

- Investigation

Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – May 2021

June 2021

Mott MacDonald 3/F International Trade Tower 348 Kwun Tong Road Kwun Tong Kowloon Hong Kong

T +852 2828 5757 mottmac.hk

Civil Engineering and Development Department Fill Management Division 5/F, Civil Engineering and Development Building 101 Princess Margaret Road Homantin, Kowloon

Agreement No. CE 59/2020 (EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2021-2026) - Investigation

Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – May 2021

June 2021



Dredging, Management and Capping of Contaminated Sediment Disposal

Facility at Sha Chau

Environmental Certification Sheet

Environmental Permit No. EP-312/2008/A

Reference Document /Plan

Document/Plan to be Certified/ Verified:

Monthly EM&A Report for Contaminated Mud Pits to

the East of Sha Chau - May 2021

Date of Report:

7 June 2021

Date prepared by ET:

7 June 2021

Date received by IA:

7 June 2021

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 10 working days 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 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.

Ir Thomas Chan, Environmental Team Leader (ETL):

Date: 7 June 2021

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 (IA):

i

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	June 2021	Various	Thomas Chan	Eric Ching	Revision A of Submission

Document reference: 423134 | 06/05/02 | A

Information class: Standard

This document is issued for the party which commissioned it and for specific purposes connected with the above-captioned project only. It should not be relied upon by any other party or used for any other purpose.

We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from us and from the party which commissioned it.

Contents

1	Introd	luction	1
	1.1	Background	1
	1.2	Reporting Period	2
	1.3	Details of Sampling and Laboratory Testing Activities	2
2	Brief	Discussion of Monitoring Results for ESC CMP V	3
	2.1	Introduction	3
	2.2	Water Column Profiling of ESC CMP Vb – in May 2021	3
		2.2.1 In-situ Measurements	3
		2.2.2 Laboratory Measurements for Suspended Solids (SS)	3
	2.3	Routine Water Quality Monitoring of ESC CMPs – in May 2021	3
		2.3.1 In-situ Measurements	4
		2.3.2 Laboratory Measurements	4
	2.4	Pit Specific Sediment Chemistry of ESC CMP Vb – in May 2021	4
3	Futur	e Key Issues	6
	3.1	Activities Scheduled for the Next Reporting Period	6
	3.2	Study Programme	6
Figu	res		
Figure Figure		Routine & Capping Water Quality Sampling Stations (Ebb-Tide) for ESC CM Pit Specific Sediment Quality Monitoring Stations for CMP V	Ps
94.		opening comments admit,e. mig control of our	

Appendices

- A. Sampling Schedule
- B. Water Quality Monitoring Results
- C. Graphical Presentations
- D. Study Programme

1 Introduction

1.1 Background

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.

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.

A proposal on the change of number of sample replication of water quality & sediment monitoring and combination of routine water quality monitoring and water quality monitoring during capping operation was submitted to EPD and agreed by EPD on 3 December 2020. The proposed changes have been effective for the EM&A activities since December 2020. The latest sampling schedule is provided in **Appendix A**.

The present EM&A programme under Agreement No. CE 59/2020 (EP) covers the dredging, disposal and capping operations of the ESC CMP V (see **Appendix A** for the EM&A programme.) Detailed works schedule for ESC CMP V is shown in **Table 1.1**. In May 2021, the following works were undertaken:

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

Table 1.1: Works Schedule for ESC CMP V

Pit	2017				2018						2019							2020							2021																										
FIL	Fit Operation		Jun .	Jul	Aug	Sej	00	t No	ov D	ec J	Jan I	eb 1	Mar A	\pr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May .	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	Dredging																																																		
ESC CMP V	Disposal						Т	Т																																											
	Capping																																																		

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.

1.2 Reporting Period

This Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – May 2021 covers the EM&A activities for the reporting period of May 2021 (from 1 to 31 May 2021).

1.3 Details of Sampling and Laboratory Testing Activities

The following monitoring activities were undertaken for ESC CMP V during the reporting period:

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

2 Brief Discussion of Monitoring Results for ESC CMP V

2.1 Introduction

This section presents a brief discussion of the results obtained from the following monitoring activities for ESC CMP V during the reporting period:

- Water Column Profiling of ESC CMP Vb;
- · Routine Water Quality Monitoring of ESC CMPs; and
- Pit Specific Sediment Chemistry of ESC CMP Vb.

2.2 Water Column Profiling of ESC CMP Vb – in May 2021

Water Column Profiling was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 5 May 2021. 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 2010 – 2019 from stations in the North Western Water Control Zone (WCZ), where the ESC CMPs are located.³ 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 **Appendix B** for details).

2.2.1 In-situ Measurements

Analyses of results for May 2021 indicated that levels of Salinity, pH and DO complied with the WQOs at both Downstream and Upstream stations (**Table B2** of **Appendix B**). Levels of DO and Turbidity at all stations complied with the Action and Limit Levels (**Tables B1 and B2** of **Appendix B**).

2.2.2 Laboratory Measurements for Suspended Solids (SS)

Analyses of results for May 2021 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 **Appendix B**).

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.

2.3 Routine Water Quality Monitoring of ESC CMPs – in May 2021

Routine Water Quality Monitoring of ESC CMPs was undertaken on 6 May 2021. The monitoring results have been assessed for compliance with the WQOs (see **Section 2.2** above for details). The monitoring results are shown in **Tables B3 and B4** of **Appendix B** and **Figures 1 to 10** of **Appendix C**. A total of sixteen (16) monitoring stations were sampled in May 2021 as shown in **Figure 2.1**.

³ http://epic.epd.gov.hk/EPICRIVER/marine/?lang=en

2.3.1 In-situ Measurements

Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in **Figures 1 to 6** of **Appendix C**. Analyses of results indicated that the levels of pH, Salinity and DO complied with the WQOs at most stations during the reporting period, except for higher levels of Salinity were recorded at Ma Wan station. The higher Salinities recorded at Ma Wan station are likely to be caused by the larger separation distance to Pearl River Delta mouth, which releases a large amount of freshwater runoff in the area during wet season, when compared to the Reference stations.

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

Overall, in-situ measurement results of the Routine Water Quality Monitoring indicated that the disposal and capping operation at ESC CMPs did not appear to cause any unacceptable impacts in water quality in May 2021.

2.3.2 Laboratory Measurements

Laboratory analysis of samples obtained during the reporting period indicated that the concentrations of Arsenic, Chromium, Copper, Lead, Nickel and Zinc were detected in the samples at all stations and their concentrations were generally similar across stations, except the concentrations of Zinc were higher at Ma Wan Station (**Table B4** of **Appendix B**; **Figure 7** of **Appendix C**).

For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at the Reference (RFF), Impact (IPF) and Intermediate (INF) stations were higher than the WQO (0.5 mg/L) (**Table B4** of **Appendix B**; **Figure 8** of **Appendix 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.⁴ Therefore, the exceedances of TIN WQO at these stations are unlikely to be caused by the disposal operation at ESC CMPs. The concentrations of Ammonia Nitrogen (NH₃-N) and Biochemical Oxygen Demand (BOD₅) were slightly higher at Ma Wan station in the reporting month (**Table B4** of **Appendix B**; **Figure 8 and 9** of **Appendix C**).

Analyses of results for the reporting period indicated that the SS levels at all stations complied with the wet season WQO (11.8 mg/L) and the Action and Limit Levels (**Tables B1 and B4** of **Appendix B**; **Figure 10** of **Appendix C**).

Overall, results of the Routine Water Quality Monitoring indicated that the disposal and capping operation at ESC CMPs did not appear to cause any unacceptable deterioration in water quality during the reporting period. Detailed statistical analysis will be presented in the Quarterly Report to investigate any spatial and temporal trends of potential concern.

2.4 Pit Specific Sediment Chemistry of ESC CMP Vb – in May 2021

Monitoring locations for Pit Specific Sediment Chemistry for ESC CMP Vb are shown in **Figure 2.2**. A total of six (6) monitoring stations were sampled on 4 May 2021.

The concentrations of most inorganic contaminants were lower than the Lower Chemical Exceedance Levels (LCELs), except for Arsenic (**Figures 11 and 12** of **Appendix C**). The concentrations of Arsenic were higher than the LCEL at Pit-Edge stations ESC-NECA and ESC-NECB and Active-Pit station ESC-NPCA.

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

⁴ http://www.epd.gov.hk/epd/misc/marine quality/1986-2005/textonly/eng/index.htm

sediments.⁵ It is presumed that the natural concentrations of Arsenic are similar in onshore and offshore sediments,⁶ 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.

For organic contaminants, the concentrations of Total Organic Carbon (TOC) were higher at Active-Pit station ESC-NPCA during the reporting period (**Figure 13** of **Appendix C**). The concentrations of Low Molecular Weight and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) were lower than the LECLs at all stations (**Figure 14** of **Appendix C**). The concentrations of Tributyltin (TBT) were higher at Active-Pit stations ESC-NPCA and ESC-NPCB (**Figure 15** of **Appendix C**). The concentrations of Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT) and 4,4'-dichlorodiphenyldichloroethylene (DDE) were below the limit of reporting at all stations during the reporting period.

Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality outside the pit area as a result of the contaminated mud disposal operations at ESC CMP Vb during the reporting period.

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.

⁵ Sewell RJ (1999) Geochemical Atlas of Hong Kong. Geotechnical Engineering Office, Government of the Hong Kong Special Administrative Region

⁶ 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

3 Future Key Issues

3.1 Activities Scheduled for the Next Reporting Period

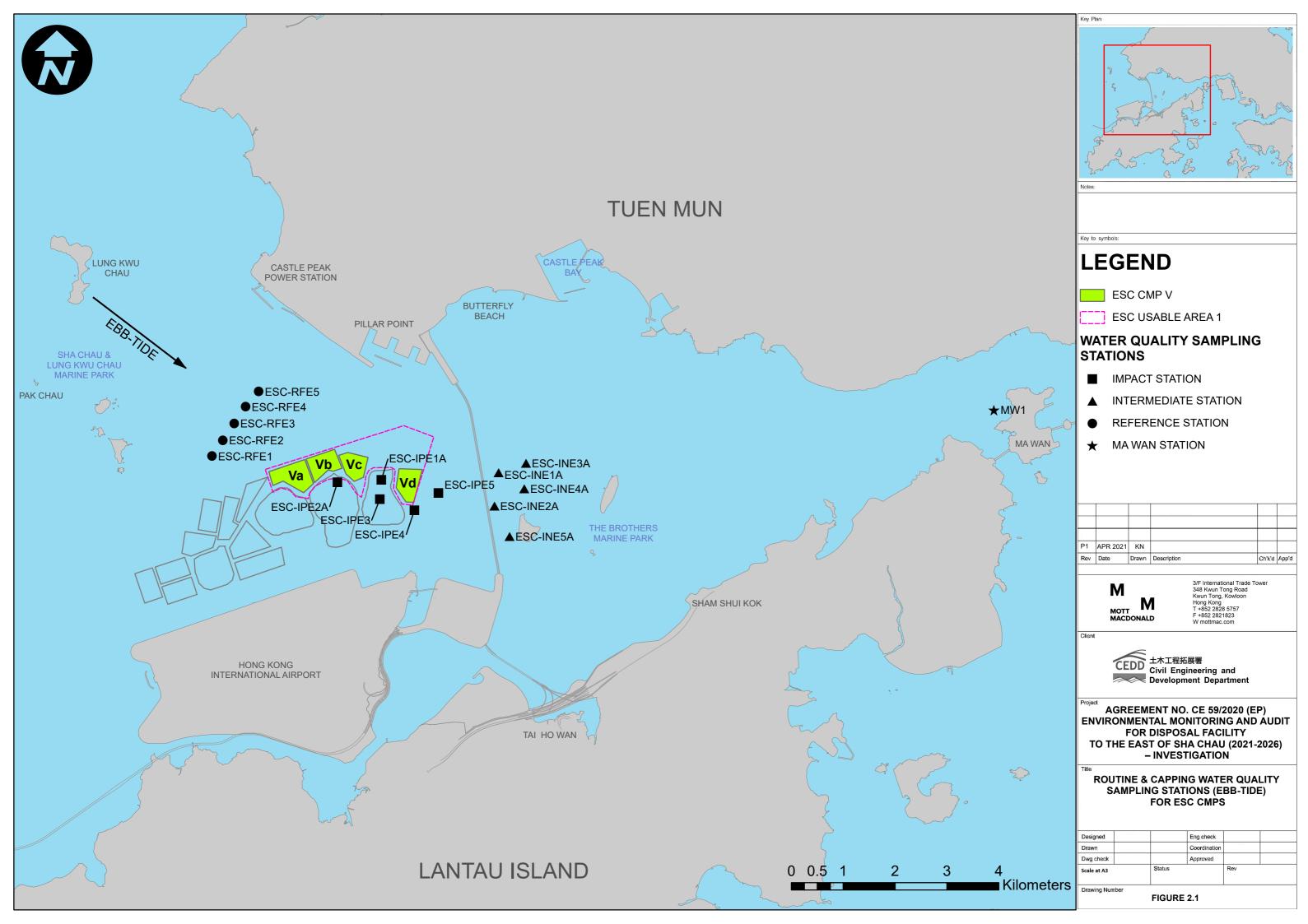
The following monitoring activities will be conducted in the next reporting period of June 2021 for ESC CMP V (see **Appendix A** for the sampling schedule):

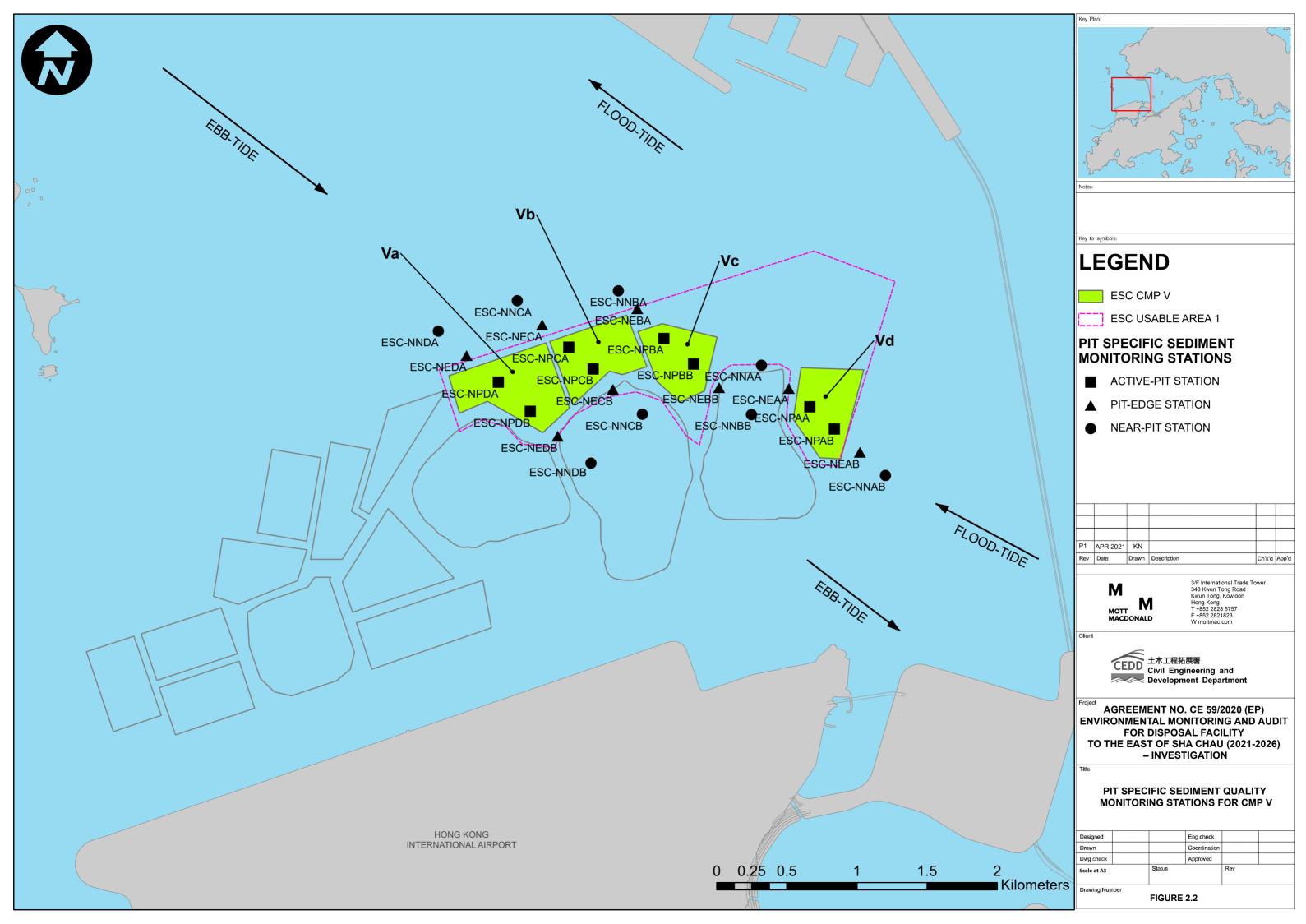
- Water Column Profiling of ESC CMP Vb;
- Routine Water Quality Monitoring of ESC CMPs;
- Pit Specific Sediment Chemistry of ESC CMP Vb; and
- Cumulative Impact Sediment Chemistry of ESC CMPs.

3.2 Study Programme

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

Figures





Appendices

- A. Sampling Schedule
- B. Water Quality Monitoring Results
- C. **Graphical Presentations**
- D. Study Programme

A. Sampling Schedule

East of Sha Chau CMPs Environmental Monitoring and Audit Sampling Schedule (January 2021 - March 2026)

Parameter / Station Type Pit Specific Sediment Ch		Frequency	2021	Anr May Jun	Jul Aug Sen	Oct Nov	Dec Jan Feb Mar	Anr May II	In Jul Aug Sen Oct Nov De	2023	May Jun Ju	L Aug Sen O	ct Nov De	2024 ec Jan Feb Mar Apr May	lun lul Aug Se	Oct Nov I	2025	Aar Anr May	Jun Jul Aug Sen Oct N	2026
Active-Pit	ESC-NPAA ESC-NPAB	Monthly Monthly	6 6 6	6 6 6	6 6 6	6 6	6 6 6 6	6 6 6	6 6 6 6 6 6 6 6 6 6 6 6 6 6	6 6 6 6	6 6 6	6 6 6	6 6 6	6 6 6 6 6 6	6 6 6 6	6 6	6 6 6	6 6 6	6 6 6 6 6	6 6 6 6 6 6 6 6 6 6 6
Pit-Edge	ESC-NEAA ESC-NEAB	Monthly Monthly	6 6 6	6 6 6	6 6 6	6 6	6 6 6 6	6 6 6	6 6 6 6 6 6 6	6 6 6 6	6 6 6	6 6 6	6 6 6	6 6 6 6 6	6 6 6 6	6 6	6 6 6	6 6 6	6 6 6 6 6	6 6 6 6 6
Near-Pit	ESC-NNAA ESC-NNAB	· ·	6 6 6	6 6 6	6 6 6	6 6	6 6 6 6	6 6 6	6 6 6 6 6 6 6	6 6 6 6	6 6 6	6 6 6	6 6 6	6 6 6 6 6 6	6 6 6 6	6 6	6 6 6	6 6 6	6 6 6 6 6	6 6 6 6 6
Cumulative Impact Sedin									un Jul Aug Sep Oct Nov De										Jun Jul Aug Sep Oct N	
Near-field Stations	ESC-RNA ESC-RNB1	4 times per year 4 times per year	6 6	6	6		6 6 6		6 6 6		6	6 6	6		6 6		6 6		6 6 6	6 6
Mid-field Stations	ESC-RMA ESC-RMB	4 times per year 4 times per year	6	6	6	Н	6 6		6 6 6		6	6 6	6		6 6		6 6 6		6 6 6	6 6
Capped Pit Stations	ESC-RCA1 ESC-RCA2	4 times per year 4 times per year	6 6	6	6		6 6		6 6 6		6	6 6	6		6 6		6 6 6		6 6 6	6 6
Far-field Stations	ESC-RFA ESC-RFB	4 times per year 4 times per year	6 6	6	6		6 6	1	6 6 6	6	6	6	6	6 6	6 6		6 6 6		6 6 6	6 6
Ma Wan Station	MW1	4 times per year	6	6	6		6 6		6 6 6		6	6	1 6		6 6		6 6		6 6	6 6
Sediment Toxicity Tests Near-pit Stations			Jan Feb Mar	Apr May Jun	Jul Aug Sep	Oct Nov		Apr May Ju	ın Jul Aug Sep Oct Nov De		May Jun Ju	Aug Sep O	ct Nov De		Jun Jul Aug Se	Oct Nov I		Mar Apr May	Jun Jul Aug Sep Oct N	
Reference Stations	ESC-TDA ESC-TDB1	2 times per year 2 times per year	5		5		5 5		5 5	5 5		5		5 5	5		5		5 5	5 5
Ma Wan Station	ESC-TRA ESC-TRB	2 times per year 2 times per year	5 5		5		5 5		5 5	5 5		5		5 5	5		5		5 5	5 5
Tissue / Whole Body Sar	MW1	2 times per year	Jan Feb Mar	Apr May Jun	Jul Aug Sen	Oct Nov	Dec Jan Feb Mar	Apr May Ju	Jul Aug Sep Oct Nov De	5 Jan Feb Mar Apr	May Jun Ju	5 Aug Sep O	ct Nov De	5 Sec Jan Feb Mar Apr May	Jun Jul Aug Se	Oct Nov	Dec Jan Feb M	Mar Apr May	Jun Jul Aug Sep Oct N	lov Dec Jan Feb Mar
Near-pit Stations	ESC-INA ESC-INB	2 times per year 2 times per year	*		*		* *		* *	* *		* *		*	*		*		* *	*
Reference North	TNA	2 times per year	*		*		*		*	*		*		*	*		*		*	*
Reference South	TNB	2 times per year 2 times per year	*		*		*		*	*		*		*	*		*		*	*
Demersal Trawling	TSB	2 times per year	Jan Feb Mar	Apr May Jun	Jul Aug Sep	Oct Nov	Dec Jan Feb Mar	Apr May Ju	un Jul Aug Sep Oct Nov De	Jan Feb Mar Apr	May Jun Ju	* Aug Sep O	ct Nov De	ec Jan Feb Mar Apr May	Jun Jul Aug Se	Oct Nov I	Dec Jan Feb M	Mar Apr May	Jun Jul Aug Sep Oct N	lov Dec Jan Feb Mar
Near-pit Stations	ESC-INA ESC-INB	4 times per year 4 times per year	5 5 5 5		5 5 5 5		5 5 5 5	Ŧ	5 5 5 5	5 5 5 5	5	5 5		5 5 5 5	5 5		5 5 5 5		5 5 5	5 5 5
Reference North	TNA TNB	4 times per year 4 times per year	5 5 5		5 5 5		5 5 5		5 5 5	5 5 5	5	5 5		5 5 5	5 5 5		5 5		5 5 5	5 5
Reference South	TSA TSB	4 times per year	5 5		5 5		5 5		5 5	5 5	5	5		5 5	5 5		5 5		5 5	5 5
Capping *	198	4 times per year	Jan Feb Mar	Apr May Jun	Jul Aug Sep	Oct Nov	Dec Jan Feb Mar	Apr May Ju	Jn Jul Aug Sep Oct Nov De	Jan Feb Mar Apr		5 Aug Sep O	ct Nov De	ec Jan Feb Mar Apr May		Oct Nov I	5 5 Dec Jan Feb M	Mar Apr May	5 5 Jun Jul Aug Sep Oct M	5 5
Ebb Tide Impact Station Downcuri	ESC-IPE1A																			
	ESC-IPE2A ESC-IPE3 ESC-IPE4	4 times per year * 4 times per year * 4 times per year *																		
Intermediate Station Dov	ESC-IPE5 vncurrent ESC-INE1A	4 times per year *																		
	ESC-INE2A ESC-INE3A	4 times per year * 4 times per year * 4 times per year *																		
Reference Station Upcur	ESC-INE5A rent	4 times per year *																		
	ESC-RFE3	4 times per year * 4 times per year * 4 times per year *																		
Ma Wan Station	ESC-RFE5	4 times per year * 4 times per year *																		
Flood Tide	MW1	4 times per year *																		
Impact Station Downcuri	ESC-IPF1 ESC-IPF2	4 times per year * 4 times per year *																		
Intermediate Station Dov	ESC-IPF3 vncurrent ESC-INF1	4 times per year *																		
Reference Station Upcur	ESC-INF2 ESC-INF3	4 times per year * 4 times per year *																		
Reference Station opcur	ESC-RFF1A ESC-RFF2A	4 times per year * 4 times per year *																		
Ma Wan Station	ESC-RFF3 MW1	4 times per year * 4 times per year *																		
Routine Water Quality Me Ebb Tide			Jan Feb Mar J	Apr May Jun	Jul Aug Sep	Oct Nov	Dec Jan Feb Mar	Apr May Ju	un Jul Aug Sep Oct Nov De	Jan Feb Mar Apr	May Jun Ju	Aug Sep O	ct Nov De	ec Jan Feb Mar Apr May	Jun Jul Aug Se	Oct Nov I	Dec Jan Feb N	Mar Apr May	Jun Jul Aug Sep Oct M	lov Dec Jan Feb Mar
Impact Station Downcuri	ESC-IPE1A ESC-IPE2A	Monthly* Monthly*		4 4 4	4 4 4	4 4	4 4 4 4	4 4 4	1	4 4 4 4	4 4 4	4 4 4	1 4 4	1 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
	ESC-IPE3 ESC-IPE4 ESC-IPE5	Monthly* Monthly* Monthly*		4 4 4	4 4 4	4 4	4 4 4 4	4 4 4	1	4 4 4 4	4 4 4	4 4 4	1 4 4	1 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
Intermediate Station Dov	ESC-INE1A ESC-INE2A	Monthly*		4 4 4 4 4 4	4 4 4 4 4 4	4 4	4 4 4 4	4 4 4	1	4 4 4 4	4 4 4	4 4 4	1 4 4	1 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
	ESC-INE3A ESC-INE4A ESC-INE5A	Monthly* Monthly* 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	1	4 4 4 4 4 4 4 4	4 4 4 4 4 4	4 4 4	1 4 4 1 4 4	1 4 4 4 4 4 1 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
Reference Station Upcur		Monthly* 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	1 4 4	1 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
	ESC-RFE3 ESC-RFE4	Monthly* 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	1	4 4 4 4 4 4 4 4	4 4 4 4 4 4	4 4 4	1 4 4 1 4 4	1 4 4 4 4 4 1 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
Ma Wan Station	ESC-RFE5	Monthly*							4 4 4 4 4 4 4 4 4 4											
Flood Tide Impact Station Downcurr		Monthly				T . T .														
	ESC-IPF1 ESC-IPF2 ESC-IPF3	Monthly* Monthly* 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 4	4 4 4	1 4 4	1 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
Intermediate Station Dov	vncurrent ESC-INF1 ESC-INF2	Monthly* 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	1	4 4 4 4 4 4 4 4	4 4 4	4 4 4	1 4 4 1 4 4	1 4 4 4 4 4 1 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
Reference Station Upcur	ESC-INF3 rent ESC-RFF1A	Monthly*	4 4 4	4	4 4 4	4 4	4 4 4 4	4 4 4	1 4 4 4 4 4 4 4	4 4 4 4	4 4 4	4 4 4	1 4 4	1 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
Ma Wan Station	ESC-RFF2A ESC-RFF3		4 4 4 4	4	4 4 4	4 4	4 4 4 4	4 4 4	1	4 4 4 4	4 4 4	4 4 4	1 4 4	1 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
Water Column Profiling *	MW1	Monthly*	4 4 4						1 4 4 4 4 4 4 4 4 4 4 III											
Plume Stations	WCP1 WCP2	Monthly* Monthly*	2 2 2	2 2 2	2 2 2	2 2	2 2 2 2	2 2 2	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2	2 2 2	2 2 2	2 2 2	2 2 2 2 2 2	2 2 2 2	2 2	2 2 2	2 2 2	2 2 2 2 2	2 2 2 2 2
Benthic Recoloinisation	Studies	Monthly*	Jan Feb Mar		Jul Aug Sep	Oct Nov			ın Jul Aug Sep Oct Nov De						2 2 2 2 2 2	Oct Nov I	Dec Jan Feb 1		2 2 2 2 2 2	
Capped Stations at CMP	ESCV-CPA ESCV-CPB	2 times per year 2 times per year																		
Reference Stations		2 times per year				H		\coprod												
	RBA RBB RBC1	2 times per year 2 times per year 2 times per year																		
Impact Monitoring for Dr		∠ unico per year	Jan Feb Mar	Apr May Jun	Jul Aug Sep	Oct Nov	Dec Jan Feb Mar	Apr May Ju	ın Jul Aug Sep Oct Nov De	Jan Feb Mar Apr	May Jun Ju	Aug Sep O	ct Nov De	ec Jan Feb Mar Apr May	Jun Jul Aug Se	Oct Nov I	Dec Jan Feb N	Mar Apr May	Jun Jul Aug Sep Oct N	lov Dec Jan Feb Mar
Upstream Stations	US1 US2	3 times per week 3 times per week						\blacksquare												
Downstream Stations	DS1 DS2	3 times per week 3 times per week						ΗĪ												
	DS3 DS4 DS5	3 times per week 3 times per week 3 times per week						\blacksquare												
Ma Wan Station	MW1	3 times per week																		
Notes: (1) The number shown in e	ach cell represer	nts the numbers of rep	licates per moni	itoring station.	The number	shown in c	reen holded text r	enrecented	I monitoring works have been	conducted before/	luring the rene	ating period (of thic Mor	othly FM&A Report while t	he number shown	in black ren	racant plannad	monitoring v	orks ofter the reporting p	ariad of this Monthly

Notes:
(1) The number shown in each cell represents the numbers of replicates per monitoring station. The number shown in green bolded text represented monitoring works have been conducted before/ during the reporting period of this Monthly EM&A Report, while the number shown in black represent planned monitoring works after the reporting period of this Monthly EM&A Report.
(2) For the planned Routine Water Quality Monitoring (i.e. the numbers of replicates per monitoring station shown in black), the monitoring will be conducted at mid-ebb OR mid-flood tide. The yearly tidal selection of this monitoring will be based on a principle to obtain 6 months monitoring data at mid-ebb, and 6 months monitoring data at mid-ebb, and 6 months monitoring data at mid-flood.

(3) Impact Monitoring for Dredging will be scheduled when dredging operations commence.

(4) Benthic Recolonisation Studies for CMP V will be scheduled when capping operation for CMP V is completed.

^{*}A proposal on the change of number of sample replication of water quality & sediment monitoring and combination of routine water quality monitoring and water quality monitoring during capping operation was submitted to EPD and agreed by EPD on 3 December 2020. The proposed changes have been implemented for the EM&A activities since December 2020. Water Quality Monitoring during Capping Operation and Routine Water Quality Monitoring are combined such that Routine Water Quality Monitoring have be conducted monthly starting in December 2020. The number of sampling replicates can be further reduced according to Sections 3 and 4, subject to the findings of the further data review.

B. Water Quality Monitoring Results



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

Parameters	Action	Limit				
Dissolved Oxygen (DO)	Surface and Middle Depth ⁽²⁾	Surface and Middle Depth ⁽²⁾				
in mg L ⁻¹ (Surface, Middle & Bottom) ⁽¹⁾	5%-ile of baseline data for surface and middle layer = 3.76	1%-ile of baseline data for surface and middle layer = 3.11 ⁽³⁾				
	and	and				
	Significantly less than the reference station's mean DO (at the same tide of the same day)	Significantly less than the reference station's mean DO (at the same tide of the same day)				
	Bottom	Bottom				
	5%-ile of baseline data for surface and middle layer = 2.96	The average of the impact station readings are < 2				
	and	and				
	Significantly less than the reference station's mean DO (at the same tide of the same day)	Significantly less than the reference station's mean DO (at the same tide of the same day)				
Suspended Solids (SS) in mg L ⁻¹	95%-ile of baseline data for depth- averaged = 37.88	99%-ile of baseline data for depth- averaged = 61.92				
(depth-averaged)(4)(5)	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				
Turbidity	95%-ile of baseline data = 28.14	99%-ile of baseline data = 38.32				
in NTU	and	and				
(depth-averaged)(4)(5)	120% of control station's Turbidity at the same tide of the same day	130% of control station's Turbidity 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. Action and Limit Levels for DO for Surface and 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 and 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
- 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 Vb in May 2021

Station	Temp.	Salinity	Turbidity	Dissolve	ed Oxygen	рН	Suspended Solids			
	(°C)	(ppt)	(NTU)	(%)	(mg L ⁻¹)		(mg L ⁻¹)			
WCP 1 (Downstream)	25.69	26.76	4.08	91.09	6.39	8.10	7.9			
WCP 2 (Upstream)	25.98	25.90	3.59	95.09	6.67	8.06	6.9			
WQO (Wet Season)	N/A	23.31 – 28.49#	N/A	N/A	>4	6.5 – 8.5	11.8			

Notes:

- 1. *Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.
- 2. Cell shaded yellow / red indicates value exceeding the Action/Limit levels.
- 3. Cell shaded grey indicates value exceeding the WQO.

Table B3: In-situ Monitoring Results for Routine Water Quality Monitoring of ESC CMPs in May 2021

Station	Temp.	Salinity	Turbidity	Dissolve	рН	
	(°C)	(ppt)	(NTU)	(%)	(mg L ⁻¹)	
RFF (Reference)	25.67	28.27	3.42	90.67	6.31	8.07
IPF (Impact)	25.66	28.13	2.02	91.11	6.34	8.09
INF (Intermediate)	25.35	29.66	2.06	91.16	6.33	8.14
Ma Wan	24.96	32.10	2.65	88.17	6.07	8.11
WQO (Wet Season)	N/A	25.45 – 31.10#	N/A	N/A	>4	6.5 – 8.5

Notes:

- 1. *Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.
- 2. Cell shaded yellow / red indicates value exceeding the Action/Limit levels.
- Cell shaded grey indicates value exceeding the WQO.

Table B4: Laboratory Results for Routine Water Quality Monitoring of ESC CMPs in May 2021

Station	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	NH ₃	TIN	BOD ₅	SS
	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
RFF	2.70	<lor< td=""><td>1.69</td><td>13.01</td><td>1.88</td><td><lor< td=""><td>2.00</td><td><lor< td=""><td>26.27</td><td>0.12</td><td>0.63</td><td>1.62</td><td>5.4</td></lor<></td></lor<></td></lor<>	1.69	13.01	1.88	<lor< td=""><td>2.00</td><td><lor< td=""><td>26.27</td><td>0.12</td><td>0.63</td><td>1.62</td><td>5.4</td></lor<></td></lor<>	2.00	<lor< td=""><td>26.27</td><td>0.12</td><td>0.63</td><td>1.62</td><td>5.4</td></lor<>	26.27	0.12	0.63	1.62	5.4
IPF	2.48	<lor< td=""><td>2.13</td><td>11.22</td><td>3.08</td><td><lor< td=""><td>1.98</td><td><lor< td=""><td>22.32</td><td>0.12</td><td>0.62</td><td>1.47</td><td>6.7</td></lor<></td></lor<></td></lor<>	2.13	11.22	3.08	<lor< td=""><td>1.98</td><td><lor< td=""><td>22.32</td><td>0.12</td><td>0.62</td><td>1.47</td><td>6.7</td></lor<></td></lor<>	1.98	<lor< td=""><td>22.32</td><td>0.12</td><td>0.62</td><td>1.47</td><td>6.7</td></lor<>	22.32	0.12	0.62	1.47	6.7
INF	2.63	<lor< td=""><td>2.05</td><td>12.04</td><td>2.92</td><td><lor< td=""><td>2.64</td><td><lor< td=""><td>26.69</td><td>0.13</td><td>0.54</td><td>1.79</td><td>5.8</td></lor<></td></lor<></td></lor<>	2.05	12.04	2.92	<lor< td=""><td>2.64</td><td><lor< td=""><td>26.69</td><td>0.13</td><td>0.54</td><td>1.79</td><td>5.8</td></lor<></td></lor<>	2.64	<lor< td=""><td>26.69</td><td>0.13</td><td>0.54</td><td>1.79</td><td>5.8</td></lor<>	26.69	0.13	0.54	1.79	5.8
Ma Wan	2.73	<lor< td=""><td>2.13</td><td>7.03</td><td>1.55</td><td><lor< td=""><td>2.18</td><td><lor< td=""><td>31.45</td><td>0.16</td><td>0.34</td><td>1.95</td><td>6.3</td></lor<></td></lor<></td></lor<>	2.13	7.03	1.55	<lor< td=""><td>2.18</td><td><lor< td=""><td>31.45</td><td>0.16</td><td>0.34</td><td>1.95</td><td>6.3</td></lor<></td></lor<>	2.18	<lor< td=""><td>31.45</td><td>0.16</td><td>0.34</td><td>1.95</td><td>6.3</td></lor<>	31.45	0.16	0.34	1.95	6.3

WQO of TIN: 0.5 mg/L Wet Season WQO of SS: 11.8 mg/L

Notes:

- 1. "<LOR" indicates the concentrations of metals and metalloids are below the limit of reporting.
- 2. Cell shaded yellow / red indicates value exceeding the Action/Limit levels.
- 3. Cell shaded grey indicates value exceeding the WQO.

C. Graphical Presentations



Routine Water Quality Monitoring for ESC CMP V - May 2021

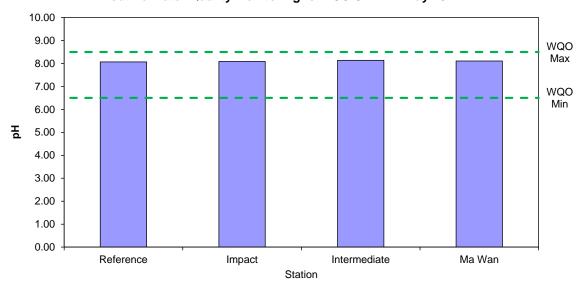


Figure 1: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2021

Routine Water Quality Monitoring for ESC CMP V - May 2021

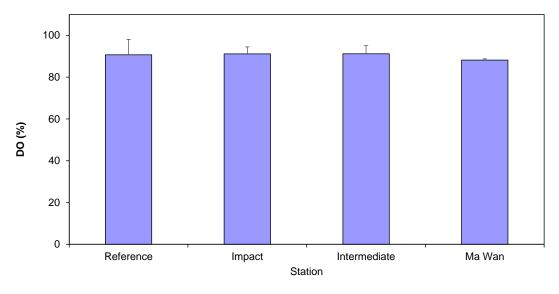


Figure 2: Level of Dissolved Oxygen (DO) (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2021

Routine Water Quality Monitoring for ESC CMP V - May 2021

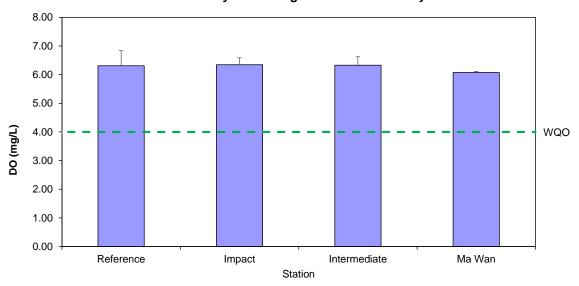


Figure 3: Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2021

Routine Water Quality Monitoring for ESC CMP V - May 2021

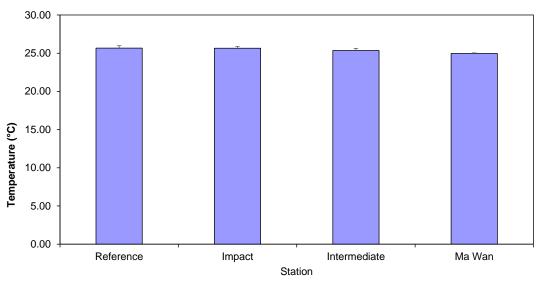


Figure 4: Level of Temperature (°C; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2021



Routine Water Quality Monitoring for ESC CMP V - May 2021

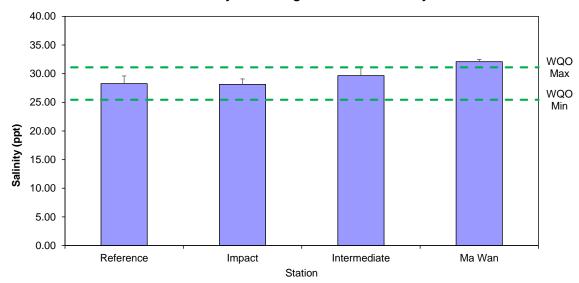


Figure 5: Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2021

Routine Water Quality Monitoring for ESC CMP V - May 2021

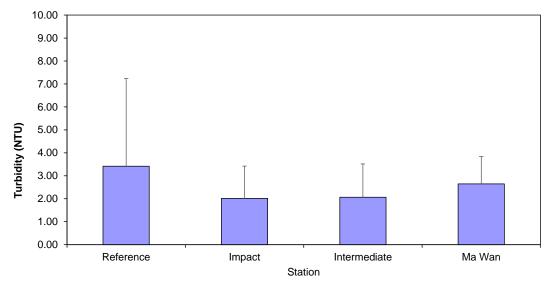


Figure 6: Level of Turbidity (NTU; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2021



Routine Water Quality Monitoring for ESC CMP V May 2021

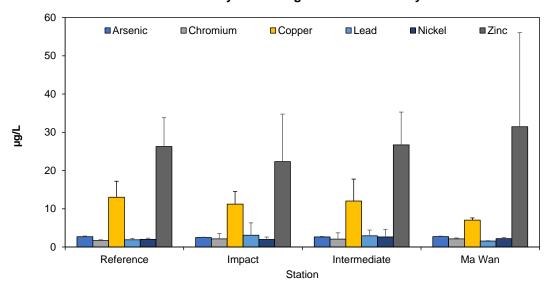


Figure 7: Concentration of Arsenic, Chromium, Copper, Lead, Nickel, and Zinc (μg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2021

Routine Water Quality Monitoring for Nutrients - May 2021

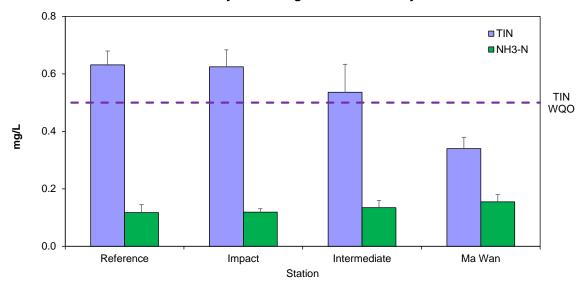


Figure 8: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen (NH3-N) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2021

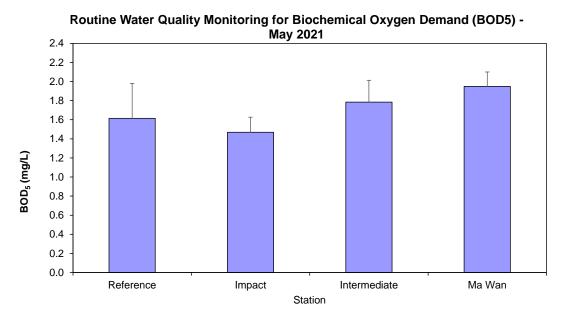
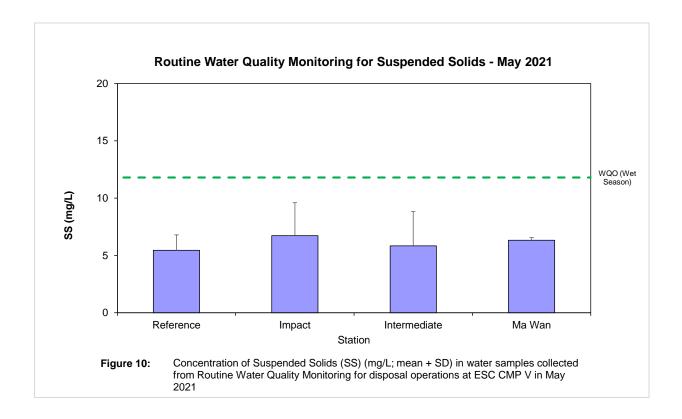
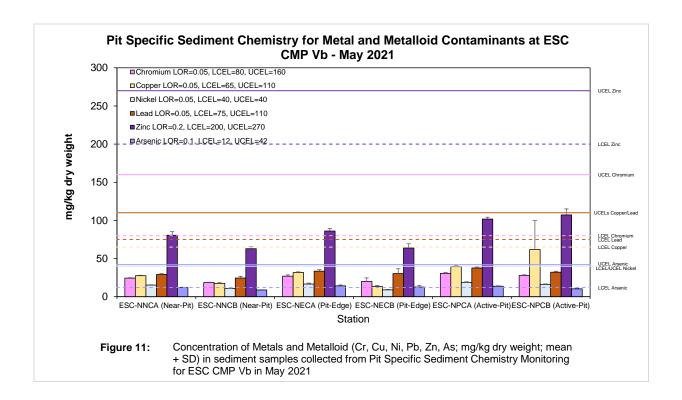
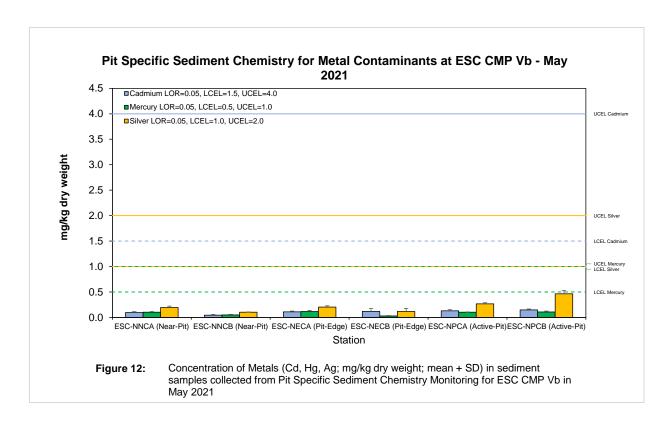


Figure 9: Level of Biochemical Oxygen Demand (BOD5) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2021

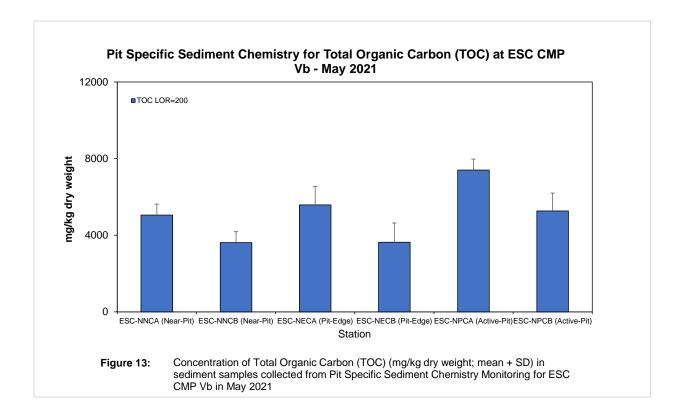


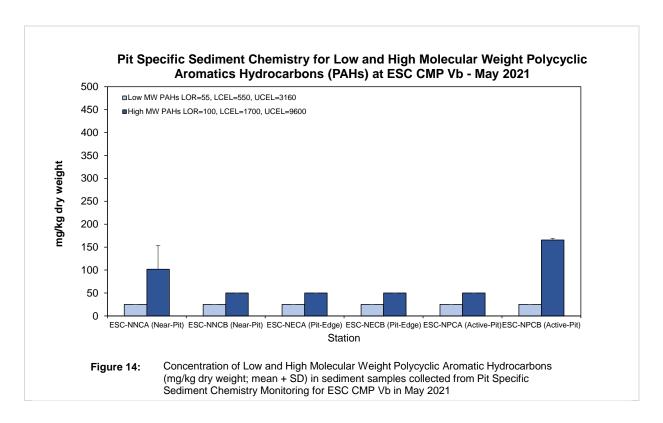


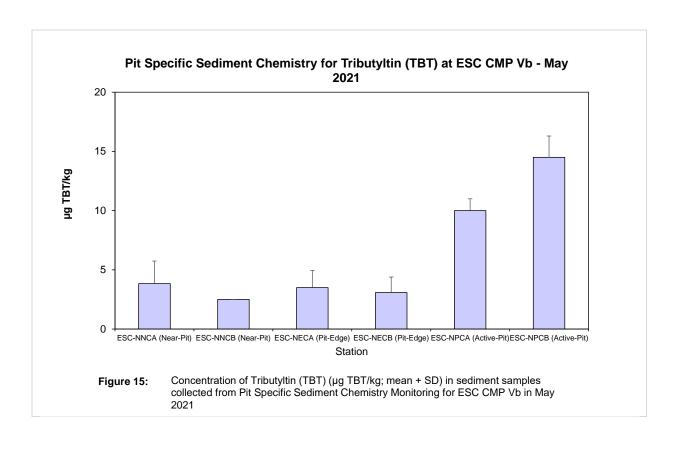












D. Study Programme

Study Programme

Agreement No. CE 59/2020 (EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2021-2026) - Investigation

Mott MacDonald Hong Kong Limited

