



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

Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – June 2019

Revision 0

July 2019

Environmental Resources Management

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Document Code: 0400720_Monthly June 2019_v0.doc

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Client:		Project No	D:		
Civil Eng	gineering and Development Department (CEDD)	0400720	0		
Summary:		Date:			
		10 July			
		Approved	by:		
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v0	Monthly EM&A Report for ESC CMPs	CY	RC	CAR	10/7/19
Revision	Description	Ву	Checked	Approved	Date
name of 'ER terms of the Business an	has been prepared by Environmental Resources Management the trading RM Hong-Kong, Limited', with all reasonable skill, care and diligence within the Contract with the client, incorporating our General Terms and Conditions of ad taking account of the resources devoted to it by agreement with the client.	Distributio	^{on} ernal		5 18001:2007 No. OHS 515956
We disclaim scope of the	any responsibility to the client and others in respect of any matters outside the above.	⊠ Puk	olic	6	BSI
nature to thi	s confidential to the client and we accept no responsibility of whatsoever rd parties to whom this report, or any part thereof, is made known. Any such on the report at their own risk.	☐ Cor	nfidential	ISO 9 Certificate	001 : 2008 2 No. FS 32515







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

Environmental Certification Sheet 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 - June 2019

Date of Report:

10 July 2019

Date prepared by ET:

10 July 2019

Date received by IA:

10 July 2019

Reference EP Condition

Environmental Permit Condition:

Condition 3.4 of EP-312/2008/A:

4 hard copies and 1 electronic copy of monthly EM&A Report shall be submitted to the Director within 2 weeks after the end of the reporting month. The EM&A Reports shall include a summary of all noncompliance (exceedances) of the environmental quality performance limits (Action and Limit Levels). The submissions shall be certified by the ET Leader and verified by the Independent Auditor. Additional copies of the submission shall be provided to the Director upon request by the Director.

ET Certification

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

Craig Reid,

Environmental Team Leader:

10/7/2019

IA Verification

I hereby verify that the above referenced document/plan complies with the above referenced condition of

Merry Wang

EP-312/2008/A

Dr Wang Wen Xiong, Independent Auditor: Date:

10/7/2019

CONTENTS

1.1	BACKGROUND	1
1.2	REPORTING PERIOD	2
1.3	DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES	2
1.4	DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS	2
1.5	BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMP V	2
1.6	ACTIVITIES SCHEDULED FOR THE NEXT MONTH	5
1.7	STUDY PROGRAMME	6
	ANNEXES	
	A A	

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

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

MONTHLY EM&A REPORT FOR JUNE 2019

1.1 BACKGROUND

- 1.1.1 The Civil Engineering and Development Department (CEDD) is managing a number of marine disposal facilities in Hong Kong waters, including the Contaminated Mud Pits (CMPs) to the South of The Brothers (SB) and to the East of Sha Chau (ESC) for the disposal of contaminated sediment, and opensea disposal grounds located to the South of Cheung Chau (SCC), East of Tung Lung Chau (ETLC) and East of Ninepins (ENP) for the disposal of uncontaminated sediment. Two Environmental Permits (EPs), EP-312/2008/A and EP-427/2011/A, were issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 and 23 December 2011 for the Dredging, Management and Capping of Contaminated Sediment Disposal Facilities at ESC CMP V and SB CMPs, respectively.
- 1.1.2 Under the requirements of the two EPs for ESC CMP V and SB CMPs, EM&A programmes which encompass water and sediment chemistry, fisheries assessment, tissue and whole body analysis, sediment toxicity and benthic recolonisation studies as set out in the EM&A Manuals are required to be implemented. EM&A programmes have been continuously carried out during the operation of the CMPs at ESC and SB. A review of the collection and analysis of such environmental data from the monitoring programme demonstrated that there had not been any adverse environmental impacts resulting from disposal activities (1) (2). The current programme will assess the impacts resulting from dredging, disposal and capping operations of CMP V as well as capping operations of SB CMPs.
- 1.1.3 The present EM&A programme under *Agreement No. CE 63/2016 (EP)* covers the dredging, disposal and capping operations of the ESC CMP V as well as the capping operations of the SB CMPs (see *Annex A* for the EM&A programme). The scheduled EM&A programme for SB CMPs was completed in December 2018. Detailed works schedule for ESC CMP V is shown in *Figure 1.1*. In June 2019, disposal of contaminated mud at ESC CMP Vd was undertaken.

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

⁽²⁾ ERM (2017) Final Report. Submitted under Agreement No. CE 23/2012 (EP) Environmental Monitoring and Audit for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012 - 2017). For CEDD.

Figure 1.1 Works Schedule for ESC CMP V

Pit	Onorotion				2017							2018									2019									2020							2	202	21	Ī													
PIL	Operation	Α	М	J	J	Α	١ (S	0	N	D	J	F	М	Α	М	J	J	A	١	S	o I	N	D	J	F	М	Α	М	J	J	Α	s	0	Ν	D	J	F	N	1 /	A N	vi .	J	J	Α	s	0	Z	D	J	F	: N	ı
	Dredging																																																			Ī	1
ESC CMP V	Disposal																		Г	Г																			Т		Τ												ı
	Capping																																																				

1.2 REPORTING PERIOD

- 1.2.1 This *Monthly EM&A Report for June 2019* covers the EM&A activities for the reporting month of June 2019.
- 1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES
- 1.3.1 The following monitoring activities were undertaken for ESC CMP V in June 2019:
 - Water Column Profiling of ESC CMP Vd;
 - Pit Specific Sediment Chemistry of ESC CMP Vd; and
 - Cumulative Impact Sediment Chemistry of ESC CMPs.
- 1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS
- 1.4.1 No outstanding sampling remained for June 2019.
- 1.5 Brief Discussion of the Monitoring Results for ESC CMP V
- 1.5.1 Brief discussion of the monitoring results of the following activities for ESC CMP V is presented in this *Monthly EM&A Report for June 2019*:
 - Water Column Profiling of ESC CMP Vd in June 2019;
 - Pit Specific Sediment Chemistry of ESC CMP Vd in June 2019; and
 - *Cumulative Impact Sediment Chemistry of ESC CMPs* in June 2019.

1.5.2 Water Column Profiling of ESC CMP Vd - June 2019

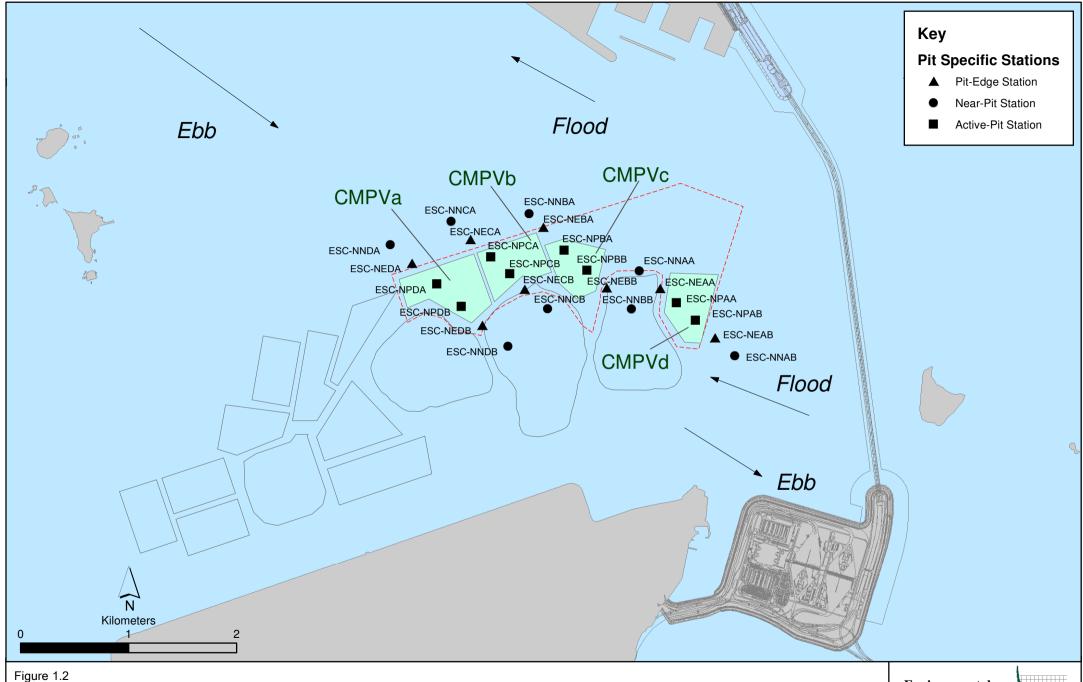
1.5.3 Water Column Profiling was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 5 June 2019. The monitoring results have been assessed for compliance with the Water Quality Objectives (WQOs) set by Environmental Protection Department (EPD). This consists of a review of the EPD routine water quality monitoring data for the wet season period (April to October) of 2008 - 2017 from stations in the Northwestern Water Control Zone (WCZ), where the ESC CMPs are located (1). For Salinity, the averaged value obtained from the Reference (Upstream) station was used for the basis as the WQO. Levels of Dissolved Oxygen (DO) and Turbidity were also assessed for compliance with the Action and Limit Levels (see Table B1 of Annex B for details).

In-situ Measurements

1.5.4 Analyses of results for June 2019 indicated that levels of Salinity, pH and DO complied with the WQOs at both Downstream and Upstream stations (*Table B2* of *Annex B*). Levels of DO and Turbidity at all stations complied with the Action and Limit Levels (*Tables B1* and *B2* of *Annex B*).

Laboratory Measurements for Suspended Solids (SS)

- 1.5.5 Analyses of results for June 2019 indicated that the SS levels at both Downstream and Upstream stations were higher than the WQO. However, the SS levels complied with the Action and Limit Levels at both Downstream and Upstream stations (*Tables B1* and *B2* of *Annex B*).
- 1.5.6 Overall, the monitoring results indicated that the mud disposal operation at ESC CMP Vd did not appear to cause any deterioration in water quality during this reporting period.
- 1.5.7 Pit Specific Sediment Chemistry of ESC CMP Vd June 2019
- 1.5.8 Monitoring locations for *Pit Specific Sediment Chemistry for ESC CMP Vd* are shown in *Figure 1.2*. A total of six (6) monitoring stations were sampled on 3 June 2019.
- 1.5.9 The concentrations of most inorganic contaminants were lower than the Lower Chemical Exceedance Levels (LCELs) at most stations, except concentrations of Arsenic were higher than the LCEL at Active Pit station ESC-NPAA and Pit-Edge station ESC-NEAB (*Figures 1 and 2* of *Annex 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 (2). It is presumed that the natural concentrations of Arsenic are similar in onshore and offshore sediments (3), 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 Vd but rather as a result of naturally occurring deposits.



Pit Specific Sediment Quality Monitoring Stations for CMPV



- 1.5.10 For organic contaminants, the concentrations of Total Organic Carbon (TOC) varied between stations in June 2019 and were higher at Active-Pit station ESC-NPAA (*Figure 3* of *Annex C*). The concentrations of Tributyltin (TBT) were also higher at Active-Pit station ESC-NPAA in June 2019 (*Figure 4* of *Annex C*). The concentrations of High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) were detected at Near-Pit station ESC-NNAB and Active-Pit stations ESC-NPAA and ESC-NPAB in June 2019 (*Figure 5* of *Annex C*). Low Molecular Weight PAHs, Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT) and 4,4'-dichlorodiphenyldichloroethylene (DDE) concentrations were below the limit of reporting at all stations.
- 1.5.11 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at ESC CMP Vd in June 2019. Statistical analysis will be undertaken and presented in the corresponding quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.

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

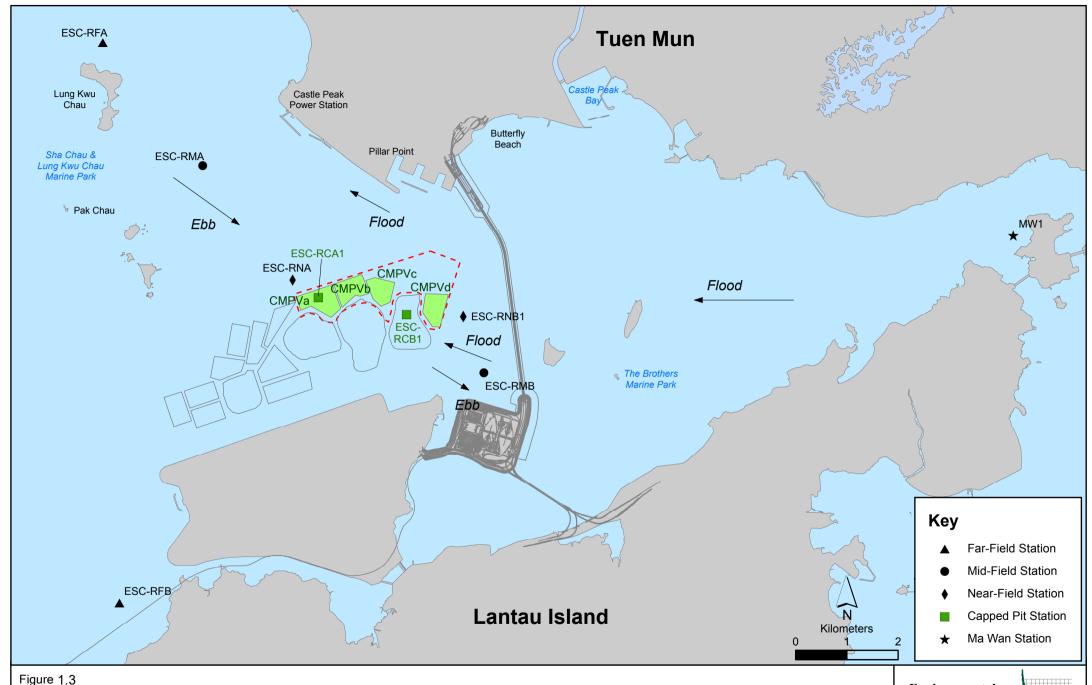
⁽²⁾ Sewell RJ (1999) Geochemical Atlas of Hong Kong. Geotechnical Engineering Office, Government of the Hong Kong Special Administrative Region

⁽³⁾ 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

- 1.5.12 Cumulative Impact Sediment Chemistry of ESC CMPs June 2019
- 1.5.13 Monitoring locations for *Cumulative Impact Sediment Chemistry for ESC CMPs* are shown in *Figure 1.3*. A total of nine (9) monitoring stations were sampled on 3 and 4 June 2019.
- 1.5.14 Analyses of results for the *Cumulative Impact Sediment Chemistry Monitoring* indicated that the concentrations of most inorganic contaminants were below the LCEL at most stations in June 2019, except concentrations of Arsenic were higher than the LCEL at Mid-field stations ESC-RMA and ESC-RMB, Far-field station ESC-RFB and Ma Wan station and concentrations of Copper were higher than the LCEL at Ma Wan station (*Figures 6* and 7 of *Annex C*). As discussed in *Section 1.5.9*, the LECL exceedances of Arsenic are unlikely to be caused by the disposal operations at ESC CMP Vd but rather as a result of naturally occurring deposits.
- 1.5.15 For organic contaminants, the concentrations of TOC varied between stations in June 2019, with the generally higher concentrations of TOC recorded at Mid-field station ESC-RMA (*Figure 8* of *Annex C*). The concentrations of TBT were generally similar against stations (*Figure 9* of *Annex C*). The concentrations of Low Molecular Weight PAHs were detected at Capped-Pit stations ESC-RCA and ESC-RCB and High Molecular Weight PAHs were detected at Capped-Pit stations ESC-RCA and ESC-RCB, Far-field station ESC-RFB and Ma Wan station (*Figure 10* of *Annex C*). Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT) and 4,4'-dichlorodiphenyldichloroethylene (DDE) concentrations were below the limit of reporting at all stations.
- 1.5.16 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at ESC CMP Vd in June 2019. Statistical analysis will be undertaken and presented in the corresponding quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.

1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

- 1.6.1 The following monitoring activities will be conducted in the next monthly period of July 2019 for ESC CMP V (see *Annex A* for the sampling schedule (1)):
 - Water Column Profiling of ESC CMP Vd;
 - Routine Water Quality Monitoring of ESC CMPs;
 - Pit Specific Sediment Chemistry of ESC CMP Vd; and
 - *Demersal Trawling for ESC CMPs.*
 - (1) The scheduled EM&A Programme for SB CMPs was completed in December 2018.



Cumulative Impacts Sediment Quality Monitoring Stations for ESC CMPs



1.7	STUDY PROGRAMME
1.7.1	A summary of the Study Programme is presented in <i>Annex D</i> .

Annex A

Sampling Schedule

Pit Specific Sediment Chemistry	Code	Frequency	A M	J J	2017 A S	0 N	N D	J F	M	A M	2018 J J	A S	0 N I) ј	F M A		19 J A S	0 1	N D	J F	МА		020 J A	s o	N D	J F
Active-Pit		Monthly			12 1		2 12										12 12 12			12 12 1						
Pit-Edge	ESC-NPAB ESC-NEAA	Monthly	12 12					12 12									12 12 12 12 12 12			12 12 1						
Near-Pit		Monthly							12 :	12 12	12 12	12 12	12 12 1	2 12 1	12 12 12	12 12	12 12 12	12 1	2 12	12 12 1	2 12	12 12	12 12	12 12	12 12	12 12
	ESC-NNAA ESC-NNAB	Monthly Monthly				2 12 1											12 12 12 12 12 12			12 12 1 12 12 1						
Cumulative Impact Sediment Che Jear-field Stations	mistry		A M	J J	A S	ON	N D	J F	M	A M	J J		0 N I) ј	F M A	M J	J A S	0 1	I D	J F	МА	M J	J A	S O	N D	J F
	ESC-RNA ESC-RNB1	4 times per year 4 times per year		12 12	12 12		12 12				12 12	12 12	1		12	12 12	12 12		12 12	12 12		12 12	12 12		12 12	12 12
Aid-field Stations	ESC-RMA ESC-RMB	4 times per year 4 times per year		12 12	12 12		12				12 12	12 12			12	12	12 12		12 12	12 12		12			12 12	12
Capped Pit Stations	ESC-RVID	4 times per year		12	12		12				12	12	1		12	12	12		12	12		12			12	12
Far-Field Stations	ESC-RCB1	4 times per year		12	12		12				12	12	1	2 1	12	12	12		12	12		12	12		12	12
W W G G	ESC-RFA ESC-RFB	4 times per year 4 times per year		12 12	12 12		12 12				12 12	12 12			12	12 12	12 12		12 12	12 12		12 12			12 12	12 12
Ma Wan Station	MW1	4 times per year		12	12		12	12	!		12	12	1	2 1	12	12	12		12	12		12	12		12	12
Sediment Toxicity Tests Near-Pit Stations			A M	J J	A 5	0 N	N D	J F	M	A M	J J	A S	O N I) ј	F M A	M J	J A S	0 1	N D	J F I	M A	M J	J A	S O	N D	J F
	ESC-TDA ESC-TDB1	2 times per year 2 times per year			5			5 5				5			5		5 5			5			5			5 5
Reference Stations	ESC-TRA	2 times per year			5			5				5			5		5			5			5			5
Ma Wan Station	ESC-TRB MW1	2 times per year 2 times per year			5			5				5			5		5			5			5			5
Fissue/ Whole Body Sampling		2 amos por your	A M	JJ	A S	6 O N	N D	J F	M	A M	J J		O N I		F M A	M J	J A S	0 1	N D		МА	M J	J A		N D	
Near-Pit Stations	ESC-INA ESC-INB	2 times per year			*			*				*			*		*			*			*			*
Reference North	TNA	2 times per year 2 times per year			*			*				*			*		*			*			*			*
Reference South	TNB	2 times per year			*	H	ŀ	*		1		*			*		*			*	Ŧ		*		\pm	*
	TSA TSB	2 times per year 2 times per year			*			*				*		$oxed{\bot}$	*		*			*			*			*
Demersal Trawling Near Pit Stations			A M	JJ	A S	0 N	N D	J F	M	A M	JJ	A S	O N I) J	F M A	M J	J A S	0 1	I D	J F I	МА	M J	J A	S O	N D	J F
von 1 n Statiofis	ESC-INA ESC-INB	4 times per year 4 times per year	Ħ		5			5 5 5 5			5				5		5 5 5			5 5 5 5	+		5 5		+	5 5 5 5
Reference North	TNA	4 times per year	Œ	5	5		L	5 5			5	5	H	5	5		5 5			5 5			5 5			5 5
Reference South	TNB	4 times per year			5	H	1	5 5		╁	5		H	5	5		5 5 5		Ħ	5 5	Ŧ		5 5			5 5
	TSA TSB	4 times per year 4 times per year			5			5 5	_		5				5		5 5			5 5			5 5			5 5
Capping Ebb Tide			A M	J J	A S	ON	N D	J F	M	A M	J J	A S	0 N I	J	F M A	M J	J A S	O	N D	J F I	M A	M J	J A	S O	N D	J F
mpact Station Downcurrent		4 times per year															3		3	3		3	3	-	3	3
	ESC-IPE3	4 times per year 4 times per year	H				F					H					3 3 3		3 3	3 3	F	3 3			3 3	3 3
ntermediate Station Downcurrent	ESC-IPE5	4 times per year 4 times per year	H							+		+			+		3		3	3	+	3	3		3	3
		4 times per year 4 times per year							Н			H					3 3		3	3		3	3		3	3
	ESC-INE4A	4 times per year 4 times per year															3		3	3		3	3		3	3
Reference Station Upcurrent	ESC-INE5A ESC-RFE1	4 times per year 4 times per year															3		3	3		3	3		3	3
	ESC-RFE2 ESC-RFE3	4 times per year 4 times per year															3		3	3		3	3		3	3
	ESC-RFE4 ESC-RFE5	4 times per year 4 times per year															3 3		3	3		3	3		3	3
Ma Wan Station Flood Tide	MW1	4 times per year							Ш			Ш					3		3	3		3	3		3	3
Impact Station Downcurrent	ESC-IPF1	4 times per year															3		3	3		3	3		3	3
	ESC-IPF2 ESC-IPF3	4 times per year 4 times per year															3 3		3	3		3	3		3	3
Intermediate Station Downcurrent	ESC-INF1	4 times per year															3		3	3		3	3		3	3
Reference Station Upcurrent	ESC-INF2 ESC-INF3	4 times per year 4 times per year															3		3	3		3	3		3	3
	ESC-RFF1A ESC-RFF2A	4 times per year 4 times per year															3 3		3	3		3	3		3	3
Ma Wan Station	ESC-RFF3	4 times per year															3		3	3		3	3		3	3
Routine Water Quality Monitoring	MW1	4 times per year	A M	JJ	Α 6		y D	I I E	М	Λ M	1 1	A 6	0 N I	Т	F M A	мі	3 J A S	0 1	3 J D	3 I E 7	м А	3 M I	3 I A	s o	3 N D	3 J F
Ebb Tide Impact Station Downcurrent	3		A M	, ,	A	, U P	N D	J F	IVI	A M))	A 5	UNI	, ,	r M A	M J	J A S	U	и	J F I	VI A	M	JA	5 0	N D	J F
•	ESC-IPE1A ESC-IPE2A	8 times per year 8 times per year	8 8	8	8	8 8	3	8 8 8 8		8 8	8 8	8	8 8	8	8 8 8 8	8	8 8		3	8 8 8 8	8	8	8 8	8	8	8 8 8 8
	ESC-IPE3 ESC-IPE4	8 times per year 8 times per year	8 8	8	8	8 8	3	8 8		8 8	8	8	8 8	8	8 8	8	8 8	8 8	3	8 8	8	8	8 8	8	8	8 8
Intermediate Station Downcurrent	ESC-IPE5 ESC-INE1A	8 times per year 8 times per year	8 8	8	8	8 8	3	8 8		8 8	8		8 8	8	8 8		8 8	8 8	3	8 8	8		8 8	8	8	8 8
	ESC-INE2A ESC-INE3A	8 times per year 8 times per year	8 8 8 8	8	8	8 8	3	8 8 8 8		8 8	8 8	8	8 8	8	8 8 8 8	8	8 8	8 8	3	8 8 8 8	8	8	8 8	8	8	8 8 8 8
Defense Co. C.	ESC-INE4A ESC-INE5A	8 times per year 8 times per year	8 8 8 8	8		8 8	3	8 8		8 8	8	8	8 8 8	8	8 8 8 8	8	8 8 8	8 8		8 8	8	8	8 8	8	8	8 8 8 8
Reference Station Upcurrent	ESC-RFE1 ESC-RFE2	8 times per year 8 times per year	8 8	8	8		3	8 8		8 8	8		8 8		8 8		8 8	8 8		8 8	8		8 8		8	8 8
	ESC-RFE3 ESC-RFE4	8 times per year 8 times per year	8 8	8	8	8 8	3	8 8 8 8		8 8 8 8	8 8	8	8 8	8	8 8 8 8	8	8 8	8 8	3	8 8	8	8	8 8 8 8	8	8	8 8 8 8
Ma Wan Station	ESC-RFE5	8 times per year	8 8	8	8		3	8 8		8 8	8	8	8 8		8 8	8	8 8	8 8	3	8 8	8		8 8	8	8	8 8
Flood Tide Impact Station Downcurrent	MW1	8 times per year	8 8	8	8	8 8	3	8 8		8 8	8	8	8 8	8	8 8	8	8 8	8 8	5	8 8	8	8	8 8	8	8	8 8
pact of auton DownCurrent	ESC-IPF1 ESC-IPF2	8 times per year 8 times per year	8 8	8		8 8	3	H	_	8 8 8 8	8	8	8 8	8	8 8	8	8 8	8 8	3	8 8	8	8	8 8	8	8	8 8 8 8
ntermediate Station Downcurrent	ESC-IPF3	8 times per year	8 8	8	8	8 8	3			8 8	8	8	8 8	8	8 8	8	8 8	8 8	3	8 8	8	8	8 8	8	8	8 8
	ESC-INF1 ESC-INF2	8 times per year 8 times per year	8 8	8		8 8	3			8 8	8	8	8 8	8	8 8	8	8 8 8	8 8	3	8 8	8	8	8 8	8	8	8 8
Reference Station Upcurrent	ESC-INF3	8 times per year	8 8	8			3	H		8 8	8		8 8		8 8		8 8		3	8 8	8		8 8		8	8 8
serereite sunton opeument	ESC-RFF1A	8 times per year 8 times per year	8 8 8 8 8 8	8 8		8 8	3			8 8 8 8 8 8	8 8	8	8 8 8 8 8 8	8	8 8 8 8 8 8	8	8 8 8 8 8 8	8 8 8	3	8 8 8 8 8 8	8 8	8	8 8 8 8 8 8	8	8 8	8 8 8 8 8 8
cereme sumon openion	ESC-RFF2A ESC-RFF3	8 times per year	- 0		8		3			8 8	8		8 8		8 8		8 8	8 8		8 8	8		8 8		8	8 8
	ESC-RFF2A		8 8	8				I E	M	A M			0 N I	рЈ	F M A	M J	J A S			J F I			J A	S O		J F
Aa Wan Station Vater Column Profiling	ESC-RFF2A ESC-RFF3 MW1	8 times per year 8 times per year	A M	J J							. 4 1 4	4 4					4 4 4				4 4	14 4		1 4 1 4	, 1	
Aa Wan Station	ESC-RFF2A ESC-RFF3	8 times per year	A M 4 4	J J 4 4	4 4	6 O N 4 4 4 4	1 4	4 4					1 - 1 - 1					4 4	1	4 4	4 4			4 4		
Aa Wan Station Vater Column Profiling Plume Stations Fenthic Recolonisation Studies	ESC-RFF2A ESC-RFF3 MW1	8 times per year 8 times per year Monthly	A M 4 4 4 4	J J 4 4 4 4	4 4	4 4	1 4 1 4	4 4	4	4 4	4 4	4 4) ј	F M A		J A S					4 4	4 4	4 4	4 4	4 4
Ma Wan Station Water Column Profiling Plume Stations	ESC-RFF2A ESC-RFF3 MW1 WCP1 WCP2	8 times per year 8 times per year Monthly	A M 4 4 4 4	J J 4 4 4 4	4 4	4 4	1 4 1 4	4 4	4	4 4	4 4	4 4) J	F M A							4 4	4 4	4 4	4 4	4 4
Ma Wan Station Water Column Profiling Plume Stations Benthic Recolonisation Studies Capped Stations at CMPV	ESC-RFF2A ESC-RFF3 MW1 WCP1 WCP2 ESCV-CPA ESCV-CPB ESCV-CPC	8 times per year 8 times per year Monthly Monthly 2 times per year	A M 4 4 4 4	J J 4 4 4 4	4 4	4 4	1 4 1 4	4 4	4	4 4	4 4	4 4		D J	F M A							4 4	4 4	4 4	4 4	4 4
Ma Wan Station Water Column Profiling Plume Stations Benthic Recolonisation Studies Capped Stations at CMPV	ESC-RFF2A ESC-RFF3 MW1 WCP1 WCP2 ESCV-CPA ESCV-CPB ESCV-CPC ESCV-CPD RBA	8 times per year 8 times per year Monthly Monthly 2 times per year	A M 4 4 4 4	J J 4 4 4 4	4 4	4 4	1 4 1 4	4 4	4	4 4	4 4	4 4		D J	F M A							4 4	4 4	4 4	4 4	4 4
Ma Wan Station Water Column Profiling Plume Stations Benthic Recolonisation Studies Capped Stations at CMPV	ESC-RFF2A ESC-RFF3 MW1 WCP1 WCP2 ESCV-CPA ESCV-CPB ESCV-CPC ESCV-CPD	8 times per year 8 times per year Monthly Monthly 2 times per year 2 times per year 2 times per year	A M 4 4 4 4	J J 4 4 4 4	4 4	4 4	1 4 1 4	4 4	4	4 4	4 4	4 4		D J	F M A							4 4	4 4	4 4	4 4	4 4
Ma Wan Station Water Column Profiling Plume Stations Benthic Recolonisation Studies Capped Stations at CMPV Reference Stations	ESC-RFF2A ESC-RFF3 MW1 WCP1 WCP2 ESCV-CPA ESCV-CPB ESCV-CPD RBA RBB	8 times per year 8 times per year Monthly Monthly 2 times per year	A M 4 4 4 4	J J 4 4 4 4 4 J J J	4 4 4 4 4 A S	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1 4 1 4 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4 4 4 4 T	4 M	4 4 A M	J J	A S	O N I			M J		0 1	N D	J F 1	M A	M J	J A	S O	4 4 N D	J F
Ma Wan Station Water Column Profiling Plume Stations Benthic Recolonisation Studies Capped Stations at CMPV Reference Stations	ESC-RFF2A ESC-RFF3 MW1 WCP1 WCP2 ESCV-CPA ESCV-CPB ESCV-CPD RBA RBB	8 times per year 8 times per year Monthly Monthly 2 times per year	A M 4 4 4 4 4 4	J J 4 4 4 4 4 4 J J J J	4 4 4 4 4 A S	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1 4 1 4 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4 4 4 4 T	4 M	4 4 A M	J J	A S	O N I			M J	J A S	0 1	N D	J F 1	M A	M J	J A	S O	4 4 N D	J F
Ma Wan Station Water Column Profiling Plume Stations Senthic Recolonisation Studies Capped Stations at CMPV Reference Stations	ESC-RFPA ESC-RFF3 MW1 WCP1 WCP2 ESCV-CPA ESCV-CPB ESCV-CPD RBA RBB RBC1 US1 US2 DS1	8 times per year 8 times per year Monthly Monthly 2 times per year 3 times per year	A M 4 4 4 4 4 4	J J J J J J J 2 2 2 2 2 2 2	A S A S A S 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	4 4 4 4 4 6 O N	1 4 1 4 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4 4 4 4 T	4 M	4 4 A M	J J	A S	O N I			M J	J A S	0 1	N D	J F 1	M A	M J	J A	S O	4 4 N D	J F
Vater Column Profiling Plume Stations Senthic Recolonisation Studies Capped Stations at CMPV Reference Stations Impact Monitoring for Dredging Jpstream Stations	ESC-RFPA ESC-RFF3 MWI WCPI WCP2 ESCV-CPA ESCV-CPB ESCV-CPD ESCV-CPD US1 US1 US2 US1 US2 US1 US2 US1 US2 US3	8 times per year 8 times per year 8 times per year 2 times per year 3 times per year 3 times per year 3 times per week	A M 4 4 4 4 4 4	J J J J J J J J J Z 2 2 2 2 2 2 2 2 2	A S A S 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	4 4 4 4 4 6 O N	1 4 1 4 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4 4 4 4 T	4 M	4 4 A M	J J	A S	O N I			M J	J A S	0 1	N D	J F 1	M A	M J	J A	S O	4 4 N D	J F
Water Column Profiling Plume Stations Senthic Recolonisation Studies Capped Stations at CMPV Reference Stations mpact Monitoring for Dredging pstream Stations Downstream Stations	ESC-RFFA ESC-RFF3 MW1 WCP1 WCP2 ESCV-CPA ESCV-CPA ESCV-CPC ESCV-CPD RBA RBB RBC1 US1 US2 DS1 DS2	8 times per year 8 times per year 8 times per year 2 times per year 3 times per year 3 times per week 3 times per week 3 times per week	A M 4 4 4 4 4 4	J J J J J J J J J Z 2 2 2 2 2 2 2 2 2	A S 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	4 4 4 4 4 6 O N	1 4 1 4 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4 4 4 4 T	4 M	4 4 A M	J J	A S	O N I			M J	J A S	0 1	N D	J F 1	M A	M J	J A	S O	4 4 N D	J F
fa Wan Station Vater Column Profiling lume Stations enthic Recolonisation Studies apped Stations at CMPV eference Stations mpact Monitoring for Dredging pstream Stations	ESC-RFPA ESC-RFF3 MW1 WCP1 WCP2 ESCV-CPA ESCV-CPB ESCV-CPD ESCV-CPD US1 US2 US1 US2 DS1 DS2 DS3 DS4	8 times per year 8 times per year 8 times per year 2 times per year 3 times per year 3 times per year 3 times per week 3 times per week	A M 4 4 4 4 4 4	J J 4 4 4 4 4 4 J J J J J J J J J J J J	A 5 A 5 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1 4 1 4 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4 4 4 4 T	4 M	4 4 A M	J J	A S	O N I			M J	J A S	0 1	N D	J F 1	M A	M J	J A	S O	4 4 N D	J F

Annex B

Water Quality Monitoring Results

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

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) (1)	Surface and Mid-depth (2)	Surface and Mid-depth (2)
	5%-ile of baseline data for surface and	1%-ile of baseline data for surface and
	middle layer = 3.76 mg L-1	middle layer = 3.11 mg L- 1 (3)
	and	and
	Significantly less than the reference	Significantly less than the reference
	stations mean DO (at the same tide of	stations mean DO (at the same tide of
	the same day)	the same day)
	Bottom	Bottom
	5%-ile of baseline data for bottom	The average of the impact station
	layers = 2.96 mg L-1	readings are <2 mg/L-1
	and	and
	Significantly less than the reference	Significantly less than the reference
	stations mean DO (at the same tide of	stations mean DO (at the same tide of
	the same day)	the same day)
Depth-averaged Suspended	95%-ile of baseline data for depth	99%-ile of baseline data for depth
Solids (SS) (4) (5)	average = 37.88 mg L-1	average = 61.92 mg L-1
	and	
		and
	120% of control station's SS at the same	130% of control station's SS at the same
	tide of the same day	tide of the same day
Depth-averaged Turbidity (Tby) (4) (5)	95%-ile of baseline data = 28.14 NTU	99%-ile of baseline data = 38.32 NTU
	and	and
	120% of control station's Tby at the	130% of control station's Tby at the
	same tide of the same day	same tide of the same day

Notes:

- (1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- (2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.
- (3) Given the Action Level for DO for Surface & Middle layers has already been lower than 4 mg L⁻¹, it is proposed to set the Limit Level at 3.11 mg L⁻¹ which is the first percentile of the baseline data.
- (4) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
- (5) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

Table B2 Water Column Profiling Results for ESC CMP Vd in June 2019

Stations	Temp	Salinity	Turbidity	Dissolved	l Oxygen	рН	Suspended Solids
	(°C)	(ppt)	(NTU)	(%)	(mg L-1)		(mg L-1)
WCP 1	27.17	19.10	10.44	78.63	5.61	7.85	11.15
(Downstream) WCP 2 (Upstream)	27.21	19.70	20.69	80.99	5.76	7.88	14.13
WQO (Wet Season)	N/A	17.73- 21.67#	N/A	N/A	>4	6.5-8.5	10.8

Note:

 $^{^{*}}$ Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station. Cell shaded yellow / red indicate value exceeding the Action/Limit levels.

Annex C

Graphical Presentations

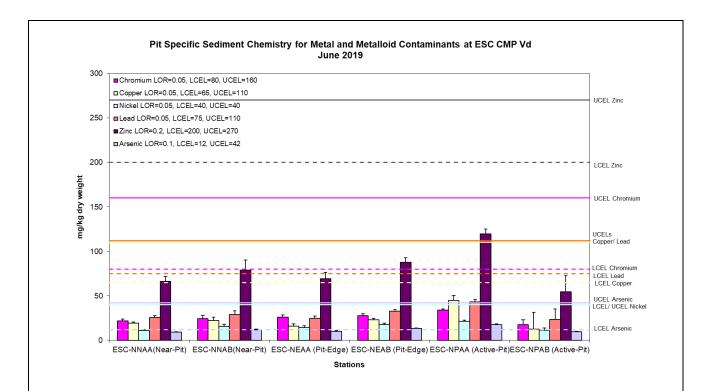


Figure 1: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in June 2019.

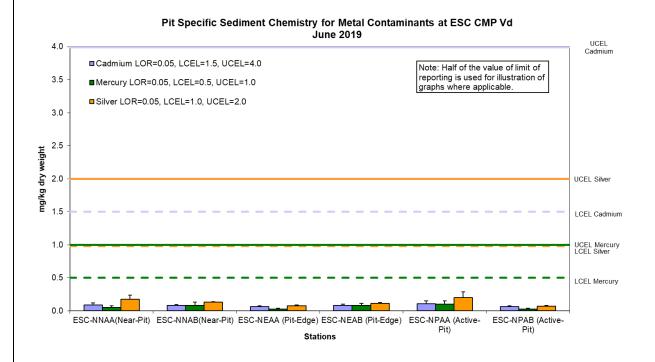


Figure 2: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in June 2019.

Date: July 2019



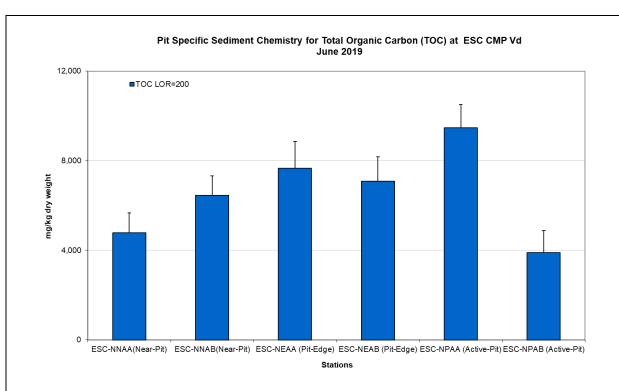


Figure 3: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in June 2019.

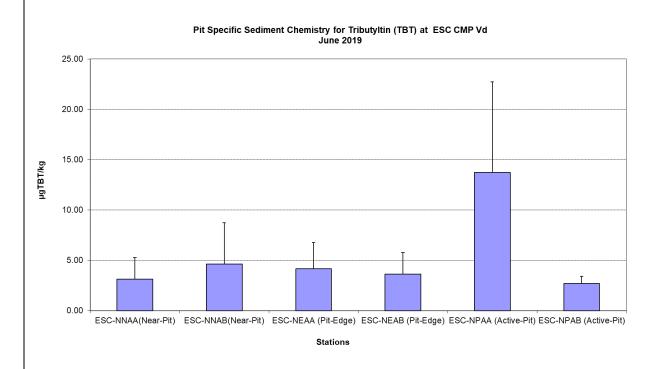


Figure 4: Concentration of Tributyltin (TBT) (μg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in June 2019.

Date: July 2019



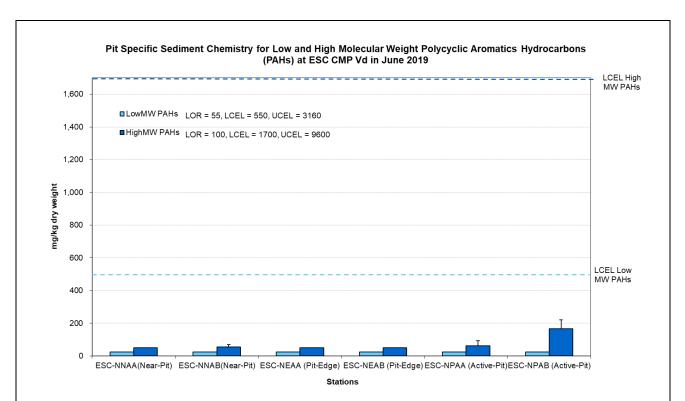


Figure 5: Concentration of Low and High Molecular Weight Polycyclic Aromatics (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in June 2019.

Date: July 2019



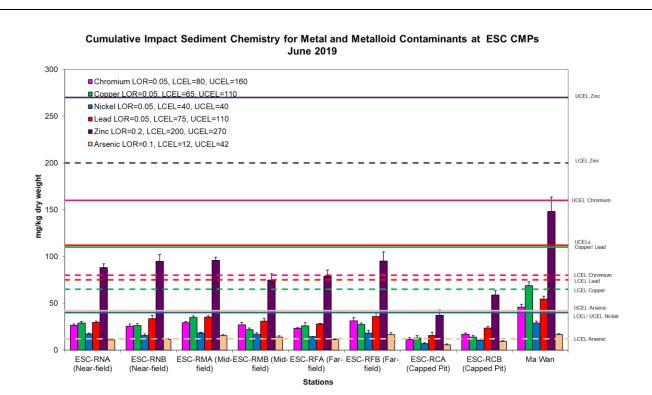


Figure 6: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in June 2019.

Cumulative Impact Sediment Chemistry for Metal Contaminants at ESC CMPs June 2019

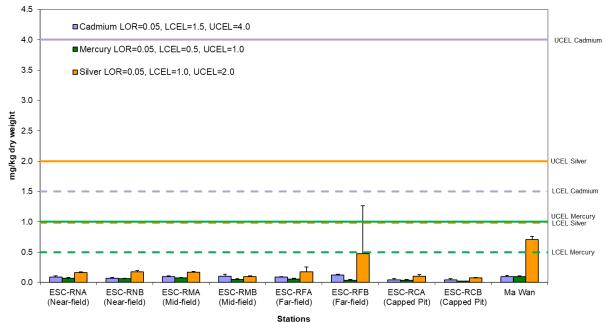


Figure 7: Concentration of Metals (Cd, Hg, Ag; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in June 2019.

Source: P:\Projects\0400720 CEDD CMP EM&A 2017-2020\02 Deliverable\05 CMP Monthly Report\27 Monthly June 2019

Date: July 2019



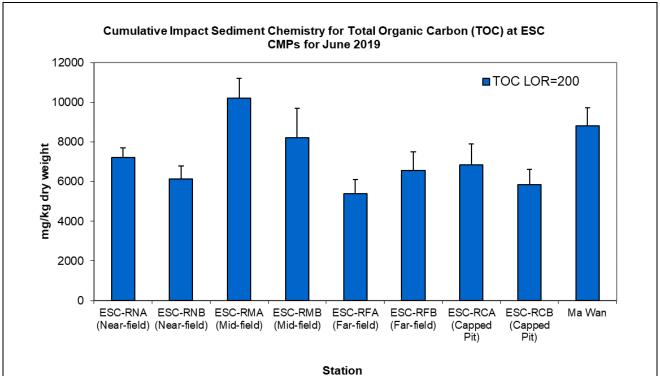


Figure 8: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in June 2019.

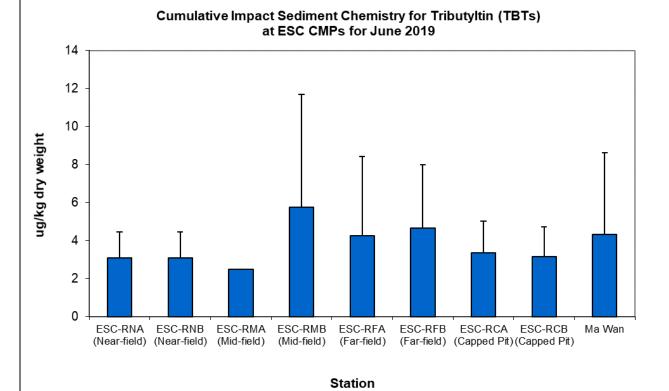


Figure 9: Concentration of Tributyltin (µg TBT/kg; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in June 2019.

Date: July 2019



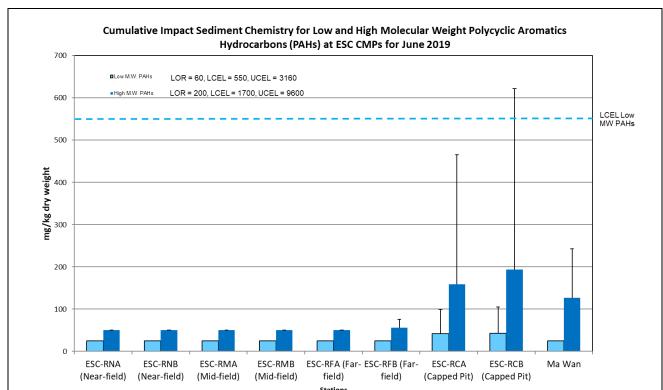


Figure 10: Concentration of Low and High Molecular Weight Polycyclic Aromatics (mg/kg dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in June 2019.

Date: July 2019



Annex D

Study Programme

