

**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)**

**52<sup>nd</sup> Monthly Progress Report for Contaminated  
 Mud Pits to the South of The Brothers and at  
 East Sha Chau – December 2016**

Final (Revision 1)

February 2017

**Environmental Resources Management**  
 16/F Berkshire House  
 25 Westlands Road  
 Quarry Bay, Hong Kong  
 Telephone (852) 2271 3000  
 Facsimile (852) 2723 5660  
[www.erm.com](http://www.erm.com)



**Dredging, Management and Capping of Contaminated Sediment Disposal  
Facility at Sha Chau and to the South of The Brothers**

**Environmental Certification Sheet  
EP-312/2008/A & EP-427/2011/A**

**Reference Document/Plan**

Document/ <del>Plan</del> to be Certified/ Verified:	52 <sup>nd</sup> Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau - December 2016
Date of Report:	13 January 2017
Date prepared by ET:	13 January 2017
Date received by IA:	13 January 2017

**Reference EP Condition**

Environmental Permit Condition:

Condition 3.4 of EP-312/2008/A and Condition 4.4 of EP-427/2011/A:  
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-312/2008/A and EP-427/2011/A

Craig A. Reid,  
Environmental Team Leader:



Date: 13/1/2017

**IA Verification**

I hereby verify that the above referenced document/~~plan~~ complies with the above referenced condition of EP-312/2008/A and EP-427/2011/A

Dr Wang Wen Xiong,  
Independent Auditor:



Date: 13/1/2017

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




## 52<sup>nd</sup> Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – December 2016

Final (Revision 1)

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### Environmental Resources Management

16/F  
 Berkshire House  
 25 Westlands Road  
 Quarry Bay  
 Hong Kong  
 Telephone: (852) 2271 3000  
 Facsimile: (852) 2723 5660  
 E-mail: post.hk@erm.com  
 http://www.erm.com

Client:		Project No:			
Civil Engineering and Development Department (CEDD)		0175086			
Summary:		Date:			
This document presents the 52 <sup>nd</sup> monthly progress report for Contaminated Mud Pits at the South of The Brothers and at East Sha Chau.		7 February 2017			
		Approved by:			
					
		Craig A. Reid Partner			
v1	52 <sup>nd</sup> Monthly Progress Report for ESC CMPs and SB CMPs	RC	JT	CAR	07/02/17
v0	52 <sup>nd</sup> Monthly Progress Report for ESC CMPs and SB CMPs	RC	JT	CAR	13/01/17
Revision	Description	By	Checked	Approved	Date
<p>This report has been prepared by Environmental Resources Management the trading name of 'ERM Hong-Kong, Limited', with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.</p> <p>We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.</p> <p>This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.</p>		<p>Distribution</p> <p><input type="checkbox"/> Internal</p> <p><input checked="" type="checkbox"/> Public</p> <p><input type="checkbox"/> Confidential</p>			
		 			

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**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**

**52<sup>ND</sup> MONTHLY PROGRESS REPORT FOR DECEMBER 2016**

**1.1 BACKGROUND**

1.1.1 Since early 1990s, contaminated sediment <sup>(1)</sup> 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) <sup>(2)</sup> 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)* <sup>(3)</sup>. 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 <sup>(4)</sup>. 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.<sup>7</sup>

(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)*





- *Pit Specific Sediment Chemistry of ESC CMP Vd* was undertaken on 8 December 2016;
- *Benthic Recolonisation Studies of ESC CMP IV* was undertaken on 15 December 2016; and
- *Cumulative Impact Sediment Chemistry of ESC CMPs* was undertaken on 20 and 22 December 2016.

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

- *Water Quality Monitoring During Capping of SB CMPs* was undertaken on 6 December 2016; and
- *Benthic Recolonisation Studies of SB CMP 1* was undertaken on 13 December 2016.

#### **1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS**

1.4.1 No outstanding sampling remained for December 2016.

1.4.2 A summary of field activities conducted are presented in *Annex A*. The following analyses are in progress and will be presented in the corresponding quarterly report:

- Laboratory analyses of sediment samples collected for *Benthic Recolonisation Studies of ESC CMPs and SB CMP 1* in December 2016.

1.4.3 The following laboratory analyses are in progress during the preparation of this monthly report and will be presented in the next monthly report once the data are available:

- Laboratory analyses of sediment samples collected for *Cumulative Impact Sediment Chemistry of ESC CMPs* in December 2016.

#### **1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMPs**

1.5.1 Brief discussion of the monitoring results of the following activities for ESC CMPs is presented in this *52<sup>nd</sup> Monthly Progress Report*:

- *Water Quality Monitoring During Dredging of ESC CMP Vb* in December 2016;
- *Water Column Profiling of ESC CMP Vd* in December 2016; and
- *Pit Specific Sediment Chemistry of ESC CMP Vd* in November and December 2016.

- 1.5.2 ***Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vb – December 2016***
- 1.5.3 Water quality monitoring was conducted three times per week during the reporting period on 2, 5, 7, 9, 12, 14, 16, 19, 21, 23, 27 and 29 December 2016. During 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 Vb. 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 December 2016 is reported in *Annex C*. Levels of Dissolved Oxygen (DO), Turbidity and Suspended Solid (SS) generally complied with the Action and Limit Levels (see *Table B2 of Annex B* for details) set in the *Baseline Monitoring Report* <sup>(1)</sup>, except for the following occasions discussed in *Table 1.1* below.
- 1.5.5 The results indicated that the dredging operations at ESC CMP Vb 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 - Hong Kong, Ltd (2009) Baseline Monitoring Report. For the Civil Engineering & Development Department, Hong Kong SAR Government.



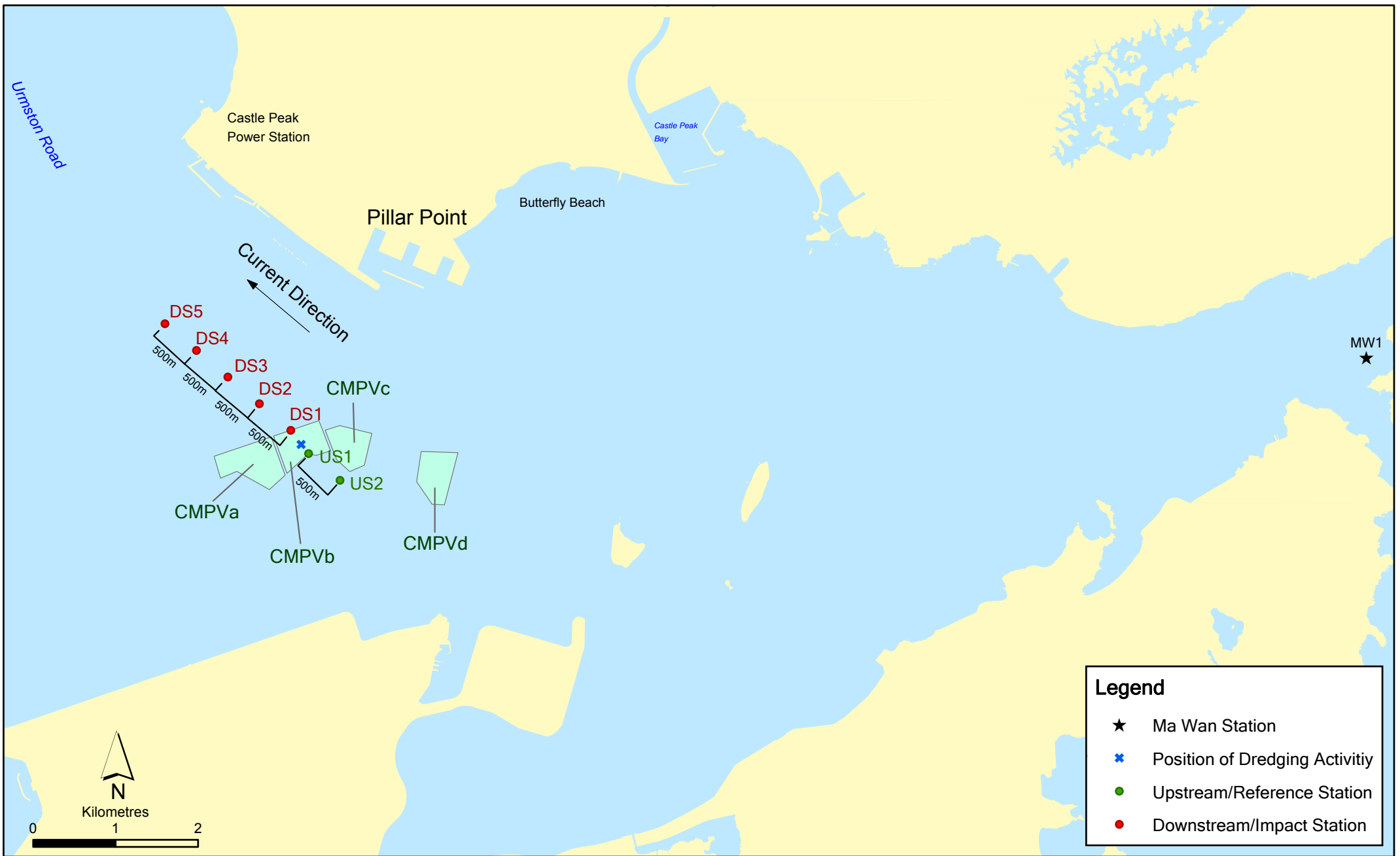


Figure 1.2

Indicative Dredging Impact Sampling Stations for CMPVb

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

**Legend**

- ★ Ma Wan Station
- ✳ Position of Dredging Activity
- Upstream/Reference Station
- Downstream/Impact Station

**Table 1.1**      *Details of Exceedances Recorded at ESC CMP Vb between 2 and 29 December 2016*

<b>Date</b>	<b>Tide</b>	<b>Parameter</b>	<b>Station</b>	<b>Type of Exceedance</b>	<b>Remarks</b>
2 December 2016	Mid-Flood	Turbidity	DS1	Action	<p>These exceedances were not considered as indicating any unacceptable impacts from the dredging operations to WSRs outside the works area due to the following reason:</p> <ul style="list-style-type: none"> <li>Action Level Exceedance of Turbidity was recorded at Stations DS1 and DS2 which is located close to the boundary of the works area during one tidal period only, and given that the dredging rate was well within the limit as specified under the EP, it is considered that the exceedance was not indicating any unacceptable impacts from the dredging operations to the nearby WSRs.</li> <li>In addition, levels of suspended solid (SS) at all stations complied with the Action and Limit levels. Therefore, it is considered that the dredging operations did not cause adverse water quality impact in terms of SS levels, which are more representative to determine the effects of dredging operation to nearby sensitive receivers (e.g. fisheries).</li> </ul>
2 December 2016	Mid-Flood	Turbidity	DS2	Action	

1.5.6 *Water Column Profiling of ESC CMP Vd - December 2016*

1.5.7 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 1 December 2016. The monitoring results 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 2006 - 2015 from stations in the Northwestern Water Control Zone (WCZ), where the ESC CMPs are located <sup>(1)</sup>. For Salinity, the averaged value obtained from the Reference (Upstream) station 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 B2 of Annex B* for details).

*In-situ Measurements*

1.5.8 Analyses of results for December 2016 indicated that levels of DO and pH complied with the WQOs at both Downstream and Upstream stations (*Table B3 of Annex B*). In addition, DO and Turbidity at all stations complied with the Action and Limit Levels (*Tables B2 and B3 of Annex B*).

*Laboratory Measurements for Suspended Solids (SS)*

1.5.9 Analyses of results for December 2016 indicated that the SS levels were higher than the WQO at both Upstream and Downstream stations. However, both Upstream and Downstream stations complied with the Action and Limit Levels (*Tables B2 and B3 of Annex B*).

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

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

- 1.5.11 ***Pit Specific Sediment Chemistry of ESC CMP Vd - November and December 2016***
- 1.5.12 Monitoring locations for *Pit Specific Sediment Chemistry for ESC CMP Vd* are shown in *Figure 1.3*. A total of six (6) monitoring stations were sampled in November and December 2016.
- 1.5.13 The concentrations of all inorganic contaminants were lower than the Lower Chemical Exceedance Level (LCEL) at all stations in November and December 2016 (*Figures 1, 2, 5 and 6 of Annex D*).
- 1.5.14 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were similar amongst the stations in November and December 2016 (*Figures 3 and 7 of Annex D*). Tributyltin (TBT) concentrations were higher at Active Pit station ESC-NPAA and Active Pit station ESC-NPAB in November and December 2016, respectively (*Figures 4 and 8 of Annex D*). Low and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs), Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT) and 4,4'-dichlorodiphenyldichloroethylene (DDE) concentrations were below the limit of reporting at all stations in November and December 2016.
- 1.5.15 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at ESC CMP Vd in November and December 2016. 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 *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 *52<sup>nd</sup> Monthly Progress Report*:
- *Water Quality Monitoring during Capping Operations of SB CMPs in December 2016.*

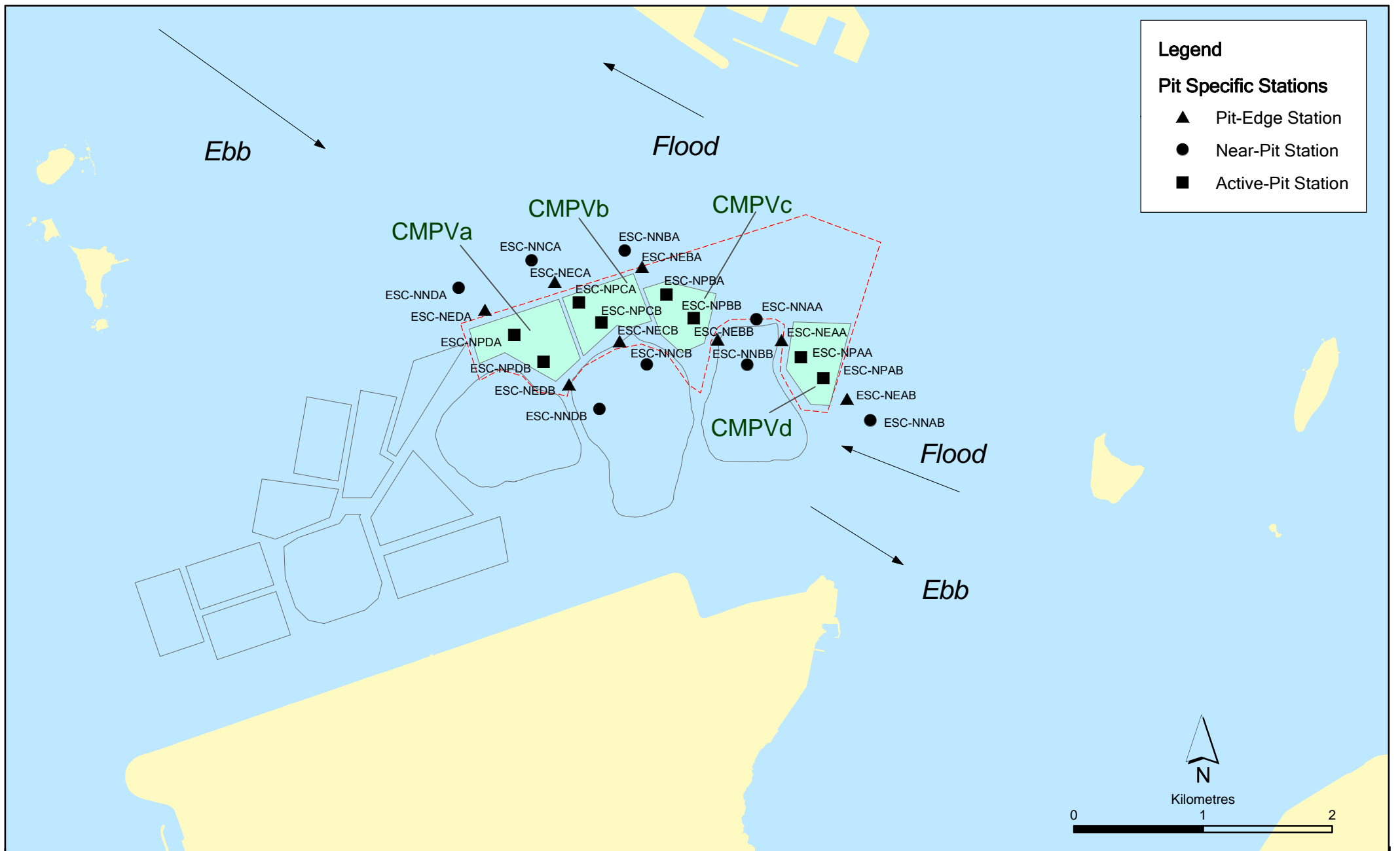


Figure 1.3

Pit Specific Sediment Quality Monitoring Stations for CMPV

File: CMPV\0103262\_SQMS\_pit specific.mxd  
Date: 29/10/2009

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## 1.6.2 *Water Quality Monitoring during Capping of SB CMPs – December 2016*

1.6.3 The monitoring results obtained during December 2016 sampling in the dry season have been assessed for compliance with the WQOs (see *Section 1.5.7* for details). Levels of DO and Turbidity were also assessed for compliance with the Action and Limit Levels (see *Table B4* of *Annex B* for details). A total of fourteen (14) monitoring stations were sampled in December 2016 as shown in *Figure 1.4*. Graphical presentation of the monitoring results is provided in *Annex D*.

### *In-situ Measurements*

1.6.4 Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in *Figures 9 - 14* of *Annex D*. The levels of pH at all stations in December 2016 complied with the WQO (*Table B5* of *Annex B*; *Figure 9* of *Annex D*). The levels of Turbidity at all stations complied with the Action and Limit levels in December 2016 (*Table B5* of *Annex B*; *Figure 10* of *Annex D*). The levels of DO at all stations complied with the WQO and the Action and Limit levels in December 2016 (*Table B5* of *Annex B*; *Figure 12* of *Annex D*). The levels of Salinity at all stations complied with the WQO in December 2016 (*Table B5* of *Annex B*; *Figure 14* of *Annex D*).

### *Laboratory Measurement*

1.6.5 The concentrations of SS were higher than the WQO (13.2 mg/L for dry season) at Tai Ho Bay 1 station in December 2016 (*Table B5* of *Annex B*; *Figure 15* of *Annex D*). However, levels of SS at all stations complied with the Action and Limit Levels (*Table B5* of *Annex B*).

1.6.6 For nutrients, concentrations of Ammonia (NH<sub>3</sub>) were relatively similar amongst all stations (*Table B5* of *Annex B*; *Figure 16* of *Annex D*). The levels of Total Inorganic Nitrogen (TIN) at Tai Ho Bay 1, Tai Ho Bay 2, Sham Shui Kok and Tai Mo To stations were higher the WQO of 0.5 mg/L (*Table B5* of *Annex B*; *Figure 17* of *Annex D*). It should be noted that due to the effect of Pearl River, the North Western WCZ has historically experienced higher levels of TIN<sup>(1)</sup> and such exceedances of TIN WQO at all stations are unlikely to be caused by the capping operation at CMP 2. Levels of 5-Day Biochemical Oxygen Demand (BOD<sub>5</sub>) were relatively similar amongst all stations (*Table B5* of *Annex B*; *Figure 18* of *Annex D*).

1.6.7 Overall, the monitoring results indicated that the capping operation at CMP 2 did not appear to cause any unacceptable deterioration in water quality in December 2016. Statistical analysis will be undertaken and presented in the quarterly report to investigate whether the capping operations at CMP 2 is causing any unacceptable impacts in water quality of the area.

<sup>(1)</sup> [http://www.epd.gov.hk/epd/misc/marine\\_quality/1986-2005/textonly/eng/index.htm](http://www.epd.gov.hk/epd/misc/marine_quality/1986-2005/textonly/eng/index.htm)



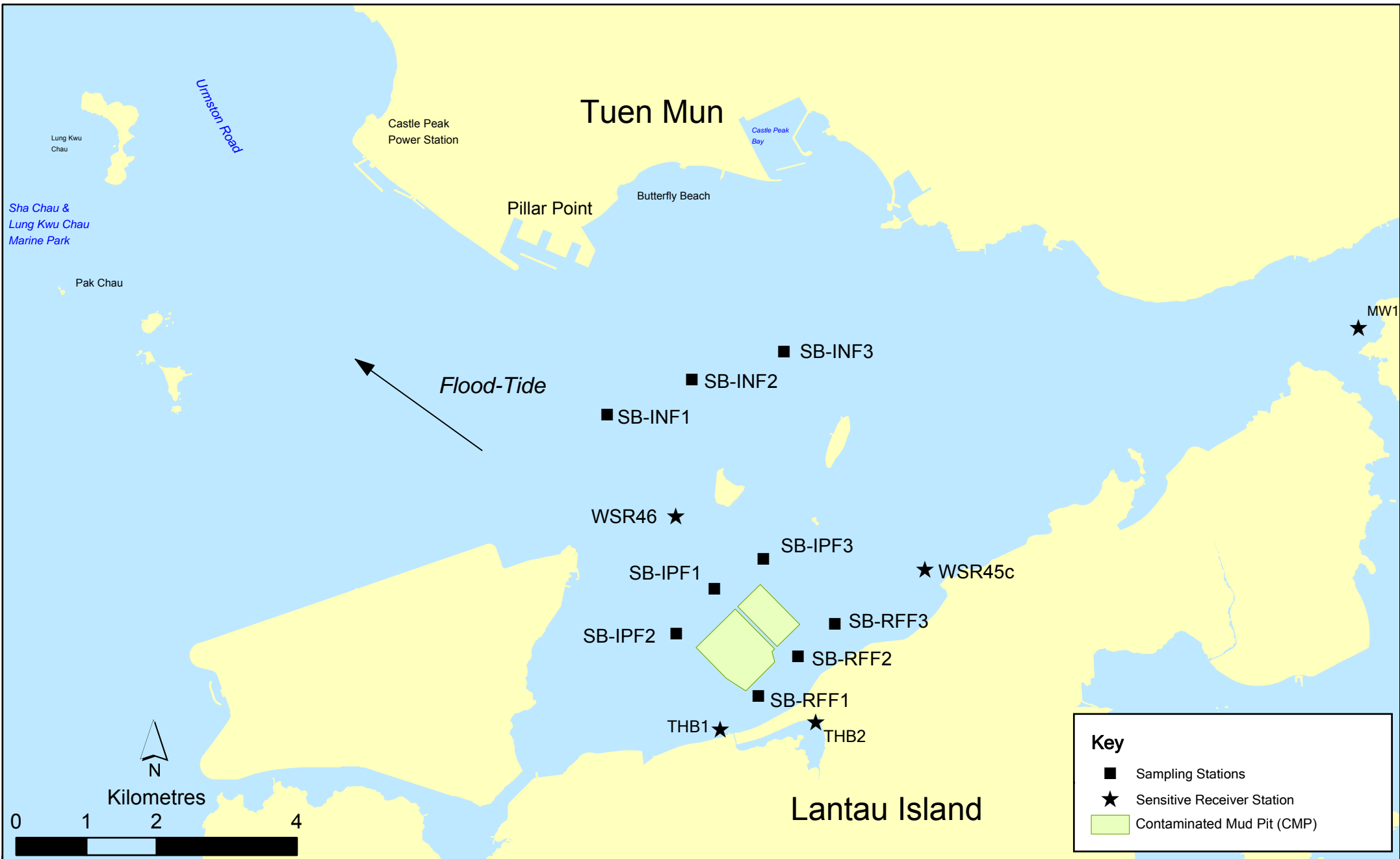


Figure 1.4

Routine & Capping Water Quality Sampling Stations (Flood-Tide) for South Brothers Facility

## **1.7**            *ACTIVITIES SCHEDULED FOR THE NEXT MONTH*

1.7.1            The following monitoring activities will be conducted in the next monthly period of January 2017 for ESC CMPs:

- *Water Column Profiling of ESC CMP Vd;*
- *Routine Water Quality Monitoring of ESC CMPs;*
- *Water Quality Monitoring During Dredging of ESC CMP Vb;*
- *Pit Specific Sediment Chemistry of ESC CMP Vd; and*
- *Demersal Trawling of ESC CMPs.*

1.7.2            No monitoring activities will be scheduled in the next monthly period of January 2017 for SB 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 A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

			2012					2013					2014					2015					2016					2017																		
			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
<b>Capping Water Quality Monitoring</b>																																														
<i>Ebb Tide</i>																																														
Impact Stations Downcurrent	SB-IPE1	4 times per year																																												
	SB-IPE2	4 times per year																																												
	SB-IPE3	4 times per year																																												
	SB-IPE4	4 times per year																																												
	SB-IPE5	4 times per year																																												
Intermediate Stations Downcurrent	SB-INE1	4 times per year																																												
	SB-INE2	4 times per year																																												
	SB-INE3	4 times per year																																												
	SB-INE4	4 times per year																																												
	SB-INE5	4 times per year																																												
Reference Stations Upcurrent	SB-RFE1	4 times per year																																												
	SB-RFE2	4 times per year																																												
	SB-RFE3	4 times per year																																												
	SB-RFE4	4 times per year																																												
	SB-RFE5	4 times per year																																												
Sensitive Receiver Stations	MW1	4 times per year																																												
	THB1	4 times per year																																												
	THB2	4 times per year																																												
	WSR45C	4 times per year																																												
	WSR46	4 times per year																																												
<i>Flood Tide</i>																																														
Impact Stations Downcurrent	SB-IPF1	4 times per year																																												
	SB-IPF2	4 times per year																																												
	SB-IPF3	4 times per year																																												
Intermediate Stations Downcurrent	SB-INF1	4 times per year																																												
	SB-INF2	4 times per year																																												
	SB-INF3	4 times per year																																												
Reference Stations Upcurrent	SB-RFF1	4 times per year																																												
	SB-RFF2	4 times per year																																												
	SB-RFF3	4 times per year																																												
Sensitive Receiver Stations	MW1	4 times per year																																												
	THB1	4 times per year																																												
	THB2	4 times per year																																												
	WSR45C	4 times per year																																												
	WSR46	4 times per year																																												
<b>Benthic Recolonisation Studies</b>																																														
Capped Contaminated Mud Pits	SB-CPA	2 times per year																																												
	SB-CPB	2 times per year																																												
Reference Stations	RBA	2 times per year																																												
	RBB	2 times per year																																												
	RBC	2 times per year																																												

Notes:  
 "n" = 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 December 2016 for Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vb*

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2016/12/02	Mid-Ebb	DS1	6.68	6.61	9.39	12.55
		DS2	6.59	6.51	11.22	14.50
		DS3	6.54	6.48	7.24	9.47
		DS4	6.45	6.49	7.22	9.62
		DS5	6.59	6.55	6.91	9.98
		US1	6.77	6.74	8.44	11.27
		US2	6.77	6.74	9.49	11.88
	Mid-Flood	MW1	6.24	6.26	7.39	7.93
		DS1	6.76	6.81	36.78	17.67
		DS2	6.75	6.77	28.67	14.08
		DS3	6.90	6.87	25.24	11.40
		DS4	6.89	6.85	18.12	14.58
		DS5	6.90	6.84	15.29	8.72
		US1	6.89	6.85	19.93	15.78
		US2	6.81	6.79	16.92	18.08
		MW1	6.18	6.21	9.92	7.97
		2016/12/05	Mid-Ebb	DS1	6.82	6.85
DS2	6.69			6.76	5.13	6.63
DS3	6.60			6.74	4.86	5.87
DS4	6.48			6.68	5.51	12.48
DS5	6.66			6.82	4.03	4.97
US1	6.73			6.79	11.52	13.58
US2	6.76			6.80	4.63	5.55
Mid-Flood	MW1		6.09	6.13	4.23	4.68
	DS1		6.65	6.68	11.94	14.77
	DS2		6.72	6.71	11.29	12.30
	DS3		6.75	6.83	11.61	14.55
	DS4		6.84	6.85	10.43	13.03
	DS5		6.82	6.77	8.29	9.35
	US1		6.75	6.72	10.66	11.80
	US2		6.84	6.78	12.02	14.23
	MW1		6.19	6.24	5.71	7.45
	2016/12/07		Mid-Ebb	DS1	6.53	6.59
DS2		6.37		6.53	4.66	7.60
DS3		6.47		6.61	4.79	6.72
DS4		6.26		6.50	4.49	7.43
DS5		6.23		6.47	4.86	7.67
US1		6.71		6.81	4.44	6.93
US2		6.68		6.86	4.94	7.87
Mid-Flood		MW1	6.06	6.05	2.73	4.92
		DS1	6.69	6.95	11.51	12.28
		DS2	6.65	6.84	13.69	14.00
		DS3	6.79	7.04	8.99	13.53
		DS4	7.02	7.16	8.13	13.40
		DS5	7.27	7.30	5.14	15.50
		US1	6.58	6.70	5.63	7.38
		US2	6.73	6.91	5.38	6.47
		MW1	6.03	6.15	3.16	7.68



Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
2016/12/09	Mid-Ebb	DS1	6.93	6.83	4.04	5.28
		DS2	6.97	6.96	3.46	5.58
		DS3	6.83	6.93	3.19	8.57
		DS4	6.66	6.85	3.66	8.37
		DS5	6.86	6.85	3.71	4.12
		US1	6.74	6.86	4.66	3.70
		US2	6.85	6.93	3.56	7.48
	MW1	6.06	6.09	2.53	3.12	
	Mid-Flood	DS1	6.96	6.95	4.04	4.07
		DS2	6.87	6.95	5.01	4.48
		DS3	6.77	6.89	7.93	4.22
		DS4	6.82	6.86	4.81	3.63
		DS5	6.93	6.93	2.99	4.38
		US1	6.92	6.97	3.84	5.40
		US2	7.00	7.04	6.32	5.20
		MW1	5.98	6.02	2.89	2.78
2016/12/12		Mid-Ebb	DS1	7.12	7.17	4.18
	DS2		7.09	7.19	4.32	4.25
	DS3		7.12	7.20	5.12	3.55
	DS4		7.00	7.18	5.24	4.45
	DS5		7.20	7.35	4.31	4.63
	US1		7.07	7.10	4.89	5.73
	US2		7.01	7.04	4.87	5.28
	MW1	6.14	6.20	5.06	6.57	
	Mid-Flood	DS1	7.29	7.42	5.99	5.95
		DS2	7.39	7.48	7.39	7.17
		DS3	7.34	7.39	8.22	7.42
		DS4	7.37	7.45	7.20	5.97
		DS5	7.40	7.44	9.46	8.75
		US1	7.37	7.56	7.27	7.82
		US2	7.43	7.60	7.84	8.70
		MW1	6.27	6.29	5.31	5.67
2016/12/14		Mid-Ebb	DS1	7.31	7.39	4.59
	DS2		7.09	7.42	4.57	14.05
	DS3		7.05	7.36	4.46	21.45
	DS4		6.84	7.28	3.91	23.07
	DS5		6.93	7.37	6.35	24.77
	US1		7.29	7.40	4.87	9.93
	US2		7.37	7.38	5.11	12.80
	MW1	6.73	6.81	4.59	24.23	
	Mid-Flood	DS1	7.22	7.17	15.17	17.50
		DS2	7.26	7.23	14.99	15.80
		DS3	7.28	7.26	15.24	22.35
		DS4	7.30	7.29	14.64	20.32
		DS5	7.13	7.02	14.19	25.70
		US1	7.21	7.22	19.33	18.53
		US2	7.21	7.22	19.68	19.57
		MW1	6.74	6.82	16.12	16.82
2016/12/16		Mid-Ebb	DS1	7.21	7.32	12.09
	DS2		7.23	7.40	3.76	4.57
	DS3		7.34	7.45	7.14	6.78
	DS4		6.92	7.26	4.79	7.62
	DS5		7.06	7.31	5.61	6.18

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
	Mid-Flood	US1	7.38	7.52	4.64	4.97
		US2	7.49	7.52	5.51	5.75
		MW1	7.05	7.09	5.97	5.08
		DS1	7.32	7.30	13.07	13.07
		DS2	7.33	7.32	15.65	16.18
		DS3	7.32	7.35	13.23	11.53
		DS4	7.47	7.49	17.55	14.83
		DS5	7.48	7.44	13.16	11.48
		US1	7.36	7.31	10.15	10.23
		US2	7.30	7.28	12.36	14.32
		MW1	6.91	6.97	11.61	12.73
2016/12/19	Mid-Ebb	DS1	7.65	7.88	4.34	5.73
		DS2	7.60	7.64	4.19	5.20
		DS3	7.44	7.62	4.66	5.25
		DS4	7.36	7.58	5.01	6.00
		DS5	7.26	7.38	6.82	7.95
		US1	7.73	7.88	3.74	5.27
		US2	7.65	7.87	4.27	5.30
		MW1	7.15	7.22	3.06	4.00
	Mid-Flood	DS1	7.45	7.48	14.74	17.32
		DS2	7.45	7.52	15.49	16.52
		DS3	7.46	7.49	12.46	13.03
		DS4	7.52	7.58	8.12	9.13
		DS5	7.40	7.51	6.92	7.97
		US1	7.40	7.47	8.50	9.77
		US2	7.49	7.50	8.25	9.53
		MW1	7.14	7.20	6.99	9.20
2016/12/21	Mid-Ebb	DS1	7.44	7.50	3.16	6.60
		DS2	7.42	7.50	3.94	7.35
		DS3	7.41	7.51	4.09	6.32
		DS4	7.33	7.46	4.71	5.60
		DS5	7.45	7.52	3.89	6.18
		US1	7.37	7.49	3.34	4.73
		US2	7.41	7.53	3.52	5.28
		MW1	7.20	7.35	2.61	5.75
	Mid-Flood	DS1	7.33	7.64	6.56	12.22
		DS2	7.42	7.73	4.91	5.17
		DS3	7.52	7.71	4.46	7.60
		DS4	7.45	7.75	4.46	6.67
		DS5	7.46	7.59	5.76	7.80
		US1	7.58	7.77	4.08	5.33
		US2	7.57	7.75	4.21	7.40
		MW1	7.08	7.17	4.67	8.15
2016/12/23	Mid-Ebb	DS1	7.15	7.30	3.38	4.00
		DS2	7.18	7.34	2.95	3.43
		DS3	7.17	7.31	3.64	4.72
		DS4	6.96	7.18	3.39	4.73
		DS5	7.20	7.33	2.53	4.03
		US1	7.31	7.52	2.80	3.13
	Mid-Flood	US2	7.34	7.54	3.51	3.45
		MW1	6.98	7.06	2.37	4.02
		DS1	7.23	7.81	3.91	5.83
		DS2	7.58	7.82	5.06	9.67

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
		DS3	7.34	8.07	4.63	5.88
		DS4	7.50	8.07	4.74	6.33
		DS5	7.55	8.47	5.10	5.97
		US1	7.54	8.02	3.61	6.18
		US2	7.62	7.95	4.03	5.55
		MW1	7.22	7.32	3.05	3.72
2016/12/27	Mid-Ebb	DS1	7.78	7.79	5.86	7.22
		DS2	7.73	7.86	4.76	6.08
		DS3	7.84	7.92	4.57	5.79
		DS4	7.91	8.05	4.91	5.39
		DS5	7.84	7.90	4.01	5.10
		US1	7.39	7.45	8.57	9.72
		US2	8.06	8.12	6.21	7.45
	Mid-Flood	MW1	6.90	7.00	3.64	3.93
		DS1	7.94	8.17	13.76	11.53
		DS2	7.80	7.98	10.81	11.06
		DS3	8.04	8.12	7.57	9.09
		DS4	8.27	8.34	7.55	9.71
		DS5	8.19	8.26	6.75	7.55
		US1	8.39	8.44	5.71	7.02
		US2	8.19	8.23	4.34	5.50
		MW1	7.26	7.22	4.11	3.79
		2016/12/29	Mid-Ebb	DS1	7.71	7.79
DS2	7.67			7.68	3.72	6.27
DS3	7.57			7.60	3.41	5.70
DS4	7.65			7.63	4.24	8.52
DS5	7.73			7.76	4.79	8.58
US1	7.79			7.81	4.32	6.37
US2	7.90			7.93	5.01	7.03
Mid-Flood	MW1		7.32	7.37	4.69	8.13
	DS1		7.66	7.66	8.02	12.48
	DS2		7.74	7.71	11.68	13.03
	DS3		7.70	7.61	10.58	12.30
	DS4		7.45	7.42	10.43	15.28
	DS5		7.40	7.34	6.46	9.72
	US1		7.66	7.62	7.84	8.20
	US2		7.67	7.65	7.74	9.22
	MW1		7.28	7.33	5.29	11.70

Notes:

1. Please refer to Table B2 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*

<b>Parameter</b>	<b>Action Level</b>	<b>Limit Level</b>
Dissolved Oxygen (DO) <sup>(1)</sup>	<u>Surface and Mid-depth</u> <sup>(2)</sup> 5%-ile of baseline data for surface and middle layer = <b>3.76 mg L<sup>-1</sup></b>	<u>Surface and Mid-depth</u> <sup>(2)</sup> 1%-ile of baseline data for surface and middle layer = <b>3.11 mg L<sup>-1</sup></b> <sup>(3)</sup>
	and	and
	Significantly less than the reference stations mean DO (at the same tide of the same day)	Significantly less than the reference stations mean DO (at the same tide of the same day)
	<u>Bottom</u> 5%-ile of baseline data for bottom layers = <b>2.96 mg L<sup>-1</sup></b>	<u>Bottom</u> The average of the impact station readings are <b>&lt;2 mg/L<sup>-1</sup></b>
	and	and
	Significantly less than the reference stations mean DO (at the same tide of the same day)	Significantly less than the reference stations mean DO (at the same tide of the same day)
Depth-averaged Suspended Solids (SS) <sup>(4)(5)</sup>	95%-ile of baseline data for depth average = <b>37.88 mg L<sup>-1</sup></b>	99%-ile of baseline data for depth average = <b>61.92 mg L<sup>-1</sup></b>
	and	and
	120% of control station's SS at the same tide of the same day	130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) <sup>(4)(5)</sup>	95%-ile of baseline data = <b>28.14 NTU</b>	99%-ile of baseline data = <b>38.32 NTU</b>
	and	and
	120% of control station's Tby at the same tide of the same day	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<sup>-1</sup>, it is proposed to set the Limit Level at 3.11 mg L<sup>-1</sup> 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** *Water Column Profiling Results for ESC CMP Vd in December 2016*

Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%) (mg L <sup>-1</sup> )		pH (mg L <sup>-1</sup> )	Suspended Solids (mg L <sup>-1</sup> )
WCP 1 (Downstream)	22.53	31.05	7.72	91.00	6.58	8.04	22.53
WCP 2 (Upstream)	22.09	30.87	11.13	93.57	6.83	8.00	22.09
WQO (Dry season)	N/A	27.79 – 33.96#	N/A	N/A	>4	6.5-8.5	13.2

**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.

**Table B4 Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities for SB CMPs**

<b>Parameter</b>	<b>Action Level</b>	<b>Limit Level</b>
Dissolved Oxygen (DO) <sup>(1)</sup>	<u>Surface and Mid-depth</u> <sup>(2)</sup> The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for surface and middle layer = <b>4.32 mg L<sup>-1</sup></b>  and  Significantly less than the reference stations mean DO (at the same tide of the same day)	<u>Surface and Mid-depth</u> <sup>(2)</sup> The average of the impact, WSR 45C and WSR 46 station readings are < <b>4 mg L<sup>-1</sup></b>  and  Significantly less than the reference stations mean DO (at the same tide of the same day)
	<u>Bottom</u> The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for bottom layers = <b>3.12 mg L<sup>-1</sup></b>  and  Significantly less than the reference stations mean DO (at the same tide of the same day)	<u>Bottom</u> The average of the impact station, WSR 45C and WSR 46 readings are < <b>2 mg L<sup>-1</sup></b>  and  Significantly less than the reference stations mean DO (at the same tide of the same day)
Depth-averaged Suspended Solids (SS) <sup>(3)(4)</sup>	The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data for depth average = <b>21.60 mg L<sup>-1</sup></b>  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 = <b>40.10 mg L<sup>-1</sup></b>  and  130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) <sup>(3)(4)</sup>	The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data = <b>25.04 NTU</b>  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 = <b>32.68 NTU</b>  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 B5** *Monitoring Results for Water Quality Monitoring during Capping of SB CMP in December 2016*

Sampling Period	Stations	Temp	Salinity	Turbidity	Dissolved Oxygen	pH	SS	NH3	TIN	BOD <sub>5</sub>	
		(°C)	(ppt)	(NTU)	(%)	(mg L <sup>-1</sup> )	(mg L <sup>-1</sup> )	(mg L <sup>-1</sup> )	(mg L <sup>-1</sup> )	(mg L <sup>-1</sup> )	(mg L <sup>-1</sup> )
December 2016	RFF (Reference)	22.26	29.33	5.95	92.94	6.82	8.05	8.86	0.07	0.49	1.76
	IPF (Impact)	22.40	29.59	8.47	91.55	6.69	7.98	10.81	0.08	0.50	1.54
	INF (Intermediate)	22.70	30.46	7.19	86.76	6.28	8.01	8.22	0.08	0.37	1.59
	Ma Wan	22.70	30.63	6.18	84.81	6.13	8.07	6.75	0.09	0.35	1.67
	Sham Shui Kok	22.40	29.79	3.37	90.63	6.62	8.00	4.40	0.18	1.04	1.83
	Tai Mo To	22.39	29.60	4.83	92.45	6.76	8.04	7.15	0.18	1.01	1.27
	Tai Ho Bay 1	22.31	29.37	10.22	94.26	6.91	7.83	13.67	0.12	0.92	1.33
	Tai Ho Bay 2	23.17	28.71	8.73	86.82	6.29	7.95	7.53	0.16	0.92	1.97
	WQO	N/A	26.40-32.27*	N/A	N/A	>4	6.5-8.5	13.2	N/A	0.50	N/A

**Notes:**

# Not exceeding 2°C of change of the results from the Reference Station.

#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 Vb



Table C1 Dredging Record at ESC CMP Vb

Date	Daily Dredging Volume (m <sup>3</sup> )	Weekly Dredging Volume (m <sup>3</sup> ) (From Sunday to Saturday)
27-Nov-2016	5,200	47,450
28-Nov-2016	4,550	
29-Nov-2016	5,850	
30-Nov-2016	8,450	
01-Dec-2016	9,750	
02-Dec-2016	7,800	
03-Dec-2016	5,850	
04-Dec-2016	5,200	29,900
05-Dec-2016	5,200	
06-Dec-2016	5,850	
07-Dec-2016	5,200	
08-Dec-2016	5,850	
09-Dec-2016	2,600	
10-Dec-2016	0	
11-Dec-2016	0	21,450
12-Dec-2016	0	
13-Dec-2016	1,300	
14-Dec-2016	5,850	
15-Dec-2016	3,900	
16-Dec-2016	5,200	
17-Dec-2016	5,200	
18-Dec-2016	7,930	43,160
19-Dec-2016	7,930	
20-Dec-2016	5,850	
21-Dec-2016	5,850	
22-Dec-2016	3,900	
23-Dec-2016	3,900	
24-Dec-2016	7,800	
25-Dec-2016	5,850	18,850
26-Dec-2016	5,850	
27-Dec-2016	5,200	
28-Dec-2016	1,950	
29-Dec-2016	0	
30-Dec-2016	0	
31-Dec-2016	0	

Annex D

## Graphical Presentations

**Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at ESC CMP Vd  
November 2016**

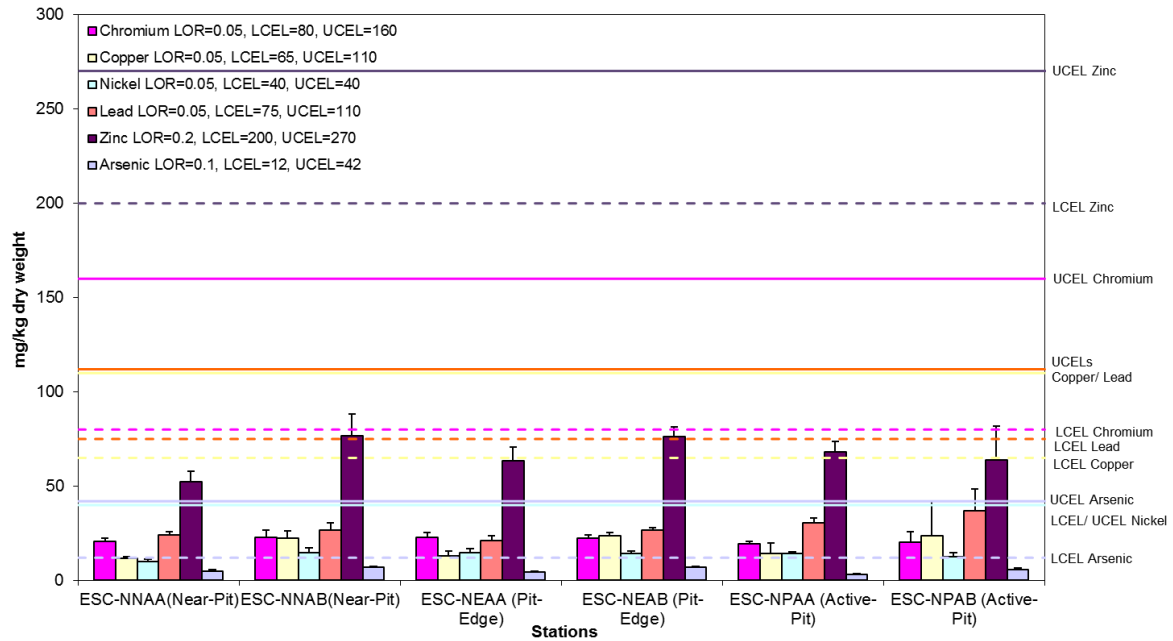


Figure 1: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in November 2016.

**Pit Specific Sediment Chemistry for Metal Contaminants at ESC CMP Vd  
November 2016**

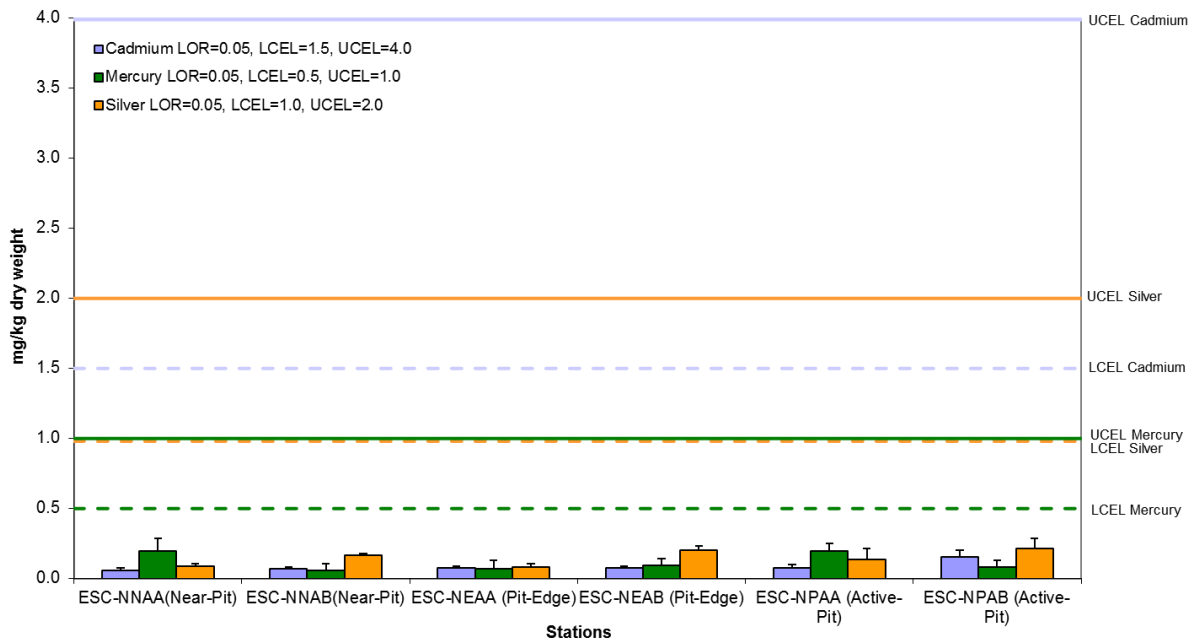


Figure 2: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in November 2016.

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**Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at ESC CMP Vd  
November 2016**

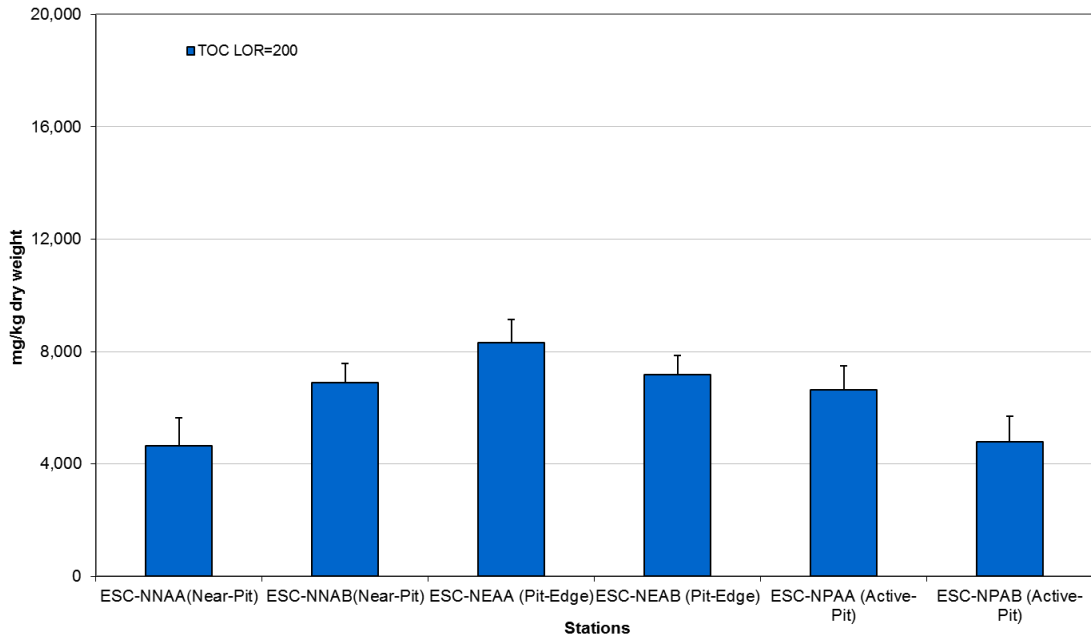


Figure 3: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in November 2016.

**Pit Specific Sediment Chemistry for Tributyltin (TBT) at ESC CMP Vd  
November 2016**

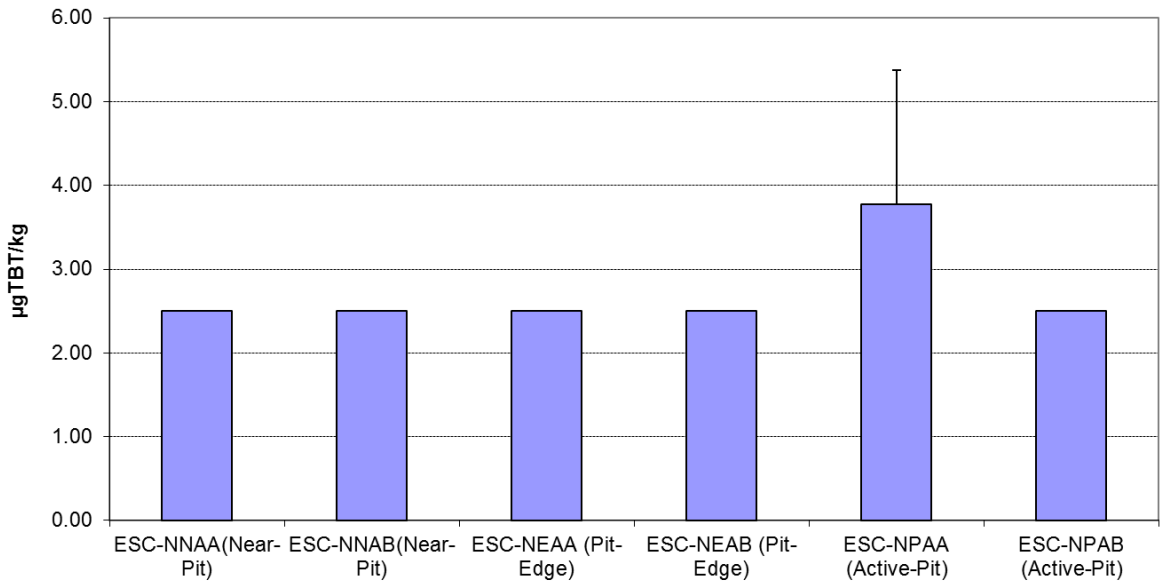


Figure 4: Concentration of Tributyltin (TBT) (µg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in November 2016.

**Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at ESC CMP Vd  
December 2016**

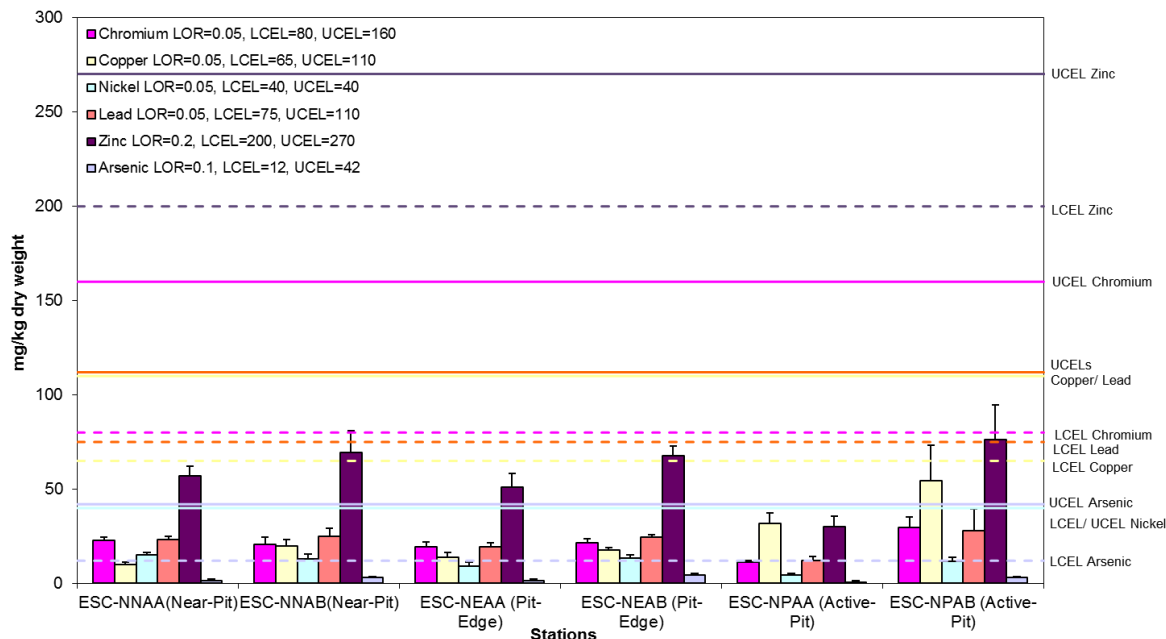


Figure 5: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in December 2016.

**Pit Specific Sediment Chemistry for Metal Contaminants at ESC CMP Vd  
December 2016**

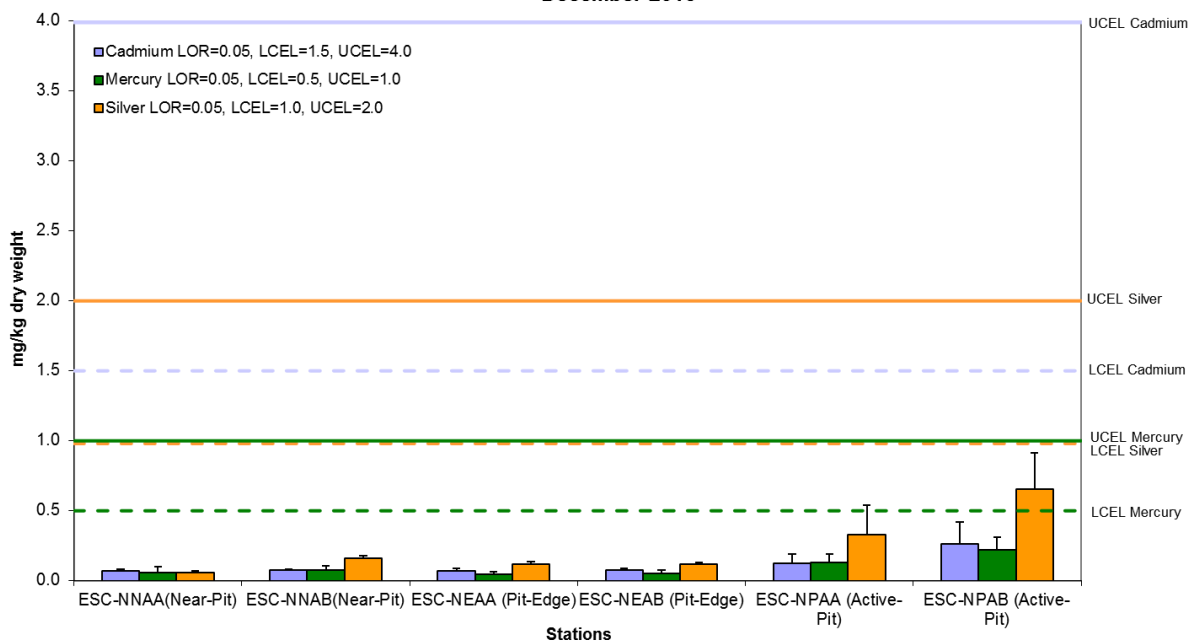


Figure 6: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in December 2016.

**Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at ESC CMP Vd  
December 2016**

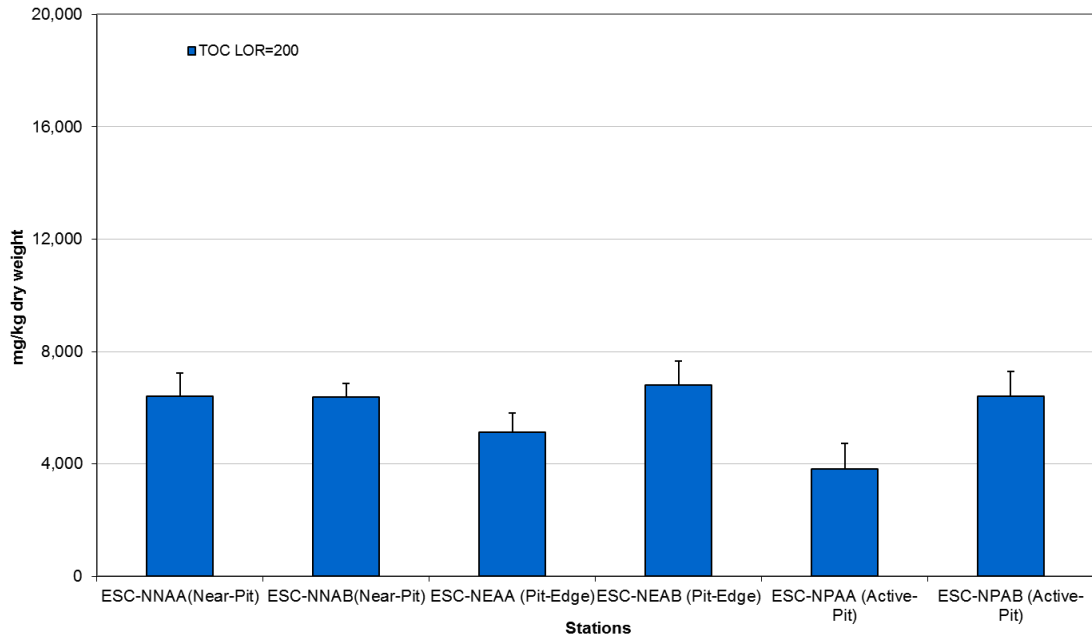


Figure 7: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in December 2016.

**Pit Specific Sediment Chemistry for Tributyltin (TBT) at ESC CMP Vd  
December 2016**

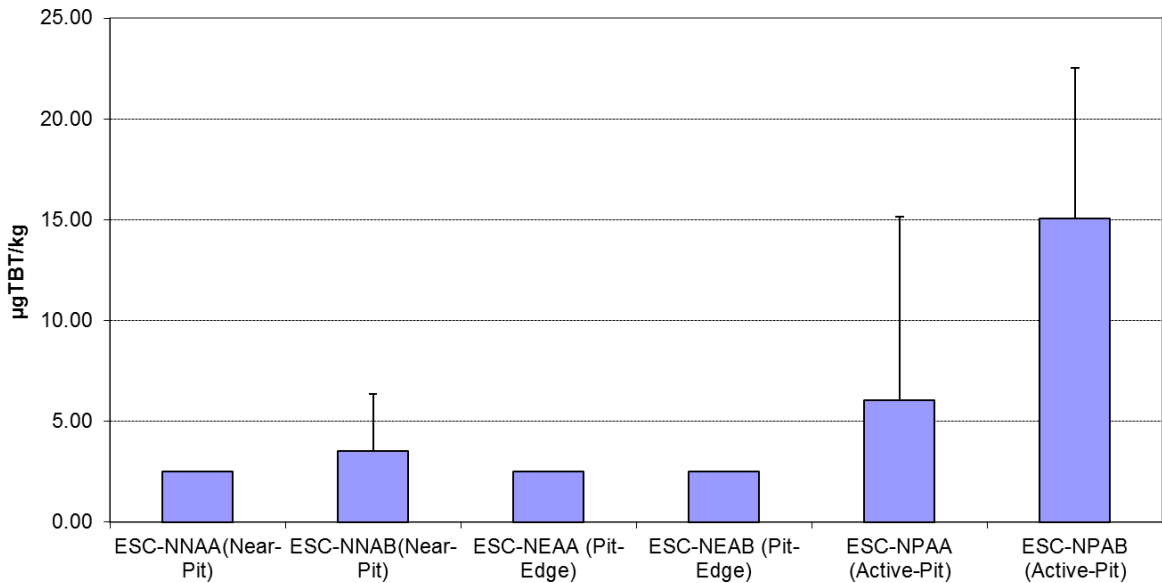


Figure 8: Concentration of Tributyltin (TBT) (µg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in December 2016.

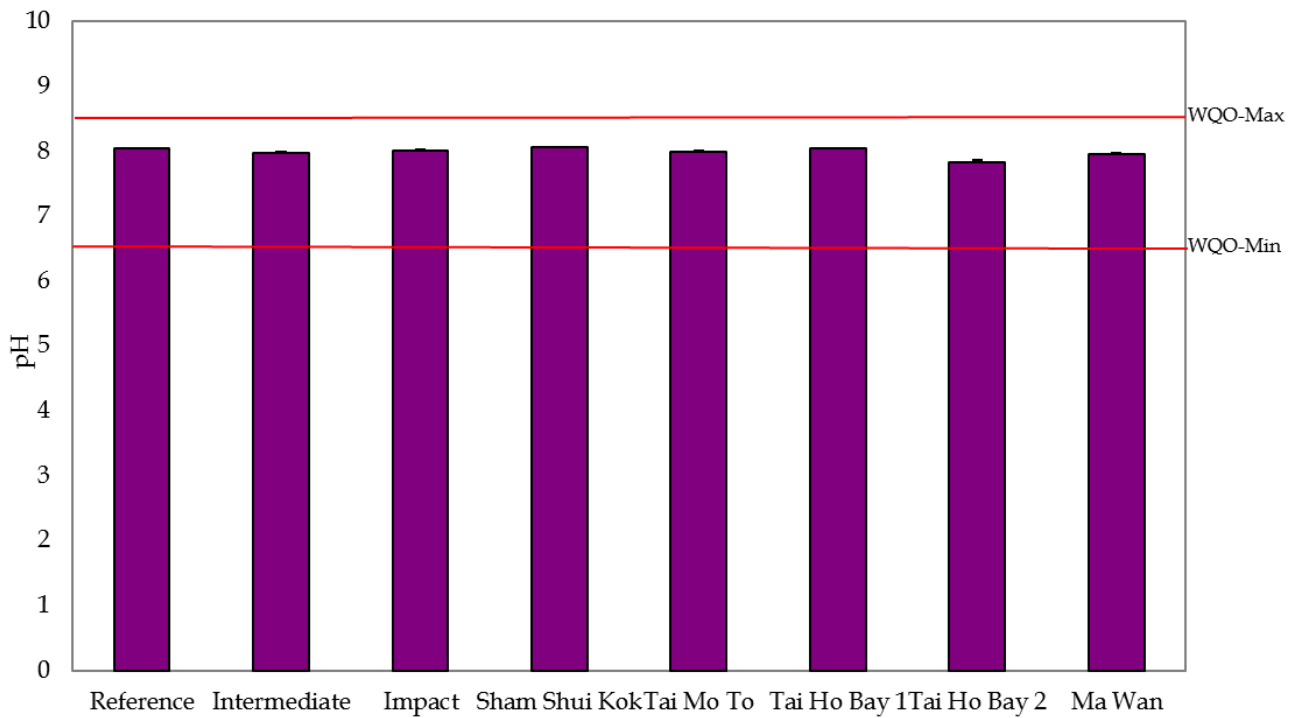


Figure 9: Levels of pH (mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in December 2016.

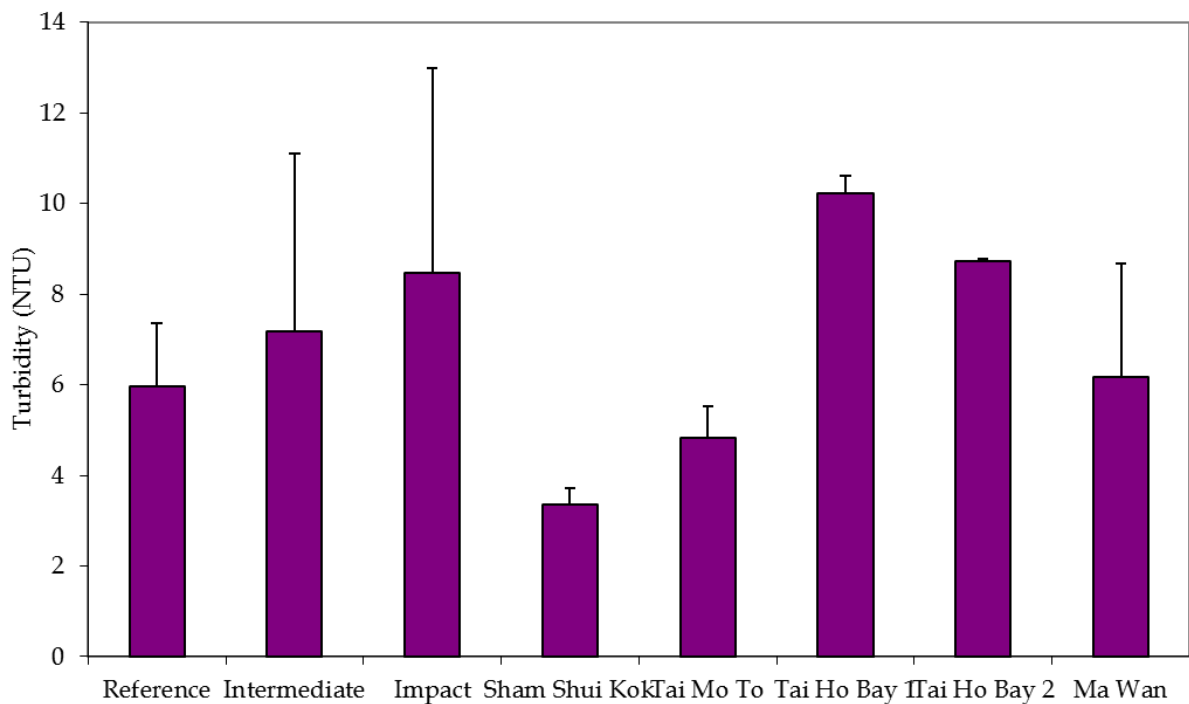


Figure 10: Levels of Turbidity (NTU; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in December 2016

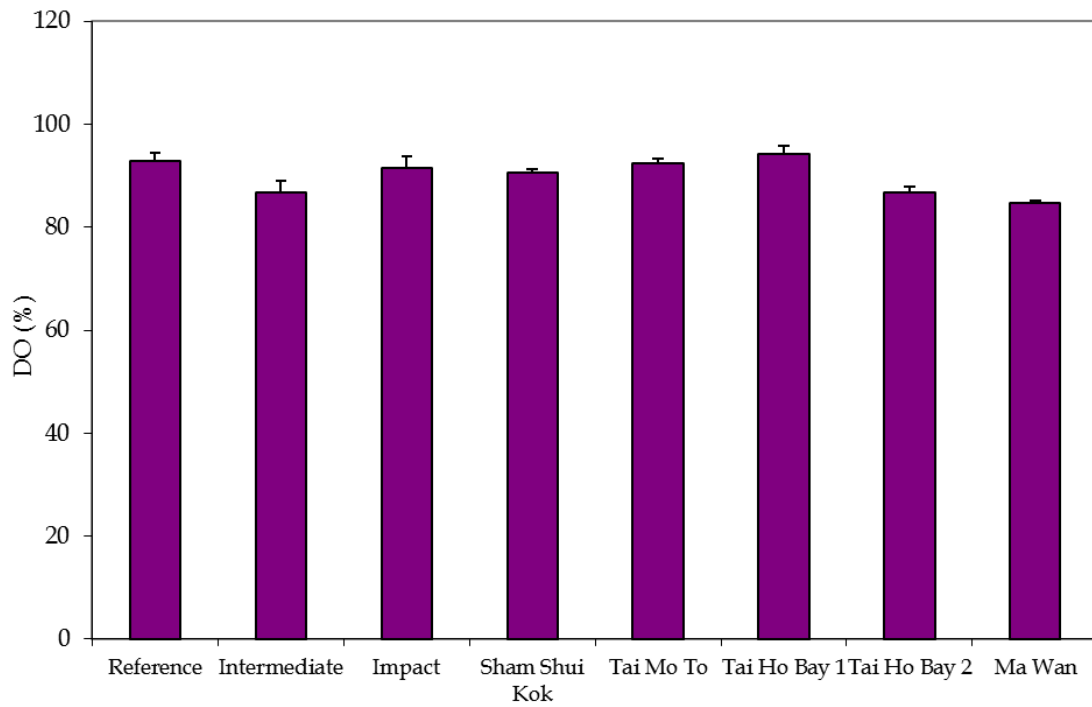


Figure 11: Levels of Dissolved Oxygen (% saturation; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in December 2016

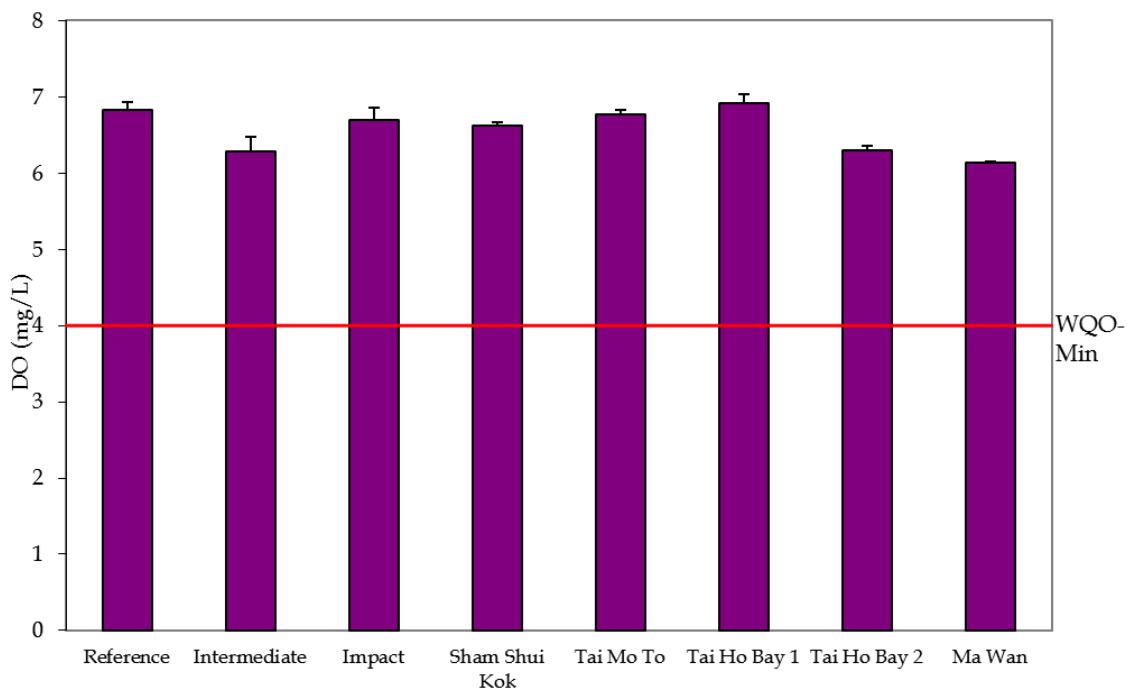


Figure 12: Levels of Dissolved Oxygen (mg/L; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in December 2016

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Resources  
Management**





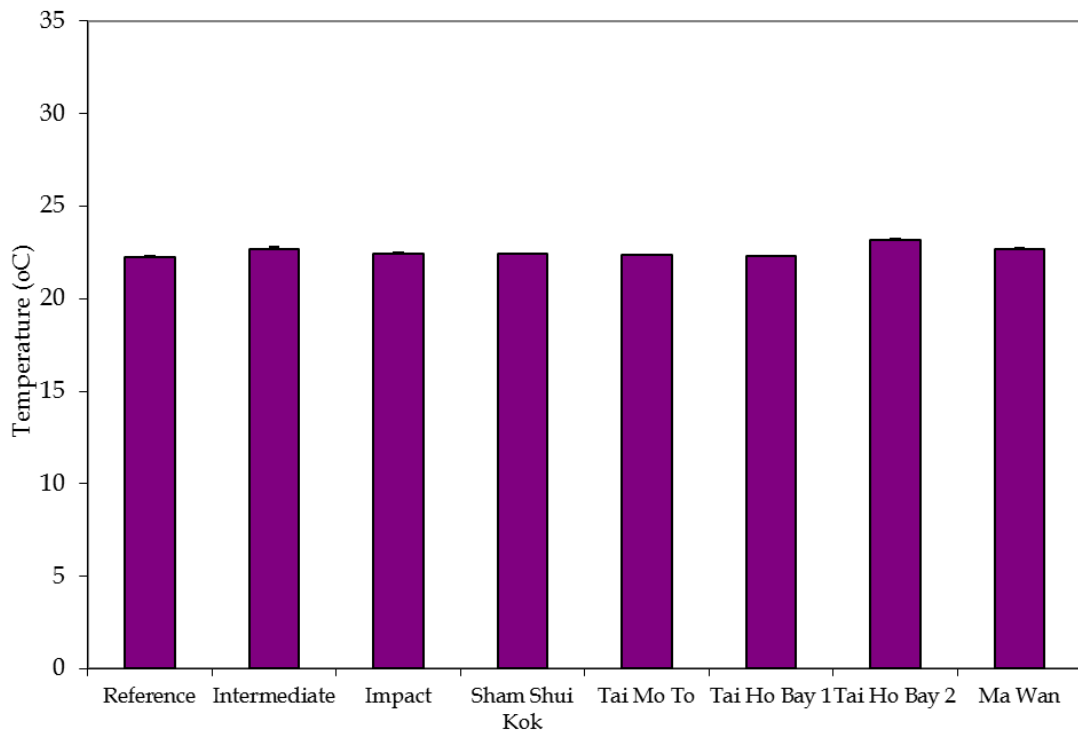


Figure 13: Levels of Temperature (°C; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in December 2016.

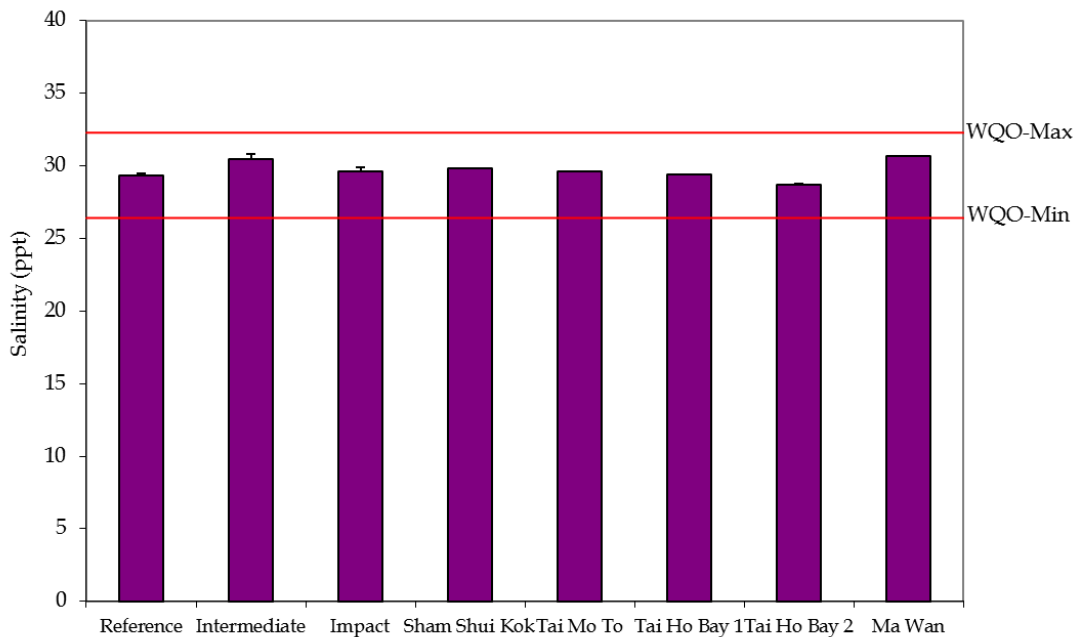


Figure 14: Levels of Salinity (ppt; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in December 2016.

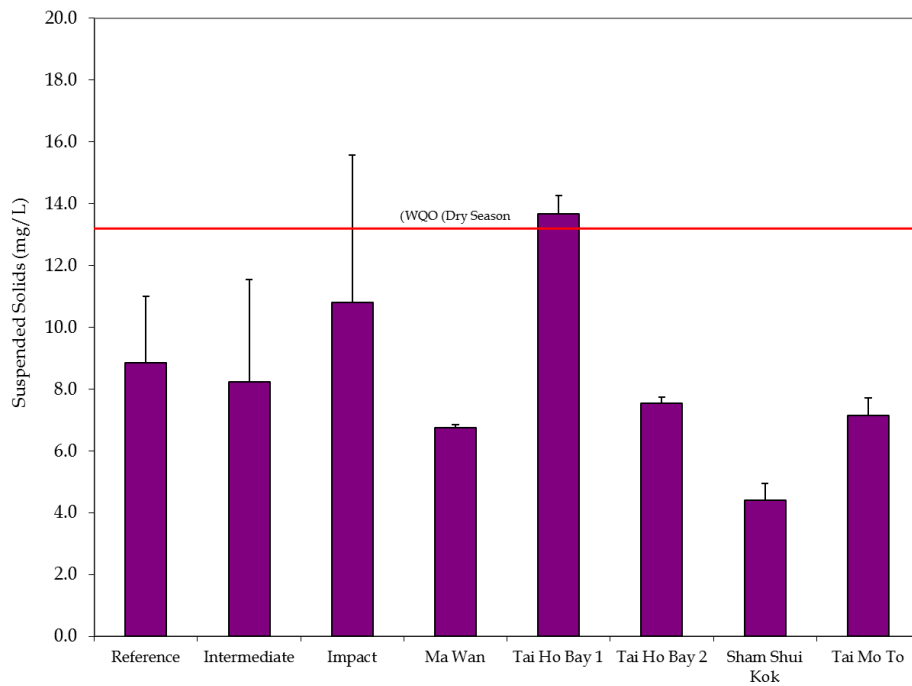


Figure 15: Levels of Suspended Solids (mg/L; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in December 2016

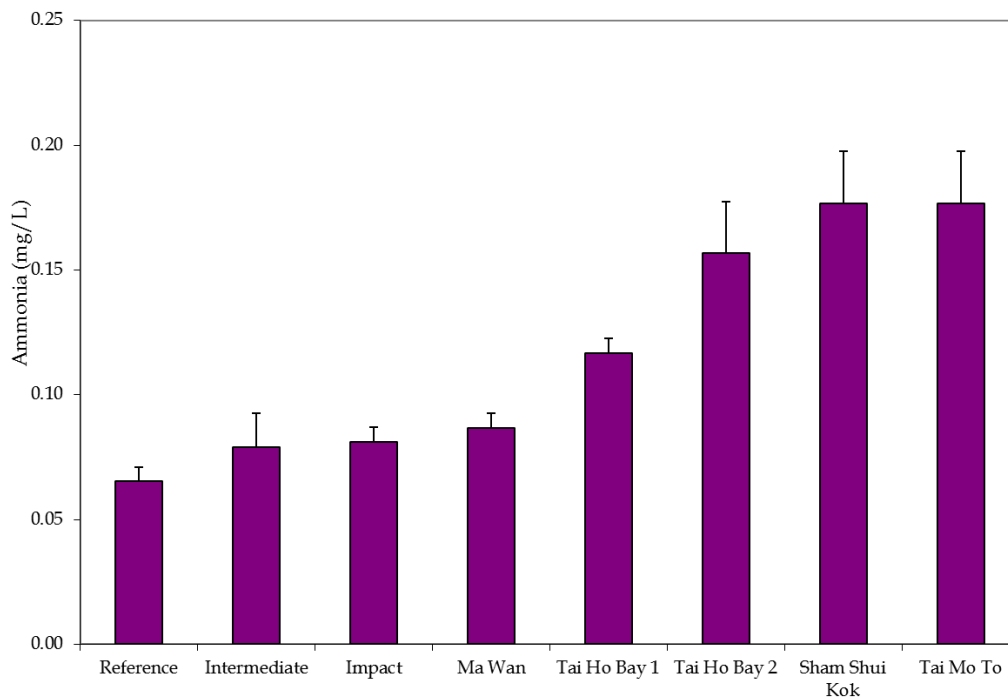


Figure 16: Level of Ammonia (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 2 in December 2016.

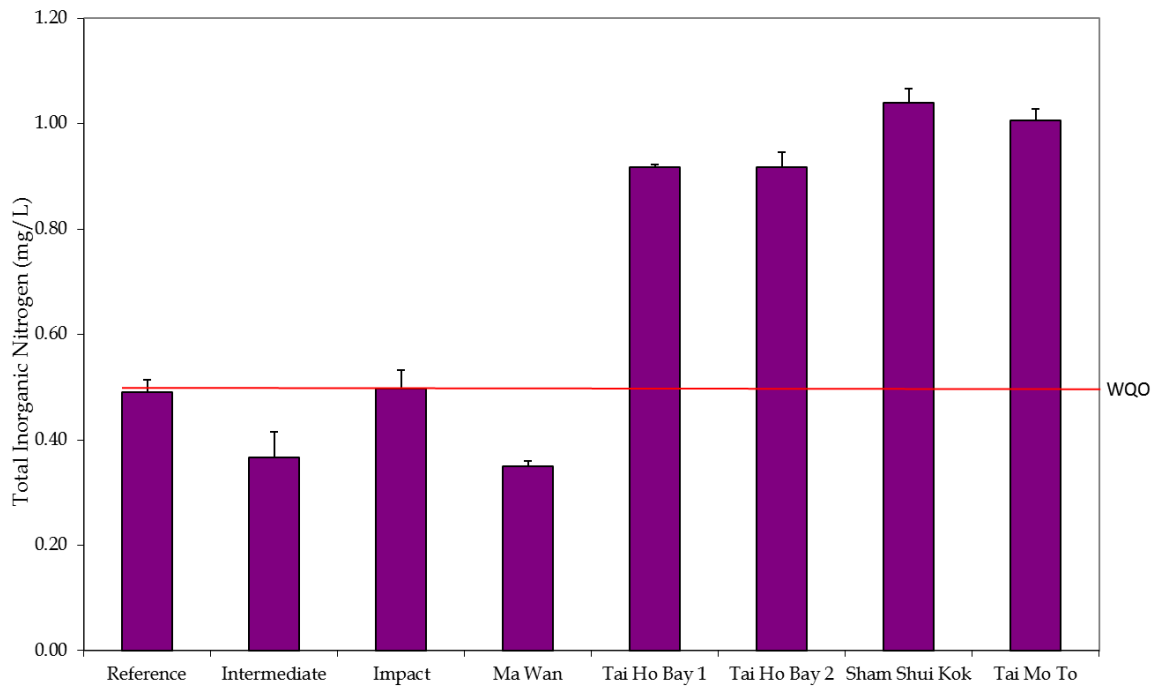


Figure 17: Level of TIN (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 2 in December 2016

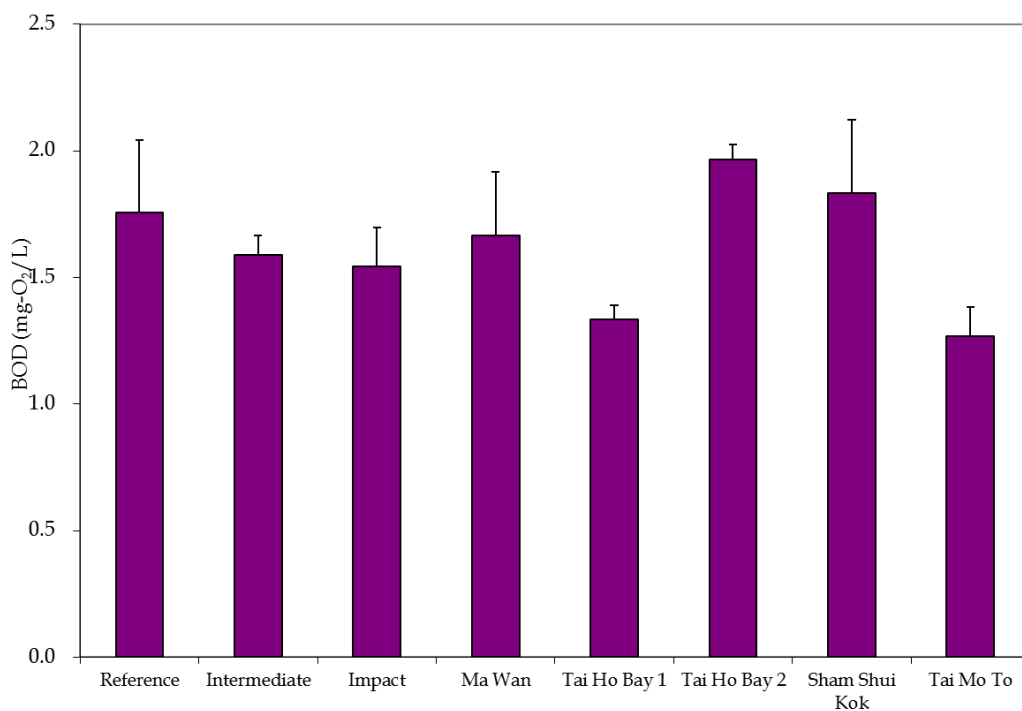


Figure 18: Level of BOD<sub>5</sub> (mg-O<sub>2</sub>/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 2 in December 2016.

Annex E

## Study Programme

