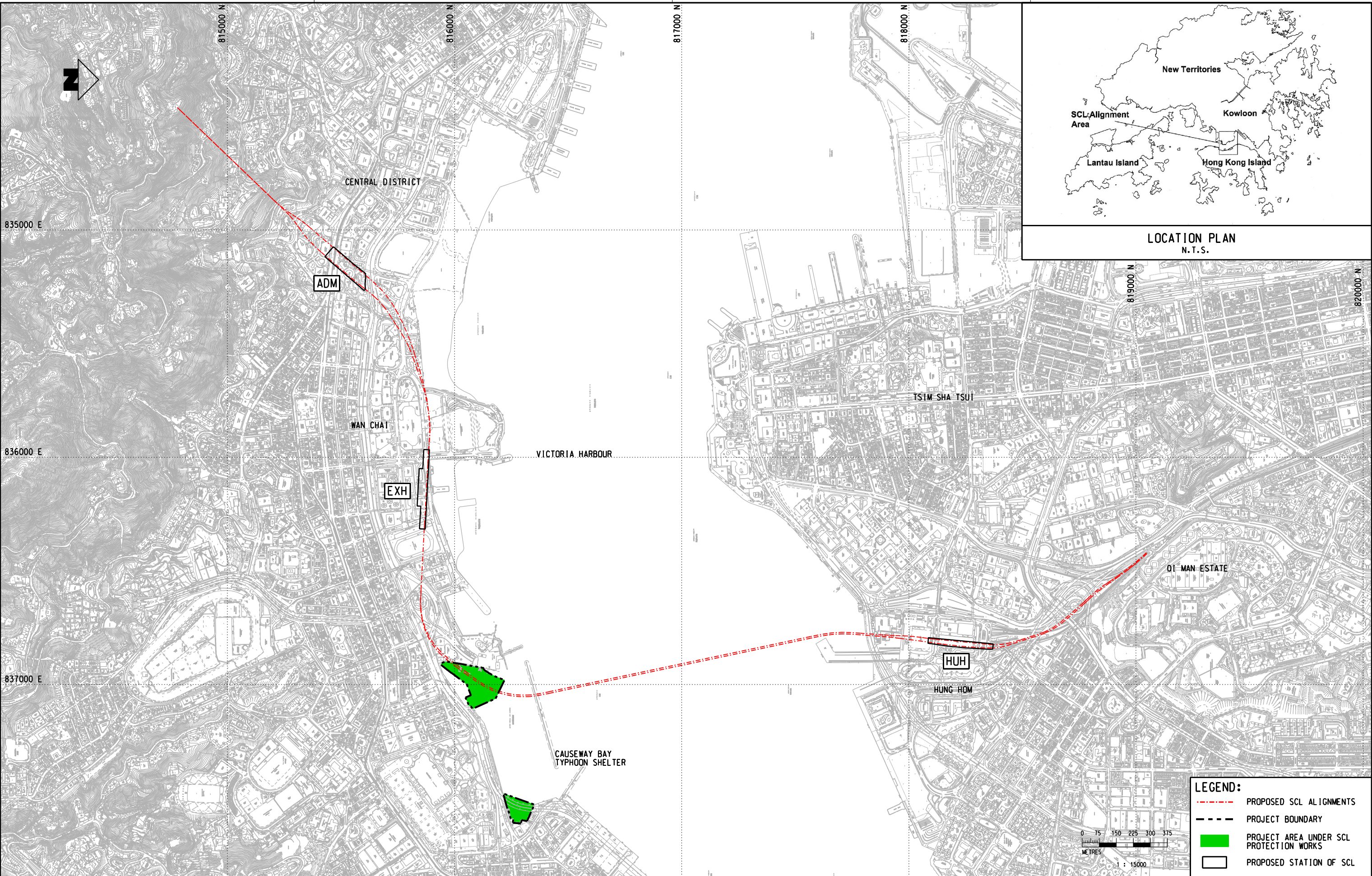
screening were to be conducted for Category H sediment with one or more contaminant levels exceeding 10 times LCEL, the test shall be conducted in a diluted manner (dilution test).

- 4.5 Data obtained from the laboratory testing in this SSTP would be used to assess the waste implications and water quality impacts associated with the construction works for the Project in the EIA Study (as per Clause 3.4.1.6(g), 3.4.2.2(i) and 3.4.2.2(iii)(a) of the Study Brief).

Figures

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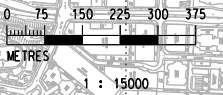
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 2009-7-13
 PRINTED BY: DANK
 DATE: 2009-7-13



LOCATION PLAN
N.T.S.

LEGEND:

- - - - - PROPOSED SCL ALIGNMENTS
- PROJECT BOUNDARY
- PROJECT AREA UNDER SCL PROTECTION WORKS
- PROPOSED STATION OF SCL



| REV | DESCRIPTION | BY | DATE | APPROVED | REV | DESCRIPTION | BY | DATE | APPROVED |
|-----|-------------|----|------|----------|-----|-------------|----|------|----------|
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| DRAWN | XCF |
| DESIGNED | --- |
| CHECKED | --- |
| APPROVED | --- |
| DATE | 21/JUL/2009 |

MTR

SHATIN TO CENTRAL LINK

AECOM

CADD REF. NEX2213_C_331_ENS_M58_510A.dgn

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|----------------|---------------------------|--|--|
| TITLE | | NEX/2213 - SCL PROTECTION WORKS EIA STUDY FOR SCL PROTECTION WORKS AT CBTS SCL OVERALL ALIGNMENT | |
| SCALE | FIGURE NO. | REV. | |
| 1 : 15000 (A3) | NEX2213/C/331/ENS/M58/510 | A | |



816200 N

816000 N

836800 E

837000 E

837200 E

837400 E

銅鑼灣避風塘
CAUSEWAY BAY TYPHOON SHELTER
CAUSEWAY BAY TYPHOON SHELTER

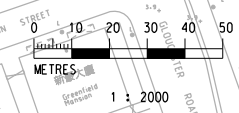
PARTS OF THE AREA FOR DREDGING UNDER THIS PROJECT OVERLAPS WITH AREA ASSESSED / APPROVED UNDER THE CWB PROJECT. NO SEDIMENT QUALITY ASSESSMENT IS REQUIRED FOR THE OVERLAPPED AREA UNDER THIS PROJECT

PROPOSED CO-ORDINATES FOR SAMPLING LOCATIONS

| LOCATION ID | EASTING | NORTHING |
|--------------------|-----------|-----------|
| 2211/SCL/EDH-VC018 | 836987.44 | 816181.47 |
| 2211/SCL/EDH-VC019 | 837023.00 | 816165.00 |
| 2211/SCL/EDH-VC021 | 837004.00 | 816124.00 |
| 2211/SCL/VC024 | 837003.00 | 816074.00 |
| 2211/SCL/EDH-VC026 | 836943.17 | 816050.56 |
| 2211/SCL/EDH-VC027 | 836966.04 | 816031.15 |
| 2211/SCL/VC028 | 836932.01 | 815992.18 |

LEGEND:

- PROPOSED SCL ALIGNMENTS
- PROJECT BOUNDARY
- PROPOSED WORKS AREA FOR DREDGING UNDER THIS PROJECT
- DREDGING AREA ASSESSED / APPROVED UNDER THE CWB PROJECT
- AUTHORIZED DRILLHOLE SAMPLING LOCATION
- PROPOSED VIBROCORE AND SURFACE SEDIMENT SAMPLING LOCATION
- PROPOSED VIBROCORE, SURFACE SEDIMENT, AND AMBIENT MARINE WATER SAMPLING LOCATION (INCLUDING TESTING FOR SEDIMENT - WATER QUALITY ASSESSMENT)
- PROPOSED AMBIENT MARINE WATER SAMPLING LOCATION (INCLUDING TESTING FOR SEDIMENT - WATER QUALITY ASSESSMENT)



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Plot: DRV: R:\us\mst\NTR\PL\DRIVER\WINDOWS\33\COL\016.dgn
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File Name: M58.dwg
Date: 2010-06-28
User: YJP

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| DRAWN | YJP |
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| APPROVED | --- |
| DATE | 28/JUN/2010 |

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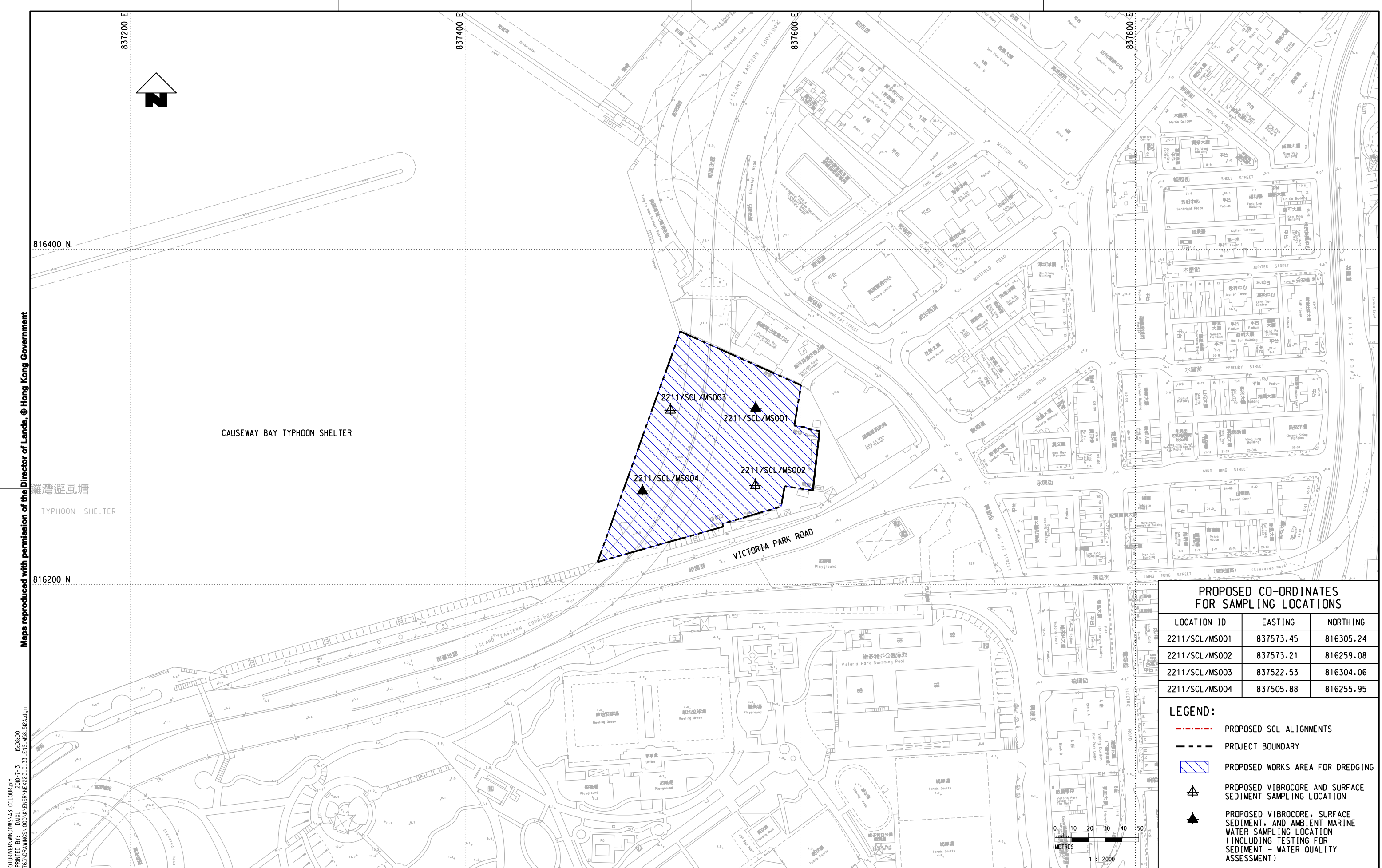
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AECOM

ORIGINATOR

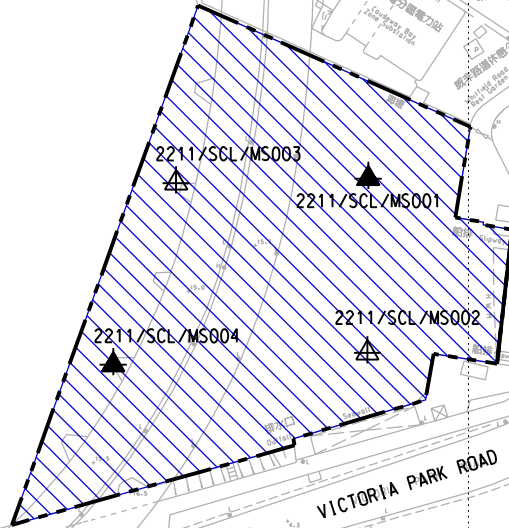
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| EIA STUDY FOR SCL PROTECTION WORKS AT CBTS | | PROPOSED PROJECT/WORKS AREA AND SEDIMENT SAMPLING LOCATIONS | |
| SHEET 1 OF 2 | | SCALE | 1 : 2000 (A3) |
| FIGURE NO. | NEX2213/C/331/ENS/M58/511 | REV. | A |



CAUSEWAY BAY TYPHOON SHELTER

避風塘
TYPHOON SHELTER



| PROPOSED CO-ORDINATES FOR SAMPLING LOCATIONS | | |
|--|-----------|-----------|
| LOCATION ID | EASTING | NORTHING |
| 2211/SCL/MS001 | 837573.45 | 816305.24 |
| 2211/SCL/MS002 | 837573.21 | 816259.08 |
| 2211/SCL/MS003 | 837522.53 | 816304.06 |
| 2211/SCL/MS004 | 837505.88 | 816255.95 |

- LEGEND:**
- PROPOSED SCL ALIGNMENTS
 - PROJECT BOUNDARY
 - PROPOSED WORKS AREA FOR DREDGING
 - PROPOSED VIBROCORE AND SURFACE SEDIMENT SAMPLING LOCATION
 - PROPOSED VIBROCORE, SURFACE SEDIMENT, AND AMBIENT MARINE WATER SAMPLING LOCATION (INCLUDING TESTING FOR SEDIMENT - WATER QUALITY ASSESSMENT)



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| DRAWN | YJP | SHATIN TO CENTRAL LINK |
| DESIGNED | --- | |
| CHECKED | LCR | |
| APPROVED | --- | |
| DATE | 28/JUN/2010 | |
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|---|---------------------------|------|
| TITLE | | |
| NEX/2213 - SCL PROTECTION WORKS EIA STUDY FOR SCL PROTECTION WORKS AT CBTS PROPOSED PROJECT/WORKS AREA AND SEDIMENT SAMPLING LOCATIONS SHEET 2 OF 2 | | |
| SCALE | FIGURE NO. | REV. |
| 1 : 2000 (A3) | NEX2213/C/331/ENS/M58/512 | A |

Appendix A

**Approval Letter from Marine Fill Committee on
Rationale for Sediment Removal**

□

SCL-COR-CEDD-GEO-001312



土木工程處
Civil Engineering Office

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E-mail 電子郵件: klwong@cedd.gov.hk
Telephone 電話 : 2762 5539
Facsimile 傳真 : 2714 0113
Our reference 本署檔號: (0EYP3-01) in FM 4/1C/70A
Your reference 來函檔號: SCL-COR-CM(SCLC)-GEO-001198

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

Pt. 36

MTR Corporation Limited
9/F Citylink Plaza
1 Shatin Station Circuit, Shatin
New Territories, Hong Kong
(Attention: Mr. Stanley Keung)

13 April 2010

(Fax: 3929 3483)

Dear Mr. Keung,

**Shatin to Central Link (SCL)
Rationale for Sediment Removal**

I refer to your earlier letter ref SCL-COR-CM(SCLC)-GEO-001193 dated 19.2.2010, our subsequent meeting on 12.3.2010 and your above letter dated 19.3.2010 enclosing the dredging rationale for sediment removal in the following areas in SCL:

1. Phase 1 Tai Wai to Hung Hom Section,
2. Phase 2 Entrusted Works to CWB in CBTS, and
3. Phase 3 Hung Hom to Admiralty Section (excluding Entrusted Works to CWB in CBTS).

I have no further comment with respect to the dredging rationale for "Phase 1 Tai Wai to Hung Hom Section" and "Phase 2 Entrusted Works to CWB in CBTS".

However, based on our latest forecast of disposal demand of contaminated sediment, the capacity of the contaminated mud pits (CMP) in Hong Kong will be exhausted by 2015. As the majority quantity of M_p & M_f type sediment generated from SCL will be in 2015 and beyond from the area: "Phase 3 Hung Hom to Admiralty Section (excluding Entrusted Works to CWB in CBTS)", there will be no space available in our CMP for disposal by then. Hence, you are requested to re-examine all management options to keep the sediment in place and to explore in details all possible ex-situ treatment, disposal, beneficial reuse options and cross-boundary disposal if removal of sediment is unavoidable before the dredging rationale for "Phase 3 Hung Hom to Admiralty Section (excluding Entrusted Works to CWB in CBTS)" can be approved.

| | | | |
|-----------------------------|--------|------|-------|
| SCL-Civil (EWL) 14 APR 2010 | | | |
| Subject File: SPOIL | | | |
| Name | Action | Copy | Info. |
| Stanley Keung | | | |
| L K Ng | | | |
| Aron Pang | | | |
| C Y Chan | | | |
| ALL | | | |

Yours faithfully,

(KL WONG)

for Secretary, Marine Fill Committee
Civil Engineering and Development Department

c.c. RDO, HyD (Attn.: Mr. K S Yeung) Fax: 2194 0417
RDO, HyD (Attn.: Mr. Michael Leung) Fax: 2761 1508

KLW/
File: SCL MTRC dredging rationale CWB entrusted works @ 13 Apr 2010

Appendix B

Analytical Methods and Reporting Limits

Appendix B Suggested Method Reference and Reporting Limit for Elutriate

| Analyte Description | Reporting limit | In house method based on |
|---------------------------------|-----------------------|--|
| Elutriate Preparation | -- | Army Method |
| Total Kjeldahl Nitrogen | 0.1mg/L | APHA 4500 N _{org} :B |
| Ammonia | 0.1mg/L | APHA 4500 NH ₃ :G |
| Nitrate | 0.1mg/L | APHA 4500 NO ₃ :F/NO ₂ :B |
| Nitrite | 0.1mg/L | APHA 4500 NO ₂ :B |
| Total Phosphorus | 0.1mg/L | APHA 4500 P:B4,F |
| Chlorinated Pesticides | 0.1 ug/L individually | USEPA 8270 |
| Sediment Oxygen Demand (5 days) | 10 mg/kg | APHA 5210B (mod) |
| Acid Volatile Sulphide (AVS) | 1 mg/kg | Allen, <i>et al</i> , Office of water regulations and standards, USEPA |
| Heavy Metals including | | USEPA6020 |
| Arsenic | 25 ug/L | |
| Cadmium | 1 ug/L | |
| Chromium | 10 ug/L | |
| Copper | 5 ug/L | |
| Lead | 10 ug/L | |
| Mercury | 0.1 ug/L | |
| Nickel | 10 ug/L | |
| Silver | 2.0 ug/L | |
| Zinc | 1 ug/L | |
| Total PAHs | 8.0 ug/L | USEPA 8270/GCMS |
| Total PCB (18 congeners) | 1.0 ug/L | USEPA 8270/GCMS |
| Tributyltin | 0.015 ug Sn/L | Krone <i>et al</i> . Marine Environmental research 27, 1-18, 1989 |

FAXED
Environmental Protection Department

Branch Office

28th Floor, Southorn Centre,
130 Hennessy Road,
Wan Chai, Hong Kong.



環境保護署分處

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一百三十號
條頓中心廿八樓

本署檢號
OUT REF:
來函檢號
YOUR REF: (28) in AX(5) to EP2/G/A/124
電話
TEL NO.: NEX2213-COR-HSD-ENV-040202
圖文傳真
FAX NO.: 2835 2390
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E-MAIL: 2591 0558
網址
HOMEPAGE: <http://www.epd.gov.hk>

Post & Fax: 2798 8822

2 August 2010

MTR Corporation Limited
MTR Headquarters Buildings, Telford Plaza,
Kowloon Bay, Hong Kong.
GPO Box 9916, Hong Kong
(Attn: Mr. Richard Kwan, Manager - Environmental)

Dear Richard,

Environmental Impact Assessment (EIA) Ordinance (Cap. 499)
Project Title: Shatin to Central Link Protection Works at Causeway Bay Typhoon Shelter
EIA Study Brief No. ESB-213/2010

Sediment Sampling and Testing Plan (SSTP)

I refer to your letter under reference dated 20 July 2010 enclosing the Sediment Sampling and Testing Plan (SSTP) for captioned SCL protection work for our agreement under Section 3.4.1.6(g) and 3.4.2.2(iii)(a) of the EIA Study Brief No. ESB-213/2010.

The SSTP has been reviewed by our waste management team and water quality assessment team, the submitted SSTP is considered acceptable and has met the requirements of EIA-Study Brief Section 3.4.1.6(g) and 3.4.2.2(iii)(a).

However, please note that when the project proponent/EP holder applies for the dumping permit under the Dumping at Sea Ordinance (DASO), they are required to submit a separate SSTP to the Territorial Control Office (TCO) of EPD.

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

- 2 -

You are also reminded that the requirements on documentations of key assessment assumptions, limitations of assessment methodologies and related prior agreement(s) with the Director of Environmental Protection as stipulated under Section 3.4.5 of the EIA Study Brief shall be followed.

Yours faithfully,



(Billy Ma)

Environmental Protection Officer
for Director of Environmental Protection

c.c.

RDO/HyD (Attn: Mr. Michael TF Leung) Fax: 2761 1508
AECOM (Attn: Mr. Freeman CHEUNG) Fax: 2317 7609

c.c. internal: S(MA)5, S(RA)4, Ag.S(MA)2, Ag. S(MA)3, S(TC)3