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 – May 2018

Revision 0

June 2018

Environmental Resources Management
2507, 25/F, One Harbourfront
18 Tak Fung Street
Hunghom, Kowloon
Hong Kong
Telephone (852) 2271 3000
Facsimile (852) 2723 5660

www.erm.com

ERM

The business of sustainability

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

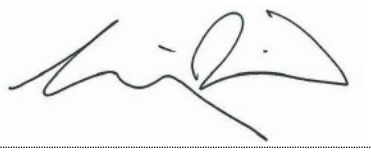
Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau and the South of The Brothers – May 2018

Revision 0

Document Code: 0400720_Monthly May 2018_v0.doc

Environmental Resources Management

2507, 25/F, One Harbourfront
18 Tak Fung Street
Hunghom, Kowloon
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)	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: 14 June 2018 Approved by:  Craig A. Reid *Partner*

Revision	Description	By	Checked	Approved	Date
v0	Monthly EM&A Report for ESC CMPs and SB CMPs	CY	JT	CAR	14/6/18

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.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

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.

Distribution

☐ Internal

☒ Public

☐ Confidential

OHSAS 18001:2007
Certificate No. OHS 515956

ISO 9001 : 2008
Certificate No. FS 32515

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

ERM

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 – May 2018
Date of Report:	14 June 2018
Date prepared by ET:	14 June 2018
Date received by IA:	14 June 2018

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: 14/6/2018

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: 14/6/2018

CONTENTS

1.1	*BACKGROUND*	*1*
1.2	*REPORTING PERIOD*	*2*
1.3	*DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES*	*2*
1.4	*DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS*	*2*
1.5	*BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMP V*	*2*
1.6	*ACTIVITIES SCHEDULED FOR THE NEXT MONTH*	*5*
1.7	*STUDY PROGRAMME*	*5*

ANNEXES

ANNEX A	*SAMPLING SCHEDULE*
ANNEX B	*WATER QUALITY MONITORING RESULTS*
ANNEX C	*GRAPHICAL PRESENTATIONS*
ANNEX D	*STUDY PROGRAMME*

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 MAY 2018

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). 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.

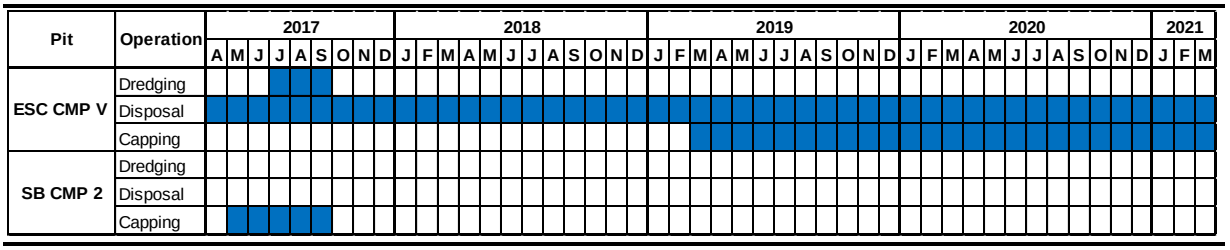
1.1.3 The present EM&A programme under *Agreement No. CE 63/2016 (EP)* covers the dredging, disposal and capping operations of the ESC CMP V as well as the capping operations of the SB CMPs (see *Annex A* for the EM&A programme). Detailed works schedule for ESC CMP V and SB CMPs is shown in *Figure 1.1*. In May 2018, the following work was being undertaken:

- Disposal of contaminated mud at ESC CMP Vd.

(1) ERM (2013) Final Report. Submitted under Agreement No. CE 4/2009 (EP) Environmental Monitoring and Audit for Contaminated Mud Pit at East Sha Chau. For CEDD.

(2) ERM (2017) Final Report. Submitted under 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). For CEDD.

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 May 2018* covers the EM&A activities for the reporting month of May 2018.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

1.3.1 The following monitoring activities were undertaken for ESC CMP V in May 2018:

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

1.3.2 No monitoring activities were undertaken for SB CMP in May 2018.

1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS

1.4.1 No outstanding sampling remained for May 2018.

1.4.2 The following laboratory analysis was still in progress during the preparation of this monthly report and hence is not presented in this monthly report

- Laboratory analyses of sediment samples collected for *Pit Specific Sediment Chemistry of ESC CMP Vd* in May 2018.

1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMP V

1.5.1 Brief discussion of the monitoring results of the following activities for ESC CMP V is presented in this *Monthly EM&A Report for May 2018*:

- *Water Column Profiling of ESC CMP Vd* in May 2018; and
- *Routine Water Quality Monitoring of ESC CMP Vd* in May 2018.

1.5.2 ***Water Column Profiling of ESC CMP Vd – May 2018***

1.5.3 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 26 May 2018. 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 2007 - 2016 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 May 2018 indicated that levels of DO, Salinity and pH complied with the WQOs at both Downstream and Upstream stations (*Table B2* of *Annex B*). In addition, levels of DO and Turbidity at all stations complied with the Action and Limit Levels (*Tables B1* and *B2* of *Annex B*).

Laboratory Measurements for Suspended Solids (SS)

1.5.5 Analyses of results for May 2018 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 ***Routine Water Quality Monitoring of ESC CMP V – May 2018***

1.5.8 *Routine Water Quality Monitoring of ESC CMP V* was undertaken on 23 May 2018. The monitoring results have been assessed for compliance with the WQOs (see *Section 1.5.3* for details). The monitoring results are shown in *Tables B3 and B4* of *Annex B* and *Figures 1 - 10* of *Annex C*. A total of ten (10) monitoring stations were sampled in May 2018 as shown in *Figure 1.2*.

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

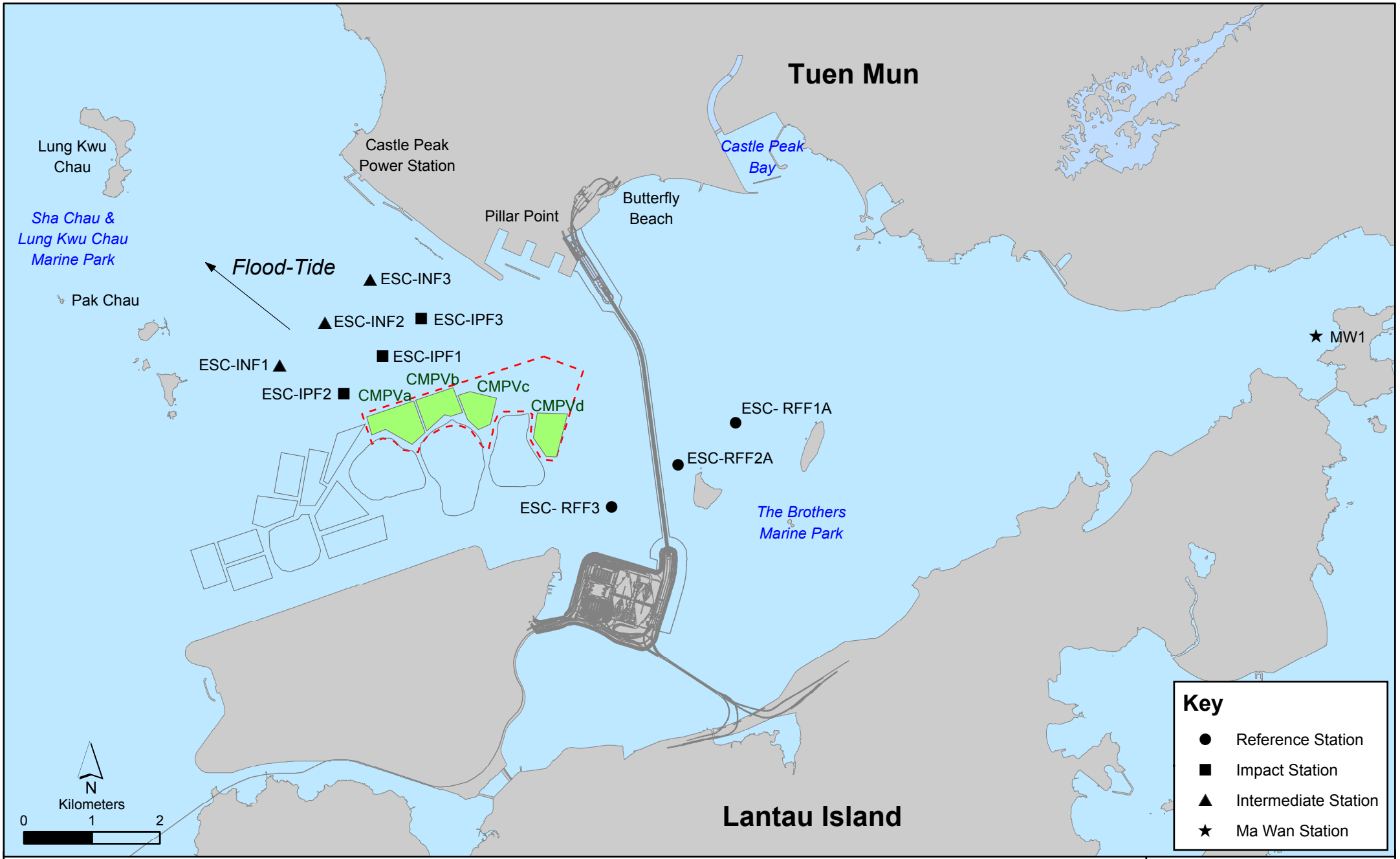


Figure 1.2

Routine & Capping Water Quality Sampling Stations (Flood-Tide) for ESC CMPs

File: T:\GIS\CONTRACT\0175086\Mxd\updated_20170419\0175086_R_C_WQMS_flood.mxd
Date: 25/4/2017

Environmental Resources Management

ERM

In-situ Measurements

1.5.9 Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in *Figures 1 - 6* of *Annex C*. Analyses of results for May 2018 indicated that the levels of pH, Salinity and DO complied with the WQOs at all stations (Impact, Intermediate, Reference and Ma Wan stations) in May 2018, except slightly higher Salinity was recorded at Ma Wan station (*Table B3* of *Annex B*; *Figures 1, 3 and 5* of *Annex C*). Ma Wan station is located further away from other monitoring stations located closer to the ESC CMP Vd where levels of Salinity complied with WQO requirements. It is thus considered that higher levels of Salinity recorded in Ma Wan station was not related to the disposal operation at ESC CMP Vd.

1.5.10 The levels of DO and Turbidity complied with the Action and Limit Levels at all stations (*Table B3* of *Annex B*; *Figures 3* and *6* of *Annex C*).

1.5.11 Overall, *in-situ* measurement results of the *Routine Water Quality Monitoring* indicated that the disposal operation at ESC CMP Vd did not appear to cause any unacceptable impacts in water quality in May 2018.

Laboratory Measurements

1.5.12 Laboratory analysis of May 2018 results indicated that concentrations of Cadmium, Silver and Mercury were below their limit of reporting at all stations. Arsenic, Chromium, Nickel, Lead, Copper and Zinc were detected in May 2018 samples at most stations and the concentrations of these metals and metalloids were similar amongst most stations (*Table B4* of *Annex B*; *Figure 7* of *Annex C*).

1.5.13 For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at all stations in May 2018 were higher than the WQO (0.5 mg/L) (*Table B4* of *Annex B*; *Figure 8* of *Annex C*). It should be noted that due to the effect of the Pearl River, the North Western WCZ has historically experienced higher levels of TIN [1]. Therefore, the exceedances of TIN WQO at these stations are unlikely to be caused by the disposal operation at ESC CMP Vd. Concentrations of Ammonia Nitrogen (NH_3-N) and 5-day Biochemical Oxygen Demand (BOD_5) were generally similar amongst most stations in May 2018 (*Table B4* of *Annex B*; *Figure 8 and 9* of *Annex C*), except generally higher BOD_5 was detected at Ma Wan station.

1.5.14 Analyses of results for May 2018 indicated that the SS levels at all stations were lower than the WQO (10.8 mg/L for wet season) and SS levels compiled with the Action and Limit Levels at all stations (*Tables B1 and B4* of *Annex B*; *Figure 10* of *Annex C*).

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

1.5.15 Overall, results of the *Routine Water Quality Monitoring* indicated that the disposal operation at ESC CMP Vd did not appear to cause any unacceptable deterioration in water quality in May 2018. Detailed statistical analysis will be presented in the Quarterly Report to investigate any spatial and temporal trends of potential concern.

1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

1.6.1 The following monitoring activities will be conducted in the next monthly period of June 2018 for ESC CMP V (see *Annex A* for the sampling schedule):

- *Water Column Profiling of ESC CMP Vd;*
- *Pit Specific Sediment Chemistry of ESC CMP Vd; and*
- *Cumulative Impact Sediment Chemistry of ESC CMP V.*

1.6.2 No monitoring activities are scheduled to be undertaken for SB CMPs in June 2018.

1.7 STUDY PROGRAMME

1.7.1 A summary of the Study Programme is presented in *Annex D*.

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		
	ESC-IPE2A	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-IPE3	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-IPE4	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-IPE5	4 times per year																							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		
	ESC-INE2A	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-INE3A	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-INE4A	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-INE5A	4 times per year																							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		
	ESC-RFE2	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-RFE3	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-RFE4	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-RFE5	4 times per year																							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		
Flood Tide																																																		
Impact Station Downcurrent																																																		
	ESC-IPF1	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-IPF2	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-IPF3	4 times per year																							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		
	ESC-INF2	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-INF3	4 times per year																							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		
	ESC-RFF2A	4 times per year																							3			3		3					3		3			3		3				3		3		
	ESC-RFF3	4 times per year																							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		

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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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	

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

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 May 2018

Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg L^{-1})	pH	Suspended Solids (mg L^{-1})
WCP 1 (Downstream)	29.05	20.51	6.76	98.25	6.74	8.00	5.78
WCP 2 (Upstream)	28.95	21.43	7.63	93.63	6.40	7.96	6.70
WQO (Wet Season)	N/A	19.28–23.57#	N/A	N/A	>4	6.5-8.5	10.8

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 In-situ Monitoring Results for Routine Water Quality Monitoring of ESC CMPs in May 2018

Sampling Period	Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg L^{-1})	pH (mg L^{-1})
May 2018	RFE (Reference)	28.30	23.64	5.24	96.38	6.58	7.98
	IPE (Impact)	28.19	23.69	5.91	86.54	5.92	7.89
	INE (Intermediate)	28.24	23.51	5.08	86.12	5.89	7.87
	Ma Wan	27.28	27.76	2.41	83.42	5.66	7.93
	WQO	N/A	21.28 – 26.00#	N/A	N/A	>4	6.5-8.5

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

Table B4 Laboratory Results for Routine Water Quality Monitoring of ESC CMPs in May 2018

Sampling Period	Stations	As (µg/L)	Cd (µg/L)	Cr (µg/L)	Cu (µg/L)	Pb (µg/L)	Hg (µg/L)	Ni (µg/L)	Ag (µg/L)	Zn (µg/L)	NH_3 (mg/L)	TIN (mg/L)	BOD_5 (mg/L)	SS (mg/L)
May 2018	RFE	1.89	<0.5	0.74	21.34	1.06	<0.5	1.75	<1.0	20.48	0.18	1.59	2.06	7.46
	IPE	1.99	<0.5	0.68	15.36	1.06	<0.5	1.95	<1.0	16.67	0.13	2.27	1.24	6.85
	INE	1.89	<0.5	0.53	14.37	1.43	<0.5	1.75	<1.0	19.54	0.10	1.65	1.40	6.17
	Ma Wan	1.98	<0.5	<1.0	21.69	1.64	<0.5	0.99	<1.0	27.14	0.14	1.20	3.35	4.58

WQO of TIN: 0.5 mg/L
Wet Season WQO of SS : 10.8 mg/L

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

Annex C

Graphical Presentations

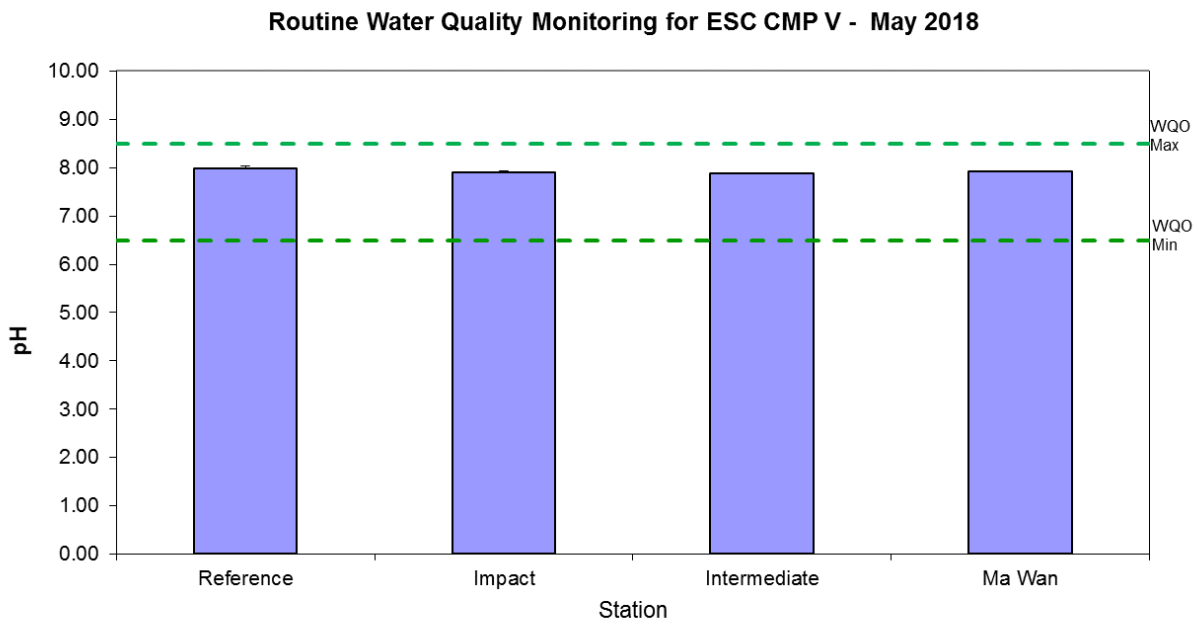


Figure 1: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2018.

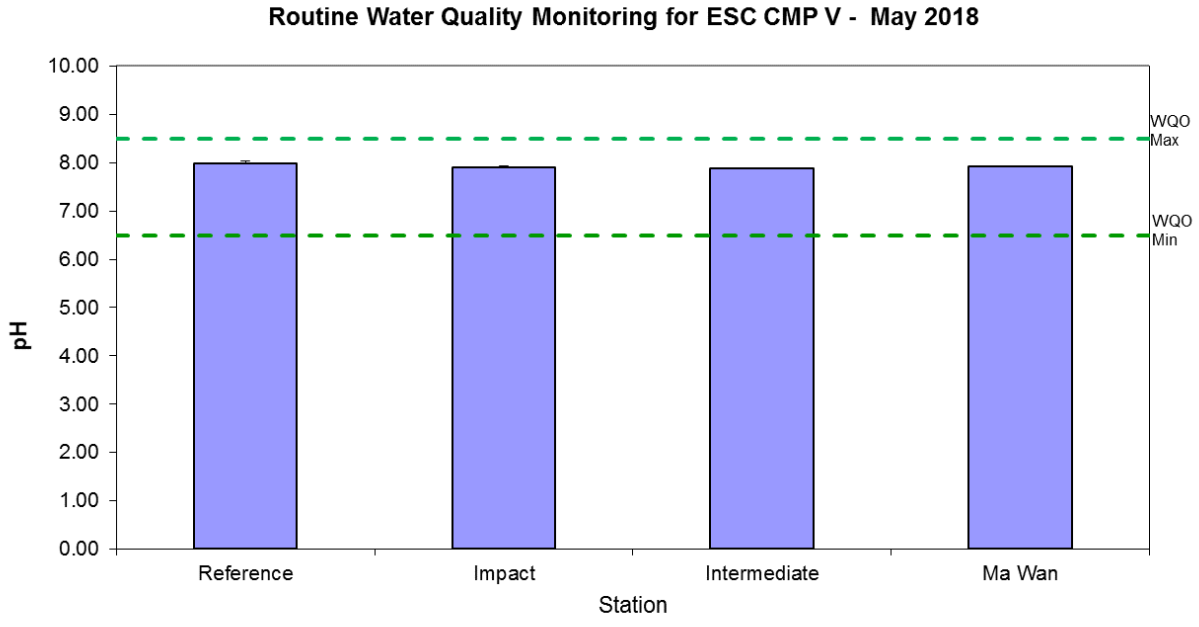


Figure 2: Level of Dissolved Oxygen (DO) (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2018.

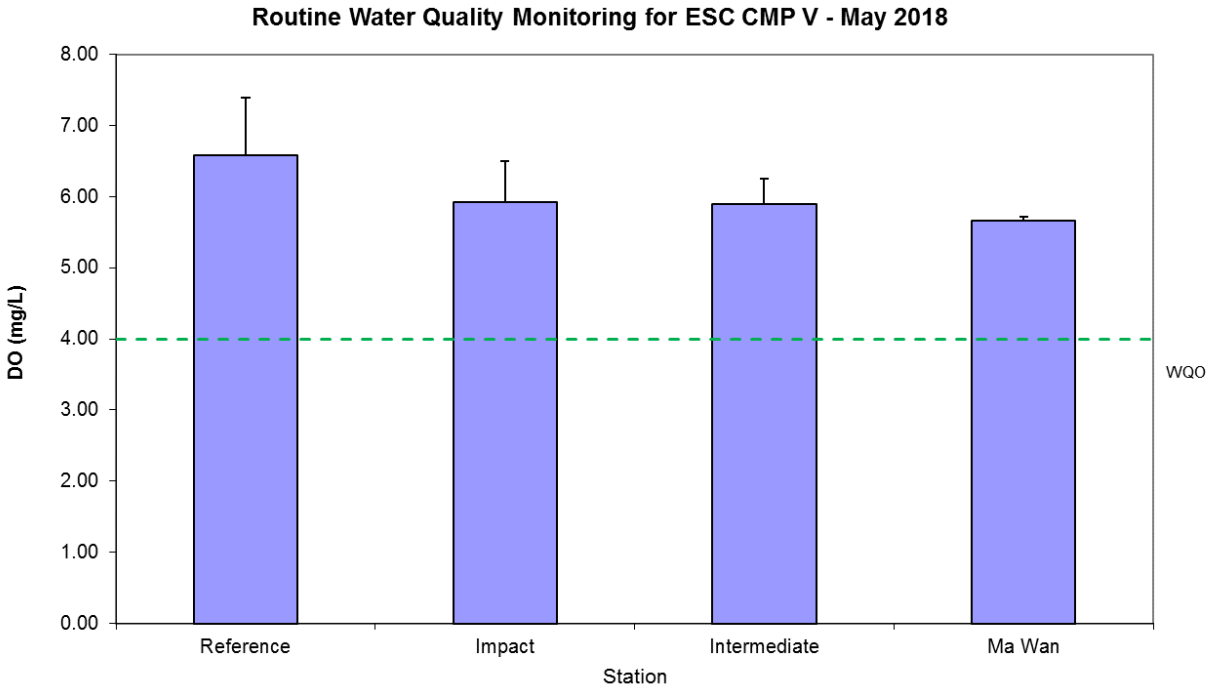


Figure 3: Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2018.

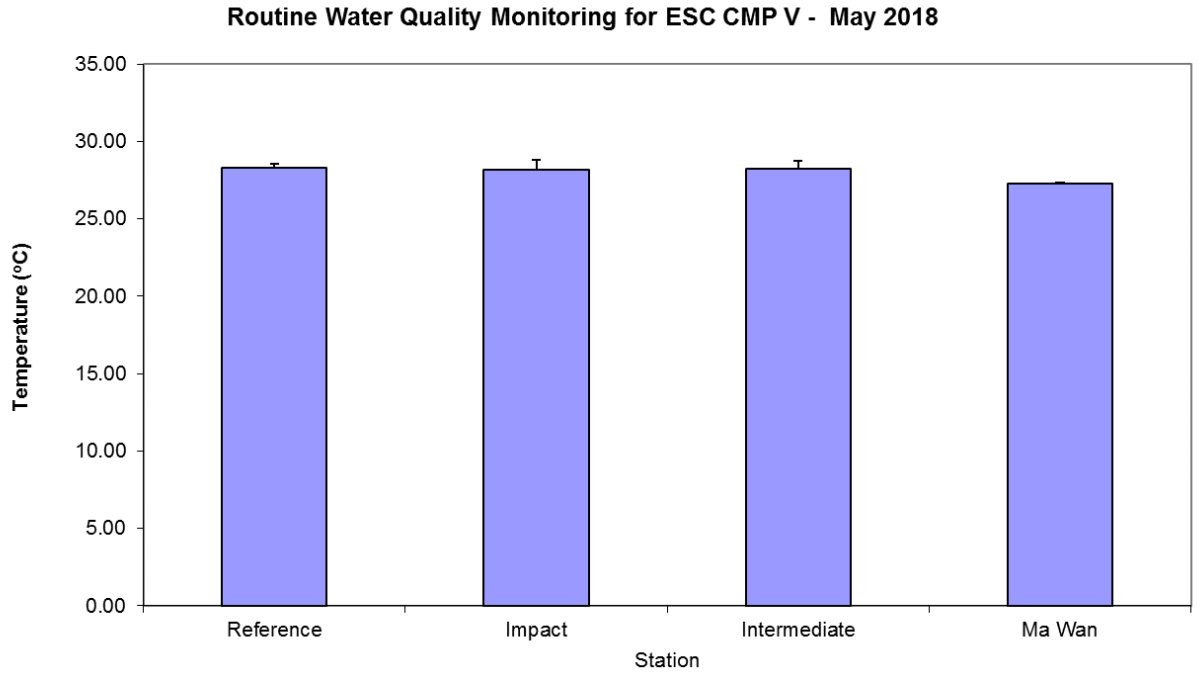


Figure 4: Level of Temperature (˚C; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2018.

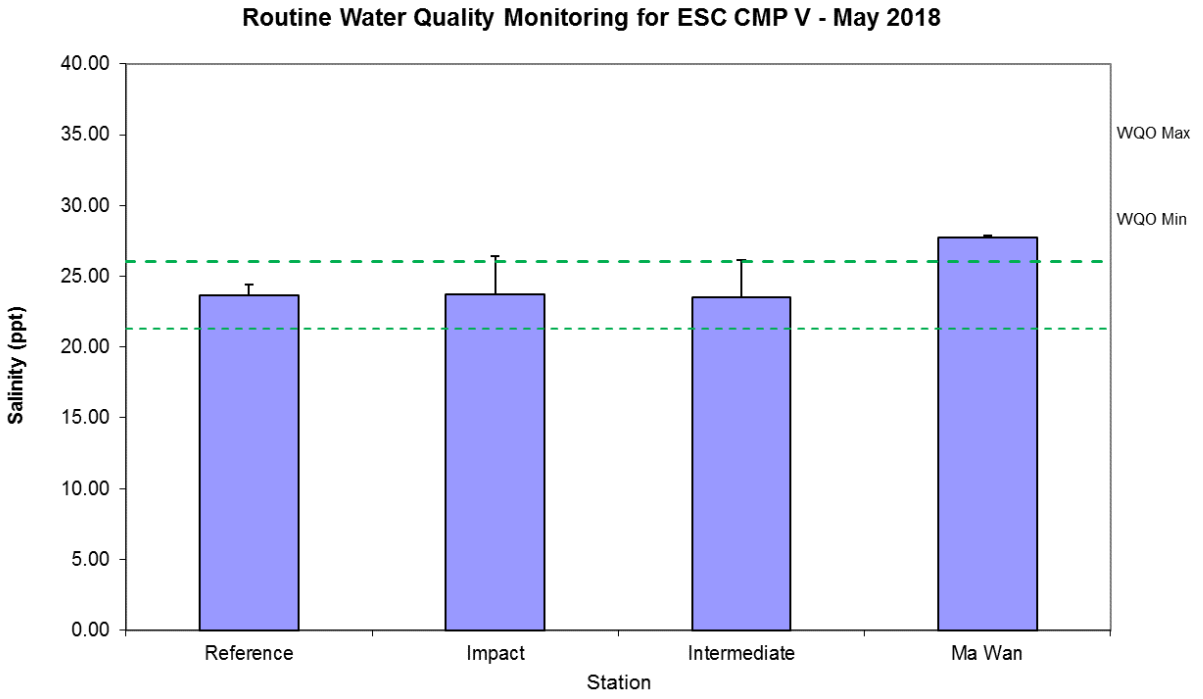


Figure 5: Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2018.

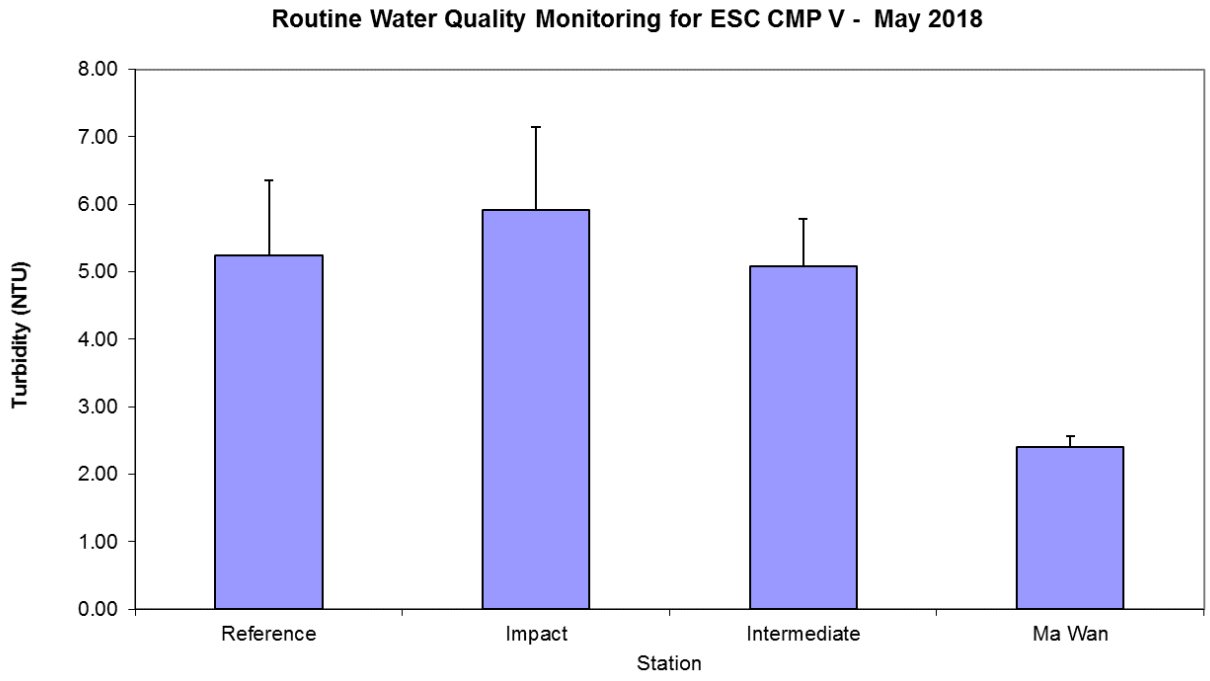


Figure 6: Levels of Turbidity (NTU; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2018.

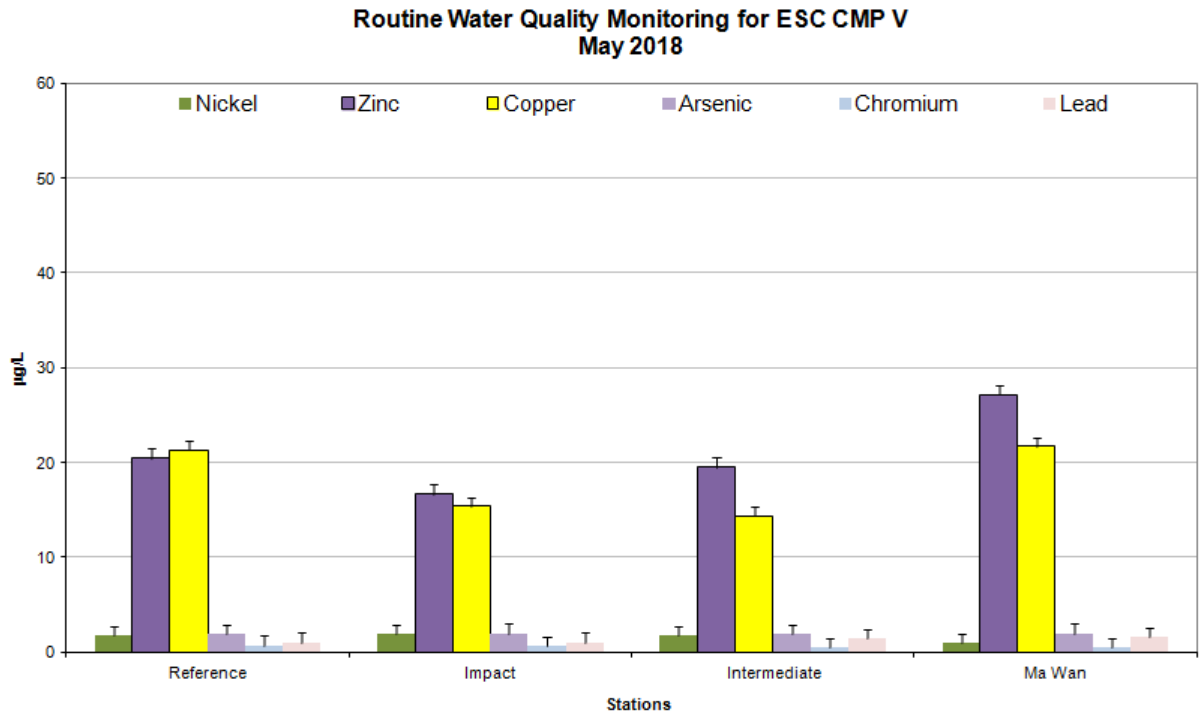


Figure 7: Concentration of Arsenic, Chromium, Nickel, Lead, Copper and Zinc (µg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2018.

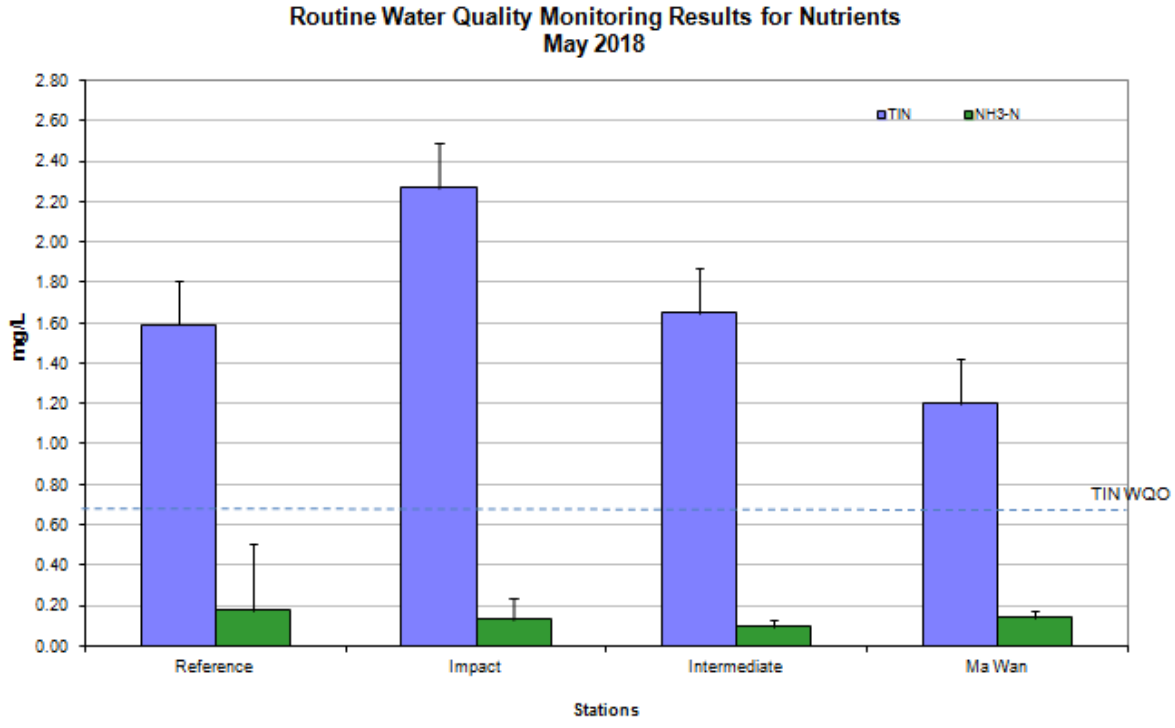


Figure 8: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen (NH3-N) (µg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2018.

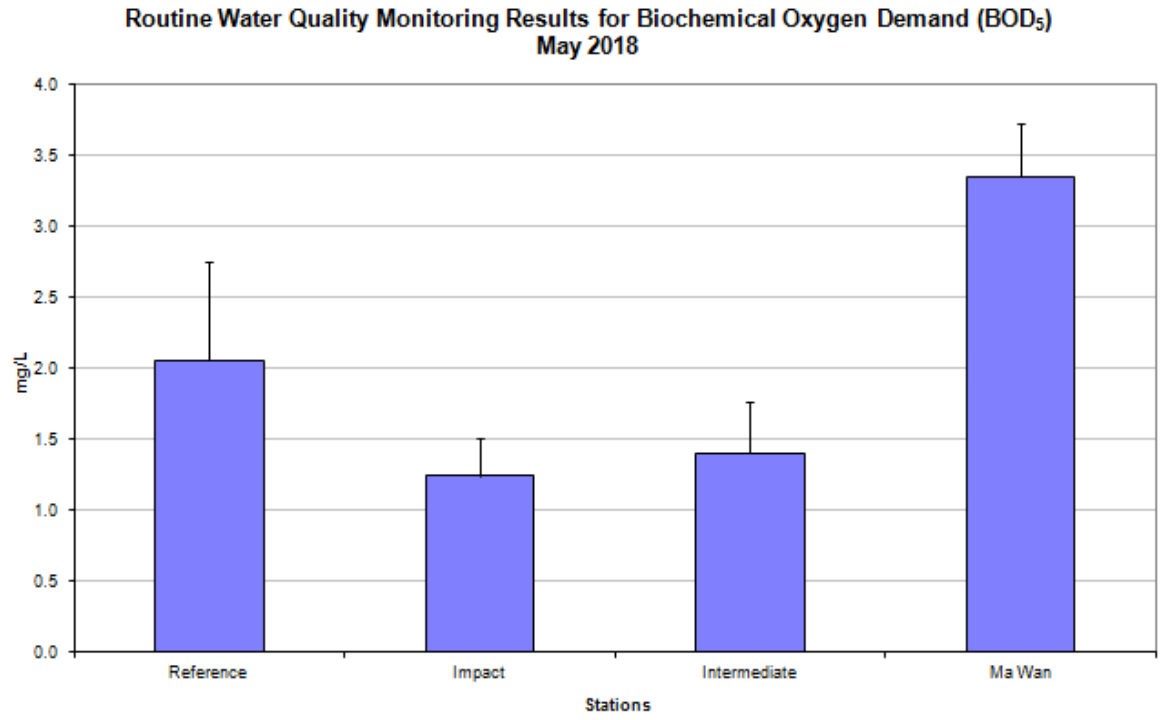


Figure 9: Level of Biochemical Oxygen Demand (BOD_5) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2018.

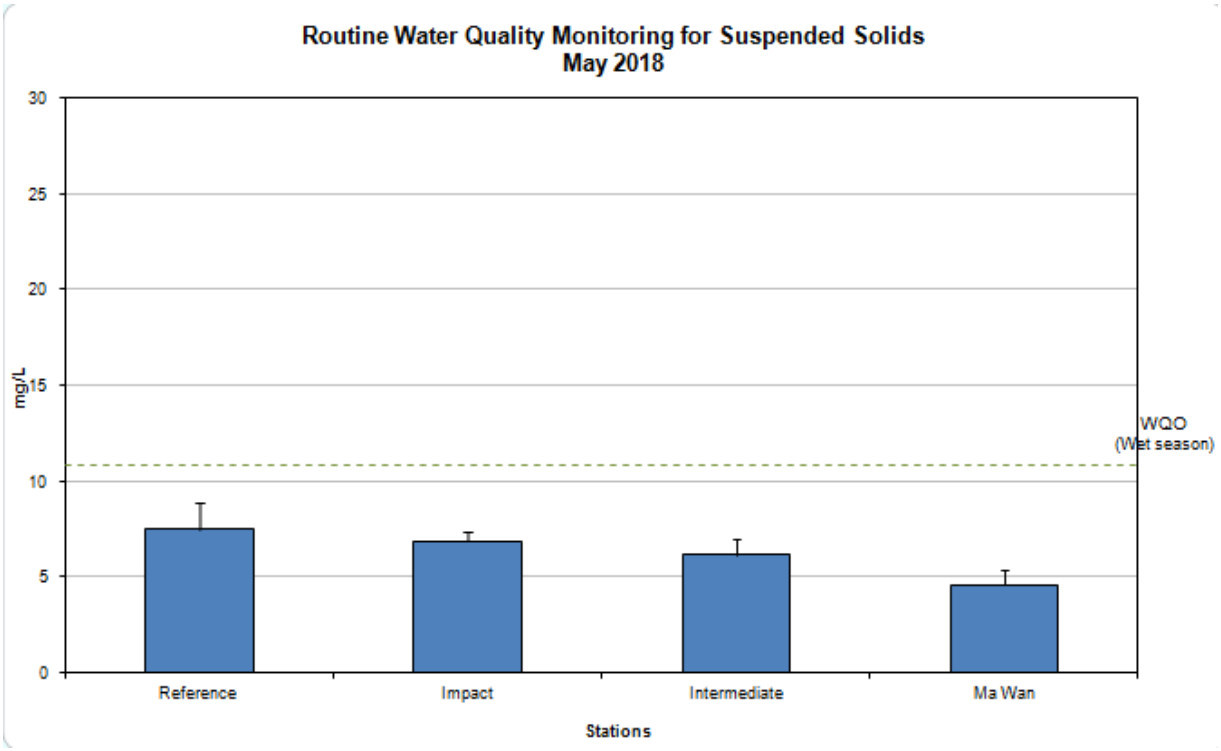
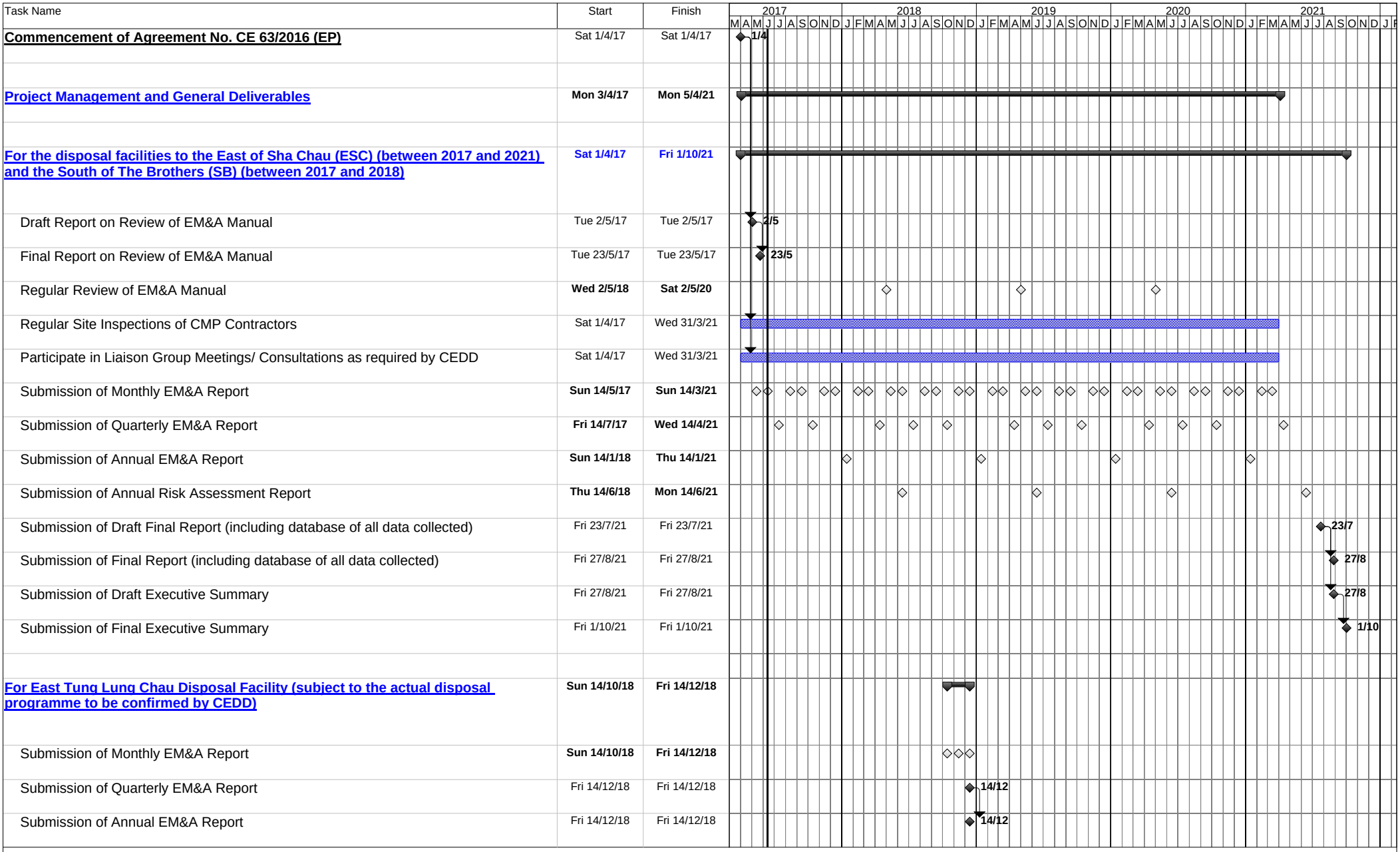


Figure 10: Concentration of Suspended Solids (SS) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2018.

Annex D

Study Programme



Study Programme
Tue 13/6/17

Task | Milestone | Summary | Rolled Up Milestone

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

0400720_CMP EM&A Programme_v1_EM&A.mpp