

**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 2022 (Finalized)

June 2022

Mott MacDonald
3/F Manulife Place
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 2022 (Finalized)

June 2022

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 2022
Date of Report:	9 June 2022
Date prepared by ET:	9 June 2022
Date received by IA:	9 June 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: 9 June 2022

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):



Date: 9 June 2022

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	Jun 2022	Various	Thomas Chan	Eric Ching	Revision A of Submission
B	Jun 2022	Various	Thomas Chan	Eric Ching	Revision B for Record (Finalized)

Document reference: 423134 | 06/05/14 | B

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	Introduction	1
1.1	Background	1
1.2	Reporting Period	2
1.3	Details of Sampling and Laboratory Testing Activities	2
1.4	Details of Outstanding Sampling or Analysis	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 2022	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 2022	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 2022	4
2.5	Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vc – May 2022	5
3	Future Key Issues	7
3.1	Activities Scheduled for the Next Reporting Period	7
3.2	Study Programme	7

Tables

Table 1.1	Works Schedule for ESC CMP V
Table 2.1	Details of Exceedances Recorded at ESC CMP Vc during the Reporting Period

Figures

Figure 2.1	Routine & Capping Water Quality Sampling Stations (Ebb-Tide) for ESC CMPs
Figure 2.2	Pit Specific Sediment Quality Monitoring Stations for CMP V
Figure 2.3	Indicative Dredging Impact Sampling Stations for ESC CMPs

Appendices

- Appendix A Sampling Schedule
- Appendix B Water Quality Monitoring Results
- Appendix C Graphical Presentations
- Appendix D Dredging Record
- Appendix E Study Programme

1.2 Reporting Period

This *Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – May 2022* covers the EM&A activities for the reporting period of May 2022 (from 1 to 31 May 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
- Water Quality Monitoring During Dredging of ESC CMP Vc.

1.4 Details of Outstanding Sampling or Analysis

No outstanding sampling remained for the reporting month (May 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
- Water Quality Monitoring During Dredging of ESC CMP Vc.

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

Water Column Profiling was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 19 May 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 May 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 May 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 May 2022

Routine Water Quality Monitoring of ESC CMPs was undertaken on 12 May 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 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 2022 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 all stations in May 2022.

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 2022.

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 of most metals and metalloids were generally similar across stations, except the concentration of Zinc which was lower at Impact (IPE) station (**Table B4 of Appendix B; Figure 7 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), Intermediate (INE) and Ma Wan stations (**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 concentration of Ammonia Nitrogen (NH₃-N) were generally similar across stations (**Table B4 of Appendix B; Figure 8 of Appendix C**). The concentrations of Biochemical Oxygen Demand (BOD₅) were higher at Reference (RFE) and Intermediate (INE) stations (**Table B4 of Appendix B; Figure 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 (12.0 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 EM&A Report to investigate any spatial and temporal trends of potential concern.

2.4 Pit Specific Sediment Chemistry of ESC CMP Vb – in May 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 5 May 2022.

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

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

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

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 concentration of Total Organic Carbon (TOC) was higher at Active-Pit station ESC-NPCA during the reporting period (**Figure 13** of **Appendix 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 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.

2.5 Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vc – May 2022

Dredging activities were carried out from 1 to 31 May 2022 during this reporting period and suspended from 7 to 12 May 2022 due to machinery issue. Water quality monitoring was conducted during the reporting period on 2, 4, 6, 9, 13, 16, 18, 20, 23, 25, 27 and 30 May 2022. During each survey day, monitoring was conducted during both mid-ebb and mid-flood tides at two Reference (Upstream) stations and five Impact (Downstream) stations around the dredging operations at ESC CMP Vc. Monitoring was also conducted at one Sensitive Receiver station situated in Ma Wan. A total of eight (8) stations were monitored and locations of the sampling stations are shown in **Figure 2.3**.

Monitoring results are presented in **Table B5** of **Appendix B**. Daily dredging volume in May 2022 is reported in **Appendix D**. Levels of DO, Turbidity and SS generally complied with the Action and Limit Levels (see **Table B1** of **Appendix B** for details), except for the following occasions discussed in **Table 2.1** below. The results indicated that the dredging operations at ESC CMP Vc did not appear to cause any unacceptable deterioration in water quality during this reporting period. Therefore, no further action, except for those recommended in the Environmental Permit (EP-312/2008/A), are considered necessary for the dredging operations.

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

Table 2.1: Details of Exceedances Recorded at ESC CMP Vc during the Reporting Period

Date	Tide	Parameter	Station	Type of Exceedance	Remarks
18 May 2022	Mid-Flood	Turbidity	DS2	Limit	These exceedances were not considered as indicating any unacceptable impacts from the dredging operations to Water Sensitive Receivers (WSRs) outside the works area due to the following reasons: <ul style="list-style-type: none"> Stations DS2 and DS3 are located further away from the works area of ESC CMP Vc when compared to station DS1 at which the levels of Turbidity did not exceed the Action and Limit Levels during the same tidal period. In addition, levels of SS at all stations complied with the Action and Limit levels. Therefore, it is considered that the dredging operations did not cause adverse water quality impact in terms of SS levels, which are more representative to determine the effects of dredging operation to nearby sensitive receivers.
18 May 2022	Mid-Flood	Turbidity	DS3	Action	

3 Future Key Issues

3.1 Activities Scheduled for the Next Reporting Period

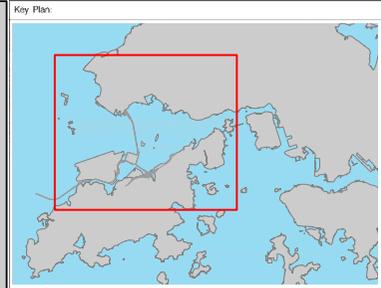
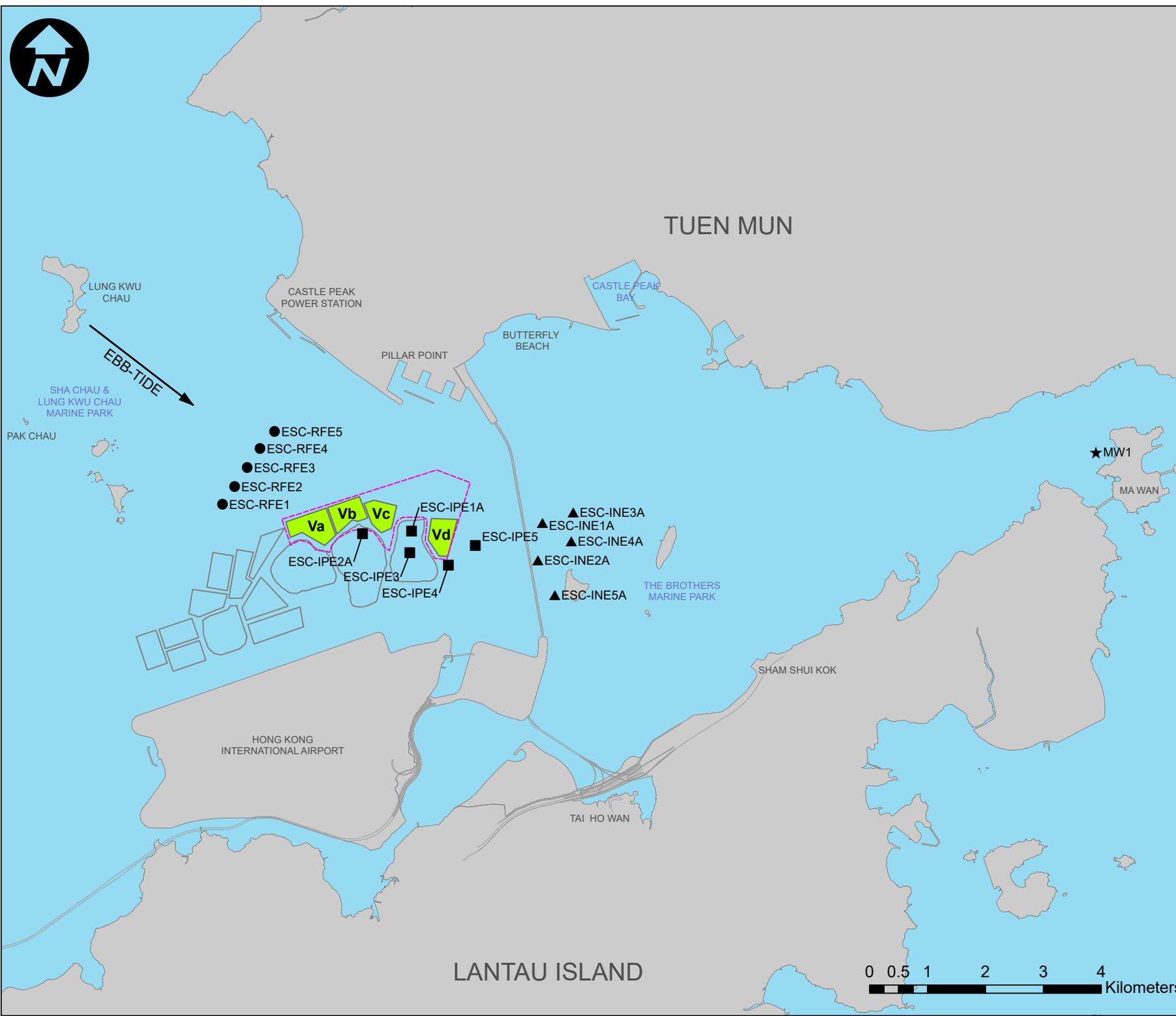
The following monitoring activities will be conducted in the next reporting period of June 2022 for ESC CMP V (see **Appendix A** for the sampling schedule):

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

3.2 Study Programme

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

Figures



Notes:

Key to symbols:

LEGEND

- ESC CMP V
 - ESC USABLE AREA 1
- #### WATER QUALITY SAMPLING STATIONS
- IMPACT STATION
 - INTERMEDIATE STATION
 - REFERENCE STATION
 - MA WAN STATION

Rev	Date	Drawn	Description	Ch'kd	App'd
P1	APR 2021	KN			

M M
MOTT
MACDONALD

3/F International Trade Tower
348 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong
T +852 2828 5757
F +852 2821823
W mottmac.com

Client

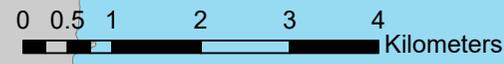
CEDD 土木工程拓展署
Civil Engineering and
Development Department

Project **AGREEMENT NO. CE 59/2020 (EP)
ENVIRONMENTAL MONITORING AND AUDIT
FOR DISPOSAL FACILITY
TO THE EAST OF SHA CHAU (2021-2026)
- INVESTIGATION**

Title **ROUTINE & CAPPING WATER QUALITY
SAMPLING STATIONS (EBB-TIDE)
FOR ESC CMPS**

Designed		Eng check	
Drawn		Coordination	
Dwg check		Approved	
Scale at A3	Status	Rev	

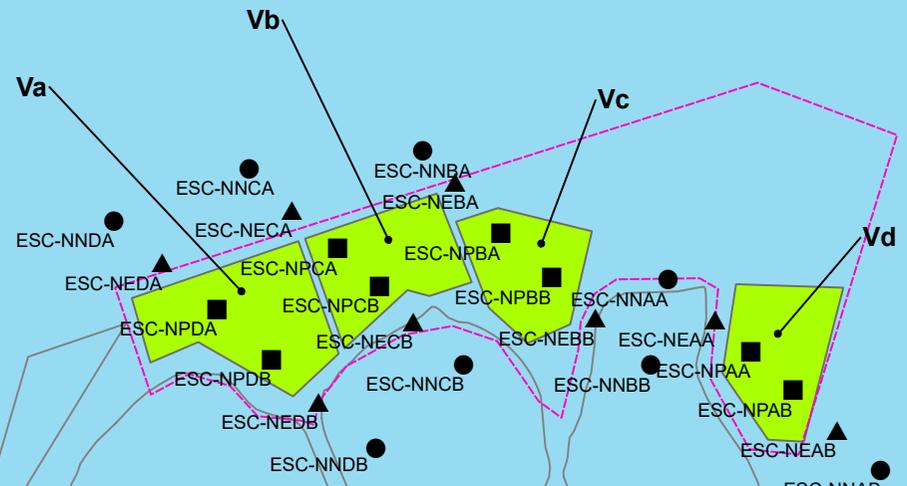
Drawing Number **FIGURE 2.1**





EBB-TIDE

FLOOD-TIDE



Notes:

Key to symbols:

LEGEND

- ESC CMP V
- ESC USABLE AREA 1
- ACTIVE-PIT STATION
- PIT-EDGE STATION
- NEAR-PIT STATION

PIT SPECIFIC SEDIMENT MONITORING STATIONS

Rev	Date	Drawn	Description	Ch'kd	App'd
P1	APR 2021	KN			

M M
MOTT
MACDONALD

3/F International Trade Tower
348 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong
T +852 2828 5757
F +852 2821823
W motmac.com

Client

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

Project **AGREEMENT NO. CE 59/2020 (EP)
ENVIRONMENTAL MONITORING AND AUDIT
FOR DISPOSAL FACILITY
TO THE EAST OF SHA CHAU (2021-2026)
- INVESTIGATION**

PIT SPECIFIC SEDIMENT QUALITY MONITORING STATIONS FOR CMP V

Designed		Eng check	
Drawn		Coordination	
Dwg check		Approved	
Scale at A3	Status	Rev	

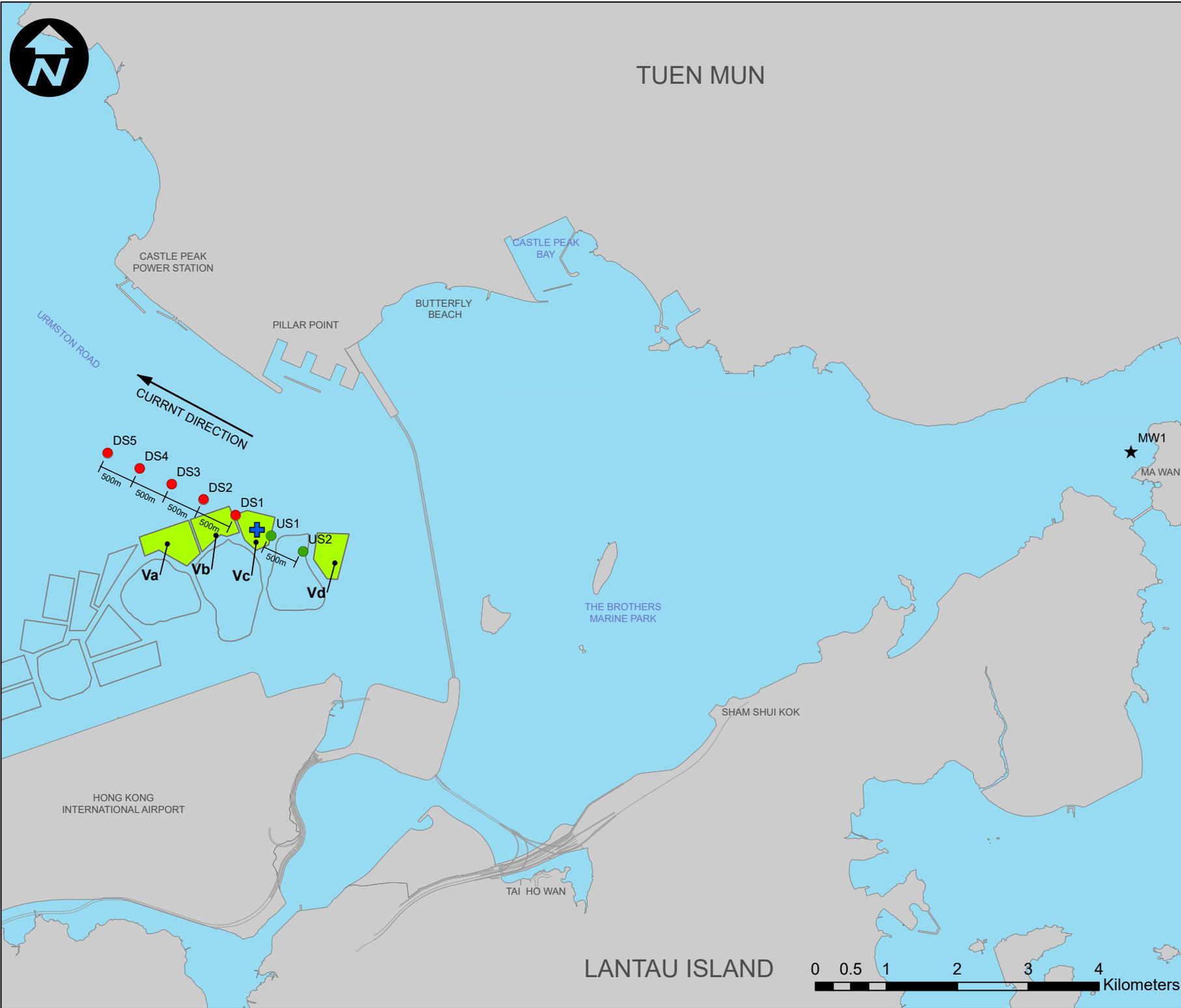
Drawing Number **FIGURE 2.2**

HONG KONG
INTERNATIONAL AIRPORT





TUEN MUN



Notes:

Key to symbols:

LEGEND

- ESC CMP V
- + POSITION OF DREDGING ACTIVITY
- DOWNSTREAM/ IMPACT STATION
- UPSTREAM/ REFERENCE STATION
- ★ MA WAN STATION

Rev	Date	Drawn	Description	Ch'kd	App'd
P1	AUG 2021	KN			

M M
MOTT
MACDONALD

3/F International Trade Tower
348 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong
T +852 2828 5757
F +852 2821823
W motmac.com

Client

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

Project **AGREEMENT NO. CE 59/2020 (EP)
ENVIRONMENTAL MONITORING AND AUDIT
FOR DISPOSAL FACILITY
TO THE EAST OF SHA CHAU (2021-2026)
- INVESTIGATION**

Title **INDICATIVE DREDGING IMPACT
SAMPLING STATIONS FOR ESC CMPS**

Designed		Eng check	
Drawn		Coordination	
Dwg check		Approved	
Scale at A3	Status	Rev	

Drawing Number **FIGURE 2.3**

LANTAU ISLAND



Appendices

- Appendix A Sampling Schedule
- Appendix B Water Quality Monitoring Results
- Appendix C Graphical Presentations
- Appendix D Dredging Record
- Appendix E Study Programme

Appendix A. Sampling Schedule

Appendix 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) in mg L ⁻¹ (Surface, Middle & Bottom) ⁽¹⁾	Surface and Middle Depth⁽²⁾ 5%-ile of baseline data for surface and middle layer = 3.76 and Significantly less than the reference station's mean DO (at the same tide of the same day)	Surface and Middle Depth⁽²⁾ 1%-ile of baseline data for surface and middle layer = 3.11 ⁽³⁾ and Significantly less than the reference station's mean DO (at the same tide of the same day)
	Bottom 5%-ile of baseline data for surface and middle layer = 2.96 and Significantly less than the reference station's mean DO (at the same tide of the same day)	Bottom The average of the impact station readings are < 2 and Significantly less than the reference station's mean DO (at the same tide of the same day)
Suspended Solids (SS) in mg L ⁻¹ (depth-averaged) ⁽⁶⁾	95%-ile of baseline data for depth-averaged = 37.88 and 120% of control station's SS at the same tide of the same day	99%-ile of baseline data for depth-averaged = 61.92 and 130% of control station's SS at the same tide of the same day
Turbidity in NTU (depth-averaged) ⁽⁴⁾⁽⁵⁾	95%-ile of baseline data = 28.14 and 120% of control station's Turbidity at the same tide of the same day	99%-ile of baseline data = 38.32 and 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.
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 2022

Station	Temp. (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg L ⁻¹)	pH	Suspended Solids (mg L ⁻¹)
WCP 1 (Downstream)	24.90	24.56	4.39	81.21	5.85	8.09	7.4
WCP 2 (Upstream)	24.90	24.22	6.82	83.20	6.00	8.10	7.3
WQO (Wet Season)	N/A	21.80-26.64 [#]	N/A	N/A	>4	6.5-8.5	12.0

Notes:

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

Table B3: In-situ Monitoring Results for Routine Water Quality Monitoring of ESC CMPs in May 2022

Station	Temp. (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%)	Dissolved Oxygen (mg L ⁻¹)	pH
RFE (Reference)	25.13	22.15	2.15	88.14	6.42	8.01
IPE (Impact)	25.18	20.83	1.74	89.91	6.58	8.03
INE (Intermediate)	25.13	22.07	1.80	89.34	6.51	8.04
Ma Wan	25.10	23.13	0.43	91.64	6.63	8.05
WQO (Wet Season)	N/A	19.93-24.36 [#]	N/A	N/A	>4	6.5-8.5

Notes:

- # Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.
- Cell shaded yellow / red 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 2022

Station	As (µg/L)	Cd (µg/L)	Cr (µg/L)	Cu (µg/L)	Pb (µg/L)	Hg (µg/L)	Ni (µg/L)	Ag (µg/L)	Zn (µg/L)	NH ₃ (mg/L)	TIN (mg/L)	BOD ₅ (mg/L)	SS (mg/L)
RFE	2.34	<LOR	1.78	8.15	1.61	<LOR	1.91	<LOR	18.03	0.16	0.90	1.92	3.9
IPE	2.13	<LOR	1.88	6.33	2.04	<LOR	2.00	<LOR	14.96	0.14	0.91	1.63	4.7
INE	2.25	<LOR	2.00	5.95	2.12	<LOR	2.13	<LOR	18.33	0.15	0.95	1.92	4.7
Ma Wan	2.20	<LOR	2.60	3.40	3.53	<LOR	2.25	<LOR	19.65	0.14	0.88	1.75	3.9

WQO of TIN: 0.5 mg/L
 Wet Season WQO of SS: 12.0 mg/L

Notes:

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

Table B5: Summary Table of DO, Turbidity and SS Levels Recorded in May 2022 for Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vc

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
02/05/2022	Mid Ebb	US1	5.89	6.04	4.20	5.72
		US2	5.75	5.99	5.53	7.15
		DS1	5.79	6.00	3.80	5.63
		DS2	5.78	6.06	4.01	5.42
		DS3	5.71	6.08	4.61	6.28
		DS4	5.83	6.11	4.15	4.02
		DS5	5.84	6.13	5.80	5.40
		MW	6.03	6.16	1.78	3.95
	Mid Flood	US1	5.76	6.00	8.31	9.40
		US2	5.72	5.96	8.85	10.78
		DS1	5.78	6.07	9.51	12.73
		DS2	5.76	5.96	11.08	15.35
		DS3	5.73	6.11	10.13	12.30
		DS4	5.78	6.01	17.05	13.80
		DS5	5.70	6.13	12.68	11.17
04/05/2022	Mid Ebb	US1	6.03	6.58	2.58	8.35
		US2	6.23	7.15	3.65	7.60
		DS1	6.06	6.55	3.30	5.85
		DS2	6.03	6.47	3.95	9.93
		DS3	6.04	6.44	3.62	6.43
		DS4	6.19	6.56	4.30	8.10
		DS5	6.36	6.64	4.53	7.48
		MW	6.22	6.59	1.43	4.43
	Mid Flood	US1	6.05	6.21	6.92	10.52
		US2	6.07	6.22	5.78	11.08
		DS1	6.03	6.27	7.08	10.82
		DS2	6.01	6.39	7.70	9.68
		DS3	6.08	6.29	5.75	10.03
		DS4	6.00	6.38	5.37	8.70
		DS5	6.06	6.54	4.38	8.98
MW	5.94	6.06	2.28	12.25		

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
06/05/2022	Mid Ebb	US1	6.98	7.47	2.53	4.80
		US2	7.27	7.86	2.58	4.65
		DS1	6.85	7.68	2.23	8.42
		DS2	6.89	7.40	2.27	5.27
		DS3	6.81	7.43	2.57	7.20
		DS4	6.99	7.48	2.13	6.38
		DS5	6.45	7.40	2.68	5.75
		MW	7.03	7.82	0.72	3.62
	Mid Flood	US1	6.37	6.99	1.98	4.62
		US2	6.08	6.59	3.87	8.18
		DS1	6.10	6.77	1.80	6.43
		DS2	6.25	6.87	2.20	5.93
		DS3	6.02	7.06	3.15	6.50
		DS4	6.17	7.01	2.37	4.07
		DS5	6.15	6.92	3.13	6.48
		MW	6.16	6.49	1.65	4.87
09/05/2022	Mid Ebb	US1	7.17	8.24	1.27	3.82
		US2	7.34	9.38	0.43	3.93
		DS1	6.97	7.99	1.13	3.45
		DS2	6.79	7.92	1.42	4.12
		DS3	5.92	7.78	1.75	4.53
		DS4	6.90	8.35	0.82	3.70
		DS5	6.96	8.16	1.07	4.40
		MW	7.13	8.70	0.48	3.38
	Mid Flood	US1	6.32	7.05	1.13	3.25
		US2	6.61	7.22	0.62	3.07
		DS1	6.43	7.03	1.05	2.93
		DS2	6.35	7.27	0.72	3.83
		DS3	6.77	7.39	0.72	2.90
		DS4	6.56	6.85	1.02	3.47
		DS5	6.58	6.85	0.95	3.12
		MW	6.56	6.54	0.57	2.90

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
13/05/2022	Mid Ebb	US1	5.68	6.34	5.93	8.92
		US2	5.72	6.62	6.37	8.53
		DS1	5.72	6.40	4.17	3.75
		DS2	5.71	6.49	4.25	13.20
		DS3	5.66	6.34	4.55	10.33
		DS4	5.75	6.50	3.70	5.50
		DS5	5.89	6.64	3.83	6.55
		MW	5.80	6.33	2.58	6.10
	Mid Flood	US1	5.88	6.66	3.67	7.97
		US2	6.31	6.94	2.03	8.32
		DS1	5.75	6.77	4.00	9.25
		DS2	5.91	6.53	3.33	7.27
		DS3	5.85	6.64	2.53	5.60
		DS4	5.92	6.49	2.37	6.72
		DS5	5.89	6.66	2.85	5.50
		MW	5.83	6.12	3.63	7.97
16/05/2022	Mid Ebb	US1	5.84	6.00	9.10	9.17
		US2	5.80	5.98	16.95	11.98
		DS1	5.82	5.88	10.66	9.43
		DS2	5.74	5.85	13.35	13.40
		DS3	5.78	5.88	12.05	12.78
		DS4	5.82	5.84	10.30	11.37
		DS5	5.66	5.82	13.75	14.05
		MW	5.60	5.73	3.15	4.57
	Mid Flood	US1	5.55	5.79	10.03	11.62
		US2	5.55	5.82	7.05	9.63
		DS1	5.62	5.93	6.43	10.57
		DS2	5.72	5.88	7.50	8.68
		DS3	5.69	5.94	5.16	6.08
		DS4	5.73	5.94	5.81	8.30
		DS5	5.61	5.85	6.80	9.12
		MW	5.55	5.55	6.13	8.70

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
18/05/2022	Mid Ebb	US1	5.80	5.95	18.85	27.85
		US2	5.99	6.19	7.38	11.73
		DS1	5.76	6.05	12.53	22.18
		DS2	5.73	6.08	15.62	20.43
		DS3	5.70	6.00	15.68	21.92
		DS4	5.81	6.03	12.33	19.80
		DS5	5.79	5.95	19.93	31.08
		MW	5.95	6.05	3.63	7.12
	Mid Flood	US1	5.69	5.86	11.25	15.28
		US2	5.67	5.79	14.08	23.72
		DS1	5.66	5.84	6.87	10.48
		DS2	5.52	5.76	39.27	28.38
		DS3	5.54	5.69	31.18	25.62
		DS4	5.56	5.78	17.65	16.32
		DS5	5.52	5.70	23.77	32.15
		MW	5.63	5.86	3.48	7.03
20/05/2022	Mid Ebb	US1	5.86	6.55	9.67	10.60
		US2	5.78	6.43	11.95	12.90
		DS1	5.71	6.76	9.90	13.23
		DS2	5.75	6.55	8.52	11.95
		DS3	5.74	6.26	10.02	13.88
		DS4	5.84	6.49	7.55	11.10
		DS5	5.86	6.43	8.80	10.90
		MW	6.39	7.06	2.07	6.03
	Mid Flood	US1	5.85	6.08	7.27	11.58
		US2	5.78	6.14	4.80	11.35
		DS1	5.59	6.02	4.52	9.58
		DS2	5.60	5.96	4.38	8.12
		DS3	5.59	5.85	5.02	9.57
		DS4	5.58	5.93	5.52	9.43
		DS5	5.61	5.98	5.48	10.40
		MW	5.61	6.01	2.82	7.75

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
23/05/2022	Mid Ebb	US1	6.11	7.14	3.83	7.95
		US2	6.20	6.53	5.21	11.43
		DS1	6.13	6.91	2.91	12.50
		DS2	6.29	7.23	3.15	9.53
		DS3	5.89	7.26	5.25	10.83
		DS4	6.90	7.56	2.98	8.67
		DS5	6.14	7.34	3.63	8.57
		MW	6.09	6.21	3.91	8.42
	Mid Flood	US1	6.34	7.13	3.96	8.90
		US2	6.08	7.03	3.50	9.47
		DS1	5.94	6.98	3.93	8.62
		DS2	5.99	7.32	3.98	8.67
		DS3	6.38	7.66	3.26	7.83
		DS4	6.55	7.62	2.85	8.27
		DS5	6.56	8.06	2.46	5.55
		MW	6.03	6.75	2.66	5.88
25/05/2022	Mid Ebb	US1	5.86	6.54	6.59	8.90
		US2	5.90	6.58	11.43	12.73
		DS1	5.81	6.29	7.93	11.92
		DS2	5.82	6.41	5.81	10.52
		DS3	5.82	6.50	6.89	13.27
		DS4	5.93	6.40	7.26	11.82
		DS5	5.90	6.32	6.71	12.18
		MW	5.91	5.99	3.79	8.93
	Mid Flood	US1	5.99	6.82	5.61	11.02
		US2	5.93	6.53	4.86	8.55
		DS1	5.87	6.30	5.38	9.70
		DS2	5.97	6.33	4.94	10.23
		DS3	5.87	6.20	5.84	10.93
		DS4	5.85	6.31	5.24	9.85
		DS5	6.08	6.43	4.79	10.37
		MW	5.87	6.05	5.26	9.15

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average SS Level (mg/L)
			Bottom	Surface and Mid Depth		
27/05/2022	Mid Ebb	US1	5.62	5.91	17.66	18.08
		US2	5.74	6.27	8.16	10.67
		DS1	5.66	5.99	12.24	13.68
		DS2	5.73	6.50	7.78	10.60
		DS3	5.66	6.08	9.66	12.83
		DS4	5.72	6.03	8.06	10.58
		DS5	5.75	6.04	7.63	12.68
		MW	5.74	5.79	5.16	11.33
	Mid Flood	US1	5.61	6.32	7.01	11.13
		US2	5.63	6.27	7.66	11.22
		DS1	5.61	6.18	6.76	9.60
		DS2	5.69	6.26	5.74	9.92
		DS3	5.76	6.34	6.68	12.90
		DS4	5.76	6.50	5.61	9.20
		DS5	5.83	6.41	5.06	10.82
		MW	5.66	5.74	7.54	12.78
30/05/2022	Mid Ebb	US1	5.55	5.97	10.63	9.65
		US2	5.51	5.96	16.28	9.83
		DS1	5.51	5.99	12.79	10.55
		DS2	5.50	5.92	11.54	9.07
		DS3	5.45	6.13	12.21	10.92
		DS4	5.59	6.13	9.94	10.18
		DS5	5.80	6.31	9.46	10.50
		MW	5.71	6.56	4.11	6.28
	Mid Flood	US1	5.52	6.52	8.13	8.10
		US2	5.56	6.13	12.16	14.65
		DS1	5.37	6.45	10.49	8.55
		DS2	5.60	6.52	7.61	7.45
		DS3	5.58	6.56	10.83	10.17
		DS4	5.70	6.73	7.23	8.07
		DS5	5.88	6.58	6.83	7.42
		MW	5.80	5.83	8.64	9.77

Notes:

1. Please refer to Table B1 above for the Action and Limit Levels for dredging activities.
2. Cell shaded yellow indicates value exceeding the Action Level criteria.
3. Cell shaded red indicates value exceeding the Limit Level criteria.

Appendix C. Graphical Presentations

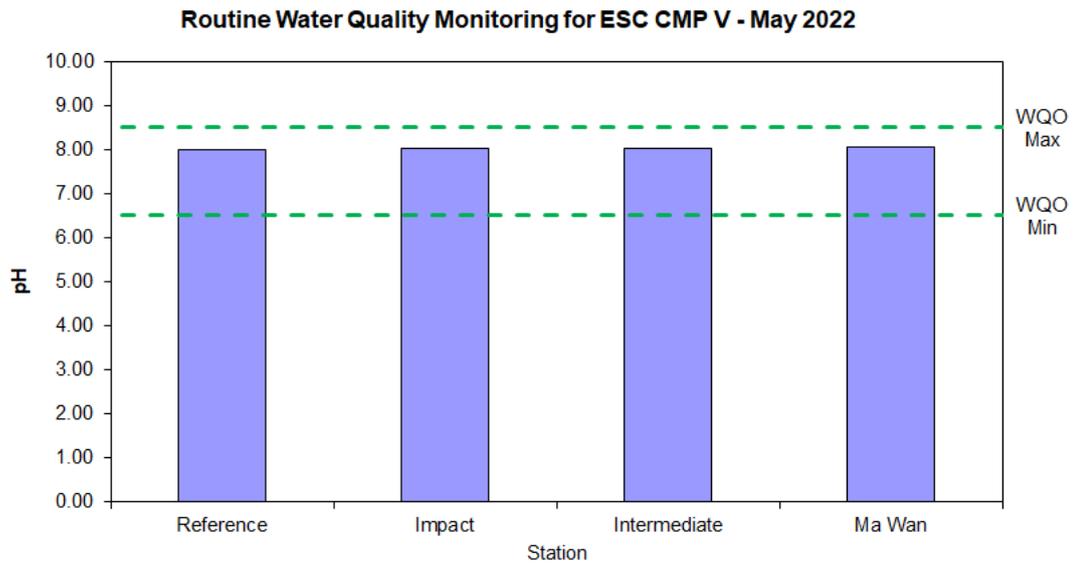


Figure 1: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2022

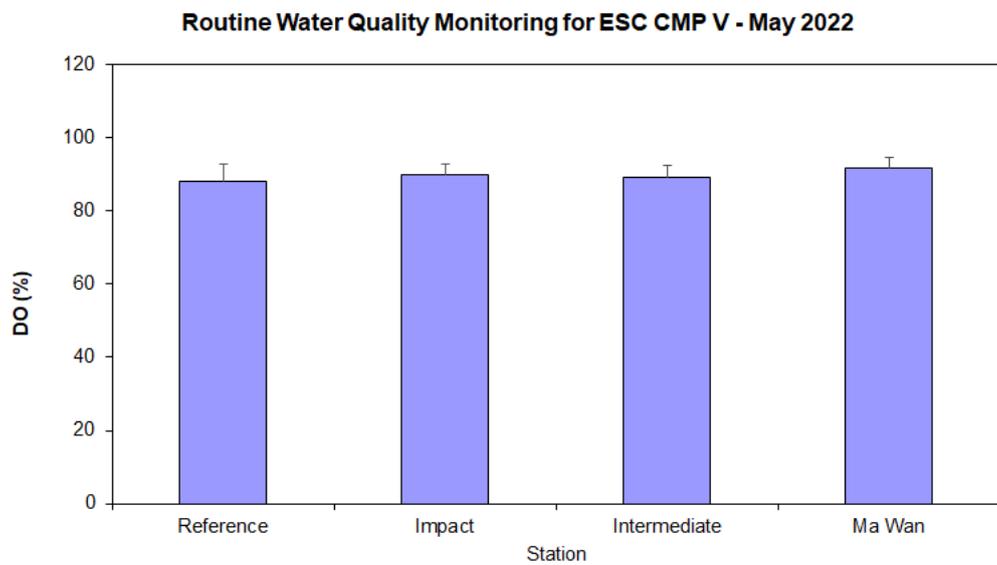


Figure 2: Level of Dissolved Oxygen (DO) (% saturation; mean + SD)¹ recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2022

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

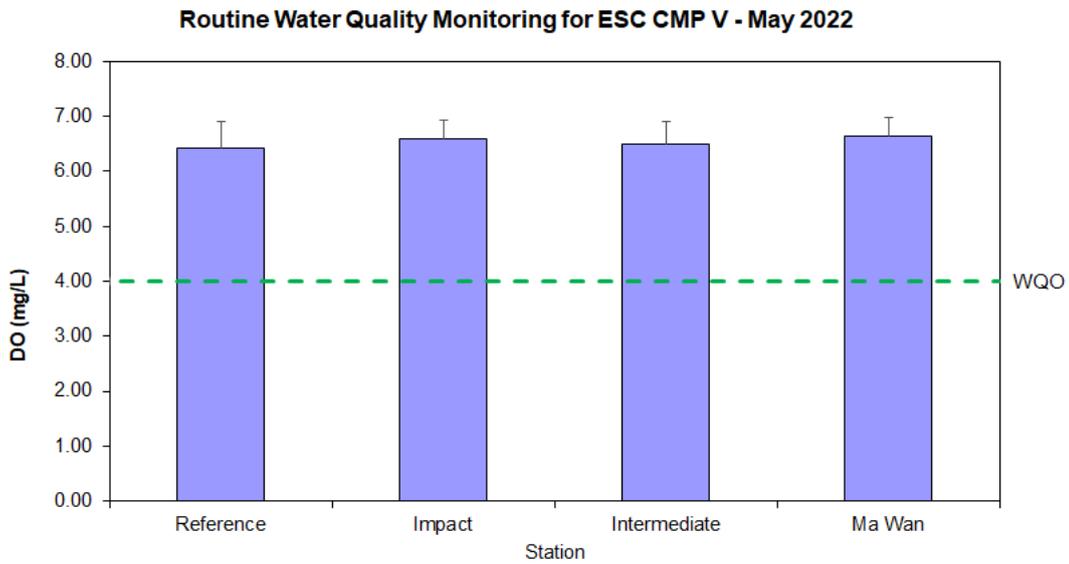


Figure 3: Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD)¹ recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2022

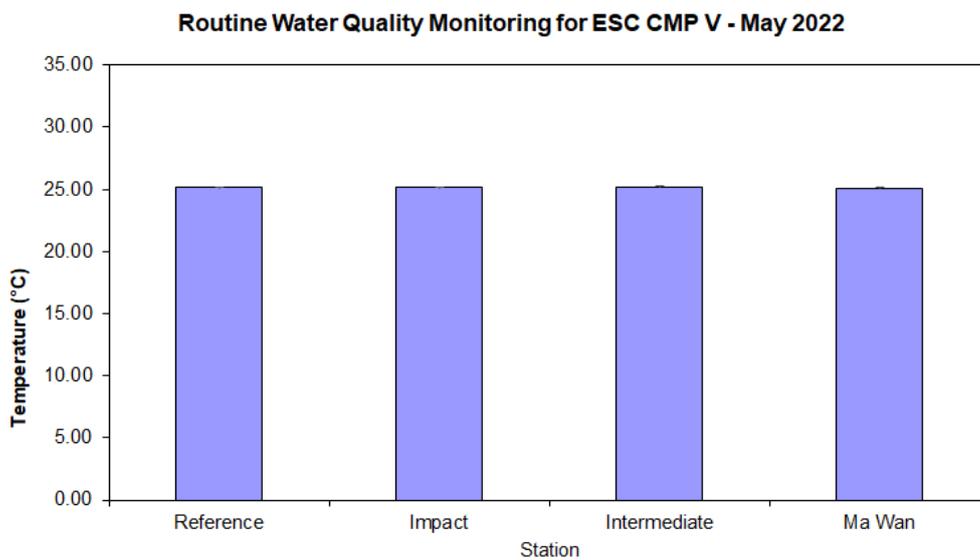


Figure 4: Level of Temperature (°C; mean + SD)¹ recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2022

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

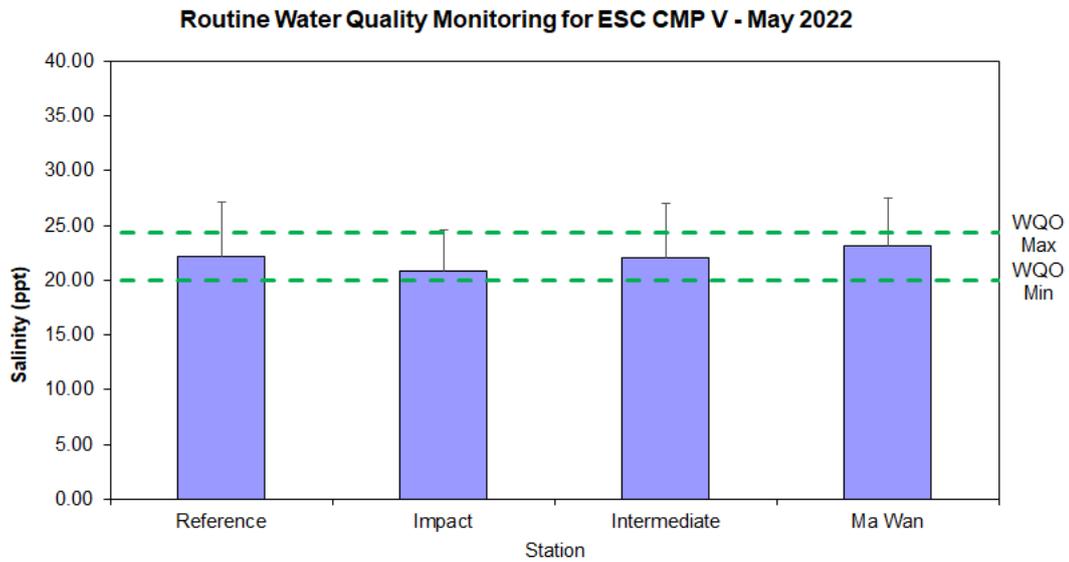


Figure 5: Level of Salinity (ppt; mean + SD)¹ recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2022

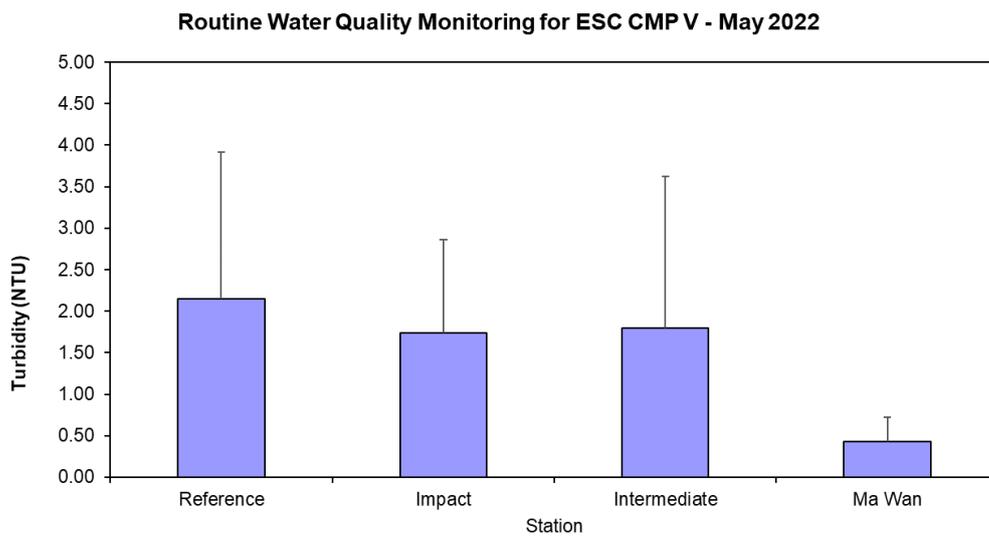


Figure 6: Level of Turbidity (NTU; mean + SD)¹ recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2022

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 May 2022

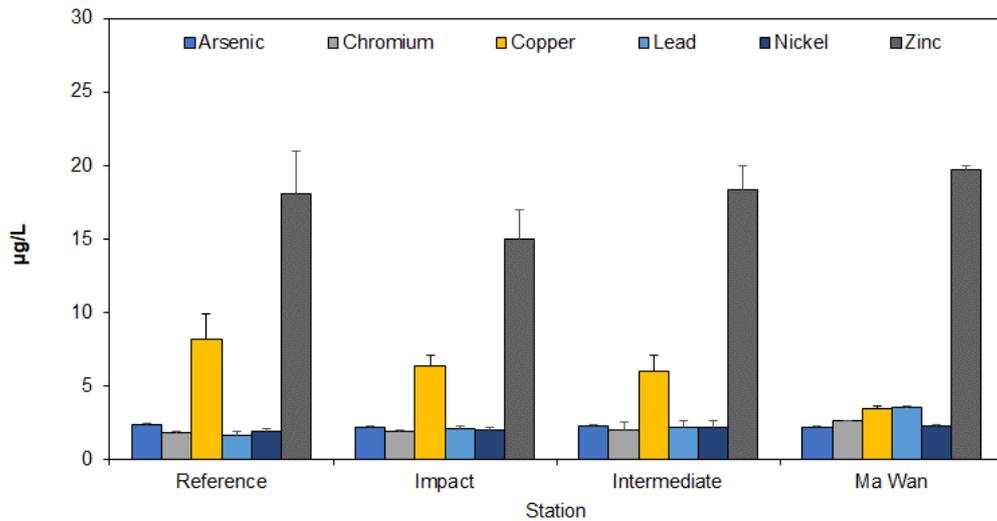


Figure 7: Concentration of Arsenic, Chromium, Copper, Lead, Nickel, and Zinc (µg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2022

Routine Water Quality Monitoring for Nutrients - May 2022

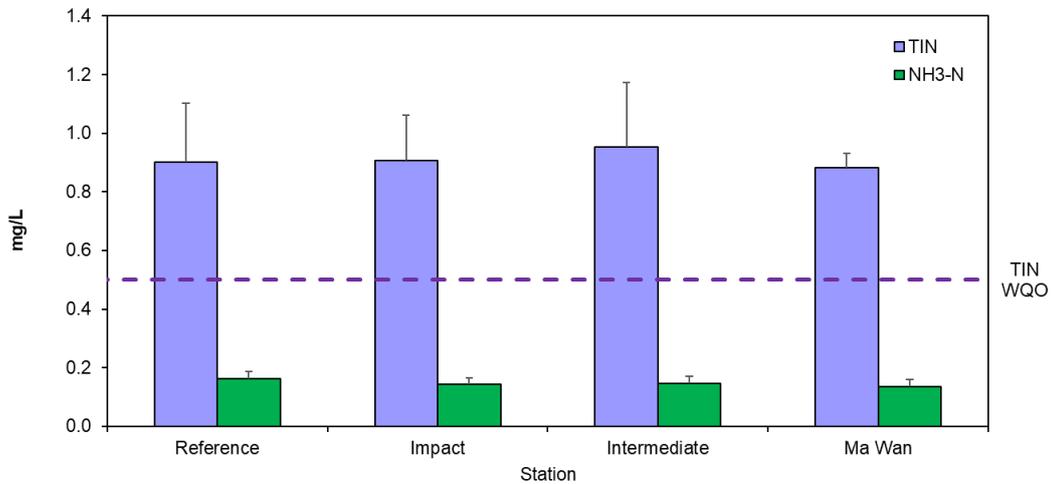


Figure 8: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen (NH3-N) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2022

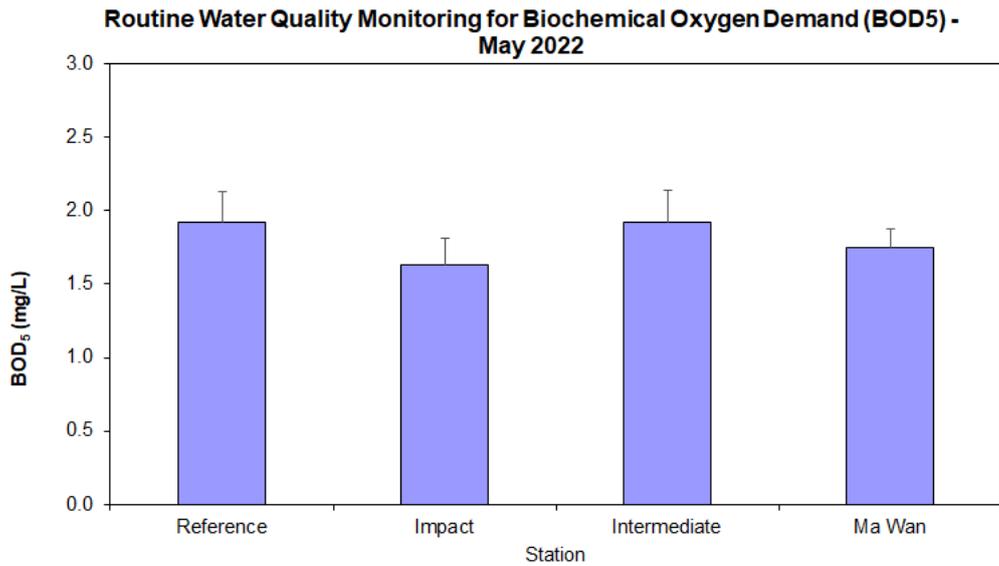


Figure 9: Level of Biochemical Oxygen Demand (BOD5) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2022

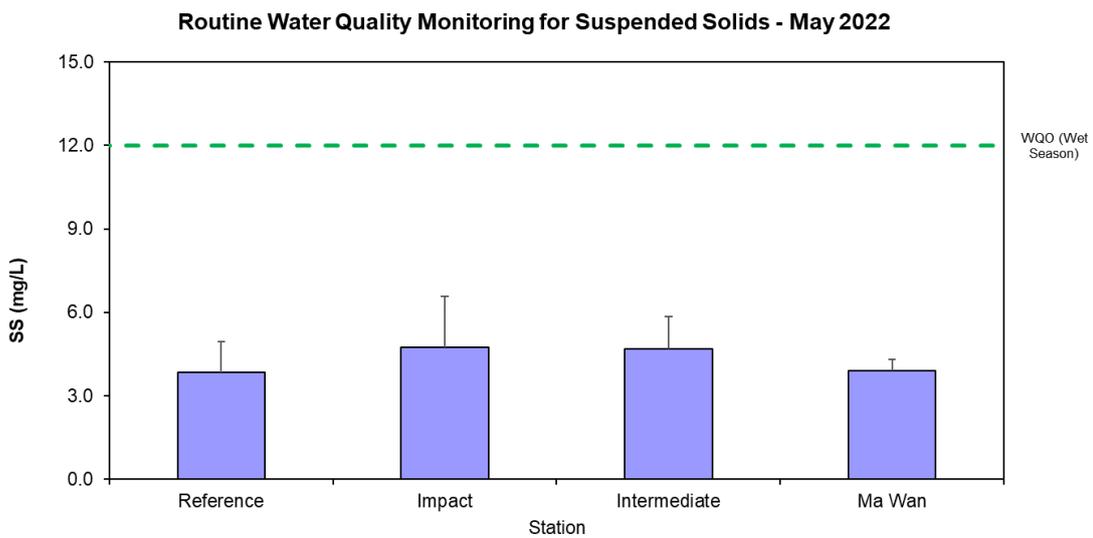


Figure 10: Concentration of Suspended Solids (SS) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in May 2022

**Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at ESC
 CMP Vb - May 2022**

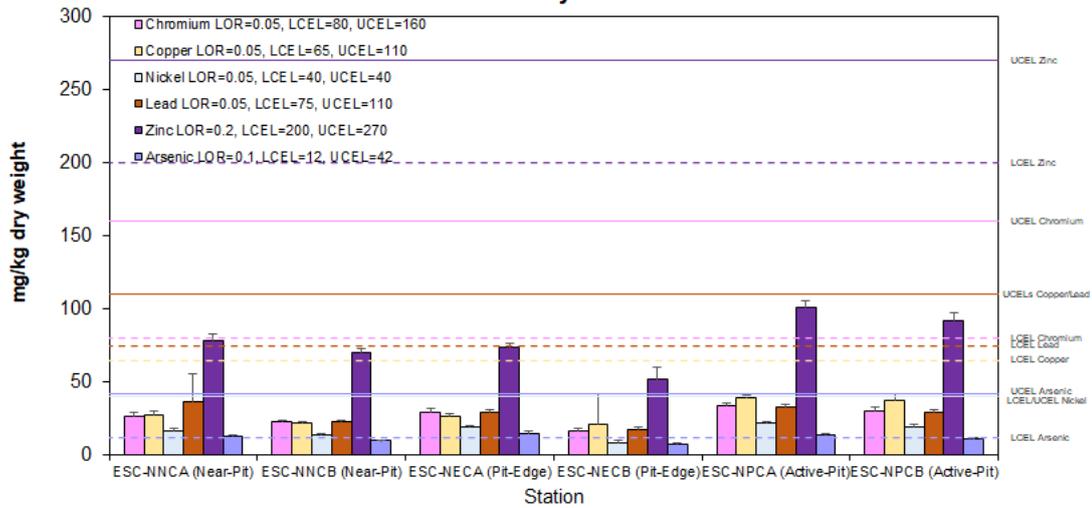


Figure 11: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in May 2022

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

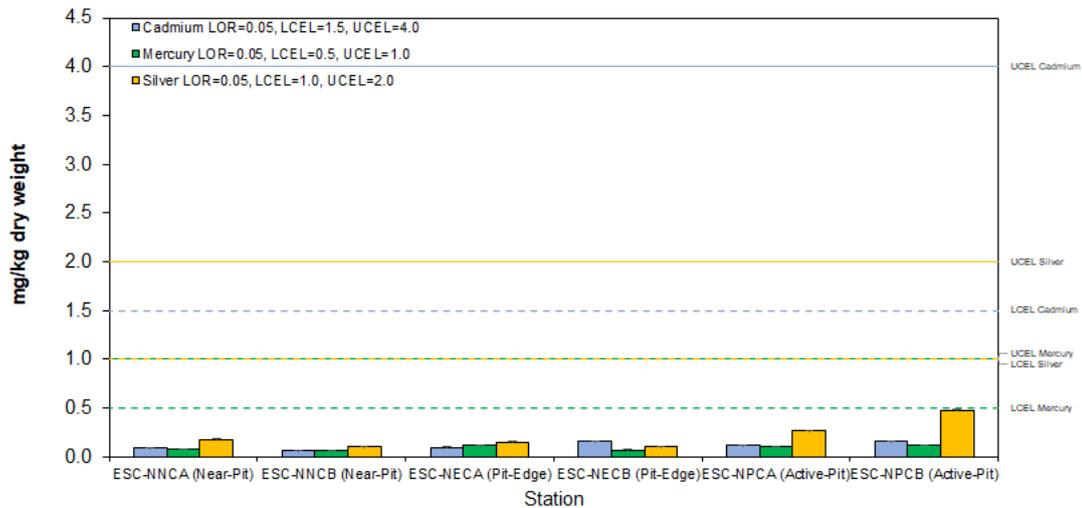


Figure 12: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in May 2022

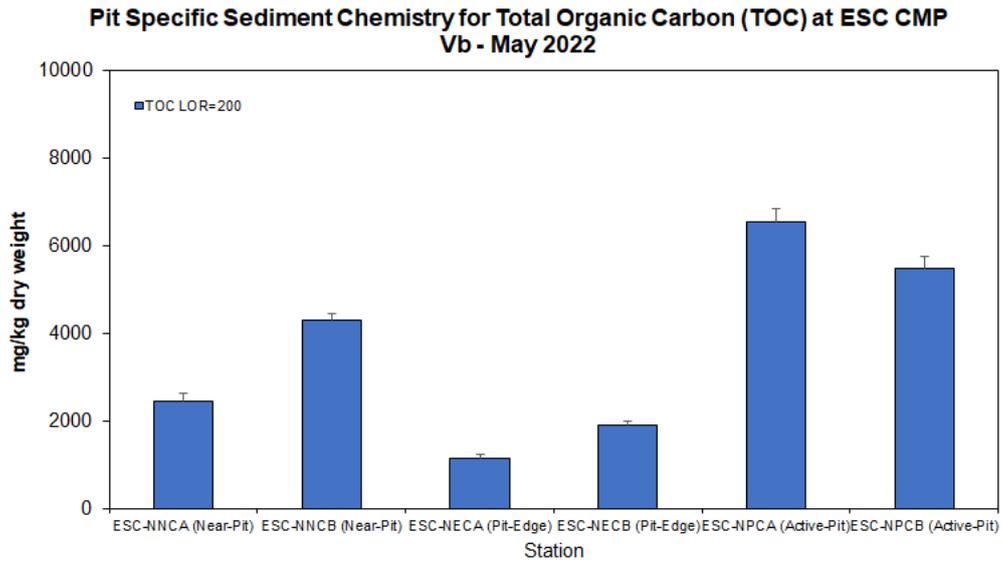


Figure 13: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vb in May 2022

Appendix D. Dredging Record

D1. Dredging Record at ESC CMP Vc

Date	Daily Dredging Volume (m ³)	Weekly Dredging Volume (m ³) (From Sunday to Saturday)
1 May 2022	650	7,800
2 May 2022	0	
3 May 2022	650	
4 May 2022	1,300	
5 May 2022	1,950	
6 May 2022	3,250	
7 May 2022	0	
8 May 2022	0	3,900
9 May 2022	0	
10 May 2022	0	
11 May 2022	0	
12 May 2022	0	
13 May 2022	650	
14 May 2022	3,250	22,100
15 May 2022	3,250	
16 May 2022	2,600	
17 May 2022	3,250	
18 May 2022	3,250	
19 May 2022	3,250	
20 May 2022	3,250	
21 May 2022	3,250	12,350
22 May 2022	3,250	
23 May 2022	1,950	
24 May 2022	2,600	
25 May 2022	1,300	
26 May 2022	1,300	
27 May 2022	650	
28 May 2022	1,300	16,250
29 May 2022	2,600	
30 May 2022	3,250	
31 May 2022	1,300	
1 Jun 2022	3,250	
2 Jun 2022	1,300	
3 Jun 2022	1,950	
4 Jun 2022	2,600	

Appendix E. Study Programme

