

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 – September 2022

October 2022

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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 – September 2022
Date of Report:	12 October 2022
Date prepared by ET:	12 October 2022
Date received by IA:	12 October 2022

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: 12 October 2022

IA Verification

condition of EP-312/2008/A.		
128		
Dr Wang Wen Xiong, Independent Auditor (IA):	Date: 12	October 2022

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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 East of Sha Chau (ESC) for the disposal of contaminated sediment, and various 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.

Environmental Permits (EPs) (Ref. No. EP-312/2008/A) was issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 for the Project - Disposal of Contaminated Sediment – Dredging, Management and Capping of Sediment Disposal Facility at Sha Chau.

Under the requirements of the EP, 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. 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.

A proposal on the change of number of sample replication of water quality and sediment monitoring as well as 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. In early 2022, after implementing the Phase 1 optimisation for at least one year, a further data review was conducted. The monitoring data has been reviewed and demonstrated that the data robustness and representativeness are maintained. Therefore, a technical note presenting the data review results served as a supplementary information was submitted to EPD and presented that Phase 2 optimization of sample replication of water quality and sediment monitoring for the Project will be implemented in 2022. EPD expressed no comment on the review and note the implementation of Phase 2 optimization of sample replication on 18 May 2022, and thus this optimization has been effective for the EM&A activities since July 2022.

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 September 2022, 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.

Table 1.1: Works Schedule for ESC CMP V



1.2 Reporting Period

This *Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – September 2022* covers the EM&A activities for the reporting period of September 2022 (from 1 to 30 September 2022).

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;
- Pit Specific Sediment Chemistry of ESC CMP Vb; and
- Demersal Trawling for ESC CMPs.

1.4 Details of Outstanding Sampling or Analysis

No outstanding sampling remained for September 2022.

The following analyses are in progress and will be presented in the corresponding quarterly report:

 Species identification of the biota samples collection from Demersal Trawling for ESC CMPs in September 2022.

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;
- Pit Specific Sediment Chemistry of ESC CMP Vb; and
- Demersal Trawling for ESC CMPs.

2.2 Water Column Profiling of ESC CMP Vb – in September 2022

Water Column Profiling was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 5 September 2022. 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 2011 – 2020 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 September 2022 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 September 2022 indicated that the SS level 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 August 2022

Further to Section 2.4.2 of the *Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – August 2022*, laboratory analysis data of dissolved metals and metalloid in Routine Water Quality Monitoring of ESC CMPs conducted in August 2022 is presented in **Table B4** of **Appendix B** and **Figure 1** of **Appendix C**. The laboratory analysis of samples indicated that the concentrations of Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver and Zinc were detected in the samples at all/some stations and their concentrations of most metals and

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

metalloids were generally similar across stations, except Lead was only detected at Ma Wan (MW1) station and the concentrations of Zinc which were higher at Reference (RFE) stations.

Laboratory analysis data of Nutrients and Suspended Solid in Routine Water Quality Monitoring of ESC CMPs in August 2022 is presented again in **Table B5** of **Appendix B** for easy reference.

Overall, results of the Routine Water Quality Monitoring which indicated that the disposal and capping operation at ESC CMPs did not appear to cause any unacceptable deterioration in water quality in August 2022. Detailed statistical analysis will be presented in the Quarterly EM&A Report to investigate any spatial and temporal trends of potential concern.

2.4 Routine Water Quality Monitoring of ESC CMPs – in September 2022

Routine Water Quality Monitoring of ESC CMPs was undertaken on 2 September 2022. 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 B6 and B7 of Appendix B and Figures 2 to 11 of Appendix C. A total of ten (10) monitoring stations were sampled in September 2022 as shown in Figure 2.1.

2.4.1 In-situ Measurements

Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in **Figures 2 to 7** of **Appendix C**. Analyses of results indicated that the levels of pH and Salinities complied with the WQOs at all stations in September 2022, except slightly lower levels of DO was recorded at Ma Wan station. The levels of DO and Turbidity complied with the Action and Limit Levels at all stations (**Table B3** of **Appendix B**; **Figures 4 and 7** 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 September 2022.

2.4.2 Laboratory Measurements

Laboratory analysis of samples obtained during the reporting period indicated that the concentrations of Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc were detected in the samples at all/some stations and their concentrations of most metals and metalloids were generally similar across stations, except Lead was only detected at Reference Station (RFF) stations and the concentration of Zinc which was higher at Ma Wan (MW1) station. The concentrations of Copper were slightly higher Intermediate (INF) stations (**Table B6** of **Appendix B**; **Figure 8 of Appendix C**).

For nutrients, concentrations of Total Inorganic Nitrogen (TIN) were higher than the WQO (0.5 mg/L) at Reference (RFE), Impact (IPE) and Intermediate (INE) stations (**Table B7** of **Appendix B**; **Figure 9** 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 concentration of Ammonia Nitrogen (NH₃-N) was similar at all stations (**Table B7** of **Appendix B**; **Figure 9** of **Appendix C**). The concentrations of Biochemical Oxygen Demand (BOD₅) was higher at Impact (IPE) station (**Table B7** of **Appendix B**; **Figure 10** of **Appendix C**).

Analyses of results for the reporting period indicated that the SS levels at all stations complied with the wet season WQO (12.0 mg/L) and the Action and Limit Levels (**Tables B1 and B7** of **Appendix B**; **Figure 11** of **Appendix C**).

⁴ <u>http://www.epd.gov.hk/epd/misc/marine_quality/1986-2005/textonly/eng/index.htm</u>

Based on the available results of the Routine Water Quality Monitoring which 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 EM&A Report to investigate any spatial and temporal trends of potential concern.

2.5 Pit Specific Sediment Chemistry of ESC CMP Vb – in September 2022

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 7 September 2022.

The concentrations of most inorganic contaminants were lower than the Lower Chemical Exceedance Levels (LCELs) at all stations, except for Arsenic. The concentrations of Arsenic were higher than the LCEL at Near-Pit station ESC-NNCA, Pit-Edge stations ESC-NECA, ESC-NECB and Active-Pit stations ESC-NPCA, ESC-NPCB (**Figures 12 and 13** of **Appendix C**).

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.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 LCEL 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 Near-Pit station ESC-NNCA and Pit-Edge station ESC-NECA (**Figure 14** of **Appendix C**). The concentrations of Low Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) were similar across all stations, while concentrations of High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) were higher at Pit-Edge station ESC-NECA (**Figure 15** of **Appendix C**). The concentrations of Tributyltin (TBT), Total Polychlorinated Biphenyls (PCBs), Total dichlorodiphenyl-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 EM&A 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 October 2022 for ESC CMP V (see **Appendix A** for the sampling schedule):

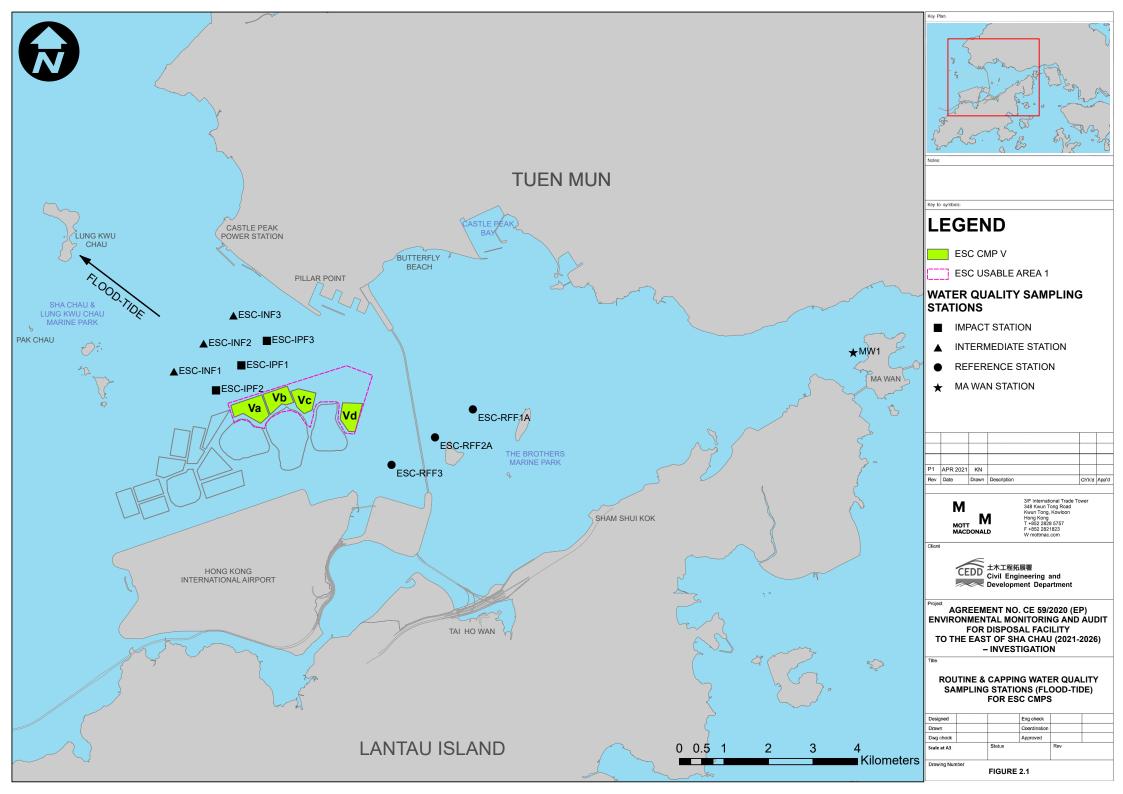
- Water Column Profiling of ESC CMP Vb;
- Routine Water Quality Monitoring of ESC CMPs; and
- Pit Specific Sediment Chemistry of ESC CMP Vb;

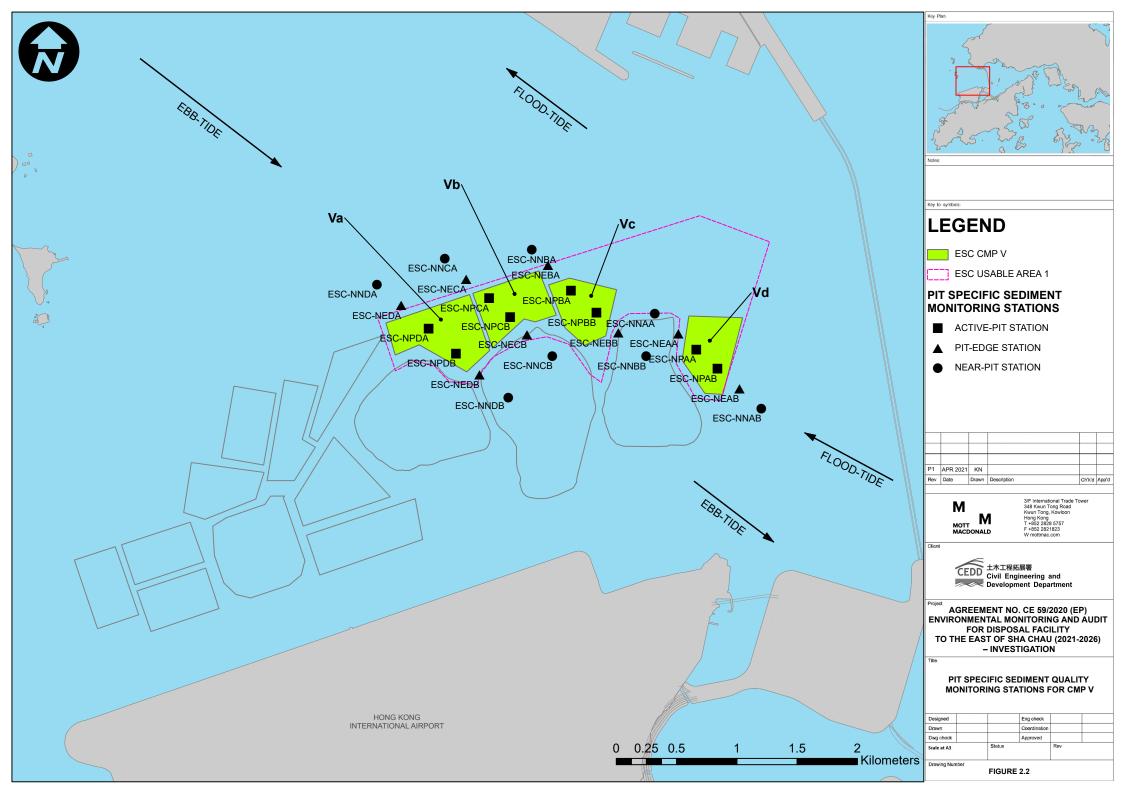
3.2 Study Programme

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

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Figures





Appendices

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- Appendix B Water Quality Monitoring Results
- Appendix C Graphical Presentations
- Appendix D Study Programme

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Appendix A. Sampling Schedule

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

Parameter / Station Type Pit Specific Sediment C		Frequency	2021 Jan Feb	Mar Ap	ər <mark> May J</mark>	Jun Jul :	Aug Sep	Oct Nov	/ Dec J	022 <mark>an Feb M</mark>	lar Apr	May Ju	1 Jul /	ug Sep	Oct Nov	Dec Jar	3 Feb Mai	Apr May	Jun Ju	Aug S	Sep Oct	Nov De	2024 <mark>c Jan F</mark>	eb Mar J	Apr May	Jun Ju	I Aug S	Sep Oct	Nov Dec	2025 Jan F	eb Mar Aj	or May J	un Jul /	Aug Sep	Oct Nov	2026 Dec Jan F	eb Mar
Active-Pit Pit-Edge	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	66 66	6 6 6 6	2	2 2 2 2	2 2 2 2	222	2 2 2 2	2 2 2 2	22 22	2	2 2 2 2	2 2 2 2	22	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
Near-Pit	ESC-NEAA ESC-NEAB	Monthly Monthly	6 6 6 6	6 6 6 6																																2 2 2	
	ESC-NNAA ESC-NNAB	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	66 66	66 66	6 6 6 6	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	22	2 2 2 2 2	2 2 2 2	222	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
Cumulative Impact Sedi Near-field Stations	iment Chemistry ESC-RNA	4 times per year	Jan Feb				Aug Sep	Oct Nov	Dec J	lan Feb M	lar Apr	May Ju		ug Sep	Oct Nov	Dec Jar	Feb Mai	Apr May	<mark>/ Jun Ju</mark>	Aug S	bep Oct	Nov De		2 Mar	Apr May	Jun Ju	I Aug S	Sep Oct	Nov Dec		e <mark>b Mar A</mark> j 2			Aug Sep	Oct Nov	Dec Jan F	eb Mar
Mid-field Stations	ESC-RNB1 ESC-RMA	4 times per year 4 times per year	6				6		6	6		6		2		2	2		2	2		2		2		2	2		2	:	2			2		2	
Capped Pit Stations	ESC-RMB	4 times per year 4 times per year	6			6	6		6	6		6		2		2	2		2	2		2	1	2		2	2		2	:	2		2	2			2
Far-field Stations	ESC-RCB1 ESC-RFA	4 times per year 4 times per year	6				6		6	6		6		2		2	2		2	2		2		2		2	2		2		2			2		2	2
Ma Wan Station	ESC-RFB MW1	4 times per year 4 times per year	6				6		6 6	6		6		2		2	2		2	2		2		2		2	2		2		2			2		2	2
Sediment Toxicity Tests Near-pit Stations	3		Jan Feb	Mar Ap	or May J	lun Jul I	Aug Sep	Oct Nov	/ Dec J	lan Feb M	lar Apr	May Ju	1 Jul /	ug Sep	Oct Nov	Dec Jar	Feb Ma	Apr May	<mark>/ Jun Ju</mark>	l Aug S	Sep Oct	Nov De	<mark>c Jan F</mark>	eb Mar J	Apr <mark>May</mark>	Jun Ju	I Aug S	Sep Oct	Nov Dec	Jan F	eb Mar Aj	or May J	un Jul /	Aug Sep	Oct Nov	Dec Jan F	eb Mar
Reference Stations	ESC-TDA ESC-TDB1	2 times per year 2 times per year	5		\blacksquare		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		\pm		5 5				5 [#]			5 5			5 5			5 5			1	5			5 5				5			5 5			5 5
	MW1	2 times per year	5				5				5"			5			5			5							5				5			5			5
Tissue / Whole Body Sa Near-pit Stations	ESC-INA	2 times per year	Jan Feb	Mar Ap	r May J	un Jul /	Aug Sep	Oct Nov	Dec J	an Feb M	tar Apr	May Ju		vug Sep	Oct Nov	Dec Jar	Feb Mai	Apr May	Jun Ju	Aug S	Sep Oct	Nov De	C Jan Fe	eb Mar	Apr May	Jun Ju	I Aug S	Sep Oct	Nov Dec	Jan F	eb Mar Aj	or May J	un Jul /	Aug Sep	Oct Nov	Dec Jan F	eb Mar
Reference North	ESC-INB	2 times per year 2 times per year					*			*				*			*			*							*				*			·			·
Reference South	TNB	2 times per year 2 times per year					*			*				•			*			*							*							*			*
Demersal Trawling	TSB	2 times per year	Jan Feb		pr May J	Jun Jul	* Aug Sep	Oct Nov	/ Dec J	an Feb M	lar Apr	May Jur	1 Jul /	kug Sep	Oct Nov	Dec Jar	* Feb Mar	Apr May	<mark>/ Jun</mark> Ju	*	Sep Oct	Nov De	c Jan Fe	eb Mar J	Apr May	Jun Ju	*	Sep Oct	Nov Dec	Jan F	eb Mar Aj	or May J	un Jul /	× Aug Sep	Oct Nov	Dec Jan F	
Near-pit Stations	ESC-INA ESC-INB	4 times per year 4 times per year	5 5 5 5		$\overline{+}$	5				555				5^ 5^ 5^ 5^			5 5		5	5			55			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			55	_		5				-	5		5	5 5		5	
Reference South	TSA TSB	4 times per year 4 times per year	5 5 5 5		$\overline{+}$	5	-			5 5 5 5				5^ 5^ 5^ 5^			5		-	5			5 5				5			5	5		-	5		5	
Capping * Ebb Tide			Jan Feb	Mar Ap	or <mark> May J</mark>	lun Jul I	Aug Sep	Oct Nov	/ Dec J	lan Feb M	lar Apr	May Ju	1 Jul /	ug Sep	Oct Nov	Dec Jar	Feb Ma	Apr Ma	<mark>/ Jun</mark> Ju	l Aug S	Sep Oct	Nov De	<mark>c Jan F</mark>	eb Mar J	Apr May	Jun Ju	I Aug S	Sep Oct	Nov Dec	Jan F	eb <mark> Mar A</mark> j	or May J	un Jul /	Aug Sep	Oct Nov	Dec Jan F	eb Mar
Impact Station Downcur	ESC-IPE1A ESC-IPE2A	4 times per year * 4 times per year *			ŦŦ	++																															\pm
	ESC-IPE3 ESC-IPE4 ESC-IPE5	4 times per year * 4 times per year * 4 times per year *			\pm	\pm																														#	\pm
Intermediate Station Do	ESC-INE1A ESC-INE2A	4 times per year * 4 times per year *			+++	++																															\mp
	ESC-INE5A	4 times per year * 4 times per year * 4 times per year *			<u>+</u> +	#			Ħ																+											#	\pm
Reference Station Upcu	ESC-RFE1 ESC-RFE2	4 times per year * 4 times per year * 4 times per year *			Ħ	#							H														H									+	\mp
Ma Wan Station	ESC-RFE3 ESC-RFE4 ESC-RFE5	4 times per year * 4 times per year * 4 times per year *			#	#			H						+										+											#	\pm
Flood Tide	MW1	4 times per year *																																		+	
Impact Station Downcur	ESC-IPF1 ESC-IPF2	4 times per year * 4 times per year *			ŦŦ			_				_		_	_						_			++	-		+ +									<u> </u>	+
Intermediate Station Do	ESC-IPF3	4 times per year *			<u>+</u> +	#																			+											#	+
Reference Station Upcu	ESC-INF2 ESC-INF3	4 times per year * 4 times per year *			Ħ	#																														#	Ŧ
	ESC-RFF1A	4 times per year * 4 times per year * 4 times per year *			Ħ	\mp																														\mp	Ŧ
Ma Wan Station	MW1	4 times per year *																																		+	
Routine Water Quality M Ebb Tide Impact Station Downcur	rrent		Jan Feb																																	Dec Jan F	
	ESC-IPE1A ESC-IPE2A ESC-IPE3	Monthly* Monthly*		4	1 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		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	2 2 2 2 2 2 2 2 2	2 2 2 2
Intermediate Station Do		Monthly* Monthly*			1 4 4	4	4	4 4 4 4		4	4	4 4		2	2 2 2 2	2 2 2 2	2 2 2 2	2 2 2 2	222	2	2 2 2 2	2 2 2	22	2 2 2 2	2 2 2 2	222	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
	ESC-INE1A ESC-INE2A ESC-INE3A	Monthly* Monthly* Monthly*		4	1 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		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 2 2 2 2 2 2 2 2	2 2 2 2
Reference Station Upcu	ESC-INE5A	Monthly*		4	1 4	4	4	4 4 4		4	4	4 4 4 4			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	22	2 2 2 2	2 2 2 2	222	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
	ESC-RFE1 ESC-RFE2 ESC-RFE3	Monthly* Monthly* Monthly*		4	1 4 4	4	4 4	4 4 4 4 4 4		4 4 4	4	4 4 4 4 4 4		2 2	2 2 2 2	2 2 2 2	2 2 2 2	2 2 2 2	222	2	2 2 2 2	2 2 2 2	2 2	2 2 2 2 2	2 2 2 2	222	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
Ma Wan Station	ESC-RFE4 ESC-RFE5	Monthly* Monthly*			1 4	4	4	4 4 4		4	4	4 4 4																								2 2 2	
Flood Tide	MW1	Monthly*		1 4	4 4 4	4	4	4 4		4	4	4 4		2	∠ 2	2 2	22	2 2	22	2	∠ 2	2 2	2 2	<u>2 2 </u>	2 2	2 2	2	∠ 2	∠ 2	2	2 2 2	: 2	2 2	2 2	2 2	2 2	<u>< 2</u>
Impact Station Downcur	ESC-IPF1 ESC-IPF2	Monthly* Monthly*	4 4 4 4	4	Ħ	4 4 4	4 4 4	+	4	4	4 4 4		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
Intermediate Station Do	ESC-IPF3 wncurrent ESC-INF1 ESC-INF2	Monthly* Monthly*	4 4 4 4 4 4	4	++	4	4		4	4	4		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
Reference Station Upcu	ESC-INF3	Monthly*	4 4 4 4 4 4	4	##	4	4		4	4	4		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
Ma Wan Station	ESC-RFF1A ESC-RFF2A ESC-RFF3		4 4 4 4 4 4	4	#	4 4 4	4 4 4		4	4	4 4 4		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 2 2	2 2 2 2 2 2	2 2 2 2 2 2	2 2 2 2 2 2	2 2 2 2
	MW1	Monthly*	4 4			4			4		4	May	2																							2 2	
Water Column Profiling Plume Stations	WCP1	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	Dec Jan F 2 2 2	2 2
Benthic Recoloinisation		Monthly*	1 - 1 -	2 2 Mar Ap																																2 2 2	
Capped Stations at CMF		2 times per year							, 1			_													_				_								

Capped Stations at CMP V																					2
ESCV-CPA	2 times per year																				
ESCV-CPB	2 times per year																				
ESCV-CPC	2 times per year																				_
ESCV-CPD	2 times per year 2 times per year 2 times per year 2 times per year																				
Reference Stations																					
RBA	2 times per year																				
RBB	2 times per year																				_
RBC1 2	2 times per year																				_

Impact Monitoring for Dredging	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	z 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 Jun Jul Aug Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
Upstream Stations					
US1 3 times per week		2 2 2 2 2 2			
US2 3 times per week		2 2 2 2 2 2			
Downstream Stations					
DS1 3 times per week		2 2 2 2 2 2			
DS2 3 times per week		2 2 2 2 2 2			
DS3 3 times per week		2 2 2 2 2 2			
DS4 3 times per week		2 2 2 2 2 2			
DS5 3 times per week		2 2 2 2 2 2			
Ma Wan Station					
MW1 3 times per week					

Note: (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 numbers 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-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.

(4) Betild Reconstrained studies to come v and combination studies to come v and combination approximation of contine 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 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 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. A technical note presenting the data review results served as a supplementary information was submitted to EPD and presented that Phase 2 optimization of sample replication of water quality and sediment monitoring for the Project will be implemented in 2022 was provided to EPD in April 2022. Phase 2 optimization of sample replication has been effective for the EM&A activities since July 2022.
 # Due to the logistic problem induced by the pandemic which adversely affecting the supply of international species adopted in testing programme of Sediment Toxicity Tests, as such, Sediment Toxicity Tests of ESC CMPs originally scheduled in February 2022 were postponed to March 2022.
 * To enable the required Research Fishing Permit could be granted by the time undertaking the Demensial Trawing, trawling originally scheduled in July and August 2022 will be tentatively postponed to August and September 2022.

Appendix B. Water Quality Monitoring Results



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) ⁽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

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

Notes:

For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits. 1.

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.

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 3. 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. For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits. 5.



Table B2: Water Column Profiling Results for ESC CMP Vb in September 2022

Station	Temp.	Salinity	Turbidity	Dissolve	ed Oxygen	рН	Suspended Solids
	(°C)	(ppt)	(NTU)	(%)	(mg L ⁻¹)		(mg L ⁻¹)
WCP 1 (Downstream)	28.70	27.26	1.31	92.44	6.14	7.98	3.5
WCP 2 (Upstream)	28.54	27.75	2.45	92.33	6.13	7.94	5.0
WQO (Wet Season)	N/A	24.98-30.53#	N/A	N/A	>4	6.5-8.5	12.0

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 September 2022

Station	Temp.	Salinity	Turbidity	Dissolve	d Oxygen	рН
	(°C)	(ppt)	(NTU)	(%)	(mg L ⁻¹)	
RFF (Reference)	28.50	26.89	8.47	61.44	4.11	7.88
IPF (Impact)	28.54	26.96	7.40	60.66	4.05	7.86
INF (Intermediate)	28.62	26.80	5.64	61.68	4.11	7.86
Ma Wan	27.74	28.64	3.33	55.12	3.69	7.93
WQO (Wet Season)	N/A	24.20-29.58	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.

3. Cell shaded grey indicates value exceeding the WQO.



Table B4: Laboratory Results for Dissolved Metals and Metalloid in Routine Water Quality Monitoring of ESC CMPs in August 2022

Station	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn
	(µg/L)								
RFE	2.03	0.04	0.15	0.97	ND	0.002	0.87	0.01	0.80
IPE	2.24	0.03	0.14	0.72	ND	0.002	0.85	0.01	0.09
INE	2.17	0.04	0.16	0.85	ND	0.002	0.89	0.01	0.08
Ma Wan	2.23	0.05	0.22	0.58	0.02	0.001	0.69	0.01	ND

Note:

1. "ND" indicates the concentrations of metals and metalloids are not detected.

Table B5: Laboratory Results for Nutrients and Suspended Solid in Routine Water Quality Monitoring of ESC CMPs in August 2022

Station	NH ₃	TIN	BOD ₅	SS
	(mg/L)	(mg/L)	(mg/L)	(mg/L)
RFE	0.03	0.55	2.12	6.6
IPE	0.07	0.52	1.48	5.9
INE	0.05	0.56	2.12	6.7
Ma Wan	0.03	0.40	1.40	4.0
				WQO of TIN: 0.5 mg/L

Wet Season WQO of SS: 12.0 mg/L

Notes:

1. "<LOR" indicates the concentrations of contaminants 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.



Table B6: Laboratory Results for Dissolved Metals and Metalloid in Routine Water Quality Monitoring of ESC CMPs in September 2022

Station	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn
	(µg/L)								
RFF	2.37	0.03	0.10	0.48	0.01	0.002	0.57	ND	0.68
IPF	2.13	0.04	0.08	0.49	ND	0.002	0.59	ND	0.10
INF	2.42	0.04	0.09	0.84	ND	0.002	0.66	ND	0.17
Ma Wan	2.23	0.04	0.11	0.34	ND	0.002	0.46	ND	1.20

Note:

1. "ND" indicates the concentrations of metals and metalloids are not detected.

Table B7: Laboratory Results for Nutrients and Suspended Solid in Routine Water Quality Monitoring of ESC CMPs in September 2022

Station	NH ₃	TIN	BOD ₅	SS
	(mg/L)	(mg/L)	(mg/L)	(mg/L)
RFF	0.10	0.51	0.65	12.0
IPF	0.10	0.53	0.73	11.2
INF	0.08	0.54	0.58	7.0
Ma Wan	0.09	0.38	0.55	6.0
				WQO of TIN: 0.5 mg/L

Wet Season WQO of SS: 12.0 mg/L

Notes:

1. "<LOR" indicates the concentrations of contaminants are below the limit of reporting.

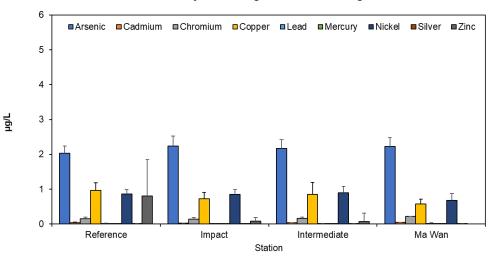
2. Cell shaded yellow / red indicates value exceeding the Action/Limit levels.

3. Cell shaded grey indicates value exceeding the WQO.

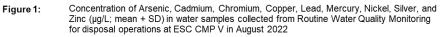
Mott MacDonald | Agreement No. CE59/2020(EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2021-2026) – Investigation Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – September 2022

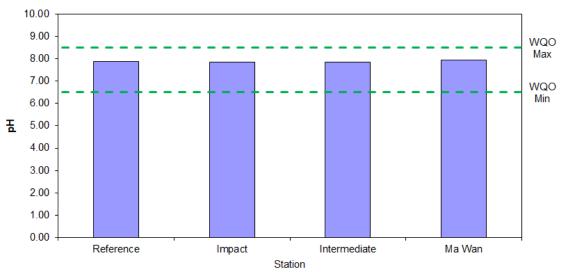
Appendix C. Graphical Presentations

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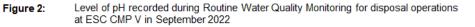


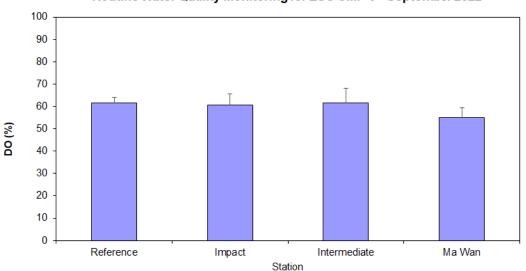
Routine Water Quality Monitoring for ESC CMP V August 2022



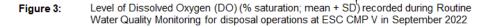


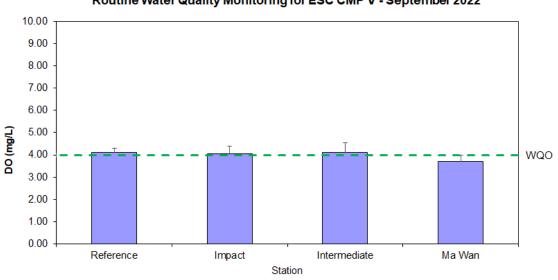
Routine Water Quality Monitoring for ESC CMP V - September 2022





Routine Water Quality Monitoring for ESC CMP V - September 2022

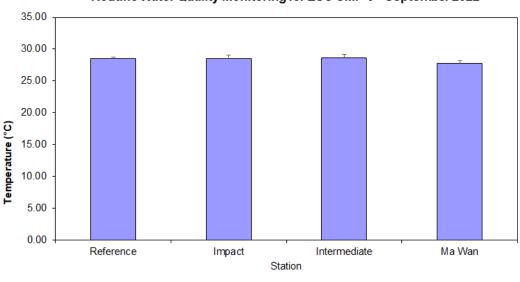




Routine Water Quality Monitoring for ESC CMP V - September 2022

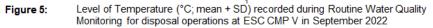
Figure 4:
 Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in September 2022

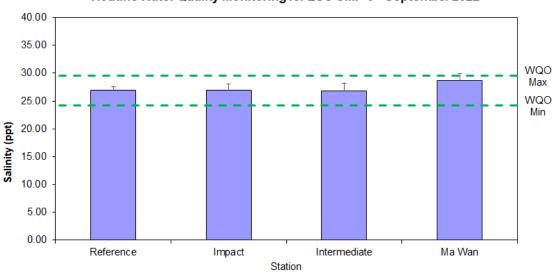
¹ The mean and standard deviation (SD) for in-situ data are the mean and SD for water columns within the area.



Routine Water Quality Monitoring for ESC CMP V - September 2022

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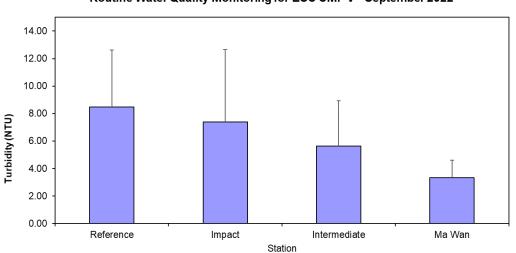




Routine Water Quality Monitoring for ESC CMP V - September 2022

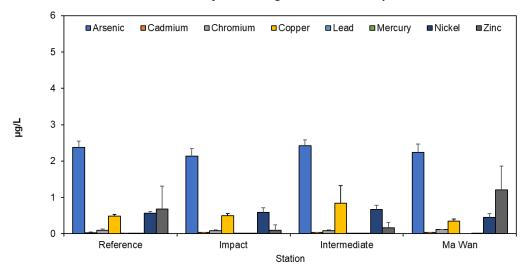
Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in September 2022 Figure 6:

¹ The mean and standard deviation (SD) for in-situ data are the mean and SD for water columns within the area.



Routine Water Quality Monitoring for ESC CMP V - September 2022

Figure 7: Level of Turbidity (NTU; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in September 2022

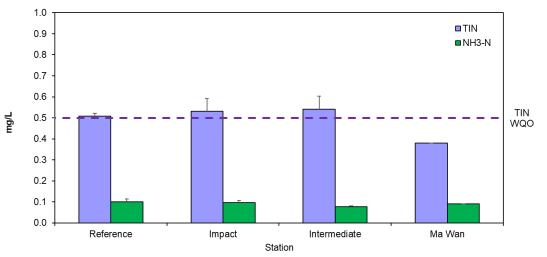


Routine Water Quality Monitoring for ESC CMP V September 2022

Figure 8: Concentration of Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, and Zinc (μg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in September 2022

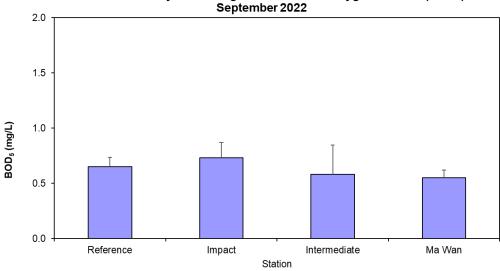
M MOTT MACDONALD

¹ The mean and standard deviation (SD) for in-situ data are the mean and SD for water columns within the area.



Routine Water Quality Monitoring for Nutrients - September 2022

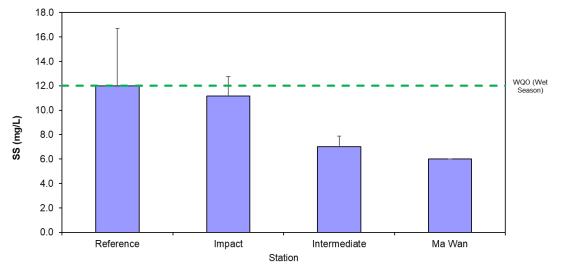
Figure 9: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen (NH3-N) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in September 2022



Routine Water Quality Monitoring for Biochemical Oxygen Demand (BOD5) -September 2022

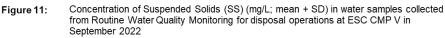
Figure 10:

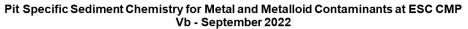
Level of Biochemical Oxygen Demand (BOD5) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in September 2022 M MOTT MACDONALD

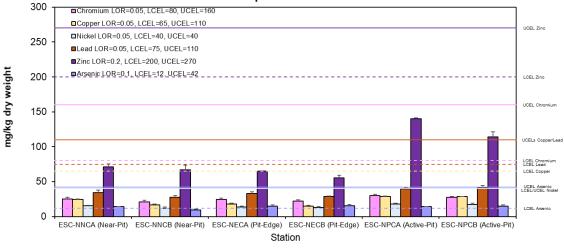


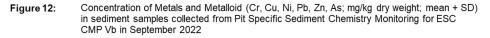
Routine Water Quality Monitoring for Suspended Solids - September 2022

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Pit Specific Sediment Chemistry for Metal Contaminants at ESC CMP Vb -September 2022

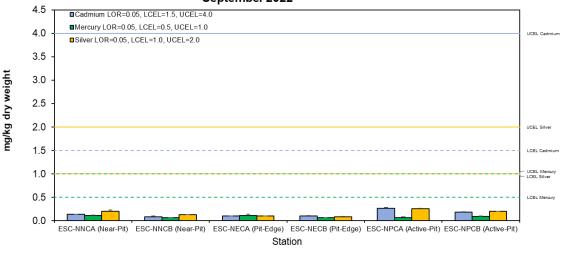
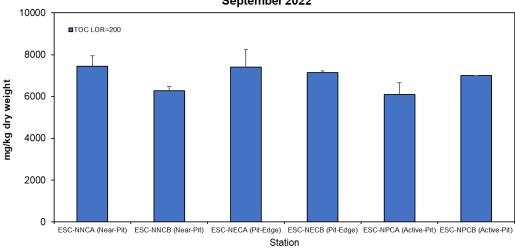
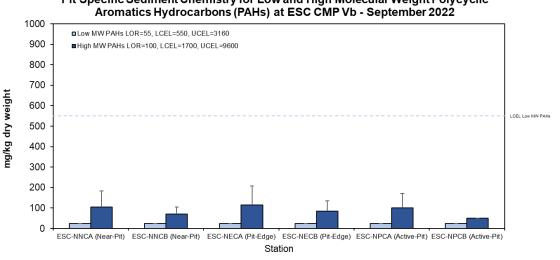


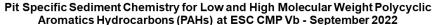
Figure 13: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in September 2022



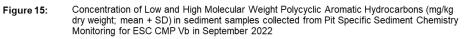
Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at ESC CMP Vb -September 2022

Figure 14: 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 September 2022





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Appendix 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

		to the E	ast of Sha Cr	1au (2021-202	26) - Investig	ation								
D	Task Name		Start	Finish		2022 24 Q1 Q2 Q3 NDJFMAMJJA	202 Q4 Q1	3 Q2 Q3	202 Q4 Q1		2025 24 Q1		2026 4 Q1	02 03
1	COMMENCEMENT OF AGREEMENT NO). CE 59/2020 (EP)	01/04/21		•		30001			MANNJJAJA		AIMITTATSIO		
2	EAST OF SHA CHAU CONTAMINATED N	NUD PITS (ESC CMPs) BETWEEN 2021 & 2026	01/04/21	25/06/26										-
3	Draft Report of First Review of EM&A Manual	(for ESC CMPs)		30/04/21	•									
4	Final Report of First Review of EM&A Manual	(for ESC CMPs)		20/05/21	•									
5	Draft Report of Subsequent Review of EM&A	Manual (for ESC CMPs) - annual basis assumed	30/04/22	30/04/25		\$		\$		\$		\$		
10	Final Report of Subsequent Review of EM&A	Nanual (for ESC CMPs) - annual basis assumed	20/05/22	20/05/25		\$		\$		\$		\$		
15	Regular Site Inspections of CMP Contractors		01/04/21	31/03/26										
16	Monthly EM&A Report		14/05/21	14/04/26	\$\$\$\$\$\$		\$\$\$\$\$	\$\$\$\$\$\$	\$\$\$\$\$	00000000	•00000·	\$\$\$\$\$\$\$	>>>>>	>
77	Quarterly EM&A Report		30/07/21	30/04/26	♦	$\diamond \diamond \diamond \diamond$	♦ ♦	♦ ♦	♦ ♦	$\diamond \diamond$	◊ ◊	$\diamond \diamond \diamond$	>	\$
98	Annual EM&A Report		30/01/22	30/01/26		\$	\$		\$		\$		\$	
104	Annual Risk Assessment Report		31/05/22	31/05/26		\$		\$		\$		\$		\$
110	Draft Final Report			30/04/26										•
111	Final Report			04/06/26										٠
112	Draft Executive Summary			04/06/26										•
113 Final Executive Summary			25/06/26										•	
114	EAST OF TUNG LUNG CHAU (ETLC) DISI SEPTEMBER 2021 & MARCH-APRIL 202	POSAL FACILITY (MONITORING PERIOD: 2)	23/11/21	31/08/22			I							
115	5 Monthly EM&A Report		23/11/21	06/06/22		\diamond $\diamond \diamond$								
119	Quarterly EM&A Report		15/07/22	15/07/22		\$								
121	Annual EM&A Report		31/08/22	31/08/22		<	>							
	amme Revision: C 11/05/22	Start/End of ET Services Location Repeating Task	Start of Agreen Submission Multiple-Occas	nent sion Submission	 ◆ ◆ ◇ 									