

**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)**

**49th Monthly Progress Report for Contaminated
 Mud Pits to the South of The Brothers and at
 East Sha Chau – September 2016**

Draft (Revision 0)

12 October 2016

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Dredging, Management and Capping of Contaminated Sediment Disposal Facility to the South of The Brothers

**Environmental Certification Sheet
 EP-427/2011/A**


Reference Document/Plan

Document/ Plan to be Certified/ Verified:	49 th Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau - September 2016
Date of Report:	12 October 2016
Date prepared by ET:	12 October 2016
Date received by IA:	12 October 2016


Reference EP Condition

Environmental Permit Condition:	Condition No.: 4.4
<p>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.</p>	

ET Certification

I hereby certify that the above referenced document/ plan complies with the above referenced condition of EP-427/2011/A	
Craig A. Reid, Environmental Team Leader:	 Date: 12/10/2016

IA Verification

I hereby verify that the above referenced document/ plan complies with the above referenced condition of EP-427/2011/A	
Dr Wang Wen Xiong, Independent Auditor:	 Date: 12/10/2016

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Client:		Project No:			
Civil Engineering and Development Department (CEDD)		0175086			
Summary:		Date:			
This document presents the 49 th monthly progress report for Contaminated Mud Pits at the South of The Brothers and at East Sha Chau.		12 October 2016			
		Approved by:			
					
		Craig A. Reid Partner			
v0	49 th Monthly Progress Report for ESC CMPs and SB CMPs	RC	JT	CAR	12/10/16
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>			
		 			



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Agreement No. CE 23/2012 (EP)
Environmental Monitoring and Audit
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Chau (2012-2017) - Investigation

49TH MONTHLY PROGRESS REPORT FOR SEPTEMBER 2016

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)*

1.3.2 No monitoring activities were scheduled to be undertaken for SB CMPs in September 2016.

1.4 *DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS*

1.4.1 No outstanding sampling and analysis remained for September 2016.

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 49th *Monthly Progress Report*:

- *Water Column Profiling of ESC CMP Vd* in September 2016;
- *Pit Specific Sediment Chemistry of ESC CMP Vd* in August and September 2016; and
- *Cumulative Impact Sediment Chemistry* of ESC CMPs in August 2016.

1.5.2 *Water Column Profiling of ESC CMP Vd – September 2016*

1.5.3 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 1 September 2016. 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 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 stations 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 September 2016 indicated that levels of Salinity, 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 (*Table B1* of *Annex B*).

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

Laboratory Measurements for Suspended Solids (SS)

- 1.5.5 Analyses of results for September 2016 indicated that the SS levels were higher than the WQO at both Upstream and Downstream stations. However, both Upstream and Downstream stations complied with the Action and Limit Levels (*Table B1 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 - August and September 2016***
- 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 August and September 2016.
- 1.5.9 The concentrations of all inorganic contaminants were lower than the Lower Chemical Exceedance Level (LCEL) at all stations in August and September 2016 (*Figures 1, 2, 5 and 6 of Annex C*).
- 1.5.10 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were similar amongst the stations in August and September 2016 (*Figures 3 and 7 of Annex C*). In August 2016, Tributyltin (TBT) concentrations were higher at Active Pit station ESC-NPAB and Pit Edge station ESC-NEAA whilst TBT concentrations were higher at Active Pit ESC-NPAA station in September 2016 (*Figures 4 and 8 of Annex C*). Low and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs), Total Polychlorinated Biphenyls (PCBs), Total dichlorodiphenyltrichloroethane (DDT) and 4,4'-dichlorodiphenyldichloroethylene (DDE) concentrations were below the limit of reporting at all stations in August and September 2016.
- 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 August and September 2016. Statistical analysis will be undertaken and presented in the 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 - August 2016*
- 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 August 2016.
- 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 August 2016 (*Figures 9 and 10 of Annex C*).
- 1.5.15 For organic contaminants, concentrations of TOC were observed to be similar among all stations (*Figure 11 of Annex C*). Concentrations of TBTs were recorded to be higher at Ma Wan station and Capped Pit station ESC-RCA (*Figure 12 of Annex C*). Total DDT, 4,4'-DDE, Total PCBs as well as Low and High Molecular Weight PAHs 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 August 2016. Statistical analysis will be undertaken and presented in the quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.



Figure 1.3

Cumulative Impacts Sediment Quality Monitoring Stations for CMPV

File: 0103262_SQMS_cum impact.mxd
Date: 29/10/2009

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1.6 *ACTIVITIES SCHEDULED FOR THE NEXT MONTH*

1.6.1 The following monitoring activities will be conducted in the next monthly period of October 2016 for ESC CMPs:

- *Water Column Profiling of ESC CMP Vd;*
- *Routine Water Quality Monitoring of ESC CMP Vd;*
- *Water Quality Monitoring During Dredging of ESC CMP Vb; and*
- *Pit Specific Sediment Chemistry of ESC CMP Vd.*

1.6.2 No monitoring activities will be scheduled in the next monthly period of October 2016 for SB CMPs.

1.6.3 The sampling schedule is presented in *Annex A*.

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 September 2016*

Stations	Temp (°C)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (%) (mg L ⁻¹)		pH (mg L ⁻¹)	Suspended Solids (mg L ⁻¹)
WCP 1 (Downstream)	28.00	24.76	29.32	64.83	4.42	7.63	22.00
WCP 2 (Upstream)	28.27	23.53	15.46	67.15	4.59	7.61	14.85
WQO (Wet season)	N/A	21.73 – 25.89 [#]	N/A	N/A	>4	6.5-8.5	11.0

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
August 2016**

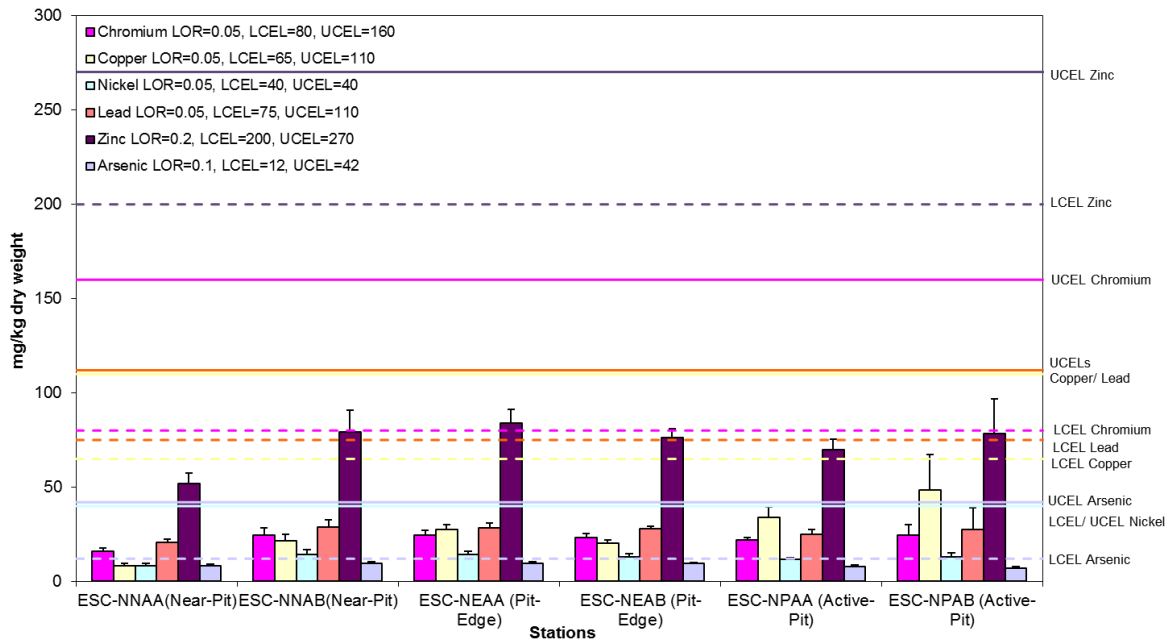


Figure 1: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in August 2016.

**Pit Specific Sediment Chemistry for Metal Contaminants at ESC CMP Vd
August 2016**

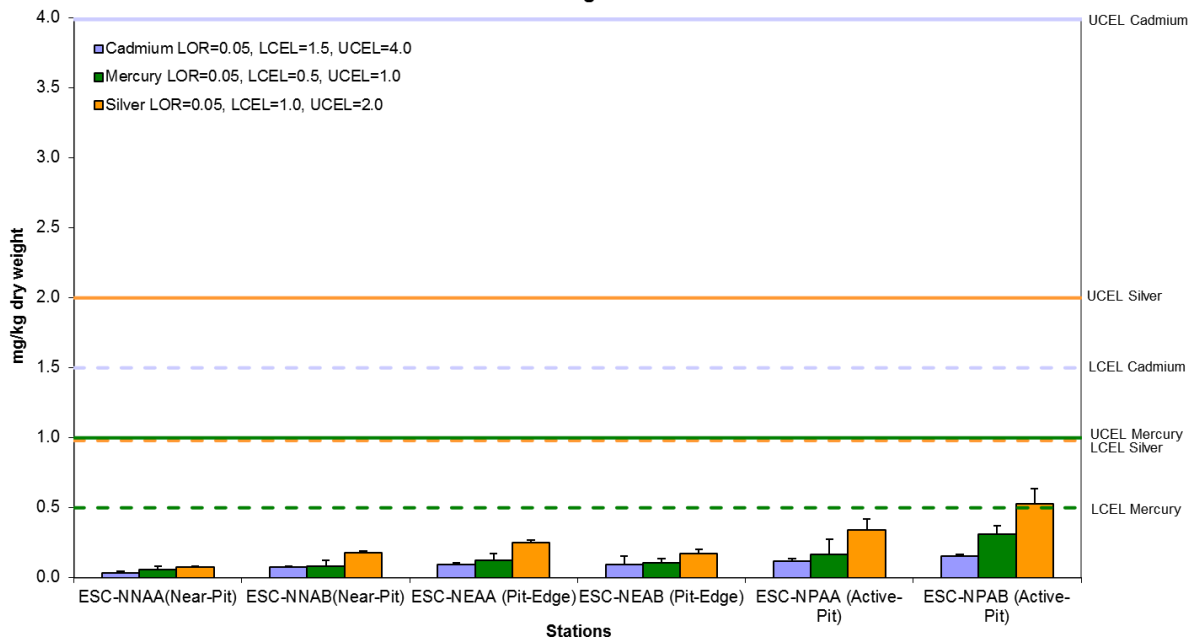


Figure 2: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in August 2016.

Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at ESC CMP Vd August 2016

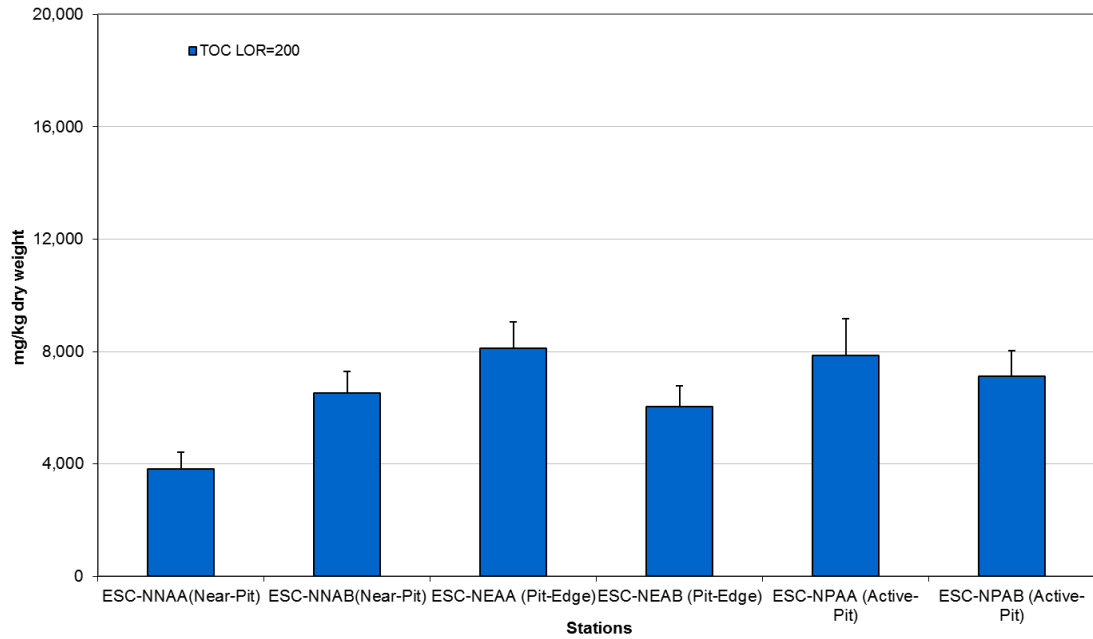


Figure 3: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in August 2016.

Pit Specific Sediment Chemistry for Tributyltin (TBT) at ESC CMP Vd August 2016

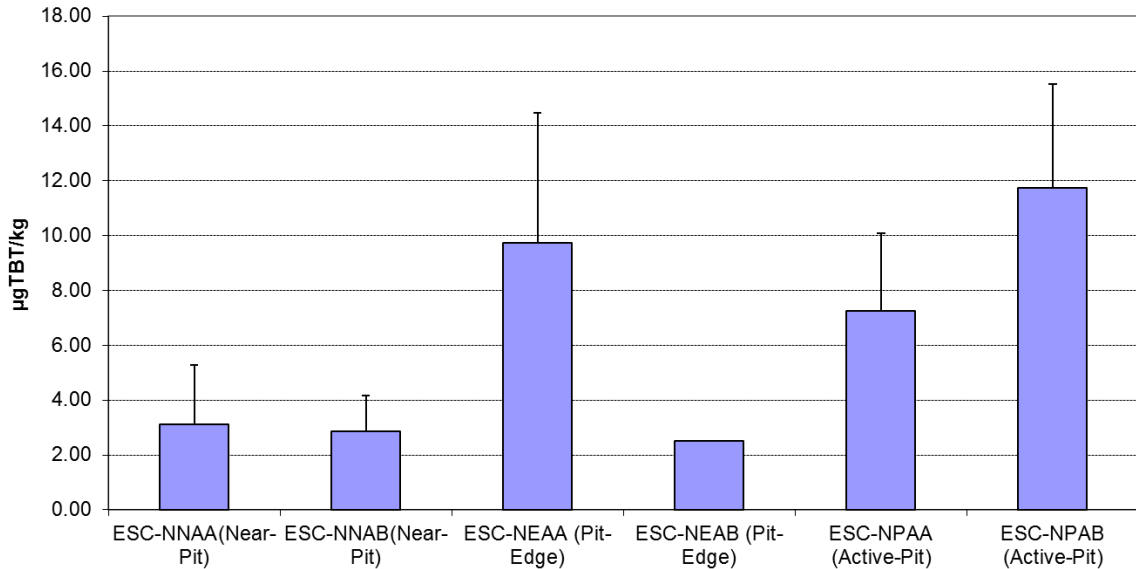


Figure 4: Concentration of Tributyltin (TBT) (µg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in August 2016.

**Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at ESC CMP Vd
September 2016**

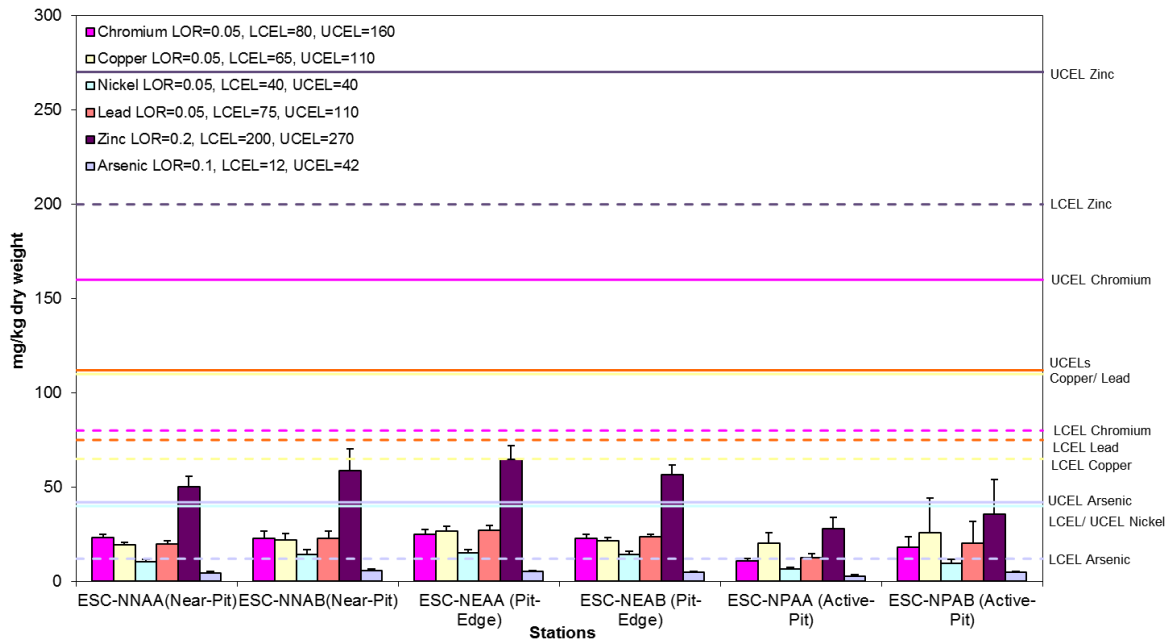


Figure 5: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in September 2016.

**Pit Specific Sediment Chemistry for Metal Contaminants at ESC CMP Vd
September 2016**

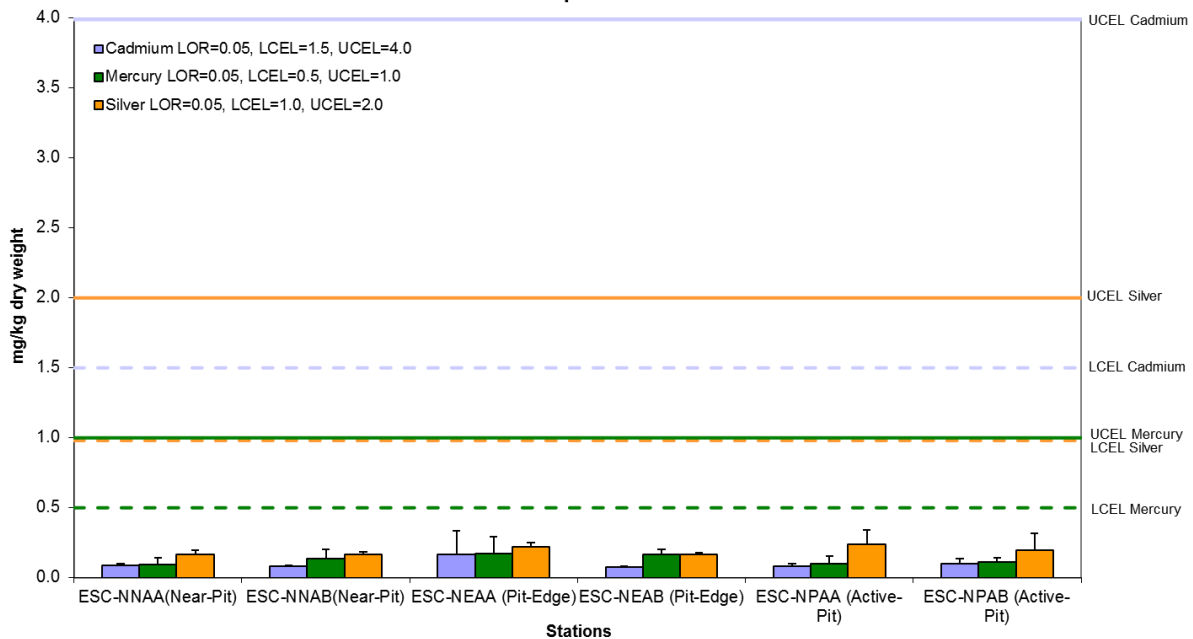


Figure 6: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in September 2016.

**Pit Specific Sediment Chemistry for Total Organic Carbon (TOC) at ESC CMP Vd
September 2016**

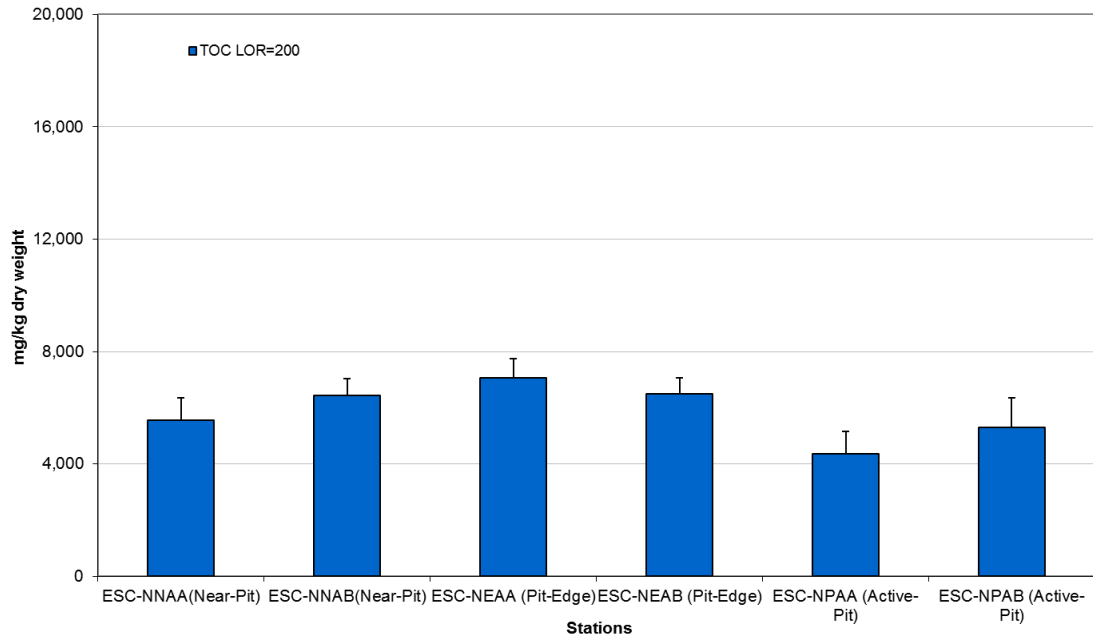


Figure 7: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in September 2016.

**Pit Specific Sediment Chemistry for Tributyltin (TBT) at ESC CMP Vd
September 2016**

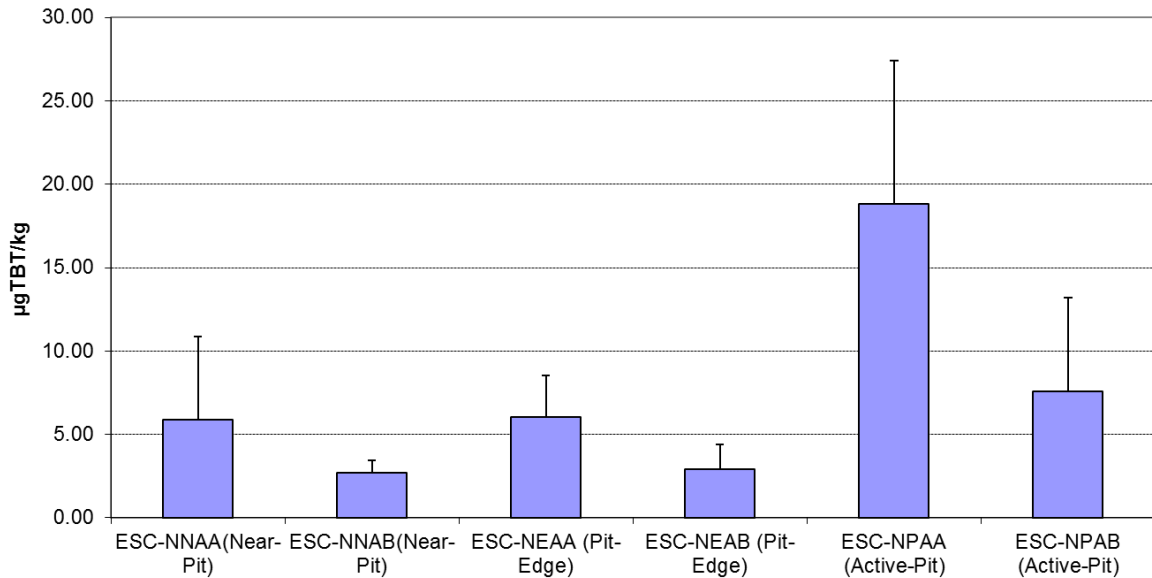


Figure 8: Concentration of Tributyltin (TBT) (µg TBT/kg; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for ESC CMP Vd in September 2016.

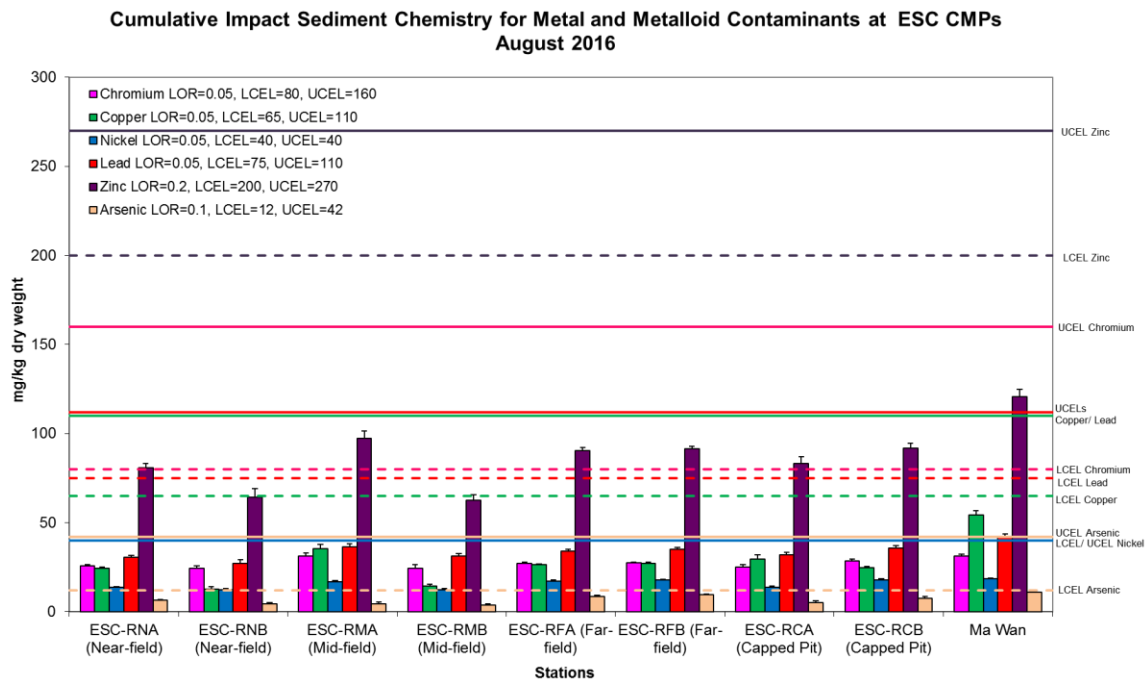


Figure 9: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in August 2016.

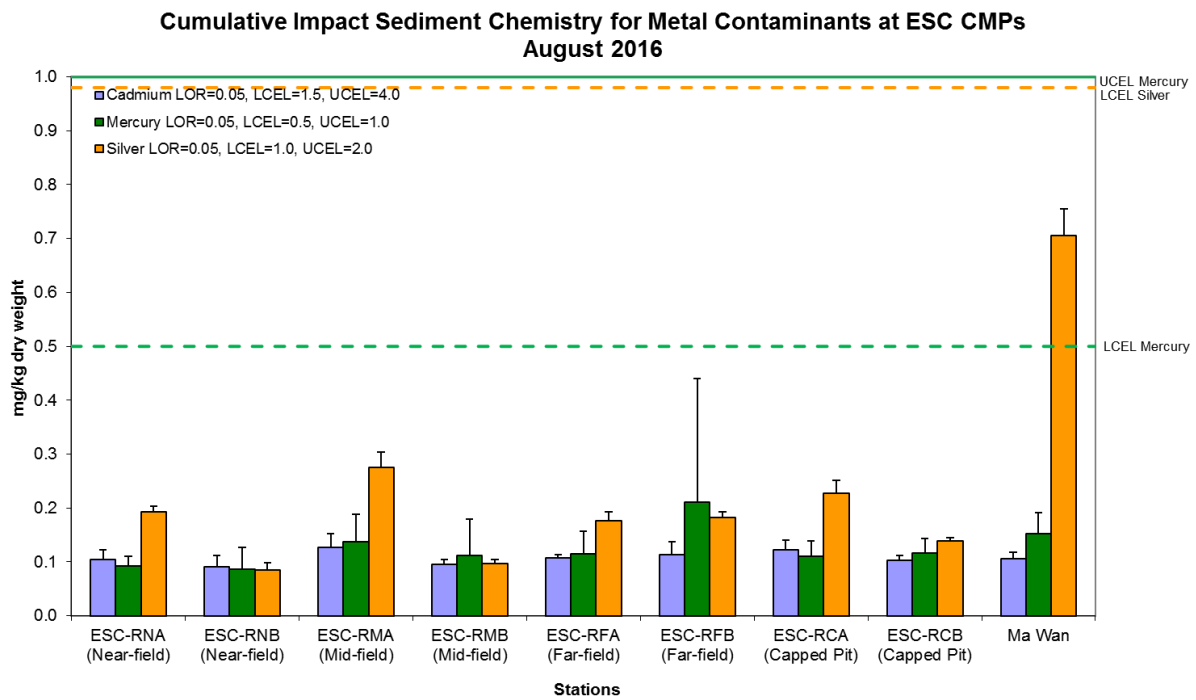


Figure 10: Concentration of Metals (Cd, Hg, Ag; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in August 2016.

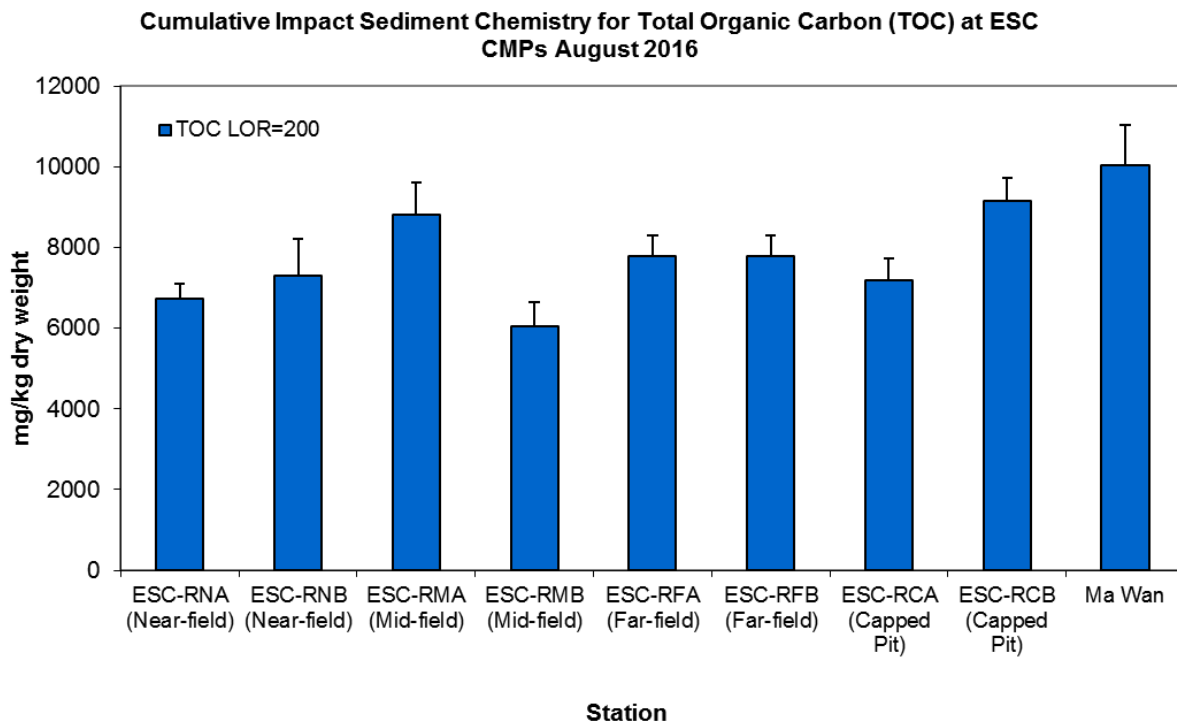


Figure 11: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in August 2016.

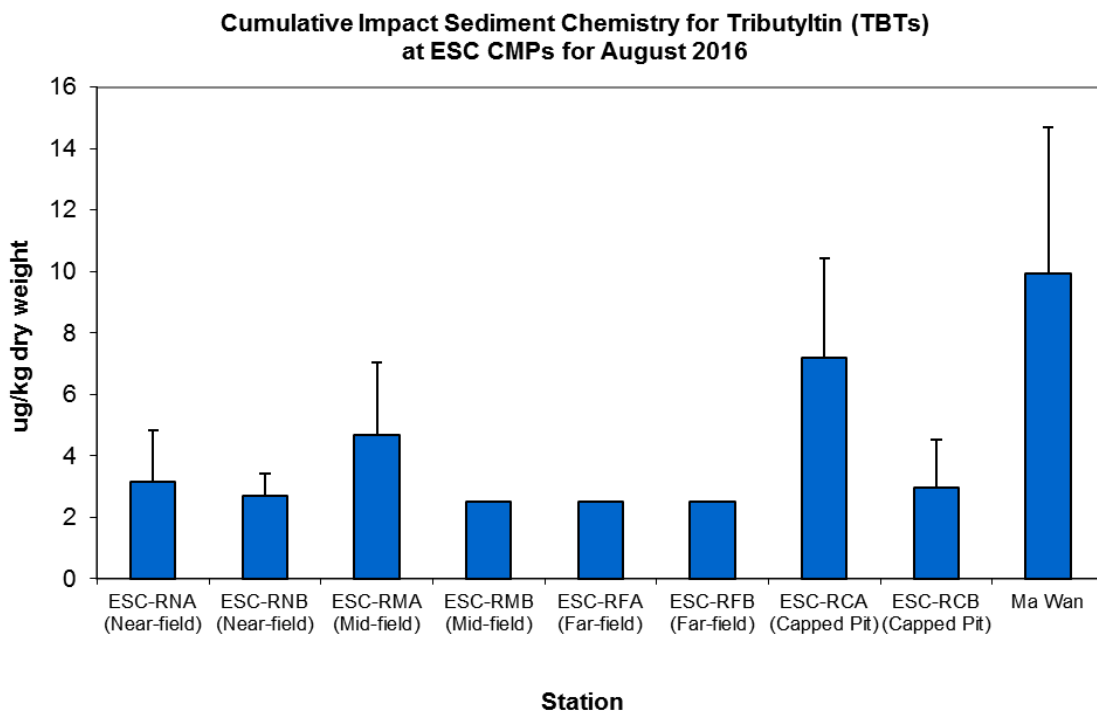


Figure 12: Concentration of Tributyltin ($\mu\text{g TBT/kg}$; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in August 2016.

Annex D

Study Programme

