土木工程拓展署
Civil Engineering and Development Department

Agreement No. CE 63/2016 (EP)

Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2017-2020) – Investigation

Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau and the South of The Brothers – June 2017

Final (Revision 1)

28 July 2017

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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/~~Plan~~ to be ~~Certified~~/ Verified:	Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau and the South of The Brothers – June 2017
Date of Report:	12 July 2017
Date prepared by ET:	12 July 2017
Date received by IA:	12 July 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.

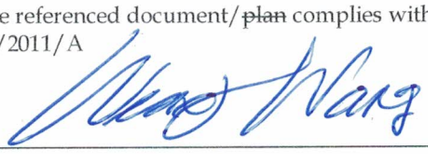
ET Certification

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

Jovy Tam,
Environmental Team Leader:  Date: 12/7/2017

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: 12/7/2017

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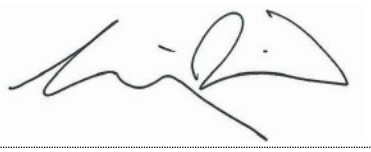
Client:	Project No:
Civil Engineering and Development Department (CEDD)	0400720
Summary: This document presents the Monthly EM&A Report for *Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau and the South of The Brothers*.	Date: 28 July 2017 Approved by:  Craig A. Reid *Partner*

Revision	Description	By	Checked	Approved	Date
v1	Monthly EM&A Report for ESC CMPs and SB CMPs	RC	JT	CAR	28/7/17
v0	Monthly EM&A Report for ESC CMPs and SB CMPs	RC	JT	CAR	12/7/17

Distribution

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ANNEXES

Agreement No. CE 63/2016 (EP)
Environmental Monitoring and Audit
for Disposal Facility to the East of Sha Chau (2017-2020) - Investigation

MONTHLY EM&A REPORT FOR JUNE 2017

1.1 BACKGROUND

1.1.1 The Civil Engineering and Development Department (CEDD) is managing a number of marine disposal facilities in Hong Kong waters, including the Contaminated Mud Pits (CMPs) to the South of The Brothers (SB) and to the East of Sha Chau (ESC) for the disposal of contaminated sediment, and open-sea disposal grounds located to the South of Cheung Chau (SCC), East of Tung Lung Chau (ETLC) and East of Ninepins (ENP) for the disposal of uncontaminated sediment. Two Environmental Permits (EPs), EP-312/2008/A and EP-427/2011/A, were issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 and 23 December 2011 for the Dredging, Management and Capping of Contaminated Sediment Disposal Facilities at ESC CMP V and SB CMPs, respectively.

1.1.2 Under the requirements of the two EPs for ESC CMP V and SB CMPs, EM&A programmes which encompass water and sediment chemistry, fisheries assessment, tissue and whole body analysis, sediment toxicity and benthic recolonisation studies as set out in the EM&A Manuals are required to be implemented. EM&A programmes have been continuously carried out during the operation of the CMPs at ESC and SB. A review of the collection and analysis of such environmental data from the monitoring programme demonstrated that there had not been any adverse environmental impacts resulting from disposal activities [(1)(2)(3)(4)(5)]. The current programme will assess the impacts resulting from dredging, disposal and capping operations of CMP V as well as capping operations of SB CMPs.

(1) ERM (2013) Environmental Monitoring and Audit for Contaminated Mud Pit V at East of Sha Chau. Final Report. For CEDD.

(2) ERM (2014) Environmental Monitoring and Audit for Contaminated Mud Pit V at East of Sha Chau (2012 - 2017). Final First Annual Review Report. For CEDD.

(3) ERM (2015) Environmental Monitoring and Audit for Contaminated Mud Pit V at East of Sha Chau (2012 - 2017). Final Second Annual Review Report. For CEDD.

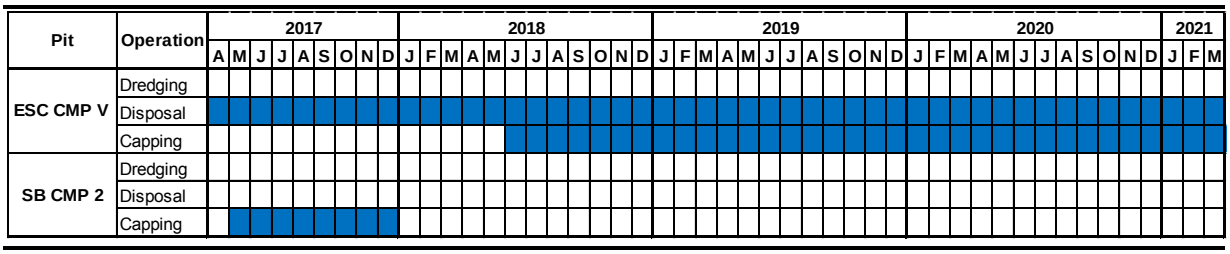
(4) ERM (2016) Environmental Monitoring and Audit for Contaminated Mud Pit V at East of Sha Chau (2012 - 2017). Final Third Annual Review Report. For CEDD.

(5) ERM (2017) Environmental Monitoring and Audit for Contaminated Mud Pit V at East of Sha Chau (2012 - 2017). Final Fourth Annual Review Report. For CEDD.

1.1.3 The present EM&A programme under *Agreement No. CE 63/2016 (EP)* covers the dredging, disposal and capping operations of the ESC CMP V as well as the capping operations of the SB CMPs (see *Annex A* for the EM&A programme). Detailed works schedule for ESC CMP V and SB CMPs is shown in *Figure 1.1*. In June 2017, the following works were being undertaken:

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

Figure 1.1 Works Schedule for ESC CMP V and SB CMPs



1.2 REPORTING PERIOD

1.2.1 This *Monthly EM&A Report for June 2017* covers the EM&A activities for the reporting month of June 2017.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

1.3.1 The following monitoring activities were undertaken for ESC CMP V in June 2017:

- *Pit Specific Sediment Chemistry of ESC CMP Vd* was undertaken on 13 June 2017;
- *Cumulative Impact Sediment Chemistry of ESC CMPs* was undertaken on 13 and 14 June 2017;
- *Water Column Profiling of ESC CMP Vd* was undertaken on 17 June 2017; and
- *Sediment Chemistry after a Major Storm of ESC CMPs* was undertaken on 19 June 2017.

1.3.2 The following monitoring activity was undertaken for SB CMP 2 in June 2017:

- *Water Quality Monitoring During Capping of SB CMPs* was undertaken on 16 June 2017.

1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS

1.4.1 No outstanding sampling remained for June 2017.

1.4.2 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 *Pit Specific Sediment Chemistry of ESC CMP Vd* in June 2017;
- Laboratory analyses of sediment samples collected for *Cumulative Impact Sediment Chemistry of ESC CMPs* in June 2017; and
- Laboratory analyses of sediment samples collected for *Sediment Chemistry after a Major Storm of ESC CMPs* in June 2017.

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 *Monthly EM&A Report for June 2017*:

- *Water Column Profiling of ESC CMP Vd* in June 2017; and
- *Pit Specific Sediment Chemistry of ESC CMP Vd* in May 2017.

1.5.2 ***Water Column Profiling of ESC CMP Vd – June 2017***

1.5.3 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 17 June 2017. 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 wet season period (April to October) of 2006 - 2015 from stations in the Northwestern Water Control Zone (WCZ), where the ESC CMPs are located [1]. For Salinity, the averaged value obtained from the Reference (Upstream) station was used for the basis as the WQO. Levels of Dissolved Oxygen (DO) and Turbidity were also assessed for compliance with the Action and Limit Levels (see *Table B1* of *Annex B* for details).

In-situ Measurements

1.5.4 Analyses of results for June 2017 indicated that levels of DO and pH complied with the WQOs at both Downstream and Upstream stations (*Table B2* of *Annex B*). In addition, DO and Turbidity at all stations complied with the Action and Limit Levels (*Tables B1* and *B2* of *Annex B*).

[1] http://epic.epd.gov.hk/EPICRIVER/marine/?lang=en

Laboratory Measurements for Suspended Solids (SS)

1.5.5 Analyses of results for June 2017 indicated that the SS levels complied with the WQO and the Action and Limit Levels at both Upstream and Downstream stations (*Tables B1* and *B2* of *Annex B*).

1.5.6 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.

1.5.7 ***Pit Specific Sediment Chemistry of ESC CMP Vd – May 2017***

1.5.8 Monitoring locations for *Pit Specific Sediment Chemistry for ESC CMP Vd* are shown in *Figure 1.2*. A total of six (6) monitoring stations were sampled in May 2017.

1.5.9 The concentrations of all inorganic contaminants were lower than the Lower Chemical Exceedance Level (LCEL) at all stations in May 2017 (*Figures 1* and *2* of *Annex C*).

1.5.10 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were similar amongst the stations in May 2017 (*Figure 3* of *Annex C*). The concentrations of Tributyltin (TBT) were higher at Active Pit stations ESC-NPAA and ESC-NPAB in May 2017 (*Figure 4* of *Annex C*). 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 May 2017.

1.5.11 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 May 2017. Statistical analysis will be undertaken and presented in the corresponding quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.

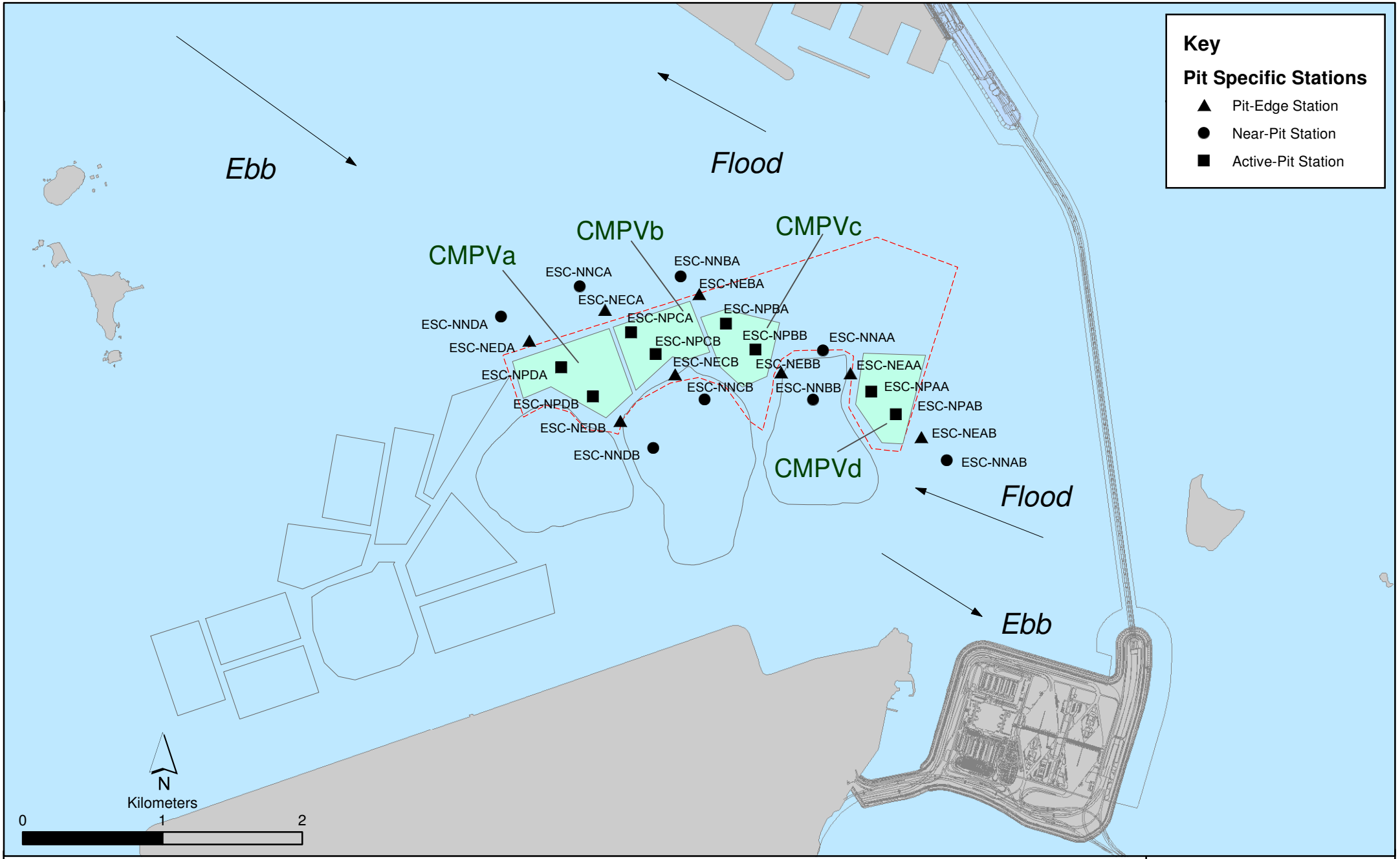


Figure 1.2

Pit Specific Sediment Quality Monitoring Stations for CMPV

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Date: 9/5/2017

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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 *Monthly EM&A Report for June 2017*:

- *Water Quality Monitoring during Capping Operations of SB CMPs* in June 2017.

1.6.2 ***Water Quality Monitoring during Capping of SB CMPs – June 2017***

1.6.3 Capping works at SB CMP 2 were conducted in June 2017 to supplement and revert the portion of consolidated capping layer to design level and is expected to be completed by December 2017. The monitoring results obtained during June 2017 sampling in the wet season have been assessed for compliance with the WQOs (see *Section 1.5.3* 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). A total of fourteen (14) monitoring stations were sampled in June 2017 as shown in *Figure 1.3*. Graphical presentation of the monitoring results is shown in *Figures 5 - 14* of *Annex C*.

In-situ Measurements

1.6.4 The levels of pH at all stations in June 2017 complied with the WQO (*Table B4* of *Annex B*; *Figure 5* of *Annex C*). The levels of Turbidity at all stations complied with the Action and Limit levels in June 2017 (*Table B4* of *Annex B; Figure 6* of *Annex C*). The levels of DO at all stations complied with the WQO and the Action and Limit levels in June 2017 (*Table B4* of *Annex B; Figure 8* of *Annex C*). The levels of Salinity at Impact, Intermediate, Ma Wan, Sham Shui Kok and Tai Mo To stations are higher than the WQO_{max} in June 2017 (*Table B4* of *Annex B; Figure 10* of *Annex C*). The Salinities at these stations were higher than the WQO_{max} as they were located further away from the Tai Ho Bay and Reference stations, thus experiencing less freshwater runoff from the nearby streams.

Laboratory Measurements

1.6.5 The concentrations of SS were higher than the WQO (11.0 mg/L for wet season) at Impact, Sham Shui Kok, Tai Mo To and Tai Ho Bay 1 station in June 2017 (*Table B4* of *Annex B*; *Figure 11* of *Annex C*). However, levels of SS at all stations complied with the Action and Limit Levels (*Table B3 and B4* of *Annex B*).

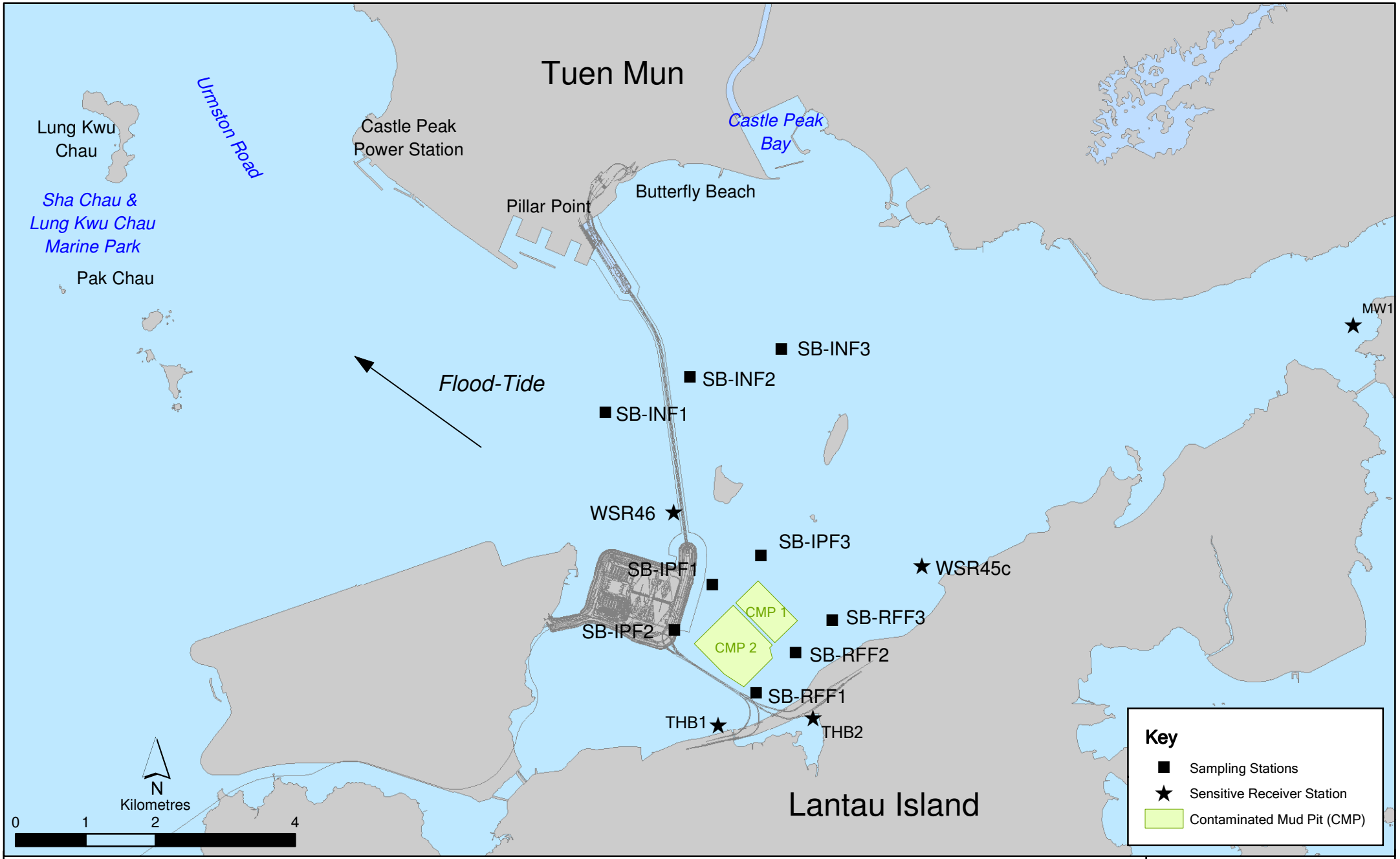

Figure 1.3

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

File: T:\GIS\CONTRACT\0400720\Mxd\0400720_Routine_Capping_WQMS_flood.mxd
Date: 6/7/2017

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1.6.6 For nutrients, concentrations of Ammonia Nitrogen (NH_3-N) were relatively similar amongst all stations, except the concentrations of NH_3-N recorded at Tai Ho Bay 2 station was lower than the other stations (*Table B4* of *Annex B*; *Figure 12* of *Annex C*). The levels of Total Inorganic Nitrogen (TIN) at all stations were higher the WQO of 0.5 mg/L (*Table B4* of *Annex B*; *Figure 13* of *Annex C*). It is important to note that due to the effect of the Pearl River, the North Western WCZ has historically experienced higher levels of TIN (1). The exceedances of TIN WQO at these stations are unlikely to be caused by the capping operation at CMP 2. Levels of 5-day Biochemical Oxygen Demand (BOD_5) were higher at Reference and Tai Ho Bay 2 stations in June 2017 (*Table B4* of *Annex B*; *Figure 14* of *Annex C*).

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 June 2017. 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.

1.7 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

1.7.1 The following monitoring activities will be conducted in the next monthly period of July 2017 for ESC CMP V (see *Annex A* for the sampling schedule):

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

1.7.2 No monitoring activities are scheduled in the next monthly period of July 2017 for SB CMPs.

1.8 STUDY PROGRAMME

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

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

Annex A

Sampling Schedule

Annex A1 - East of Sha Chau Environmental Monitoring and Audit Sampling Schedule for CMP (April 2017 - March 2021)

			2017									2018												2019												2020												2021		
Pit Specific Sediment Chemistry	**Code**	**Frequency**	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
Active-Pit																																																			
	ESC-NPAA	Monthly	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	ESC-NPAB	Monthly	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Pit-Edge																																																			
	ESC-NEAA	Monthly	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	ESC-NEAB	Monthly	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Near-Pit																																																			
	ESC-NNAA	Monthly	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	ESC-NNAB	Monthly	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12

Cumulative Impact Sediment Chemistry			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
Near-field Stations																																																			
	ESC-RNA	4 times per year			12		12				12		12				12		12				12		12				12		12				12		12				12		12				12		12	
	ESC-RNB1	4 times per year			12		12				12		12				12		12				12		12				12		12				12		12				12		12				12		12	
Mid-field Stations																																																			
	ESC-RMA	4 times per year			12		12				12		12				12		12				12		12				12		12				12		12				12		12				12		12	
	ESC-RMB	4 times per year			12		12				12		12				12		12				12		12				12		12				12		12				12		12				12		12	
Capped Pit Stations																																																			
	ESC-RCA1	4 times per year			12		12				12		12				12		12				12		12				12		12				12		12				12		12				12		12	
	ESC-RCB1	4 times per year			12		12				12		12				12		12				12		12				12		12				12		12				12		12				12		12	
Far-Field Stations																																																			
	ESC-RFA	4 times per year			12		12				12		12				12		12				12		12				12		12				12		12				12		12				12		12	
	ESC-RFB	4 times per year			12		12				12		12				12		12				12		12				12		12				12		12				12		12				12		12	
Ma Wan Station																																																			
	MW1	4 times per year			12		12				12		12				12		12				12		12				12		12				12		12				12		12				12		12	

Sediment Toxicity Tests			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
Near-Pit Stations																																																			
	ESC-TDA	2 times per year					5						5						5						5						5						5						5						5	
	ESC-TDB1	2 times per year					5						5						5						5						5						5						5						5	
Reference Stations																																																			
	ESC-TRA	2 times per year					5						5						5						5						5						5						5						5	
	ESC-TRB	2 times per year					5						5						5						5						5						5						5						5	
Ma Wan Station																																																			
	MW1	2 times per year					5						5						5						5						5						5						5						5	

Tissue/ Whole Body Sampling			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
Near-Pit Stations																																																			
	ESC-INA	2 times per year					*						*						*						*						*						*						*						*	
	ESC-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					*						*						*						*						*						*						*						*	

Demersal Trawling			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
Near Pit Stations																																																			
	ESC-INA	4 times per year				5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
	ESC-INB	4 times per year				5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
Reference North																																																			
	TNA	4 times per year				5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
	TNB	4 times per year				5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
Reference South																																																			
	TSA	4 times per year				5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
	TSB	4 times per year				5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	

Capping			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
Ebb Tide																																																			
Impact Station Downcurrent																																																			
	ESC-IPE1A	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-IPE2A	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-IPE3	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-IPE4	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-IPE5	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
Intermediate Station Downcurrent																																																			
	ESC-INE1A	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-INE2A	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-INE3A	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-INE4A	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-INE5A	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
Reference Station Upcurrent																																																			
	ESC-RFE1	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-RFE2	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-RFE3	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-RFE4	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-RFE5	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
Ma Wan Station																																																			
	MW1	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
Flood Tide																																																			
Impact Station Downcurrent																																																			
	ESC-IPF1	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-IPF2	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-IPF3	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
Intermediate Station Downcurrent																																																			
	ESC-INF1	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-INF2	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-INF3	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
Reference Station Upcurrent																																																			
	ESC-RFF1A	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-RFF2A	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
	ESC-RFF3	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	
Ma Wan Station																																																			
	MW1	4 times per year															3		3				3		3				3		3				3		3				3		3				3		3	

Routine Water Quality Monitoring			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
Ebb Tide																																																			
Impact Station Downcurrent																																																			
	ESC-IPE1A	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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-IPE2A	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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8		8	8	
Intermediate Station Downcurrent																																																			
	ESC-INE1A	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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-INE2A	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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-INE3A	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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-INE4A	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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-INE5A	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	8		8	8		8	8		8	8		8	8		8	8	
Reference Station Upcurrent																																																			
	ESC-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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8		8	8	
Ma Wan Station																																																			
	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	8		8	8		8	8		8	8		8	8		8	8	
Flood Tide																																																			
Impact Station Downcurrent																																																			
	ESC-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	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8	
Intermediate Station Downcurrent																																																			
	ESC-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	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8	
Reference Station Upcurrent																																																			
	ESC-RFF1A	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	8		8	8		8	8		8	8		8	8	
	ESC-RFF2A	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	8		8	8		8	8		8	8		8	8	
	ESC-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	8		8	8		8	8		8	8		8	8	
Ma Wan Station																																																			
	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	8		8	8		8	8		8	8		8	8	

Water Column Profiling			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
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	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	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Benthic Recolonisation Studies			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
Capped Stations at CMPV																																																			
	ESCV-CPA	2 times per year																																																		
	ESCV-CPB	2 times per year																																																		
	ESCV-CPC	2 times per year																																																		
	ESCV-CPD	2 times per year																																																		
Reference Stations																																																			
	RBA	2 times per year																																																		
	RBB	2 times per year																																																		
	RBC1	2 times per year																																																		

Impact Monitoring for Dredging			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
Upstream Stations																																																			
	US1	3 times per week																																																		
	US2	3 times per week																																																		
Downstream Stations																																																			
	DS1	3 times per week																																																		
	DS2	3 times per week																																																		
	DS3	3 times per week																																																		
	DS4	3 times per week																																																		
	DS5	3 times per week																																																		
Ma Wan Station																																																			
	MW1	3 times per week																																																		

Notes:
The number shown in each cell represents the numbers of replicates per monitoring station
Impact Monitoring for Dredging will be scheduled when dredging operations commence.
Benthic Recolonisation Studies for CMP V will be scheduled when capping operation for CMP V is completed.

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (April 2017 - December 2018)

			2017									2018										
Capping Water Quality Monitoring			**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Ebb Tide																							
Impact Stations Downcurrent																							
	SB-IPE1	4 times per year		3	3		3				3												
	SB-IPE2	4 times per year		3	3		3				3												
	SB-IPE3	4 times per year		3	3		3				3												
	SB-IPE4	4 times per year		3	3		3				3												
	SB-IPE5	4 times per year		3	3		3				3												
Intermediate Stations Downcurrent																							
	SB-INE1	4 times per year		3	3		3				3												
	SB-INE2	4 times per year		3	3		3				3												
	SB-INE3	4 times per year		3	3		3				3												
	SB-INE4	4 times per year		3	3		3				3												
	SB-INE5	4 times per year		3	3		3				3												
Reference Stations Upcurrent																							
	SB-RFE1	4 times per year		3	3		3				3												
	SB-RFE2	4 times per year		3	3		3				3												
	SB-RFE3	4 times per year		3	3		3				3												
	SB-RFE4	4 times per year		3	3		3				3												
	SB-RFE5	4 times per year		3	3		3				3												
Sensitive Receiver Stations																							
	MW1	4 times per year		3	3		3				3												
	THB1	4 times per year		3	3		3				3												
	THB2	4 times per year		3	3		3				3												
	WSR45C	4 times per year		3	3		3				3												
	WSR46	4 times per year		3	3		3				3												
Flood Tide																							
Impact Stations Downcurrent																							
	SB-IPF1	4 times per year		3	3		3				3												
	SB-IPF2	4 times per year		3	3		3				3												
	SB-IPF3	4 times per year		3	3		3				3												
Intermediate Stations Downcurrent																							
	SB-INF1	4 times per year		3	3		3				3												
	SB-INF2	4 times per year		3	3		3				3												
	SB-INF3	4 times per year		3	3		3				3												
Reference Stations Upcurrent																							
	SB-RFF1	4 times per year		3	3		3				3												
	SB-RFF2	4 times per year		3	3		3				3												
	SB-RFF3	4 times per year		3	3		3				3												
Sensitive Receiver Stations																							
	MW1	4 times per year		3	3		3				3												
	THB1	4 times per year		3	3		3				3												
	THB2	4 times per year		3	3		3				3												
	WSR45C	4 times per year		3	3		3				3												
	WSR46	4 times per year		3	3		3				3												

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

Notes:
The number shown in each cell represents the numbers of replicates per monitoring station
Capping works are planned to be conducted between May and December 2017.

Annex B

Water Quality Monitoring Results

Table B1 Action and Limit Levels of Water Quality for Dredging, Disposal and Capping Activities at ESC CMP V

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 B2 Water Column Profiling Results for ESC CMP Vd in June 2017

Stations	Temp	Salinity	Turbidity	Dissolved Oxygen		pH	Suspended Solids
	(°C)	(ppt)	(NTU)	(%)	(mg L^{-1})	(mg L^{-1})	(mg L^{-1})
WCP 1 (Downstream)	28.22	19.47	7.75	71.58	5.01	7.93	4.65
WCP 2 (Upstream)	28.23	18.98	6.69	74.76	5.25	7.93	5.03
WQO (Wet season)	N/A	17.09 – 20.88#	N/A	N/A	>4	6.5-8.5	11.0

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 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 Monitoring Results for Water Quality Monitoring during Capping of SB CMP in June 2017

Sampling Period	Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg L-1)	pH (mg L-1)	SS (mg L-1)	NH3 (mg L-1)	TIN (mg L-1)	BOD_5 (mg L-1)
June 2017	RFF (Reference)	28.67	17.12	6.86	82.76	5.82	7.95	7.89	0.12	1.39	0.88
	IPF (Impact)	28.32	19.70	13.34	75.65	5.28	7.92	15.75	0.12	1.21	0.29
	INF (Intermediate)	27.36	26.42	11.23	60.12	4.11	7.92	10.97	0.11	0.81	0.28
	Ma Wan	27.33	26.83	4.08	58.92	4.02	7.92	5.30	0.12	0.75	0.25
	Sham Shui Kok	27.74	23.68	7.77	63.40	4.37	7.92	16.02	0.14	1.13	0.25
	Tai Mo To	28.04	21.72	11.33	69.89	4.85	7.91	12.10	0.14	0.97	0.33
	Tai Ho Bay 1	28.60	17.59	14.68	83.12	5.84	7.95	16.57	0.10	1.30	0.37
	Tai Ho Bay 2	28.67	17.56	10.45	69.14	4.85	7.80	5.57	0.05	0.81	0.73
	WQO	N/A	15.41-18.83*	N/A	N/A	>4	6.5-8.5	11.0	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

Graphical Presentations

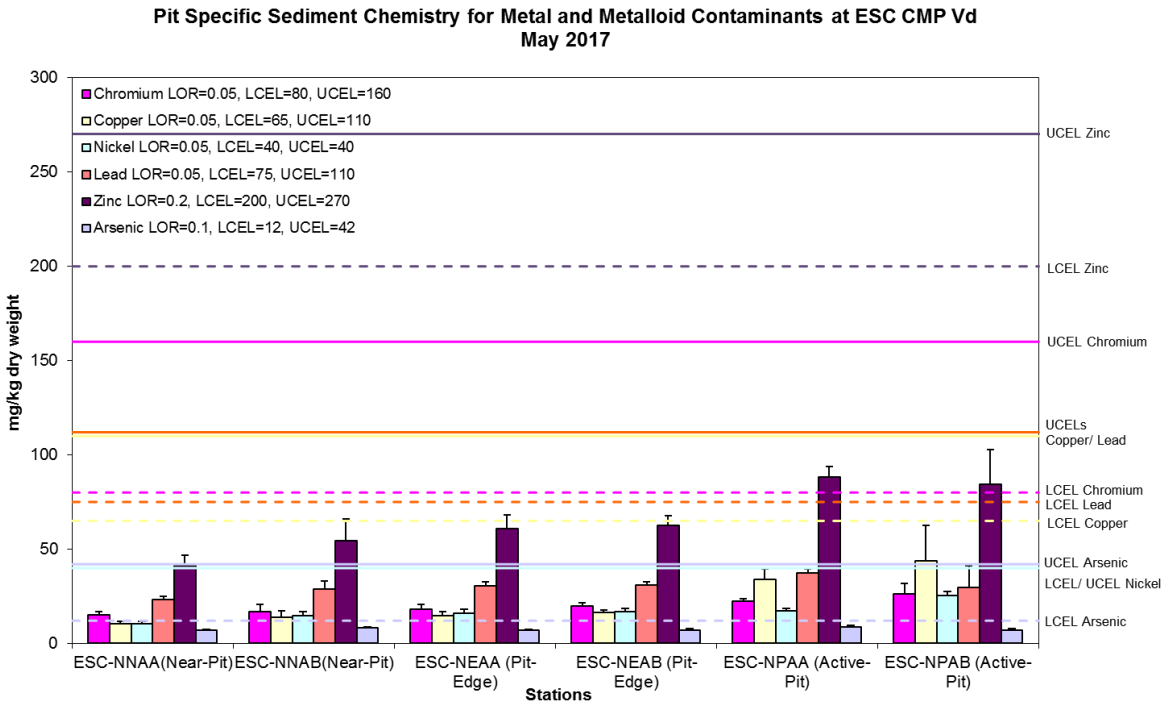


Figure 1: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in May 2017.

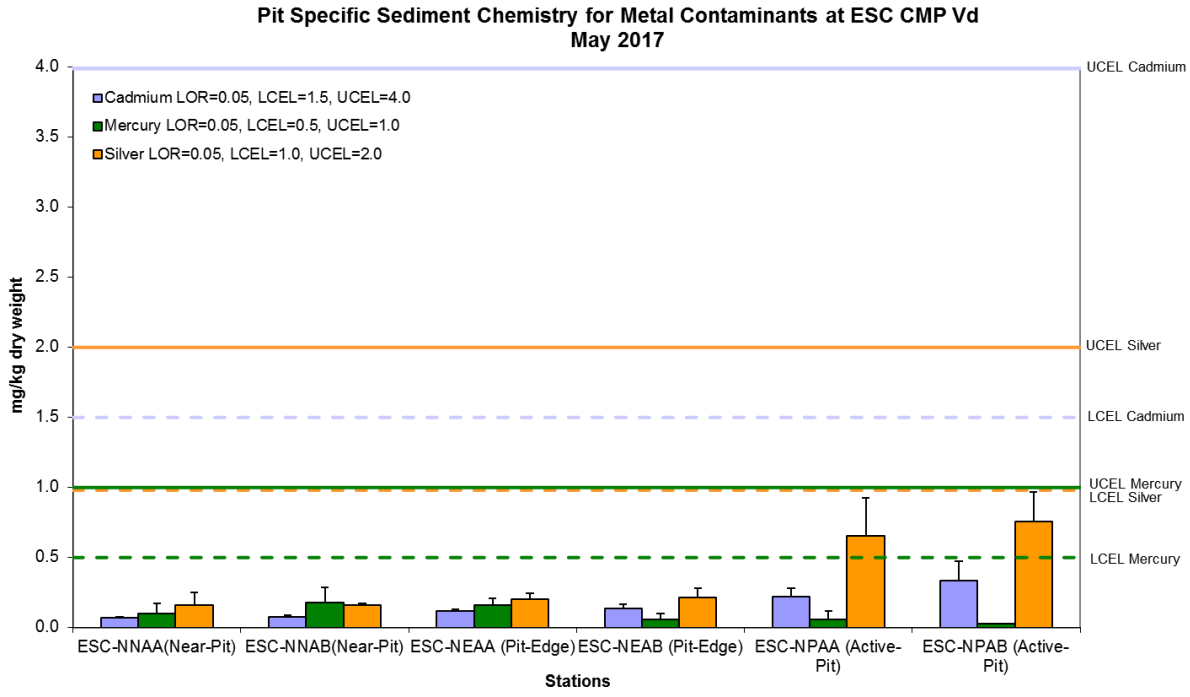


Figure 2: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in May 2017.

Source: H:\Team\EM\GMS Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\3rd (June 2017)

Date: July 2017

Environmental Resources Management

ERM

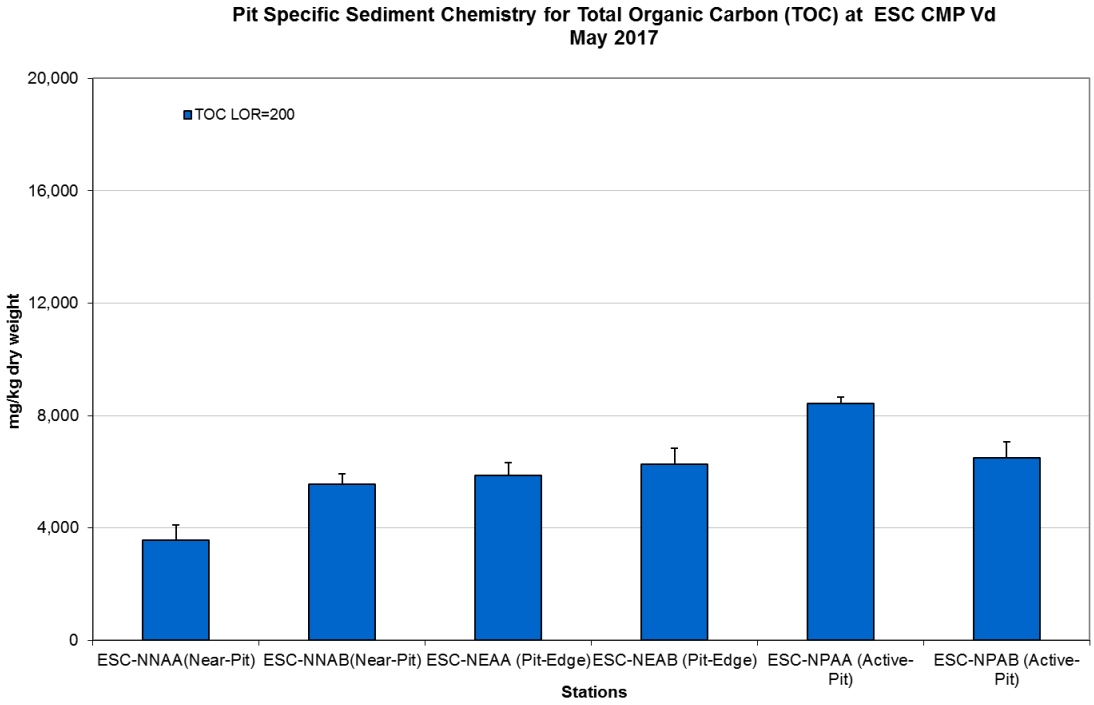


Figure 3: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in May 2017.

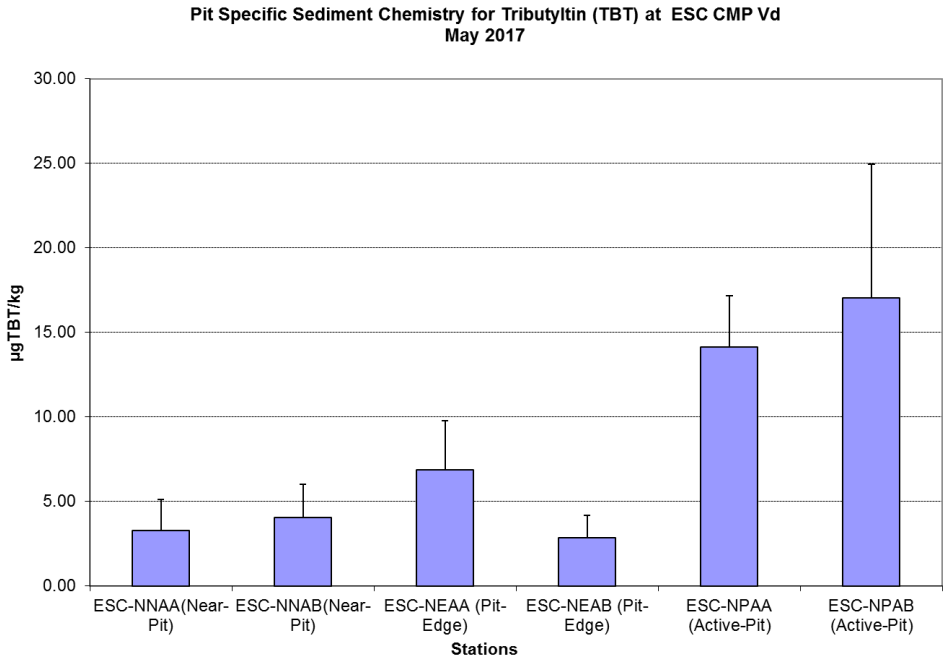


Figure 4: Concentration of Tributyltin (TBT) (µg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in May 2017.

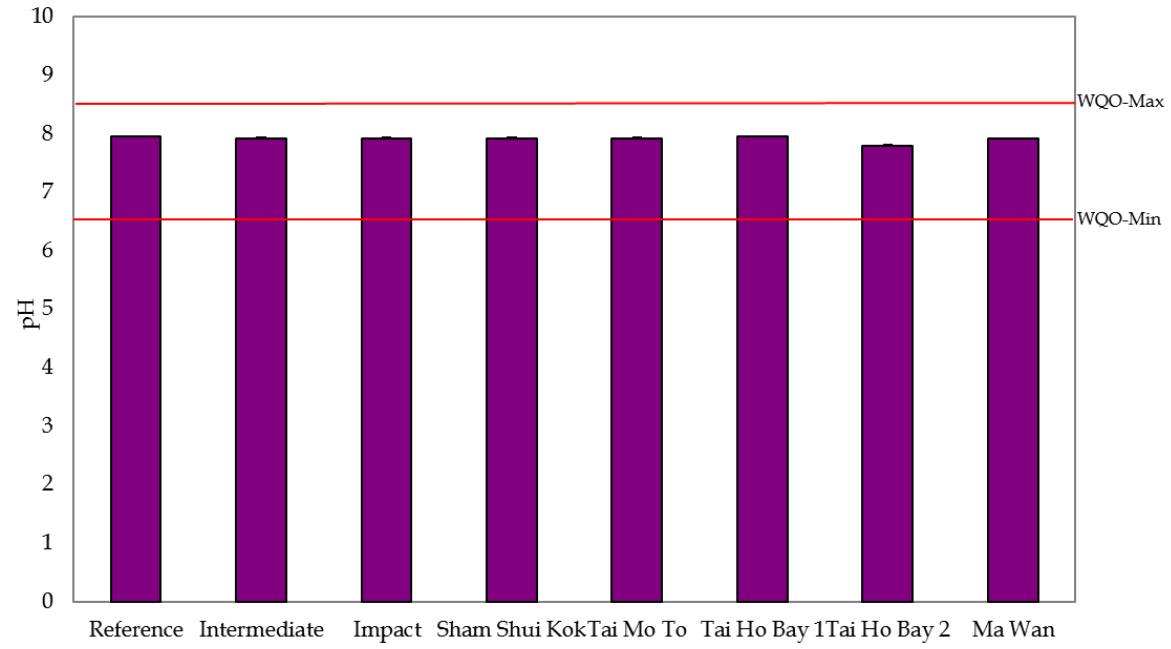


Figure 5: Levels of pH (mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in June 2017.

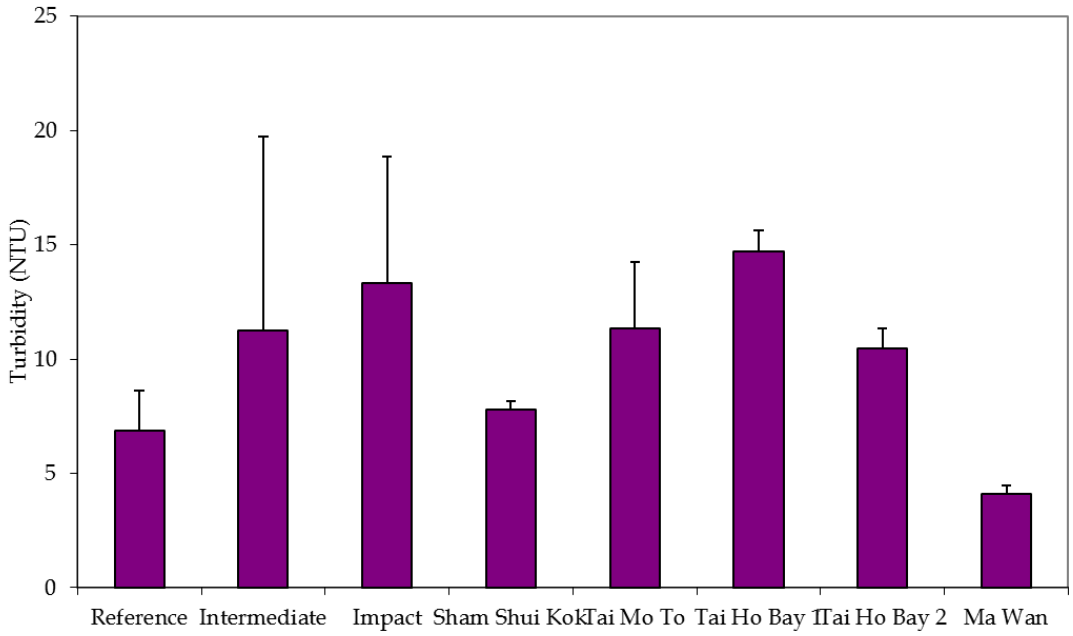


Figure 6: Levels of Turbidity (NTU; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in June 2017

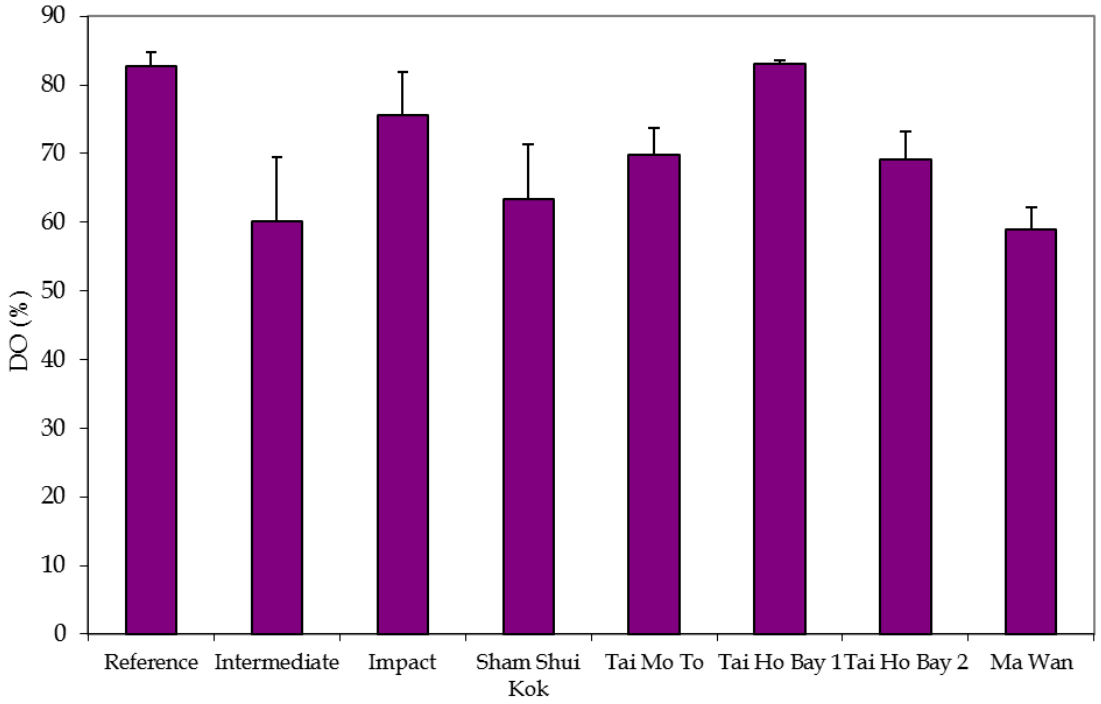


Figure 7: Levels of Dissolved Oxygen (% saturation; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in June 2017

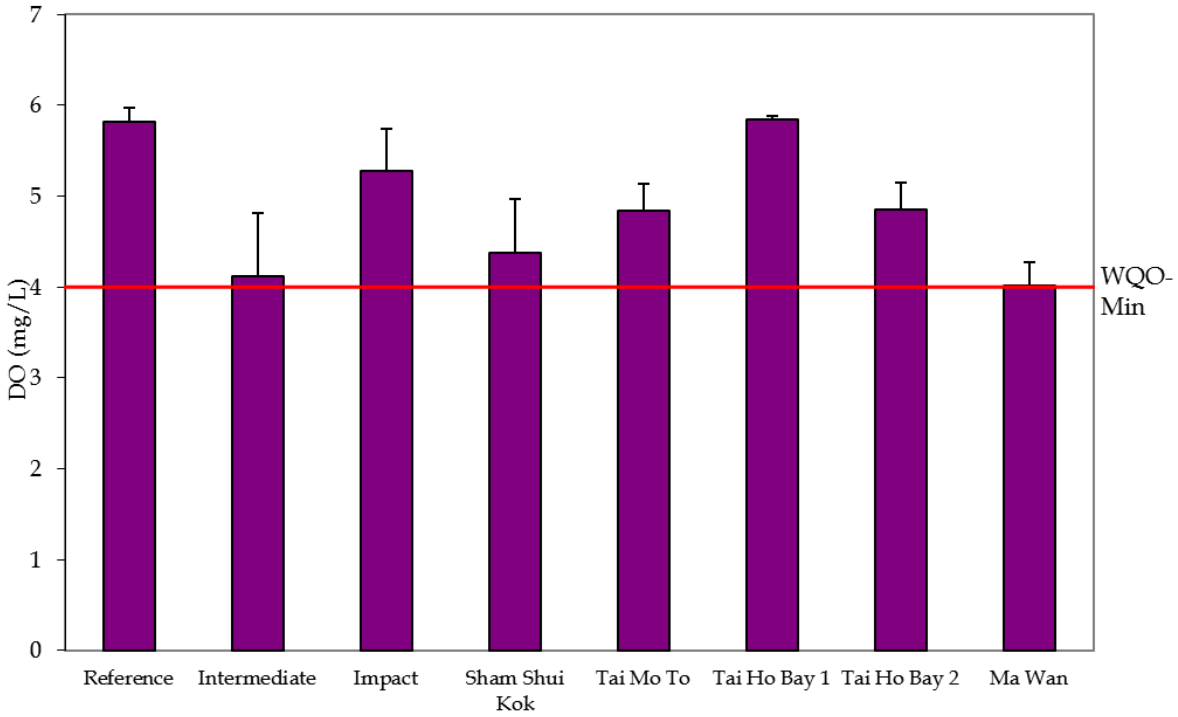


Figure 8: Levels of Dissolved Oxygen (mg/L; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in June 2017

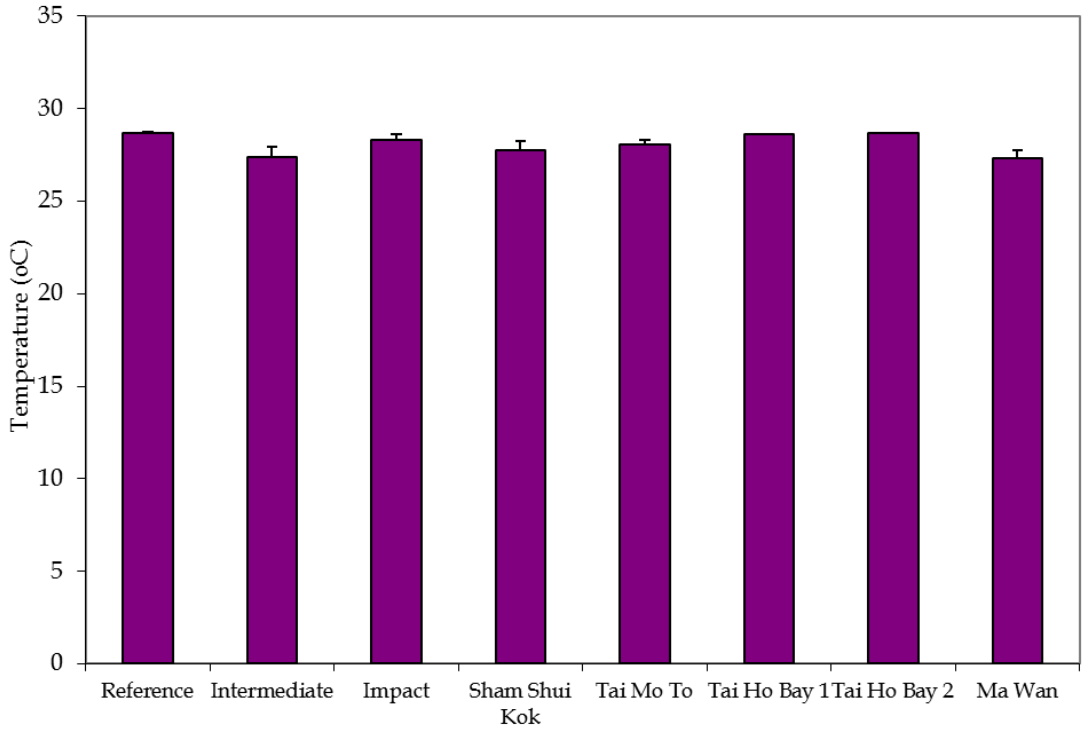


Figure 9: Levels of Temperature (˚C; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in June 2017.

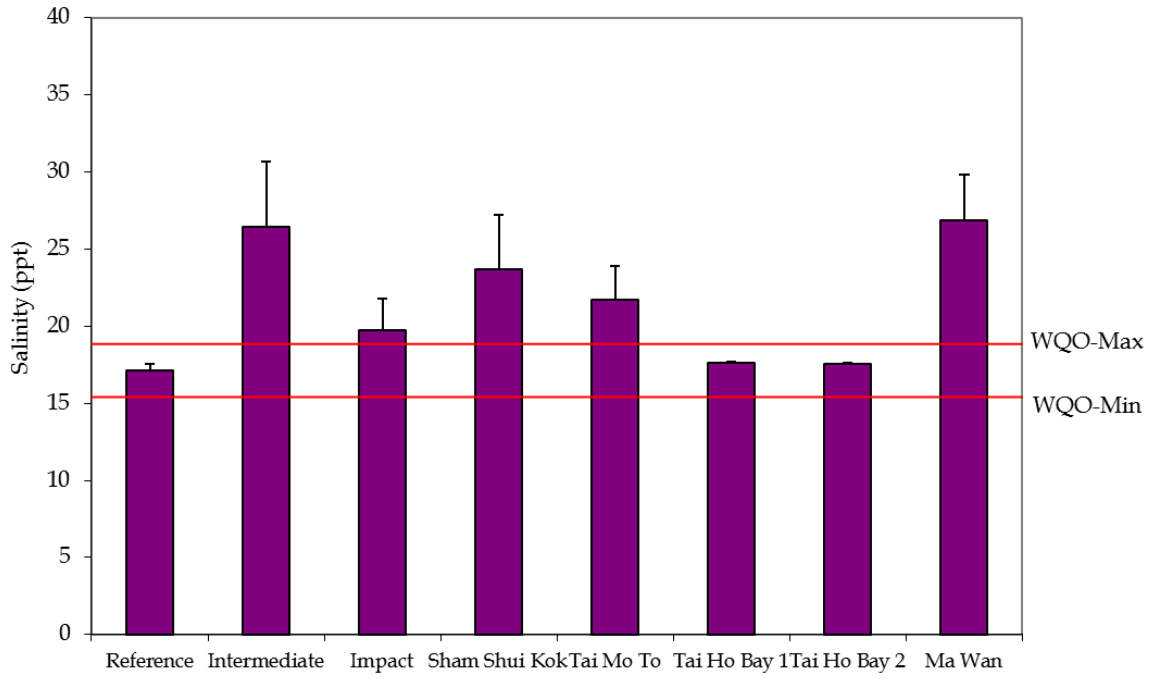


Figure 10: Levels of Salinity (ppt; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in June 2017.

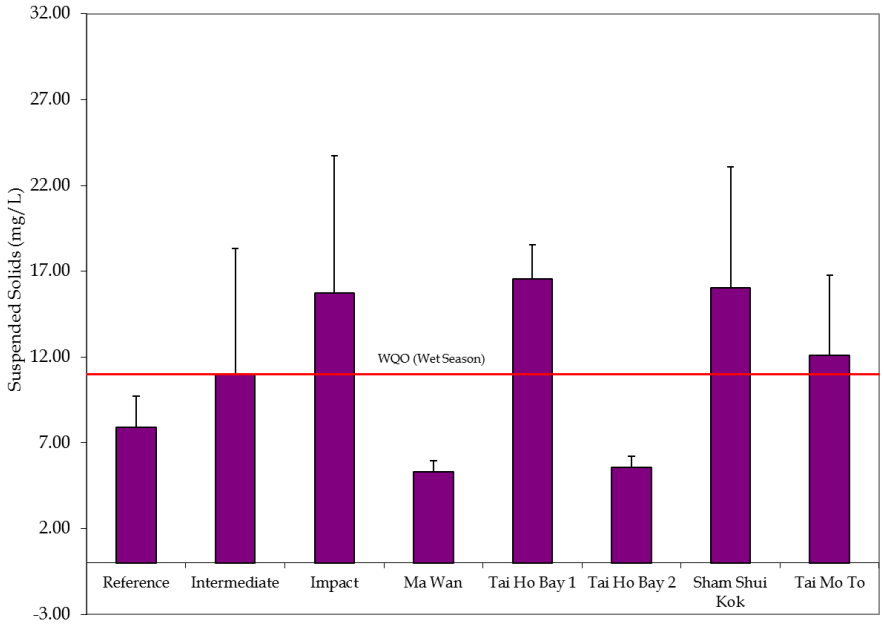


Figure 11: Levels of Suspended Solids (mg/L; mean +SD) recorded from Water Quality Monitoring during Capping of SB CMP 2 in June 2017

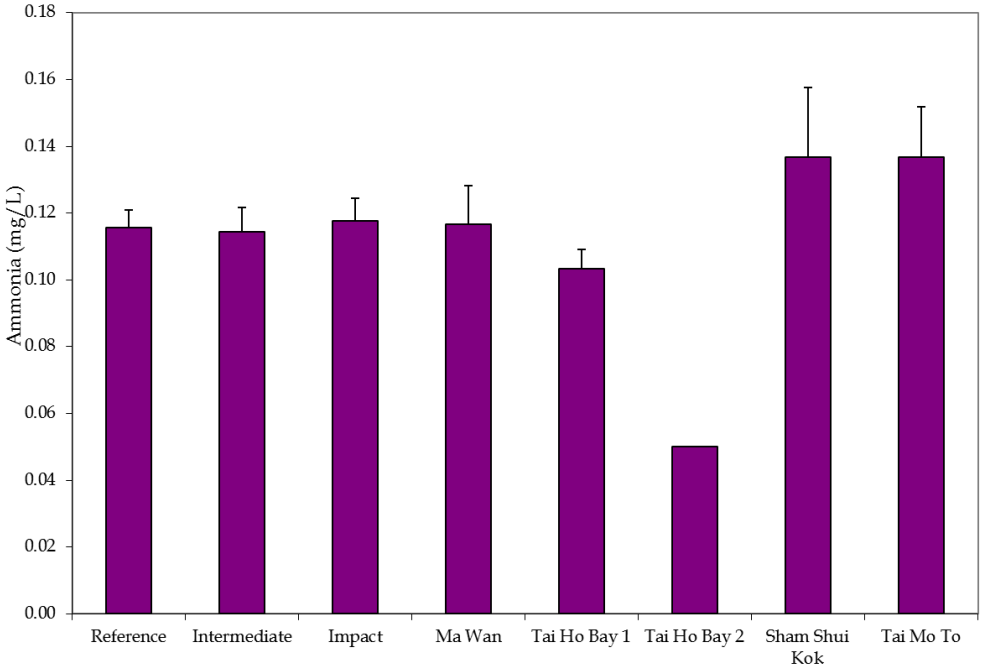


Figure 12: Level of Ammonia (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 2 in June 2017.

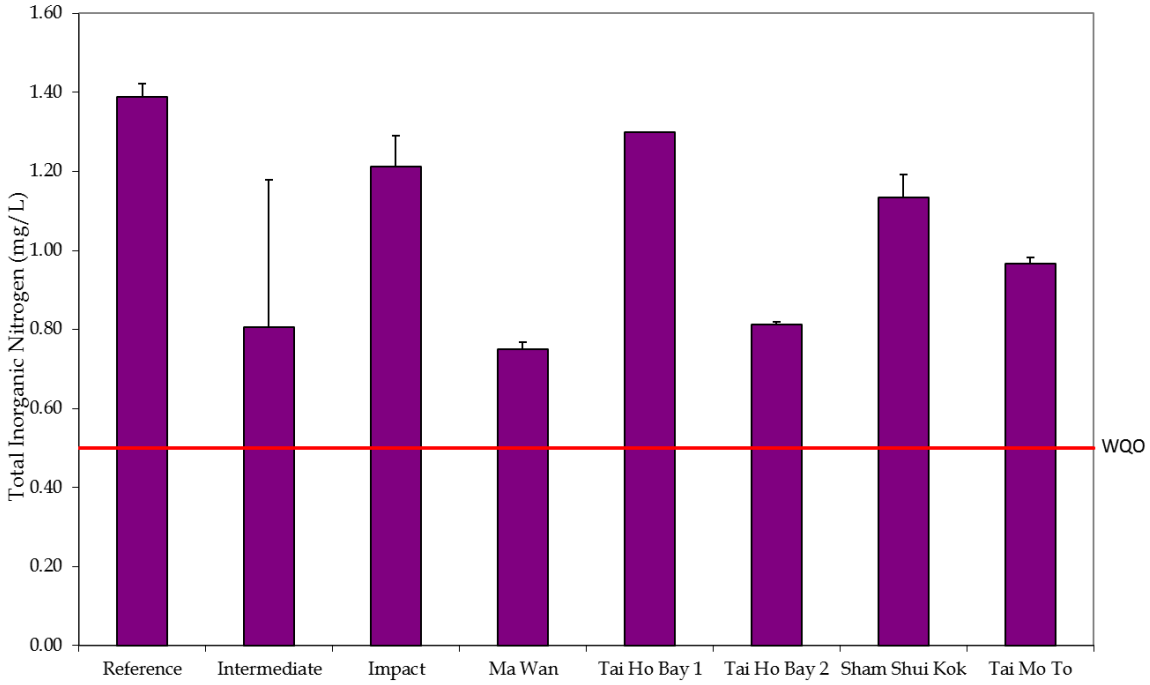


Figure 13: Level of TIN (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 2 in June 2017

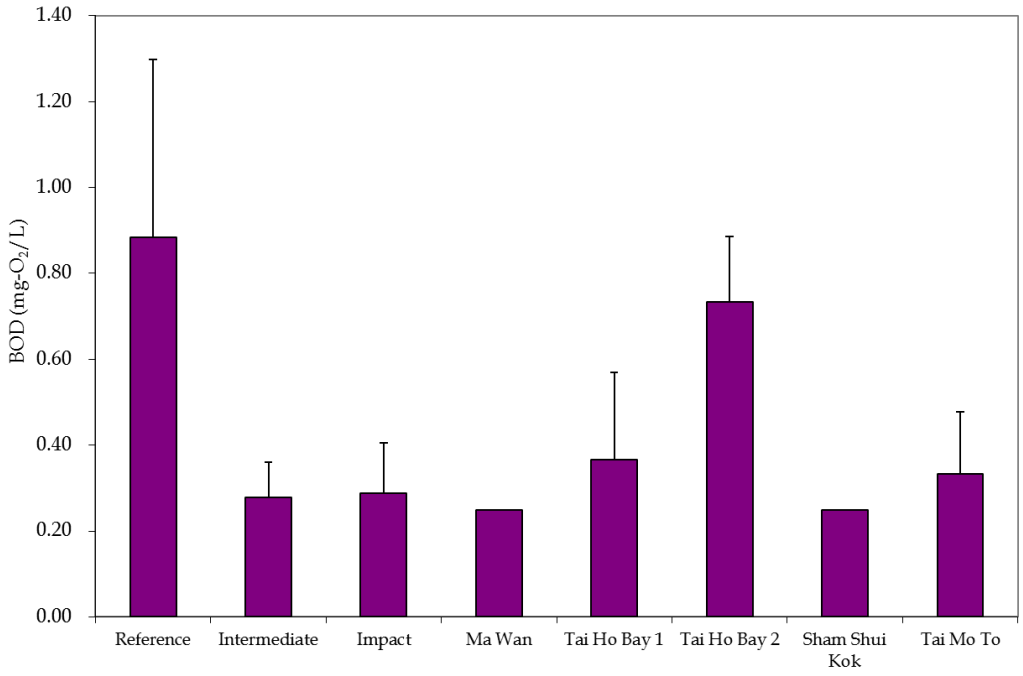
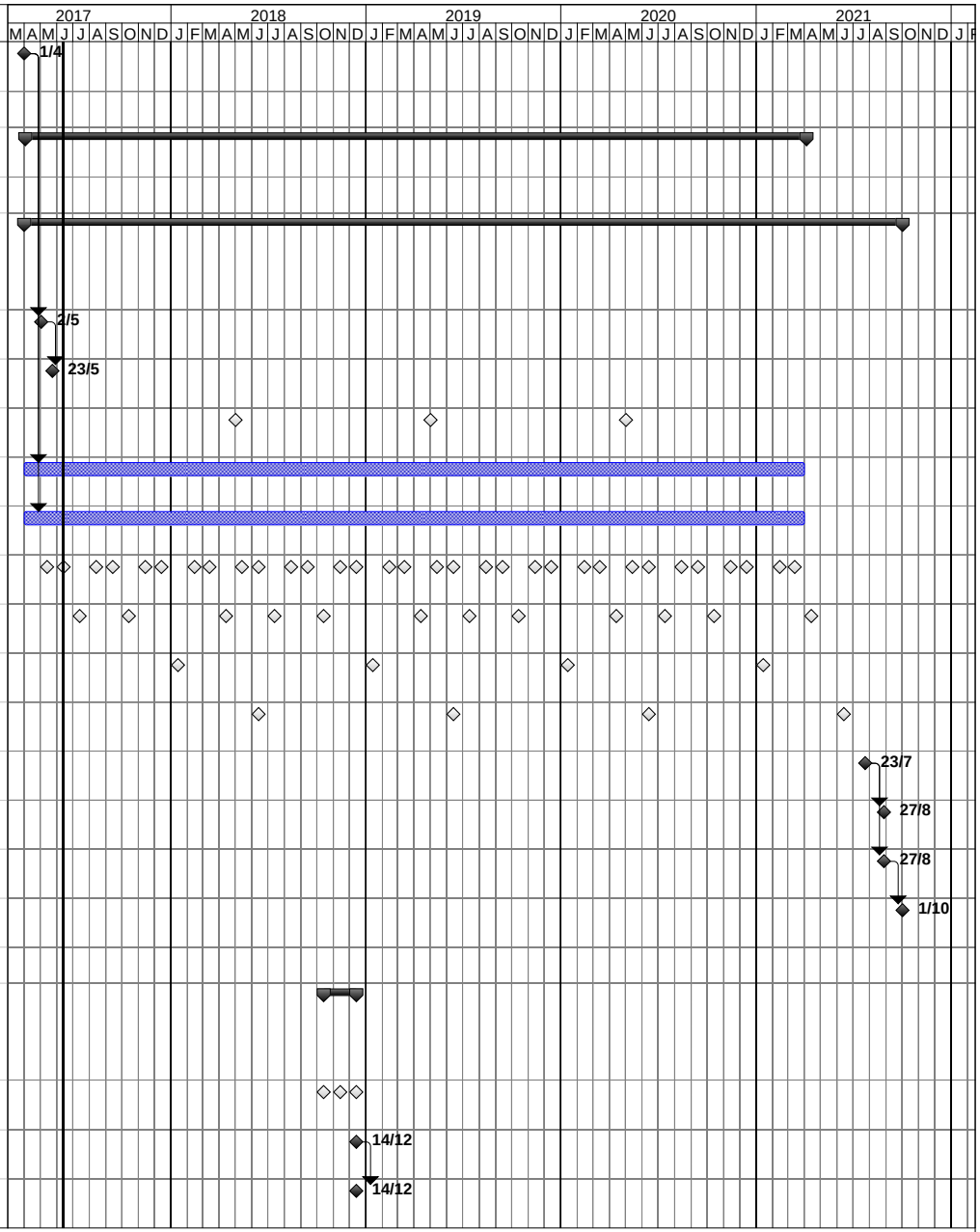


Figure 14: Level of BOD_5 (mg-O_2/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 2 in June 2017.

Annex D

Study Programme

Task Name	Start	Finish
Commencement of Agreement No. CE 63/2016 (EP)	Sat 1/4/17	Sat 1/4/17
Project Management and General Deliverables	**Mon 3/4/17**	**Mon 5/4/21**
For the disposal facilities to the East of Sha Chau (ESC) (between 2017 and 2021) and the South of The Brothers (SB) (between 2017 and 2018)	**Sat 1/4/17**	**Fri 1/10/21**
Draft Report on Review of EM&A Manual	Tue 2/5/17	Tue 2/5/17
Final Report on Review of EM&A Manual	Tue 23/5/17	Tue 23/5/17
Regular Review of EM&A Manual	**Wed 2/5/18**	**Sat 2/5/20**
Regular Site Inspections of CMP Contractors	Sat 1/4/17	Wed 31/3/21
Participate in Liaison Group Meetings/ Consultations as required by CEDD	Sat 1/4/17	Wed 31/3/21
Submission of Monthly EM&A Report	**Sun 14/5/17**	**Sun 14/3/21**
Submission of Quarterly EM&A Report	**Fri 14/7/17**	**Wed 14/4/21**
Submission of Annual EM&A Report	**Sun 14/1/18**	**Thu 14/1/21**
Submission of Annual Risk Assessment Report	**Thu 14/6/18**	**Mon 14/6/21**
Submission of Draft Final Report (including database of all data collected)	Fri 23/7/21	Fri 23/7/21
Submission of Final Report (including database of all data collected)	Fri 27/8/21	Fri 27/8/21
Submission of Draft Executive Summary	Fri 27/8/21	Fri 27/8/21
Submission of Final Executive Summary	Fri 1/10/21	Fri 1/10/21
For East Tung Lung Chau Disposal Facility (subject to the actual disposal programme to be confirmed by CEDD)	**Sun 14/10/18**	**Fri 14/12/18**
Submission of Monthly EM&A Report	**Sun 14/10/18**	**Fri 14/12/18**
Submission of Quarterly EM&A Report	Fri 14/12/18	Fri 14/12/18
Submission of Annual EM&A Report	Fri 14/12/18	Fri 14/12/18



Study Programme
Tue 13/6/17

Task | Milestone | Summary | Rolled Up Milestone