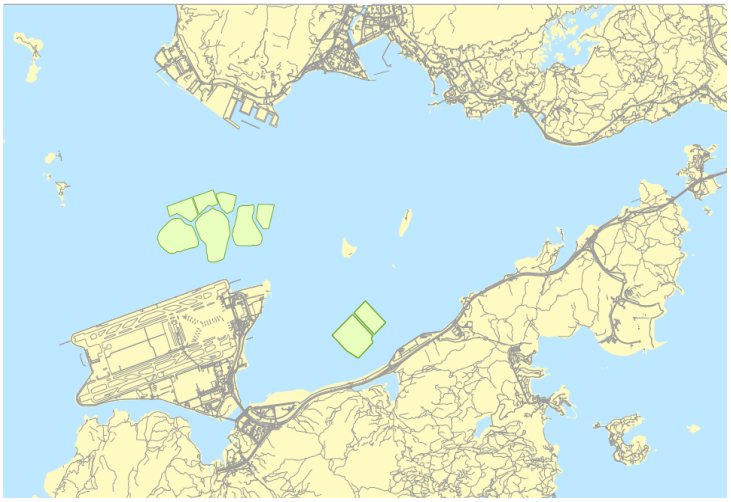

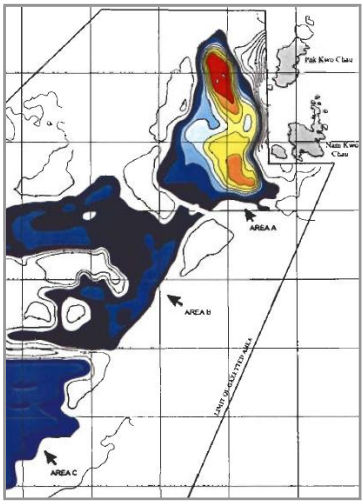

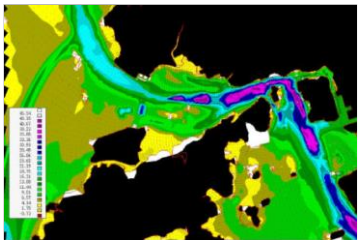

CEDD 土木工程拓展署
Civil Engineering and Development Department

Environmental Monitoring and Audit for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012-2017) – Investigation

Agreement No. CE 23/2012(EP)

41st Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – January 2016

Draft (Revision 0)

15 February 2016

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Client:	Project No:
Civil Engineering and Development Department (CEDD)	0175086
Summary: This document presents the 41st monthly progress report for Contaminated Mud Pits at the South of The Brothers and at East Sha Chau.	Date: 15 February 2016 Approved by:  Craig A. Reid *Partner*

Revision	Description	By	Checked	Approved	Date
v0	41st Monthly Progress Report for ESC CMPs and SB CMPs	EL	JT	CAR	15/2/16

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CONTENTS

ANNEXES

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Dredging, Management and Capping of Contaminated Sediment Disposal Facility to the South of The Brothers

Environmental Certification Sheet
EP-427/2011/A

Reference Document/Plan

Document/~~Plan~~ to be ~~Certified~~/ Verified:	41st Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – January 2016
Date of Report:	15 February 2016
Date prepared by ET:	15 February 2016
Date received by IA:	15 February 2016

Reference EP Condition

Environmental Permit Condition: Condition No.: 4.4

4 hard copies and 1 electronic copy of monthly EM&A Report shall be submitted to the Director within 2 weeks after the end of the reporting month. The EM&A Reports shall include a summary of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit Levels). The submissions shall be certified by the ET Leader and verified by the Independent Auditor. Additional copies of the submission shall be provided to the Director upon request by the Director.

ET Certification

I hereby certify that the above referenced document/~~plan~~ complies with the above referenced condition of EP-427/2011/A

Craig A. Reid,
Environmental Team Leader:  Date: 15/2/2016

IA Verification

I hereby verify that the above referenced document/~~plan~~ complies with the above referenced condition of EP-427/2011/A

Dr Wang Wen Xiong,
Independent Auditor:  Date: 15/2/2016

Agreement No. CE 23/2012 (EP)
Environmental Monitoring and Audit
for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012-2017) - Investigation

41ST MONTHLY PROGRESS REPORT FOR JANUARY 2016

1.1 BACKGROUND

1.1.1 Since early 1990s, contaminated sediment (1) arising from various construction works (e.g. dredging and reclamation projects) in Hong Kong has been disposed of at a series of seabed pits at East of Sha Chau (ESC). In late 2008, a review indicated that the existing and planned facilities at ESC would not be able to meet the disposal demand after 2012. In order to meet this demand, the Hong Kong Special Administrative Region Government (HKSARG) decided to implement a new contained aquatic disposal (CAD) (2) facility at the South of The Brothers (SB CMPs) which had been under consideration for a number of years.

1.1.2 The environmental acceptability of the construction and operation of the Project had been confirmed by findings of the associated Environmental Impact Assessment (EIA) study completed in 2005 under *Agreement No. CE 12/2002(EP)* (3). The Director of Environmental Protection (DEP) approved this EIA report under the *Environmental Impact Assessment Ordinance* (*Cap. 499*) (*EIAO*) in September 2005 (*EIA Register No.: AEIAR-089/2005*).

1.1.3 In accordance with the EIA recommendation, prior to commencement of construction works for the SB CMPs, the Civil Engineering and Development Department (CEDD) undertook a detailed review and update of the EIA findings for the SB site (4). Findings of the EIA review undertaken in 2009/ 2010 confirmed that the construction and operation of the SB site had been predicted to be environmentally acceptable.

(1) According to the Management Framework of Dredged/ Excavated Sediment of ETWB TC(W) No. 34/2002, contaminated sediment in general shall mean those sediment requiring Type 2 – Confined Marine Disposal as determined according to this TC(W).

(2) CAD options may involve use of excavated borrow pits, or may involve purpose-built excavated pits. CAD sites are those which involve filling a seabed pit with contaminated mud and capping it with uncontaminated material such that the original seabed level is restored and the contaminated material is isolated from the surrounding marine environment.7

(3) Detailed Site Selection Study for a Proposed Contaminated Mud Disposal Facility within the Airport East/ East of Sha Chau Area (Agreement No. CE 12/2002(EP))

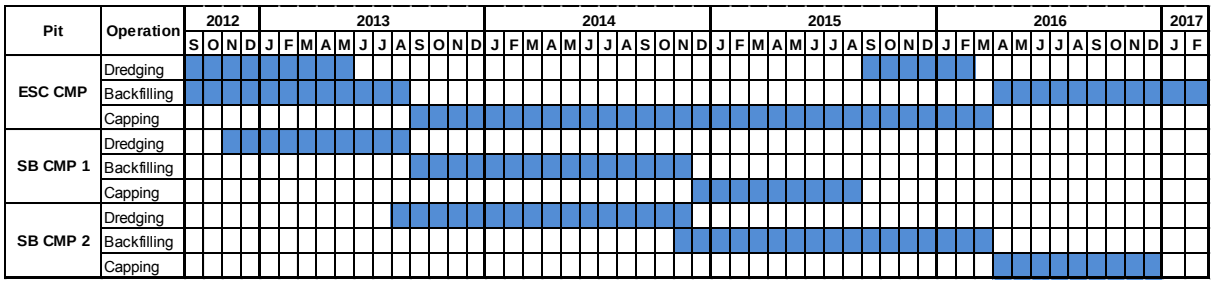
(4) Under the CEDD study *Contaminated Sediment Disposal Facility to the South of The Brothers (Agreement No. FM 2/2009)*

1.1.4 *Environmental Permits (EPs)* (*EP-312/2008/A* and *EP-427/2011A*) were issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 for ESC CMP V and on 23 December 2011 for SB CMPs, respectively. Under the requirements of the *EPs*, an Environmental Monitoring and Audit (EM&A) programme as set out in the EM&A Manuals (1) (2) is required to be implemented for the CMPs.

1.1.5 The present EM&A programme under *Agreement No. CE 23/2012 (EP)* covers the dredging, disposal and capping operations of the SB CMPs as well as ESC CMPs. Detailed works schedule for both CMPs is shown in *Figure 1.1*. In January 2016, the following works were being undertaken at the CMPs:

- Dredging operation at ESC CMP Vd;
- Capping operation at ESC CMP Va; and
- Disposal of contaminated mud at SB CMP 2.

Figure 1.1 Works Schedule for ESC CMPs and SB CMPs



1.2 REPORTING PERIOD

1.2.1 This *41st Monthly Progress Report* covers the EM&A activities for the reporting month of January 2016.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

1.3.1 The following monitoring activities have been undertaken for ESC CMPs in January 2016:

- *Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vd* was undertaken on 5 and 12 January 2016.

(1) ERM (2012) Environmental Monitoring and Audit (EM&A) Manual. Final First Review. Environmental Monitoring and Audit for Contaminated Mud Pits to the South of the Brothers and at East Sha Chau (2012-2017) – Investigation. Agreement No. CE 23/2012(EP). Submitted to EPD in November 2012.

(2) ERM (2010) Environmental Monitoring and Audit (EM&A) Manual. Final Second Review. Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation. Agreement No. CE 4/2009(EP). Submitted to EPD in November 2010.

1.3.2 The following monitoring activities have been undertaken for SB CMPs in January 2016:

- *Routine Water Quality Monitoring of CMP 2* was undertaken on 6 January 2016;
- *Pit Specific Sediment Chemistry of CMP 2* was undertaken on 7 January 2016*;*
- *Water Column Profiling of CMP 2* was undertaken on 11 January 2016; and
- *Demersal Trawling for SB CMP* was undertaken on 18 and 19 January 2016.

1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS

1.4.1 No outstanding sampling remained for January 2016.

1.4.2 A summary of field activities conducted are presented in *Annex A*. The following laboratory analyses were still in progress during the preparation of this monthly report and hence are not presented in this monthly report:

- Laboratory analyses of sediment samples collected for *Pit Specific Sediment Chemistry of SB CMP 2* in January 2016.

1.4.3 The following laboratory analyses are in progress and will be presented in the corresponding quarterly report:

- Laboratory analyses of sediment samples collected for *Demersal Trawling for SB CMP* in January 2016.

1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMPS

1.5.1 Brief discussion of the monitoring results of the *Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vd* conducted in January 2016 is presented below.

1.5.2 ***Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vd – January 2016***

1.5.3 Dredging activities were carried out on 2 – 4, 8, 12 and 13 January 2016 during this reporting period and monitoring was conducted on 5 and 12 January 2016. On each survey day, monitoring was conducted during both mid-ebb and mid-flood tides at two Reference (Upstream) stations and five Impact (Downstream) stations around the dredging operations at ESC CMP Vd. Monitoring was also conducted at one Sensitive Receiver station situated in Ma Wan. A total of eight (8) stations were monitored and locations of the sampling stations are shown in *Figure 1.2*.

1.5.4 Monitoring results are presented in *Table B1* of *Annex B*. Daily dredging volume in January 2016 is reported in *Annex C*. Levels of Dissolved Oxygen (DO), Turbidity and Suspended Solid (SS) complied with the Action and Limit Levels (see *Table B2* of *Annex B* for details) set in the *Baseline Monitoring Report* (1).

1.5.5 The results indicated that the dredging operations at ESC CMP Vd did not appear to cause any unacceptable deterioration in water quality during this reporting period. Therefore, no further action, except for those recommended in the Environmental Permit (*EP-312/2008/A*), are considered necessary for the dredging operations.

(1) ERM (2009). Draft Second Review of the EM&A Manual. Under Agreement No. CE 4/2009 (EP) EM&A for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation

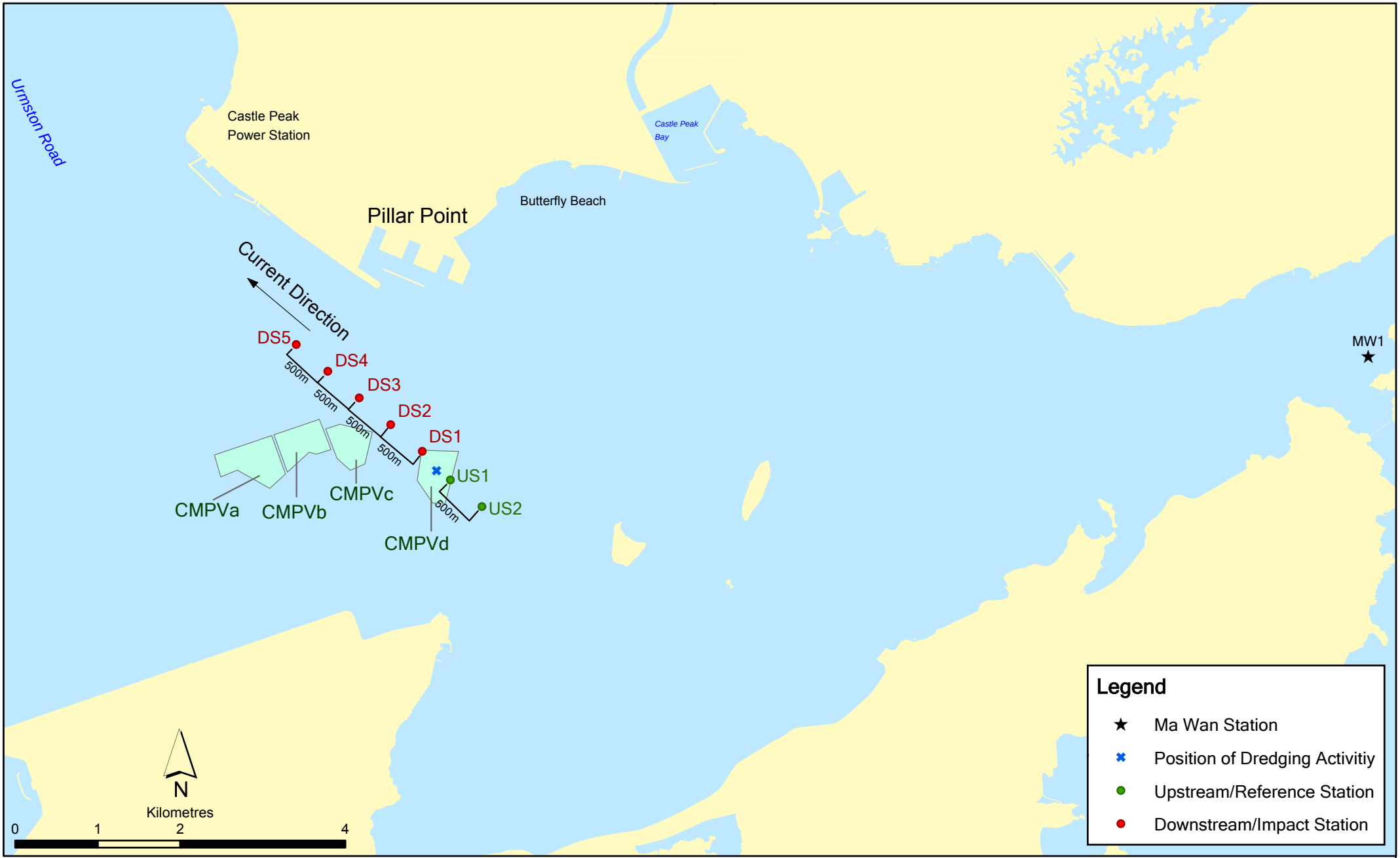


Figure 1.2

Indicative Dredging Impact Sampling Stations for CMPVd

Note: The locations of sampling stations will be determined on site based on current direction and position of dredging activities.

File: T:\GIS\CONTRACT\0103262\Mxd\CMPV\0103262_modelling stations2.mxd
Date: 28/11/2012

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1.6 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR SB CMPS

1.6.1 Brief discussion of the monitoring results of the following activities for SB CMPs is presented in this *41st Monthly Progress Report*:

- *Pit Specific Sediment Chemistry of CMP 2* in December 2015;
- *Cumulative Impact Sediment Chemistry of CMP 2* in December 2015;
- *Routine Water Quality Monitoring of CMP 2* in January 2016; and
- *Water Column Profiling of CMP 2* in January 2016.

1.6.2 ***Pit Specific Sediment Chemistry of CMP 2 – December 2015***

1.6.3 Monitoring locations for *Pit Specific Sediment Chemistry for CMP 2* are shown in *Figure 1.3*. A total of six (6) monitoring stations were sampled in December 2015.

1.6.4 The concentrations of all inorganic contaminants (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver and Zinc) were lower than the Lower Chemical Exceedance Level (LCEL) at all stations (*Figures 1* and *2* of *Annex D*).

1.6.5 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were similar at most stations and it was observed to be higher at Active Pit station SB-NPBA and lower at Active Pit station SB-NPBB (*Figure 3* of *Annex D*). Tributyltin (TBT) concentrations were observed to be higher at Active Pit station SB-NPBA and SB-NPBB (*Figure 4* of *Annex D*). Low and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs), Total Polychlorinated Biphenyls (PCBs), 4,4'-dichlorodiphenyldichloroethylene (DDE) and Total dichlorodiphenyltrichloroethane (DDT) concentrations were below the limit of reporting at most stations, except High Molecular Weight PAHs at Active Pit stations SB-NPBA (*Figure 5* of *Annex D*).

1.6.6 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at CMP 2 in December 2015. Statistical analysis will be undertaken and presented in the quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.

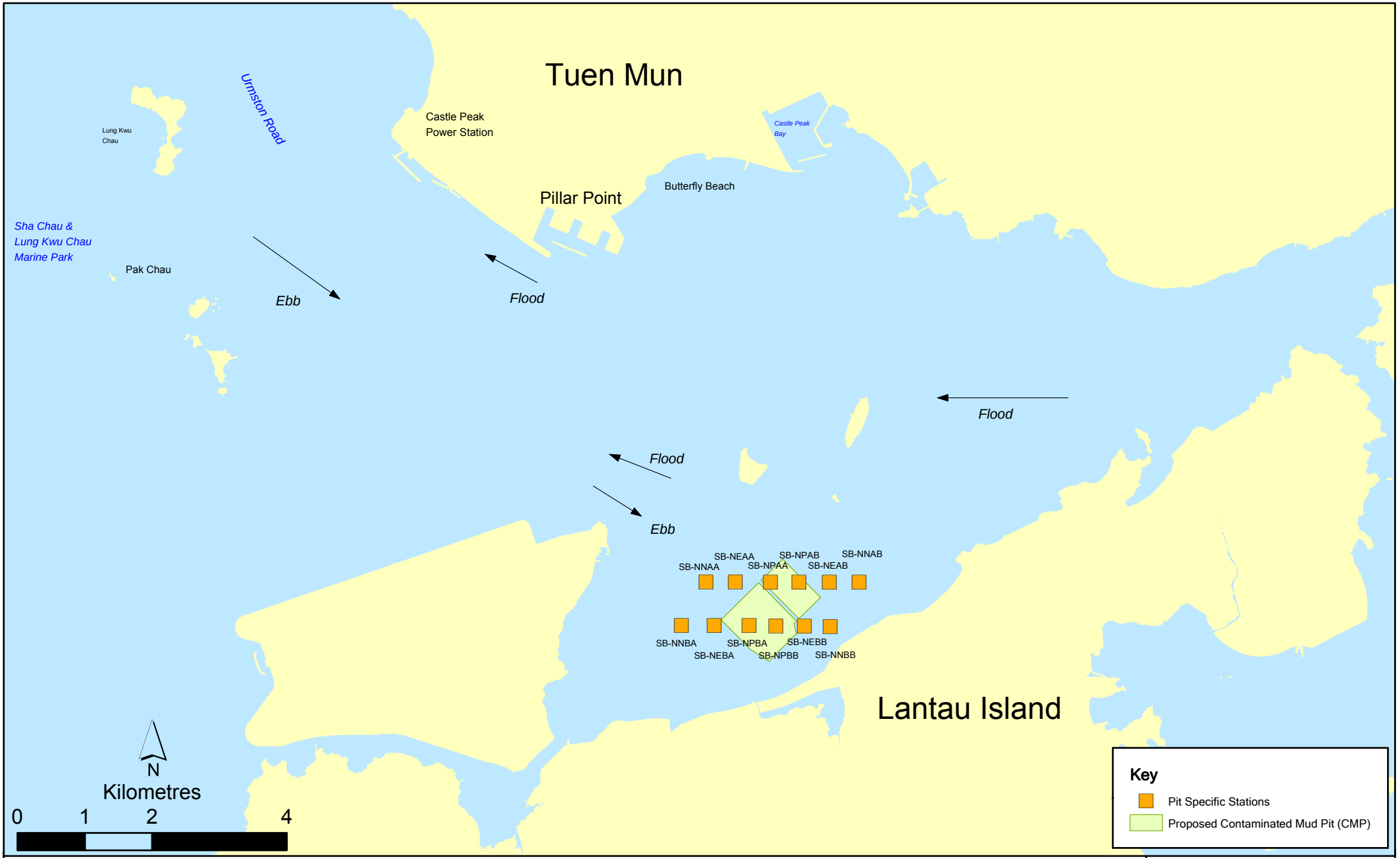

Figure 1.3

Pit Specific Sediment Quality Monitoring Stations for South Brothers Facility

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Date: 12/12/2012

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1.6.7 ***Cumulative Impact Sediment Chemistry of SB CMPs – December 2015***

1.6.8 Monitoring locations for *Cumulative Impact Sediment Chemistry for SB CMPs* are shown in *Figure 1.4*. A total of eleven (11) monitoring stations were sampled in December 2015.

1.6.9 Analyses of results for the *Cumulative Impact Sediment Chemistry Monitoring* indicated that the concentrations of all inorganic contaminants were below the LCEL in December 2015 (*Figures 6* and *7* of *Annex D*).

1.6.10 For organic contaminants, concentrations of TOC at Near-field station SB-RNA and Mid-field stations SB-RMA and SB-RMB were recorded to be lower than other stations (*Figure 8* of *Annex D*). Concentrations of TBTs were recorded to be higher at Mid-field station SB-RMB and Ma Wan station (*Figure 9* of *Annex D*). Total DDT, 4,4'-DDE, Total PCBs as well as Low and High Molecular Weight PAHs were recorded below the limit of reporting at all stations.

1.6.11 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at CMP 2 in December 2015. Statistical analysis will be undertaken and presented in the quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.

1.6.12 ***Routine Water Quality Monitoring of SB CMP 2 – January 2016***

1.6.13 The monitoring results for the Routine Water Quality Monitoring conducted in January 2016 in the dry season have been assessed for compliance with the Water Quality Objectives (WQOs) set by Environmental Protection Department (EPD). This consists of a review of the EPD routine water quality monitoring data for the dry season period (November to March) of 2005 - 2014 from stations in the Northwestern Water Control Zone (WCZ), where the CMPs are located (***1***). For Salinity, the averaged value obtained from the Reference stations was used for the basis as the WQO. Levels of DO and Turbidity were also assessed for compliance with the Action and Limit Levels (see *Table B3* of *Annex B* for details). The monitoring results are shown in *Tables B4 and B5* of *Annex B* and *Figures 10 - 20* of *Annex D*. A total of twenty (20) monitoring stations were sampled in January 2016 as shown in *Figure 1.5*.

(1) http://epic.epd.gov.hk/EPICRIVER/marine/?lang=en

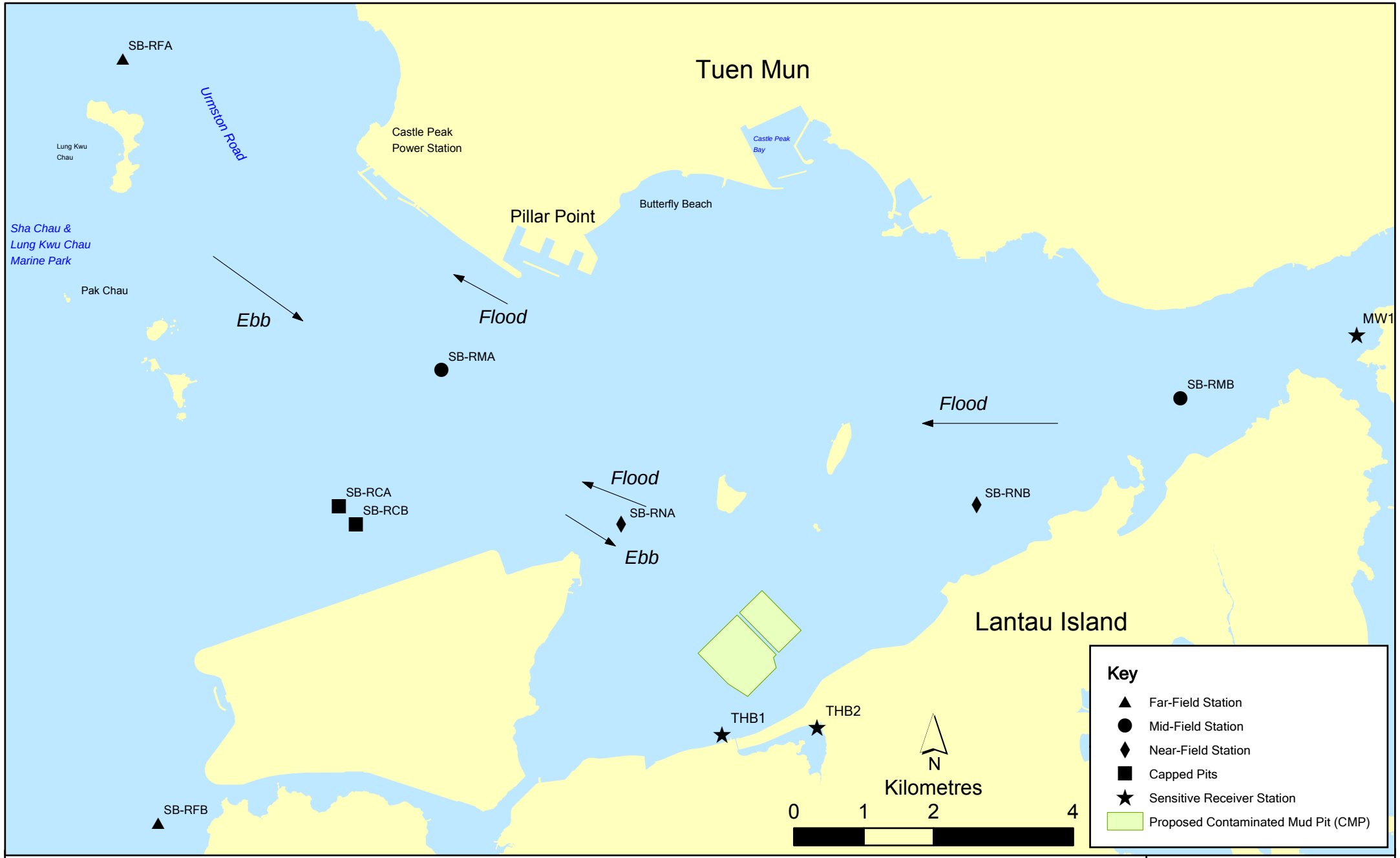

Figure 1.4

Cumulative Impacts Sediment Quality Monitoring Stations for South Brothers Facility

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Date: 11/12/2012

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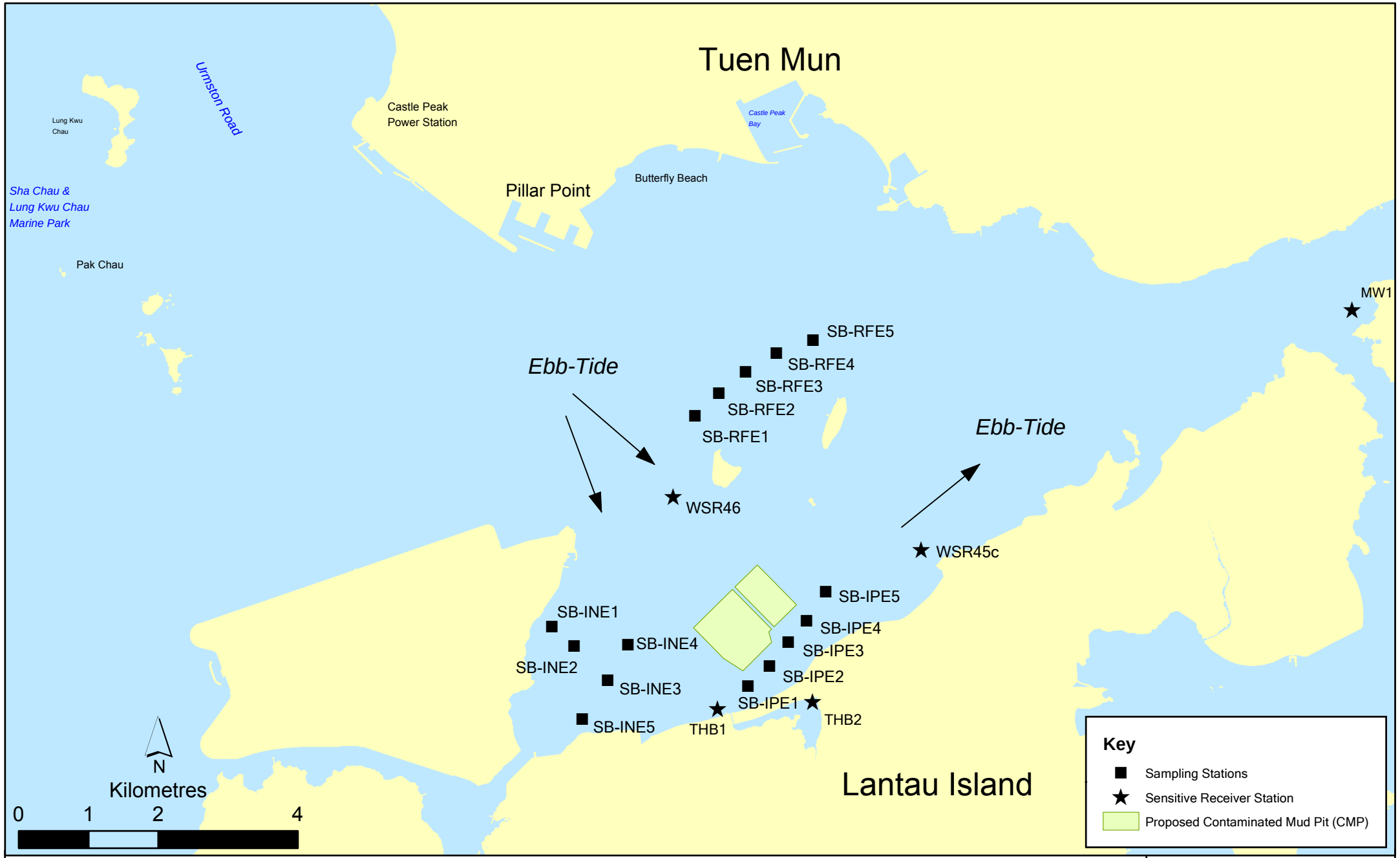

Figure 1.5

Routine Water Quality Sampling Stations (Ebb-Tide) for South Brothers Facility

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Date: 11/12/2012

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In-situ Measurements

1.6.14 Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in *Figures 10 -15* of *Annex D.* Analyses of results for January 2016 indicated that the levels of pH, DO and Salinity complied with the WQOs at all stations (Impact, Intermediate, Reference and Water Sensitive Receiver stations) in January 2016 (*Table B4* of *Annex B; Figures 10 - 12, 14* of *Annex D*).

1.6.15 The levels of DO and Turbidity complied with the Action and Limit Levels at all stations (*Table B4* of *Annex B; Figures 12* and 15 of *Annex D*).

1.6.16 Overall, *in-situ* measurement results of the *Routine Water Quality Monitoring* indicated that the disposal operation at CMP 2 did not appear to cause any unacceptable impacts in water quality in January 2016.

Laboratory Measurements

1.6.17 Laboratory analysis of January 2016 results indicated that concentrations of Cadmium, Lead, Silver and Mercury were below their limit of reporting at all stations. Arsenic, Chromium, Copper, Nickel and Zinc were detected in January 2016 samples and the concentrations were similar amongst stations (*Table B5* of *Annex B*; *Figures 16 and 17* of *Annex D*).

1.6.18 For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at all stations in January 2016 exceeded the WQO (0.5 mg/L) (*Table B5* of *Annex B*; *Figure 18* of *Annex D*). It should be noted that due to effect of Pearl River, the North Western WCZ has historically experienced higher levels of TIN (1). Since TIN concentrations were recorded to be similar amongst all stations, the exceedances of TIN WQO at all stations are unlikely to be caused by the disposal operation at CMP 2. Ammonia Nitrogen (NH3-N) concentration was relatively similar amongst all stations (*Table B5* of *Annex B*; *Figure 18* of *Annex D*). Levels of 5-day Biochemical Oxygen Demand (BOD_5) appear to be higher at Tai Ho Bay 1 and 2 stations in January 2016 (*Table B5* of *Annex B*; *Figure 19* of *Annex D*).

1.6.19 Concentrations of SS complied with the WQO (13.5 mg/L for dry season) and the Action and Limit Levels at all stations in January 2016 (*Table B5* of *Annex B*; *Figure 20* of *Annex D*).

1.6.20 Overall, results of the *Routine Water Quality Monitoring* indicated that the disposal operation at CMP 2 did not appear to cause any unacceptable deterioration in water quality in January 2016. Detailed statistical analysis will be presented in the Quarterly Report to investigate any spatial and temporal trends of potential concern.

(1) http://www.epd.gov.hk/epd/misc/marine_quality/1986-2005/textonly/eng/index.htm

1.6.21 ***Water Column Profiling of CMP 2 – January 2016***

1.6.22 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 11 January 2016. The monitoring results have been assessed for compliance with the WQOs (see *Section 1.6.12* for details). Levels of DO and Turbidity were also assessed for compliance with the Action and Limit Levels (see *Table B3* of *Annex B* for details).

In-situ Measurements

1.6.23 Analyses of results for January 2016 indicated that levels of Salinity, DO and pH complied with the WQOs at both Downstream and Upstream stations (*Table B6* of *Annex B*). In addition, DO and Turbidity at all stations complied with the Action and Limit Levels (*Table B6* of *Annex B*).

Laboratory Measurements for SS

1.6.24 Analyses of results for December 2015 indicated that the SS levels complied with the WQO at Downstream stations. Both Upstream and Downstream stations complied with the Action and Limit Levels (*Table B6* of *Annex B*).

1.6.25 Overall, the monitoring results indicated that the mud disposal operation at CMP 2 did not appear to cause any deterioration in water quality during this reporting period.

1.7 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

1.7.1 The following monitoring activities will be conducted in the next monthly period of February 2016 for SB CMPs:

- *Pit Specific Sediment Chemistry of CMP 2;*
- *Cumulative Impact Sediment Chemistry of CMP 2;*
- *Sediment Toxicity Tests of CMP 2;*
- *Routine Water Quality Monitoring of CMP 2;*
- *Water Column Profiling of CMP 2;*
- *Water Quality Monitoring During Capping of CMP 1; and*
- *Demersal Trawling of SB CMPs.*

1.7.2 The following monitoring activities will be conducted in the next monthly period of February 2016 for ESC CMPs:

- *Impact Water Quality Monitoring during Dredging Operations of ESC CMP V; and*
- *Water Quality Monitoring During Capping of ESC CMPs.*

1.7.3 The sampling schedule is presented in *Annex A*.

1.8 STUDY PROGRAMME

1.8.1 A summary of the Study programme is presented in *Annex E.*

Annex A

Sampling Schedule

Annex A1 - Environmental Monitoring and Audit Sampling Schedule for East of Sha Chau (September 2012 - February 2017)

Pit Specific Sediment Chemistry	Code	2012 S	O	N	D	2013 J	F	M	A	M	J	J	A	S	O	N	D	2014 J	F	M	A	M	J	J	A	S	O	N	D	2015 J	F	M	A	M	J	J	A	S	O	N	D	2016 J	F	M	A	M	J	J	A	S	O	N	D	2017 J	F
Active-Pit																																																						
	ESC-NPDA	*	*	*	*	*	*	*	*	*	*	*	*																																*	*	*	*	*	*	*	*	*	*	*	*
	ESC-NPDB	*	*	*	*	*	*	*	*	*	*	*	*																																*	*	*	*	*	*	*	*	*	*	*	*
Pit-Edge																																																							
	ESC-NEDA	*	*	*	*	*	*	*	*	*	*	*	*																																*	*	*	*	*	*	*	*	*	*	*	*
	ESC-NEDB	*	*	*	*	*	*	*	*	*	*	*	*																																*	*	*	*	*	*	*	*	*	*	*	*
Near-Pit																																																							
	ESC-NNDA	*	*	*	*	*	*	*	*	*	*	*	*																																*	*	*	*	*	*	*	*	*	*	*	*
	ESC-NNDB	*	*	*	*	*	*	*	*	*	*	*	*																																*	*	*	*	*	*	*	*	*	*	*	*

Cumulative Impact Sediment Chemistry	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Near-field Stations																																																						
ESC-RNA				*		*				*		*																																		*		*							*		*
ESC-RNB				*		*				*		*																																		*		*							*		*
Mid-field Stations																																																							
ESC-RMA				*		*				*		*																																		*		*							*		*
ESC-RMB				*		*				*		*																																		*		*							*		*
Capped Pit Stations																																																							
ESC-RCA				*		*				*		*																																		*		*							*		*
ESC-RCB				*		*				*		*																																		*		*							*		*
Far-Field Stations																																																							
ESC-RFA				*		*				*		*																																		*		*							*		*
ESC-RFB				*		*				*		*																																		*		*							*		*
Ma Wan Station																																																							
MW1				*		*				*		*																																		*		*							*		*

Sediment Toxicity Tests	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Near-Field Stations																																																					
ESC-TDA						*						*																																		*										*
ESC-TDB						*						*																																		*										*
Reference Stations																																																						
ESC-TRA						*						*																																		*										*
ESC-TRB						*						*																																		*										*
Ma Wan Station																																																						
MW1						*						*																																		*										*

Tissue/ Whole Body Sampling	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Impact Stations																																																					
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ESC-TSA						*						*																																		*										*
ESC-TSB						*						*																																		*										*

Demersal Trawling	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Impact Stations																																																					
ESC-INA					*	*					*	*																																		*	*									*	*
ESC-INB					*	*					*	*																																		*	*									*	*
Reference Stations																																																							
ESC-TNA					*	*					*	*																																		*	*									*	*
ESC-TNB					*	*					*	*																																		*	*									*	*
ESC-TSA					*	*					*	*																																		*	*									*	*
ESC-TSB					*	*					*	*																																		*	*									*	*

Water Column Profiling		S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Plume Stations	WCP1	*	*	*	*	*	*	*	*	*	*	*	*																																*	*	*	*	*	*	*	*	*	*	*	*
	WCP2	*	*	*	*	*	*	*	*	*	*	*	*																																*	*	*	*	*	*	*	*	*	*	*	*

Annex A1 - Environmental Monitoring and Audit Sampling Schedule for East of Sha Chau (September 2012 - February 2017)

	2012				2013												2014												2015												2016												2017	
Benthic Recolonisation Studies	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Capped Contaminated Mud Pits IVa-c																																																			
ESC-CPA				*								*				*								*				*								*				*								*				*		
ESC-CPB				*								*				*								*				*								*				*								*				*		
ESC-CPC				*								*				*								*				*								*				*								*				*		
Reference Stations																																																					
ESC-RBA				*								*				*								*				*								*				*								*				*		
ESC-RBB				*								*				*								*				*								*				*								*				*		
ESC-RBC				*								*				*								*				*								*				*								*				*		

Impact Monitoring for Dredging	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Upstream/Reference Stations																																																						
US1	*	*	*	*	*	*	*	*	*																												*	*	*	*	*	*													
US2	*	*	*	*	*	*	*	*	*																												*	*	*	*	*	*													
Downstream/Impact Stations																																																						
DS1	*	*	*	*	*	*	*	*	*																												*	*	*	*	*	*													
DS2	*	*	*	*	*	*	*	*	*																												*	*	*	*	*	*													
DS3	*	*	*	*	*	*	*	*	*																												*	*	*	*	*	*													
DS4	*	*	*	*	*	*	*	*	*																												*	*	*	*	*	*													
DS5	*	*	*	*	*	*	*	*	*																												*	*	*	*	*	*													
Ma Wan Station																																																						
MW1	*	*	*	*	*	*	*	*	*																												*	*	*	*	*	*													

Capping	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Ebb Tide																																																					
Impact Station																																																						
ESC-IPE1																*		*				*		*				*		*				*		*				*								*				*		
ESC-IPE2																*		*				*		*				*		*				*		*				*								*				*		
ESC-IPE3																*		*				*		*				*		*				*		*				*								*				*		
ESC-IPE4																*		*				*		*				*		*				*		*				*								*				*		
ESC-IPE5																*		*				*		*				*		*				*		*				*								*				*		
Intermediate Station																																																					
ESC-INE1																*		*				*		*				*		*				*		*				*								*				*		
ESC-INE2																*		*				*		*				*		*				*		*				*								*				*		
ESC-INE3																*		*				*		*				*		*				*		*				*								*				*		
ESC-INE4																*		*				*		*				*		*				*		*				*								*				*		
ESC-INE5																*		*				*		*				*		*				*		*				*								*				*		
Reference Station																																																					
ESC-RFE1																*		*				*		*				*		*				*		*				*								*				*		
ESC-RFE2																*		*				*		*				*		*				*		*				*								*				*		
ESC-RFE3																*		*				*		*				*		*				*		*				*								*				*		
ESC-RFE4																*		*				*		*				*		*				*		*				*								*				*		
ESC-RFE5																*		*				*		*				*		*				*		*				*								*				*		
Ma Wan Station																																																						
MW1																*		*				*		*				*		*				*		*				*								*				*		
Flood Tide																																																					
Impact Station																																																					
ESC-IPF1																*		*				*		*				*		*				*		*				*								*				*		
ESC-IPF2																*		*				*		*				*		*				*		*				*								*				*		
ESC-IPF3																*		*				*		*				*		*				*		*				*								*				*		
Intermediate Station																																																					
ESC-INF1																*		*				*		*				*		*				*		*				*								*				*		
ESC-INF2																*		*				*		*				*		*				*		*				*								*				*		
ESC-INF3																*		*				*		*				*		*				*		*				*								*				*		
Reference Station																																																					
ESC-RFF1																*		*				*		*				*		*				*		*				*								*				*		
ESC-RFF2																*		*				*		*				*		*				*		*				*								*				*		
ESC-RFF3																*		*				*		*				*		*				*		*				*								*				*		
Ma Wan Station																																																						
MW1																*		*				*		*				*		*				*		*				*								*				*		

Annex A1 - Environmental Monitoring and Audit Sampling Schedule for East of Sha Chau (September 2012 - February 2017)

		2012				2013												2014												2015												2016												2017	
Routine Water Quality Monitoring		S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Ebb Tide																																																				
Impact Station																																																					
	ESC-IPE1		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-IPE2		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-IPE3		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-IPE4		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-IPE5		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
Intermediate Station																																																					
	ESC-INE1		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-INE2		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-INE3		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-INE4		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-INE5		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
Reference Station																																																					
	ESC-RFE1		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-RFE2		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-RFE3		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-RFE4		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-RFE5		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
Ma Wan Station																																																					
	MW1		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
Flood Tide																																																				
Impact Station																																																					
	ESC-IPF1		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-IPF2		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-IPF3		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
Intermediate Station																																																					
	ESC-INF1		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-INF2		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-INF3		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
Reference Station																																																					
	ESC-RFF1		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-RFF2		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
	ESC-RFF3		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*
Ma Wan Station																																																					
	MW1		*	*		*	*		*	*		*	*																																*	*		*	*		*	*		*	*

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

Baseline Monitoring Prior to Dredging	Code	Frequency	2012 J	2012 A	2012 S	2012 O	2012 N	2012 D	2013 J	2013 F	2013 M	2013 A	2013 M	2013 J	2013 J	2013 A	2013 S	2013 O	2013 N	2013 D	2014 J	2014 F	2014 M	2014 A	2014 M	2014 J	2014 J	2014 A	2014 S	2014 O	2014 N	2014 D	2015 J	2015 F	2015 M	2015 A	2015 M	2015 J	2015 J	2015 A	2015 S	2015 O	2015 N	2015 D	2016 J	2016 F	2016 M	2016 A	2016 M	2016 J	2016 J	2016 A	2016 S	2016 O	2016 N	2016 D	2017 J	2017 F
Far Field Stations																																																								
	SB-WFA	3 days per week for 4 weeks	*	*																																																			
	SB-WFB	3 days per week for 4 weeks	*	*																																																		
Mid Field Stations																																																							
	SB-WMA	3 days per week for 4 weeks	*	*																																																		
	SB-WMB	3 days per week for 4 weeks	*	*																																																		
Near Field Stations																																																							
	SB-WNAA	3 days per week for 4 weeks	*	*																																																		
	SB-WNAB	3 days per week for 4 weeks	*	*																																																		
	SB-WNBA	3 days per week for 4 weeks	*	*																																																		
	SB-WNBB	3 days per week for 4 weeks	*	*																																																		
Reference Stations																																																							
	NM1	3 days per week for 4 weeks	*	*																																																		
	NM2	3 days per week for 4 weeks	*	*																																																		
	NM3	3 days per week for 4 weeks	*	*																																																		
	NM5	3 days per week for 4 weeks	*	*																																																		
	NM6	3 days per week for 4 weeks	*	*																																																		
Sensitive Receiver Stations																																																							
	MW1	3 days per week for 4 weeks	*	*																																																		
	THB1	3 days per week for 4 weeks	*	*																																																		
	THB2	3 days per week for 4 weeks	*	*																																																		
	WSR45C	3 days per week for 4 weeks	*	*																																																		
	WSR46	3 days per week for 4 weeks	*	*																																																		

Impact Monitoring for Dredging	Code	Frequency	2012 J	2012 A	2012 S	2012 O	2012 N	2012 D	2013 J	2013 F	2013 M	2013 A	2013 M	2013 J	2013 J	2013 A	2013 S	2013 O	2013 N	2013 D	2014 J	2014 F	2014 M	2014 A	2014 M	2014 J	2014 J	2014 A	2014 S	2014 O	2014 N	2014 D	2015 J	2015 F	2015 M	2015 A	2015 M	2015 J	2015 J	2015 A	2015 S	2015 O	2015 N	2015 D	2016 J	2016 F	2016 M	2016 A	2016 M	2016 J	2016 J	2016 A	2016 S	2016 O	2016 N	2016 D	2017 J	2017 F
Upstream Stations																																																									
	US1	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
	US2	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
Downstream Stations																																																									
	DS1	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
	DS2	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
	DS3	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
	DS4	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
	DS5	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
Sensitive Receiver Stations																																																									
	MW1	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
	THB1	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
	THB2	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
	WSR45C	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											
	WSR46	3 days per week					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*																											

Pit Specific Sediment Chemistry	Code	Frequency	2012 J	2012 A	2012 S	2012 O	2012 N	2012 D	2013 J	2013 F	2013 M	2013 A	2013 M	2013 J	2013 J	2013 A	2013 S	2013 O	2013 N	2013 D	2014 J	2014 F	2014 M	2014 A	2014 M	2014 J	2014 J	2014 A	2014 S	2014 O	2014 N	2014 D	2015 J	2015 F	2015 M	2015 A	2015 M	2015 J	2015 J	2015 A	2015 S	2015 O	2015 N	2015 D	2016 J	2016 F	2016 M	2016 A	2016 M	2016 J	2016 J	2016 A	2016 S	2016 O	2016 N	2016 D	2017 J	2017 F
SB CMP 1 Active																																																								
Near-Pit																																																							
	SB-NNAA	Monthly														12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12																											
	SB-NNAB	Monthly														12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12																											
Pit-Edge																																																						
	SB-NEAA	Monthly														12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12																											
	SB-NEAB	Monthly														12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12																											
Active-Pit																																																						
	SB-NPAA	Monthly														12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12																											
	SB-NPAB	Monthly														12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12																											
SB CMP 2 Active																																																							
Near-Pit																																																							
	SB-NNBA	Monthly																													12	12	12	12	12	12	12	12	12	12	12	12	12	12															
	SB-NNBB	Monthly																													12	12	12	12	12	12	12	12	12	12	12	12	12	12															
Pit-Edge																																																							
	SB-NEBA	Monthly																													12	12	12	12	12	12	12	12	12	12	12	12	12	12															
	SB-NEBB	Monthly																													12	12	12	12	12	12	12	12	12	12	12	12	12	12															
Active-Pit																																																						
	SB-NPBA	Monthly																													12	12	12	12	12	12	12	12	12	12	12	12	12	12															
	SB-NPBB	Monthly																													12	12	12	12	12	12	12	12	12	12	12	12	12	12															

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

			2012						2013												2014												2015												2016												2017	
Cumulative Impact Sediment Chemistry			J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Near-field Stations																																																						
	SB-RNA	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					
	SB-RNB	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					
Mid-field Stations																																																						
	SB-RMA	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					
	SB-RMB	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					
Far-Field Stations																																																					
	SB-RFA	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					
	SB-RFB	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					
Capped Pit Stations																																																					
	SB-RCA	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					
	SB-RCB	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					
Sensitive Receiver Stations																																																					
	MW1	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					
	THB1	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					
	THB2	4 times per year													12				12		12				12		12				12		12				12		12				12		12				12		12					

			2012						2013												2014												2015												2016												2017	
Sediment Toxicity Tests			J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
SB CMP 1 Active																																																					
Reference																																																						
	SB-TRA	2 times per year													5							5						5																												
	SB-TRB	2 times per year													5							5						5																												
Near-Field																																																					
	SB-TAA	2 times per year													5							5						5																												
	SB-TAB	2 times per year													5							5						5																												
Sensitive Receiver Stations																																																					
	MW1	2 times per year													5							5						5																												
	THB1	2 times per year													5							5						5																												
	THB2	2 times per year													5							5						5																												
SB CMP 2 Active																																																					
Reference																																																						
	SB-TRA	2 times per year																																5						5						5										
	SB-TRB	2 times per year																																5						5						5										
Near-Field																																																					
	SB-TBA	2 times per year																																5						5						5										
	SB-TBB	2 times per year																																5						5						5										
Sensitive Receiver Stations																																																					
	MW1	2 times per year																																5						5						5										
	THB1	2 times per year																																5						5						5										
	THB2	2 times per year																																5						5						5										

			2012						2013												2014												2015												2016												2017	
Tissue/ Whole Body Sampling			J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Near-Pit Stations																																																					
	SB-INA	2 times per year																				*						*						*						*						*										
	SB-INB	2 times per year																				*						*						*						*						*										
Reference North																																																					
	TNA	2 times per year																				*						*						*						*						*										
	TNB	2 times per year																				*						*						*						*						*										
Reference South																																																					
	TSA	2 times per year																				*						*						*						*						*										
	TSB	2 times per year																				*						*						*						*						*										

			2012						2013												2014												2015												2016												2017	
Demersal Trawling			J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Impact																																																					
	SB-INA 1-5	4 times per year													5						5	5					5	5					5	5					5	5					5	5									
	SB-INB 1-5	4 times per year													5						5	5					5	5					5	5					5	5					5	5									
Reference North																																																					
	TNA 1-5	4 times per year													5						5	5					5	5					5	5					5	5					5	5									
	TNB 1-5	4 times per year													5						5	5					5	5					5	5					5	5					5	5									
Reference South																																																					
	TSA 1-5	4 times per year													5						5	5					5	5					5	5					5	5					5	5									
	TSB 1-5	4 times per year													5						5	5					5	5					5	5					5	5					5	5									

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

			2012						2013												2014												2015												2016												2017	
Routine Water Quality Monitoring			J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Ebb Tide																																																										
Impact Stations Downcurrent																																																										
	SB-IPE1	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-IPE2	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-IPE3	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-IPE4	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-IPE5	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
Intermediate Stations Downcurrent																																																										
	SB-INE1	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-INE2	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-INE3	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-INE4	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-INE5	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
Reference Stations Upcurrent																																																										
	SB-RFE1	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-RFE2	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-RFE3	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-RFE4	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-RFE5	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
Sensitive Receiver Stations																																																										
	MW1	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	THB1	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	THB2	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	WSR45C	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	WSR46	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
Flood Tide																																																										
Impact Stations Downcurrent																																																										
	SB-IPF1	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-IPF2	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-IPF3	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
Intermediate Stations Downcurrent																																																										
	SB-INF1	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-INF2	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-INF3	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
Reference Stations Upcurrent																																																										
	SB-RFF1	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-RFF2	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	SB-RFF3	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
Sensitive Receiver Stations																																																										
	MW1	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	THB1	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	THB2	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	WSR45C	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												
	WSR46	8 times per year														8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8		8	8												

Water Column Profiling			J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Plume Stations	WCP1	Monthly														4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4											
	WCP2	Monthly														4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4											

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

			2012						2013												2014												2015												2016												2017	
Capping Water Quality Monitoring			J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Ebb Tide																																																					
Impact Stations Downcurrent																																																						
	SB-IPE1	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-IPE2	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-IPE3	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-IPE4	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-IPE5	4 times per year																													3		3				3		3				3		3				3		3				3			
Intermediate Stations Downcurrent																																																					
	SB-INE1	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-INE2	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-INE3	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-INE4	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-INE5	4 times per year																													3		3				3		3				3		3				3		3				3			
Reference Stations Upcurrent																																																					
	SB-RFE1	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-RFE2	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-RFE3	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-RFE4	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-RFE5	4 times per year																													3		3				3		3				3		3				3		3				3			
Sensitive Receiver Stations																																																					
	MW1	4 times per year																													3		3				3		3				3		3				3		3				3			
	THB1	4 times per year																													3		3				3		3				3		3				3		3				3			
	THB2	4 times per year																													3		3				3		3				3		3				3		3				3			
	WSR45C	4 times per year																													3		3				3		3				3		3				3		3				3			
	WSR46	4 times per year																													3		3				3		3				3		3				3		3				3			
Flood Tide																																																					
Impact Stations Downcurrent																																																					
	SB-IPF1	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-IPF2	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-IPF3	4 times per year																													3		3				3		3				3		3				3		3				3			
Intermediate Stations Downcurrent																																																					
	SB-INF1	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-INF2	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-INF3	4 times per year																													3		3				3		3				3		3				3		3				3			
Reference Stations Upcurrent																																																					
	SB-RFF1	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-RFF2	4 times per year																													3		3				3		3				3		3				3		3				3			
	SB-RFF3	4 times per year																													3		3				3		3				3		3				3		3				3			
Sensitive Receiver Stations																																																					
	MW1	4 times per year																													3		3				3		3				3		3				3		3				3			
	THB1	4 times per year																													3		3				3		3				3		3				3		3				3			
	THB2	4 times per year																													3		3				3		3				3		3				3		3				3			
	WSR45C	4 times per year																													3		3				3		3				3		3				3		3				3			
	WSR46	4 times per year																													3		3				3		3				3		3				3		3				3			

Benthic Recolonisation Studies			J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Capped Contaminated Mud Pits																																																							
	SB-CPA	2 times per year																															12				12						12				12						12				12			
	SB-CPB	2 times per year																															12				12						12				12						12				12			
Reference Stations																																																							
	RBA	2 times per year																															12				12						12				12						12				12			
	RBB	2 times per year																															12				12						12				12						12				12			
	RBC	2 times per year																															12				12						12				12						12				12			

Notes:
"*" = Number of replicates depends on parameters
Naming of stations are tentative only and will be subjected to changes

Annex B

Water Quality Monitoring Results

Table B1 Summary Table of DO, Turbidity and SS Levels Recorded in January 2016

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2016/01/05	Mid-Ebb	DS1	6.97	7.14	1.85	3.60
		DS2	7.02	7.17	1.71	3.57
		DS3	7.06	7.06	1.56	2.23
		DS4	7.00	7.08	1.61	3.78
		DS5	6.95	7.08	1.73	3.53
		US1	6.93	7.11	2.19	3.63
		US2	7.07	7.27	1.43	2.12
		MW1	6.72	6.92	1.23	3.38
	Mid-Flood	DS1	7.06	7.24	1.23	3.23
		DS2	6.98	7.22	1.33	3.37
		DS3	6.98	7.27	1.56	4.30
		DS4	7.03	7.20	1.78	3.48
		DS5	6.95	7.20	1.48	3.60
		US1	7.08	7.17	1.51	2.70
		US2	7.06	7.29	1.71	3.68
		MW1	6.73	6.99	1.10	2.45
2016/01/12	Mid-Ebb	DS1	7.36	7.70	2.21	5.30
		DS2	7.38	7.74	2.12	4.20
		DS3	7.40	7.72	2.11	5.80
		DS4	7.41	7.66	2.10	4.63
		DS5	7.46	7.83	2.04	4.98
		US1	7.41	7.64	2.65	8.32
		US2	7.45	7.64	2.56	4.18
		MW1	7.41	7.51	1.28	3.57
	Mid-Flood	DS1	7.41	7.45	3.67	5.02
		DS2	7.41	7.45	3.50	5.43
		DS3	7.29	7.38	3.33	5.50
		DS4	7.41	7.43	2.92	5.40
		DS5	7.41	7.42	3.53	6.37
		US1	7.51	7.53	2.93	4.97
		US2	7.47	7.50	3.44	6.02
		MW1	7.16	7.26	2.65	5.25

Notes:

1. Please refer to Table C2 below for the Action and Limit Levels for dredging activities.
2. Cell shaded yellow indicated value exceeding the Action Level criteria.
3. Cell shaded red indicated value exceeding the Limit Level criteria.

Table B2 Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities at ESC CMPs

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) (1)	Surface and Mid-depth (2) 5%-ile of baseline data for surface and middle layer = **3.76 mg L^{-1}** and Significantly less than the reference stations mean DO (at the same tide of the same day)	Surface and Mid-depth (2) 1%-ile of baseline data for surface and middle layer = **3.11 mg L^{-1}** (3) and Significantly less than the reference stations mean DO (at the same tide of the same day)
	Bottom 5%-ile of baseline data for bottom layers = **2.96 mg L^{-1}** and Significantly less than the reference stations mean DO (at the same tide of the same day)	Bottom The average of the impact station readings are **<2 mg/L^{-1}** and Significantly less than the reference stations mean DO (at the same tide of the same day)
Depth-averaged Suspended Solids (SS) (4) (5)	95%-ile of baseline data for depth average = **37.88 mg L^{-1}** and 120% of control station's SS at the same tide of the same day	99%-ile of baseline data for depth average = **61.92 mg L^{-1}** and 130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) (4) (5)	95%-ile of baseline data = **28.14 NTU** and 120% of control station's Tby at the same tide of the same day	99%-ile of baseline data = **38.32 NTU** and 130% of control station's Tby at the same tide of the same day

Notes:

(1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.

(2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.

(3) Given the Action Level for DO for Surface & Middle layers has already been lower than 4 mg L^{-1}, it is proposed to set the Limit Level at 3.11 mg L^{-1} which is the first percentile of the baseline data.

(4) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.

(5) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

Table B3 Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities for SB CMPs

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) (1)	Surface and Mid-depth (2) The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for surface and middle layer = **4.32 mg L^{-1}** and Significantly less than the reference stations mean DO (at the same tide of the same day)	Surface and Mid-depth (2) The average of the impact, WSR 45C and WSR 46 station readings are **< 4 mg L^{-1}** and Significantly less than the reference stations mean DO (at the same tide of the same day)
	Bottom The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for bottom layers = **3.12 mg L^{-1}** and Significantly less than the reference stations mean DO (at the same tide of the same day)	Bottom The average of the impact station, WSR 45C and WSR 46 readings are **< 2 mg L^{-1}** and Significantly less than the reference stations mean DO (at the same tide of the same day)
Depth-averaged Suspended Solids (SS) (3) (4)	The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data for depth average = **21.60 mg L^{-1}** and 120% of control station's SS at the same tide of the same day	The average of the impact, WSR 45C and WSR 46 station readings are > 99%-ile of baseline data for depth average = **40.10 mg L^{-1}** and 130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) (3) (4)	The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data = **25.04 NTU** and 120% of control station's Tby at the same tide of the same day	The average of the impact, WSR 45C and WSR 46 station readings are > 99%-ile of baseline data = **32.68 NTU** and 130% of control station's Tby at the same tide of the same day

Notes:

(1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.

(2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.

(3) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.

(4) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

Table B4 In-situ Monitoring Results for Routine Water Quality Monitoring of SB CMP in January 2016

Sampling Period	Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg L^{-1})	pH (mg L^{-1})
January 2016	RFF (Reference)	19.90	29.62	1.31	88.67	6.78	7.98
	IPF (Impact)	19.96	28.25	4.42	91.12	7.02	7.98
	INF (Intermediate)	20.19	27.72	5.56	92.42	7.11	7.97
	Ma Wan	19.97	30.23	0.58	90.09	6.86	7.99
	Shum Shui Kok	19.86	30.31	1.69	87.27	6.65	7.96
	Tai Mo To	19.93	28.11	1.37	90.80	7.00	7.94
	Tai Ho Bay 1	20.08	27.75	3.52	91.15	7.03	7.97
	Tai Ho Bay 2	20.74	27.58	9.39	89.98	6.86	7.91
	WQO	N/A	26.66 – 32.58#	N/A	N/A	>4	6.5-8.5

Notes:
#Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.
Cell shaded yellow / red indicate value exceeding the Action/Limit levels.
Cell shaded grey indicate value exceeding the WQO.

Table B5 Laboratory Results for Routine Water Quality Monitoring of SB CMP in January 2016

Sampling Period	Stations	As (µg/L)	Cd (µg/L)	Cr (µg/L)	Cu (µg/L)	Pb (µg/L)	Hg (µg/L)	Ni (µg/L)	Ag (µg/L)	Zn (µg/L)	NH_3 (mg/L)	TIN (mg/L)	BOD_5 (mg/L)	SS (mg/L)
January 2016	RFF	2.08	<LOR	3.29	3.90	<LOR	<LOR	1.67	<LOR	12.32	0.19	0.61	1.42	4.89
	IPF	2.09	<LOR	4.46	12.98	<LOR	<LOR	2.86	<LOR	14.39	0.20	0.74	1.39	7.08
	INF	2.07	<LOR	2.55	8.02	<LOR	<LOR	2.09	<LOR	9.43	0.17	0.74	1.45	7.92
	Ma Wan	2.29	<LOR	5.53	4.83	<LOR	<LOR	1.58	<LOR	10.74	0.20	0.57	1.14	2.30
	Shum Shui Kok	2.08	<LOR	3.38	12.92	<LOR	<LOR	1.90	<LOR	12.86	0.21	0.61	1.40	3.25
	Tai Mo To	2.10	<LOR	3.22	7.42	<LOR	<LOR	2.42	<LOR	12.01	0.27	0.87	1.15	3.28
	Tai Ho Bay 1	2.00	<LOR	5.91	10.16	<LOR	<LOR	2.26	<LOR	9.16	0.17	0.73	1.79	4.50
	Tai Ho Bay 2	1.94	<LOR	5.16	3.00	<LOR	<LOR	2.44	<LOR	15.50	0.19	0.81	1.80	3.01
												WQO of TIN: 0.5 mg/L		
													Dry Season WQO of SS : 13.5 mg/L	

Notes: Cell shaded yellow / red indicate value exceeding the Action/Limit levels.
Cell shaded grey indicate value exceeding the WQO.

Table B6 Water Column Profiling Results for SB CMP 2 in January 2016

Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg L^{-1})	pH (mg L^{-1})	Suspended Solids (mg L^{-1})
WCP 1 (Downstream)	19.80	29.66	2.95	98.06	7.51	7.99	4.55
WCP 2 (Upstream)	19.88	29.60	2.96	98.15	7.51	7.98	4.58
WQO (Dry season)	N/A	26.67 - 32.56#	N/A	N/A	>4	6.5-8.5	13.5

Note:
#Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.
Cell shaded yellow / red indicate value exceeding the Action/Limit levels.
Cell shaded grey indicate value exceeding the WQO.

Annex C

Dredging Record for ESC CMP Vd

Table C1 Dredging Record at ESC CMP Vd

Date	Daily Dredging Volume (m^3)	Weekly Dredging Volume (m^3) (From Sunday to Saturday)
27-Dec-2015	0	12,350
28-Dec-2015	3,250	
29-Dec-2015	2,600	
30-Dec-2015	3,250	
31-Dec-2015	1,300	
01-Jan-2016	0	
02-Jan-2016	1,950	
03-Jan-2016	3,900	5,200
04-Jan-2016	650	
05-Jan-2016	0	
06-Jan-2016	0	
07-Jan-2016	0	
08-Jan-2016	650	
09-Jan-2016	0	
10-Jan-2016	0	1,950
11-Jan-2016	0	
12-Jan-2016	1,300	
13-Jan-2016	650	
14-Jan-2016	0	
15-Jan-2016	0	
16-Jan-2016	0	
17-Jan-2016	0	0
18-Jan-2016	0	
19-Jan-2016	0	
20-Jan-2016	0	
21-Jan-2016	0	
22-Jan-2016	0	
23-Jan-2016	0	
24-Jan-2016	0	0
25-Jan-2016	0	
26-Jan-2016	0	
27-Jan-2016	0	
28-Jan-2016	0	
29-Jan-2016	0	
30-Jan-2016	0	
31-Jan-2016	0	0

Annex D

Graphical Presentations

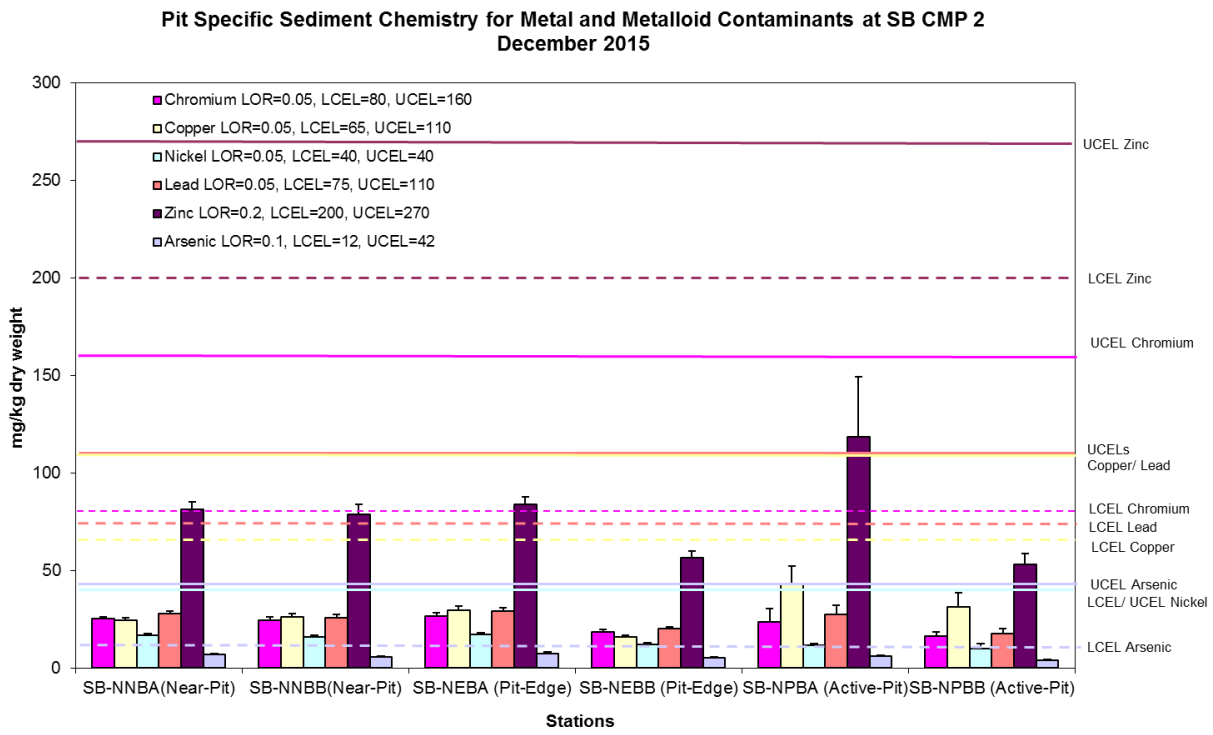

Figure 1: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP 2 in December 2015.

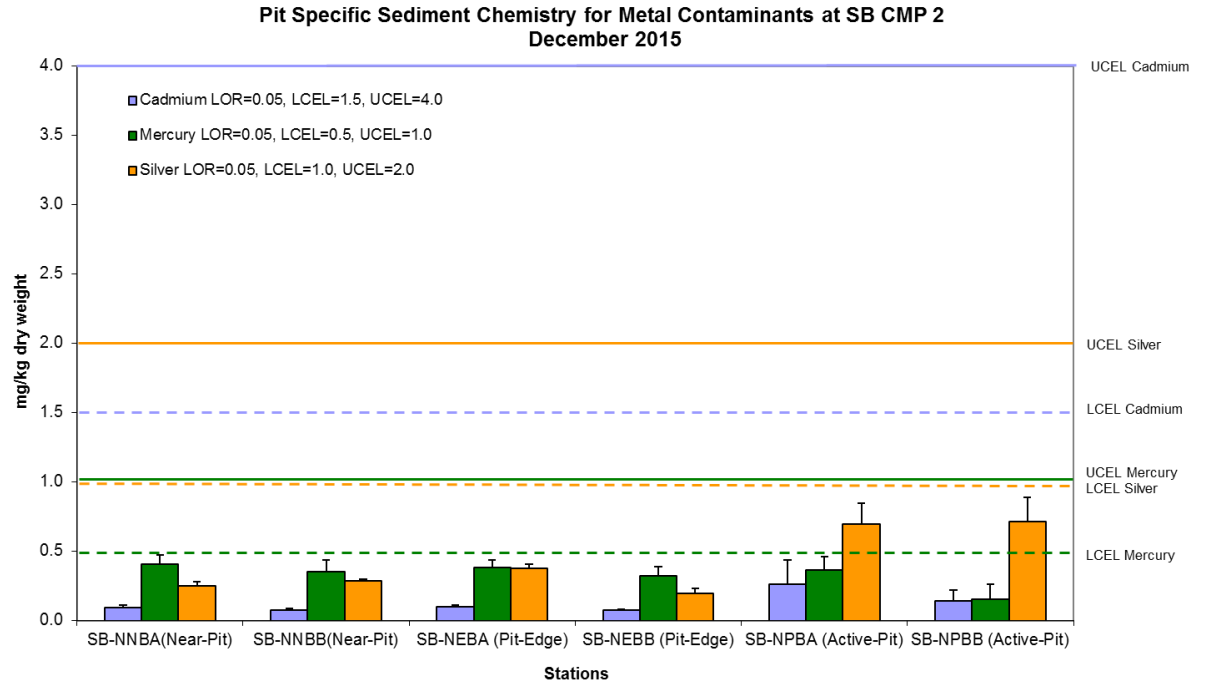

Figure 2: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP 2 in December 2015.

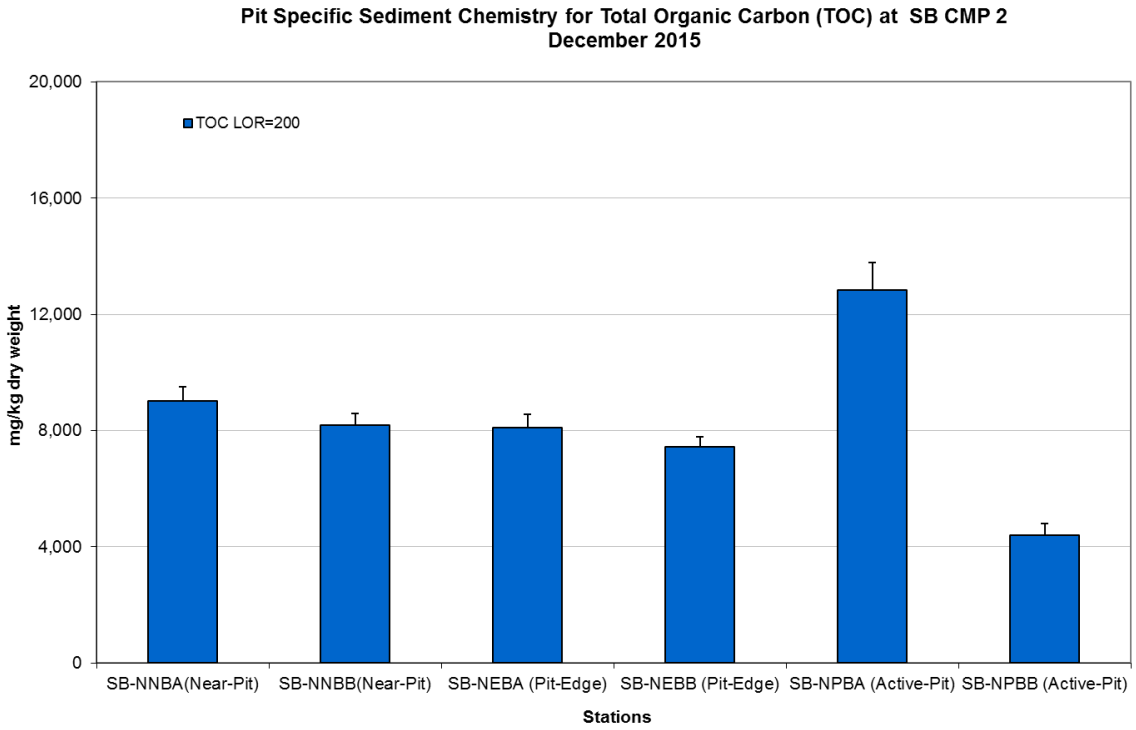

Figure 3: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP 2 in December 2015.

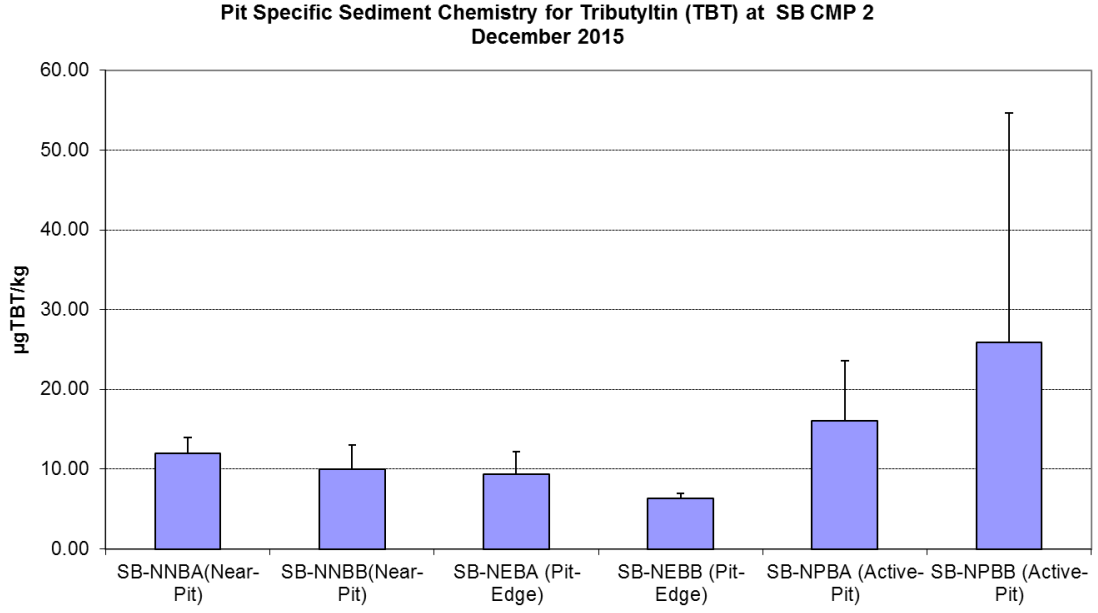

Figure 4: Concentration of Tributyltin (TBT) (µg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP 2 in December 2015.

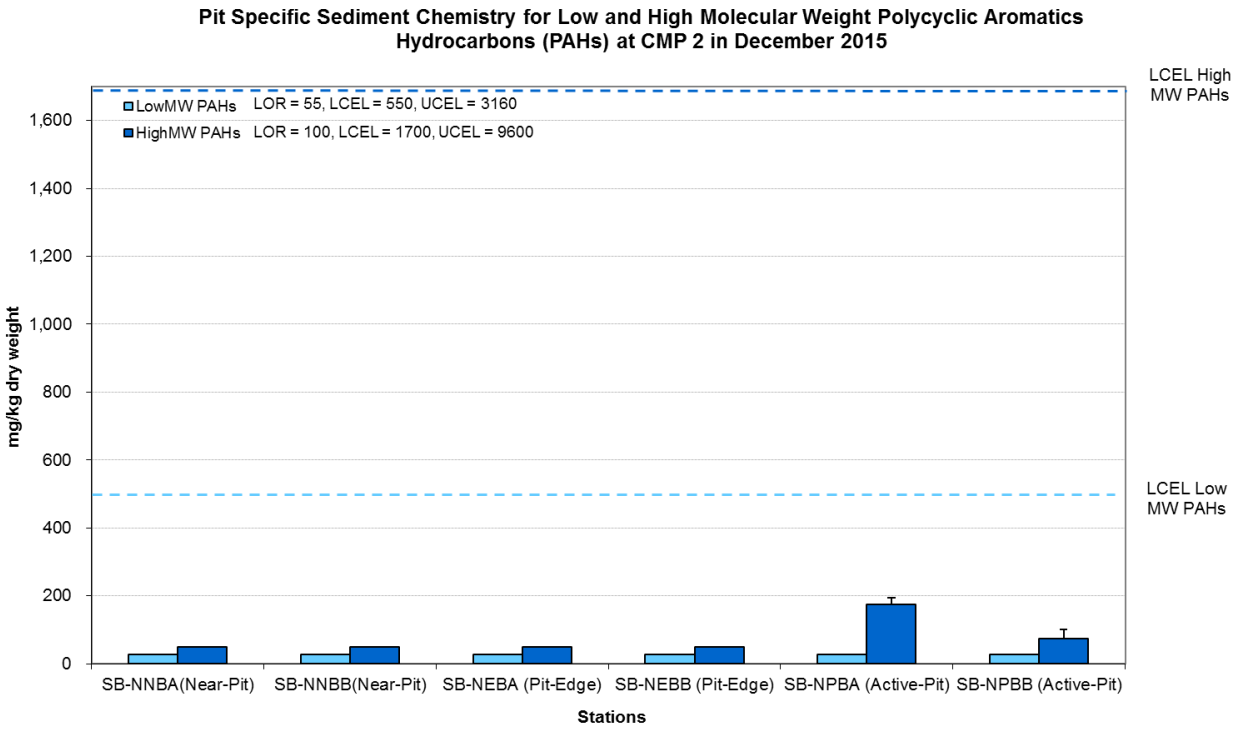

Figure 5: Concentration of Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (PAHs) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP 2 in December 2015.

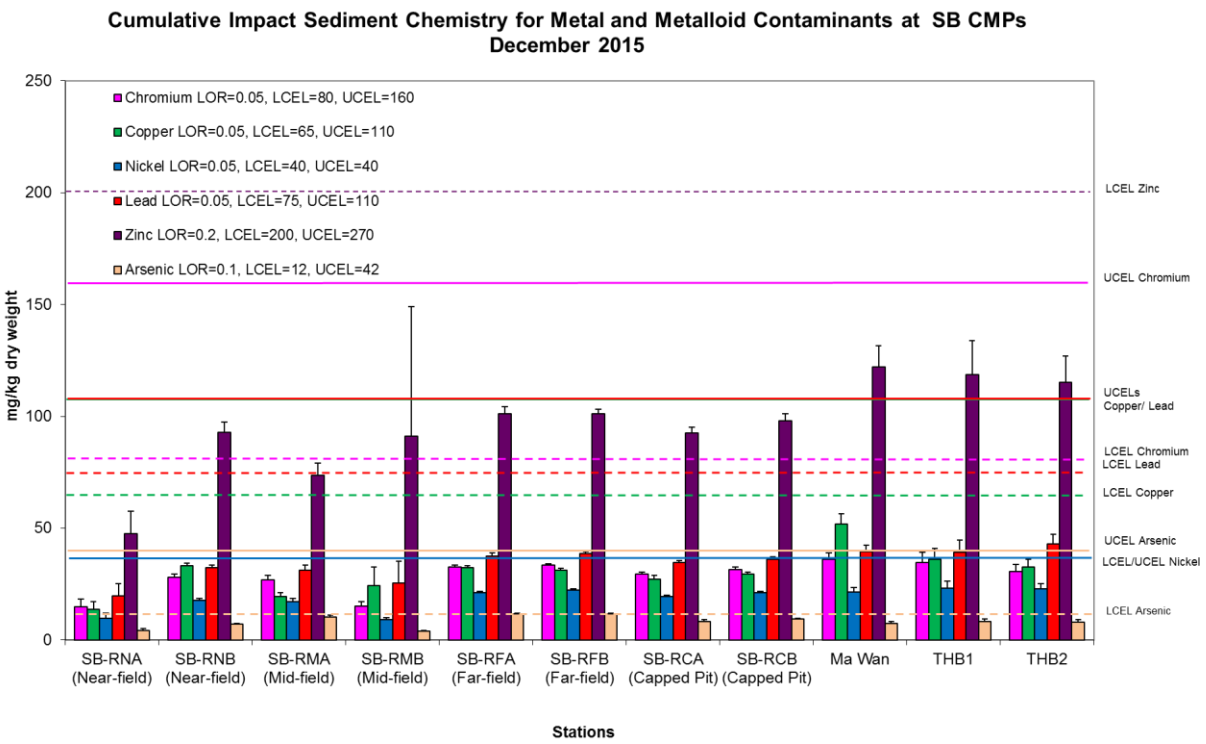

Figure 6: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for SB CMPs in December 2015.

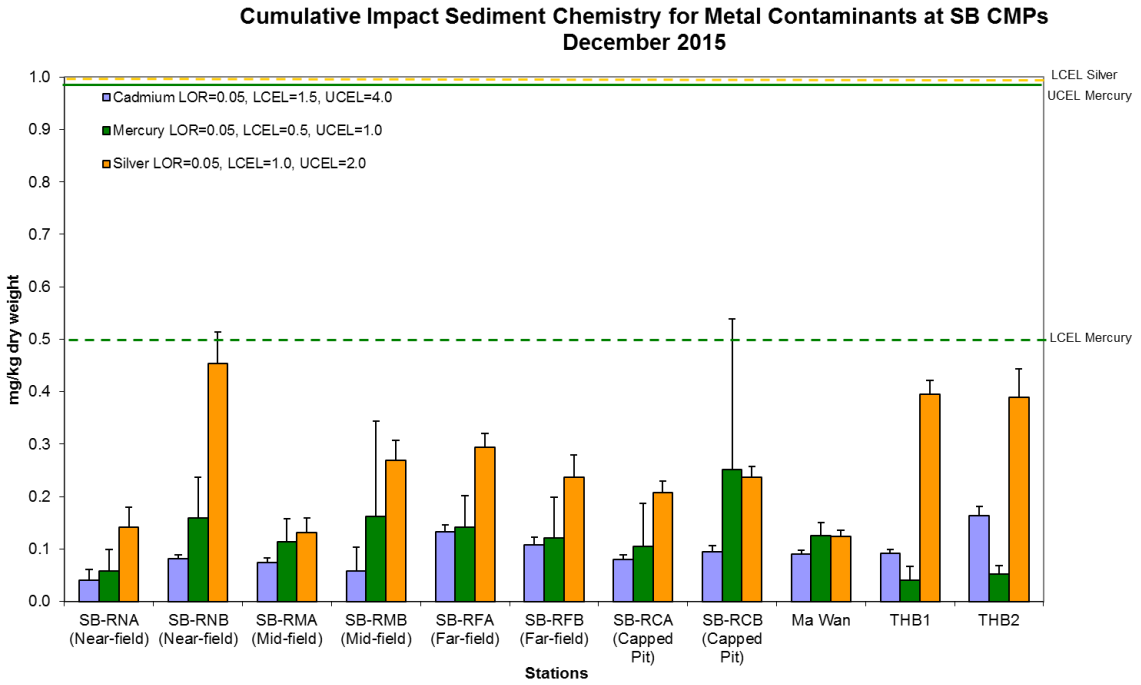

Figure 7: Concentration of Metals (Cd, Hg, Ag; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for SB CMPs in December 2015.

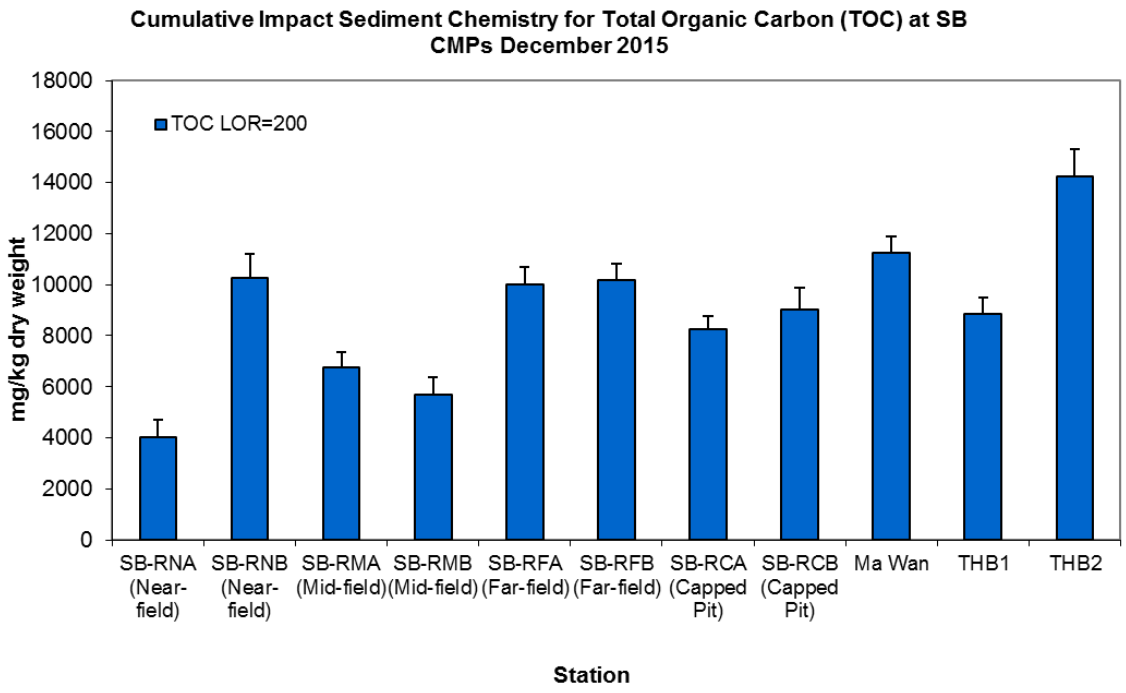

Figure 8: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for SB CMPs in December 2015.

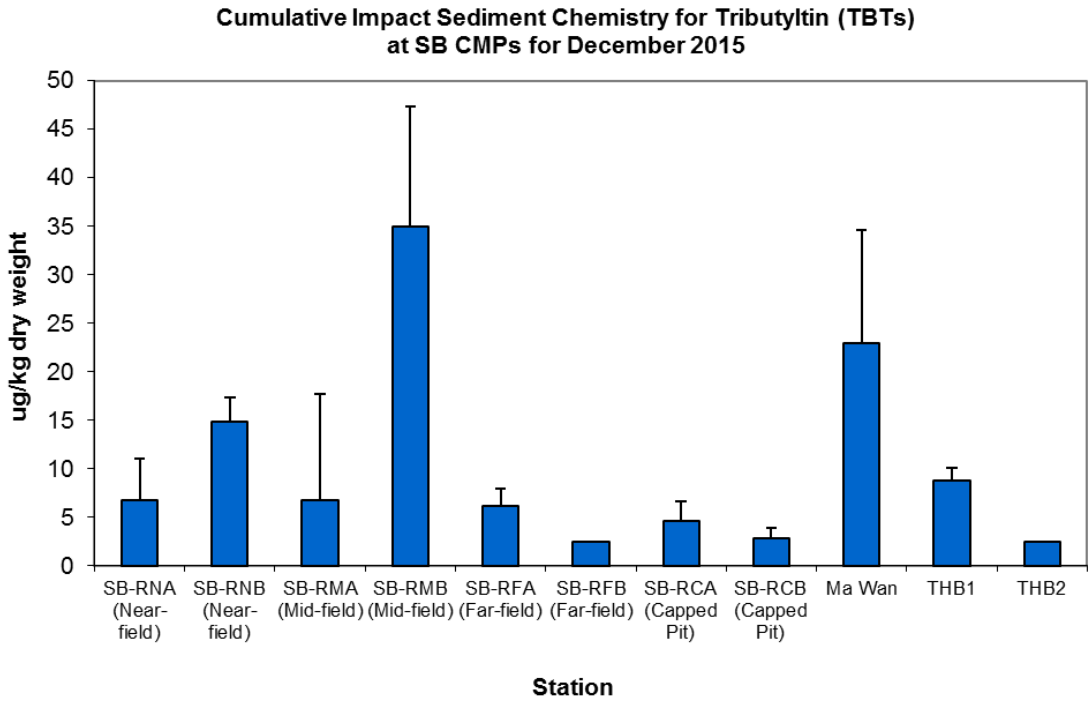

Figure 9: Concentration of Tributyltin (µg TBT/kg; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for SB CMPs in December 2015.

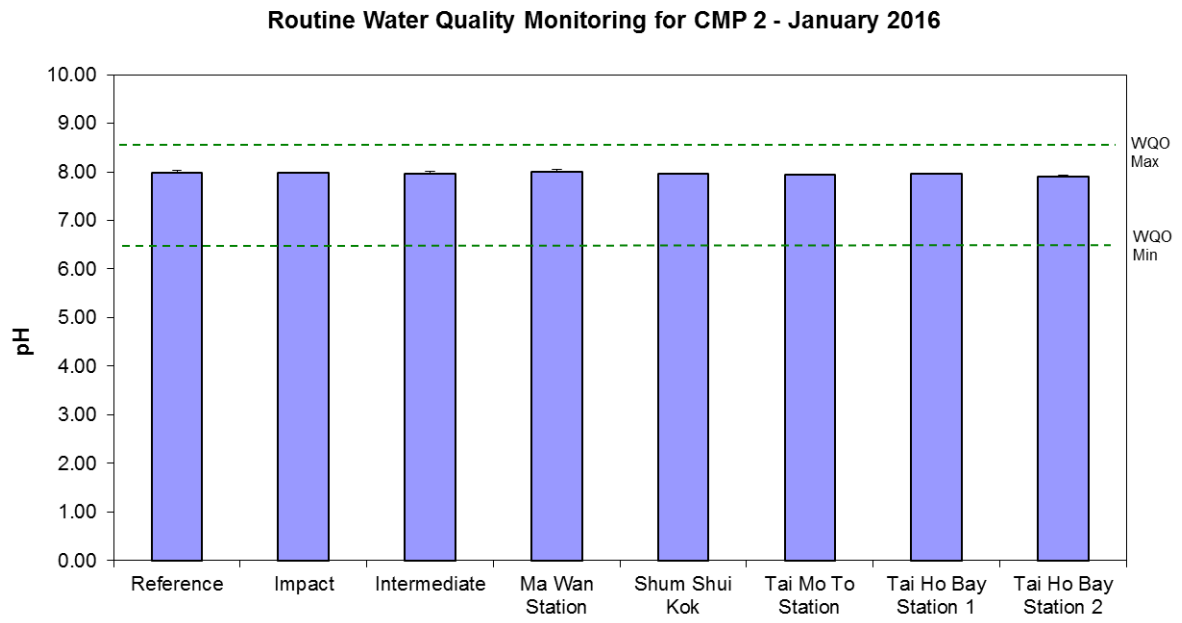

Figure 10: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

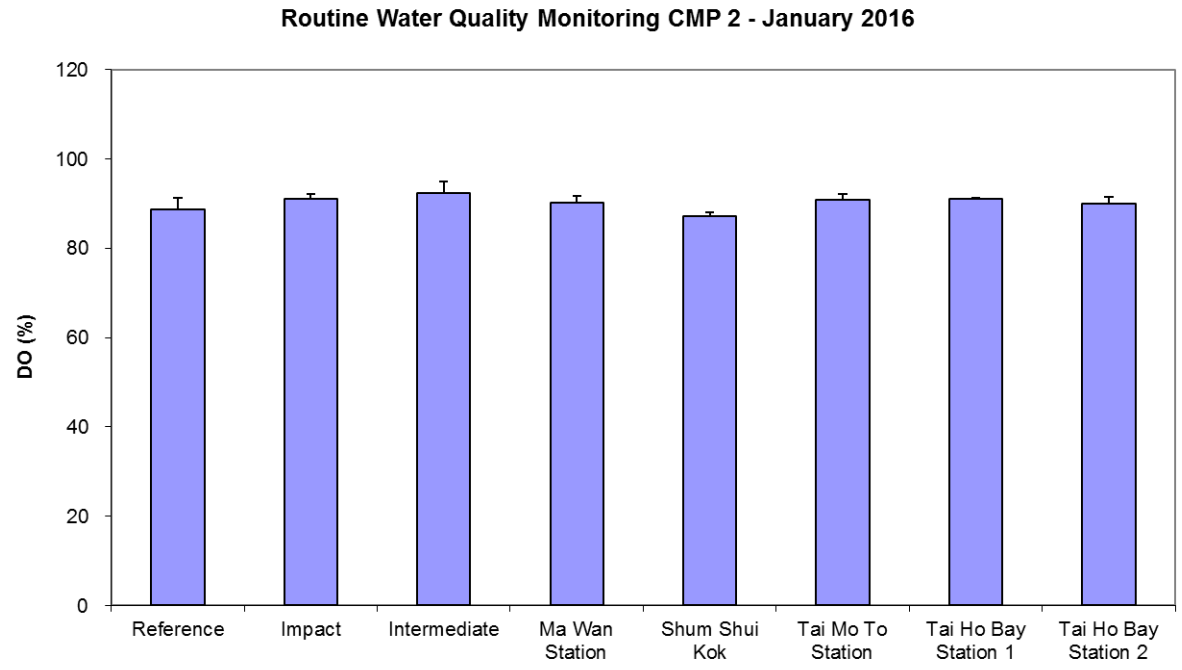

Figure 11: Level of Dissolved Oxygen (DO) (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

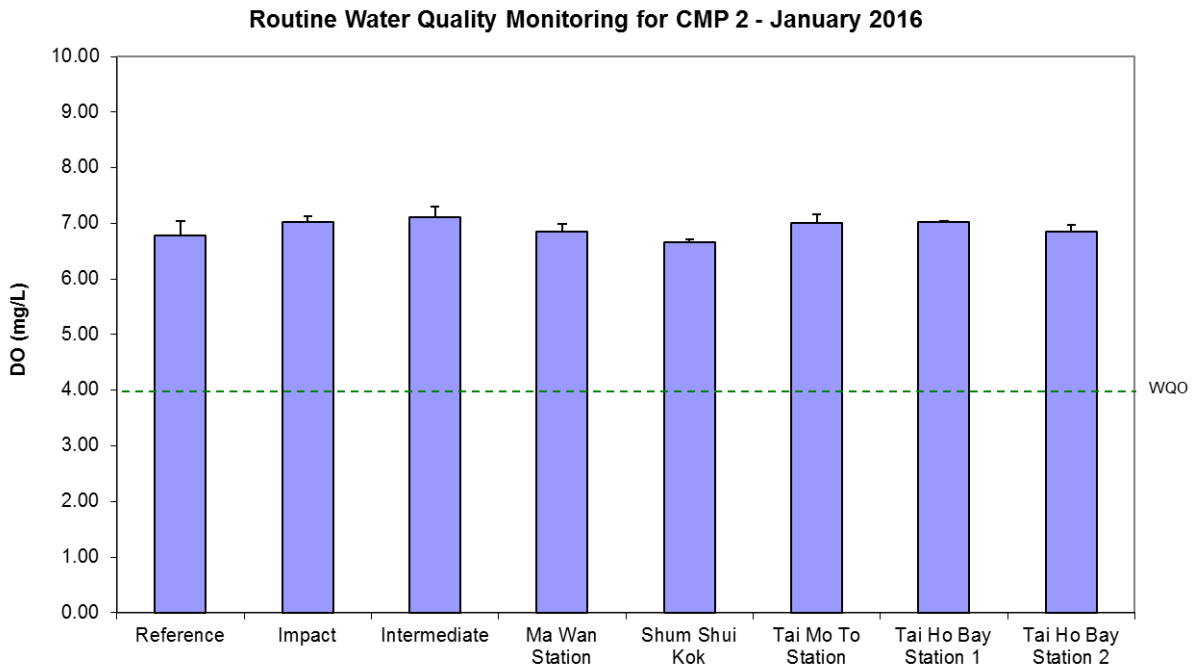

Figure 12: Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

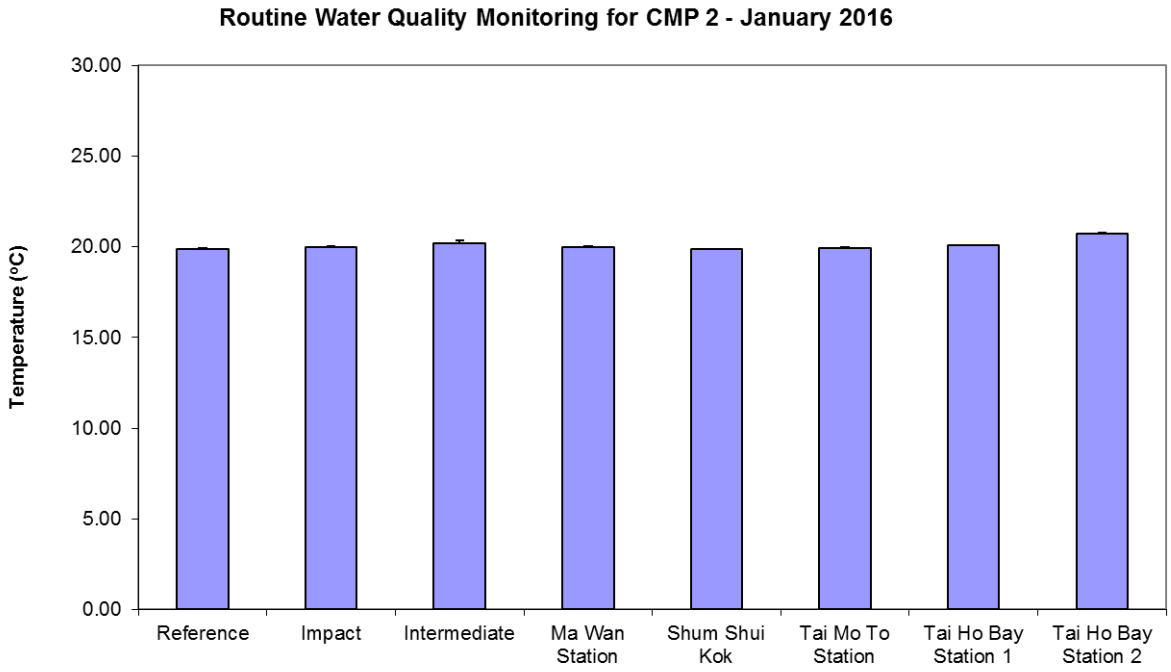

Figure 13: Level of Temperature (˚C; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

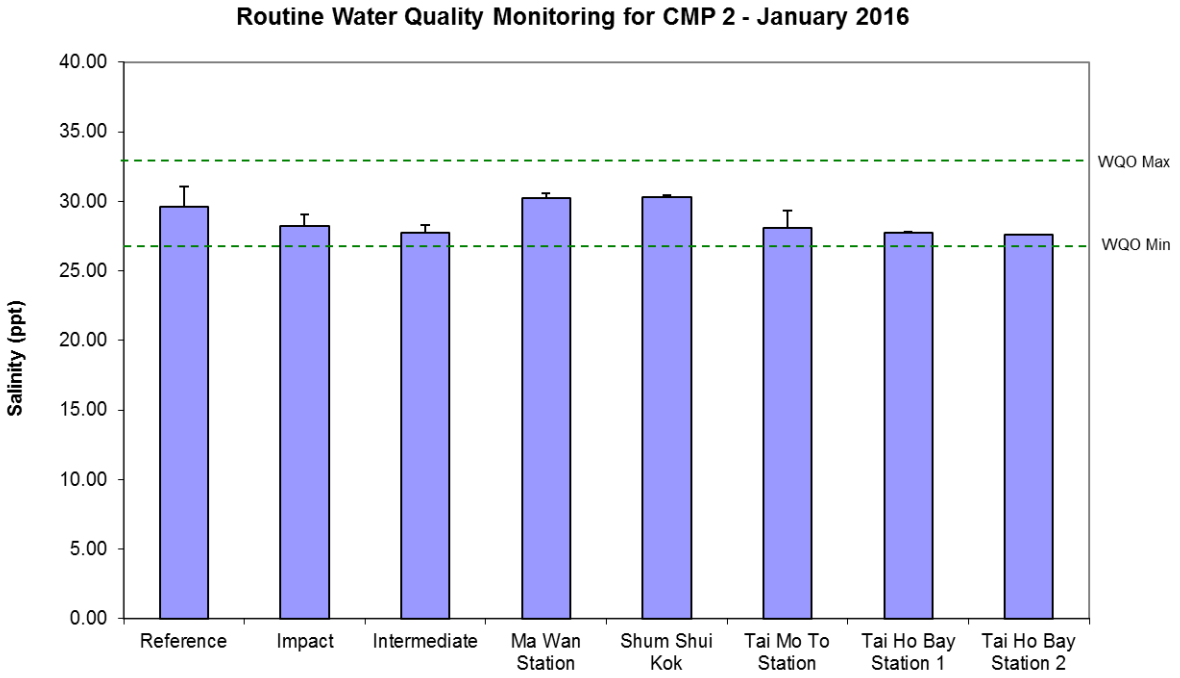

Figure 14: Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

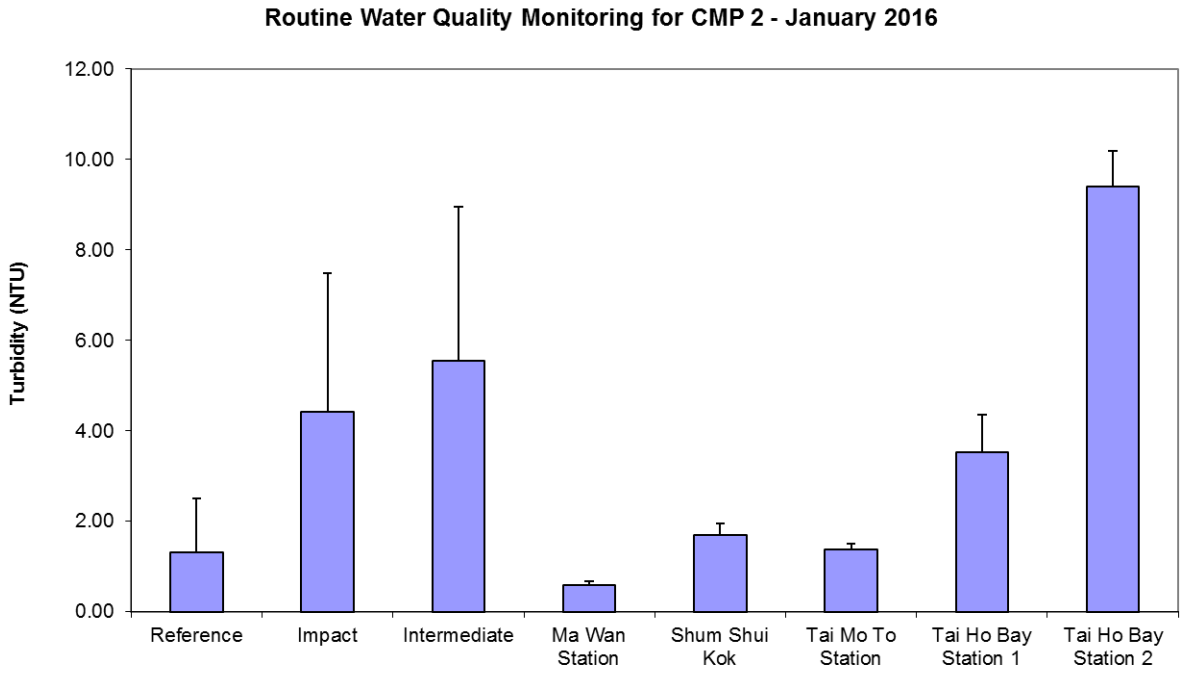

Figure 15: Levels of Turbidity (NTU; ,mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

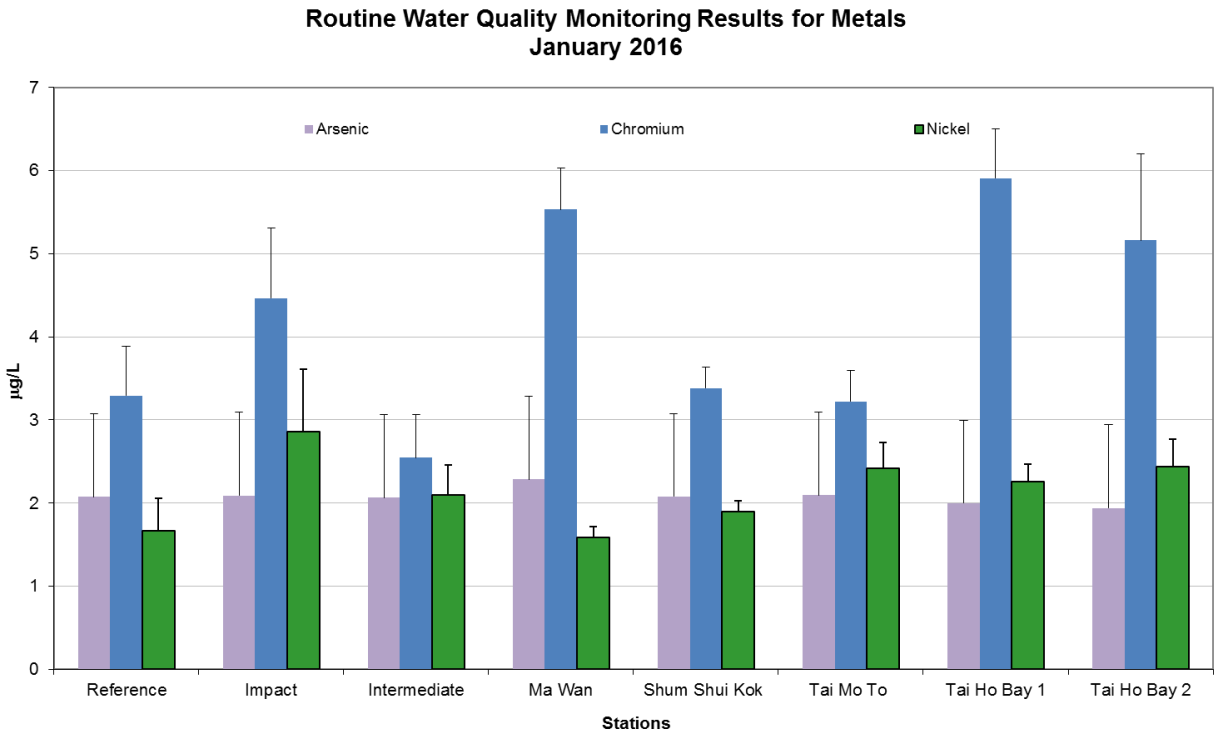

Figure 16: Concentration of Arsenic, Chromium and Nickel (µg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

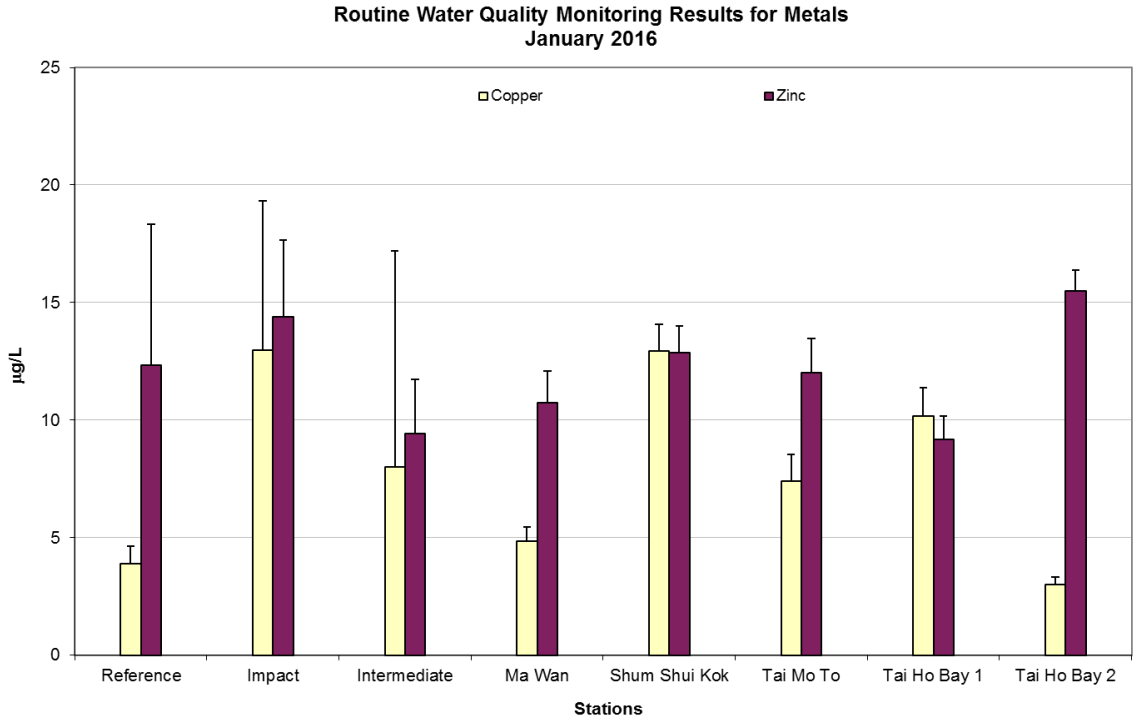

Figure 17: Concentration of Copper and Zinc (µg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

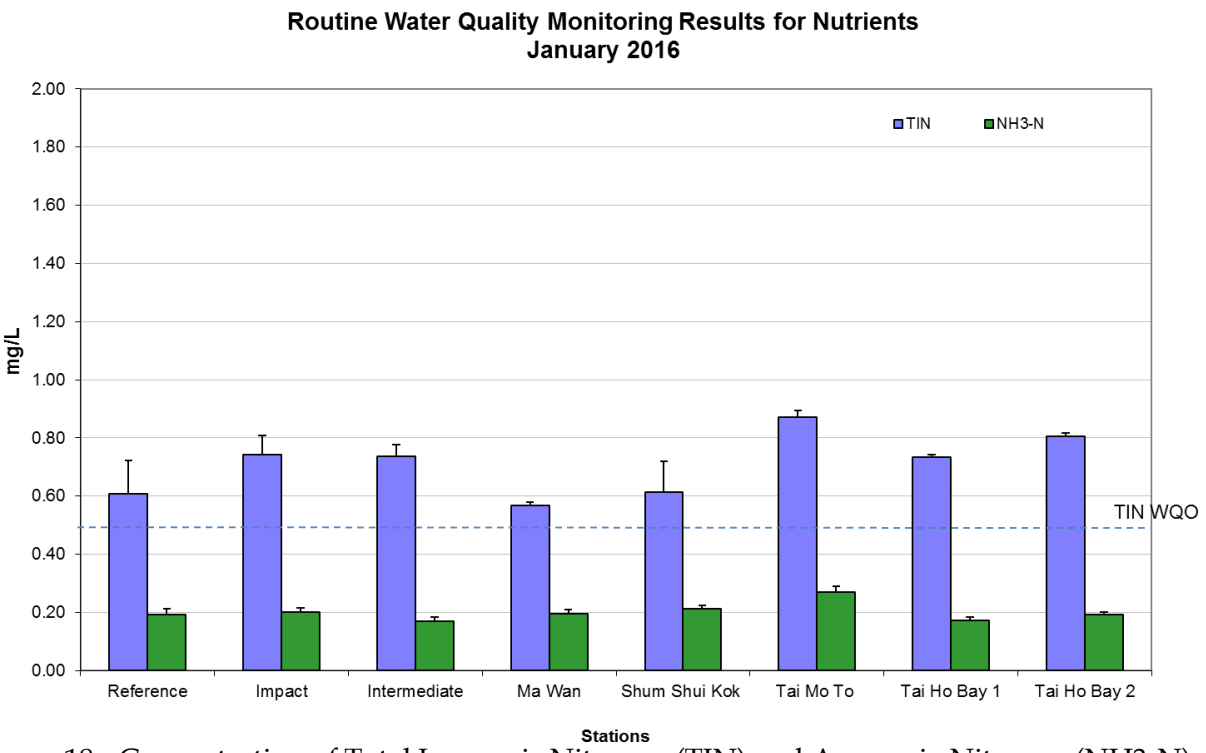

Figure 18: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen (NH3-N) (µg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

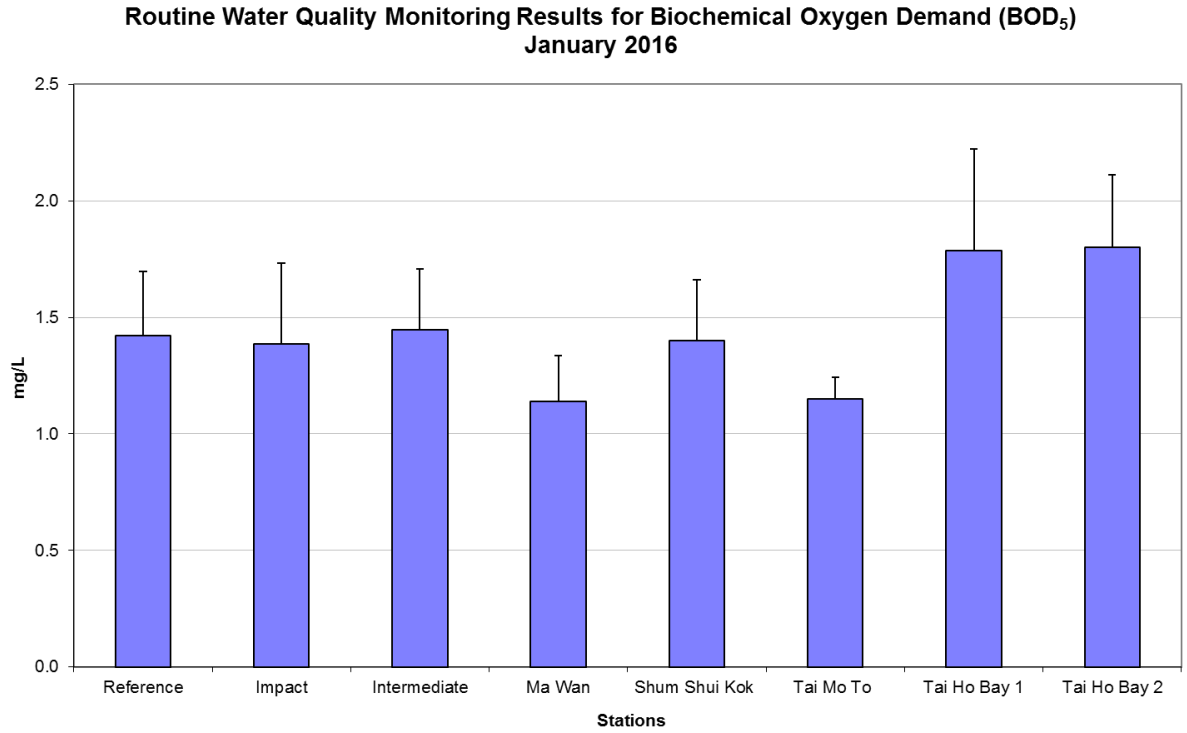

Figure 19: Level of Biochemical Oxygen Demand (BOD5) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

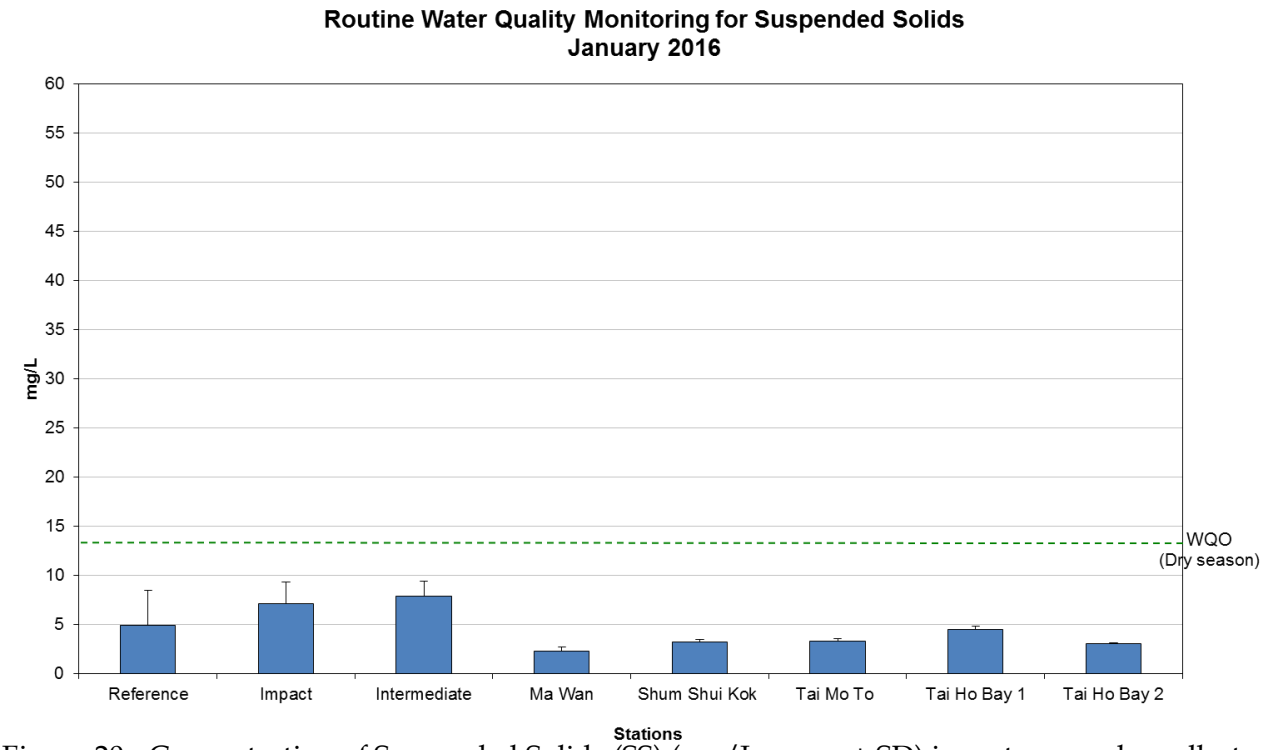

Figure 20: Concentration of Suspended Solids (SS) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP 2 in January 2016.

Annex E

Study Programme

Task Name	2012	2013	2014	2015	2016	2017
	M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J
Project Commencement	9/5					
For South Brothers CMPs and East of Sha Chau CMPs						
Submission of Draft Inception Report & Draft Programme	9/18					
Submission of Final Inception Report & Final Programme	10/2					
Submission of Draft EM&A Manual (First Review)	9/18					
Submission of Final EM&A Manual (First Review)	10/2					
Submission of Draft EM&A Manual (Second Review)	10/30					
Submission of Final EM&A Manual (Second Review)	11/27					
Submission of Subsequent EM&A Manual Updates						
Submission of Draft Operations Manual		12/31				
Submission of Final Operations Manual		1/14				
Submission of Operations Manual Updates						
Monitoring Contracts						
Regular Site Inspections of CMP Contractors						
Participate in Liaison Group Meetings/ Consultations as required by CEDD						
Submission of Report on Dredging & Capping Operations						
Submission of Monthly Progress Report						
Submission of Quarterly EM&A Report						
Submission of Annual Review Report						
Submission of Annual Risk Assessment Report						
Submission of Draft Final Report						3/20
Submission of the Final Report						4/14
Submission of Draft Executive Summary Report						4/14
Submission of Final Executive Summary Report						4/28
For East Tung Lung Chau Disposal Facility						
Submission of Monitoring Results & Monthly EM&A Progress Report						
Submission of Initial Review Report (assume disposal commences in November 2012)		2/15				
Submission of Quarterly EM&A Report						
Submission of Annual Report						
Alternative / Modified Capping Design						
Submission of Investigation Report		2/5				
Submission of Quarterly Report						
Submission of Annual Report						
Submission of Draft Final Report						3/20
Submission of the Final Report						4/14
Baseline Pelagic and Demersal Fisheries Survey						
Baseline Shrimp Trawl & Hang Trawl Surveys, twice before SB CMPs dredging						
Submission of Baseline Pelagic and Demersal Fisheries Survey Report	11/20					

Study Programme	Task	Milestone	Summary	Rolled Up Task	Rolled Up Milestone

Agreement No. CE 23/2012 (EP) Environmental Monitoring and Audit for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012-2017) - Investigation