



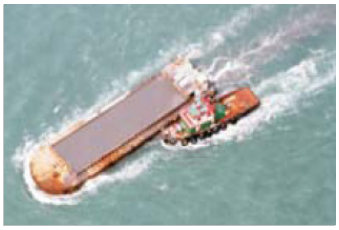
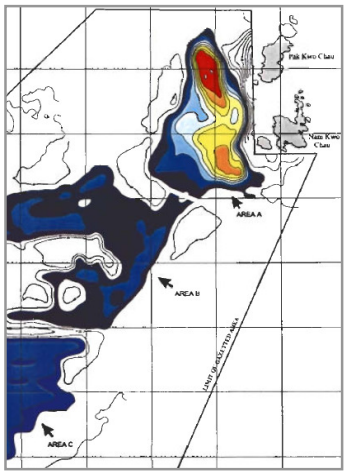

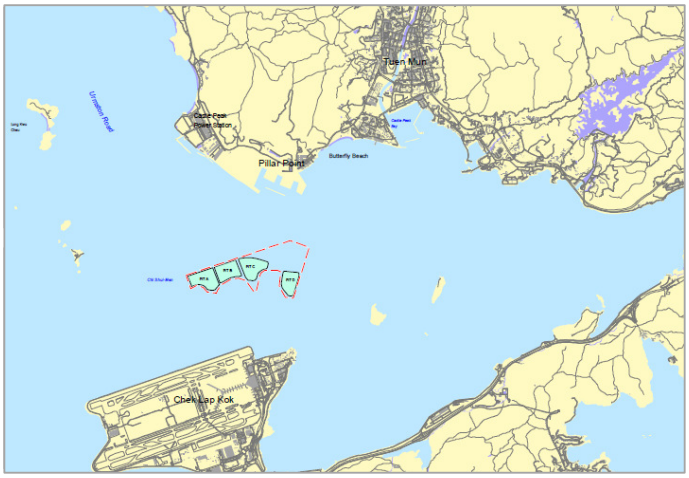

CEDD 土木工程拓展署
Civil Engineering and Development Department

Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation

Agreement No. CE 4/2009(EP)

38th Monthly Progress Report for Contaminated Mud Pits at Sha Chau – August 2012

Revision 0

3 December 2012

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Client: Civil Engineering and Development Department (CEDD)	Project No: 0103262
Summary: This document presents progress of monitoring works on contaminated mud pits at Sha Chau in August 2012 under Agreement No. CE 4/2009 (EP).	Date: 3 December 2012 Approved by:  *Dr Robin Kennish* *Director*

Revision	Description	By	Checked	Approved	Date
0	38th Monthly Progress Report for CMP	RC	JT	RK	3/12/12

Distribution

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CONTENTS

ANNEXES

Agreement No. CE 4/2009 (EP)
Environmental Monitoring and Audit
for Contaminated Mud Pit at Sha Chau (2009-2013) - Investigation

38th MONTHLY PROGRESS REPORT FOR CONTAMINATED MUD PITS AT SHA CHAU August 2012

1.1 BACKGROUND

1.1.1 Since 1992, the East of Sha Chau area has been the site of a series of dredged Contaminated Mud Pits (CMPs) designed to provide confined marine disposal capacity for contaminated mud arising from the HKSAR's dredging and reclamation projects. In August 2012, the following works were being undertaken at the CMPs:

- Capping was being undertaken at CMP IVc;
- Disposal of contaminated mud was taking place at CMP Va; and
- The dredging of CMP Vd was in progress.

1.1.2 The Environmental Monitoring and Audit (EM&A) programme for the CMPs at the East of Sha Chau area (ESC) presently covers the above operations.

1.2 REPORTING PERIOD

1.2.1 This *Monthly Progress Report* covers the reporting month of August 2012.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

1.3.1 The following monitoring activities have been undertaken for CMP Va in August 2012:

- *Sediment Chemistry after a Major Storm Event* was conducted for CMP Va on 1 and 22 August 2012;
- *Pit Specific Sediment Chemistry* was conducted for CMP Va on 10 August 2012;
- *Water Column Profiling* was conducted for CMP Va on 13 August 2012,
- *Demersal Trawling* was conducted for CMP Va on 15 and 16 August 2012
- *Routine Water Quality Monitoring* was conducted for CMP Va on 20 August 2012;
- *Sediment Toxicity Test* was conducted for CMP Va on 24 August 2012;

- *Cumulative Impact Sediment Chemistry* was conducted for CMP Va on 27 August 2012, and
- *Impact Water Quality Monitoring during Dredging Operations* was conducted for CMP Vd on 29 August 2012.

1.3.2 A summary of field activities is presented in *Annex A*.

1.4 DETAILS OF OUTSTANDING SAMPLING AND / OR ANALYSIS

1.4.1 No outstanding sampling and laboratory analysis remained from August 2012.

1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR CMP V

1.5.1 *Table 1.1* summarises the monitoring results that are presented in the current monthly report. All monitoring data collected for CMP V in August 2012 will be presented in this monthly report.

Table 1.1 Monitoring activities in August 2012

Monitoring activities	Date of Monitoring	Monitoring results presented in this report?
Sediment Chemistry after a Major Storm Event for CMP Va	1 and 22 August 2012	Yes
Pit Specific Sediment Chemistry Monitoring for CMP Va	10 August 2012	Yes
Water Column Profiling for CMP Va	13 August 2012	Yes
Demersal Trawling for CMP Va	15 and 16 August 2012	Yes
Routine Water Quality Monitoring for CMP Va	20 August 2012	Yes
Sediment Toxicity Test	24 August 2012	Yes
Cumulative Impact Sediment Chemistry Monitoring for CMP Va	27 August 2012	Yes
Impact Water Quality Monitoring during Dredging Operations of CMP Vd	29 August 2012	Yes

1.5.2 Brief discussion of the monitoring results is presented in this section. Detailed discussion will be presented in the corresponding *Quarterly Report*.

1.5.3 Sediment Chemistry after a Major Storm Event of CMP Va – 1 August and 22 August 2012

1.5.4 Samplings for *Sediment Chemistry after Major Storm Events* were conducted on 1 August and 22 August 2012 after the visit of Tropical Storms Vincente and Kai-tak, which led to the issue of Typhoon Signal No. 10 on 23 & 24 July 2012 and Typhoon Signal No. 8 on 16 August 2012 respectively. A total of nine monitoring stations were being sampled. The tracks of Vincente and Kai-tak are shown in *Figures 1.1 and 1.2*.

Figure 1.1 Track of Typhoon Vicente from 20 to 25 July 2012 (Source: Hong Kong Observatory)

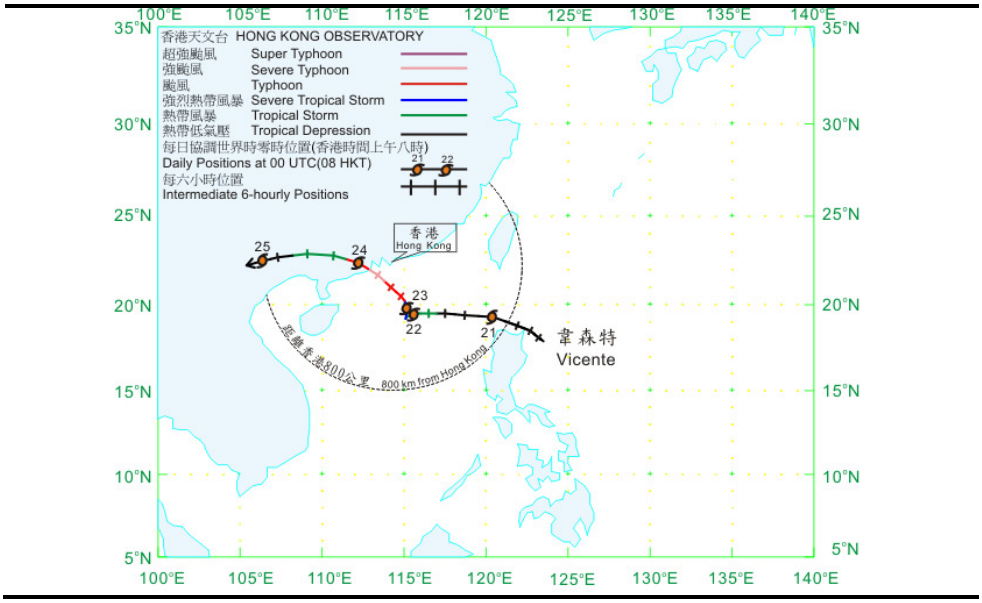
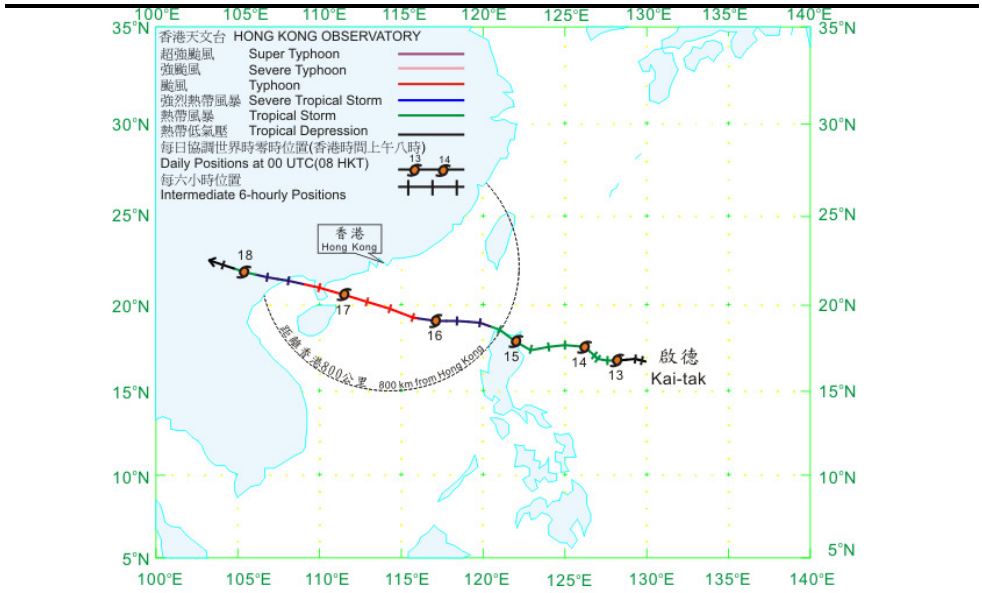


Figure 1.2 Track of Typhoon Kai-tak from 12 to 18 August 2012 (Source: Hong Kong Observatory)



1.5.5 Concentrations of all metals, except Arsenic, were below the Lower Chemical Exceedance Limit (*LCEL*) (*Figures 1-2* and *5-6 of Annex B*) on both 1 and 22 August 2012. Concentrations of Arsenic in sediments exceeded *LCEL* (12 mg/kg) at most of the stations, but remained below Upper Chemical Exceedance Limit (*UCEL)* (42 mg/kg). It is important to note that relatively high natural levels of Arsenic are present in Hong Kong's marine sediments. Therefore, the slight exceedances of the LCEL for Arsenic are unlikely to be caused by the storm events and disposal operations at CMP Va but rather as a result of naturally occurring deposits.

1.5.6 Overall, there appeared to be no evidence of showing the failure of CMP Va in retaining disposed mud or causing contamination of sediments after the major storm events in August 2012.

1.5.7 Pit Specific Sediment Chemistry of CMP Va – August 2012

1.5.8 Monitoring locations for Pit Specific Sediment Chemistry for CMP Va are shown in *Figure 1.3*. A total of six monitoring stations were being sampled. Concentrations of metals at all stations in August 2012 were below the *LCEL*, with the exception of Arsenic (*Figures 8 and 9 of Annex B*). Concentrations of Arsenic exceeded the LCEL at Pit-Edge (NEDB) and Near-Pit (NNDA) stations in August 2012. As discussed in *Section 1.5.5* above, the slight exceedances of the LCEL for Arsenic are unlikely to be caused by the disposal operations at CMP Va but rather as a result of naturally occurring deposits.

1.5.9 For organic contaminants, Total Polychlorinated Biphenyls (PCBs), 4,4''-Dichlorodiphenyldichloroethylene (4,4''-DDE) and total Dichlorodiphenyl-trichloroethane (DDT) were below the limit of reporting at all stations in August 2012. Levels of Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (Low and High M.W. PAHs) were higher than the limit of reporting at Active Pit stations (NPDA and NPDB) and Pit-Edge station (NEDB) in August 2012. Total Organic Carbon (TOC) concentration was similar amongst all stations (*Figure 10 of Annex B*). Tributyltin (TBT) concentration was the highest at Pit-Edge station NEDB in August 2012 when compared to other stations (*Figure 11 of Annex B*).

1.5.10 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at CMP Va during this monthly period.

1.5.11 Cumulative Impact Sediment Chemistry for CMP Va – August 2012

1.5.12 Monitoring locations for Cumulative Impact Sediment Chemistry for CMP Va are shown in *Figure 1.4*. A total of nine monitoring stations were being sampled.

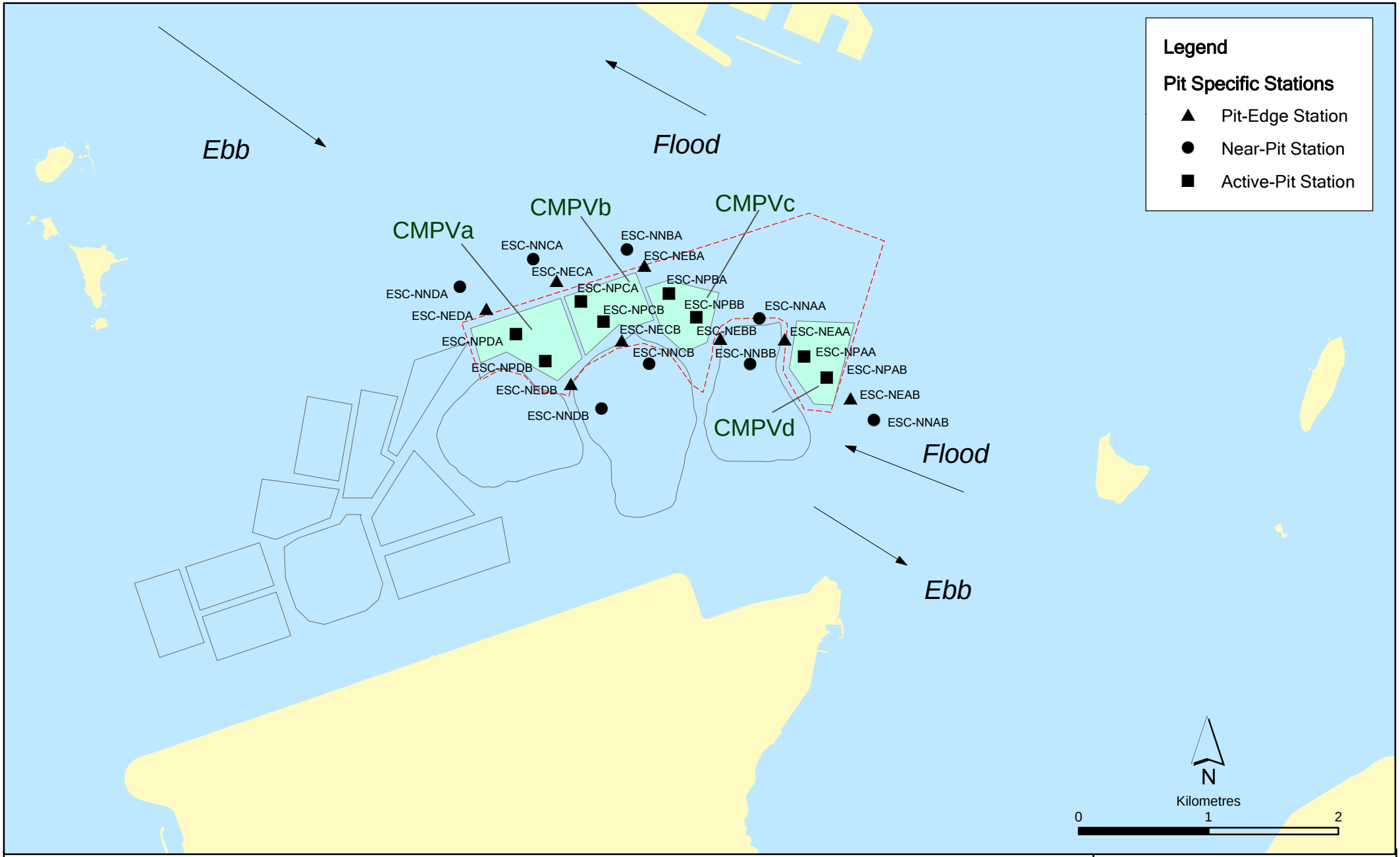


Figure 1.3

Pit Specific Sediment Quality Monitoring Stations for CMPV

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Date: 29/10/2009

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Figure 1.4

Cumulative Impacts Sediment Quality Monitoring Stations for CMPV

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Date: 3/12/2012

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1.5.13 Analyses of results for the Cumulative Impact Sediment Chemistry Monitoring indicated that the concentrations of all metals, except Arsenic, were below the *LCEL* (*Figures 12* and *13* of *Annex B*). Concentrations of Arsenic in sediments from all stations, except Near Field (RNB), exceeded the *LCEL*. As presented in *Section 1.5.5* above, the slight exceedances of *LCEL* for Arsenic do not necessarily indicate any adverse impacts to sediment quality caused by disposal operations at CMP Va. Generally, there were only minor differences in metal concentrations amongst the stations.

1.5.14 The concentration of TOC was higher at the Mid Field station RMA than at other stations (*Figure 14 of Annex B*). TBTs were recorded in sediment samples at Near Field (RNA), Mid Field (RMA and RMB), Capped Pit (RCA) and Ma Wan Stations (*Figure 15 of Annex B*). Total DDT, 4,4''-DDE, Total PCBs, Low and High M.W. PAHs were below the limit of detection at all stations.

1.5.15 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at CMP Va during this monthly period.

1.5.16 Sediment Toxicity Test – August 2012

1.5.17 Sediment Toxicity Tests were undertaken for sediments collected from the Near Pit, Reference and Ma Wan stations (as shown in *Figure 1.5*) in August 2012 using three international species (burrowing amphipod *Leptocheirus plumulosus*, marine benthic polychaete *Neanthes arenaceodentata* and marine bivalave *Crassostrea gigas*) and two local species (barnacles *Balanus amphitrite* and shrimp *Penaeus vannaamei*). A total of five stations were being sampled.

1.5.18 Results of the Sediment Toxicity Tests in August 2012 showed that the survival rates of the burrowing amphipod, bivalve, shrimp and barnacle as well as the total dry weight of the benthic polychaete were not significantly different between animals exposed to the sediments taken from Near Pit, Reference and Ma Wan stations. Therefore, there did not appear to be any evidence of adverse impacts to sediment toxicity due to the mud disposal operations at the CMP Va of the ESC area.

Figure 1.5

Sediment Toxicity Monitoring Stations for CMPV

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Date: 3/12/2012

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1.5.19 Impact Water Quality Monitoring during Dredging Operations of CMP Vd – August 2012

1.5.20 *Impact Water Quality Monitoring during Dredging Operations of CMP Vd* was conducted on 29 August 2012. On the survey day, sampling was conducted during both mid-ebb and mid-flood tides at two Reference (Upstream) stations upstream and five Impact (Downstream) stations downstream of the dredging operations at CMP Vd (*Figure 1.6*). Monitoring was also conducted at Ma Wan station. At each station, *in-situ* measurements of water quality parameters as well as water samples were taken from three depths in the water column (ie surface: 1 m below sea surface, mid-depth and bottom: 1 m above the seabed).

1.5.21 Monitoring results are presented in *Table C1 of Annex C*. Levels of DO, Turbidity and TSS generally complied with the Action and Limit Levels set in the *Baseline Monitoring Report* (1), except for Average Turbidity Level at station DS2 during mid-flood tide. The single case of exceedance recorded at station DS2 is not likely to be caused by the dredging operations at CMP Vd since the turbidity levels well complied with the Action level at stations closer to dredging operations at CMP Vd (ie DS1 and DS2).

1.5.22 Overall, the results indicated that the dredging operations at CMP Vd did not appear to cause any unacceptable deterioration in water quality during this reporting period. Therefore, no further mitigation measures, except for those recommended in the Environmental Permit (*EP-312/2008*), are considered required for the dredging operations of CMP Vd.

1.5.23 Routine Water Quality Monitoring for CMP Va – August 2012

1.5.24 The results for the *Routine Water Monitoring* conducted in the wet season have been assessed for compliance with the Water Quality Objectives (WQOs) (please see *Figure 1.7* for the monitoring locations). This consists of a review of the Environmental Protection Department (EPD) routine water quality monitoring data for the wet season period (April to October) of 1999-2010 from stations in the Northwestern Water Control Zone, where CMPs are located. For Salinity, the average value obtained from the reference stations was used for the basis as the WQO. *In-situ* monitoring and laboratory results are shown in *Table 1.2* and *1.3* respectively, with graphical presentation provided in *Annex B*. Monitoring was undertaken at a total of sixteen stations in the reporting month.

(1) ERM (2009) Baseline Monitoring Report. Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation. Agreement No. CE 4/2009(EP). Submitted to EPD in September 2009.

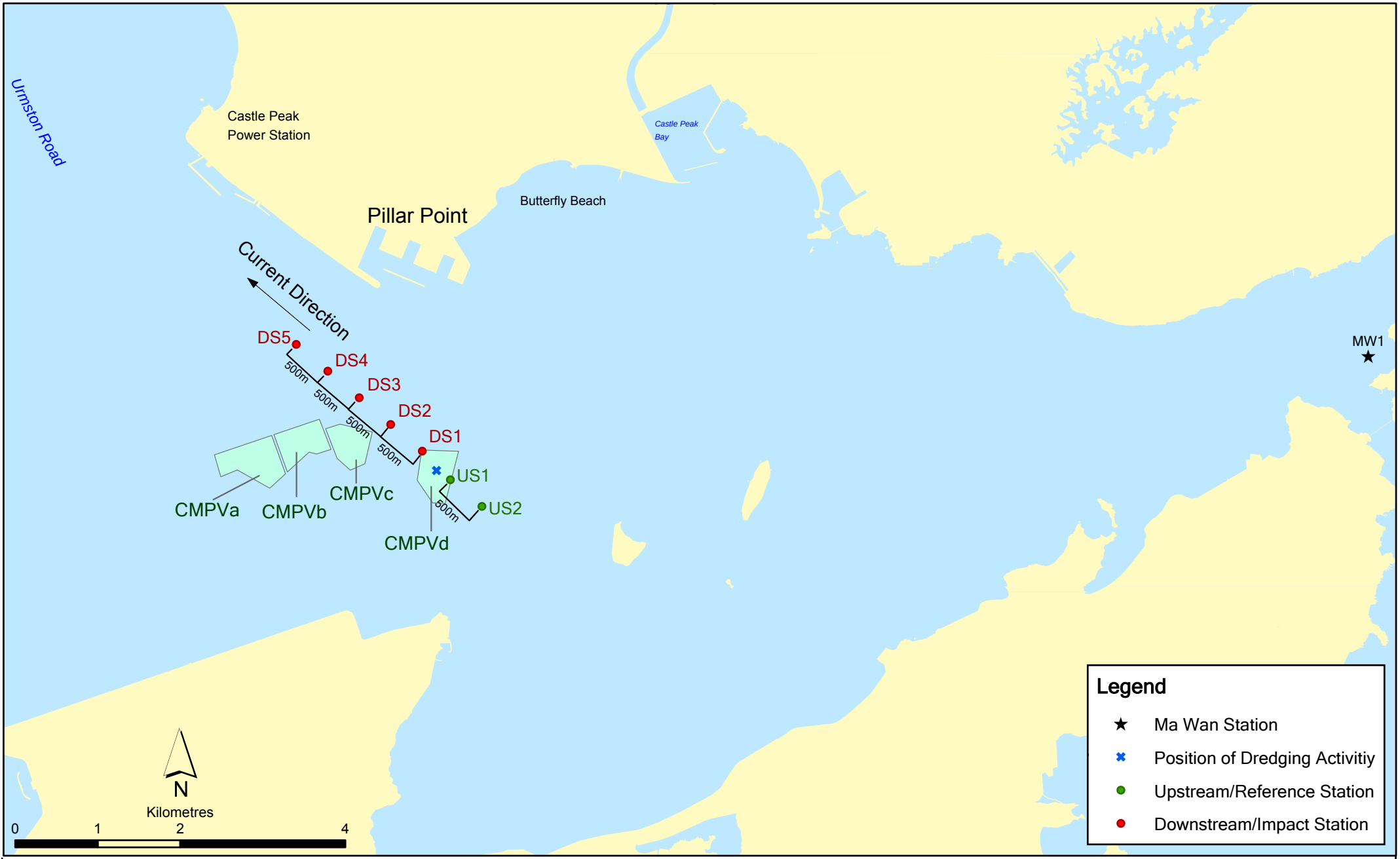

Figure 1.6

Indicative Dredging Impact Sampling Stations for CMPVd

Note: The locations of sampling stations will be determined on site based on current direction and position of dredging activities.

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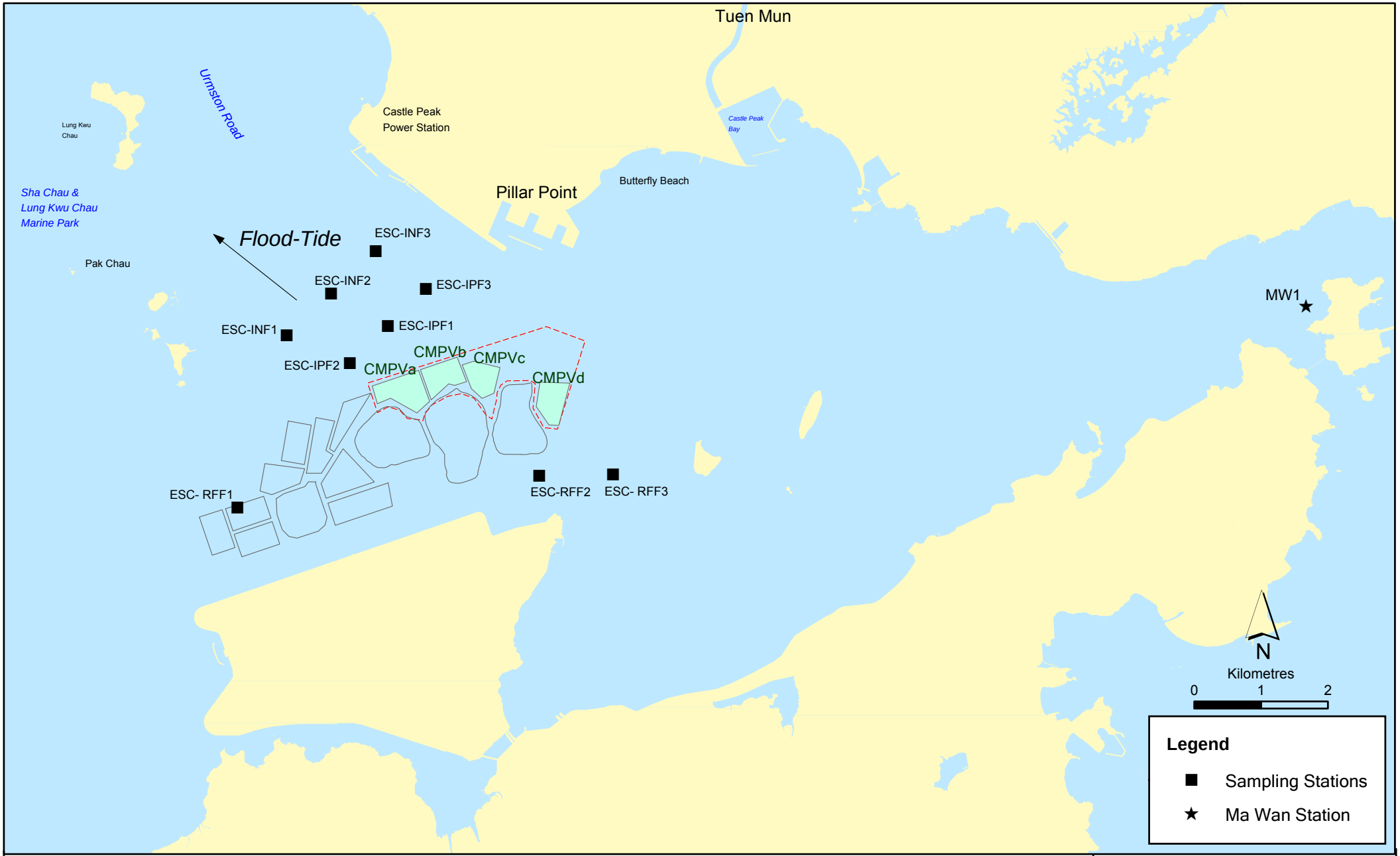

Figure 1.7

Routine & Capping Water Quality Sampling Stations (Flood-Tide) for CMPV

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Date: 3/12/2012

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In-situ Measurements

1.5.25 Analyses of results for August 2012 indicated that for all stations (Impact, Intermediate and Reference), levels of pH and DO complied with the WQOs (*Figures 16-18 of Annex B*). Levels of Salinity complied with WQO at all stations, except at Intermediate station (*Figure 19 of Annex B*). Levels of DO and Turbidity within the reporting month complied with the Action and Limit Levels set in the *EM&A Manual* (1) (*Figures 17, 18, 20 of Annex B*). All *in-situ* water quality measurements showed relatively minor variations between Impact, Intermediate and Reference stations (*Figures 16 to 20* of *Annex B*).

Laboratory Measurements

1.5.26 Analyses of August 2012 results indicate that majority of metal concentrations (i.e. Cadmium, Mercury and Silver) were below their limit of reporting at all stations. Copper and Nickel were detected in samples from all stations. Arsenic was detected at Impact, Intermediate and Ma Wan stations while Lead was detected at Impact and Intermediate stations. Chromium was only detected at Intermediate stations while Zinc was detected at Reference and Impact stations (*Figures 21 and 22 of Annex B*). Concentration of Arsenic, Copper, Lead, Nickel and Zinc appeared to be similar amongst all stations. Levels of 5-day Biochemical Oxygen Demand (BOD_5), Total Inorganic Nitrogen (TIN) and NH_3-N also appeared to be similar amongst all stations (*Figures 23 and 24 of Annex B*). Concentrations of TSS exceed WQO (12.74 mg/L for wet season) at Intermediate and Impact Stations while all of them complied with the Action and Limit Levels at all stations within the reporting month (*Figure 25 of Annex B*).

(1) ERM (2009). Draft Second Review of the EM&A Manual. Prepared for CEDD for EM&A for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation Agreement No. CE 4/2009 (EP).

Table 1.2 ***In-situ Monitoring Results for Routine Water Quality Monitoring during August 2012***

Stations	Temp (°C)	Salinity	Turbidity (NTU)	pH	Dissolved Oxygen (%)	Dissolved Oxygen (mg L^{-1})
RFE (Reference)	28.79	21.41	8.42	7.60	73.03	5.01
IPE (Impact)	28.96	21.06	12.79	7.63	73.37	5.03
INE (Intermediate)	28.47	24.05	9.88	7.68	75.38	5.12
Ma Wan Station	29.11	22.21	6.64	7.66	80.40	5.46
WQO	*N/A*	19.27-23.56	*N/A*	*6.5-8.5*	*N/A*	>4

Note: # Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.

Table 1.3 ***Laboratory Results for Routine Water Quality Monitoring during August 2012***

Stations	As	Ag	Cd	Cr	Cu	Hg	Pb	Ni	Zn	NH_3-N	TIN	BOD_5	TSS
RFE	1.65	<LOR	<LOR	<LOR	2.13	<LOR	<LOR	2.80	5.73	0.08	0.94	0.70	10.50
IPE	2.08	<LOR	<LOR	<LOR	1.90	<LOR	0.66	2.48	5.45	0.08	0.94	0.64	19.20
INE	2.13	<LOR	<LOR	0.71	1.09	<LOR	0.55	1.98	3.23	0.06	0.72	0.88	13.93
Ma Wan Station	2.13	<LOR	<LOR	<LOR	1.25	<LOR	<LOR	2.13	2.50	0.09	0.86	0.78	9.75
											WQO of TSS		12.74

1.5.27 Overall, the results indicated that the disposal operation at CMP Va did not appear to cause any deterioration in water quality during this reporting period.

1.5.28 Water Column Profiling for CMP Va – August 2012

1.5.29 Water Column Profiling was undertaken at a total of two sampling stations in August 2012. The water quality monitoring results have been assessed for compliance with the WQOs set by EPD as presented in *Section 1.5.24* above. Graphical presentation of the monitoring results is provided in *Annex B*.

In-situ Measurements

1.5.30 Analyses of results for August 2012 indicated that levels of Salinity, pH and Dissolved Oxygen (DO) all complied with the WQOs at both Upstream and Downstream stations (*Figures 26, 27 and 28 of Annex B*). DO and Turbidity complied with the Action and Limit Levels set in the *EM&A Manual* (1).

(1) ERM (2009). Draft Second Review of the EM&A Manual. Prepared for CEDD for EM&A for Contaminated Mud Pit at Sha Chau (2009-2013) – Investigation Agreement No. CE 4/2009 (EP).

Laboratory Measurements for Total Suspended Solids (TSS)

1.5.31 Analyses of data obtained in August 2012 indicated that the TSS levels at Upstream and Downstream stations complied with the WQO (*Figure 29 of Annex B*). TSS levels measured in August 2012 complied with the Action and Limit Levels set in the *EM&A Manual*.

1.5.32 Overall, the results indicated that the mud disposal operation at CMP Va did not appear to cause any deterioration in water quality during this reporting period.

1.5.33 Demersal Trawling for CMP Va – August 2012

Abundance and Biomass

1.5.34 Demersal Trawling was undertaken at a total of six sampling stations in August 2012. The average number of species collected is presented in *Table 1.4*. In August 2012, species richness was relatively similar between Impact and Reference stations.

Table 1.4 Summary of the Mean Number of Faunal Species Caught during August 2012 Monitoring

Date of Sampling	Impact Stations		Reference Stations			
	INA	INB	TNA	TNB	TSA	TSB
August 2012	43.4	45.0	42.4	42.2	47.4	42.4

1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

1.6.1 The following monitoring programmes will be conducted in the next monthly period of September 2012:

CMP V

- *Pit Specific Sediment Chemistry* for CMP Va;
- *Water Column Profiling* for CMP Va; and
- *Impact Water Quality Monitoring during Dredging Operations* for CMP Vd.

1.6.2 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 A1 - East of Sha Chau Environmental Monitoring and Audit Sampling Schedule for CMP IV (January 2012 - December 2013)

		2012												2013											
Tissue/ Whole Body Sampling		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Near-Pit Stations																									
	INA		*																						
	INB		*																						
Reference North																									
	TNA		*																						
	TNB		*																						
Reference South																									
	TSA		*																						
	TSB		*																						
Demersal Trawling		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Near Pit Stations																									
	INA 1-5	*	*																						
	INB 1-5	*	*																						
Reference North																									
	TNA 1-5	*	*																						
	TNB 1-5	*	*																						
Reference South																									
	TSA 1-5	*	*																						
	TSB 1-5	*	*																						
Capping		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Ebb Tide																									
Impact Station Downcurrent																									
	IPE1		*				*		*				*												
	IPE2		*				*		*				*												
	IPE3		*				*		*				*												
	IPE4		*				*		*				*												
	PFC1		*				*		*				*												
Intermediate Station Downcurrent																									
	INE1		*				*		*				*												
	INE2		*				*		*				*												
	INE3		*				*		*				*												
	INE4		*				*		*				*												
	INE5		*				*		*				*												
Reference Station Upcurrent																									
	RFE1		*				*		*				*												
	RFE2		*				*		*				*												
	RFE3		*				*		*				*												
	RFE4		*				*		*				*												
	RFE5		*				*		*				*												
Flood Tide																									
Impact Station Downcurrent																									
	INF1		*				*		*				*												
	PFC2		*				*		*				*												
	INF3		*				*		*				*												
Intermediate Station Downcurrent																									
	IPF1		*				*		*				*												
	IPF2		*				*		*				*												
	IPF3		*				*		*				*												
Reference Station Upcurrent																									
	RFF1		*				*		*				*												
	RFF2		*				*		*				*												
	RFF3		*				*		*				*												
Water Column Profiling		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Plume Stations	WCP1	*																							
	WCP2	*																							
Benthic Recolonisation Studies		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Capped Contaminated Mud Pits III																									
CPA	1 grab per station								*				*								*				*
CPB	1 grab per station								*				*								*				*
CPC	1 grab per station								*				*								*				*
Reference Stations																									
RBA	1 grab per station								*				*								*				*
RBB	1 grab per station								*				*								*				*
RBC	1 grab per station								*				*								*				*

"*" = Number of replicates depends on field catch or parameters

Sampling completed

Sampling to be completed

Annex A2 - East of Sha Chau Environmental Monitoring and Audit Sampling Schedule for CMP V (January 2012 - February 2014)

Pit Specific Sediment Chemistry	Code	2012 J	F	M	A	M	J	J	A	S	O	N	D	2013 J	F	M	A	M	J	J	A	S	O	N	D	2014 J	F
Active-Pit																											
	ESC-NPDA		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
	ESC-NPDB		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
Pit-Edge																											
	ESC-NEDA		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
	ESC-NEDB		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
Near-Pit																											
	ESC-NNDA		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
	ESC-NNDB		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								

Cumulative Impact Sediment Chemistry		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
Near-field Stations																											
	ESC-RNA		*				*		*				*		*				*								
	ESC-RNB		*				*		*				*		*				*								
Mid-field Stations																											
	ESC-RMA		*				*		*				*		*				*								
	ESC-RMB		*				*		*				*		*				*								
Capped Pit Stations																											
	ESC-RCA		*				*		*				*		*				*								
	ESC-RCB		*				*		*				*		*				*								
Far-Field Stations																											
	ESC-RFA		*				*		*				*		*				*								
	ESC-RFB		*				*		*				*		*				*								
Ma Wan Station																											
	MW1		*				*		*				*		*				*								

Sediment Toxicity Tests		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
Near-Field Stations																											
	ESC-TDA		*						*						*												
	ESC-TDB		*						*						*												
Reference Stations																											
	ESC-TRA		*						*						*												
	ESC-TRB		*						*						*												
Ma Wan Station																											
	MW1		*						*						*												

Tissue/ Whole Body Sampling		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
Impact Stations																											
	ESC-INA								*						*												
	ESC-INB								*						*												
Reference																											
	ESC-TNA								*						*												
	ESC-TNB								*						*												
	ESC-TSA								*						*												
	ESC-TSB								*						*												

Demersal Trawling		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
Impact Stations																											
	ESC-INA							*	*					*	*												
	ESC-INB							*	*					*	*												
Reference Stations																											
	ESC-TNA							*	*					*	*												
	ESC-TNB							*	*					*	*												
	ESC-TSA							*	*					*	*												
	ESC-TSB							*	*					*	*												

Capping		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
Ebb Tide																											
Impact Station																											
	ESC-IPE1																				*				*		*
	ESC-IPE2																				*				*		*
	ESC-IPE3																				*				*		*
	ESC-IPE4																				*				*		*
	ESC-IPE5																				*				*		*
Intermediate Station																											
	ESC-INE1																				*				*		*
	ESC-INE2																				*				*		*
	ESC-INE3																				*				*		*
	ESC-INE4																				*				*		*
	ESC-INE5																				*				*		*
Reference Station																											
	ESC-RFE1																				*				*		*
	ESC-RFE2																				*				*		*
	ESC-RFE3																				*				*		*
	ESC-RFE4																				*				*		*
	ESC-RFE5																				*				*		*
Ma Wan Station																											
	MW1																				*				*		*
Flood Tide																											
Impact Station																											
	ESC-IPF1																				*				*		*
	ESC-IPF2																				*				*		*
	ESC-IPF3																				*				*		*
Intermediate Station																											
	ESC-INF1																				*				*		*
	ESC-INF2																				*				*		*
	ESC-INF3																				*				*		*
Reference Station																											
	ESC-RFF1																				*				*		*
	ESC-RFF2																				*				*		*
	ESC-RFF3																				*				*		*
Ma Wan Station																											
	MW1																				*				*		*

		2012												2013												2014	
Routine Water Quality Monitoring		**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**
Ebb Tide																											
Impact Station																											
	ESC-IPE1		*		*	*		*	*		*	*		*	*		*	*									
	ESC-IPE2		*		*	*		*	*		*	*		*	*		*	*									
	ESC-IPE3		*		*	*		*	*		*	*		*	*		*	*									
	ESC-IPE4		*		*	*		*	*		*	*		*	*		*	*									
	ESC-IPE5		*		*	*		*	*		*	*		*	*		*	*									
Intermediate Station																											
	ESC-INE1		*		*	*		*	*		*	*		*	*		*	*									
	ESC-INE2		*		*	*		*	*		*	*		*	*		*	*									
	ESC-INE3		*		*	*		*	*		*	*		*	*		*	*									
	ESC-INE4		*		*	*		*	*		*	*		*	*		*	*									
	ESC-INE5		*		*	*		*	*		*	*		*	*		*	*									
Reference Station																											
	ESC-RFE1		*		*	*		*	*		*	*		*	*		*	*									
	ESC-RFE2		*		*	*		*	*		*	*		*	*		*	*									
	ESC-RFE3		*		*	*		*	*		*	*		*	*		*	*									
	ESC-RFE4		*		*	*		*	*		*	*		*	*		*	*									
	ESC-RFE5		*		*	*		*	*		*	*		*	*		*	*									
Ma Wan Station																											
	MW1		*		*	*		*	*		*	*		*	*		*	*									
Flood Tide																											
Impact Station																											
	ESC-IPF1		*		*	*		*	*		*	*		*	*		*	*									
	ESC-IPF2		*		*	*		*	*		*	*		*	*		*	*									
	ESC-IPF3		*		*	*		*	*		*	*		*	*		*	*									
Intermediate Station																											
	ESC-INF1		*		*	*		*	*		*	*		*	*		*	*									
	ESC-INF2		*		*	*		*	*		*	*		*	*		*	*									
	ESC-INF3		*		*	*		*	*		*	*		*	*		*	*									
Reference Station																											
	ESC-RFF1		*		*	*		*	*		*	*		*	*		*	*									
	ESC-RFF2		*		*	*		*	*		*	*		*	*		*	*									
	ESC-RFF3		*		*	*		*	*		*	*		*	*		*	*									
Ma Wan Station																											
	MW1		*		*	*		*	*		*	*		*	*		*	*									

Water Column Profiling		**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**
Plume Stations	WCP1		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
	WCP2		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									

Benthic Recolonisation Studies		**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**
Capped Contaminated Mud Pits IVa-c																											
	ESC-CPA								*				*								*				*		
	ESC-CPB								*				*								*				*		
	ESC-CPC								*				*								*				*		
Reference Stations																											
	ESC-RBA								*				*								*				*		
	ESC-RBB								*				*								*				*		
	ESC-RBC								*				*								*				*		

Impact Monitoring for Dredging		**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**
Upstream/Reference Stations																											
	US1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
	US2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
Downstream/Impact Stations																											
	DS1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
	DS2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
	DS3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
	DS4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
	DS5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
Ma Wan Station																											
	MW1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								

Sampling completed

Sampling to be completed

Annex B

Monitoring Results

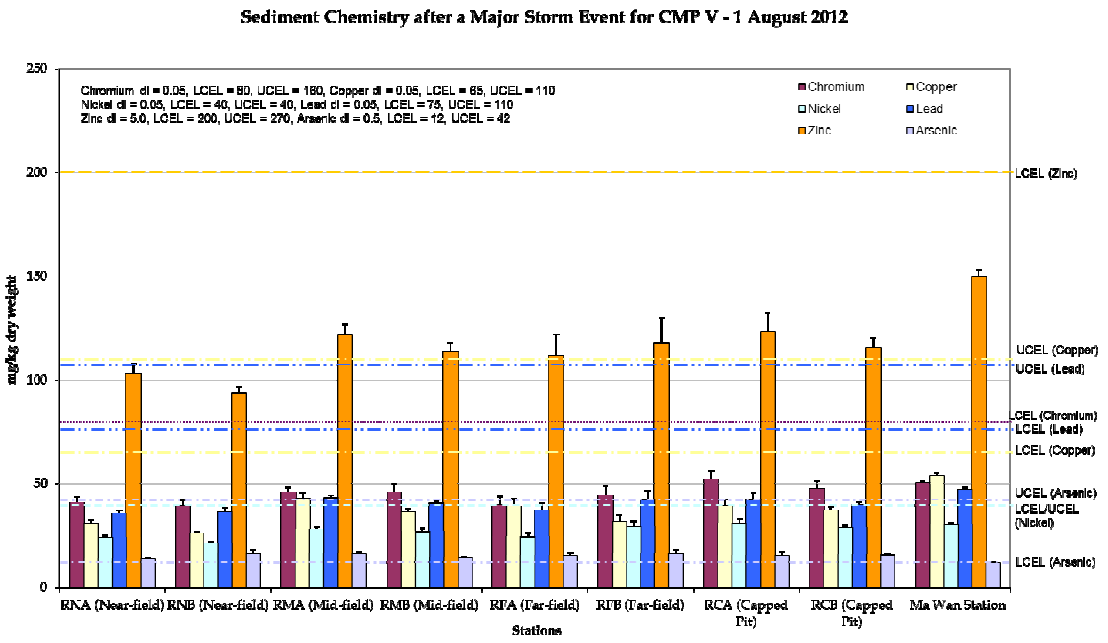

Figure 1: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mean + SD) in sediment samples collected from Sediment Chemistry after a Major Storm Event for CMP Va on 1 August 2012.

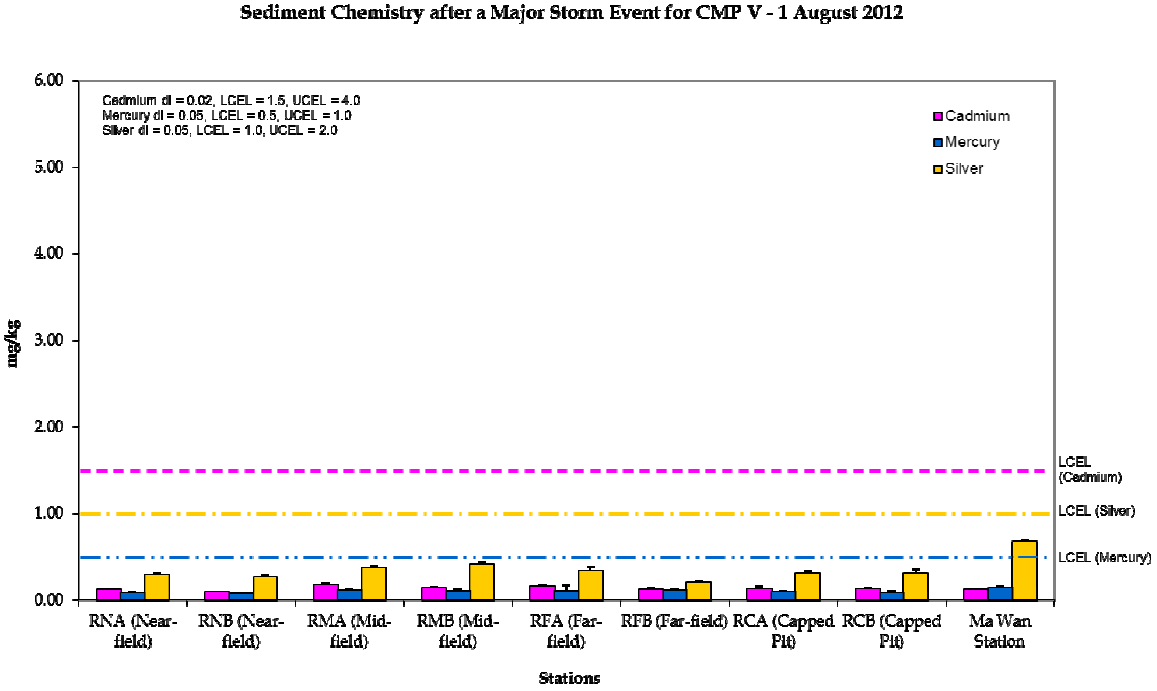

Figure 2: Concentration of Metals (Cd, Hg, Ag; mean + SD) in sediment samples collected from Sediment Chemistry after a Major Storm Event for CMP Va on 1 August 2012.

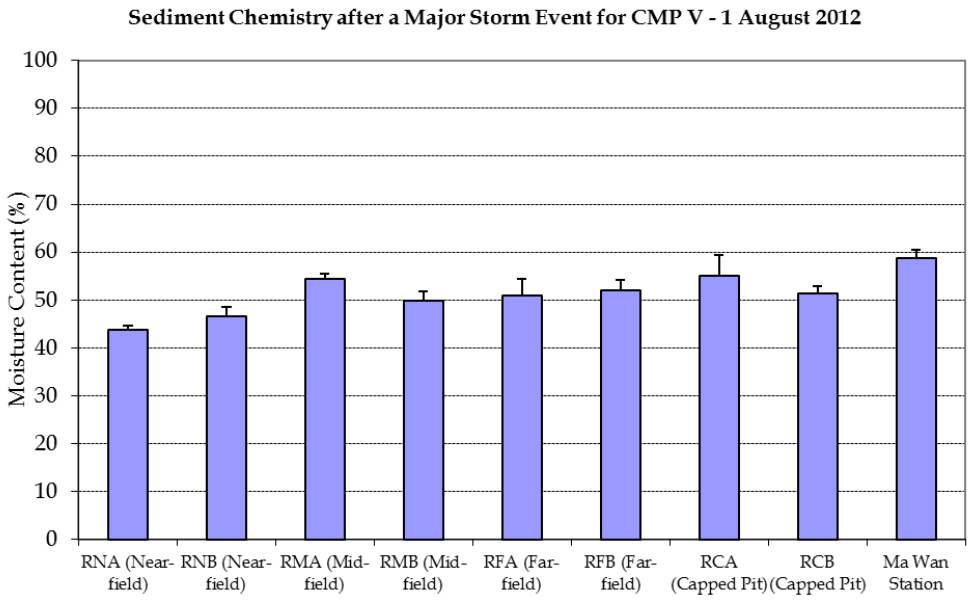

Figure 3: Moisture Content (%; mean + SD) in sediment samples collected from Sediment Chemistry after a Major Storm Event for CMP Va on 1 August 2012.

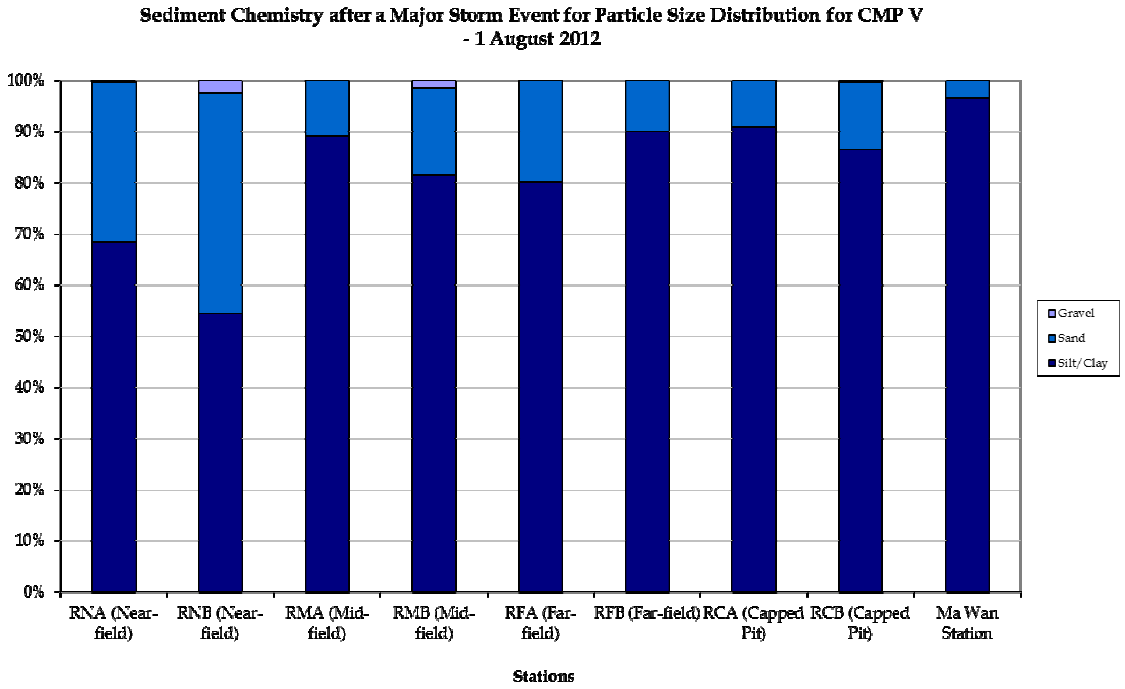

Figure 4: Particle Size Distribution in sediment samples collected from Sediment Chemistry after a Major Storm Event for CMP Va on 1 August 2012.

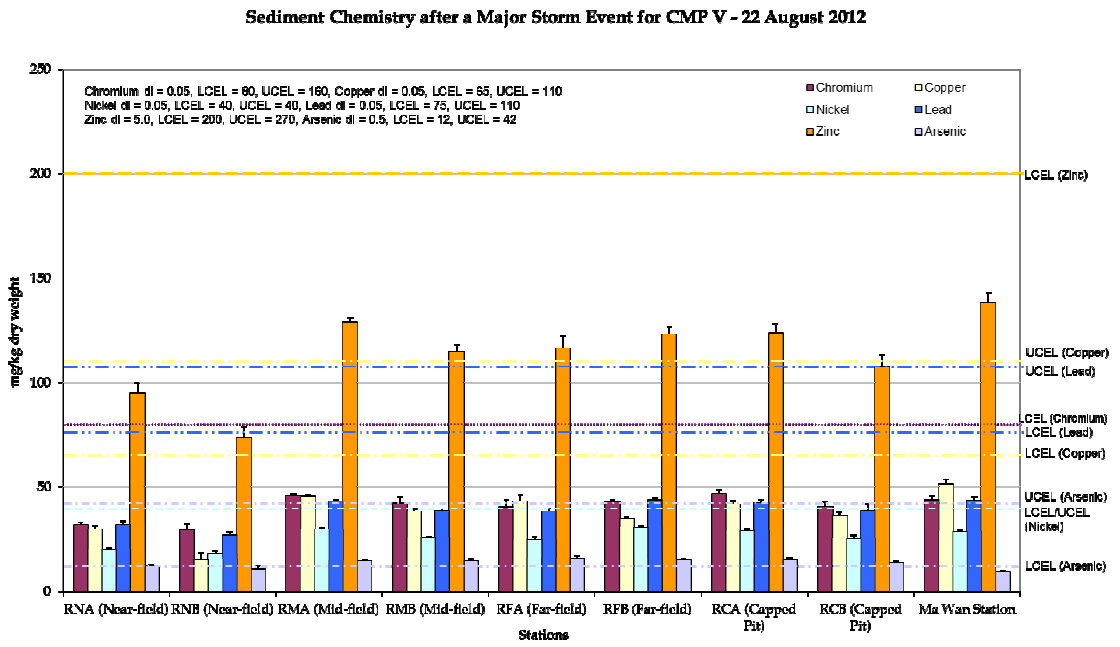

Figure 5: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mean + SD) in sediment samples collected from Sediment Chemistry after a Major Storm Event for CMP Va on 22 August 2012.

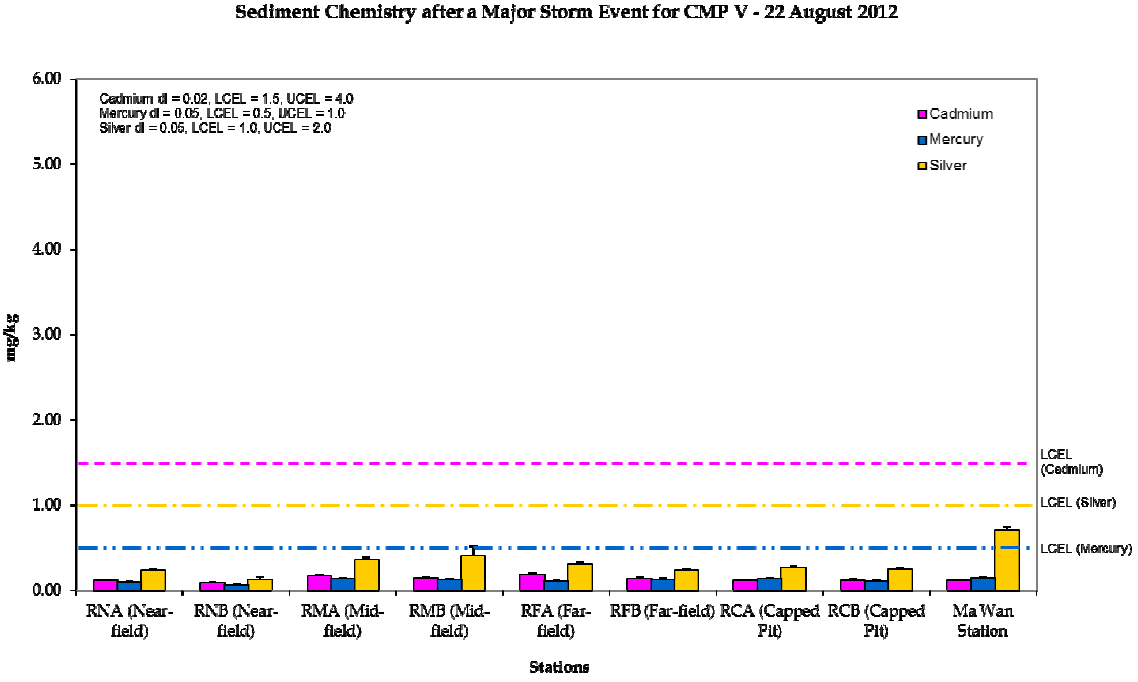

Figure 6: Concentration of Metals (Cd, Hg, Ag; mean + SD) in sediment samples collected from Sediment Chemistry after a Major Storm Event for CMP Va on 22 August 2012.

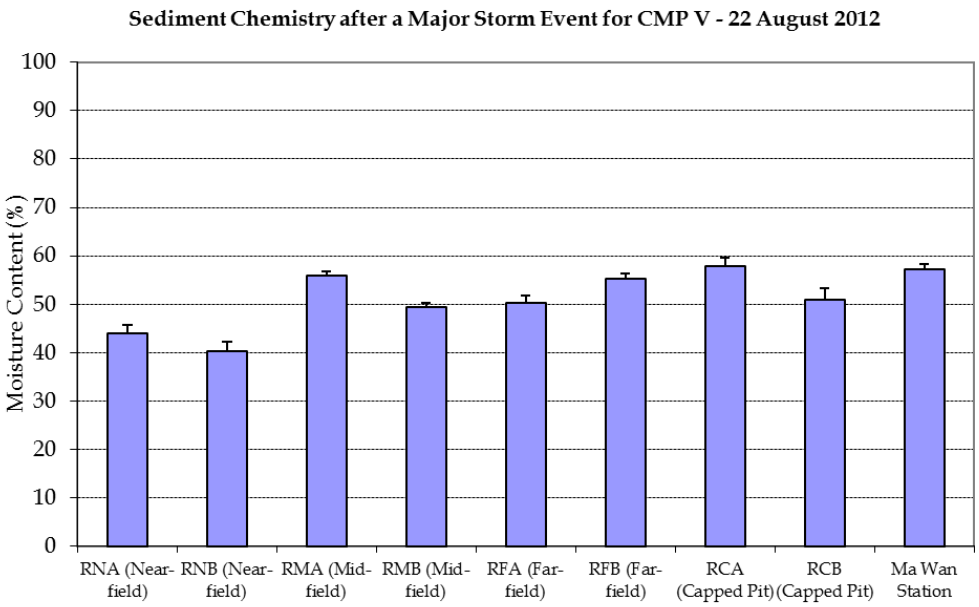

Figure 7: Moisture Content (%; mean + SD) in sediment samples collected from Sediment Chemistry after a Major Storm Event for CMP Va on 22 August 2012.

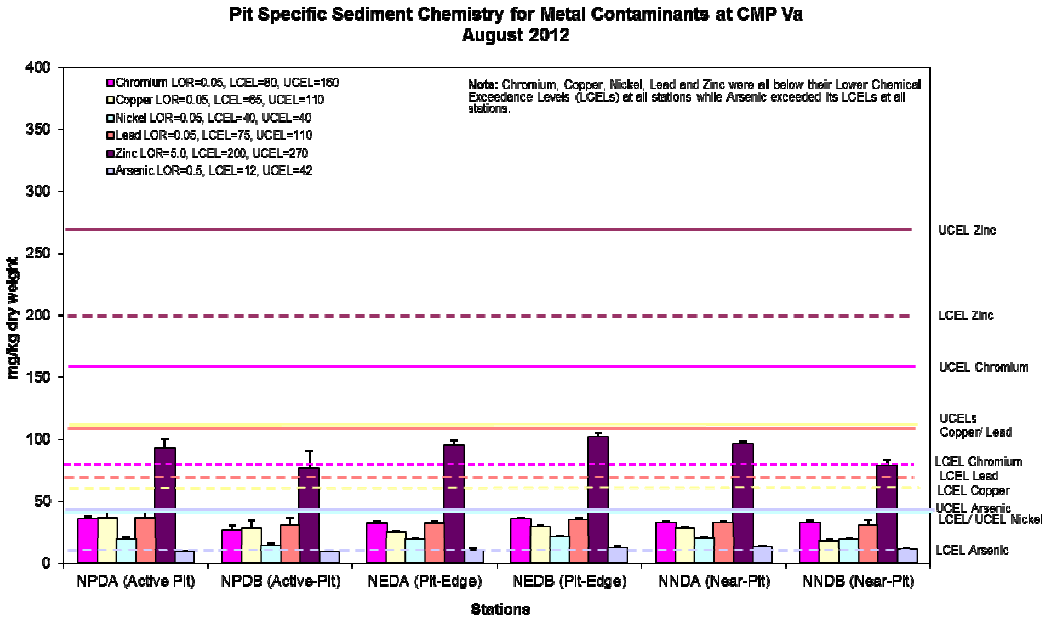

Figure 8: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP Va in August 2012.

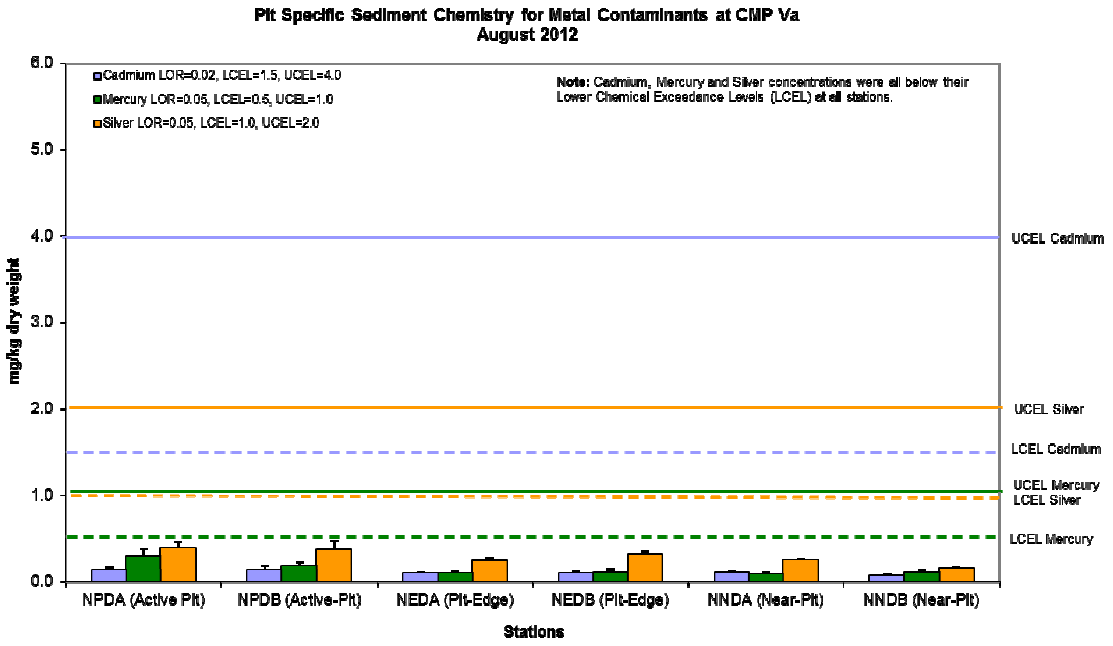

Figure 9: Concentration of Metals (Cd, Hg, Ag; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP Va in August 2012.

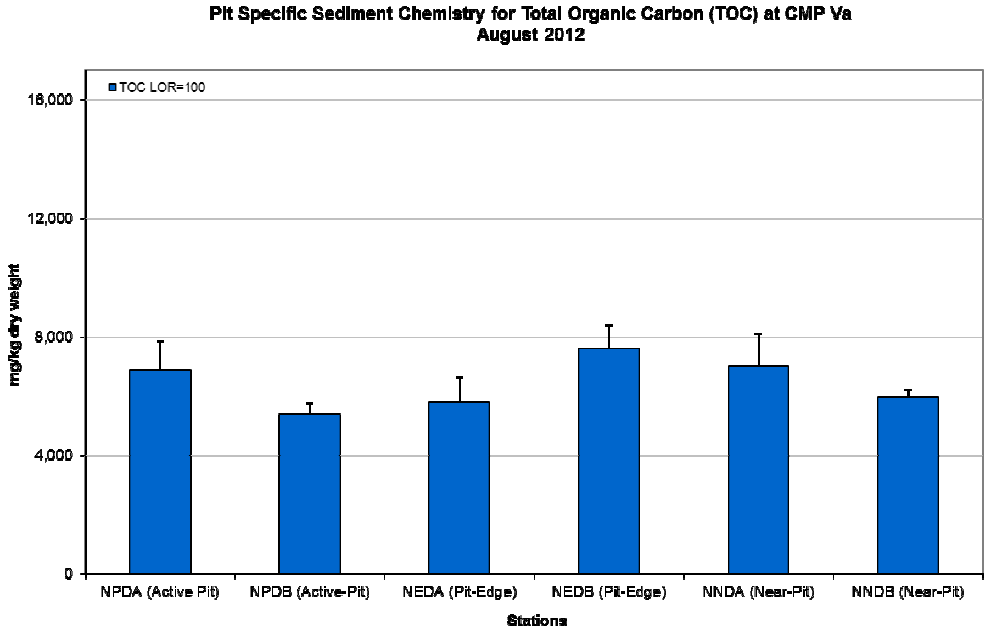

Figure 10: Concentration of Total Organic Carbon (mg/kg dry weight; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP Va in August 2012.

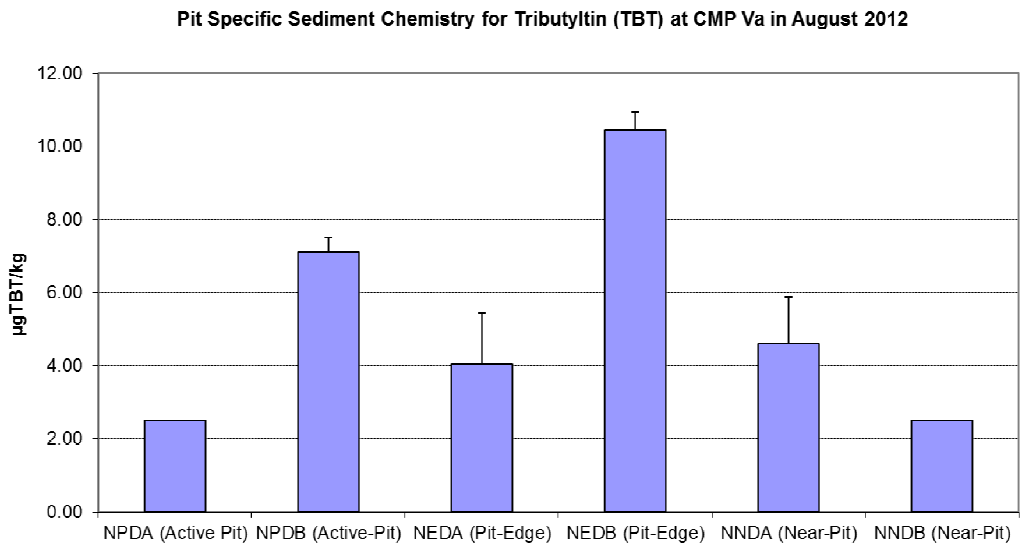

Figure 11: Concentration of Tributyltin (µg TBT/kg; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring of CMP Va in August 2012.

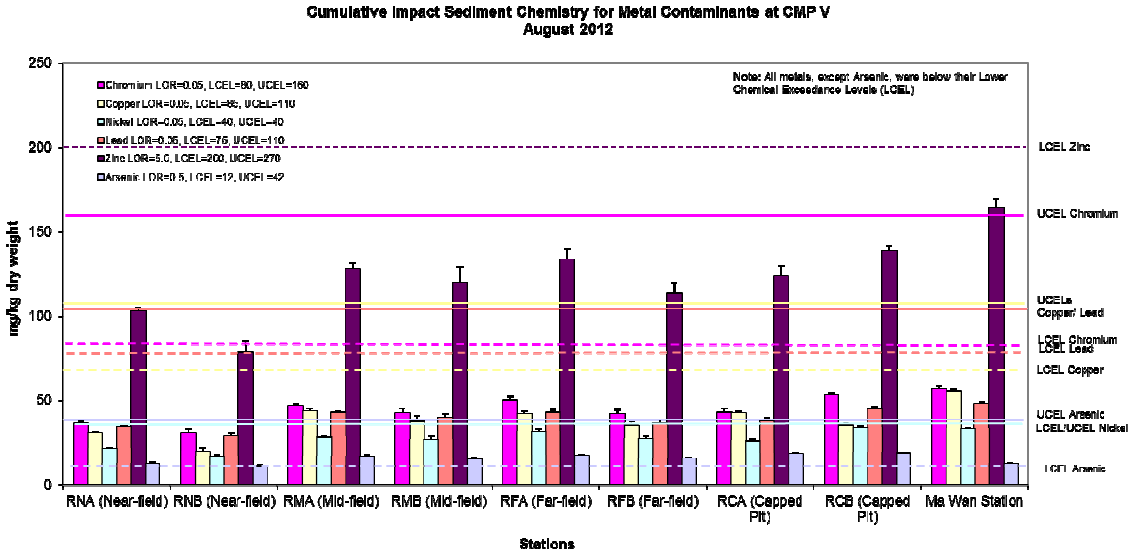

Figure 12: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mean + SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for CMP Va in August 2012.

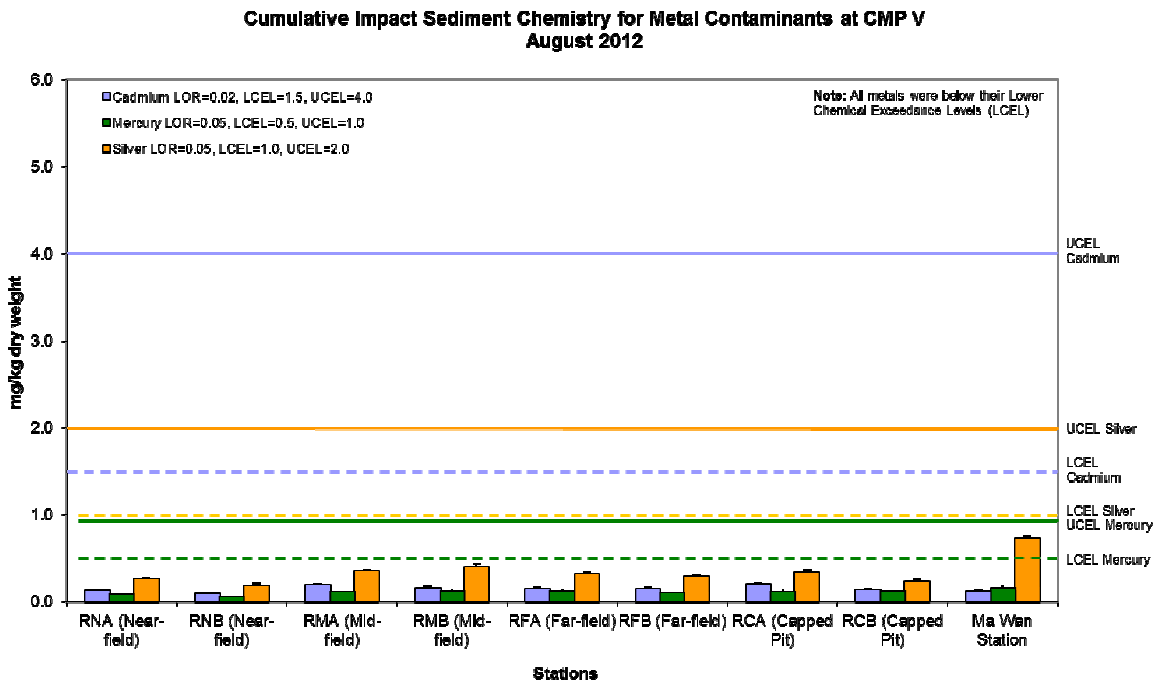

Figure 13: Concentration of Metals (Cd, Hg, Ag; mean + SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring of CMP Va in August 2012.

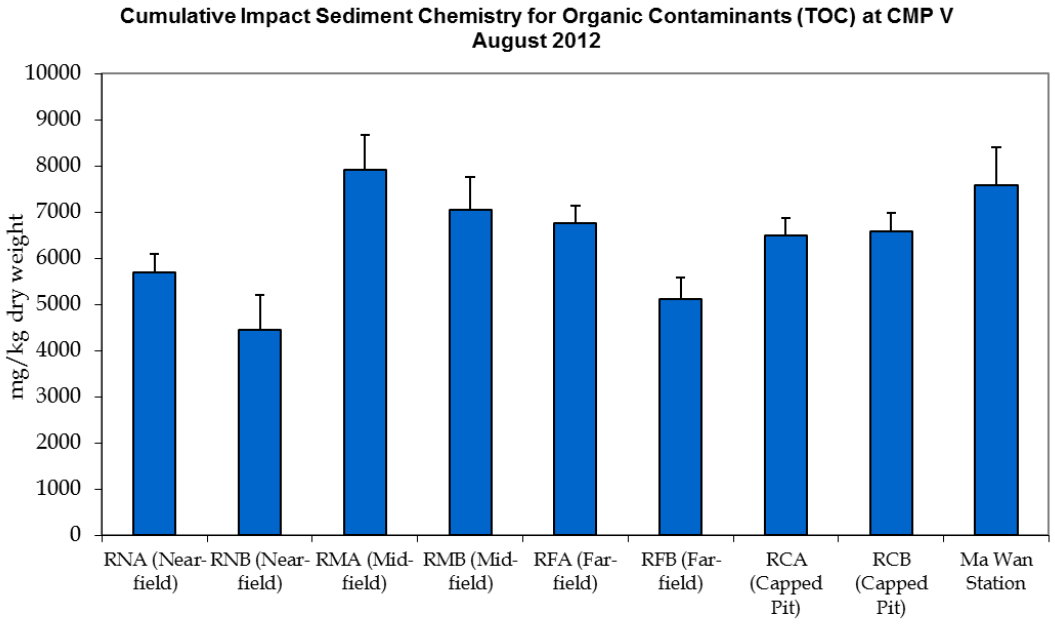

Figure 14: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean + SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring of CMP Va in August 2012.

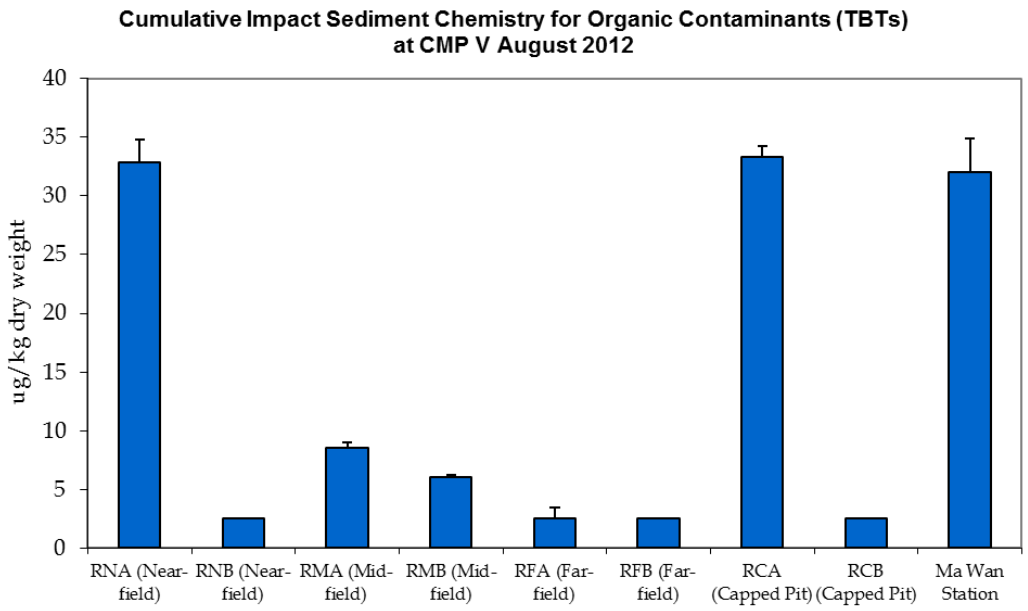

Figure 15: Concentration of Tributyltin (µg TBT/kg; mean + SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring of CMP Va in August 2012.

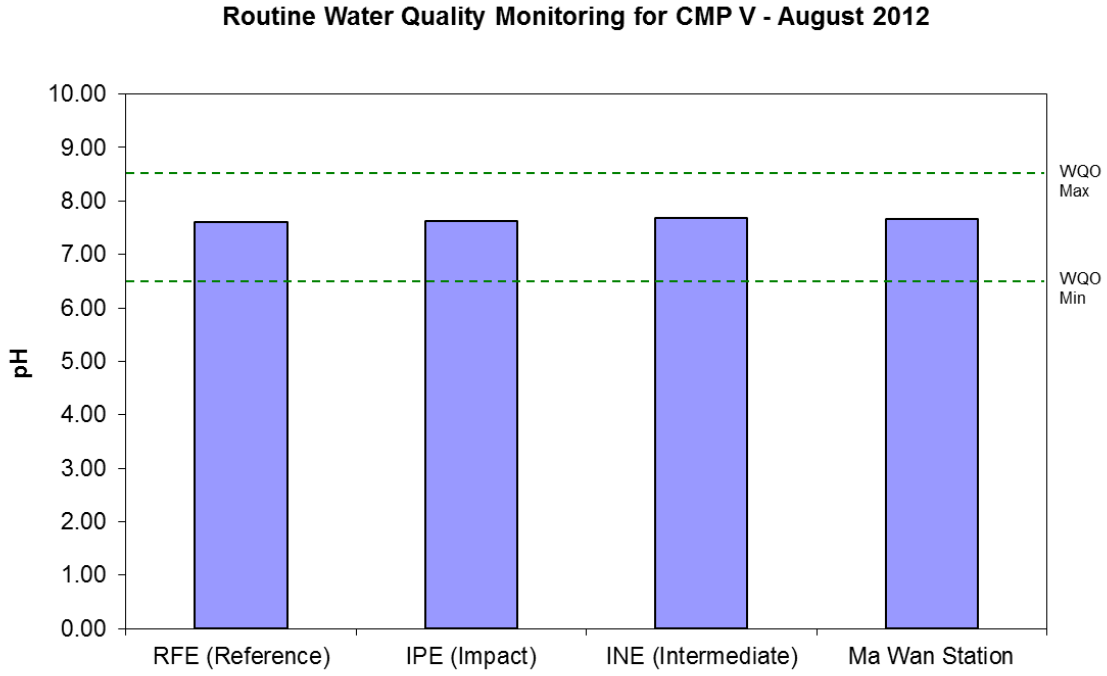

Figure 16: Level of pH (mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP Va in August 2012.

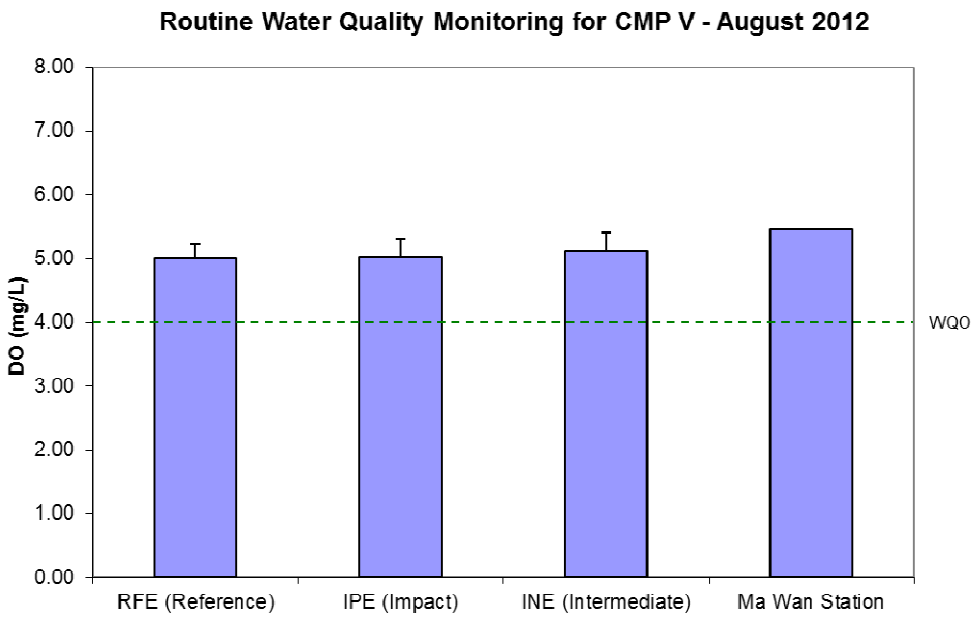

Figure 17: Concentration of Dissolved Oxygen (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP Va in August 2012.

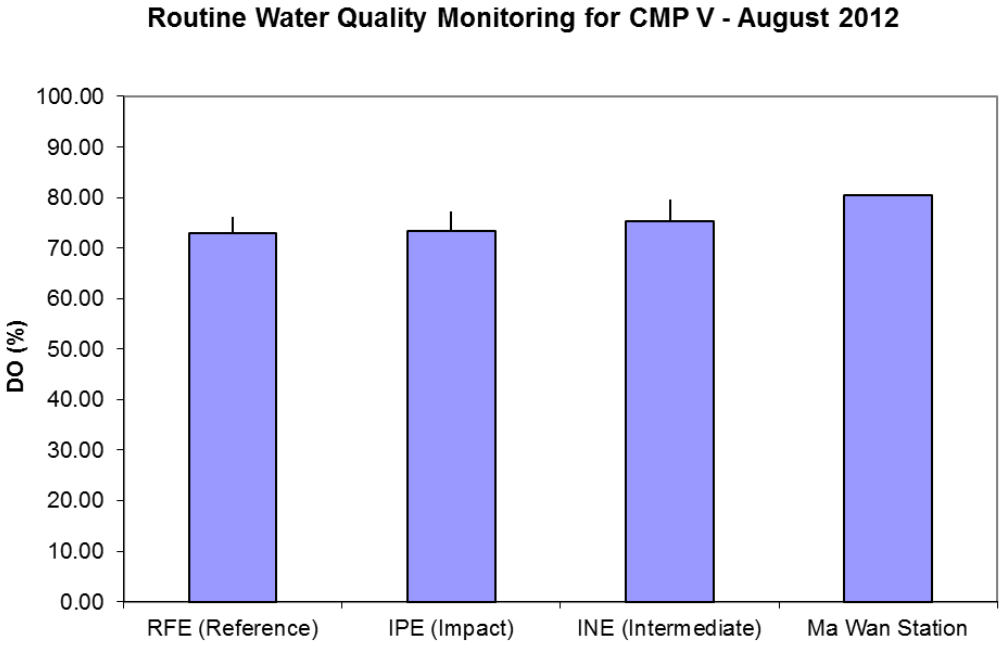

Figure 18: Level of Dissolved Oxygen (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP Va in August 2012.

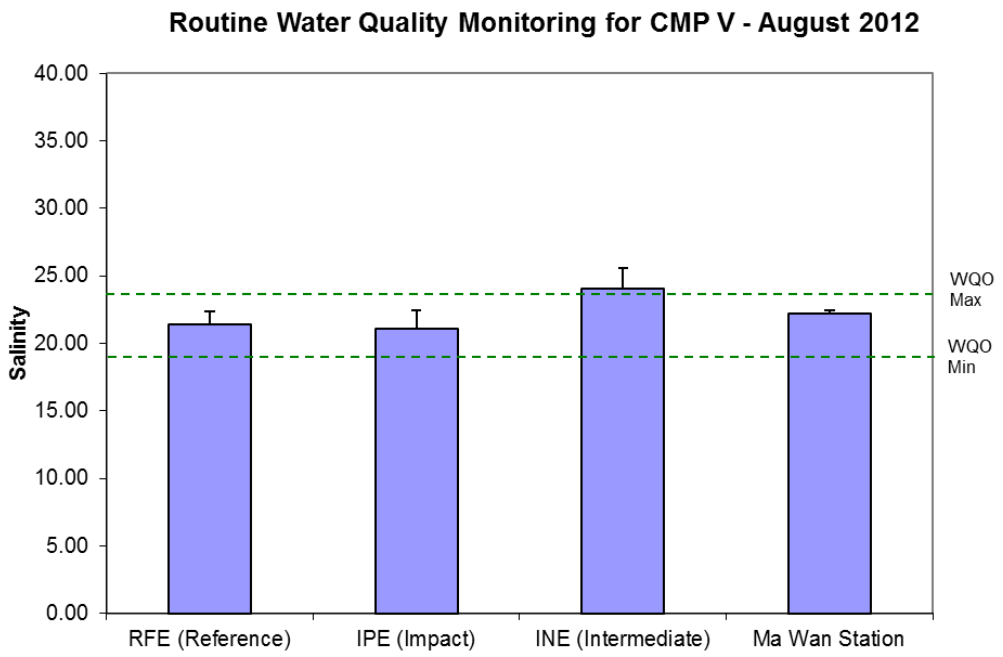

Figure 19: Level of Salinity (mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP Va in August 2012.

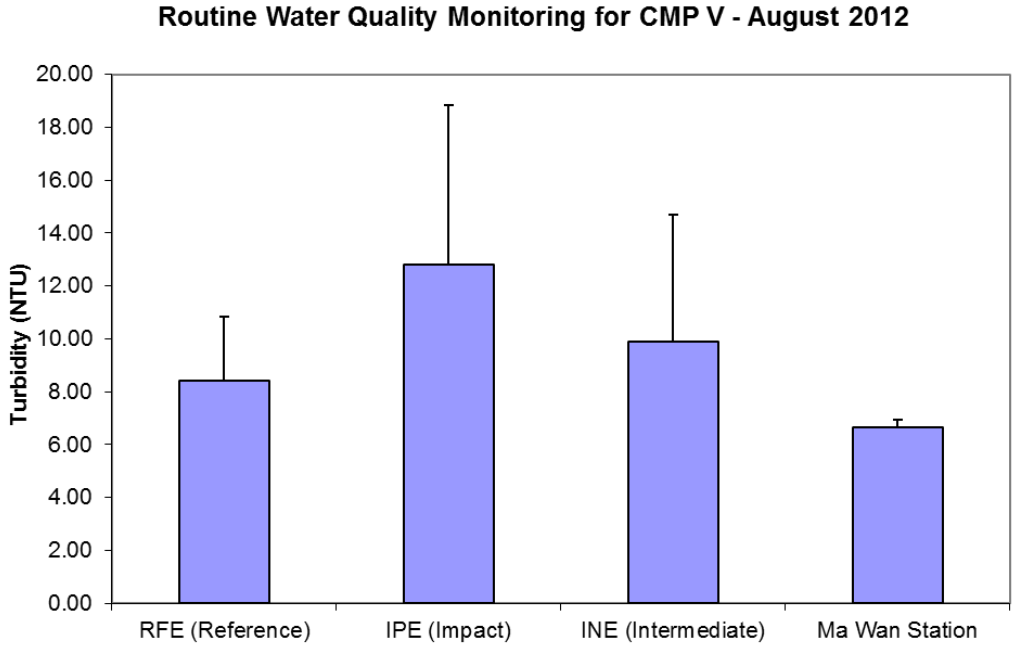

Figure 20: Level of Turbidity (NTU; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at CMP Va in August 2012.

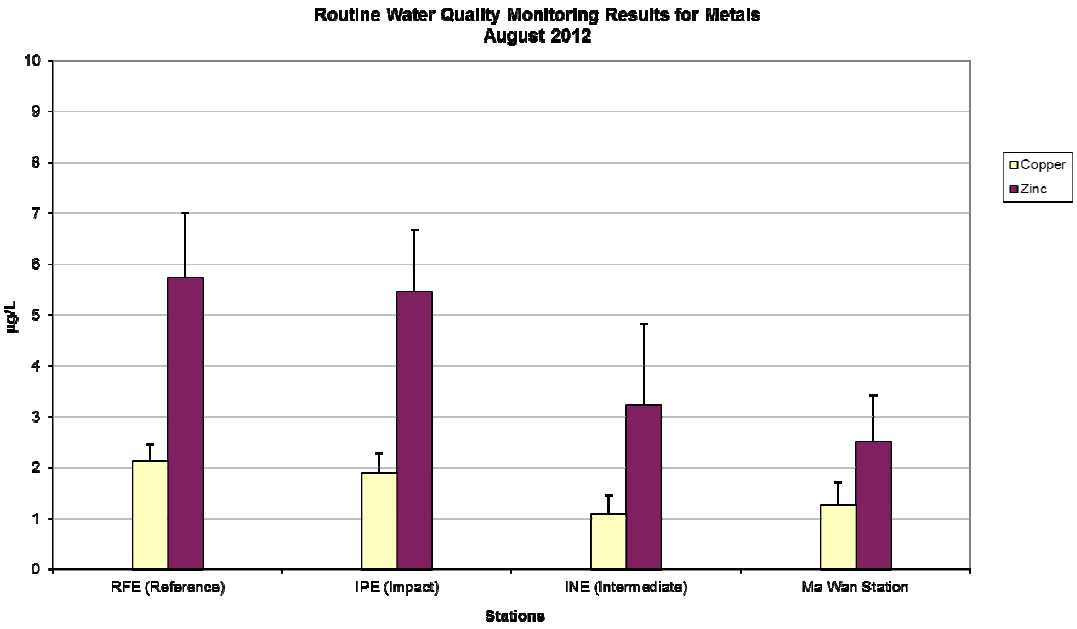

Figure 21: Concentration of Copper and Zinc (mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP Va in August 2012.

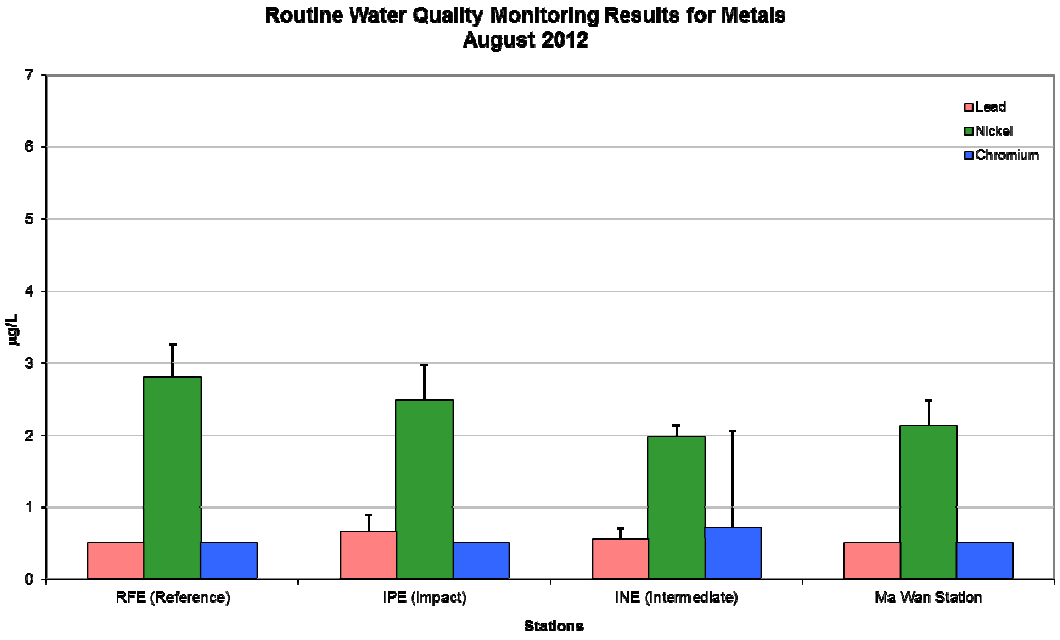

Figure 22: Concentration of Lead, Nickel and Chromium (mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP Va in August 2012.

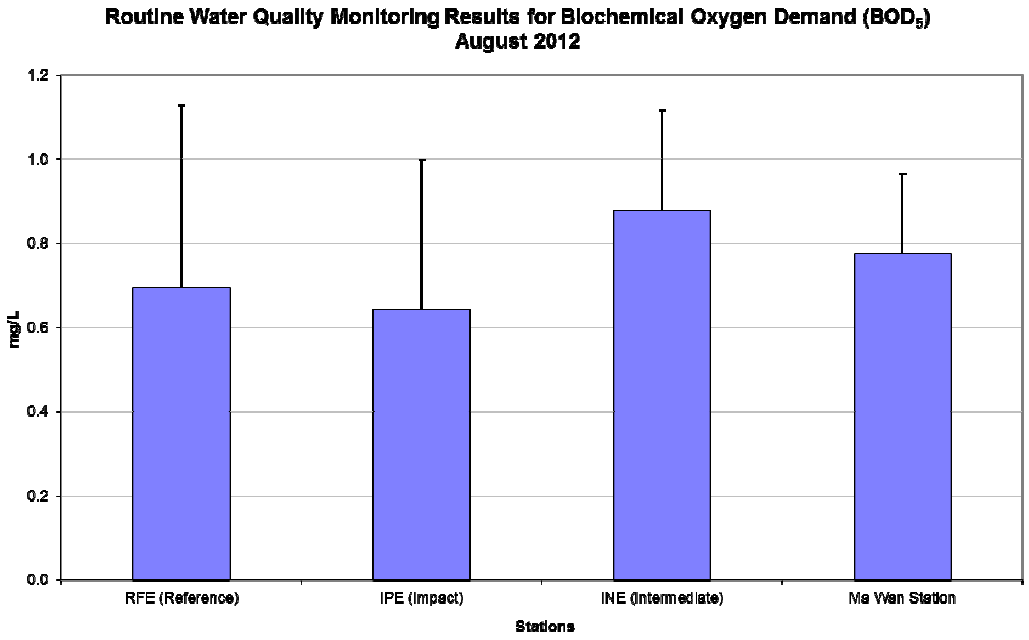

Figure 23: Level of Biochemical Oxygen Demand (BOD_5; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP Va in August 2012.

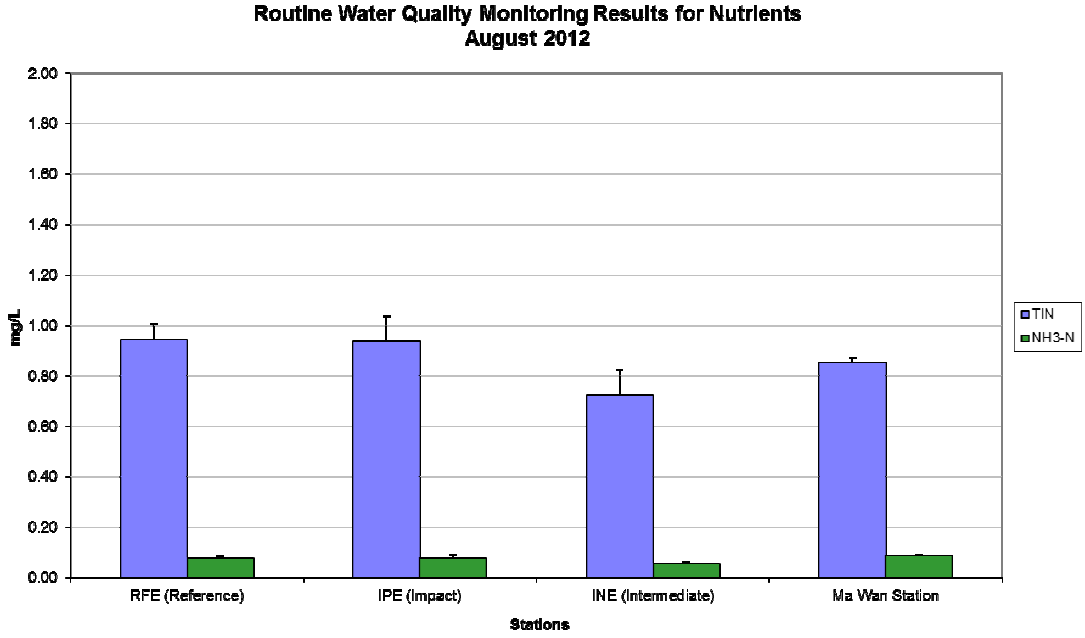

Figure 24: Concentration of Total Inorganic Nitrogen and NH_3-N (mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP Va in August 2012.

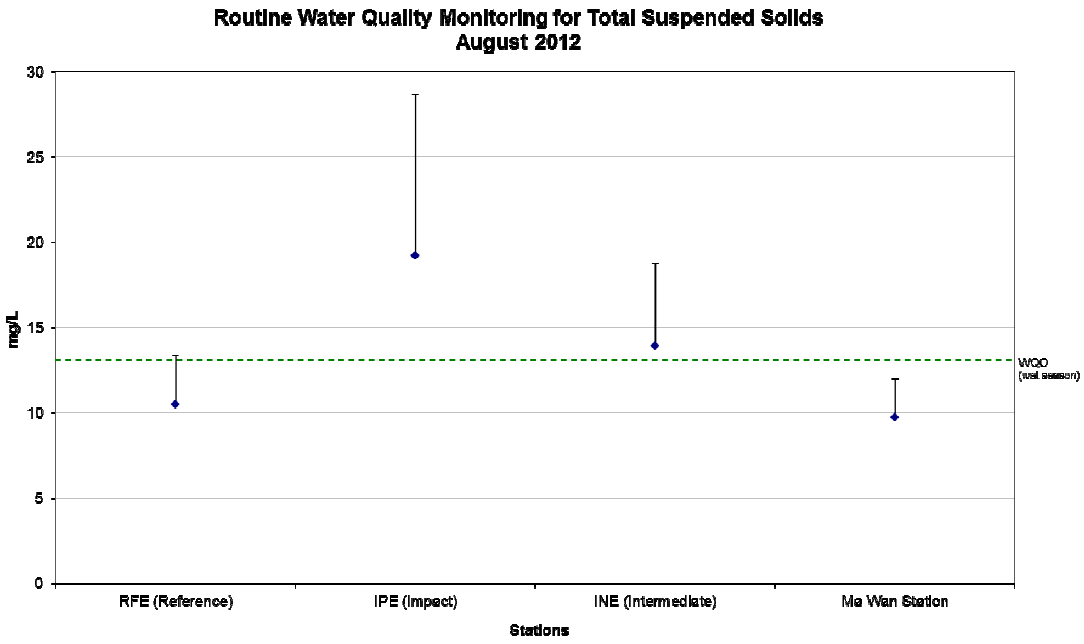

Figure 25: Concentration of Total Suspended Solids (mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at CMP Va in August 2012.

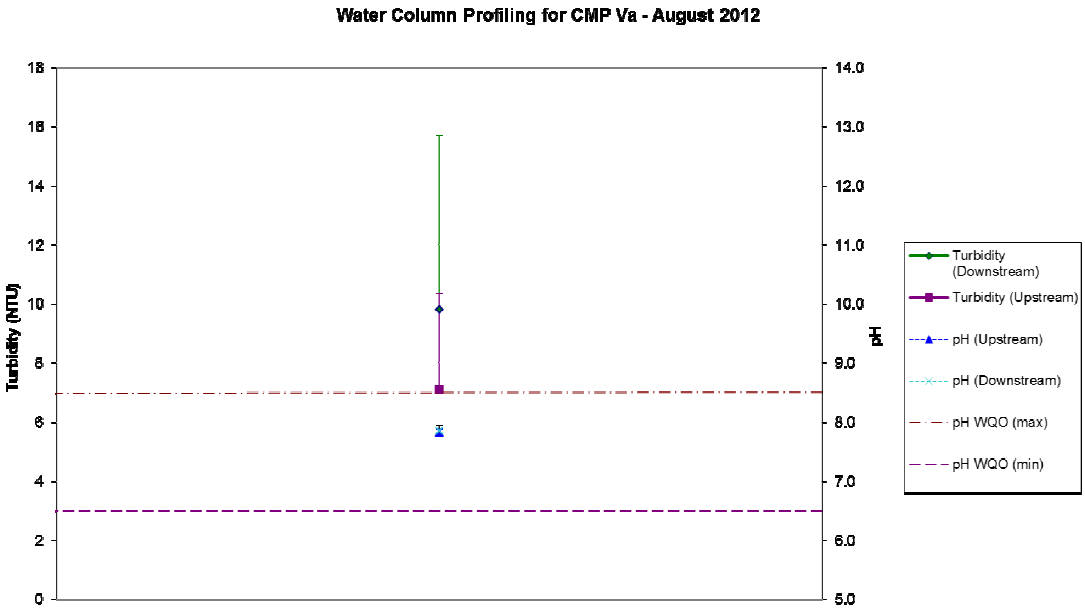

Figure 26: Turbidity and pH (mean + SD) recorded during Water Column Profiling for disposal operation at CMP Va in August 2012.

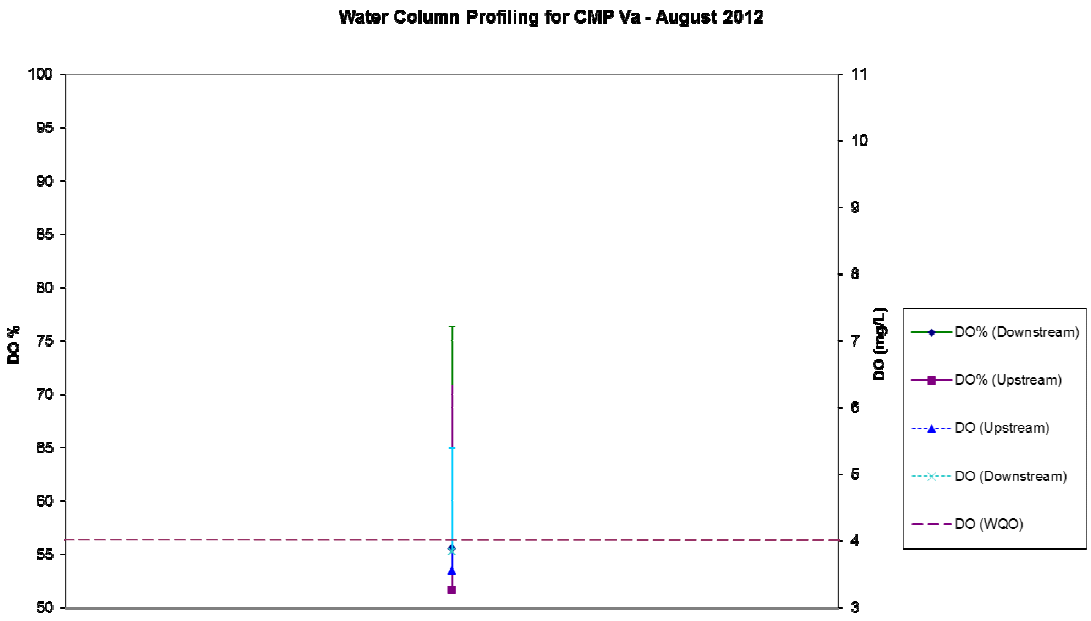

Figure 27: Dissolved Oxygen (mean + SD) recorded during Water Column Profiling for disposal operations at CMP Va in August 2012.

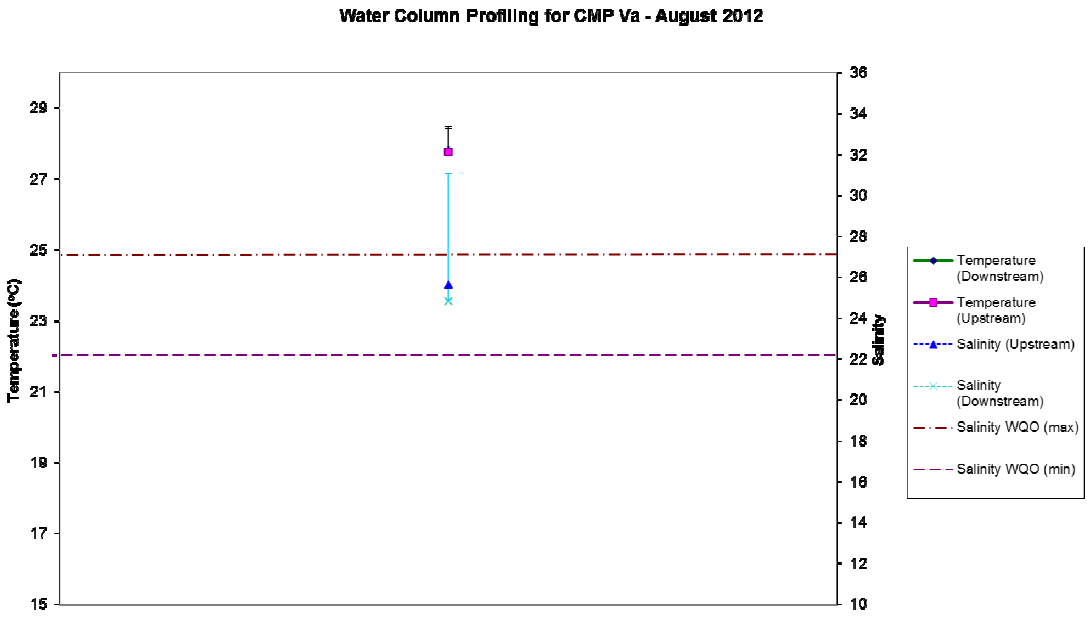

Figure 28: Salinity and Temperature (mean + SD) recorded during Water Column Profiling for disposal operations at CMP Va in August 2012.

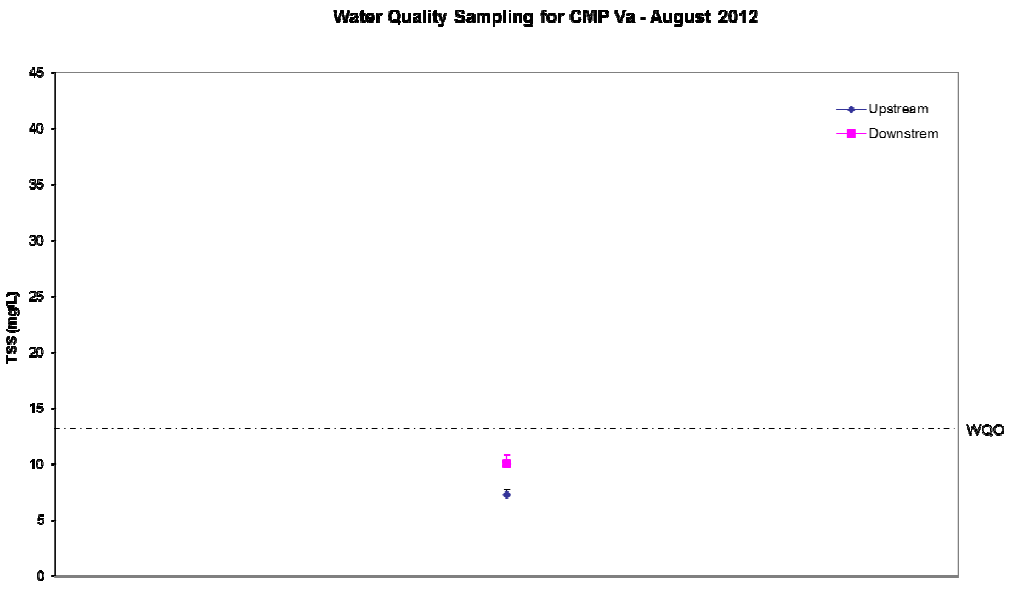

Figure 29: Total Suspended Solids (mean + SD) recorded during Water Column Profiling for disposal operations at CMP Va in August 2012.

Annex C

Results of Impact Monitoring during CMP Vd Dredging Operations for August 2012

Table C1 Summary Table of DO, Turbidity and TSS Levels Recorded in August 2012

Sampling Date	Tidal Period	Station	Average DO Levels (mg/L)		Average Turbidity Level (NTU)	Average TSS Level (mg/L)
			Bottom	Surface and Mid Depth		
2012/08/29	ME	DS1	5.11	5.66	7.71	9.33
		DS2	5.11	5.68	8.63	9.50
		DS3	4.88	5.62	11.21	10.83
		DS4	5.26	5.70	8.24	9.83
		DS5	6.13	6.30	6.50	6.17
		MW1	4.59	5.37	5.87	6.67
		US1	4.77	5.56	8.44	8.17
		US2	4.54	5.59	7.08	11.17
	MF	DS1	4.39	5.62	12.54	12.83
		DS2	4.42	5.64	30.05	21.33
		DS3	3.91	5.20	14.85	14.33
		DS4	3.88	5.04	11.06	9.67
		DS5	4.77	5.54	9.16	10.33
		MW1	4.47	4.73	10.47	11.17
		US1	4.41	5.49	13.28	15.17
		US2	4.67	5.54	11.94	12.33

Notes:

1. Cell shaded yellow indicated value exceeding the Action Level criteria.
2. Cell shaded red indicated value exceeding the Limit Level criteria.
3. DO for Surface and Mid-depth: less than 3.76 mg L^{-1} (Action Level); less than 3.11 mg L^{-1} (Limit Level)
   DO for Bottom: less than 2.96 mg L^{-1} (Action Level); less than 2 mg L^{-1} (Limit Level)
   Depth-average Turbidity: greater than 28.14 NTU(Action Level); greater than 38.32 NTU(Limit Level)
   Depth-average SS: greater than 37.88 mg L^{-1} (Action Level); greater than 61.92 mg L^{-1} (Limit Level)

Annex D

Study Programme

ID	Task Name
1	**Project Commencement**
2	
3	**For CMP IV and New Facility at East Sha Chau**
4	
5	Submission of Draft Inception Report & Draft Programme
6	Submission of Final Inception Report & Final Programme
7	Submission of Draft Operations Manual
8	Submission of Final Operations Manual
9	**Submission of Operations Manual Updates**
17	Submission of Draft Monitoring And Audit Manual (Rev 1)
18	Submission of Final Monitoring And Audit Manual (Rev 1)
19	Submission of Draft Monitoring And Audit Manual (Rev 2)
20	Submission of Final Monitoring And Audit Manual (Rev 2)
21	**Submission of EM&A Manual Updates**
29	
30	**Monitoring Contract Works**
31	Prepare Draft Letters of Invitation, Gazette Documents & Tender Documents
32	Submission of Draft Tender Documents
33	Submission of Draft Gazette Documents
34	Submission of Final Tender Documents
35	Submission of Final Gazette Documents
36	Tendering and Tender Assessment
37	Prepare Contact Documents
38	Submission of Contract Documents
39	Administrate and Supervise Contracted Field and Laboratory Works
40	**Submission of Report on Dredging & Capping Operations**
49	**Monthly Progress Report**
101	**Quarterly EM&A Reports**
115	**Submission of Annual Review Report**
120	**Submission of Annual Risk Assessment Report**
125	**Submission of Draft Final Report**
126	**Submission of the Final Report**
127	**Submission of Draft Executive Summary Report**
128	**Submission of Final Executive Summary Reports**
129	
130	**For East Tung Lung Chau Disposal Facility**
131	
132	**Submission of Monitoring Results & Monthly EM&A Progress Report**
133	October 2009
134	November 2009
135	December 2009
136	January 2010

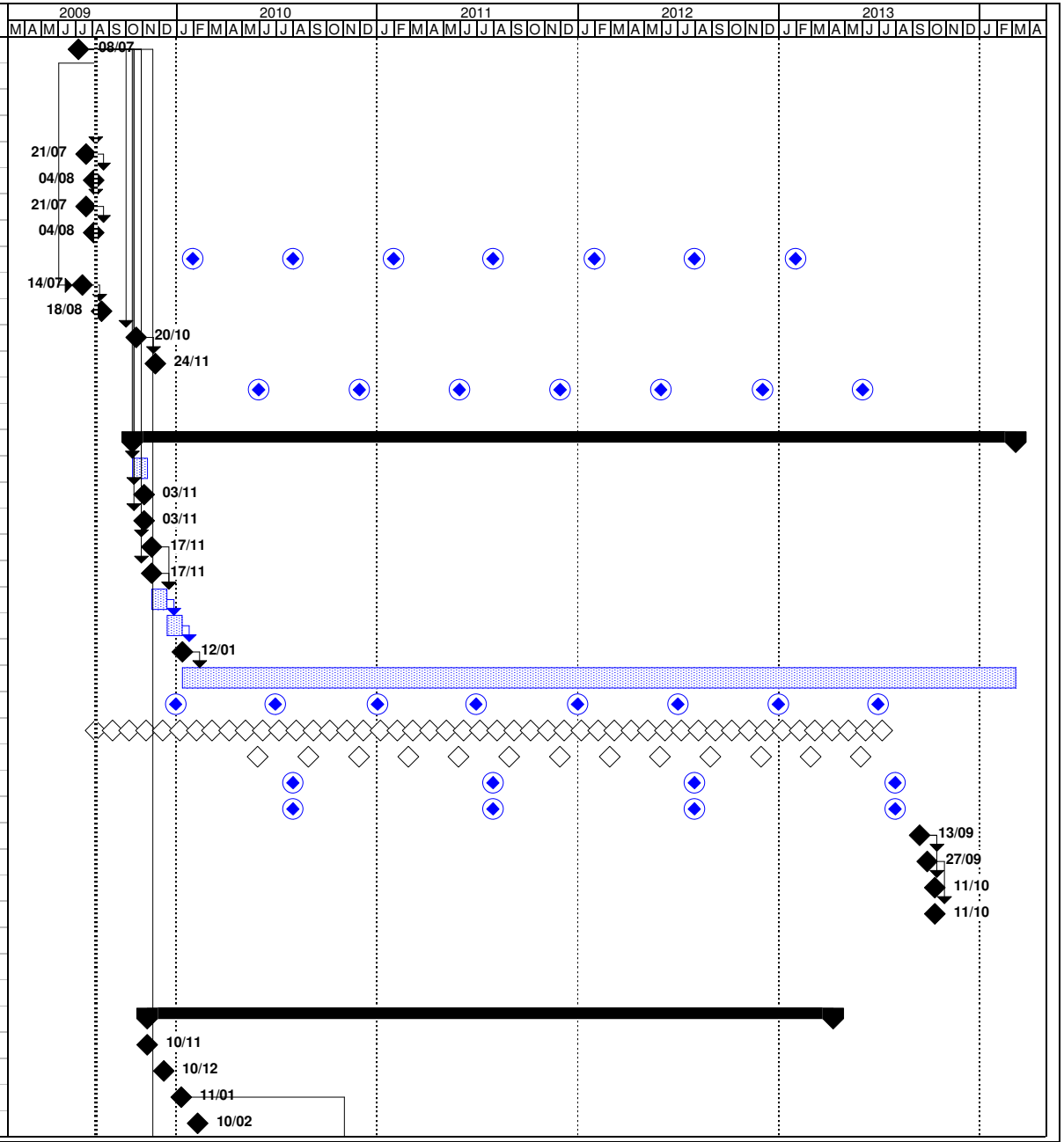

Figure 4.1 - Study Programme

Task | Milestone | Rolled Up Task
Progress | Summary | Rolled Up Milestone

Project: Agreement No. CE 4/2009 (EP) Environmental Monitoring and Audit for Contaminated Mud Pits at Sha Chau (2009-2013) - Investigation

ID	Task Name
137	February 2010
138	March 2010
139	October 2010
140	November 2010
141	December 2010
142	January 2011
143	February 2011
144	March 2011
145	October 2011
146	November 2011
147	December 2011
148	January 2012
149	February 2012
150	March 2012
151	October 2012
152	November 2012
153	December 2012
154	January 2013
155	February 2013
156	March 2013
157	**Submission of Initial Review Report**
158	**Submission of Quarterly EM&A Report**
159	Quarter 1 2010
160	Quarter 2 2010
161	Quarter 3 2011
162	Quarter 4 2011
163	Quarter 5 2012
164	Quarter 2 2012
165	Quarter 1 2013
166	**Submission of Annual Report**
167	Annual Report 1 2010
168	Annual Report 2 2011
169	Annual Report 3 2012
170	
171	**Alternative / Modified Capping Design**
172	
173	**Submission of Investigation Report**
174	**Submission of Annual Report**
175	Capping Design Annual Report 2010
176	Capping Design Annual Report 2011
177	Capping Design Annual Report 2012

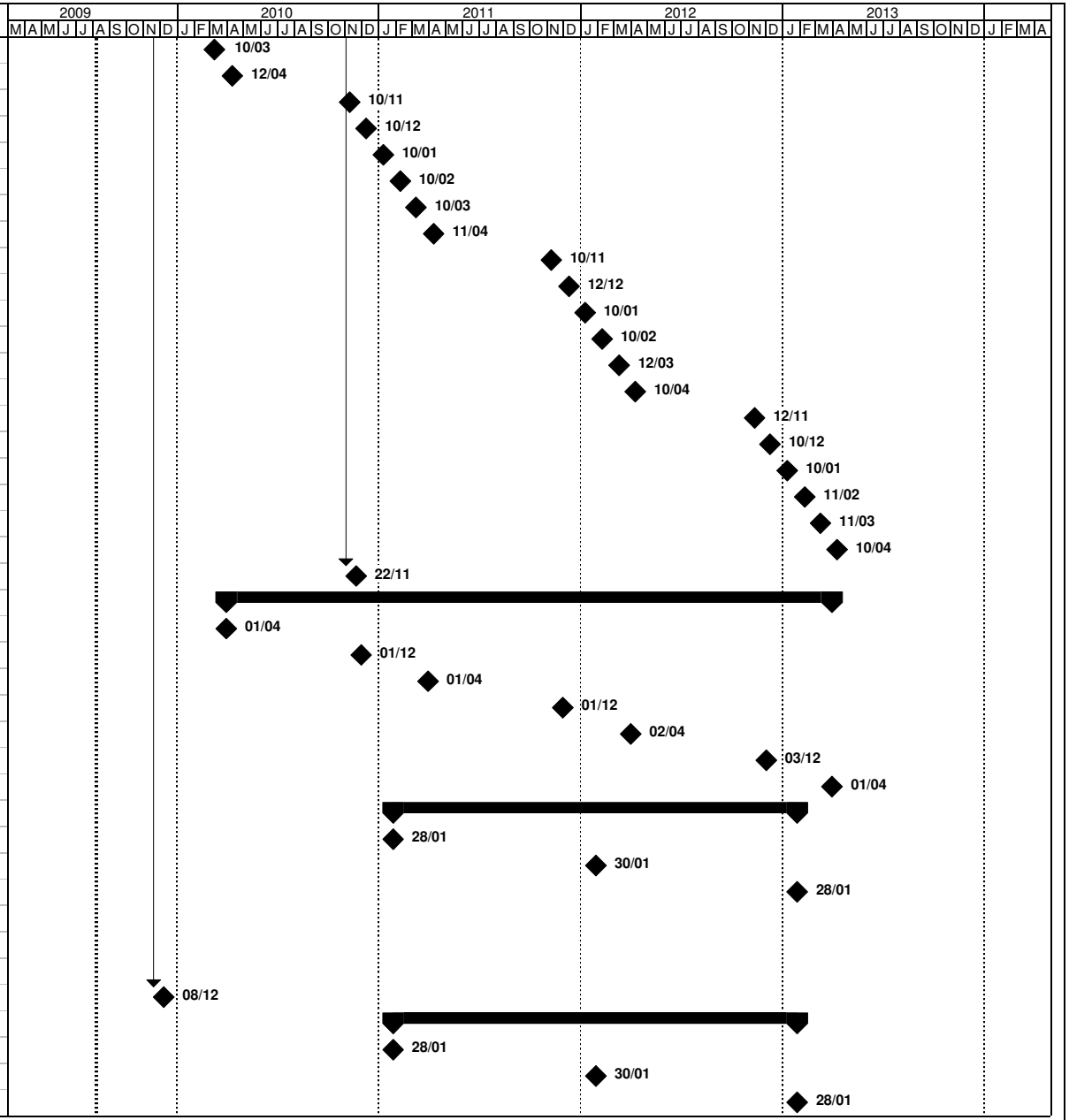

Figure 4.1 - Study Programme

Task | Milestone | Rolled Up Task
Progress | Summary | Rolled Up Milestone

Project: Agreement No. CE 4/2009 (EP) Environmental Monitoring and Audit for Contaminated Mud Pits at Sha Chau (2009-2013) - Investigation