

**Environmental Monitoring and Audit
for Contaminated Mud Pits to the
South of The Brothers and at East
Sha Chau (2012-2017) – Investigation
Agreement No. CE 23/2012(EP)**

**55th Monthly Progress Report for Contaminated
Mud Pits to the South of The Brothers and at
East Sha Chau – March 2017**

Final (Revision 1)

May 2017

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Summary: This document presents the 55 th monthly progress report for Contaminated Mud Pits at the South of The Brothers and at East Sha Chau.		Date: 16 May 2017			
		Approved by: 			
		Craig A. Reid Partner			
v1	55 th Monthly Progress Report for ESC CMPs and SB CMPs	RC	JT	CAR	16/05/17
v0	55 th Monthly Progress Report for ESC CMPs and SB CMPs	RC	JT	CAR	18/04/17
Revision	Description	By	Checked	Approved	Date
<p>This report has been prepared by Environmental Resources Management the trading name of 'ERM Hong-Kong, Limited', with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.</p> <p>We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.</p> <p>This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.</p>		<p>Distribution</p> <p><input type="checkbox"/> Internal</p> <p><input checked="" type="checkbox"/> Public</p> <p><input type="checkbox"/> Confidential</p>			
		 			

**Dredging, Management and Capping of Contaminated Sediment Disposal
Facility at Sha Chau and to the South of The Brothers**

**Environmental Certification Sheet
EP-312/2008/A & EP-427/2011/A**


Reference Document/Plan

Document/ Plan to be Certified/ Verified:	55 th Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau - March 2017
Date of Report:	18 April 2017
Date prepared by ET:	18 April 2017
Date received by IA:	18 April 2017


Reference EP Condition

Environmental Permit Condition: Condition 3.4 of EP-312/2008/A and Condition 4.4 of EP-427/2011/A: 4 hard copies and 1 electronic copy of monthly EM&A Report shall be submitted to the Director within 2 weeks after the end of the reporting month. The EM&A Reports shall include a summary of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit Levels). The submissions shall be certified by the ET Leader and verified by the Independent Auditor. Additional copies of the submission shall be provided to the Director upon request by the Director.
--

ET Certification

I hereby certify that the above referenced document/ plan complies with the above referenced condition of EP-312/2008/A and EP-427/2011/A	
Craig A. Reid, Environmental Team Leader:	 Date: 18/4/2017

IA Verification

I hereby verify that the above referenced document/ plan complies with the above referenced condition of EP-312/2008/A and EP-427/2011/A	
Dr Wang Wen Xiong, Independent Auditor:	 Date: 18/4/2017

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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) - Investigation

55TH MONTHLY PROGRESS REPORT FOR MARCH 2017

1.1 BACKGROUND

1.1.1 Since early 1990s, contaminated sediment ⁽¹⁾ arising from various construction works (e.g. dredging and reclamation projects) in Hong Kong has been disposed of at a series of seabed pits at East of Sha Chau (ESC). In late 2008, a review indicated that the existing and planned facilities at ESC would not be able to meet the disposal demand after 2012. In order to meet this demand, the Hong Kong Special Administrative Region Government (HKSARG) decided to implement a new contained aquatic disposal (CAD) ⁽²⁾ facility at the South of The Brothers (SB CMPs) which had been under consideration for a number of years.

1.1.2 The environmental acceptability of the construction and operation of the Project had been confirmed by findings of the associated Environmental Impact Assessment (EIA) study completed in 2005 under *Agreement No. CE 12/2002(EP)* ⁽³⁾. The Director of Environmental Protection (DEP) approved this EIA report under the *Environmental Impact Assessment Ordinance (Cap. 499) (EIAO)* in September 2005 (*EIA Register No.: AEIAR-089/2005*).

1.1.3 In accordance with the EIA recommendation, prior to commencement of construction works for the SB CMPs, the Civil Engineering and Development Department (CEDD) undertook a detailed review and update of the EIA findings for the SB site ⁽⁴⁾. Findings of the EIA review undertaken in 2009/2010 confirmed that the construction and operation of the SB site had been predicted to be environmentally acceptable.

(1) According to the Management Framework of Dredged/ Excavated Sediment of ETWB TC(W) No. 34/2002, contaminated sediment in general shall mean those sediment requiring Type 2 – Confined Marine Disposal as determined according to this TC(W).

(2) CAD options may involve use of excavated borrow pits, or may involve purpose-built excavated pits. CAD sites are those which involve filling a seabed pit with contaminated mud and capping it with uncontaminated material such that the original seabed level is restored and the contaminated material is isolated from the surrounding marine environment.⁷

(3) Detailed Site Selection Study for a Proposed Contaminated Mud Disposal Facility within the Airport East/ East of Sha Chau Area (*Agreement No. CE 12/2002(EP)*)

(4) Under the CEDD study *Contaminated Sediment Disposal Facility to the South of The Brothers (Agreement No. FM 2/2009)*

1.1.4 *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 for ESC CMP V and on 23 December 2011 for SB CMPs, respectively. Under the requirements of the EPs, an Environmental Monitoring and Audit (EM&A) programme as set out in the EM&A Manuals ^{(1) (2)} is required to be implemented for the CMPs.*

1.1.5 The present EM&A programme under *Agreement No. CE 23/2012 (EP)* covers the dredging, disposal and capping operations of the SB CMPs as well as ESC CMPs. Detailed works schedule for ESC CMPs and SB CMPs is shown in *Figure 1.1*. In March 2017, the following works were being undertaken:

- Disposal of contaminated mud at ESC CMP Vd.

Figure 1.1 Works Schedule for ESC CMPs and SB CMPs

Pit	Operation	2012			2013					2014					2015					2016					2017						
		S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
ESC CMP	Dredging																														
	Backfilling																														
	Capping																														
SB CMP 1	Dredging																														
	Backfilling																														
	Capping																														
SB CMP 2	Dredging																														
	Backfilling																														
	Capping																														

1.2 REPORTING PERIOD

1.2.1 This 55th Monthly Progress Report covers the EM&A activities for the reporting month of March 2017.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

1.3.1 The following monitoring activities have been undertaken for ESC CMPs in March 2017:

- *Water Column Profiling of ESC CMP Vd* was undertaken on 16 March 2017; and
- *Pit Specific Sediment Chemistry of ESC CMP Vd* was undertaken on 17 March 2017.

(1) ERM (2012) Environmental Monitoring and Audit (EM&A) Manual. Final First Review. Environmental Monitoring and Audit for Contaminated Mud Pits to the South of the Brothers and at East Sha Chau (2012-2017) - Investigation. Agreement No. CE 23/2012(EP). Submitted to EPD in November 2012.

(2) ERM (2010) Environmental Monitoring and Audit (EM&A) Manual. Final Second Review. Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2009-2013) - Investigation. Agreement No. CE 4/2009(EP). Submitted to EPD in November 2010.

1.3.2 No monitoring activities were scheduled to be undertaken for SB CMPs in March 2017.

1.4 *DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS*

1.4.1 No outstanding sampling and analysis remained for March 2017.

1.5 *BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMPs*

1.5.1 Brief discussion of the monitoring results of the following activities for ESC CMPs is presented in this 55th *Monthly Progress Report*:

- *Water Column Profiling of ESC CMP Vd* in March 2017;
- *Pit Specific Sediment Chemistry of ESC CMP Vd* in January, February and March 2017; and
- *Cumulative Impact Sediment Chemistry of ESC CMPs* in February 2017.

1.5.2 *Water Column Profiling of ESC CMP Vd - March 2017*

1.5.3 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 16 March 2017. The monitoring results have been assessed for compliance with the Water Quality Objectives (WQOs) set by Environmental Protection Department (EPD). This consists of a review of the EPD routine water quality monitoring data for the dry season period (November to March) of 2006 - 2015 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 March 2017 indicated that levels of DO and pH complied with the WQOs at both Downstream and Upstream stations (*Table B2 of Annex B*). In addition, 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⁾ <http://epic.epd.gov.hk/EPICRIVER/marine/?lang=en>

- 1.5.5 Analyses of results for March 2017 indicated that the SS levels complied with the WQO and the Action and Limit Levels at Downstream station (*Tables B1 and B2 of Annex B*). SS levels at Upstream station were higher than the WQO, however the SS levels at Upstream station complied with the Action and Limit Levels.
- 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 - January, February and March 2017***
- 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 in January, February and March 2017.
- 1.5.9 The concentrations of all inorganic contaminants were lower than the Lower Chemical Exceedance Level (LCEL) at all stations in January, February and March 2017 (*Figures 1, 2, 5, 6, 8 and 9 of Annex C*).
- 1.5.10 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were similar amongst the stations in January, February and March 2017 (*Figures 3, 7 and 10 of Annex C*). The concentrations of tributyltin (TBT) were similar amongst the stations in January and March 2017 (*Figures 4 and 11 of Annex C*) whilst the concentrations of TBT were below the limit of reporting at all stations in February 2017. Low and High Molecular Weight Polycyclic Aromatic Hydrocarbons (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 in January, February and March 2017.
- 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 January, February and March 2017. Statistical analysis will be undertaken and presented in the corresponding quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.
- 1.5.12 ***Cumulative Impact Sediment Chemistry of ESC CMPs - February 2017***
- 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 in February 2017.
- 1.5.14 Analyses of results for the *Cumulative Impact Sediment Chemistry Monitoring* indicated that the concentrations of all inorganic contaminants were below the LCEL in February 2017 (*Figures 12 and 13 of Annex C*).

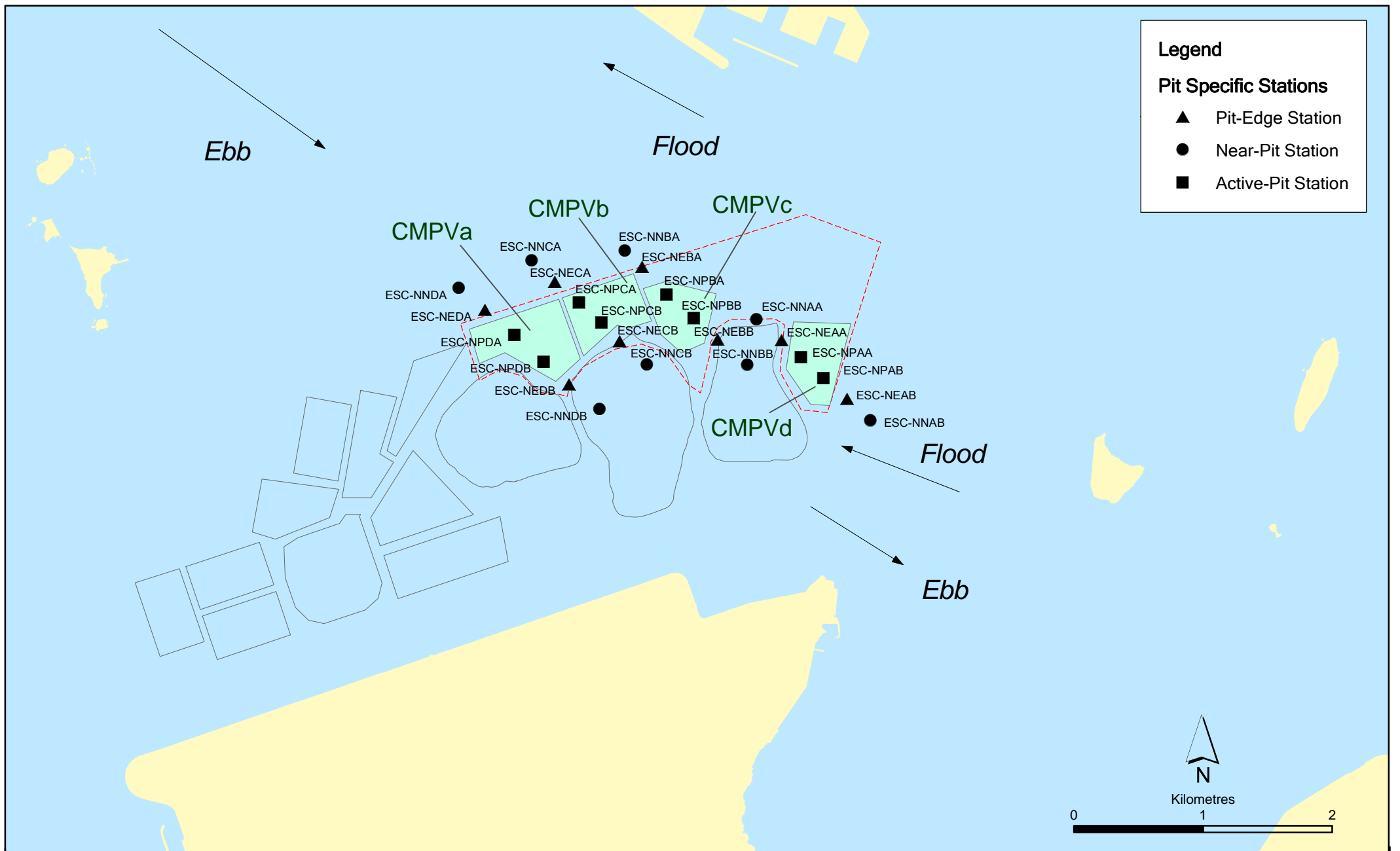


Figure 1.2

Pit Specific Sediment Quality Monitoring Stations for CMPV

File: CMPV\0103262_SQMS_pit specific.mxd
Date: 29/10/2009

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Figure 1.3

Cumulative Impacts Sediment Quality Monitoring Stations for CMPV

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Date: 29/10/2009

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- 1.5.15 For organic contaminants, concentrations of TOC were observed to be similar amongst all stations (*Figure 14 of Annex C*). Concentrations of TBT were recorded to be higher at Ma Wan station (*Figure 15 of Annex C*). Low and High Molecular Weight PAHs, PCBs, DDT and DDE concentrations were recorded 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 February 2017. 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 April 2017 for ESC CMPs (see *Annex A* for the sampling schedule):
- *Water Column Profiling of ESC CMP Vd;*
 - *Routine Water Quality Monitoring of ESC CMPs; and*
 - *Pit Specific Sediment Chemistry of ESC CMP Vd.*
- 1.6.2 No monitoring activities are scheduled in the next monthly period of April 2017 for SB CMPs.
- 1.6.3 The monitoring activities starting in April 2017 will be reported under a new consultancy *Agreement No. CE 63/2016 (EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2017-2020) – Investigation.*

1.7 *STUDY PROGRAMME*

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

Annex A

Sampling Schedule

Annex B

Water Quality Monitoring Results

Table B1 *Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities at ESC CMPs*

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

Notes:

- (1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- (2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.
- (3) Given the Action Level for DO for Surface & Middle layers has already been lower than 4 mg L⁻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 March 2017

Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%) (mg L ⁻¹)		pH (mg L ⁻¹)	Suspended Solids (mg L ⁻¹)
WCP 1 (Downstream)	18.48	29.54	7.42	91.02	7.15	7.94	7.38
WCP 2 (Upstream)	18.47	29.23	17.97	92.40	7.28	7.98	16.40
WQO (Dry season)	N/A	26.31 - 32.16#	N/A	N/A	>4	6.5-8.5	13.2

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.

Cell shaded grey indicate value exceeding the WQO.

Annex C

Graphical Presentations

**Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at ESC CMP Vd
February 2017**

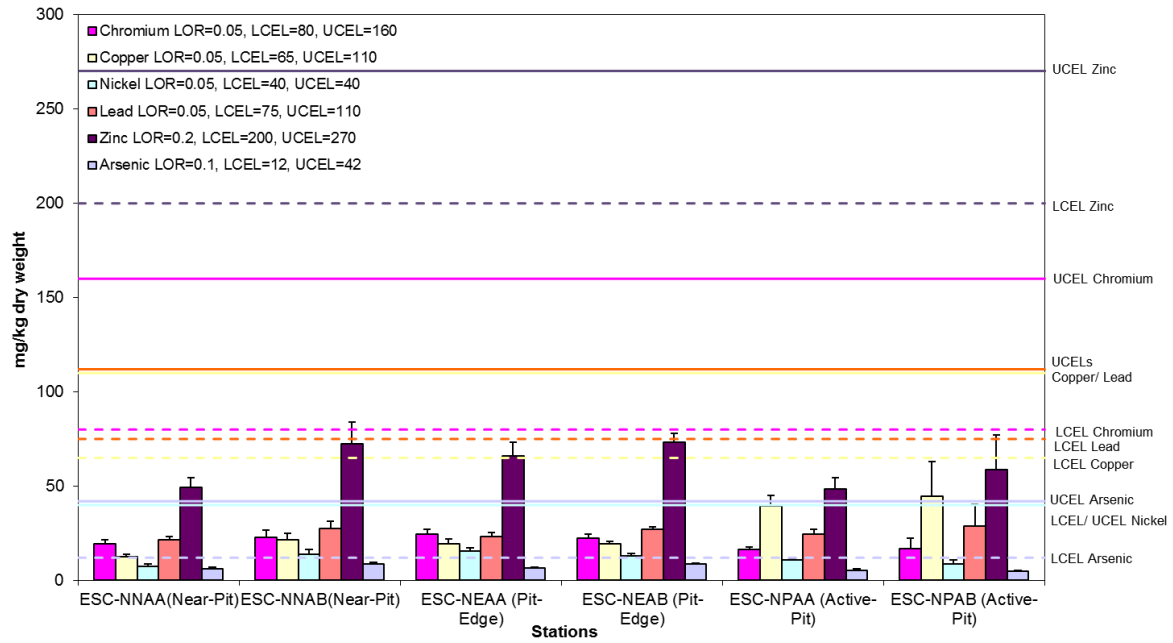


Figure 1: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in February 2017.

**Pit Specific Sediment Chemistry for Metal Contaminants at ESC CMP Vd
February 2017**

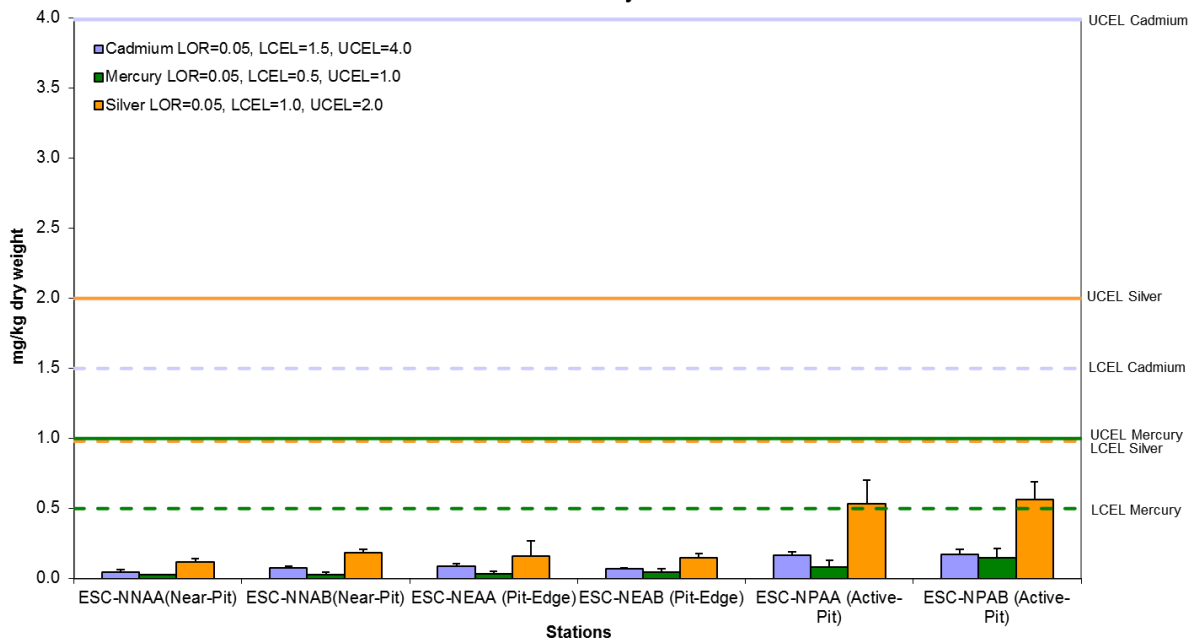


Figure 2: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in February 2017.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02 Deliverable\07 CMP Monthly Report\55th (March 2017)

Date: April 2017

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**Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at ESC CMP Vd
February 2017**

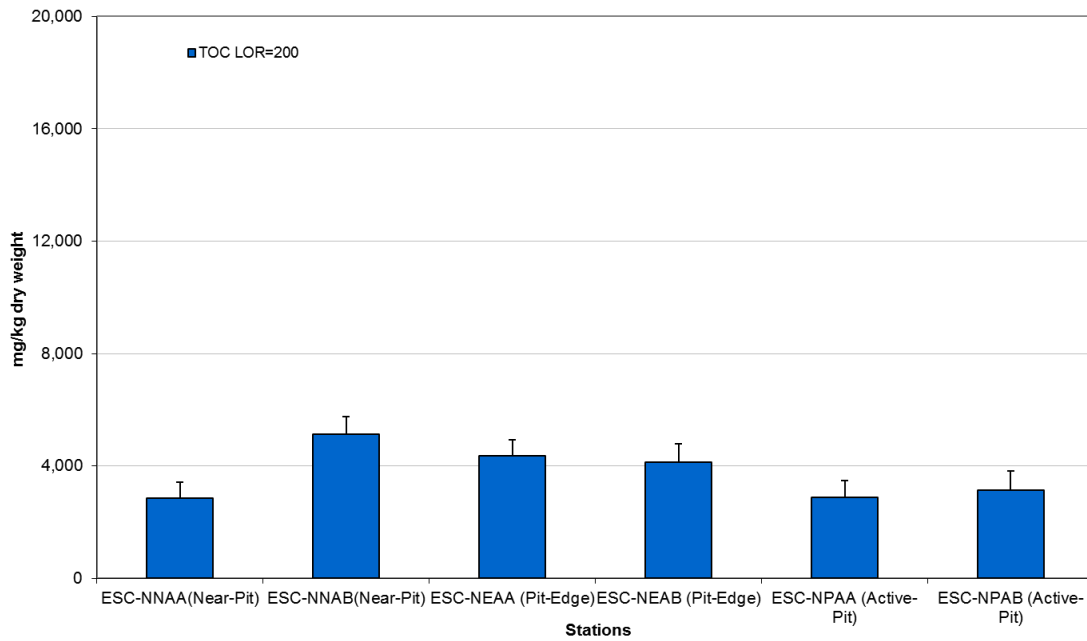


Figure 3: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in February 2017.

**Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at ESC CMP Vd
March 2017**

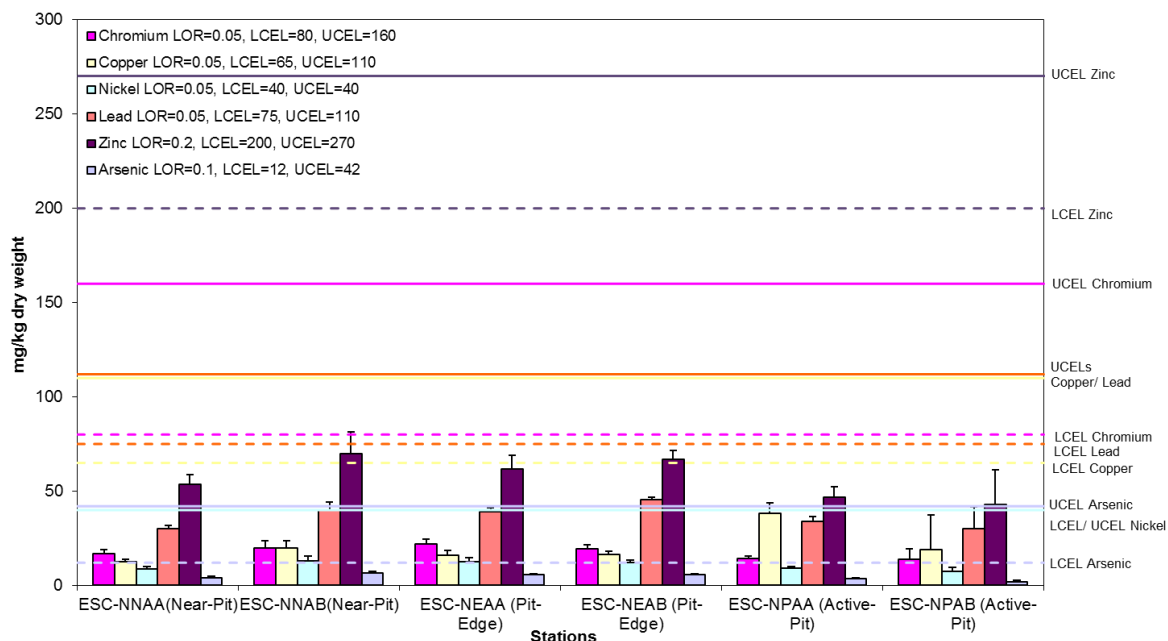


Figure 4: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in March 2017.

**Pit Specific Sediment Chemistry for Metal Contaminants at ESC CMP Vd
March 2017**

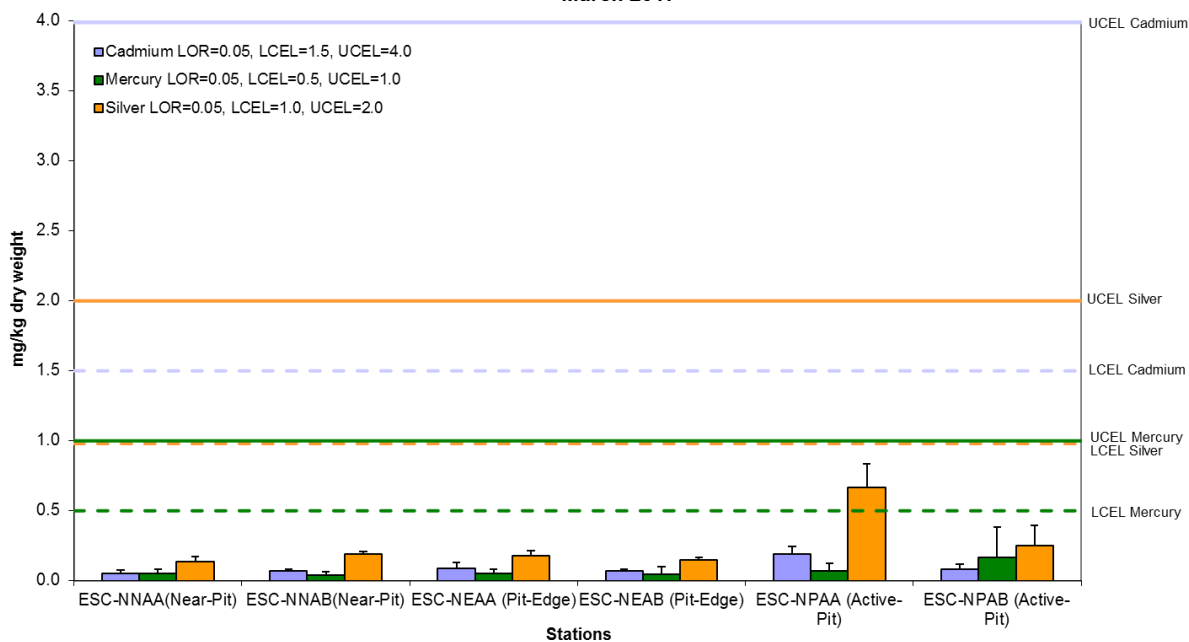


Figure 5: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in March 2017.

**Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at ESC CMP Vd
March 2017**

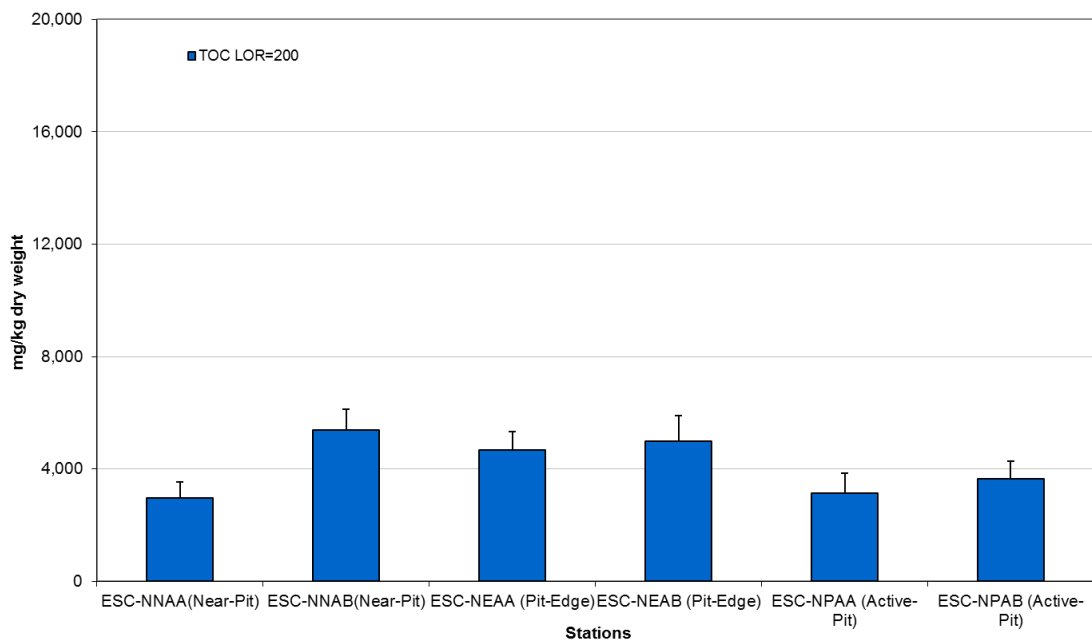


Figure 6: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in March 2017.

**Pit Specific Sediment Chemistry for Tributyltin (TBT) at ESC CMP Vd
March 2017**

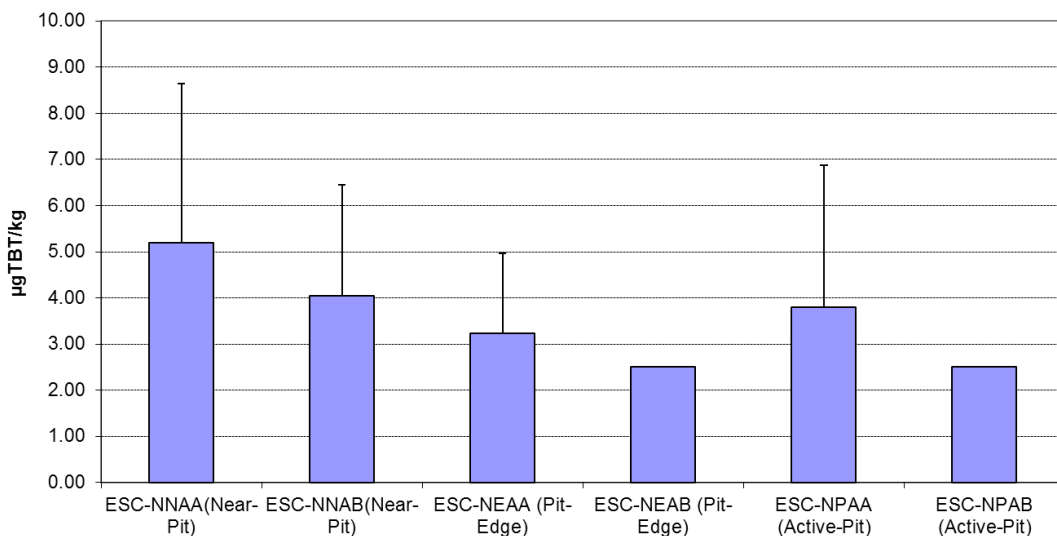


Figure 7: Concentration of Tributyltin (TBT) (µg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in March 2017.

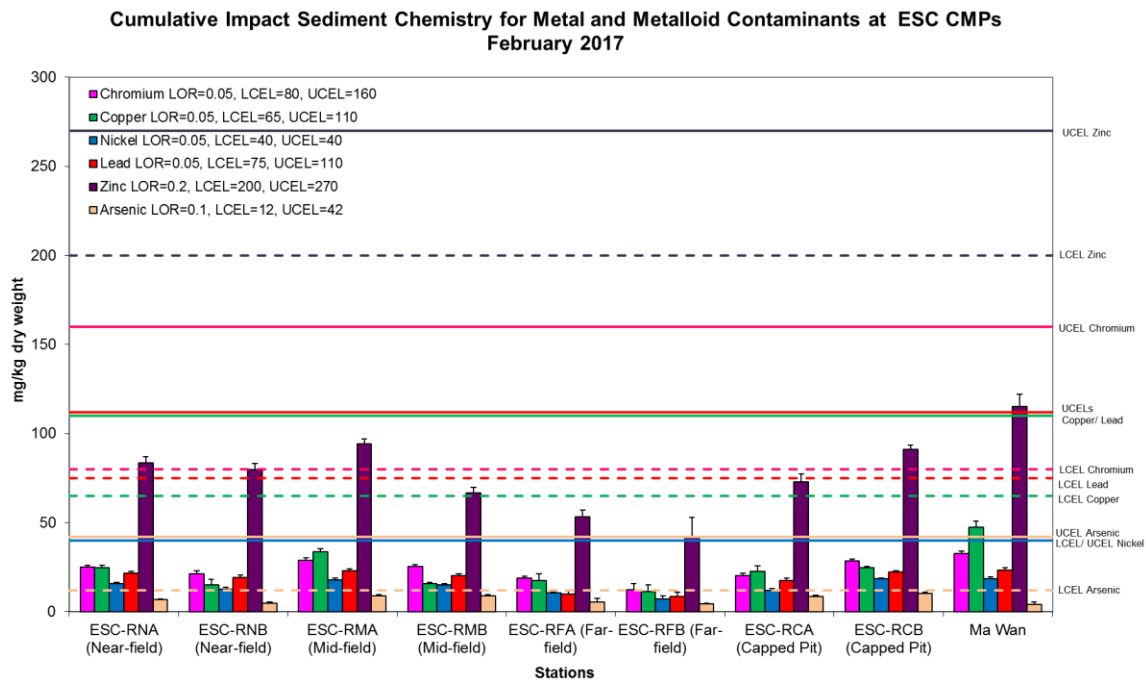


Figure 8: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in February 2017.

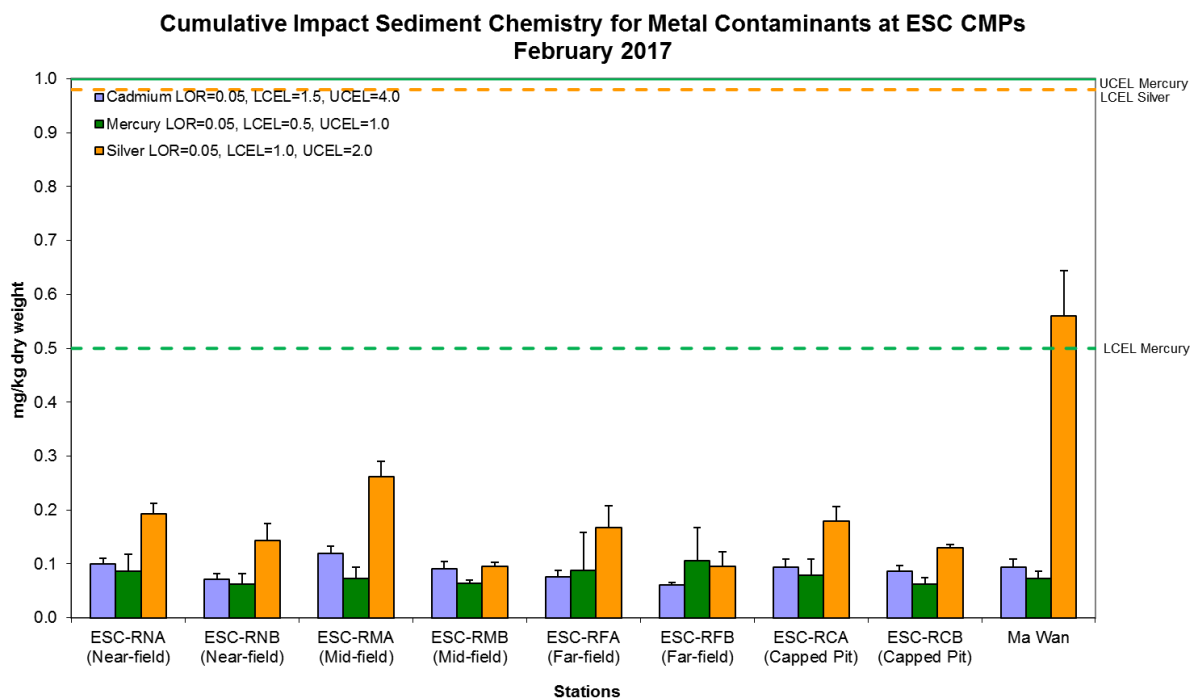


Figure 9: Concentration of Metals (Cd, Hg, Ag; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in February 2017.

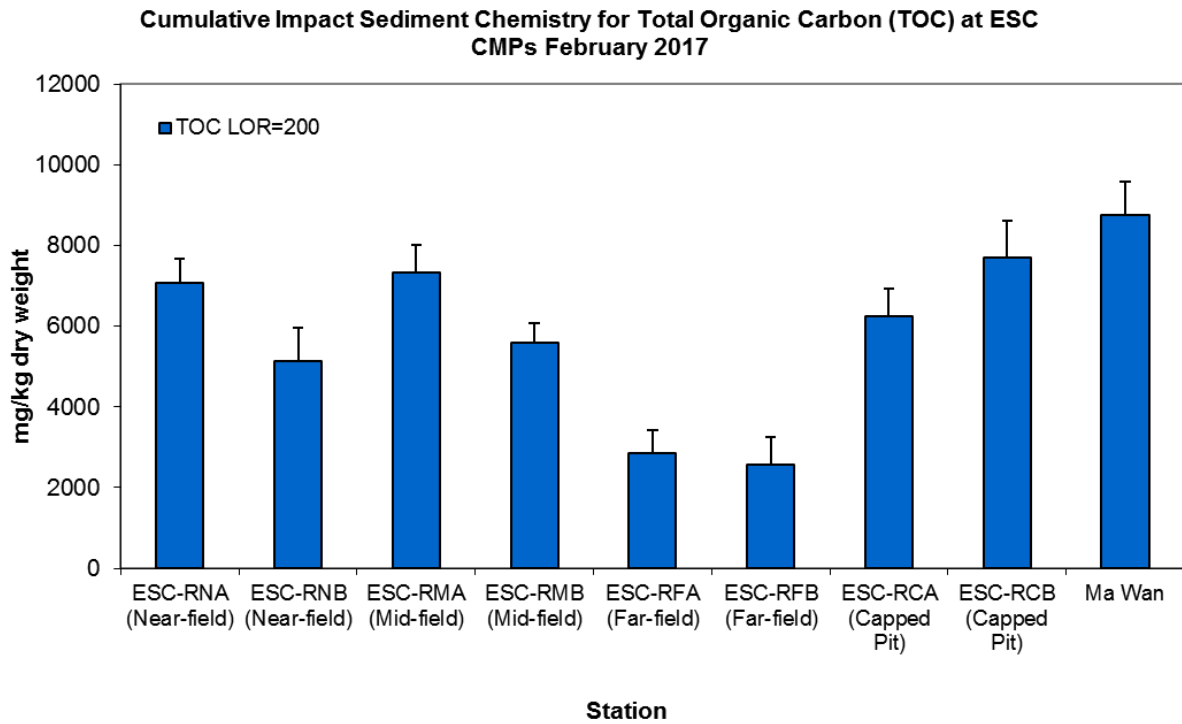


Figure 10: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in February 2017.

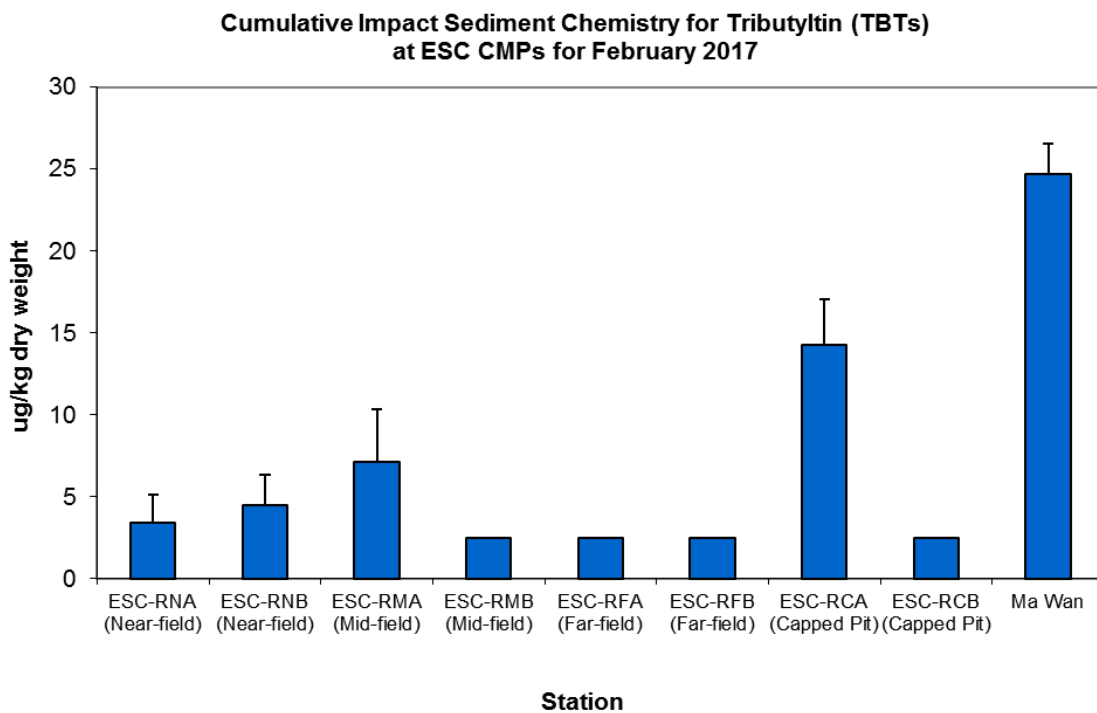


Figure 11: Concentration of Tributyltin ($\mu\text{g TBT}/\text{kg}$; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in February 2017.

Annex D

Study Programme

