



**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 –  
February 2020**

Revision 0

March 2020

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

[www.erm.com](http://www.erm.com)

**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 – February 2020**

**Revision 0**

**Environmental Resources  
Management**

2507, 25/F, One Harbourfront  
18 Tak Fung Street  
Hungghom, Kowloon  
Hong Kong  
Telephone: (852) 2271 3000  
Facsimile: (852) 2723 5660  
E-mail: post.hk@erm.com  
http://www.erm.com

*Document Code: 0400720\_Monthly February 2020\_v0.doc*

Client:  Civil Engineering and Development Department (CEDD)		Project No:  0400720			
Summary:  This document presents the Monthly EM&A Report for <i>Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau</i> .		Date: 6 March 2020		Approved by:  	
		Craig A. Reid Partner			
v0	Monthly EM&A Report for ESC CMPs	GS	RC	CAR	06/03/20
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> <div style="text-align: right;">    </div>			

## Dredging, Management and Capping of Contaminated Sediment Disposal Facility at Sha Chau

### Environmental Certification Sheet EP-312/2008/A

#### Reference Document/Plan

Document/ <del>Plan to be Certified</del> / Verified:	Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau - February 2020
Date of Report:	6 March 2020
Date prepared by ET:	6 March 2020
Date received by IA:	6 March 2020

#### Reference EP Condition

Environmental Permit Condition:

Condition 3.4 of EP-312/2008/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

Craig Reid,  
Environmental Team Leader:



Date: 06/03/2020

#### IA Verification

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

Dr Wang Wen Xiong,  
Independent Auditor:



Date: 06/03/2020

## **CONTENTS**

<b>1.1</b>	<b>BACKGROUND</b>	<b>1</b>
<b>1.2</b>	<b>REPORTING PERIOD</b>	<b>2</b>
<b>1.3</b>	<b>DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES</b>	<b>2</b>
<b>1.4</b>	<b>DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS</b>	<b>2</b>
<b>1.5</b>	<b>BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMP V</b>	<b>3</b>
<b>1.6</b>	<b>ACTIVITIES SCHEDULED FOR THE NEXT MONTH</b>	<b>7</b>
<b>1.7</b>	<b>STUDY PROGRAMME</b>	<b>7</b>

## **ANNEXES**

<b>ANNEX A</b>	<b>SAMPLING SCHEDULE</b>
<b>ANNEX B</b>	<b>WATER QUALITY MONITORING RESULTS</b>
<b>ANNEX C</b>	<b>GRAPHICAL PRESENTATIONS</b>
<b>ANNEX D</b>	<b>STUDY PROGRAMME</b>

**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 FEBRUARY 2020**

**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 <sup>(1)</sup> <sup>(2)</sup>. 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). The scheduled EM&A programme for SB CMPs was completed in December 2018. Detailed works schedule for ESC CMP V is shown in *Figure 1.1*. In February 2020, the following works were undertaken:

- Disposal of contaminated mud at ESC CMP Vb; and
- Capping operations 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.





## 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 February 2020*:

- *Water Column Profiling of ESC CMP Vb;*
- *Routine Water Quality Monitoring of ESC CMPs;*
- *Pit Specific Sediment Chemistry of ESC CMP Vb;*
- *Cumulative Impact Sediment Chemistry of ESC CMPs; and*
- *Water Quality Monitoring During Capping of ESC CMPs.*

1.5.2 ***Water Column Profiling of ESC CMP Vb - February 2020***

1.5.3 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 3 February 2020. 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 2009 - 2018 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 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 February 2020 indicated that levels of Salinity, pH and DO complied with the WQOs at both Downstream and Upstream stations (*Table B2 of Annex B*). 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 February 2020 indicated that the SS levels at both Downstream and Upstream stations complied with the WQO and the Action and Limit Levels (*Tables B1 and B2 of Annex B*).

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

1.5.7 ***Routine Water Quality Monitoring of ESC CMPs - February 2020***

1.5.8 *Routine Water Quality Monitoring of ESC CMPs* was undertaken on 4 February 2020. 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 February 2020 as shown in *Figure 1.2*.

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



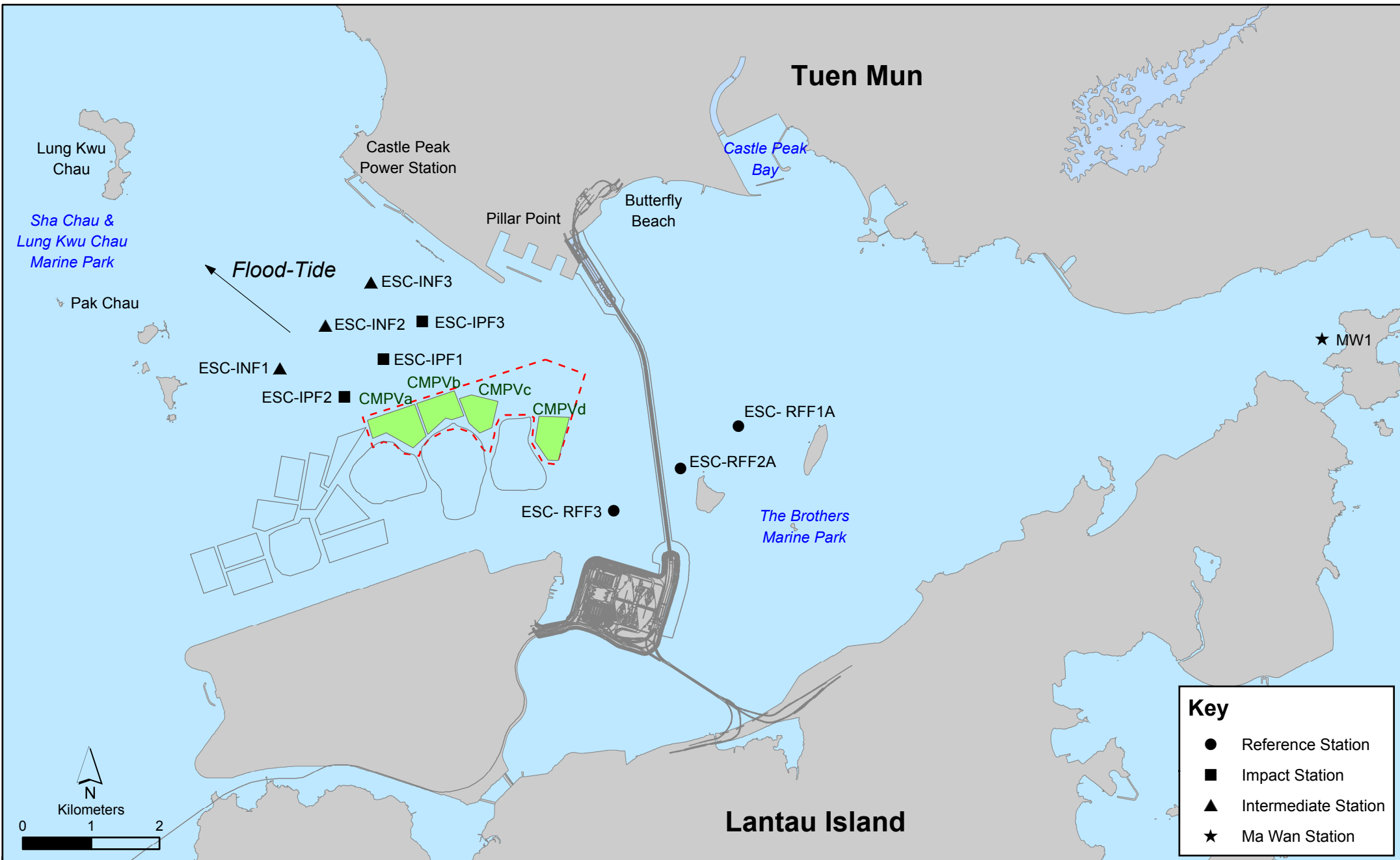


Figure 1.2

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

### *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 February 2020 indicated that the levels of pH, Salinity and DO complied with the WQOs at all stations in February 2020.
- 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 Vb did not appear to cause any unacceptable impacts in water quality in February 2020.

### *Laboratory Measurements*

- 1.5.12 Laboratory analysis of February 2020 results indicated that concentrations of Arsenic, Cadmium, Chromium, Copper, Mercury, Lead, Nickel and Zinc were detected in February 2020 samples at most stations and the concentrations of these metals and metalloids were similar amongst the stations, except the concentrations of Zinc and Copper were higher at Reference stations and Impact stations, respectively (*Table B4 of Annex B; Figure 7 of Annex C*).
- 1.5.13 For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at all stations were lower than the WQO (0.5 mg/L) (*Table B4 of Annex B; Figure 8 of Annex C*). The concentrations of Ammonia Nitrogen (NH<sub>3</sub>-N) were higher at Ma Wan station and the concentrations of 5-day Biochemical Oxygen Demand (BOD<sub>5</sub>) were similar amongst all stations in February 2020 (*Table B4 of Annex B; Figure 8 and 9 of Annex C*).
- 1.5.14 Analyses of results for February 2020 indicated that the SS levels at all stations were lower than the WQO (13.6 mg/L for dry season) and complied with the Action and Limit Levels (*Tables B1 and B4 of Annex B; Figure 10 of Annex C*).
- 1.5.15 Overall, results of the Routine Water Quality Monitoring indicated that the disposal operation at ESC CMP Vb did not appear to cause any unacceptable deterioration in water quality in February 2020. Detailed statistical analysis will be presented in the Quarterly Report to investigate any spatial and temporal trends of potential concern.
- 1.5.16 ***Pit Specific Sediment Chemistry of ESC CMP Vb – February 2020***
- 1.5.17 Monitoring locations for *Pit Specific Sediment Chemistry* for ESC CMP Vb are shown in *Figure 1.3*. A total of six (6) monitoring stations were sampled on 5 February 2020.
- 1.5.18 The concentrations of most inorganic contaminants were lower than the Lower Chemical Exceedance Levels (LCELs) at most stations, except for Arsenic (*Figures 11 and 12 of Annex C*). The concentrations of Arsenic were higher than the LCEL at Pit-Edge stations ESC-NECA and ESC-NECB.

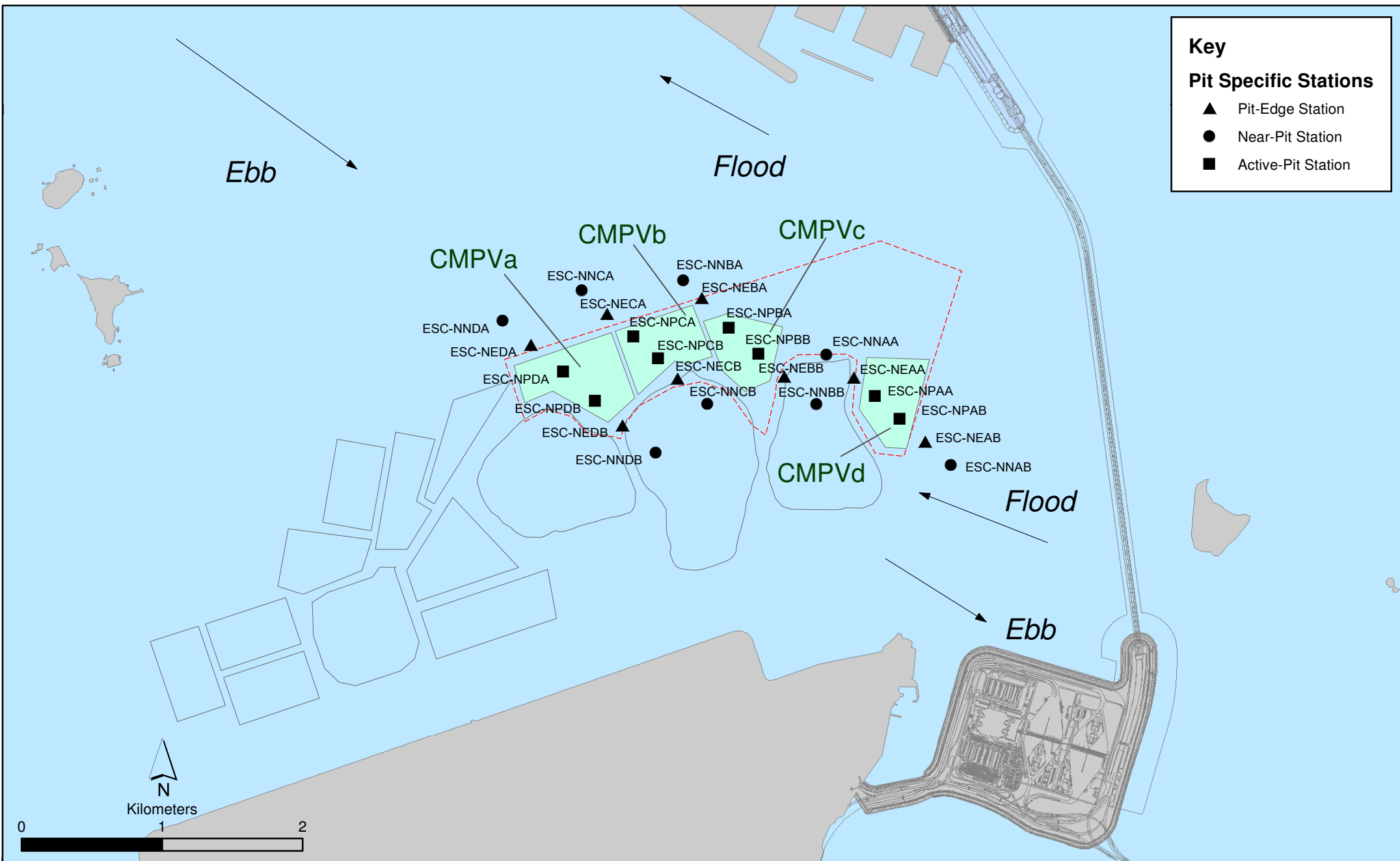


Figure 1.3

Pit Specific Sediment Quality Monitoring Stations for CMPV

- 1.5.19 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were higher at Active-Pit stations in February 2020 (*Figure 13 of Annex C*). The concentrations of Tributyltin (TBT), Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT), 4,4'-dichlorodiphenyldichloroethylene (DDE), Low Molecular Weight and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) were below the limit of reporting at all stations in February 2020.
- 1.5.20 Whilst the average concentration of Arsenic in the Earth's crust is generally ~2mg/kg, significantly higher Arsenic concentrations (median = 14 mg/kg) have been recorded in Hong Kong's onshore sediments <sup>(1)</sup>. It is presumed that the natural concentrations of Arsenic are similar in onshore and offshore sediments <sup>(2)</sup>, and relatively high Arsenic levels may thus occur throughout Hong Kong. Therefore, the LECL exceedances of Arsenic are unlikely to be caused by the disposal operations at ESC CMP Vb but rather as a result of naturally occurring deposits.
- 1.5.21 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.
- 1.5.22 ***Cumulative Impact Sediment Chemistry of ESC CMPs – February 2020***
- 1.5.23 Monitoring locations for Cumulative Impact Sediment Chemistry for ESC CMPs are shown in *Figure 1.4*. A total of nine (9) monitoring stations were sampled on 6 and 7 February 2020.
- 1.5.24 Analyses of results for the *Cumulative Impact Sediment Chemistry Monitoring* indicated that the concentrations of most inorganic contaminants were below the LCEL at most stations in February 2020, except concentrations of Arsenic were higher than the LCEL at Near-field station ESC-RNB, Mid-field stations ESC-RMA and ESC-RMB and Far-field station ESC-RFB (*Figures 14 and 15 of Annex C*). As discussed in *Section 1.5.20*, the LECL exceedances of Arsenic are unlikely to be caused by the disposal operations at ESC CMP Vb but rather as a result of naturally occurring deposits.
- 1.5.25 For organic contaminants, the concentrations of TOC varied between stations in February 2020, with the generally higher concentrations of TOC recorded at Ma Wan station (*Figure 16 of Annex C*). The concentrations of TBT, Total PCBs, Total DDT, 4,4'-DDE, Low Molecular Weight and High Molecular Weight PAHs were below the limit of reporting at all stations in February 2020.
- 1.5.26 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 Vb in February 2020. 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.

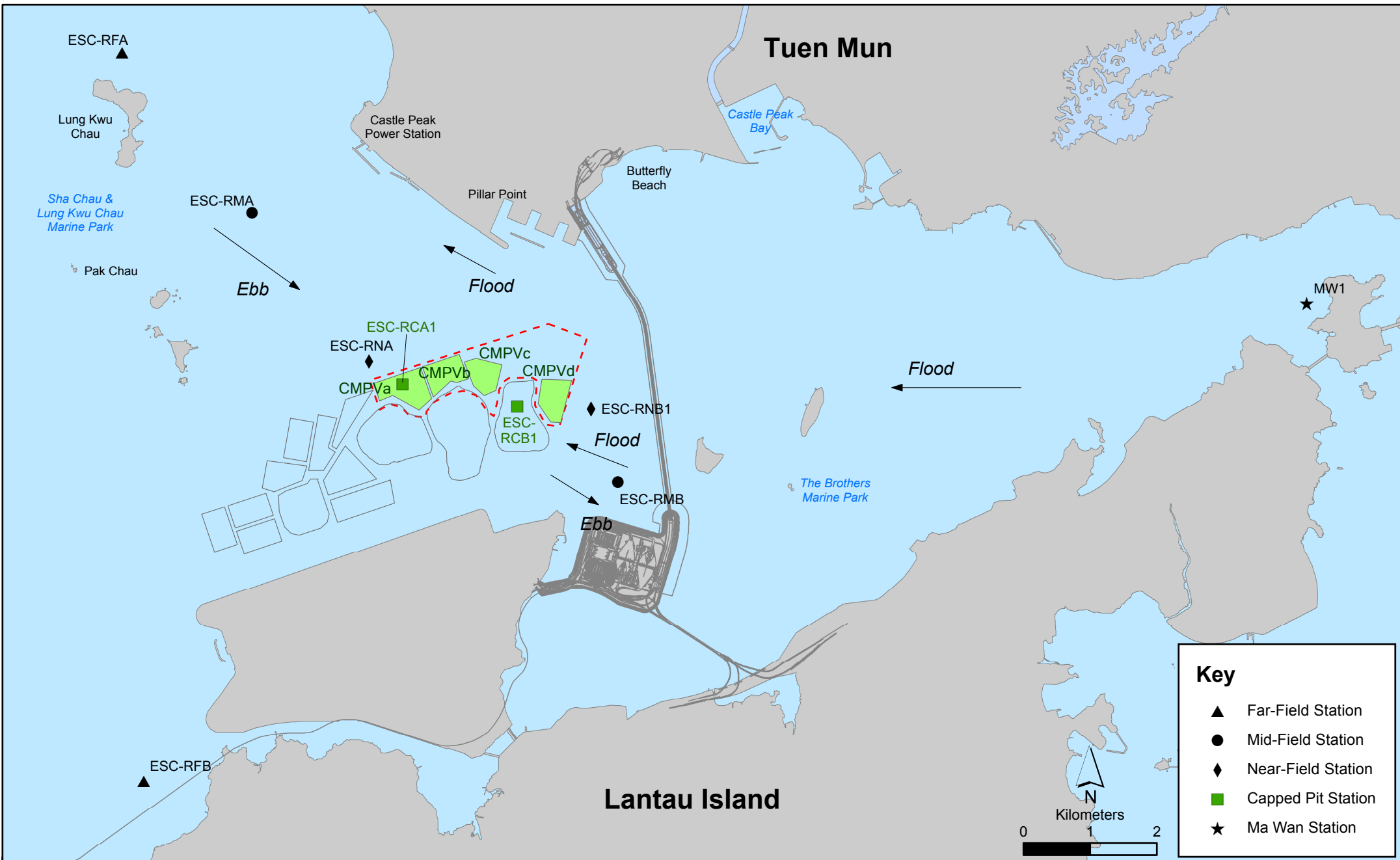


Figure 1.4

Cumulative Impacts Sediment Quality Monitoring Stations for ESC CMPs

1.5.27 ***Water Quality Monitoring during Capping of ESC CMPs – February 2020***

1.5.28 The monitoring results obtained during February 2020 sampling in the dry season have been assessed for compliance with the WQOs (see Section 1.5.3 for details). A total of sixteen (16) monitoring stations were sampled on 10 February 2020 as shown in *Figure 1.5*.

*In-situ Measurements*

1.5.29 Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in *Figures 17-22 of Annex C*. Levels of Salinity, DO and pH at all stations in February 2020 complied with the WQO (*Table B5 of Annex B*). Level of DO and Turbidity also complied the Action and Limit levels (*Table B5 of Annex B*).

*Laboratory Measurements for Suspended Solids (SS)*

1.5.30 Concentrations of SS complied with the WQO at most stations, except at the impact stations. Concentrations of SS complied with the Action and Limit Levels at all stations in February 2020 (*Table B5 of Annex B; Figure 23 of Annex D*).

1.5.31 Overall, results of the Water Quality Monitoring during Capping of ESC CMPs indicated that the capping operation at ESC CMP Vd did not appear to cause any unacceptable deterioration in water quality in February 2020. Further statistical analysis will be undertaken in the quarterly report to investigate whether the capping operations at ESC CMP Vd is causing any unacceptable deterioration in water quality of the area.

**1.6 *ACTIVITIES SCHEDULED FOR THE NEXT MONTH***

1.6.1 The following monitoring activities will be conducted in the next monthly period of March 2020 for ESC CMP V (see *Annex A* for the sampling schedule <sup>(3)</sup>):

- *Water Column Profiling of ESC CMP Vb; and*
- *Pit Specific Sediment Chemistry of ESC CMP Vb.*

**1.7 *STUDY PROGRAMME***

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

(1) Sewell RJ (1999) Geochemical Atlas of Hong Kong. Geotechnical Engineering Office, Government of the Hong Kong Special Administrative Region

(2) Whiteside PGD (2000) Natural geochemistry and contamination of marine sediments in Hong Kong. In: The Urban Geology of Hong Kong (ed Page A & Reels SJ). Geological Society of Hong Kong Bulletin No. 6, p109-121

(2) The scheduled EM&A Programme for SB CMPs was completed in December 2018.

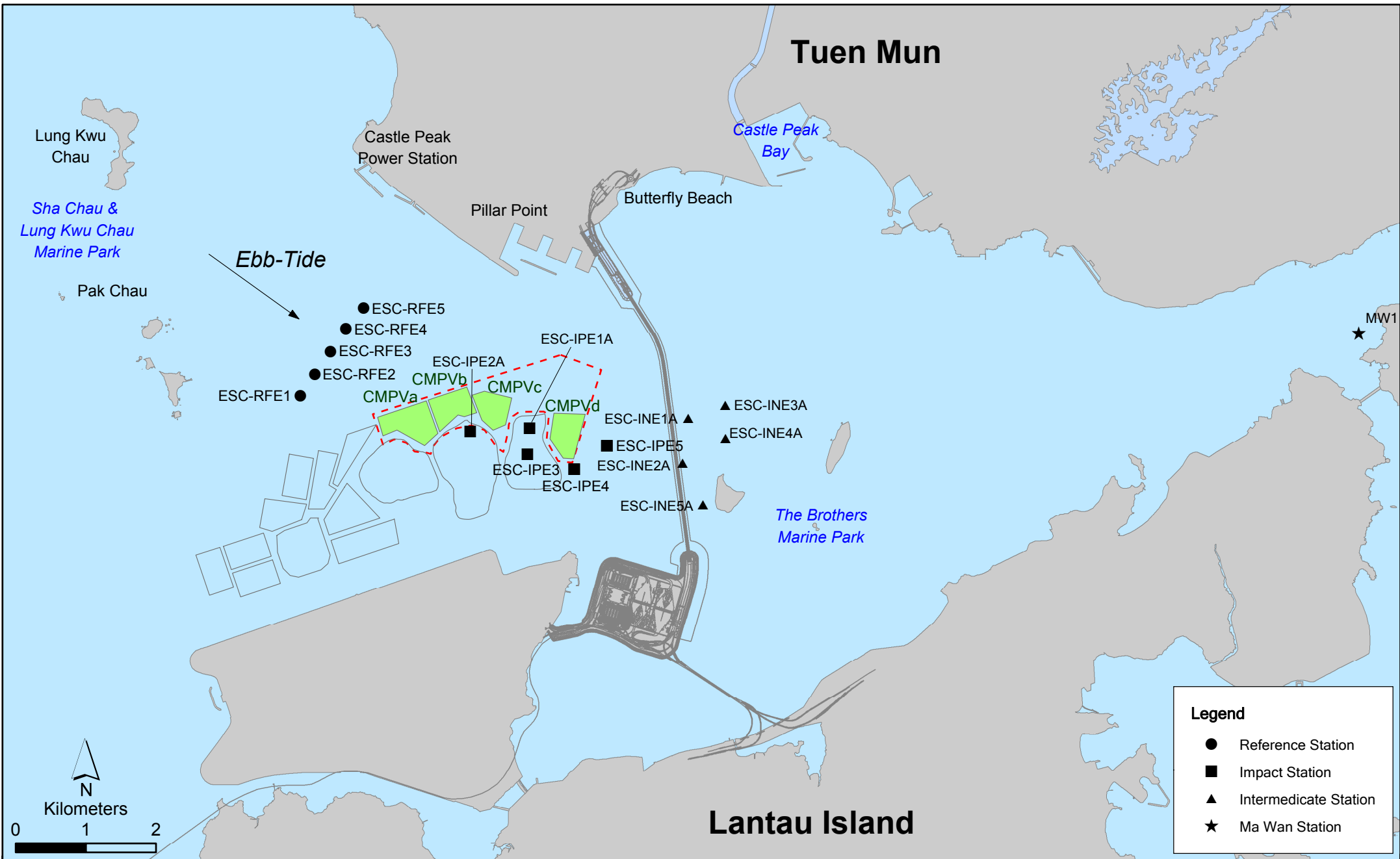


Figure 1.5

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



Annex A

## Sampling Schedule

Pit Specific Sediment Chemistry	Code	Frequency	2017				2018				2019				2020				2021																			
			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
	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
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
	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
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
	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
<b>Cumulative Impact Sediment Chemistry</b>			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	
	ESC-RNB1	4 times per year			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	
	ESC-RMB	4 times per year			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	
	ESC-RCB1	4 times per year			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	
	ESC-RFB	4 times per year			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	
<b>Sediment Toxicity Tests</b>			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				5	
	ESC-TDB1	2 times per year			5				5				5				5				5				5				5				5				5	
Reference Stations	ESC-TRA	2 times per year			5				5				5				5				5				5				5				5				5	
	ESC-TRB	2 times per year			5				5				5				5				5				5				5				5				5	
Ma Wan Station																																						
	MW1	2 times per year			5				5				5				5				5				5				5				5				5	
<b>Tissue/Whole Body Sampling</b>			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			*				*				*				*				*				*				*				*				*	
<b>Demersal Trawling</b>			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			5	5
	ESC-INB	4 times per year			5	5			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			5	5
	TNB	4 times per year			5	5			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			5	5
	TSB	4 times per year			5	5			5	5			5	5			5	5			5	5			5	5			5	5			5	5			5	5
<b>Capping</b>			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
<b>Ebb Tide</b>																																						
Impact Station Downcurrent	ESC-IP1A	4 times per year																																				
	ESC-IP2A	4 times per year																																				
	ESC-IP3	4 times per year																																				
	ESC-IP4	4 times per year																																				
	ESC-IP5	4 times per year																																				
Intermediate Station Downcurrent	ESC-INE1A	4 times per year																																				
	ESC-INE2A	4 times per year																																				
	ESC-INE3A	4 times per year																																				
	ESC-INE4A	4 times per year																																				
	ESC-INE5A	4 times per year																																				
Reference Station Upcurrent	ESC-RFE1	4 times per year																																				
	ESC-RFE2	4 times per year																																				
	ESC-RFE3	4 times per year																																				
	ESC-RFE4	4 times per year																																				
	ESC-RFE5	4 times per year																																				
Ma Wan Station																																						
	MW1	4 times per year																																				
<b>Flood Tide</b>																																						
Impact Station Downcurrent	ESC-IPF1	4 times per year																																				
	ESC-IPF2	4 times per year																																				

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*

<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 B2** *Water Column Profiling Results for ESC CMP Vd in February 2020*

Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen		pH	Suspended Solids (mg L <sup>-1</sup> )
				(%)	(mg L <sup>-1</sup> )		
WCP 1 (Downstream)	18.60	32.30	4.56	102.30	7.89	8.29	5.65
WCP 2 (Upstream)	18.81	32.45	2.66	102.88	7.90	8.25	7.68
WQO (Dry Season)	N/A	29.21-35.70 <sup>#</sup>	N/A	N/A	>4	6.5-8.5	13.6

**Note:**

<sup>#</sup>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 February 2020*

Sampling Period	Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen		pH (mg L <sup>-1</sup> )
					(%)	(mg L <sup>-1</sup> )	
February 2020	RFE (Reference)	19.53	33.09	2.28	90.04	6.79	8.20
	IPE (Impact)	19.09	32.60	3.16	97.11	7.41	8.23
	INE (Intermediate)	18.98	32.52	2.90	97.86	7.49	8.23
	Ma Wan	19.13	32.50	2.44	95.13	7.27	8.13
	WQO	N/A	29.78- 36.40 <sup>#</sup>	N/A	N/A	>4	6.5-8.5

**Notes:**

<sup>#</sup>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 February 2020*

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 <sub>3</sub> (mg/L)	TIN (mg/L)	BOD <sub>5</sub> (mg/L)	SS (mg/L)
February 2020	RFE	1.88	0.26	1.68	10.30	1.98	0.77	0.84	<1	43.70	0.09	0.16	1.60	4.50
	IPE	1.93	<0.5	2.13	15.47	1.61	0.71	1.54	<1	9.94	0.08	0.18	1.50	6.37
	INE	1.79	<0.5	1.76	9.29	1.21	0.41	1.16	<1	17.92	0.06	0.17	1.30	7.58
	Ma Wan	1.74	<0.5	1.49	7.11	1.33	0.25	0.50	<1	12.73	0.14	0.22	1.31	5.01

WQO of TIN: 0.5 mg/L

Dry Season WQO of SS : 13.6 mg/L

**Notes:**

Cell shaded yellow / red indicate value exceeding the Action/Limit levels.

Cell shaded grey indicate value exceeding the WQO.

**Table B5** *Monitoring Results for Water Quality Monitoring during Capping of ESC on 10 February 2020*

Sampling Period	Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg L <sup>-1</sup> )	pH (mg L <sup>-1</sup> )	SS (mg L <sup>-1</sup> )
February 2020	RFF (Reference)	18.59	32.28	9.15	93.06	7.18	8.21	11.7
	IPF (Impact)	18.56	32.37	12.39	94.43	7.29	8.24	14.8
	INF (Intermediate)	18.76	32.64	6.91	91.35	7.01	8.24	9.21
	Ma Wan	18.99	33.00	7.77	82.08	6.26	8.17	11.7
	WQO	N/A	29.05-35.50*	N/A	N/A	>4	6.5-8.5	13.6

**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



### Routine Water Quality Monitoring for ESC CMP V - February 2020

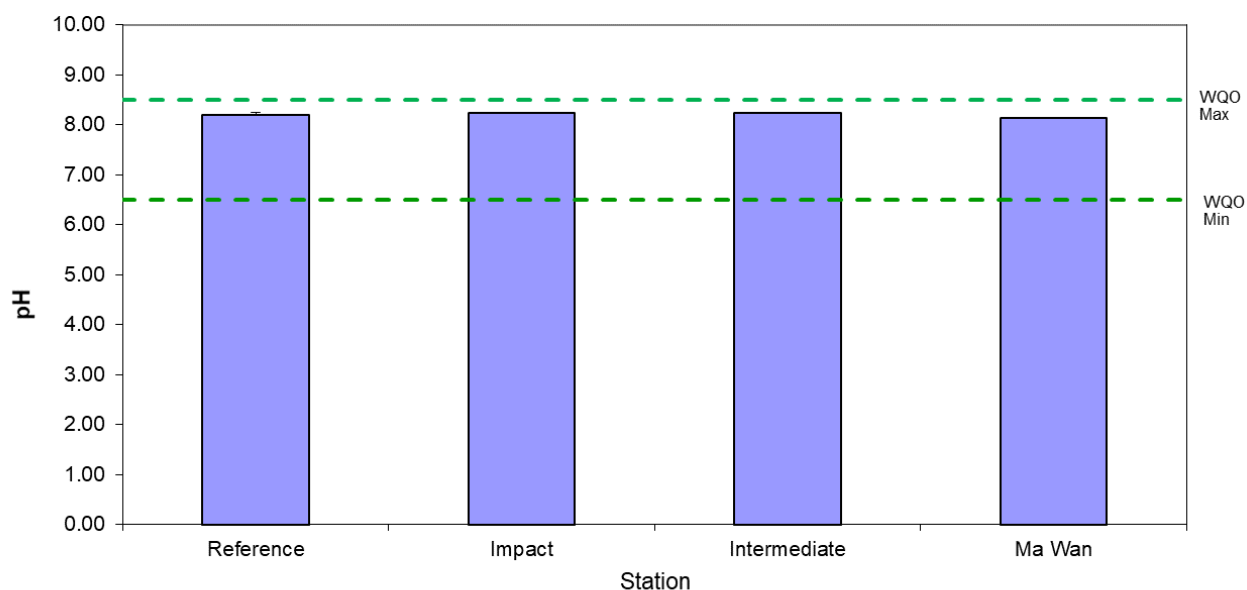


Figure 1: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in February 2020.

### Routine Water Quality Monitoring ESC CMP V - February 2020

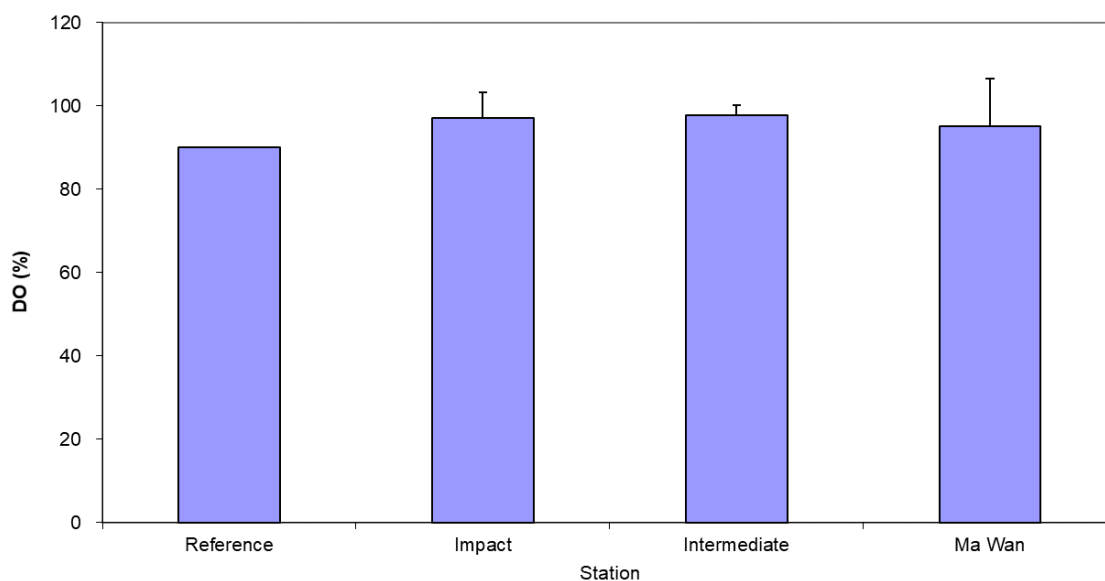


Figure 2: Level of Dissolved Oxygen (DO) (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental  
Resources  
Management**



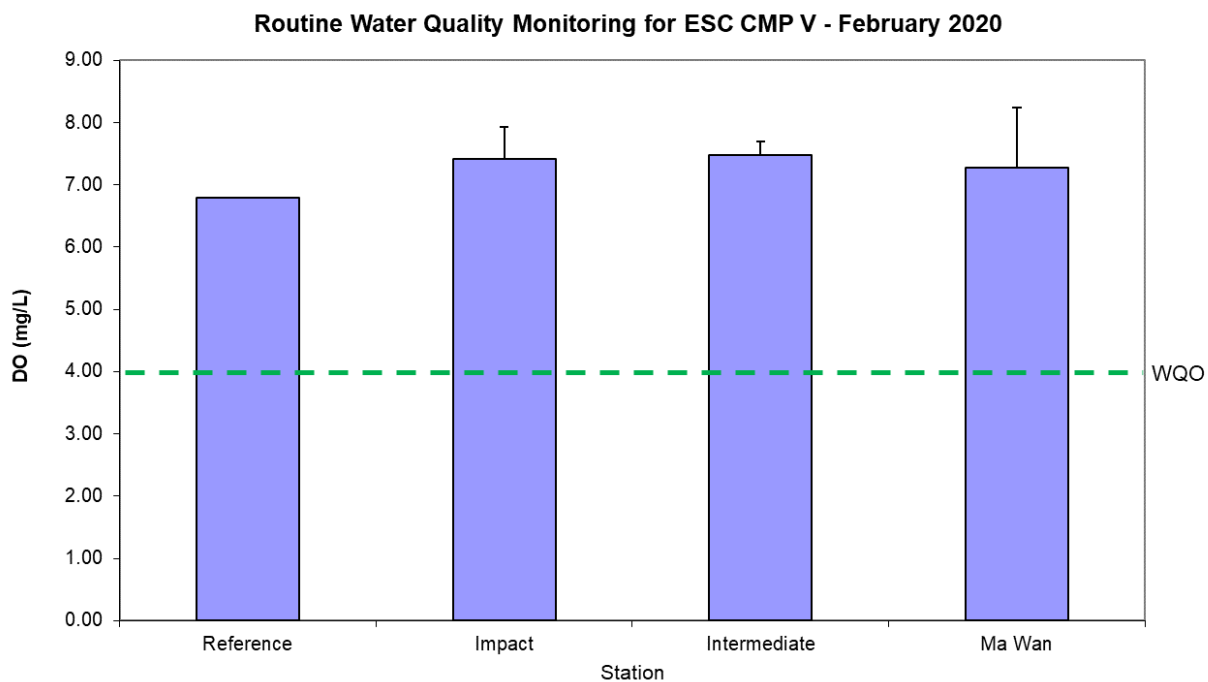


Figure 3: Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in February 2020.

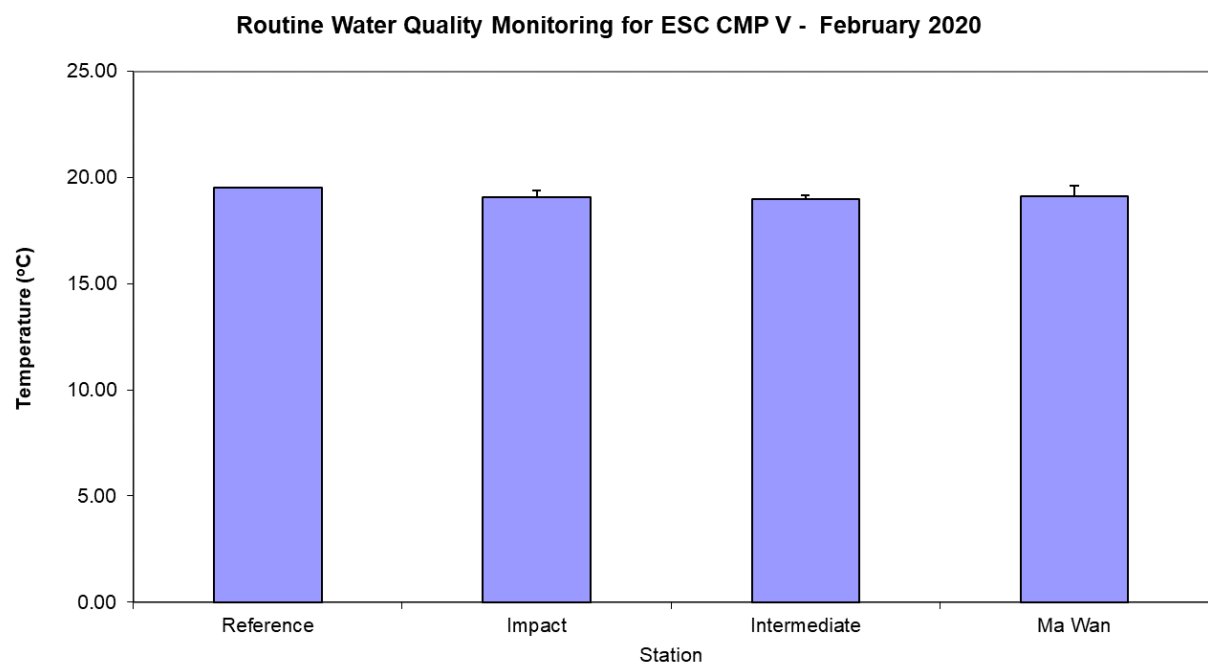


Figure 4: Level of Temperature (°C; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in February 2020.

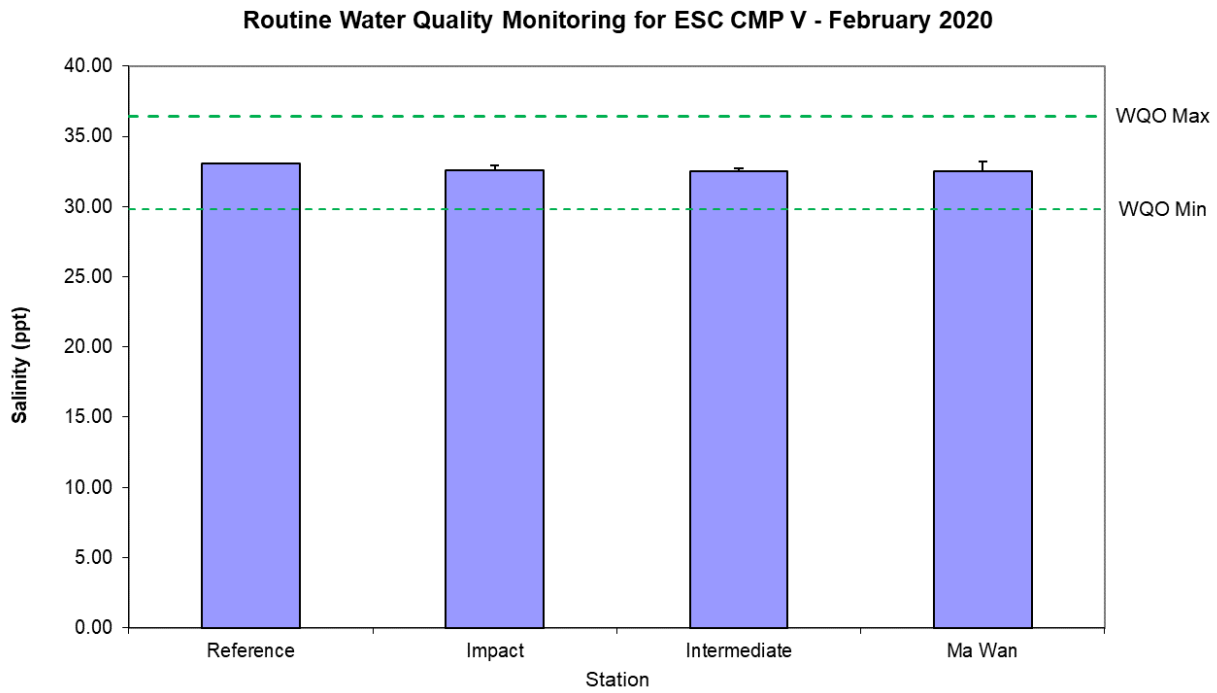


Figure 5: Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in February 2020.

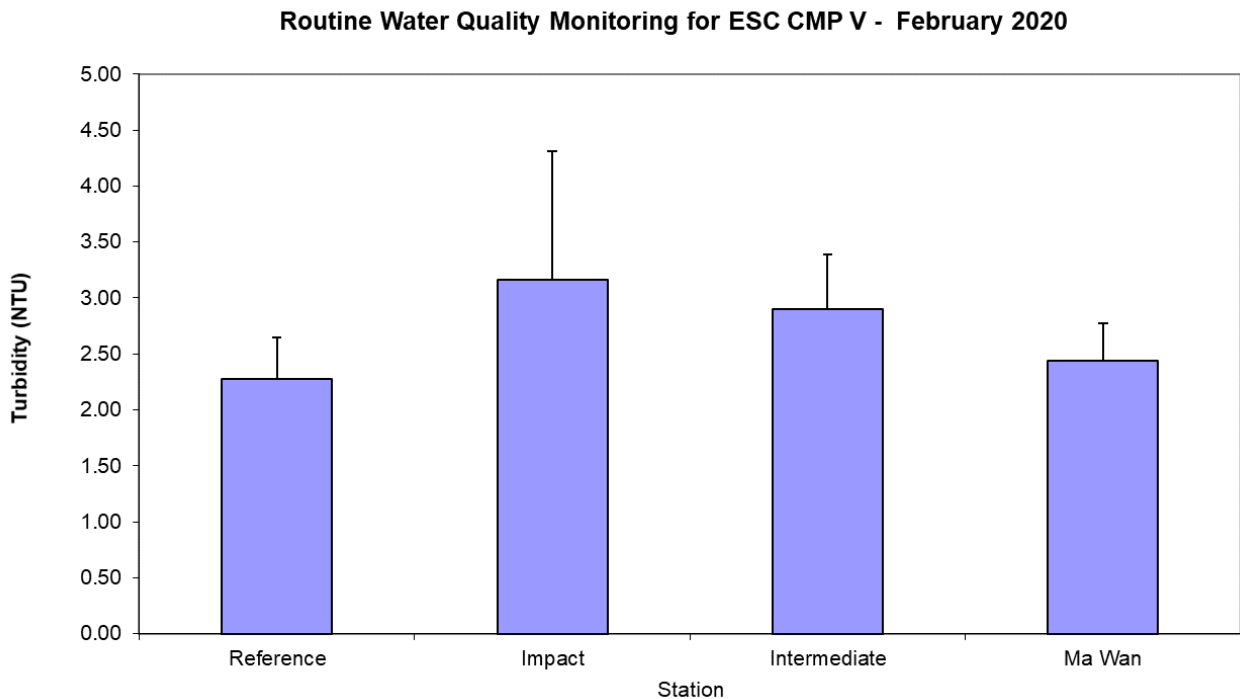


Figure 6: Levels of Turbidity (NTU; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental  
Resources  
Management**



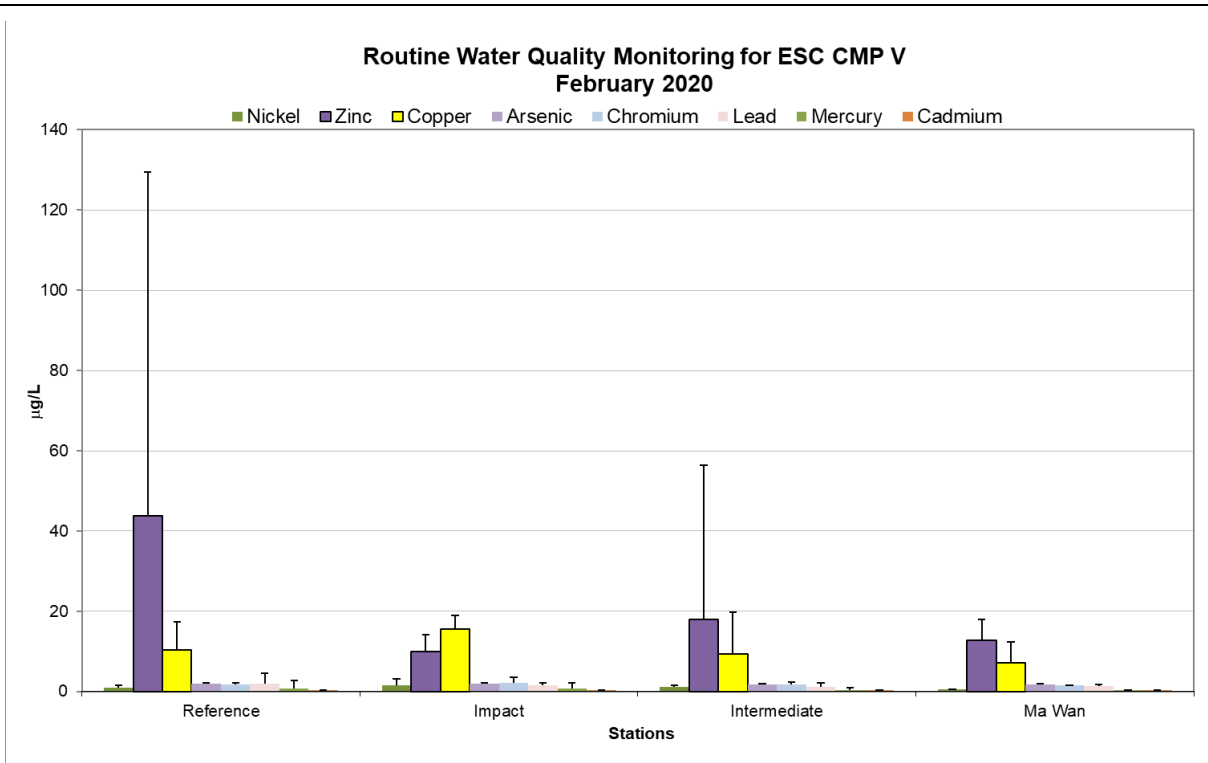


Figure 7: Concentration of Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc ( $\mu\text{g/L}$ ; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in February 2020.

**Routine Water Quality Monitoring Results for Nutrients  
February 2020**

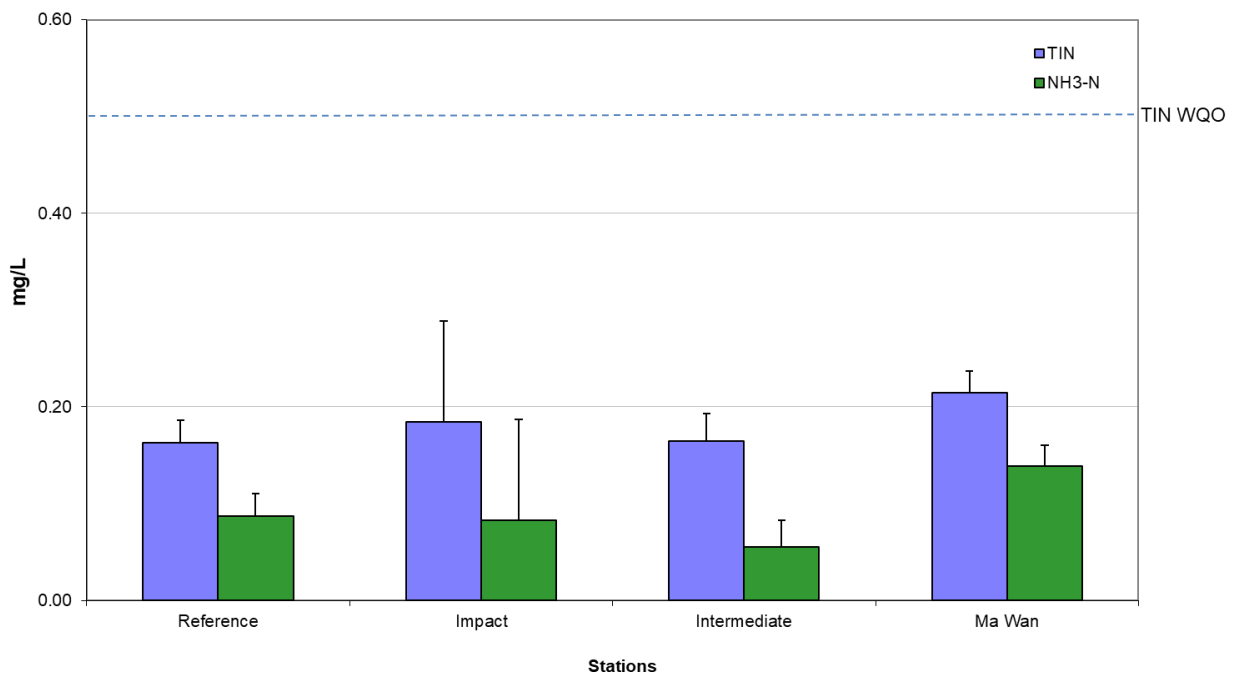


Figure 8: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen ( $\text{NH}_3\text{-N}$ ) ( $\text{mg/L}$ ; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental  
Resources  
Management**



**Routine Water Quality Monitoring Results for Biochemical Oxygen Demand (BOD<sub>5</sub>)  
February 2020**

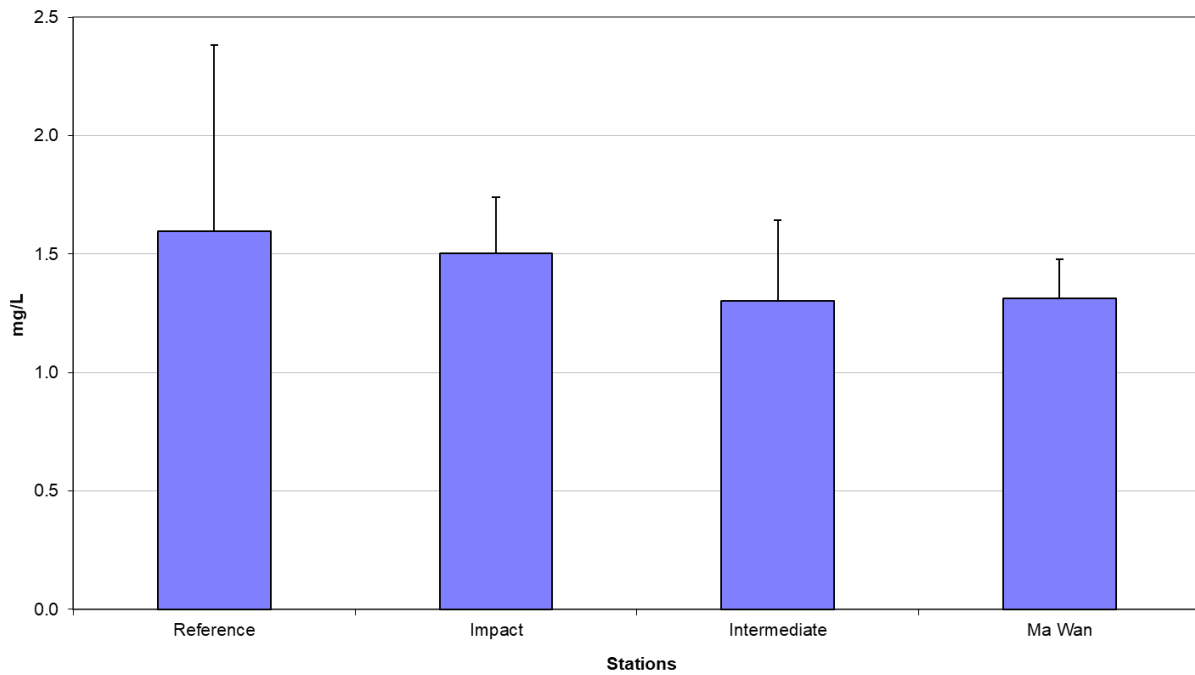


Figure 9: Level of Biochemical Oxygen Demand (BOD<sub>5</sub>) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in February 2020.

**Routine Water Quality Monitoring for Suspended Solids  
February 2020**

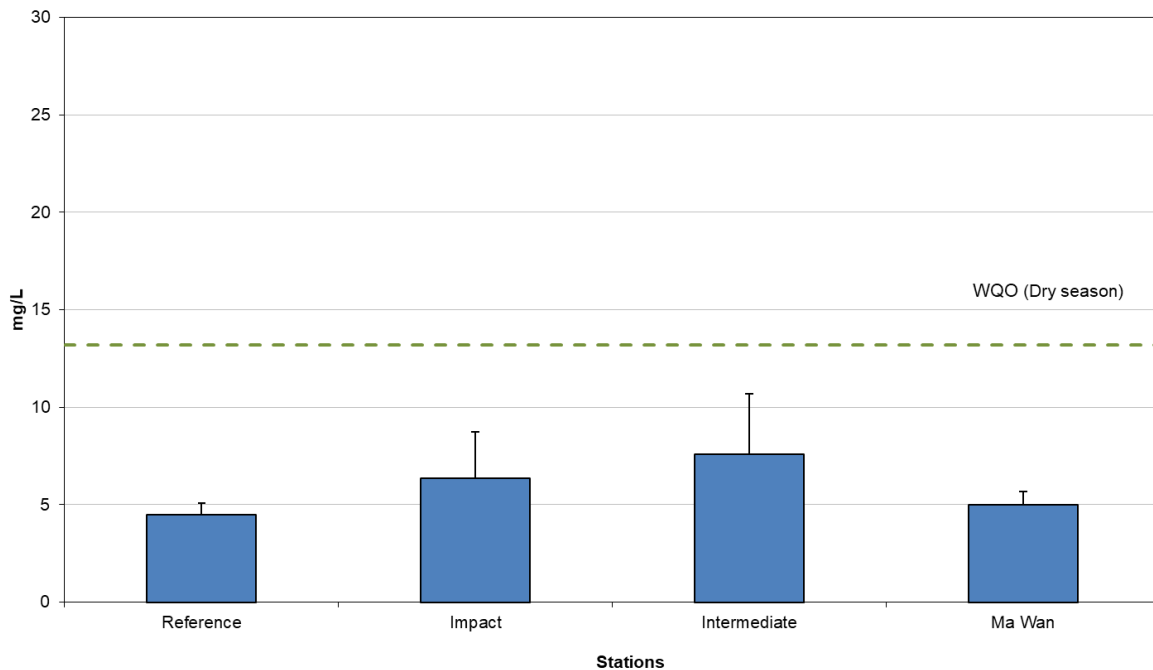


Figure 10: Concentration of Suspended Solids (SS) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental  
Resources  
Management**



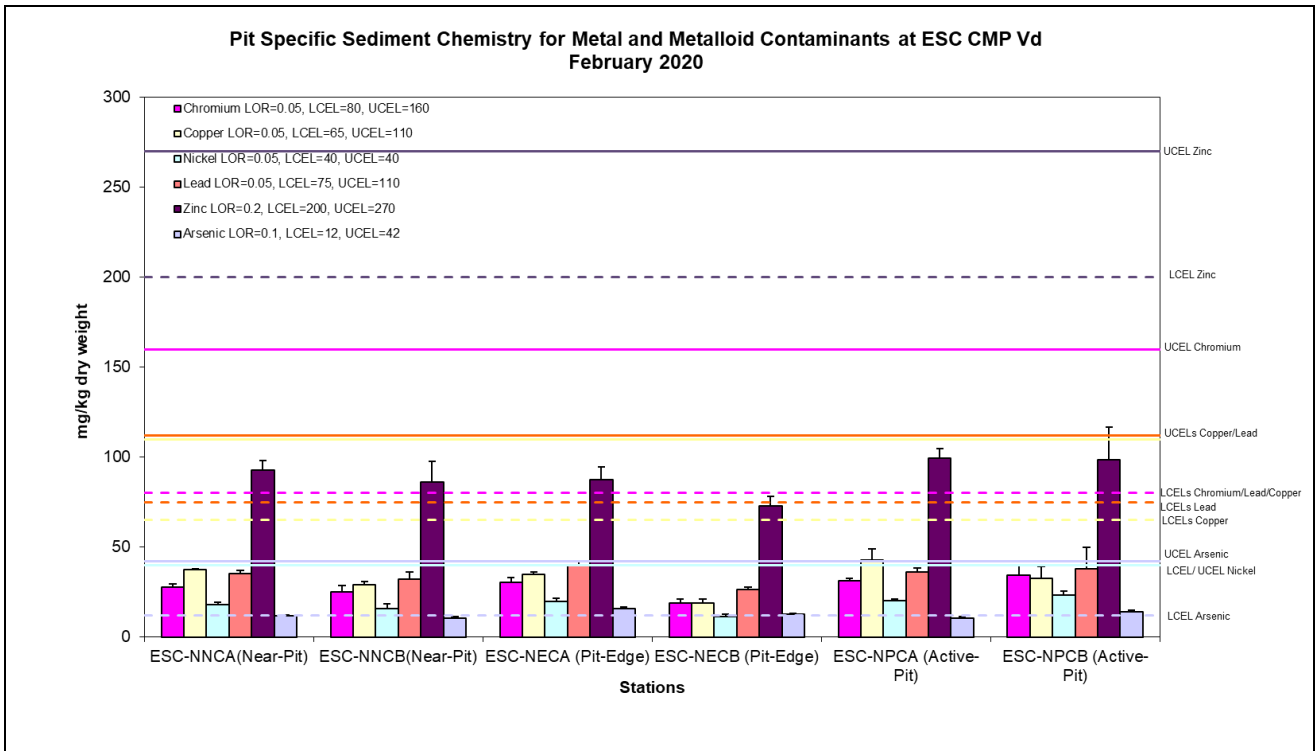


Figure 11: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in February 2020.

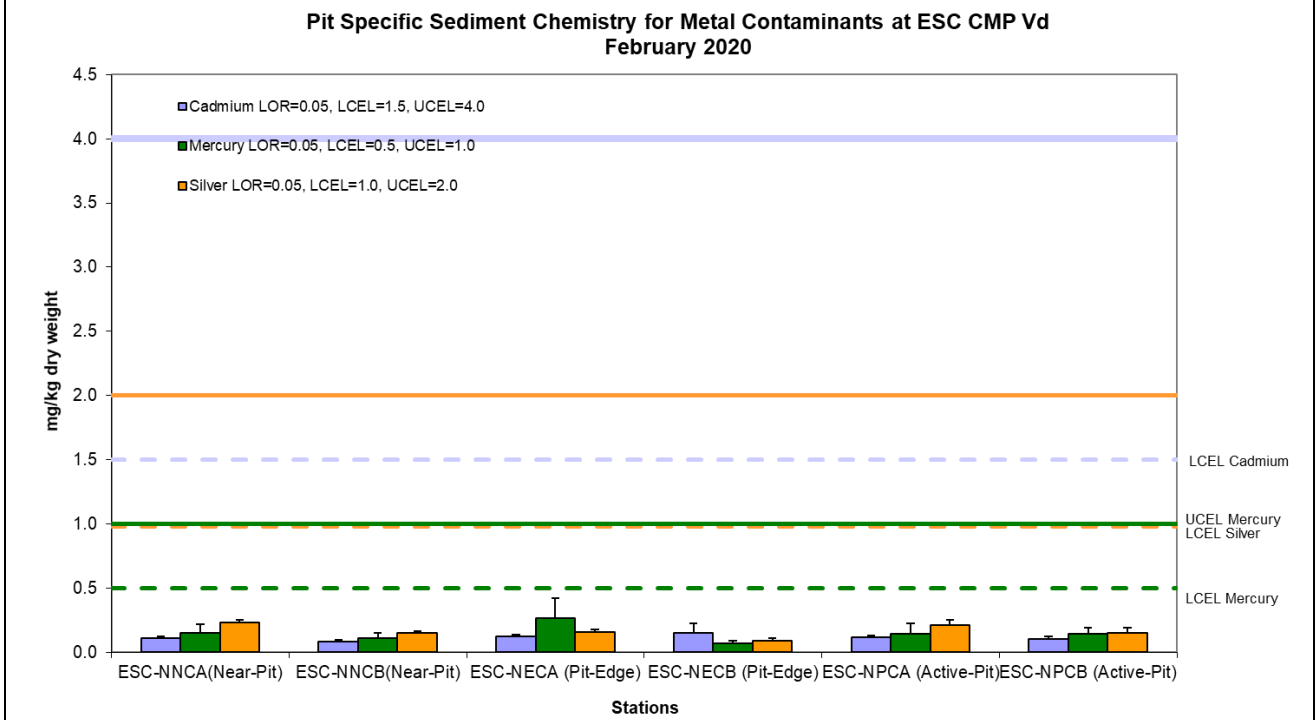


Figure 12: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental Resources Management**



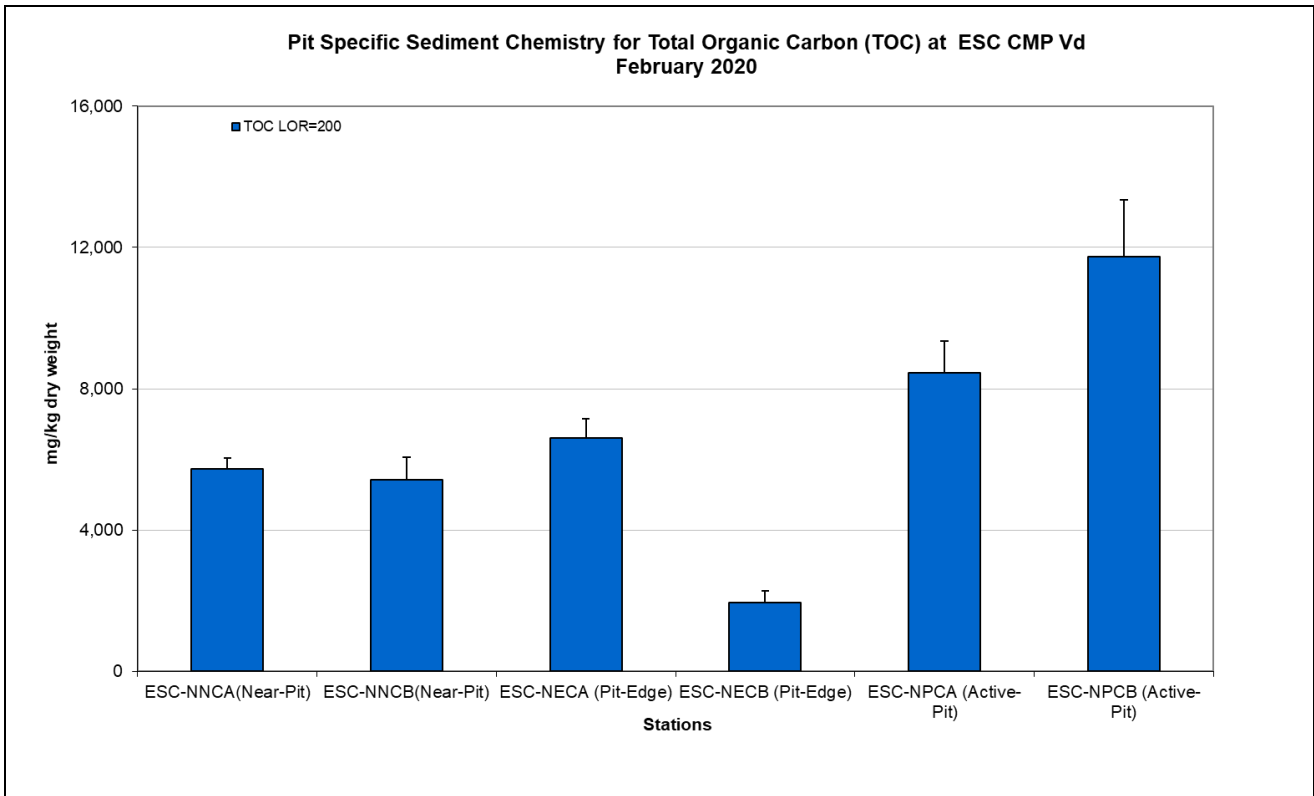


Figure 13: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in February 2020.

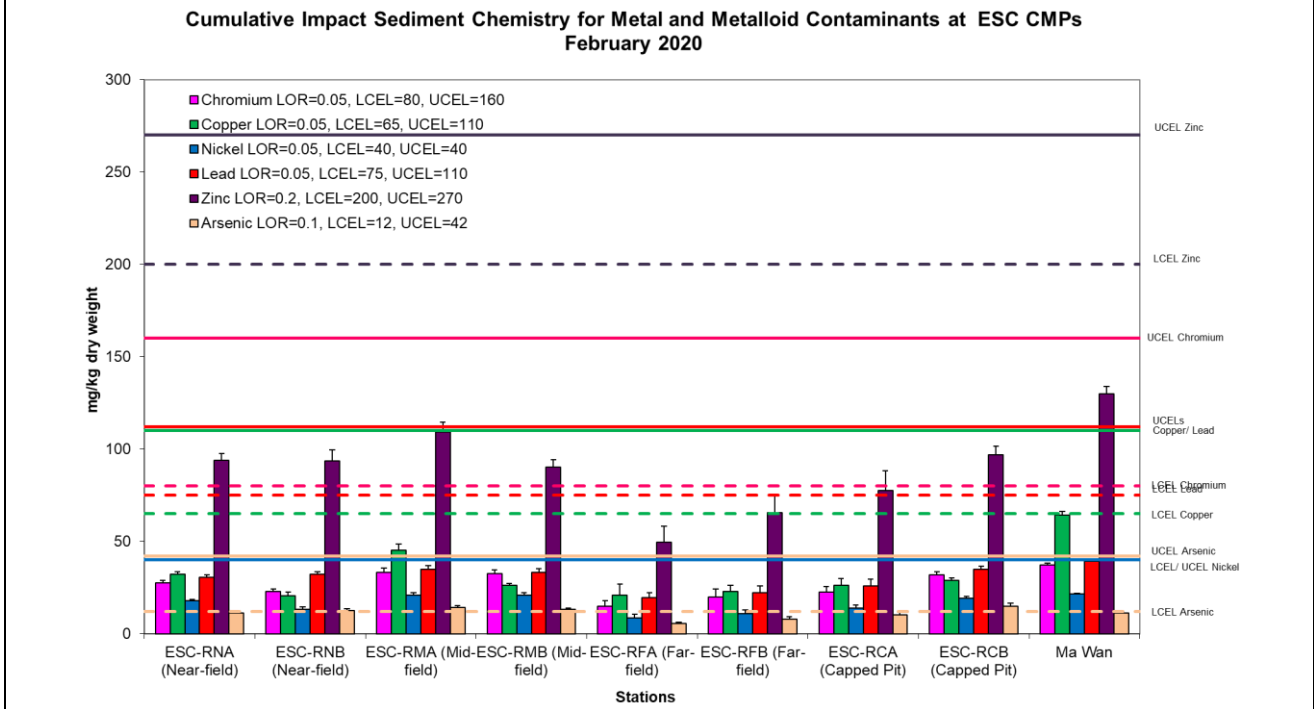


Figure 14: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental Resources Management**





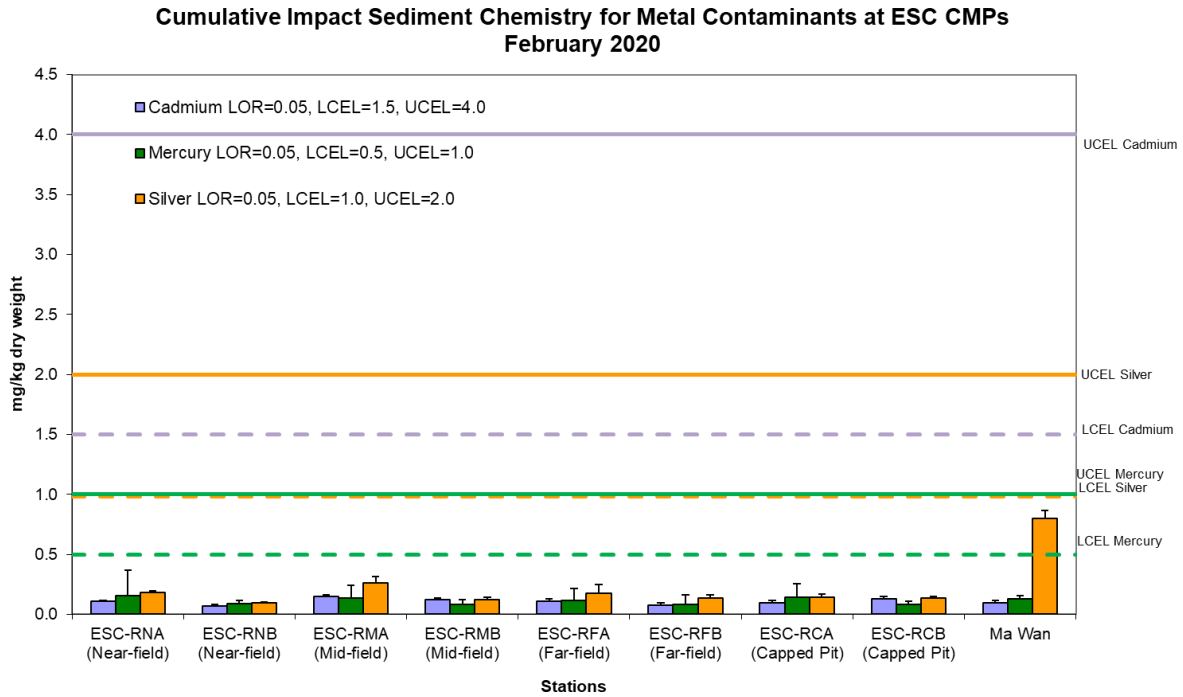


Figure 15: Concentration of Metals (Cd, Hg, Ag; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in February 2020.

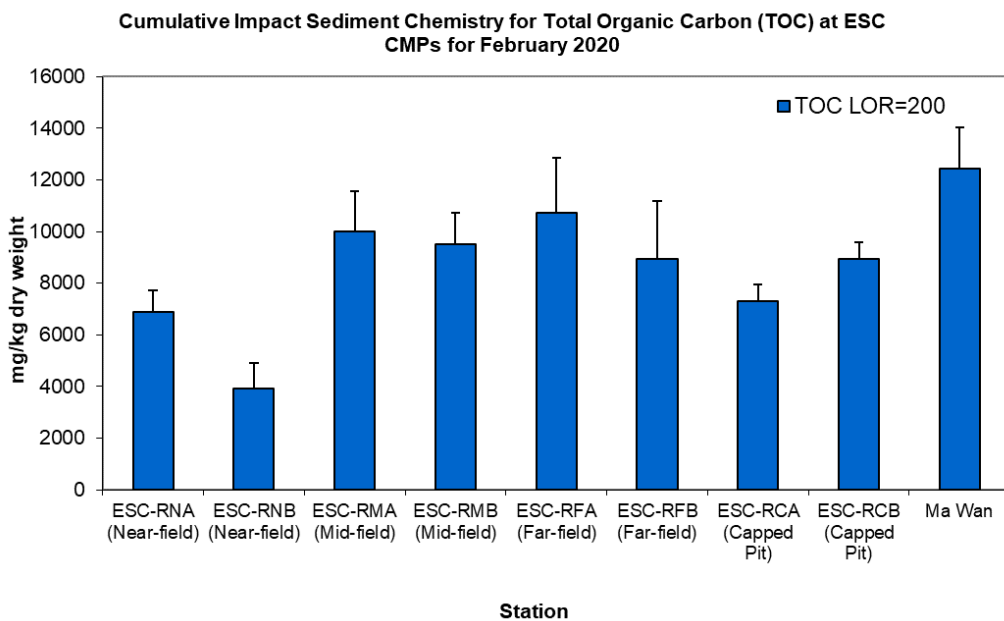


Figure 16: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental  
Resources  
Management**



Water Quality Monitoring During Capping at ESC  
February 2020

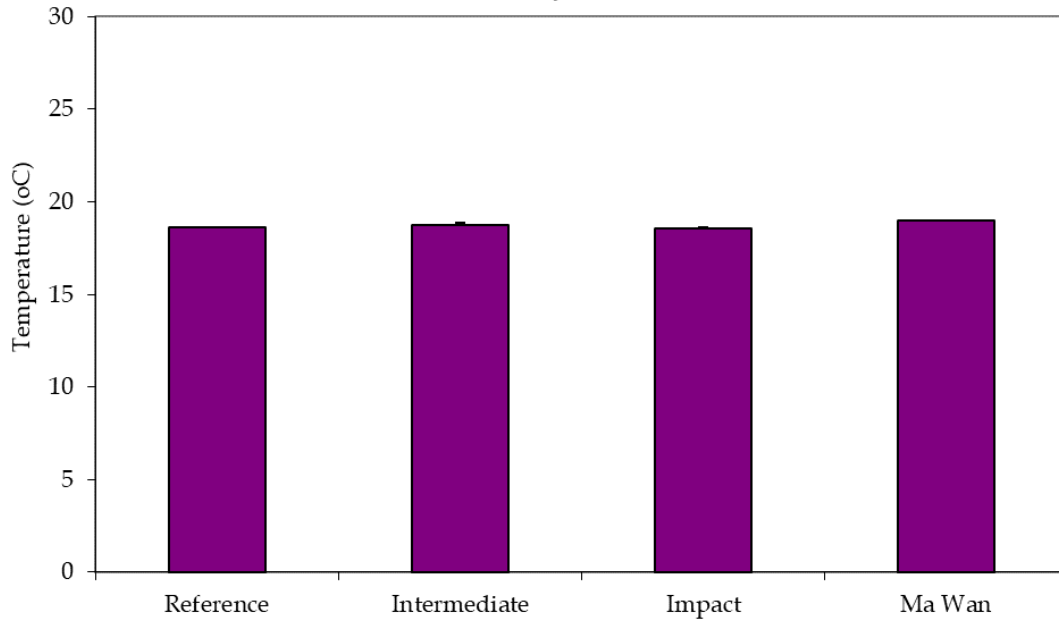


Figure 17: Levels of Temperature (°C; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in February 2020.

Water Quality Monitoring During Capping at ESC  
February 2020

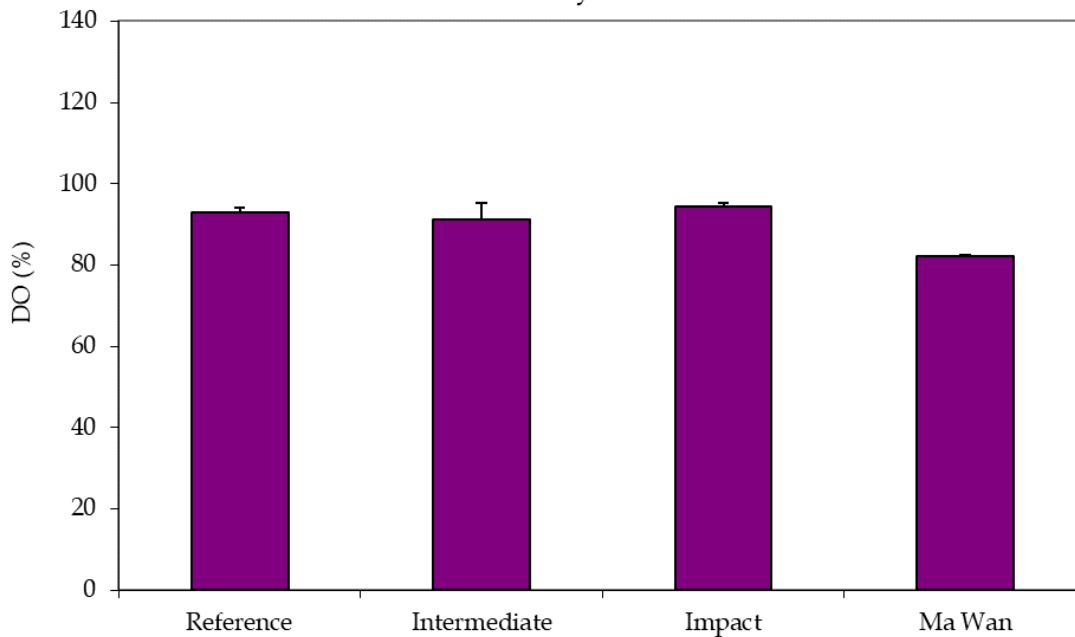


Figure 18: Levels of Dissolved Oxygen (% saturation; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental  
Resources  
Management**



Water Quality Monitoring During Capping at ESC  
February 2020

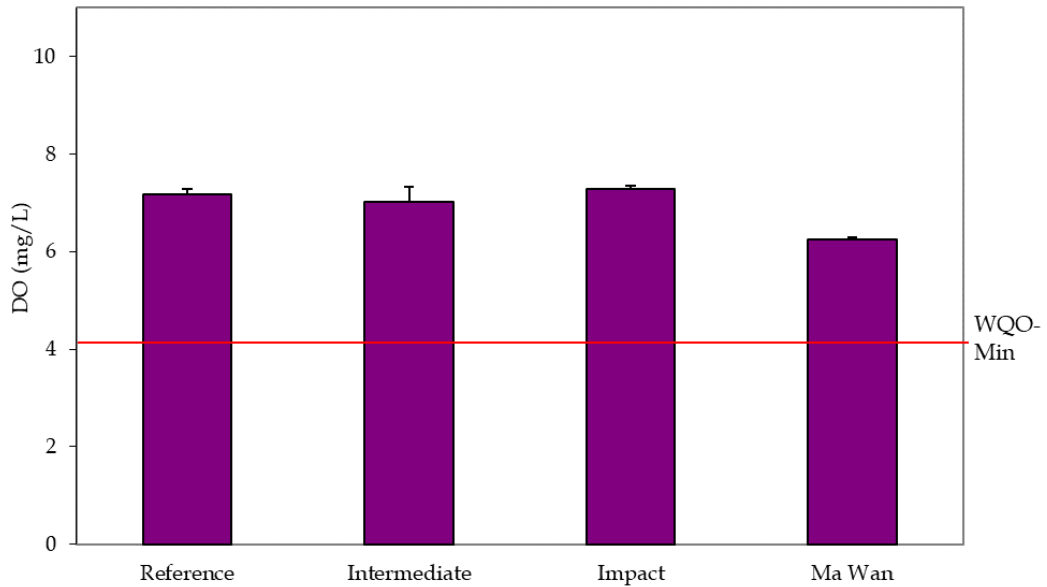


Figure 19: Levels of Dissolved Oxygen (mg/L; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in February 2020.

Water Quality Monitoring During Capping at ESC  
February 2020

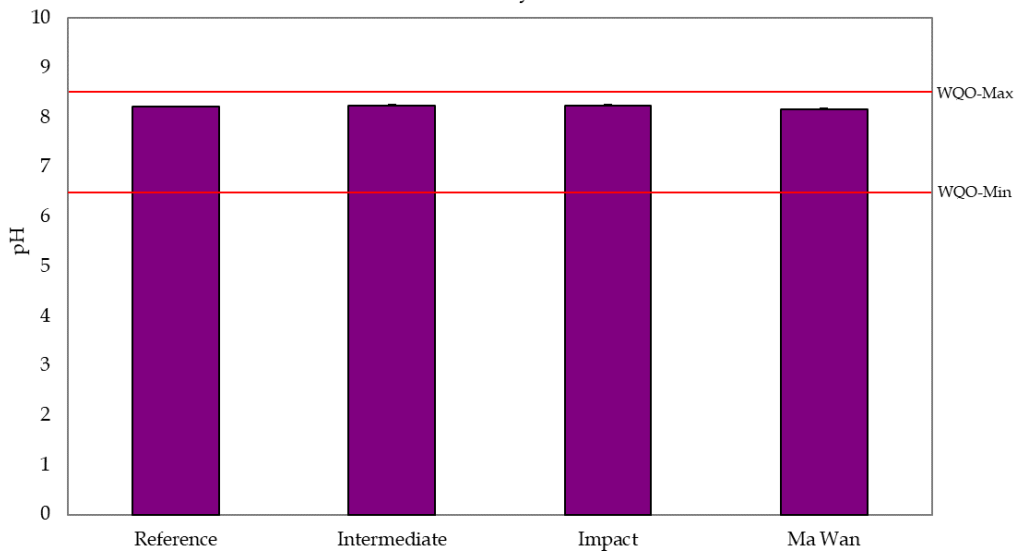


Figure 20: Levels of pH (mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental  
Resources  
Management**



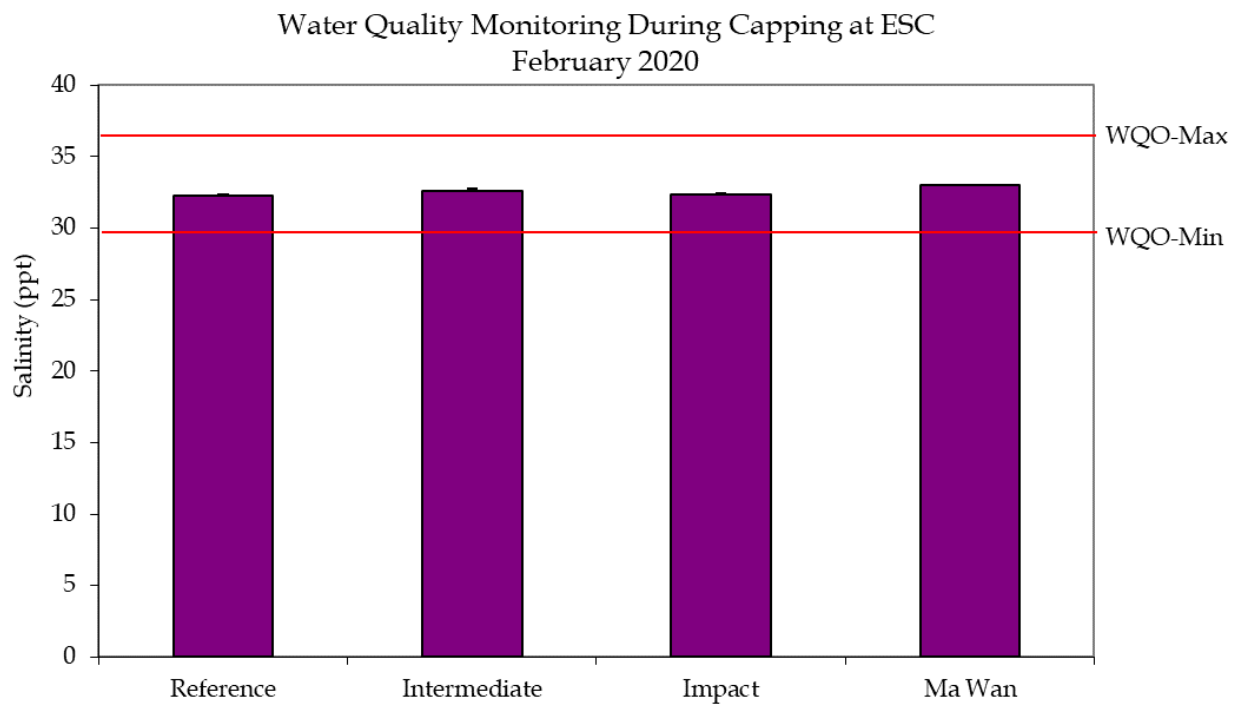


Figure 21: Levels of Salinity (ppt; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in February 2020.

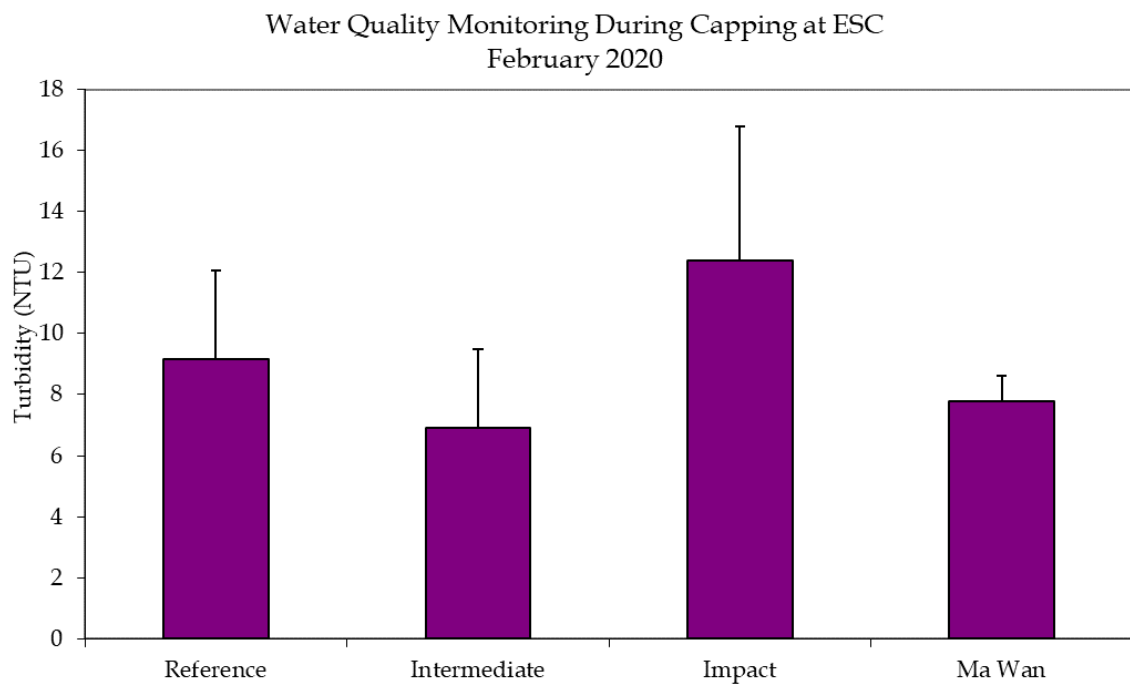


Figure 22: Levels of Turbidity (NTU; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental  
Resources  
Management**



Water Quality Monitoring During Capping at ESC  
February 2020

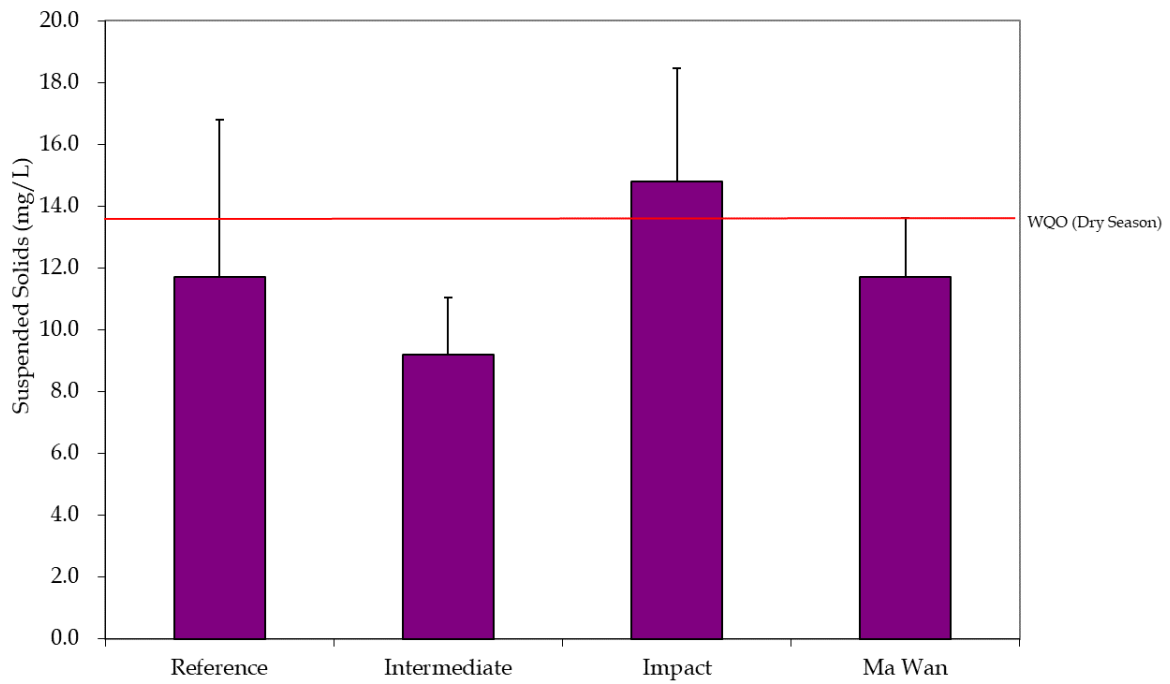


Figure 23: Levels of Suspended Solids (mg/L; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in February 2020.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\35 Monthly February 2020

Date: March 2020

**Environmental  
Resources  
Management**



Annex D

## Study Programme

