




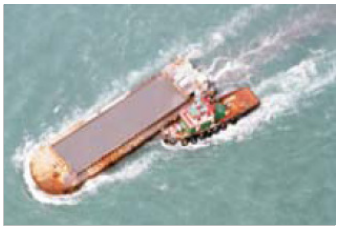
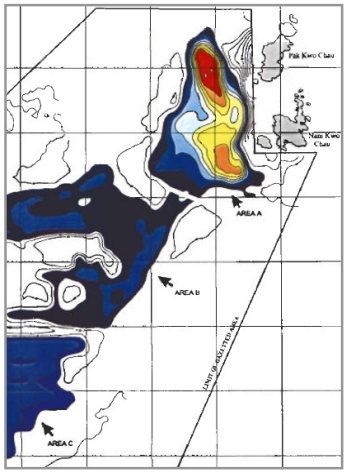

CEDD 土木工程拓展署
Civil Engineering and Development Department

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

Agreement No. CE 4/2009(EP)

33rd Monthly Progress Report for Contaminated Mud Pits at Sha Chau – March 2012

Revision 1

18 May 2012

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

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Client:	Project No:
Civil Engineering and Development Department (CEDD)	0103262
Summary: This document presents progress of monitoring works on contaminated mud pits at Sha Chau in March 2012 under Agreement No. CE 4/2009 (EP).	Date: 18 May 2012 Approved by:  *Dr Robin Kennish* *Director*

Revision	Description	By	Checked	Approved	Date
1	33rd Monthly Progress Report for CMP	CL	JT	RK	18/05/12

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ANNEXES

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

33rd MONTHLY PROGRESS REPORT FOR CONTAMINATED MUD PITS AT SHA CHAU March 2012

1.1 BACKGROUND

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 March 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 Vc was in progress.

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

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

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

The following monitoring activities have been undertaken for CMP V in March 2012:

- *Pit Specific Sediment Chemistry* was conducted for CMP Va on 6 March;
- *Impact Water Quality Monitoring during Dredging Operations* was conducted for CMP Vc on 13 March; and
- *Water Column Profiling* was conducted for CMP Va on 22 March.

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

A summary of monitoring data submitted by the Contractor in this reporting month is presented in *Table 1.1*.

Table 1.1 ***Summary of monitoring data submitted by the Contractor for the reporting month***

Key Task	Monitoring Component	Date of Results Received from the Contractor
CMP Vc		
Impact Monitoring during Dredging Operations	Water Quality	30 March 2012

1.4 DETAILS OF OUTSTANDING SAMPLING AND / OR ANALYSIS

No outstanding sampling and laboratory analysis remained from March 2012.

1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR CMP V

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

1.5.1 Sediment Toxicity Test – February 2012

Sediment Toxicity Tests were undertaken for sediments collected from the Near Field, Reference and Ma Wan stations in February 2012 using three international species (burrowing amphipod *Leptocheirus plumulosus*, marine benthic polychaete *Neanthes arenaceodentata* and marine bivalve *Crassostrea gigas*) and two local species (barnacles *Balanus amphitrite* and shrimp (*Penaeus vannaamei*).

Results of the Sediment Toxicity Tests in February 2012 showed that the survival rates of the burrowing amphipods, bivalve, shrimp and barnacles 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 V of the ESC area.

1.5.2 Routine Water Quality Monitoring of CMP Va – February 2012

The results for the Routine Water Monitoring conducted during February 2012 in the dry season period have been assessed for compliance with the Water Quality Objectives (WQOs) (please see *Figure 1.1* for the monitoring locations). This consists of a review of the Environmental Protection Department (EPD) routine water quality monitoring data for the dry season period (November to March) of 1999-2010 from stations in the Northwestern Water Control Zone, where CMP V is located. For Salinity, the average value obtained from the upstream station 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*.

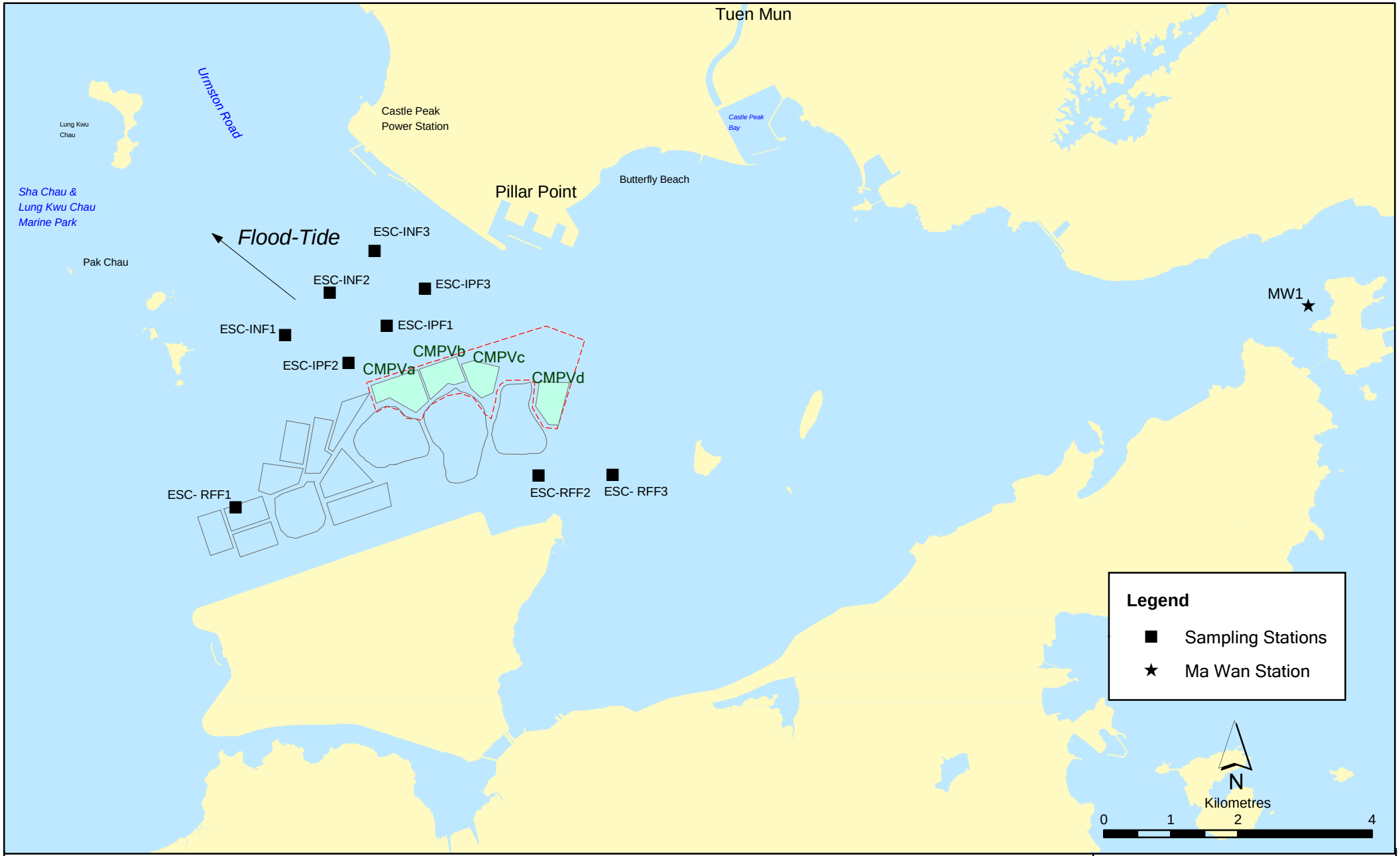

Figure 1.1

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

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

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In-situ Measurements

Analyses of results for February 2012 indicated that for all stations (Impact, Intermediate and Reference), levels of pH, Salinity and DO complied with the WQOs (*Figure 3, 4* and *6* 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)]. All *in-situ* water quality measurements showed relatively minor variations between Impact, Intermediate and Reference stations (*Figure 1 to 6* of *Annex B*).

Laboratory Measurements

Analyses of February 2012 results indicate that majority of metal concentrations (i.e. Cadmium, Mercury and Silver) were below their limit of reporting at all stations. Copper, Lead, Nickel and Zinc were detected in samples from all stations while Arsenic and Chromium levels were below the limits of reporting at all stations (*Figure 7* and *8* of *Annex B*). Concentrations of Copper appeared to be higher in samples obtained from Impact stations compared to those from the Intermediate and Reference stations while concentrations of Lead and Nickel were similar among all stations. Concentrations of Zinc were slightly higher at the Impact and Intermediate stations. The higher concentration of Copper recorded at the Impact Station will be further analyzed in the Quarterly Report in order to determine any spatial trend of potential concern (ie increasing Copper concentrations with proximity to the pit). Levels of 5-day Biochemical Oxygen Demand (BOD_5) and Total Inorganic Nitrogen (TIN) were slightly higher at Intermediate station (INF) compared to other stations (*Figure 9* and *10* of *Annex B*). Concentrations of TSS complied with the WQO (15.60 mg/L for dry season) at all sampled stations (*Figure 19* of *Annex B*) and also complied with the Action and Limit Levels within the reporting month.

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) 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 February 2012***

Stations	Temp (°C)	Salinity	Turbidity (NTU)	pH	Dissolved Oxygen (%)	Dissolved Oxygen (mg L^{-1})
RFF (Reference)	16.48	31.69	8.64	7.69	95.85	7.73
IPF (Impact)	16.69	31.27	6.03	7.66	93.05	7.49
INF (Intermediate)	16.64	31.25	5.76	7.62	92.88	7.49
Ma Wan Station	16.35	32.01	6.72	7.68	90.84	7.33
WQO	*N/A*	28.52-34.86#	*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 February 2012***

Stations	As	Ag	Cd	Cr	Cu	Hg	Pb	Ni	Zn	NH_3-N	TIN	BOD_5	TSS
RFF	<LOR	<LOR	<LOR	<LOR	11.04	<LOR	2.54	2.33	13.04	0.12	0.45	1.24	10.13
IPF	<LOR	<LOR	<LOR	<LOR	16.54	<LOR	2.08	2.33	16.58	0.19	0.67	1.30	10.96
INF	<LOR	<LOR	<LOR	<LOR	12.79	<LOR	2.54	2.75	16.25	0.18	0.83	1.74	6.88
Ma Wan Station	<LOR	<LOR	<LOR	<LOR	13.63	<LOR	1.50	2.13	12.00	0.15	0.41	0.76	10.63

1.5.3 Cumulative Impact Sediment Chemistry – February 2012

Monitoring locations for Cumulative Impact Sediment Chemistry for CMP Va is shown in *Figure 1.2*. Analyses of results for the Cumulative Impact Sediment Chemistry Monitoring indicated that the concentrations of all metals, except Arsenic, were below the Lower Chemistry Exeedance Level (LCEL, *Figure 12* and *13* of *Annex B*). Concentrations of Arsenic in sediments from all stations exceeded the LCEL, except at the Near Field station RNB. It is important to note that relatively high natural levels of Arsenic are present in Hong Kong's marine sediments. Whilst the average concentration of Arsenic in the Earth's crust is generally ~2mg/kg, significantly higher Arsenic concentrations (median = 14 mg/kg) been recorded in Hong Kong's onshore sediments (1). It is presumed that the natural concentrations of Arsenic are similar in onshore and offshore sediments (2), and relatively high Arsenic levels may thus occur throughout Hong Kong. Therefore, the slight exceedances of the LCEL for the Arsenic do not necessarily indicate any adverse impacts to sediment quality caused by disposal operation at CMP Va.

Concentrations of Total Organic Carbon (TOC) and Tributyltins (TBTs) were highest at Ma Wan station compared to Near Field, Mid Field, Far Field and Capped Pit stations (*Figure 14* and *15* of *Annex B*).

Concentrations of Total Dichlorodiphenyltrichloroethane (DDT) and 4,4''-Dichlorodiphenyldichloroethylene (4,4''-DDE) were found to be highest at

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

(2) 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

Figure 1.2

Cumulative Impacts Sediment Quality Monitoring Stations for CMPV

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

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Mid Field station RMA (*Figure 16* of *Annex B*). Total Polychlorinated Biphenyls (PCBs), Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (Low M.W. PAHs and High M.W. PAHs) were below the limit of reporting at all stations. Sediments were mainly composed of silt and clay materials (68 – 96%, *Figure 17* of *Annex B*).

Overall, the contaminated mud disposal operation at ESC did not appear to cause any deterioration in sediment quality of the area.

1.5.4 Pit Specific Sediment Chemistry Monitoring – February and March 2012

Monitoring locations for Pit Specific Sediment Chemistry for CMP Va are shown in *Figure 1.3*. Concentrations of metals at all stations in February and March 2012 were below the LCEL, with the exception of Arsenic (*Figure 18* and *24* of *Annex B*). Concentrations of Arsenic exceeded the LCEL at all stations in February 2012 while it exceeded the LCEL in all stations except in Pit Edge (NEDA) and Near Pit station (NNDB) in March 2012. It is important to note that relatively high natural levels of Arsenic are present in Hong Kong's marine sediments (see *Section 1.5.3* above). Therefore, 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.

For organic contaminants, PCBs, Low M.W. PAHs and High M.W. PAHs were all below the limit of reporting at all stations in February 2012. Levels of Low M.W. PAHs and High M.W. PAHs were higher than the limit of reporting in only a few samples collected in March 2012 while PCBs were below the limit of reporting in all samples in March 2012. TOC concentrations were the highest at Active Pit stations (NPDB) in both February and March 2012 when compared to other stations (*Figure 20* and *26* of *Annex B*). Highest concentrations of TBTs were recorded at Active Pit stations (NPDB and NPDA) in sediment samples collected in February and March 2012, but were not detected in any interstitial water samples (*Figure 21* and *27* of *Annex B*).

Concentrations of DDT and 4,4''-DDE were higher than the limit of reporting at all stations for both February and March 2012 (*Figure 22* and *28* of *Annex B*). In February 2012, concentrations of Total DDT and DDE were similar among all stations. In March 2012, highest level of Total DDT and DDE were recorded at Active Pit stations (NPDA and NPDB). Sediments were mainly composed of silt and clay (60 - 92%) materials and sand (9 – 39%, *Figure 23* and *29* of *Annex B*).

It should be noted that the Action Pit stations are located within CMP Va which were receiving contaminated mud during the reporting month. Therefore, the higher concentrations of contaminants recorded at the Action Pit stations alone are not considered as indicating any dispersal of contaminated mud from CMP Va and thus not considered as indicating any unacceptable environmental impacts from the mud disposal operations. Nevertheless, detailed analysis will be presented in the Quarterly Report to

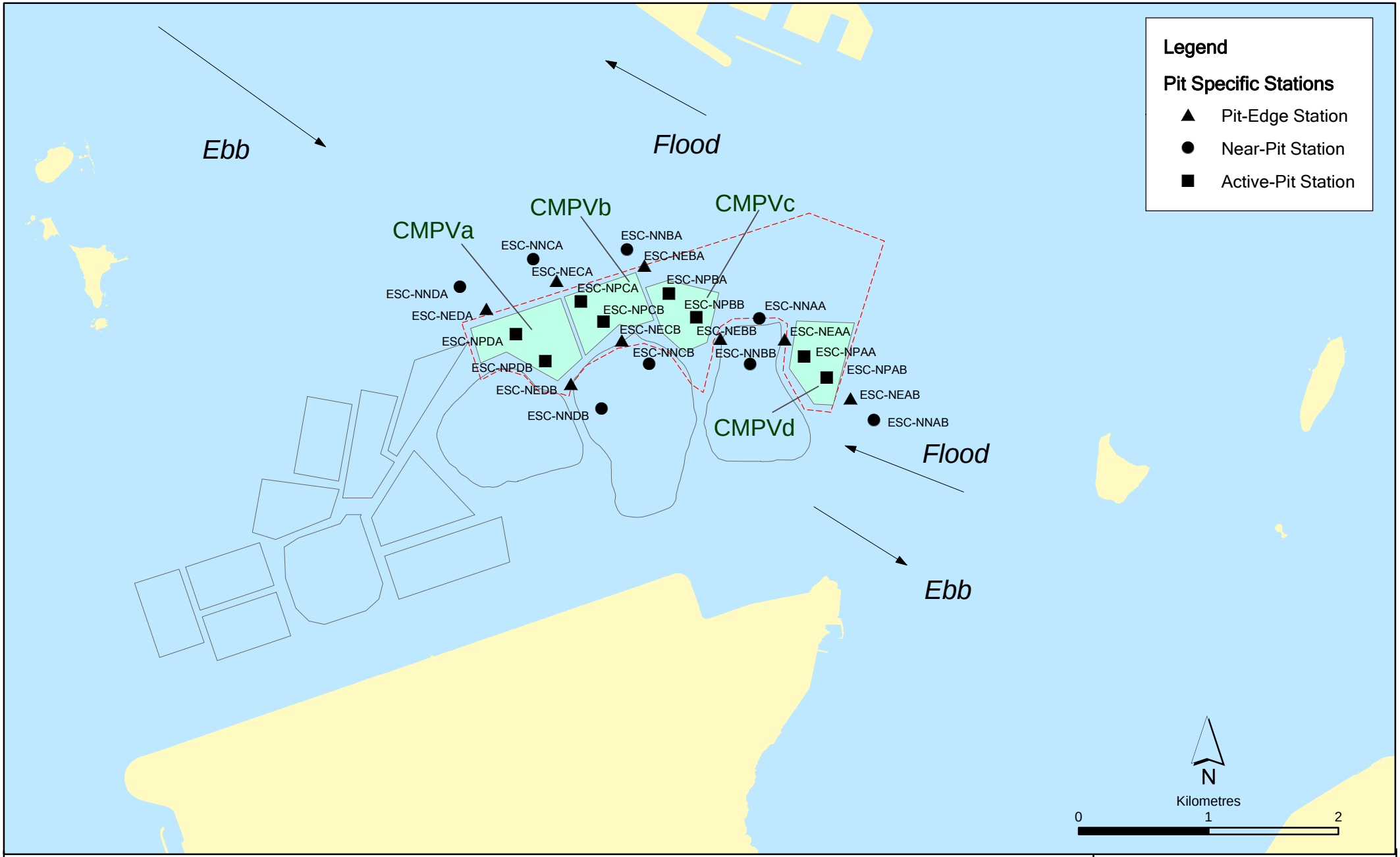

Figure 1.3

Pit Specific Sediment Quality Monitoring Stations for CMPV

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Date: 29/10/2009

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reveal any trend of increasing sediment contaminant concentrations towards CMP Va.

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.

1.5.5 Impact Water Quality Monitoring during Dredging Operations of CMP V – March 2012

Impact Water Quality Monitoring during Dredging Operations of CMP V was conducted on 13 March 2012 for CMP Vc. 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 Vc (*Figure 1.4*). Monitoring was also conducted at the 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).

Monitoring results are presented in *Table B1* of *Annex C*. Levels of DO, Turbidity and TSS generally complied with the Action and Limit Levels set in the *Baseline Monitoring Report* (1). Levels of TSS exceeded the Action Level in the downstream station DS1 during the mid-ebb tide. Station DS1 is located on the edge of the works area of CMP Vc and the compliance of Action and Limit Levels at other downstream stations outside the works area (ie DS2-4) would indicate that there is no evidence of any unacceptable adverse water quality impacts outside the dredging works area of CMP Vc.

Overall, the results indicated that the dredging operations at CMP Vc 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 Vc.

(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.

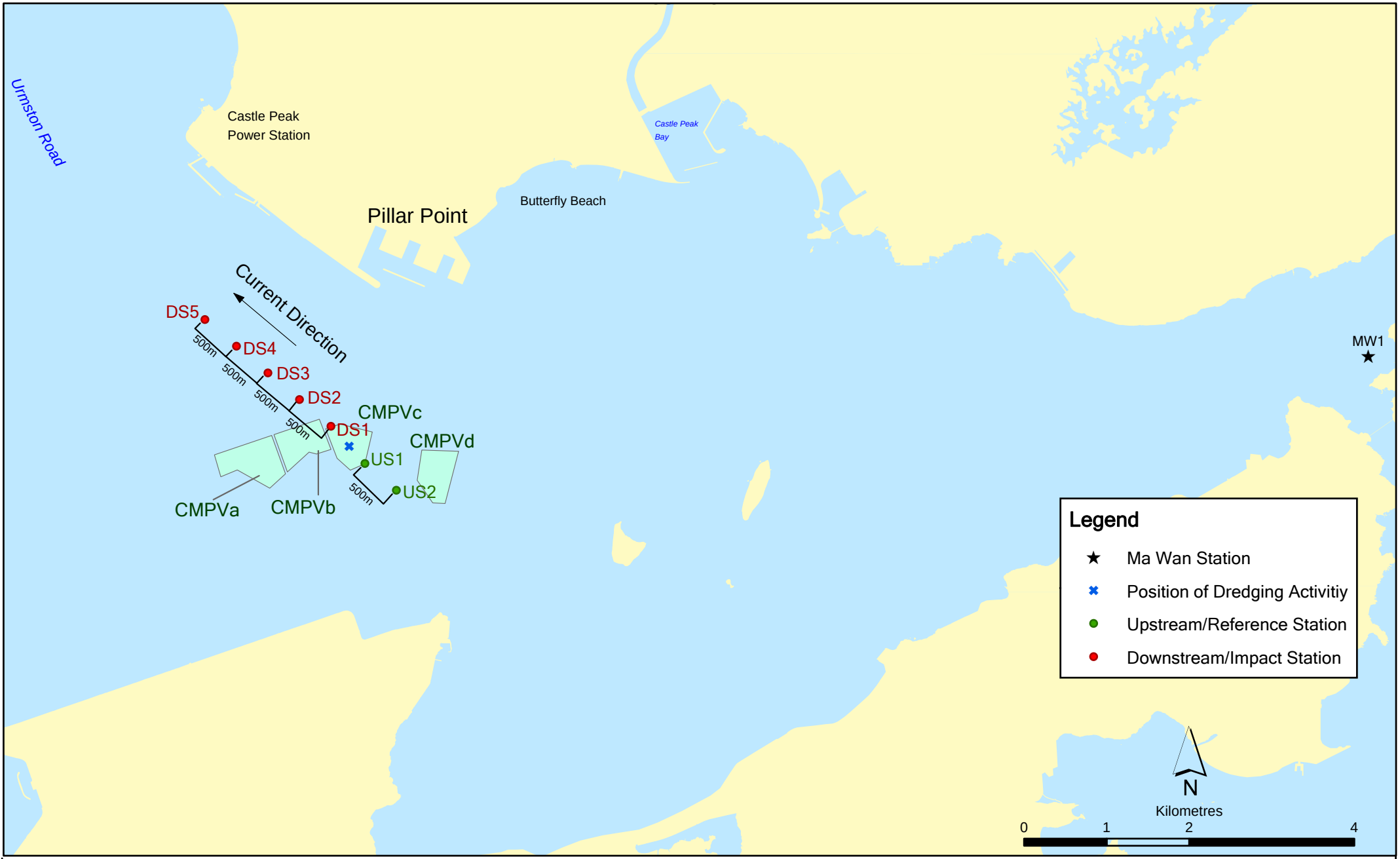

Figure 1.4

Indicative Dredging Impact Sampling Stations for CMPVc

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

File: CMPV\0103262_modelling stations2.mxd
Date: 27/03/2012

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1.5.6 Water Column Profiling for CMP Va – February and March 2012

In-situ Measurements

The water quality monitoring results for February and March 2012 in the dry season period have been assessed for compliance with the WQOs set by EPD (please refer to *Section 1.5.2* for details of setting the WQOs). Graphical presentation of the monitoring results is provided in *Annex B*.

Analyses of results for February and March 2012 indicated that levels of Salinity, pH and Dissolved Oxygen (DO) all complied with the WQOs at both Upstream and Downstream stations (*Figure 30* to *36* in *Annex B*). DO and Turbidity complied with the Action and Limit Levels set in the EM&A Manual [(1)].

Laboratory Measurements for Total Suspended Solids (TSS)

Analyses of data obtained in February and March 2012 indicated that the TSS levels at both Upstream and Downstream stations complied with the WQO for the dry season period (*Figure 33* and *37* in *Annex B*). TSS levels measured during February and March 2012 complied with the Action and Limit Levels set in the EM&A Manual.

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.

1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

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

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

The sampling schedule is presented in *Annex A*.

1.7 STUDY PROGRAMME

A summary of the Study Programme is presented in *Annex D*.

(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).

Annex A

Sampling Schedule

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

		2012											
Tissue/ Whole Body Sampling		**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**
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**
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**
Plume Stations	WCP1	*											
	WCP2	*											

"*" = 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	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
		2012												2013												2014	
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														*				*		*				*		*

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

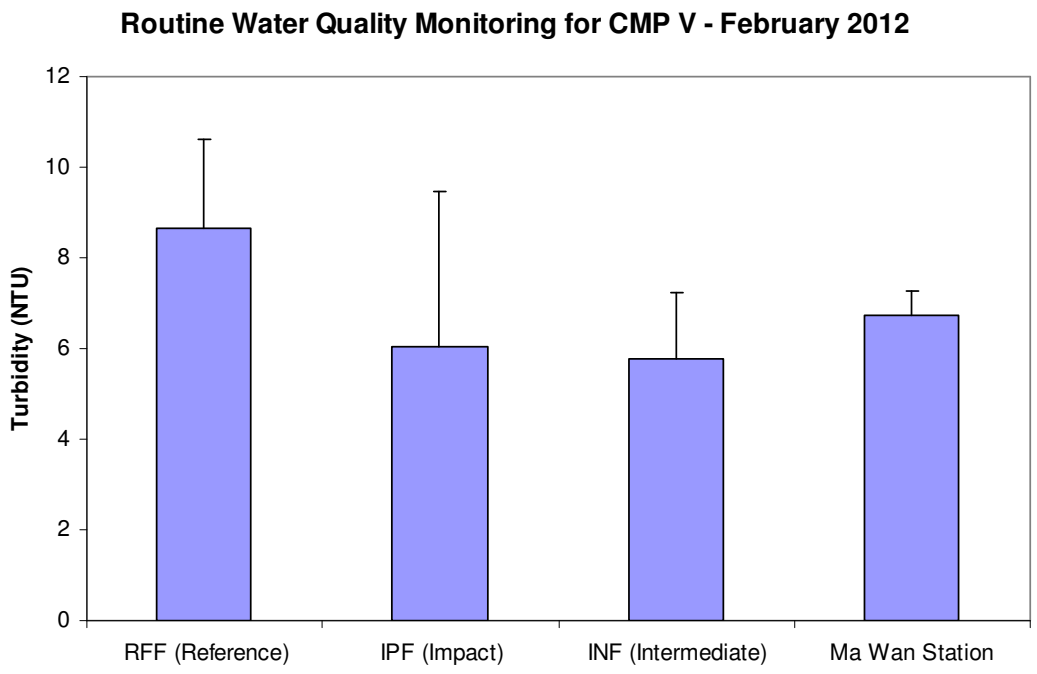

Figure 1: Level of Turbidity (mean + SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP V in February 2012.

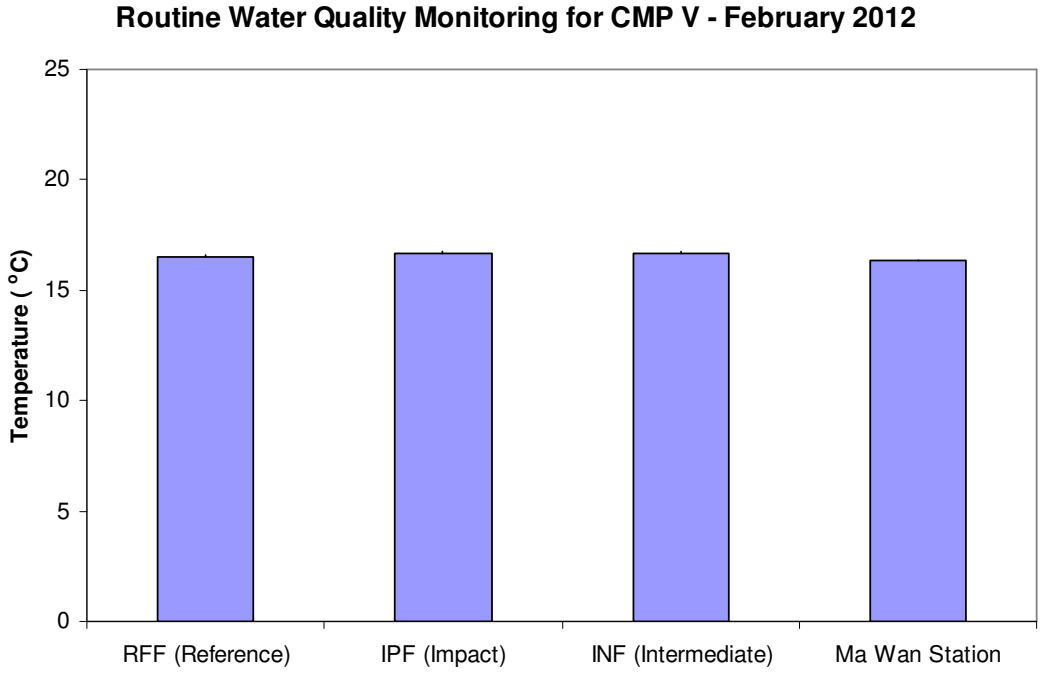

Figure 2: Temperature (mean + SD) during in-situ measurements for Routine Water Quality Monitoring for CMP V in February 2012.

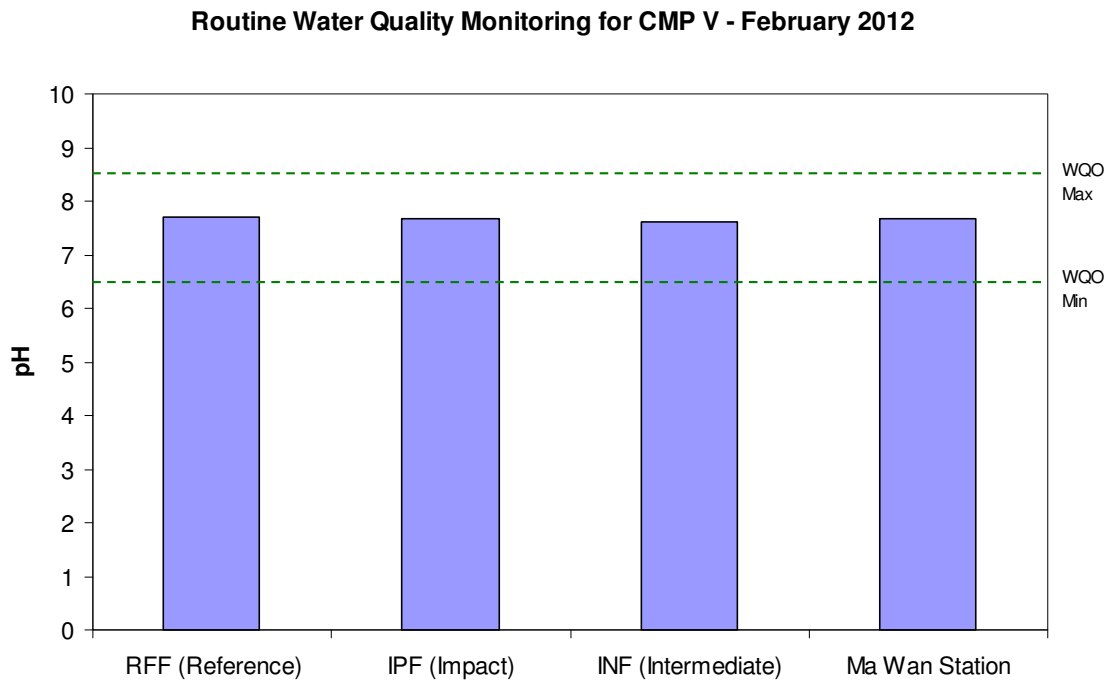

Figure 3: Level of pH (mean + SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP V in February 2012.

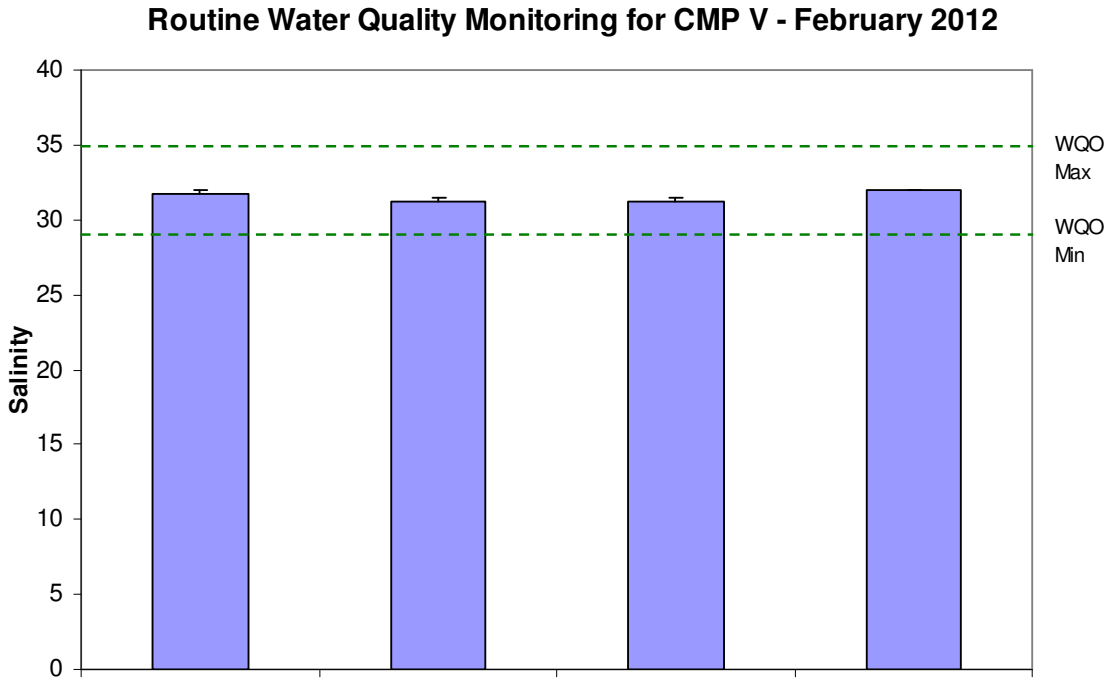

Figure 4: Level of Salinity (mean + SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP V in February 2012.

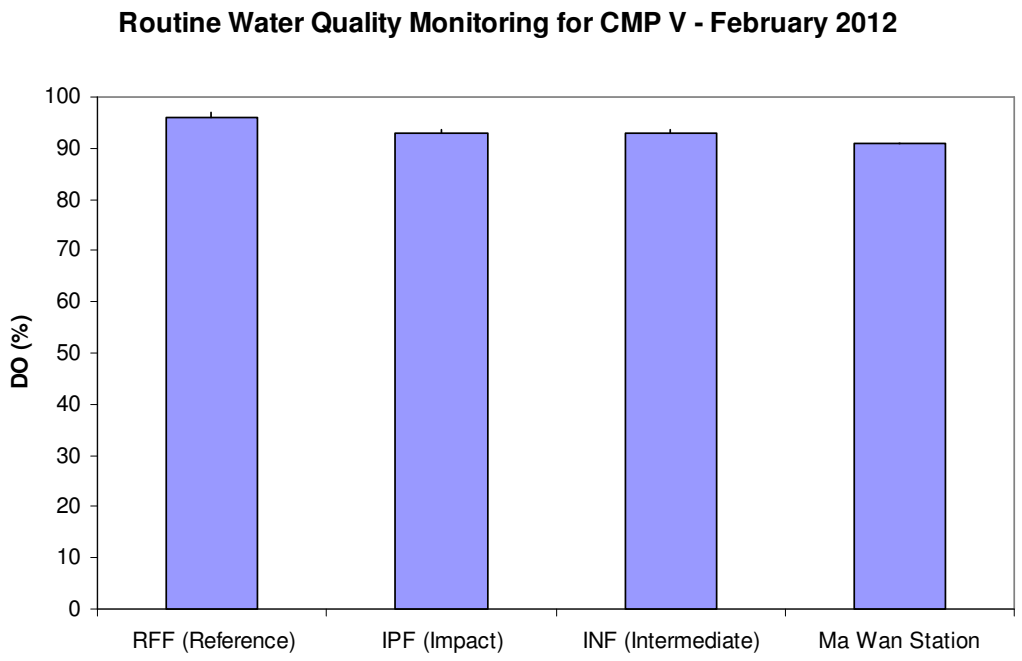

Figure 5: Level of Dissolved Oxygen (mean + SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP IV in February 2012.

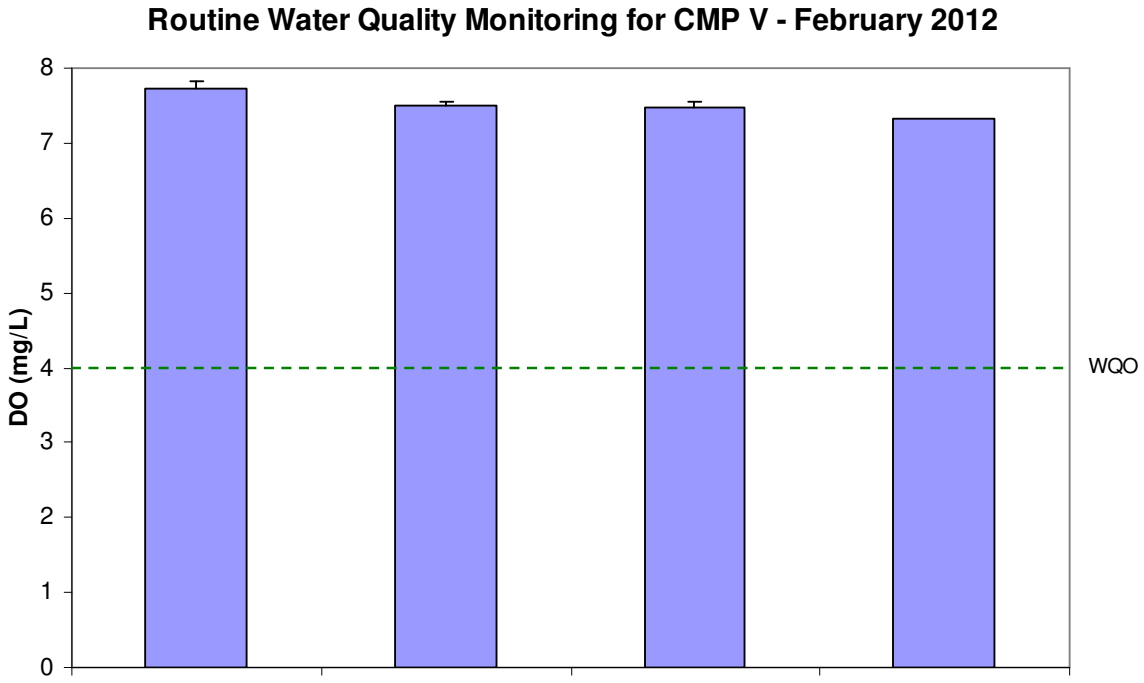

Figure 6: Concentration of Dissolved Oxygen (mg/L; mean + SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP V in February 2012.

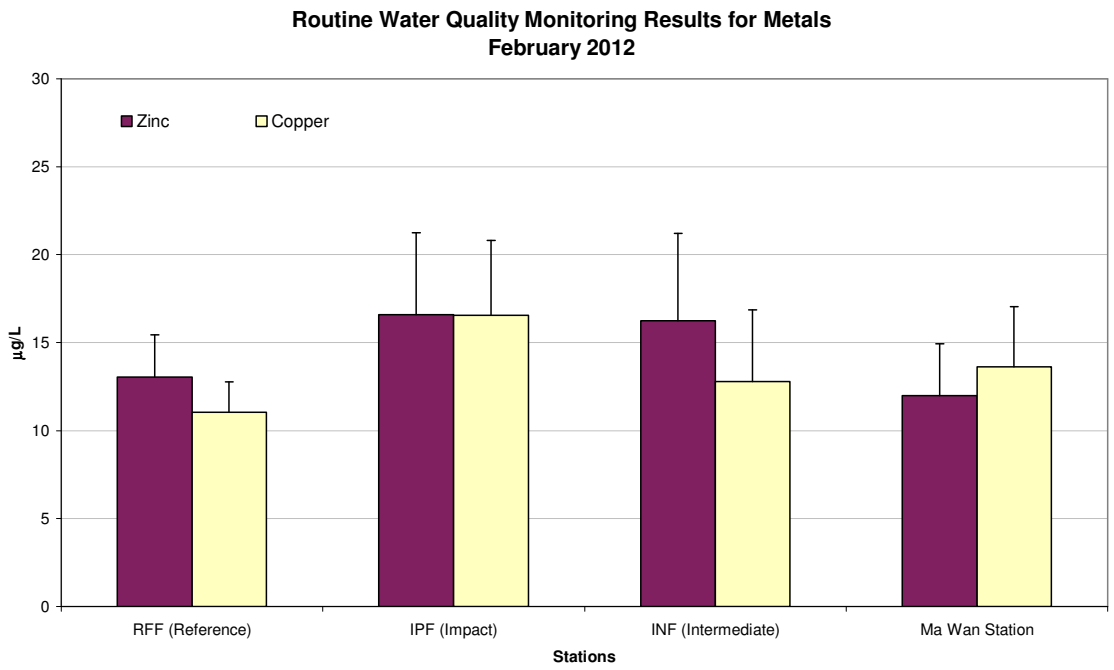

Figure 7: Concentration of Zinc and Copper (mean + SD) in water samples for Routine Water Quality Monitoring for CMP V in February 2012.

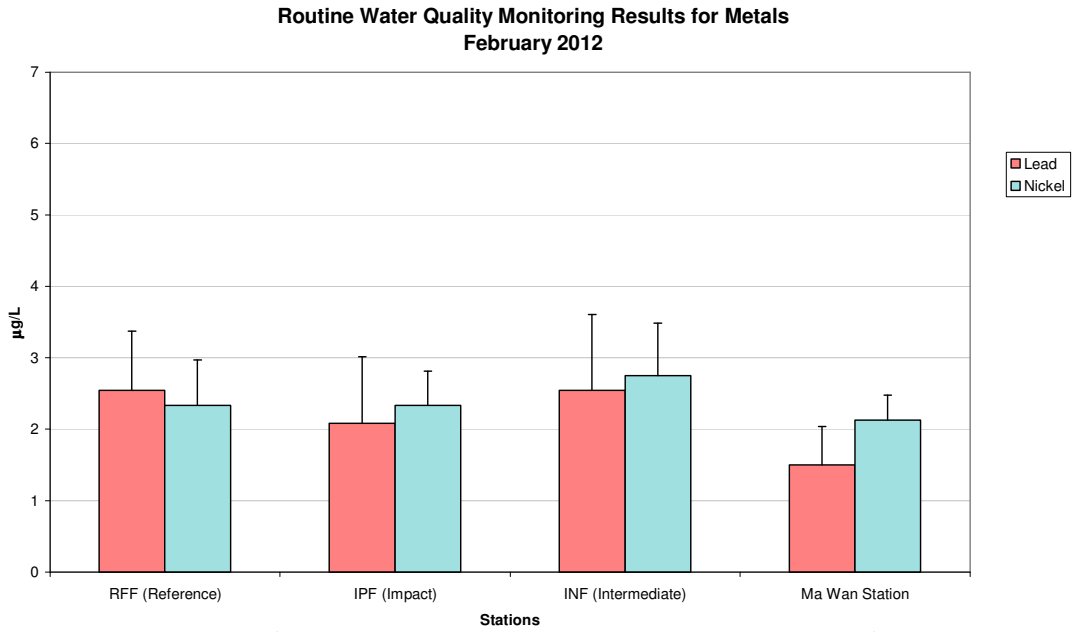

Figure 8: Concentration of Lead and Nickel (mean + SD) in water samples for Routine Water Quality Monitoring for CMP V in February 2012.

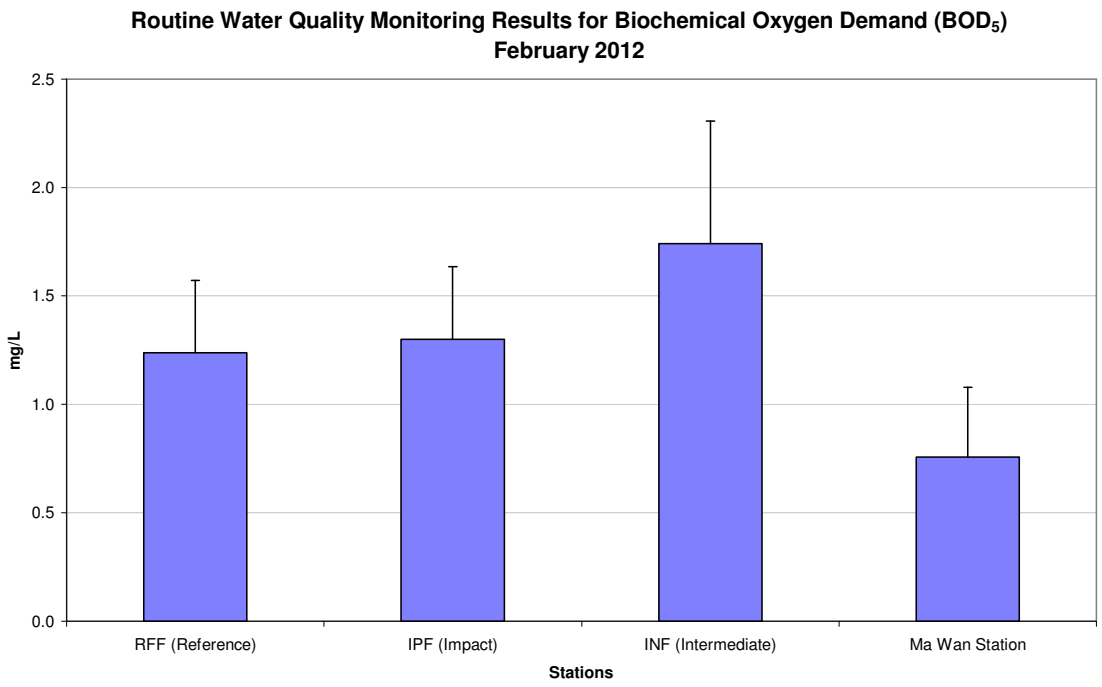

Figure 9: Level of Biological Oxygen Demand (BOD_5, mean + SD) during in-situ measurements for Routine Water Quality Monitoring for CMP V in February 2012.

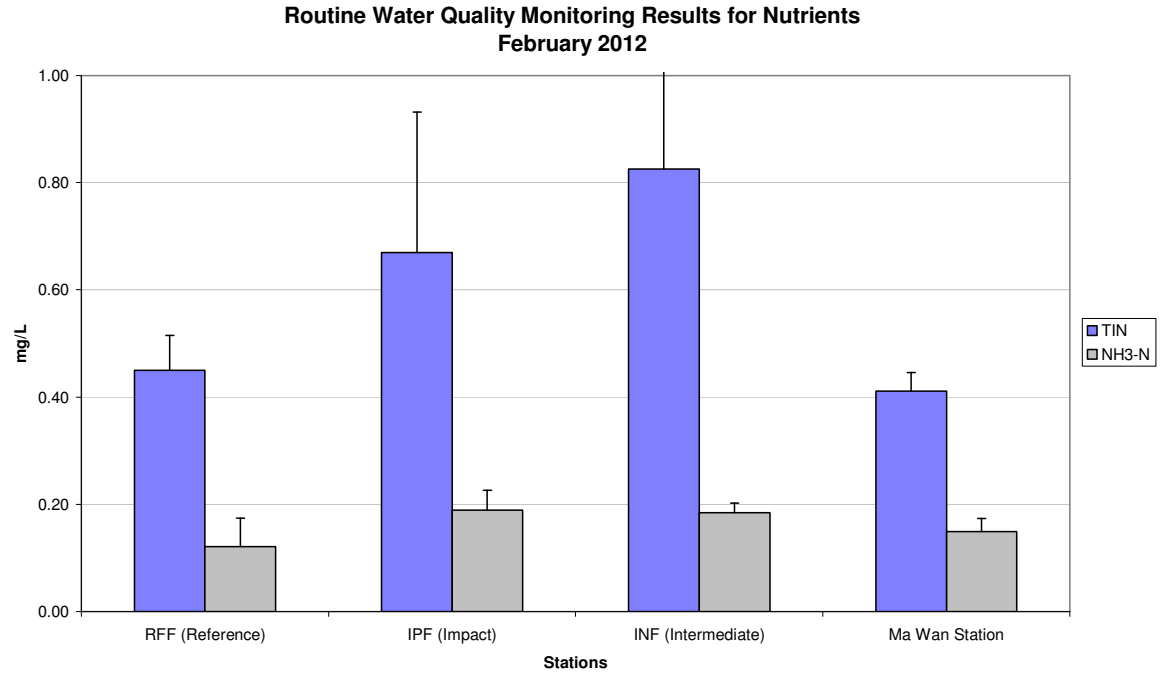

Figure 10: Concentration of Total Inorganic Nitrogen (mean + SD) in water samples for Routine Water Quality Monitoring for CMP V in February 2012.

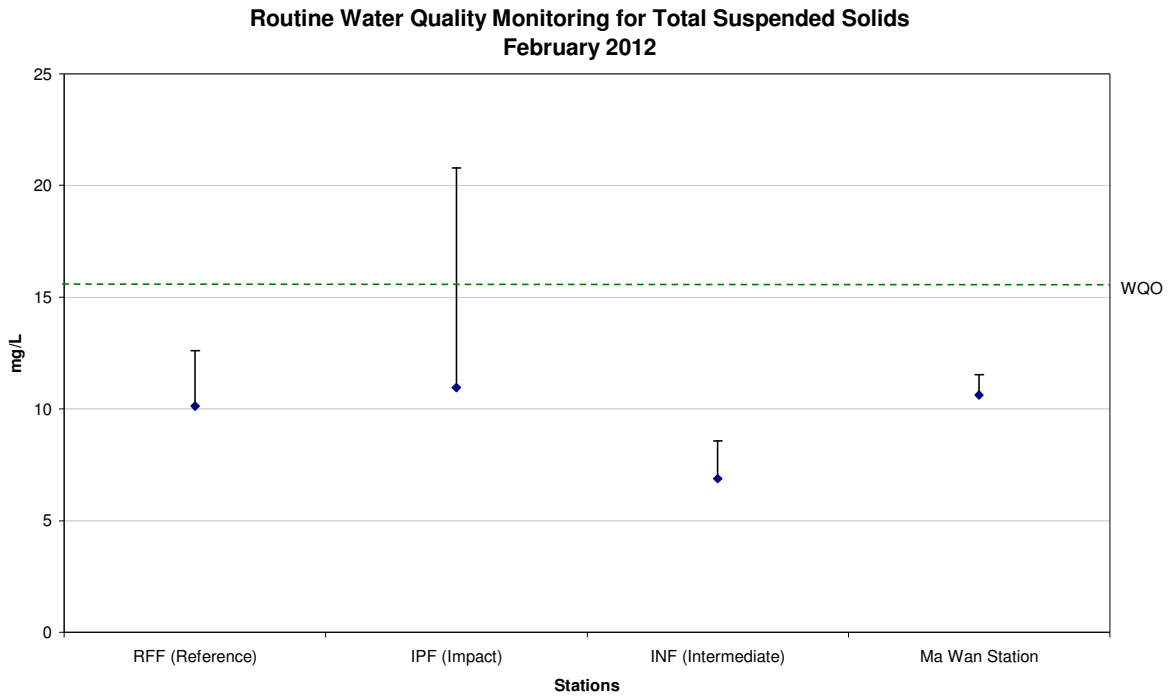

Figure 11: Concentration of Total Suspended Solids (mean + SD) in water samples for Routine Water Quality Monitoring for CMP V in February 2012.

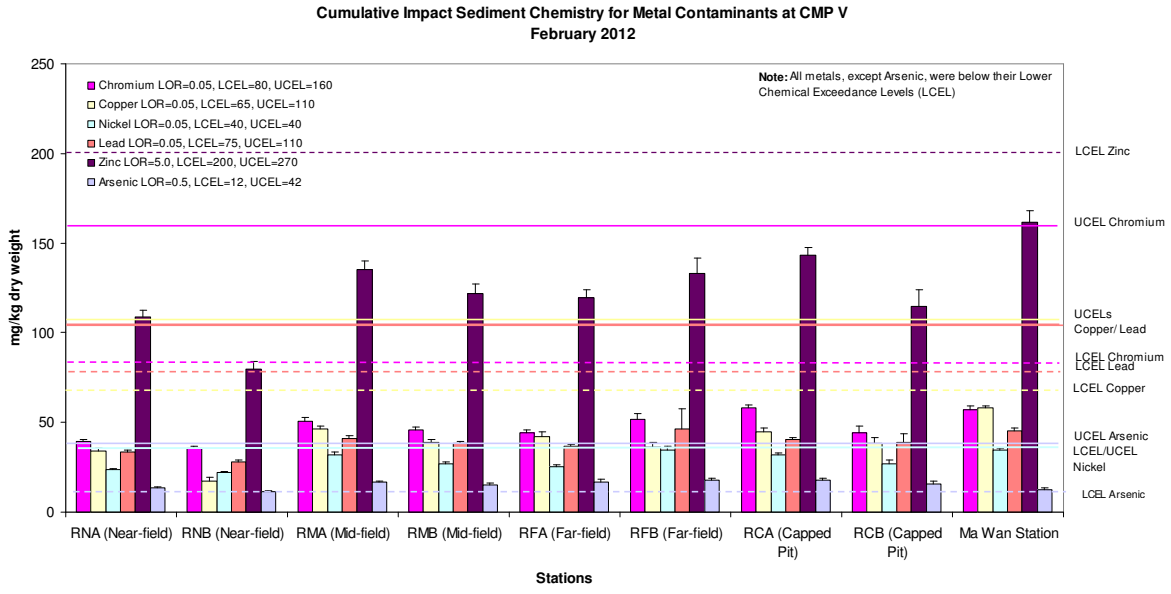

Figure 12: Concentration of Metals (CR, Cu, Ni, Pb, Zn, As; mean + SD) in sediment samples for Cumulative Impact Sediment Analysis for CMP V during February 2012.

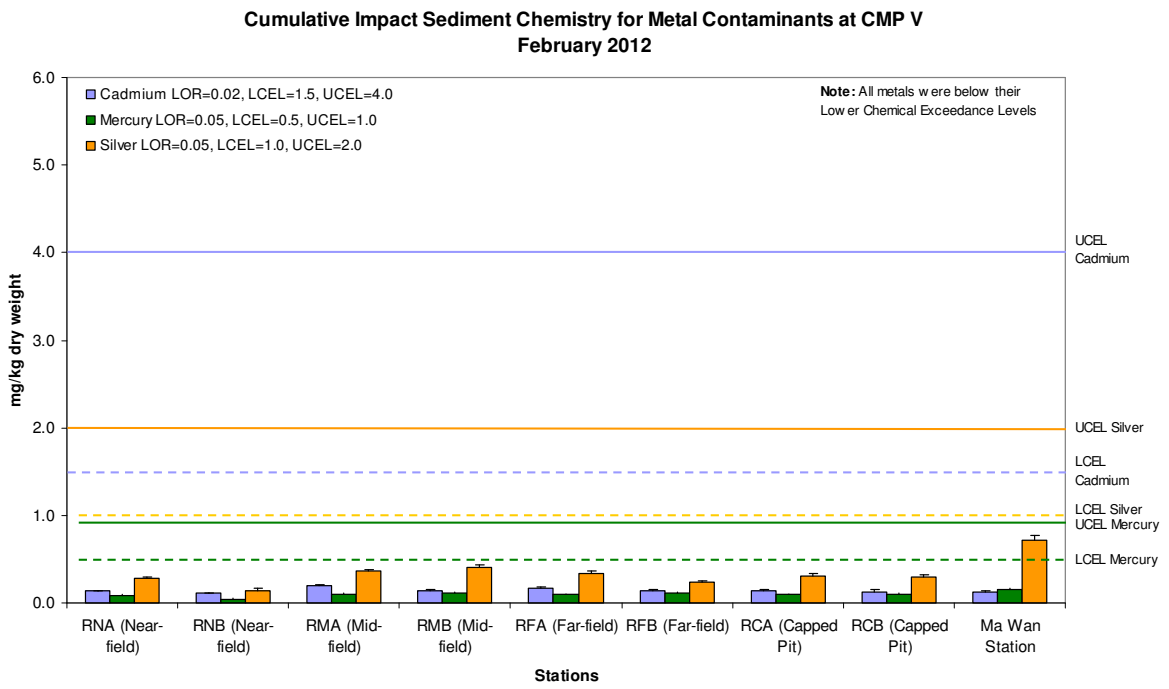

Figure 13: Concentration of Metals (Cd, Hg, Ag; mean + SD) in sediment samples for Cumulative Impact Sediment Analysis for CMP V during February 2012.

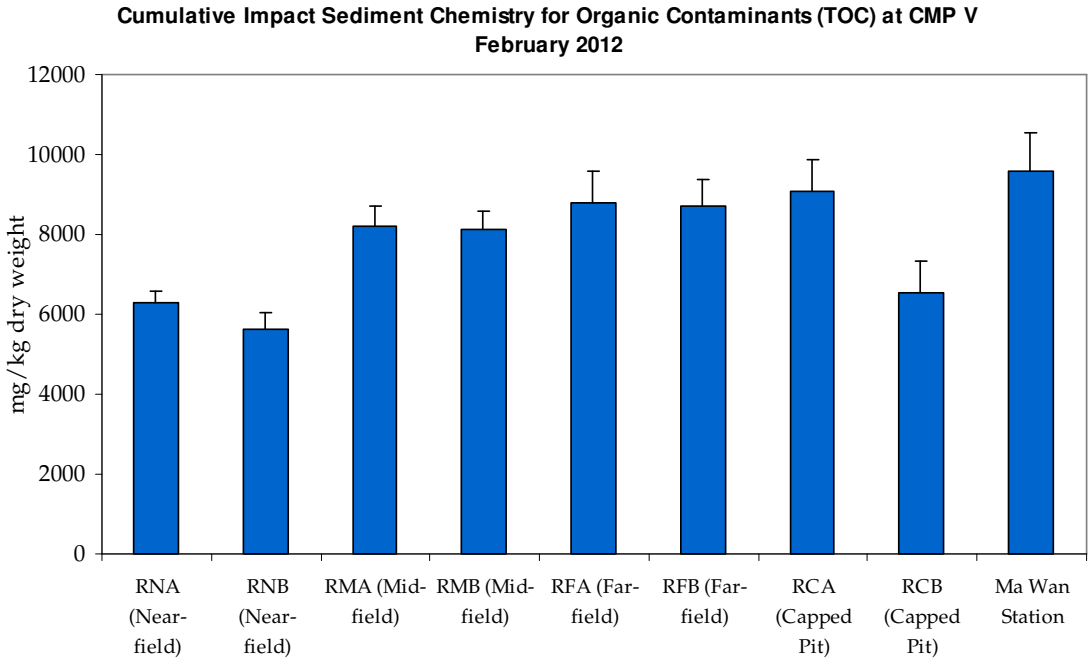

Figure 14: Concentration of Total Organic Carbon (TOC; mean + SD) in sediment samples for Cumulative Impact Sediment Analysis for CMP V during February 2012.

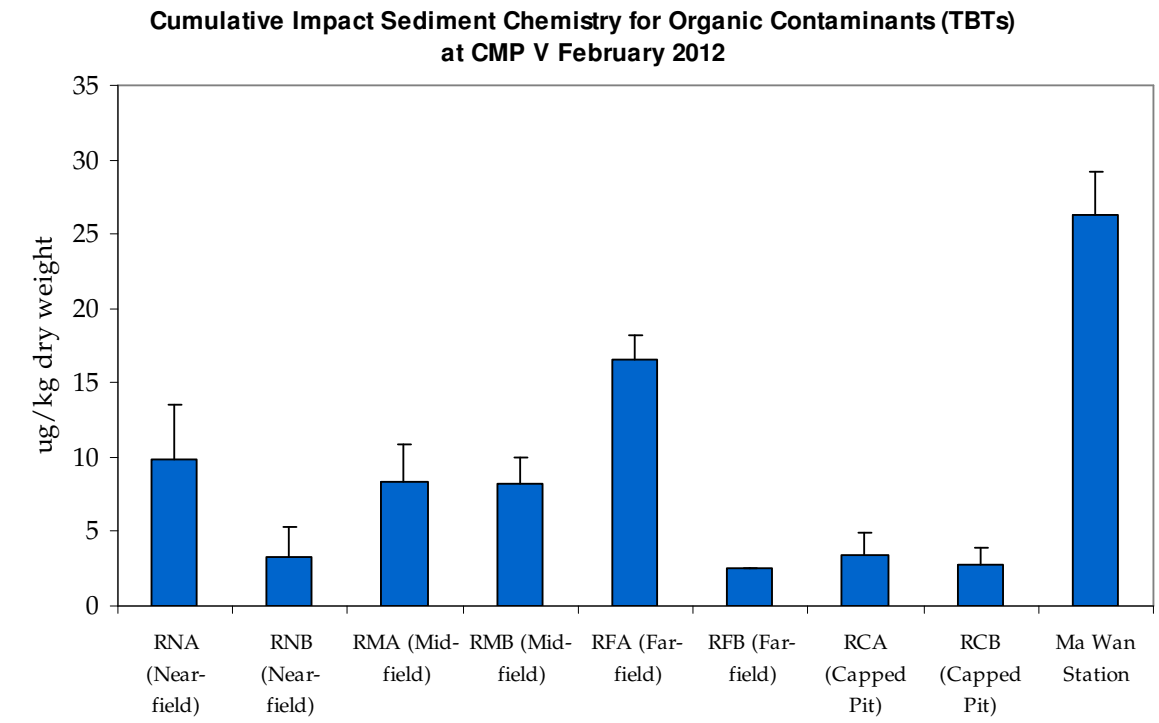

Figure 15: Concentration of Tributyltin (TBT; mean + SD) in sediment samples for Cumulative Impact Sediment Analysis during February 2012.

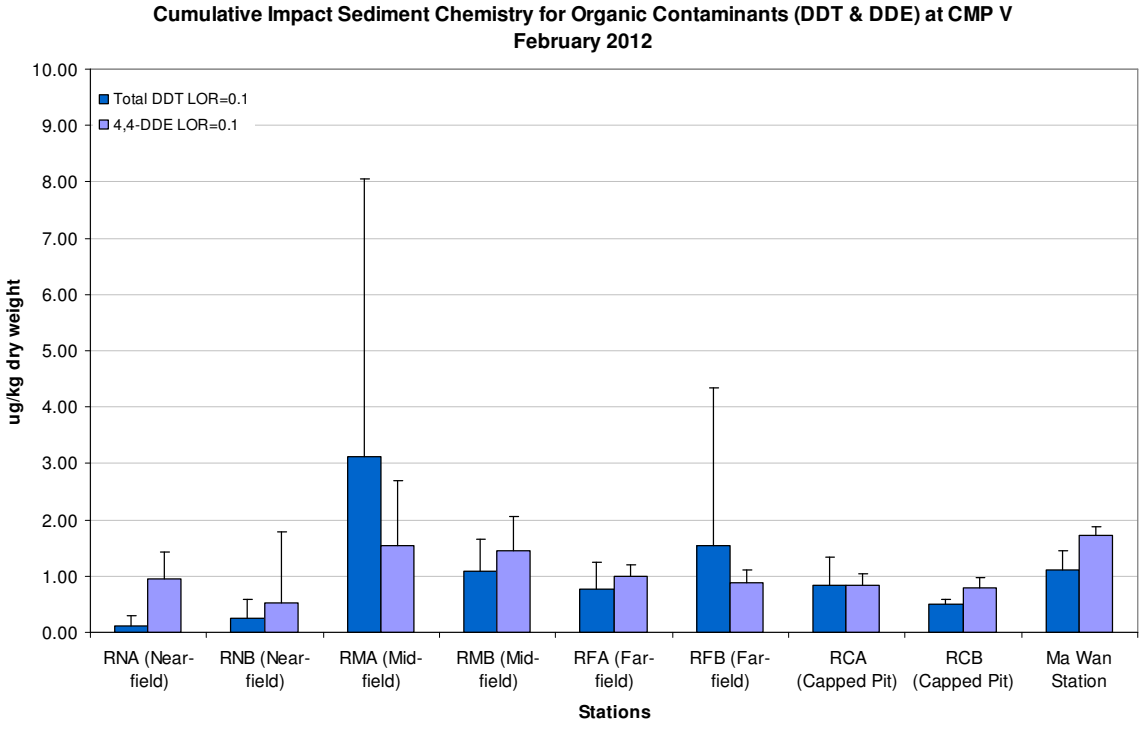

Figure 16: Concentration of Total DDT and 4,4″-DDE (mean + SD) in sediment samples for Cumulative Impact Sediment Chemistry for CMP V during March 2012.

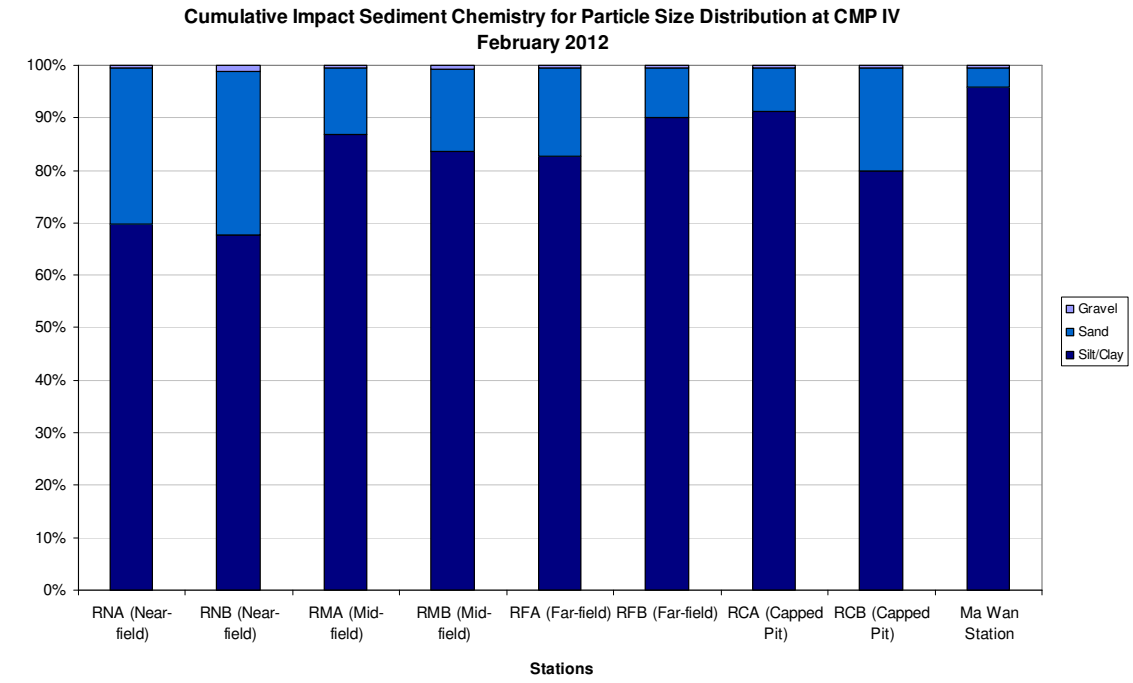

Figure 17: Particle Size Distribution (% mean) of sediment samples for Cumulative Impact Sediment Chemistry for CMP V during March 2012.

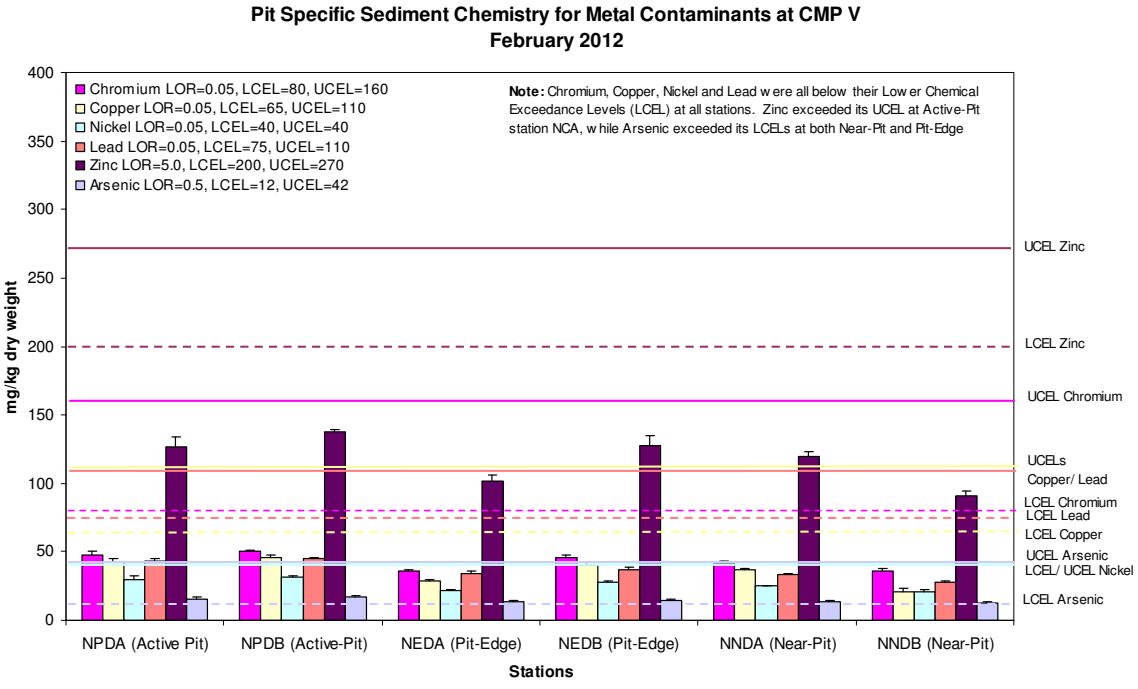

Figure 18: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mean + SD) in sediment samples for Pit Specific Sediment Chemistry for CMP V during February 2012.

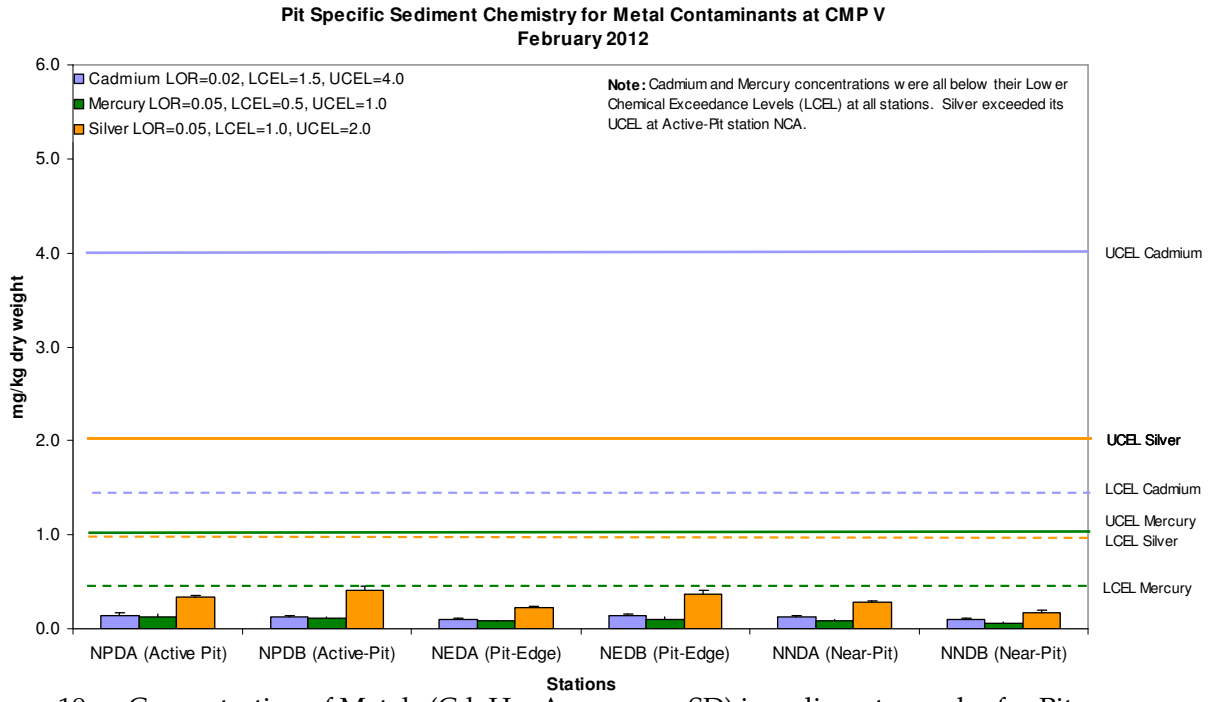

Figure 19: Concentration of Metals (Cd, Hg, Ag; mean + SD) in sediment samples for Pit Specific Sediment Chemistry for CMP V during February 2012.

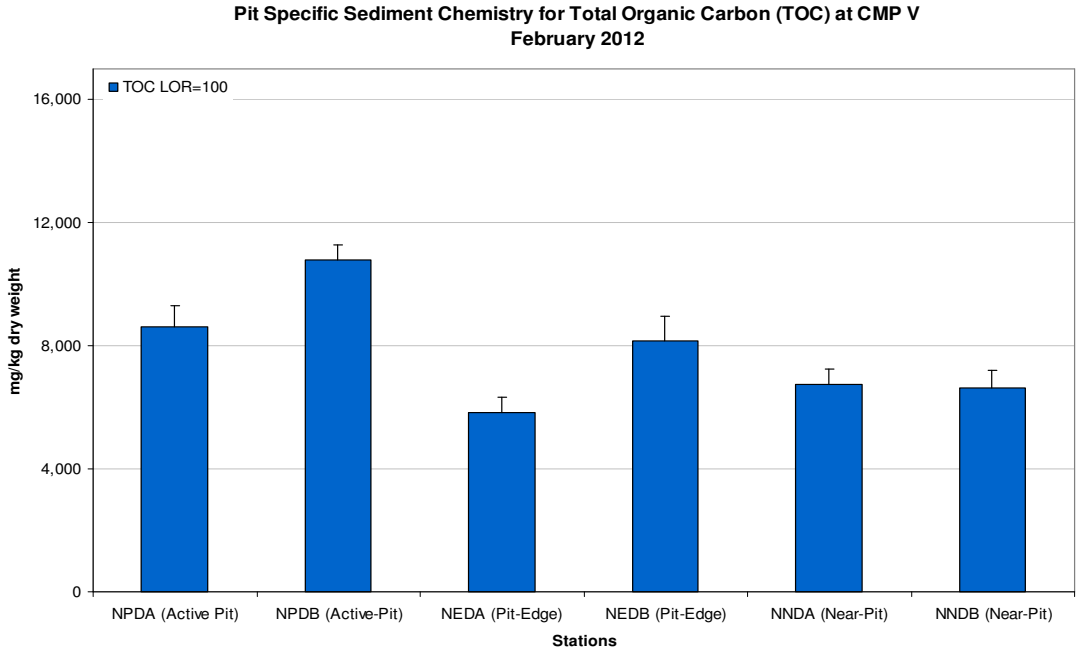

Figure 20: Concentration of Total Organic Carbon (TOC; mean + SD) in sediment samples for Pit Specific Sediment Chemistry for CMP V during February 2012.

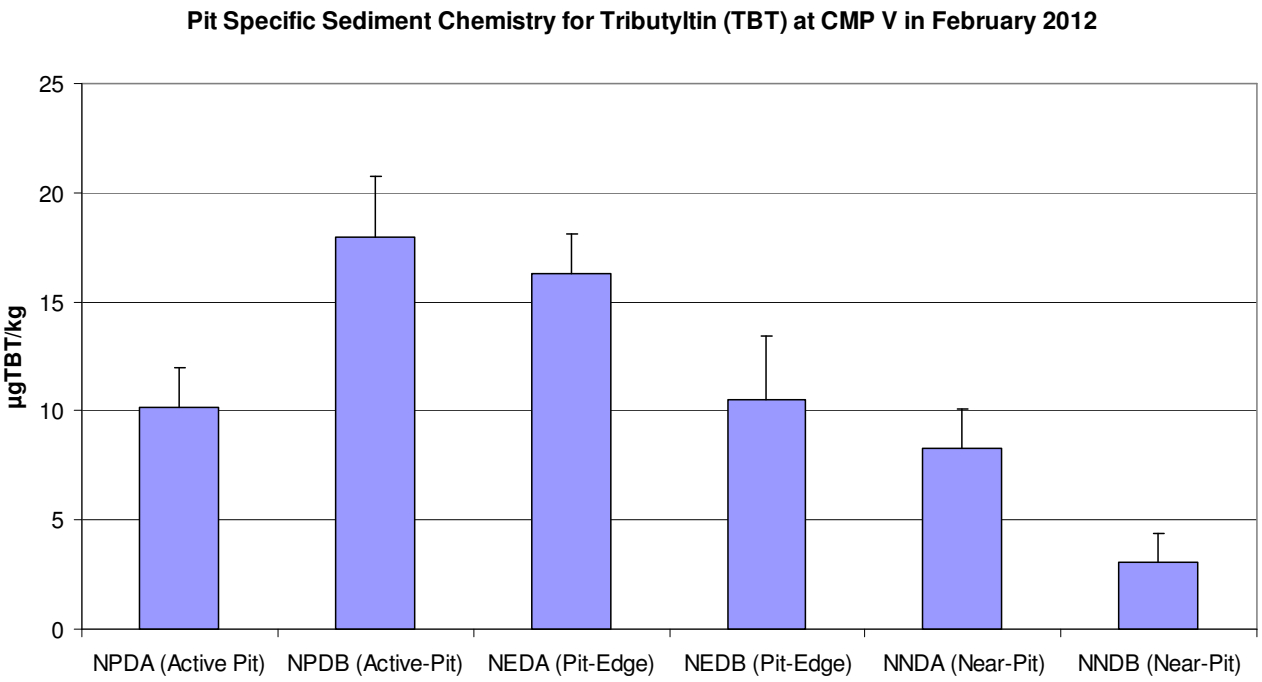

Figure 21: Concentration of Tributyltin (TBT; mean + SD) in sediment samples for Pit Specific Sediment Chemistry for CMP V during February 2012.

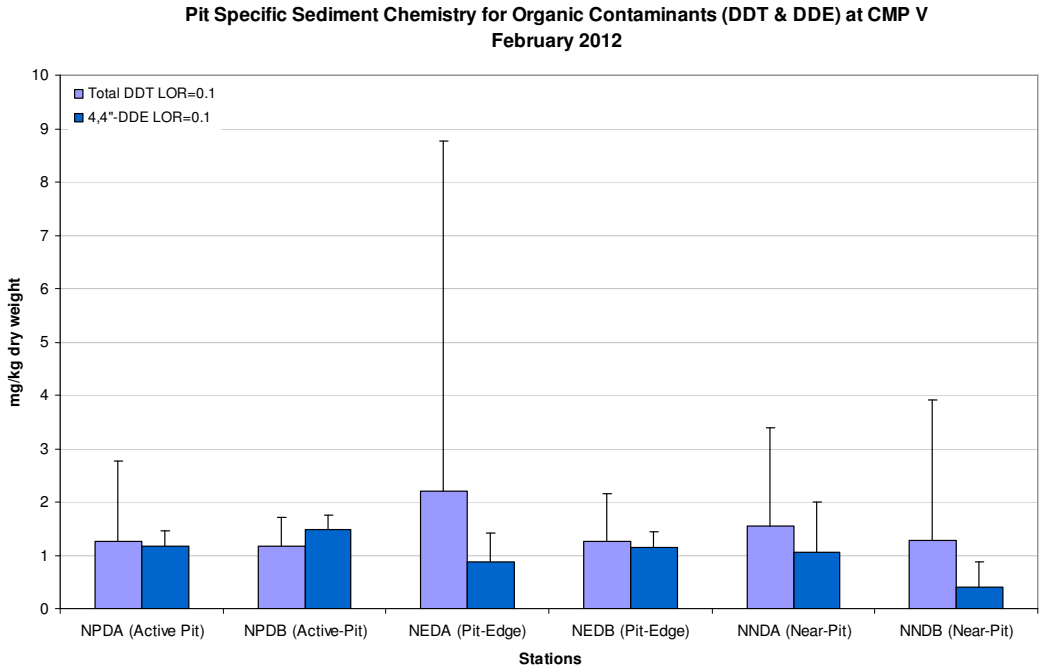

Figure 22: Concentration of Total DDT and 4,4″-DDE (mean + SD) in sediment samples for Pit Specific Sediment Chemistry for CMP V during February 2012.

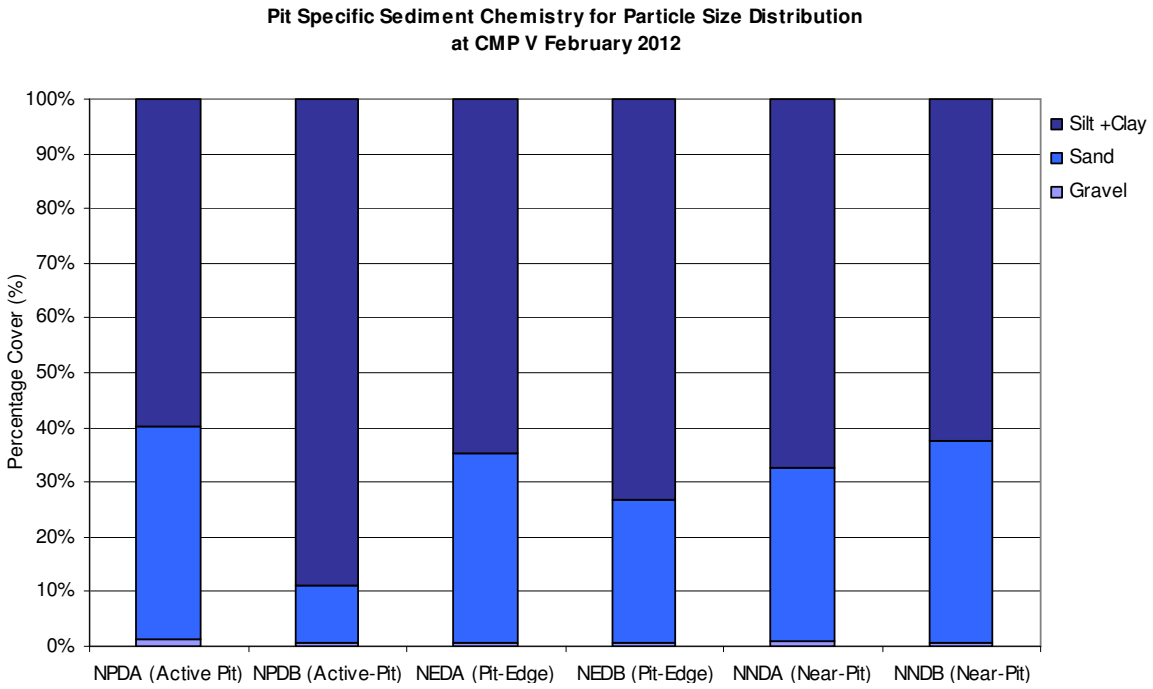

Figure 23: Particle Size Distribution (% mean) of sediment samples for Pit Specific Sediment Chemistry for CMP V during February 2012.

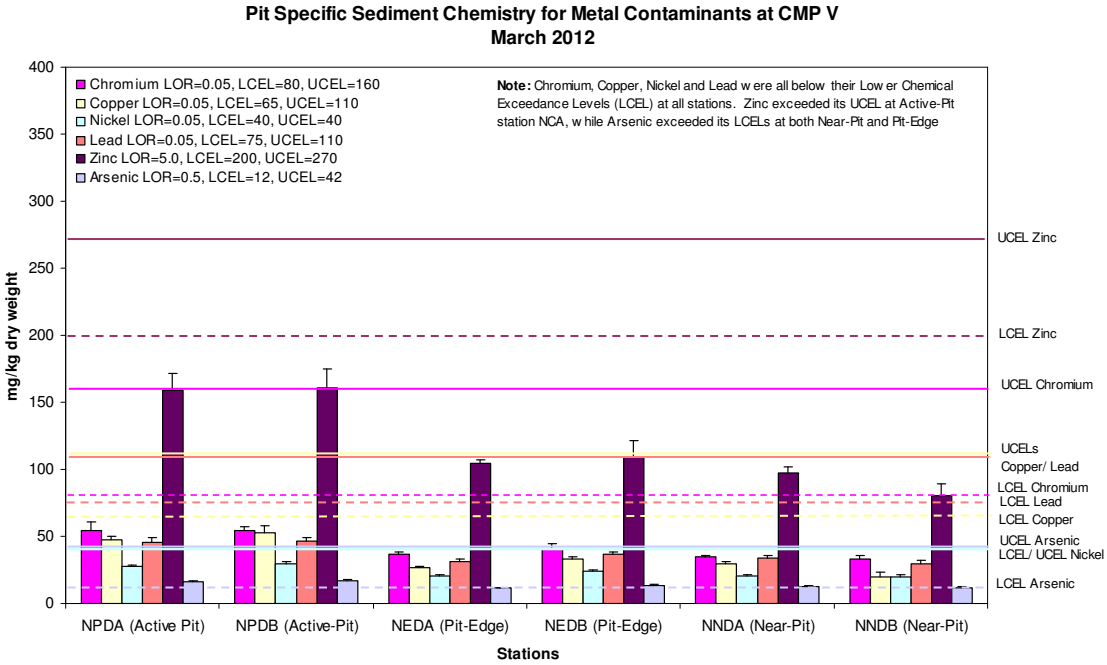

Figure 24: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mean + SD) in sediment samples for Pit Specific Sediment Chemistry for CMP V during March 2012.

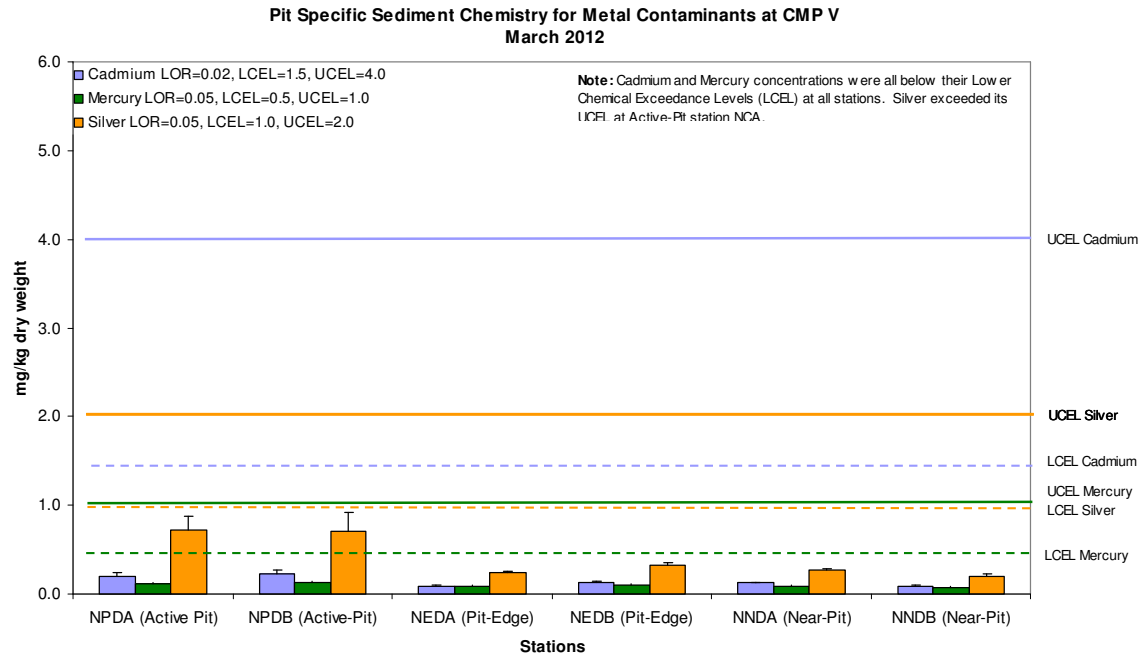

Figure 25: Concentration of Metals (Cd, Hg, Ag; mean + SD) in sediment samples for Pit Specific Sediment Chemistry for CMP V during March 2012.

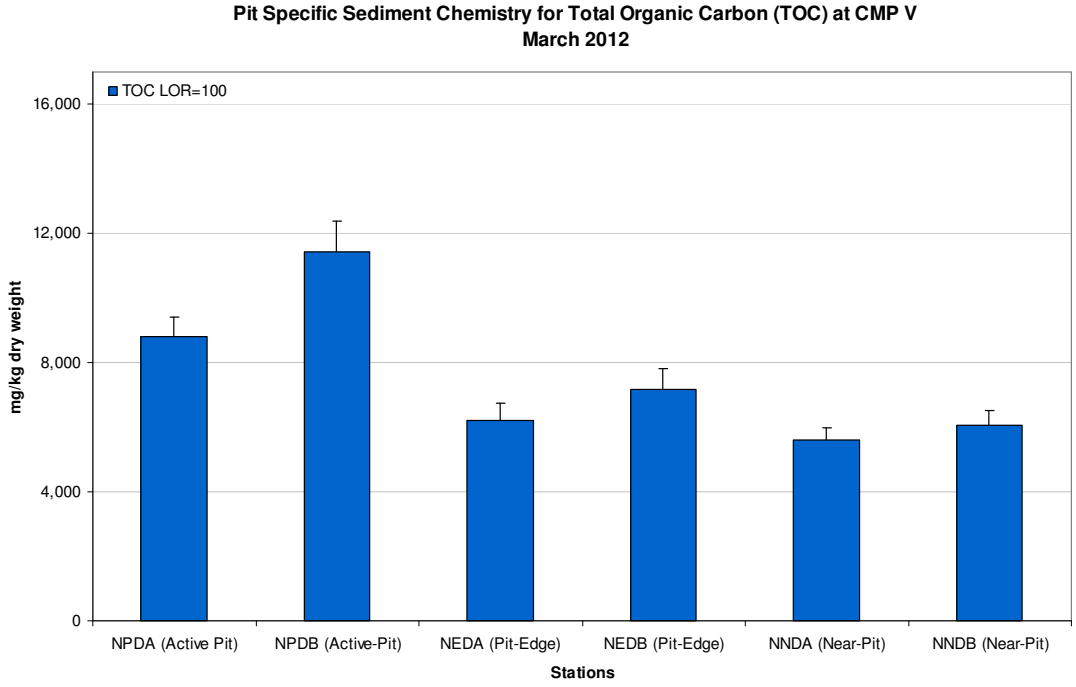

Figure 26: Concentration of Total Organic Carbon (TOC; mean + SD) in sediment samples for Pit Specific Sediment Chemistry for CMP V during March 2012.

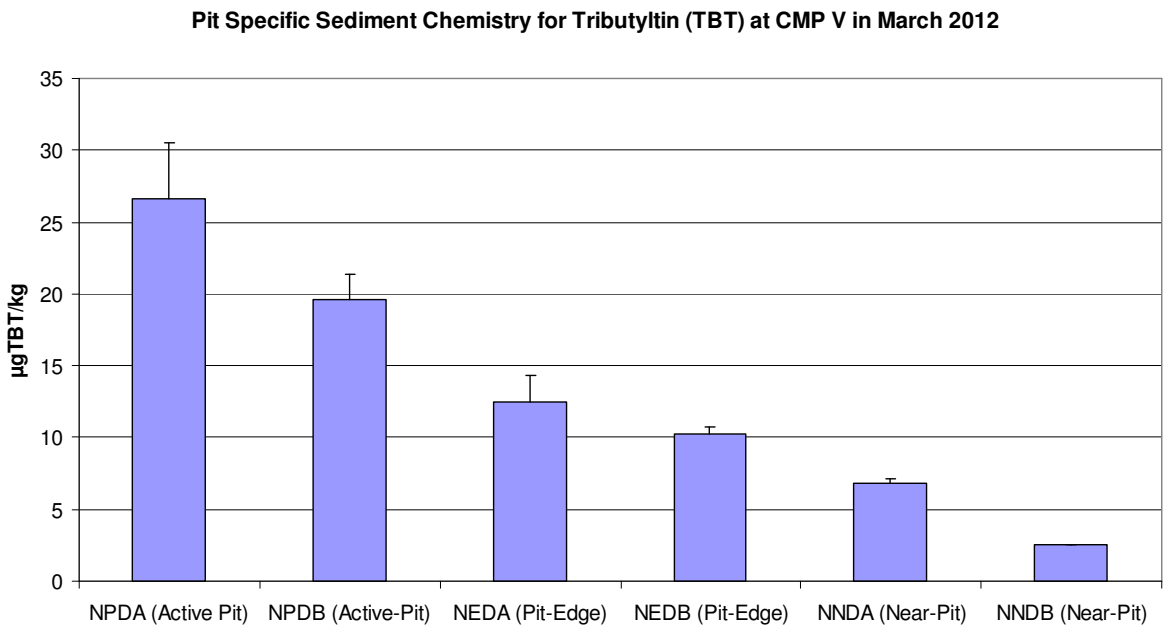

Figure 27: Concentration of Tributyltin (TBT; mean + SD) in sediment samples for Pit Specific Sediment Chemistry for CMP V during March 2012.

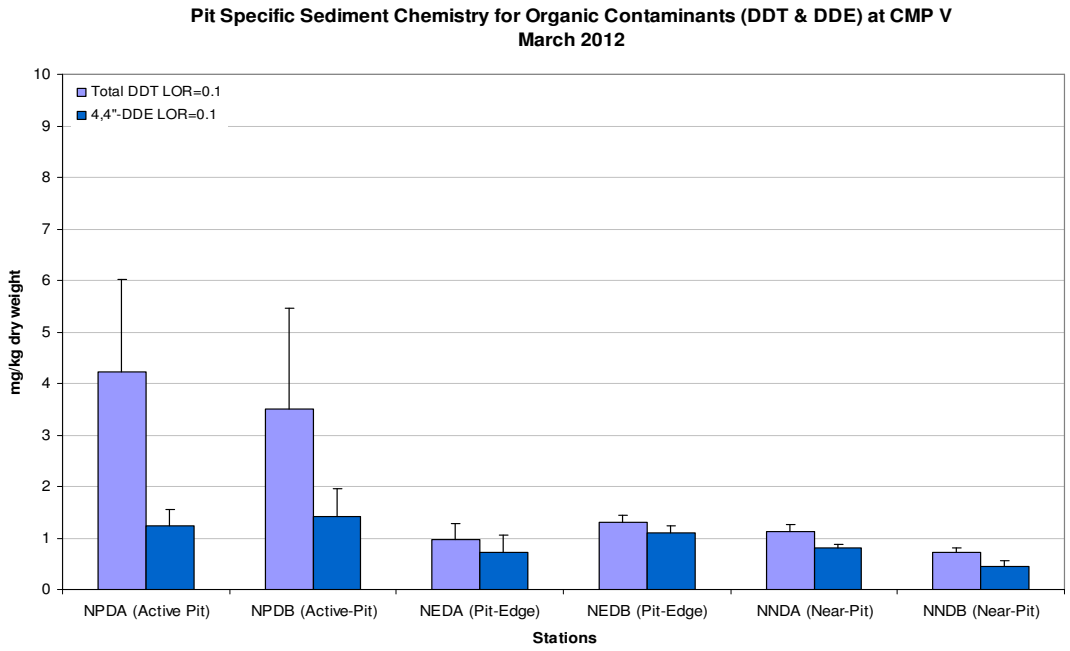

Figure 28: Concentration of Total DDT and 4,4″-DDE (mean + SD) in sediment samples for Pit Specific Sediment Chemistry for CMP V during March 2012.

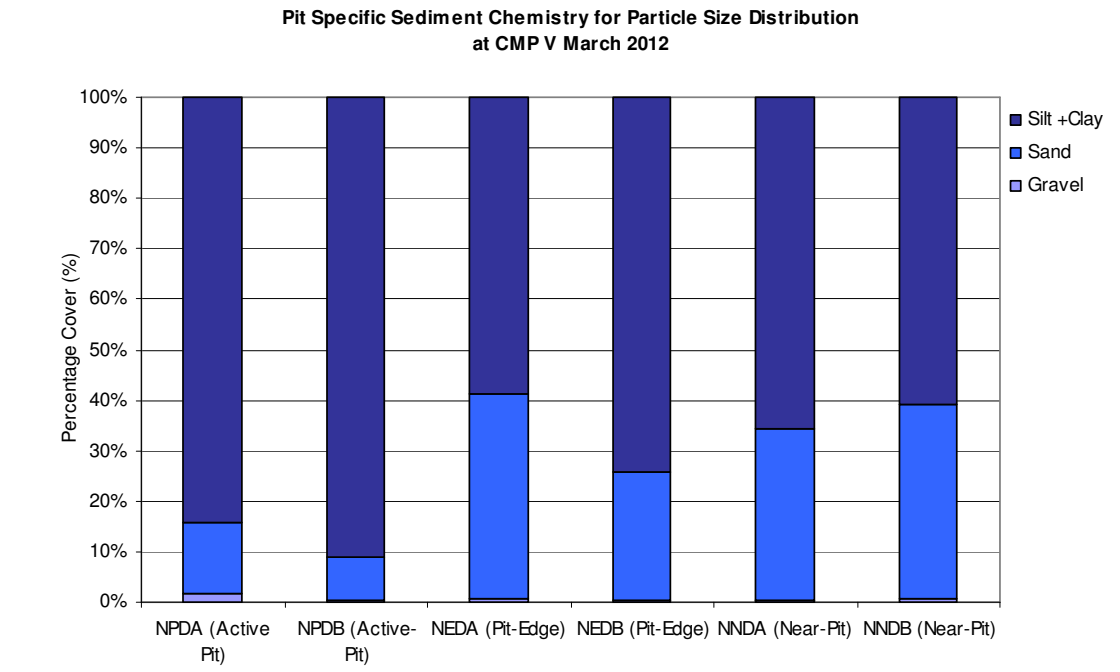

Figure 29: Particle Size Distribution (% mean) of sediment samples for Pit Specific Sediment Chemistry for CMP V during March 2012.

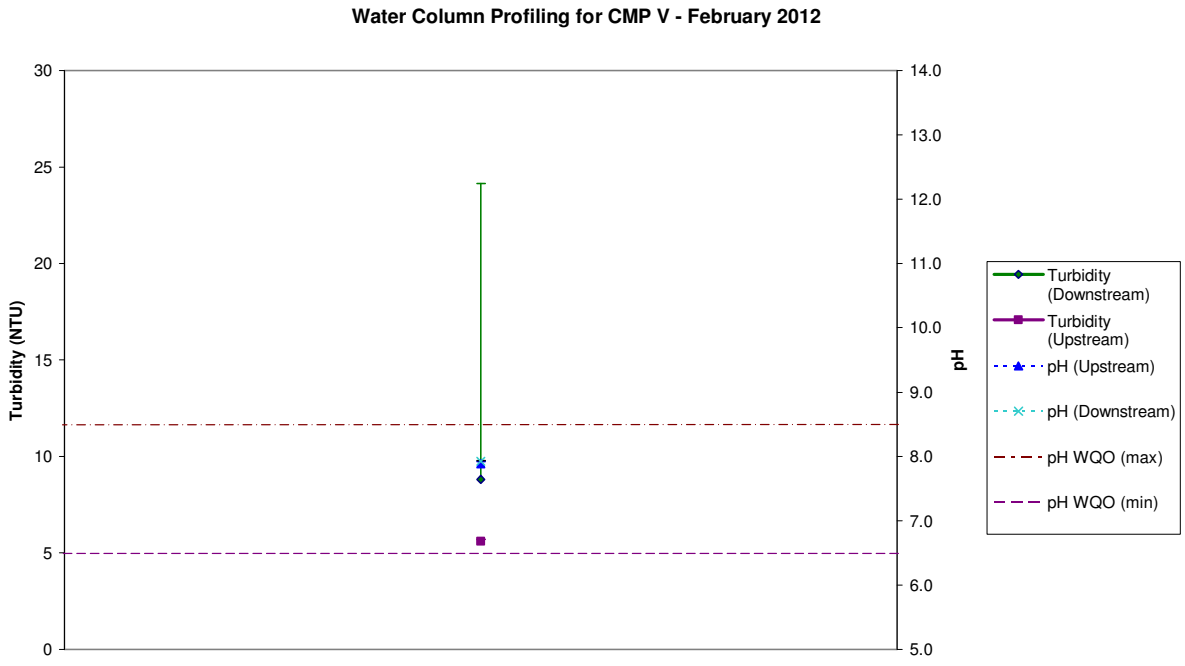

Figure 30: Turbidity and pH (mean + SD) during Water Column Profiling for CMP V in February 2012.

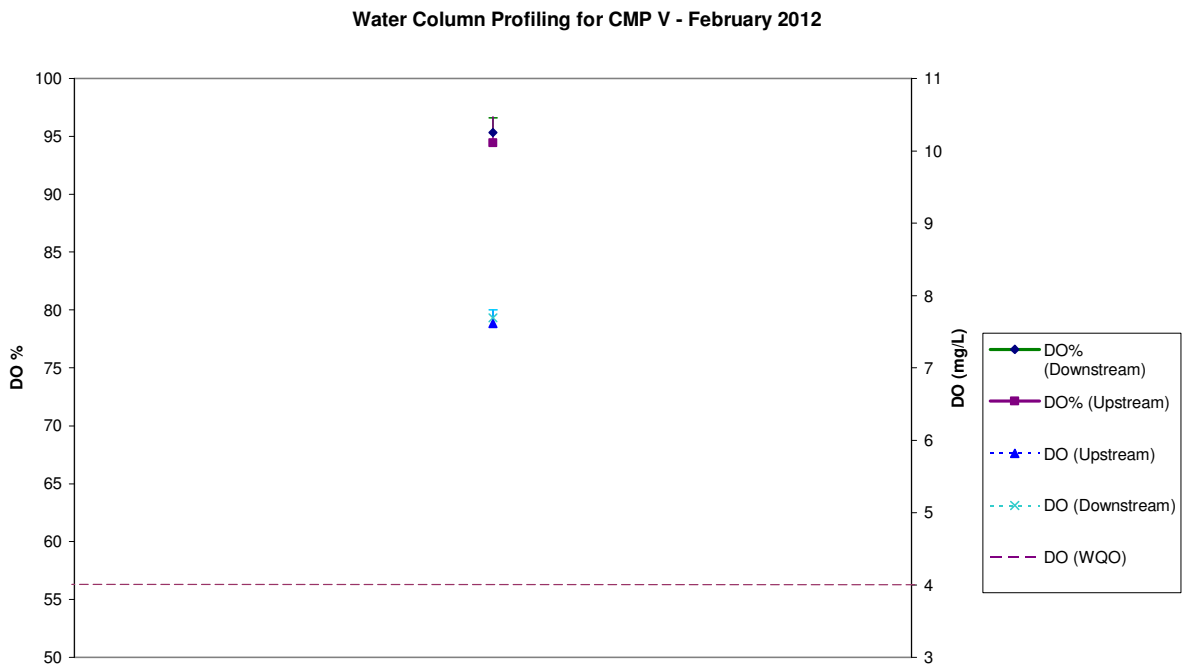

Figure 31: Dissolved Oxygen (mean + SD) during Water Column Profiling for CMP V in February 2012.

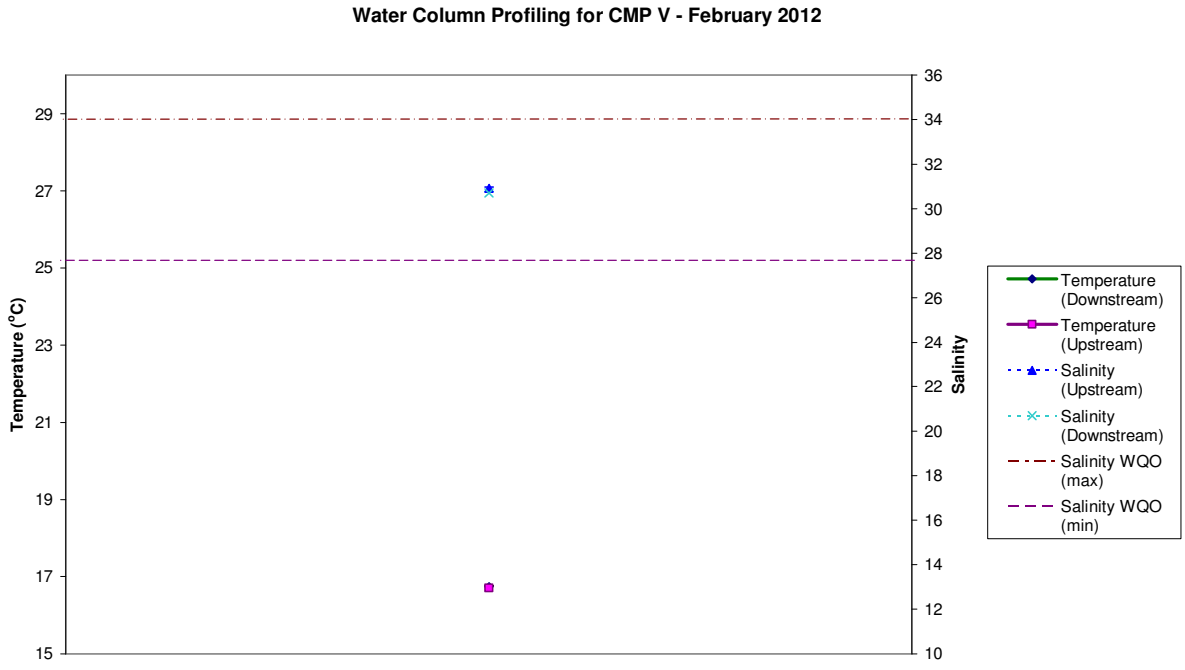

Figure 32: Salinity and Temperature (mean + SD) during Water Column Profiling for CMP V in February 2012.

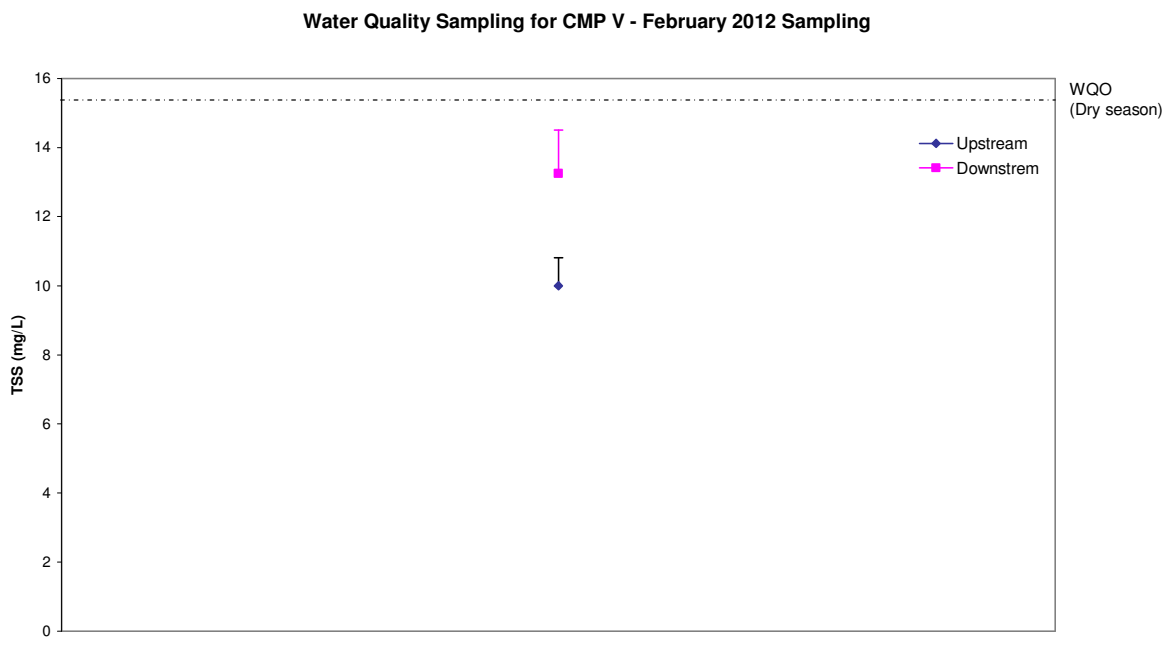

Figure 33: Total Suspended Solid Levels (mean + SD) during Water Column Profiling for CMP V in February 2012.

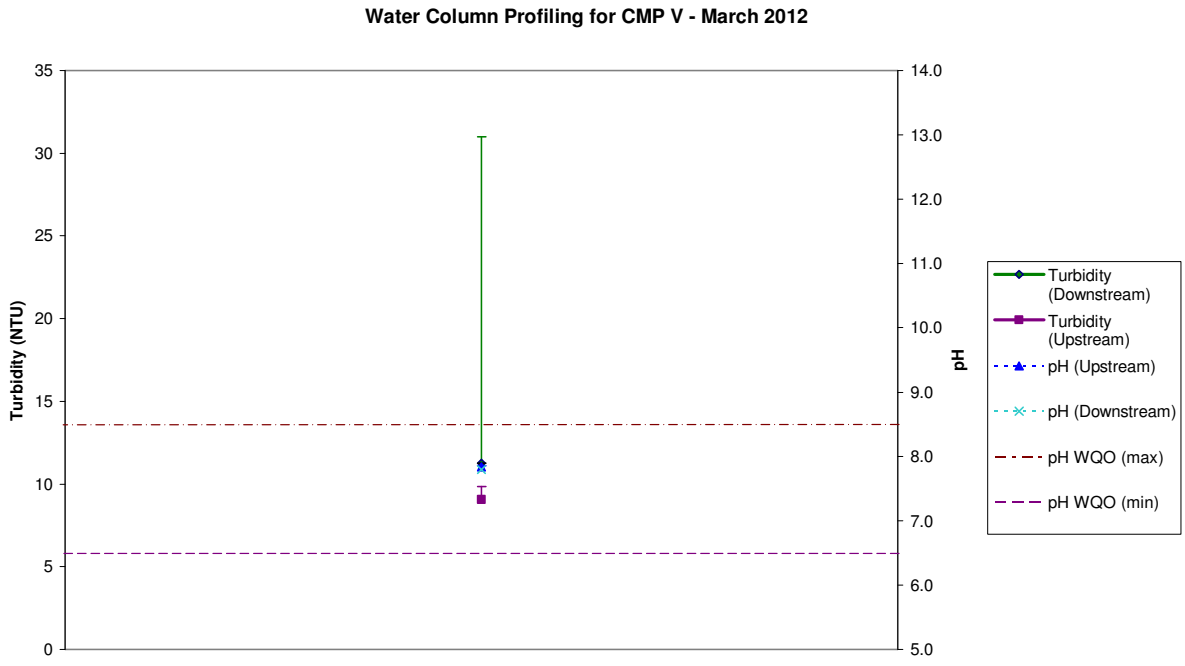

Figure 34: Turbidity and pH (mean + SD) during Water Column Profiling for CMP V in March 2012.

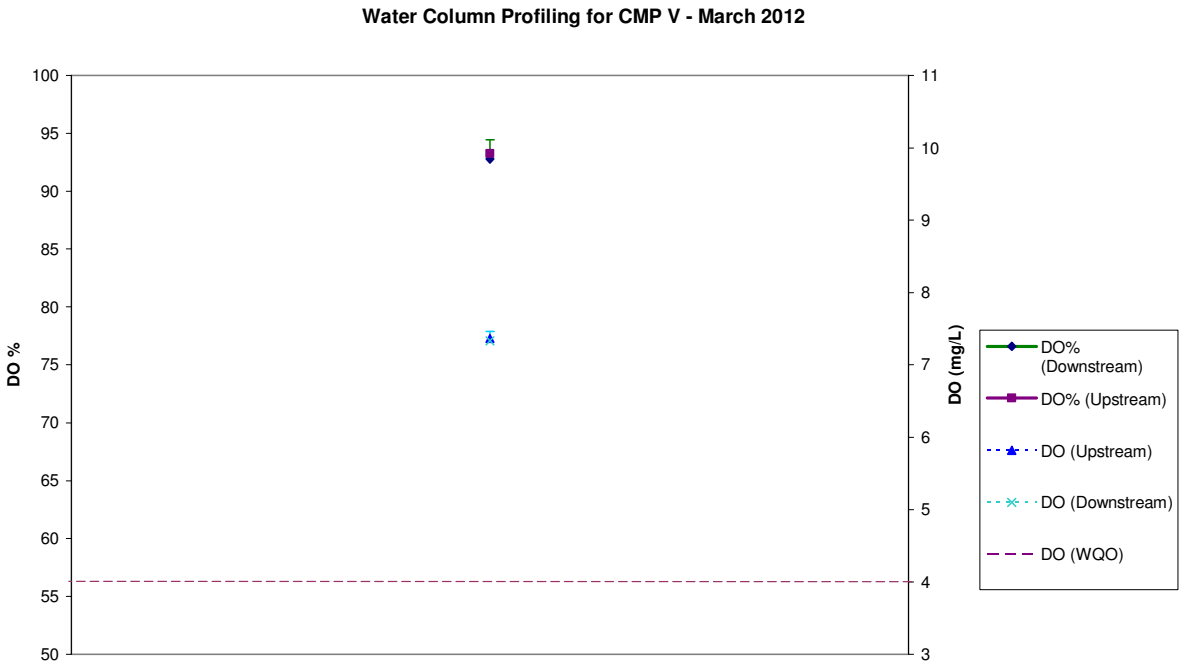

Figure 35: Dissolved Oxygen (mean + SD) during Water Column Profiling for CMP V in March 2012.

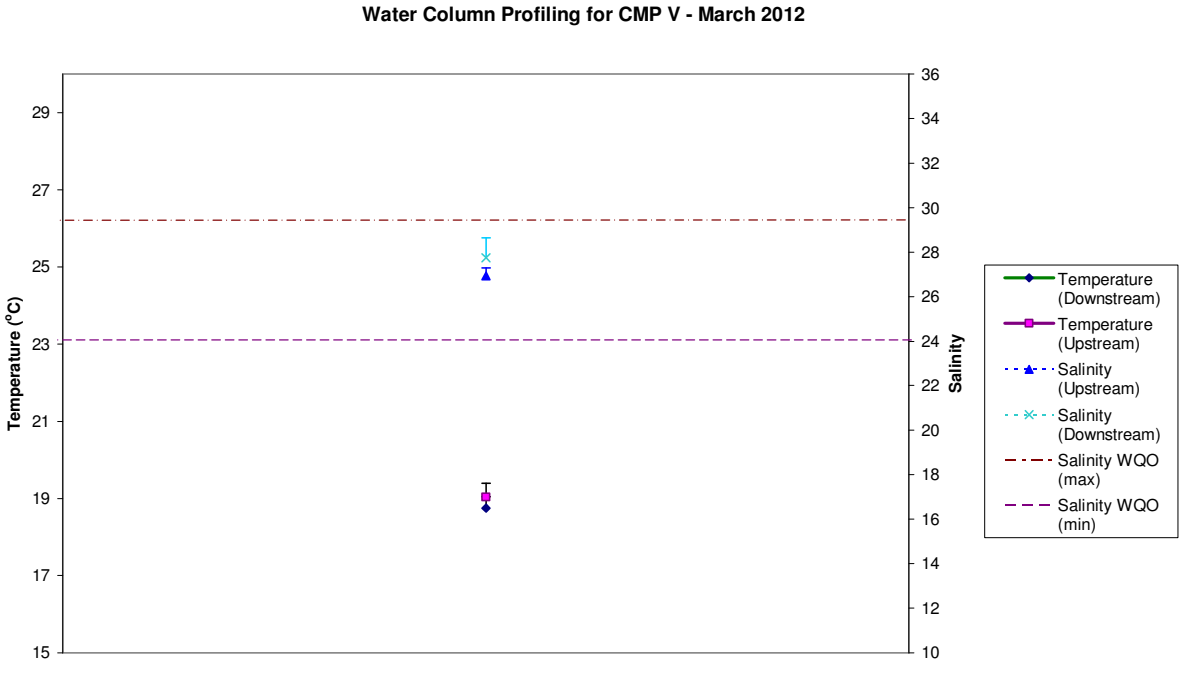

Figure 36: Salinity and Temperature (mean + SD) during Water Column Profiling for CMP V in March 2012.

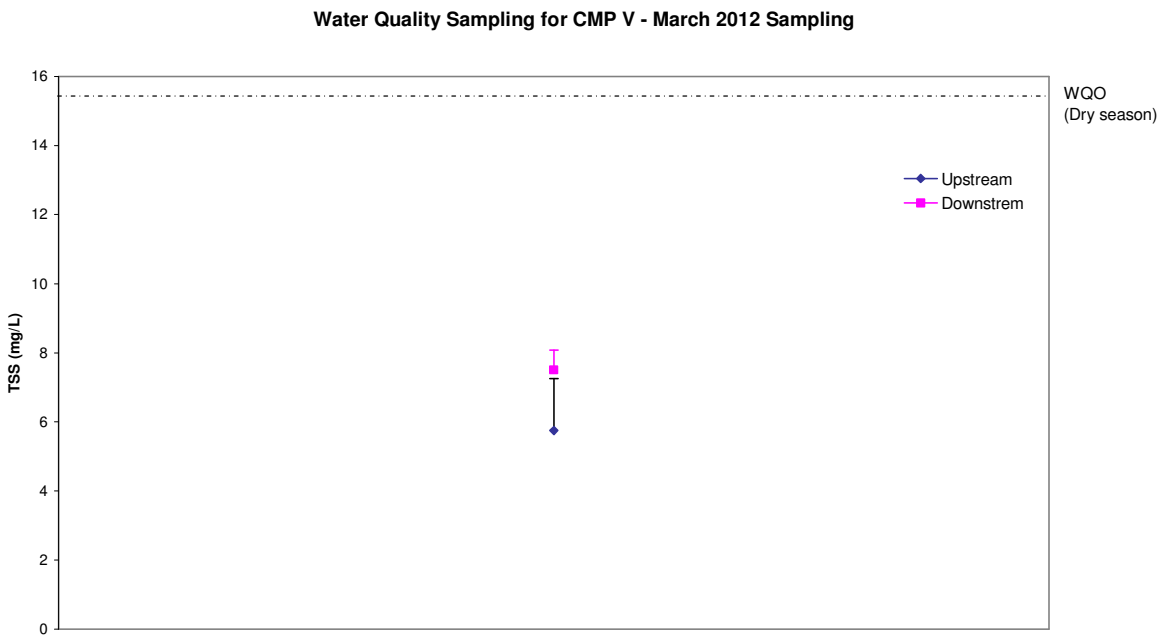

Figure 37: Total Suspended Solid Levels (mean + SD) during Water Column Profiling for CMP V in March 2012.

Annex C

Results of Impact Monitoring during CMP V Dredging Operations for March 2012

Table B1 Summary Table of DO, Turbidity and TSS Levels Recorded in March 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		
2012/03/13	ME	DS1	7.70	7.65	25.40	38.20
		DS2	7.50	7.53	18.80	35.50
		DS3	7.65	7.51	20.00	33.20
		DS4	7.56	7.48	20.40	33.20
		DS5	7.50	7.48	16.60	22.50
		MW1	7.45	7.41	2.80	6.30
		US1	7.82	7.71	17.20	27.70
		US2	7.73	7.70	4.40	20.20
	MF	DS1	7.64	7.65	15.90	28.50
		DS2	7.67	7.70	15.60	27.30
		DS3	7.81	7.80	17.60	26.20
		DS4	7.54	7.54	13.20	19.80
		DS5	7.60	7.16	8.20	14.30
		MW1	7.23	7.16	3.20	8.67
		US1	7.75	7.75	20.40	31.50
		US2	7.73	7.74	20.70	29.50

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

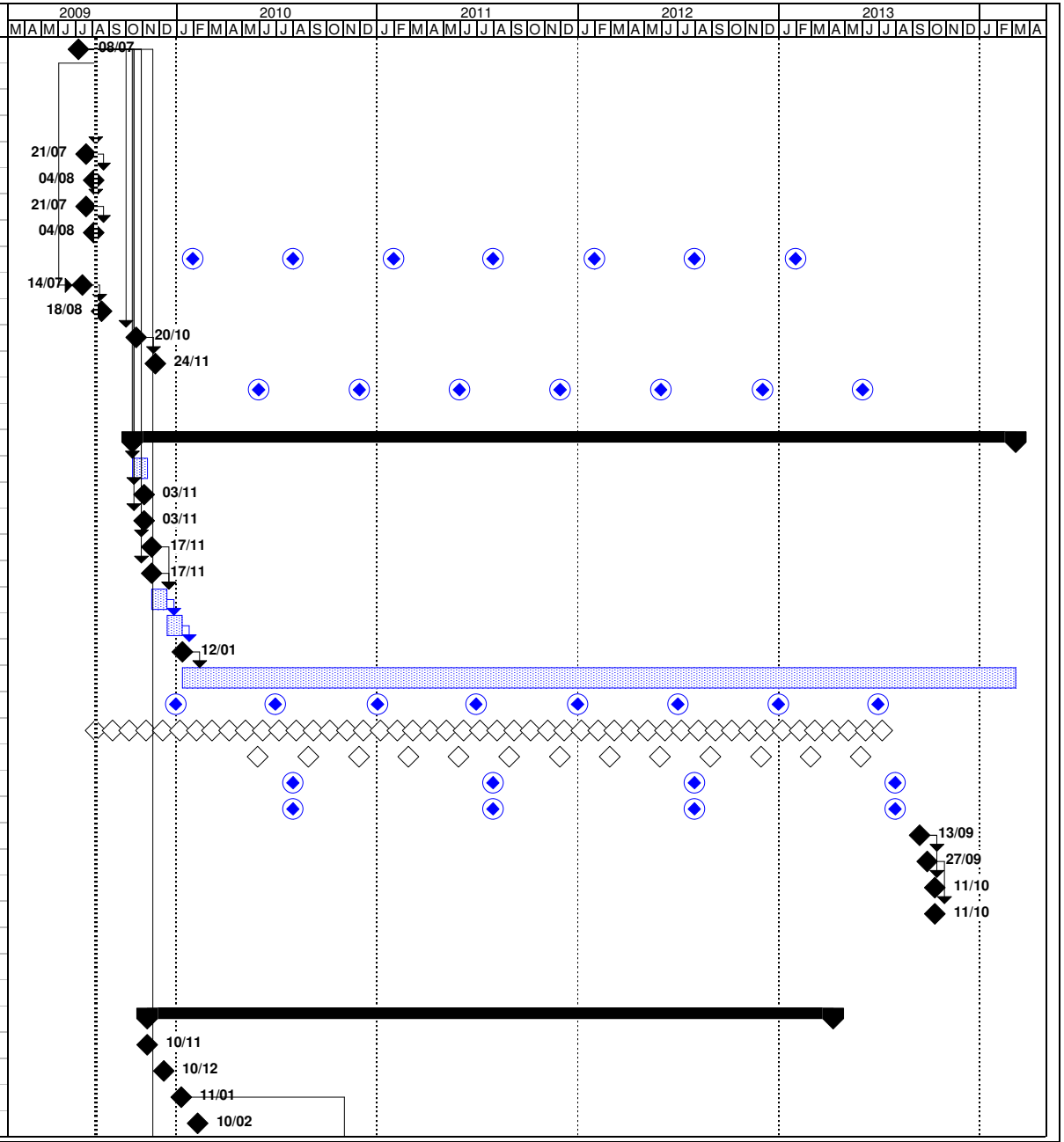

Figure 4.1 - Study Programme

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

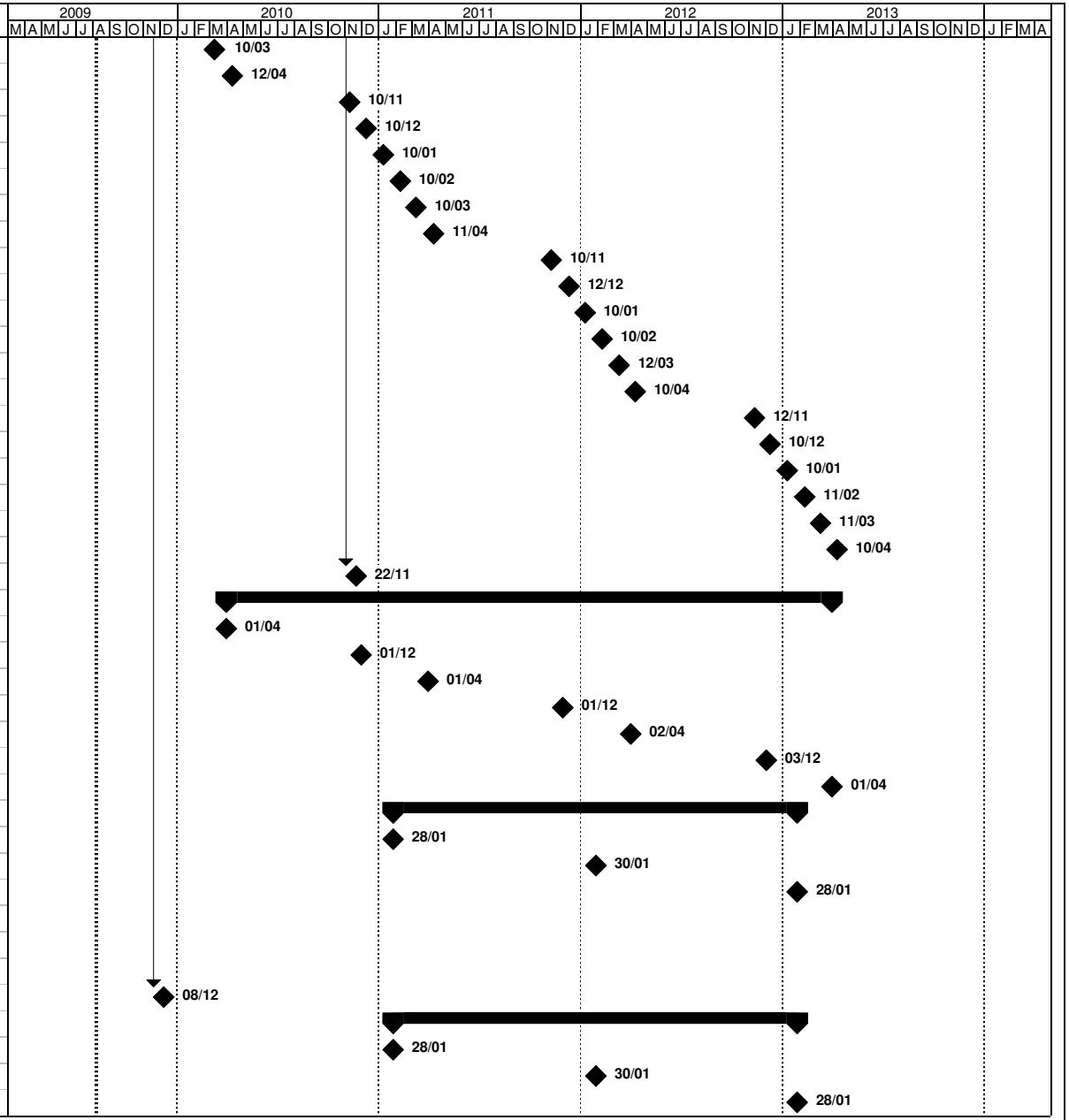

Figure 4.1 - Study Programme

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