








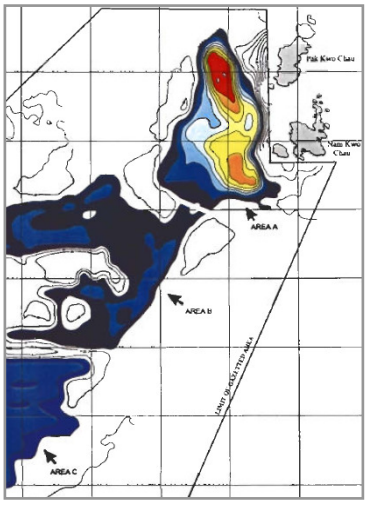

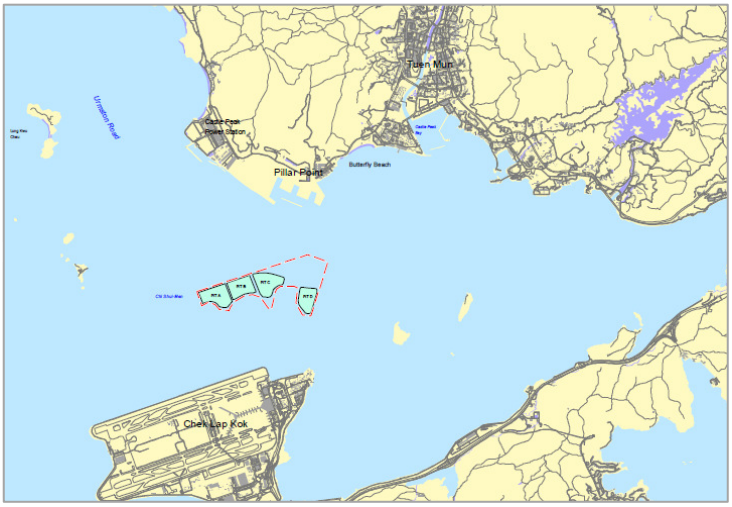

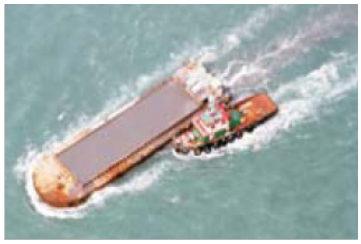

土木工程拓展署
Civil Engineering and Development Department

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

Agreement No. CE 4/2009(EP)

4th Monthly Progress Report for Contaminated Mud Pits at Sha Chau – October 2009

Final (Revision 0)

9 December 2009

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

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Client:	Proposal No:
Civil Engineering and Development Department (CEDD)	0103262
Summary:	Date: 9 December 2009
This document presents progress of monitoring works on contaminated mud pits at Sha Chau in October 2009 under Agreement No. CE 4/2009 (EP).	Approved by: *Dr Robin Kennish* *Director*

0	4th Monthly Progress Report for CMP – Final (Revision 0)	EW	CAR	RK	09/12/09
Revision	Description	By	Checked	Approved	Date

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

4th MONTHLY PROGRESS REPORT FOR CONTAMINATED MUD PITS AT SHA CHAU - October 2009

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. CMP IVc is presently in operation for backfilling by contaminated mud and is anticipated to reach its capacity in 2010. A series of four newly constructed seabed pits at the East of Sha Chau area, CMP Va-d, will be provided for the disposal of contaminated mud after CMP IVc is full. Dredging operations are now taking place to construct CMP Va. The environmental monitoring and audit (EM&A) programme for the CMPs at the East of Sha Chau area presently covers disposal operations at CMP IVc and dredging operations at CMP V.

1.2 REPORTING PERIOD

This Monthly Progress Report covers the monitoring period from July to October 2009.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

Sampling for *Impact Monitoring during Dredging Operations of CMP V* was conducted on 8 October 2009. Data for laboratory analysis of samples collected in July 2009 for *Sediment Chemistry after a Major Storm Event* and *Water Column Profiling for CMP IV* were received from the Contractor on 15 October 2009. A summary of field activities are presented in *Annex A*.

1.4 DETAILS OF OUTSTANDING SAMPLING AND / OR ANALYSIS

Water Column Profiling for CMP V was not conducted in this sampling month as there were no dredging activities on the scheduled sampling day due to maintenance of the dredger. Data from the Contractor that remain outstanding include concentrations of Total Polycyclic Aromatic Hydrocarbons (PAHs) and Tributyltin (TBT) in sediment samples and TBT in interstitial water samples for *Pit Specific Sediment Chemistry* and *Cumulative Impact Sediment Chemistry*. In addition, data for Particle Size Distribution of the sediment samples for July 2009 sampling for *Sediment Chemistry after a Major Storm Event* remain outstanding from the Contractor.

1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS

For CMP IV, monitoring results for *Water Column Profiling, Sediment Chemistry after a Major Storm Event* and *Demersal Trawling* for July and August 2009 as well as *Routine Water Quality Monitoring, Benthic Macro-Infauna & Taxonomic Identification, Pit Specific Sediment Chemistry* and *Cumulative Impact Sediment Chemistry* for August 2009 are presented below. Further for CMP V, monitoring results are presented for *Impact Monitoring during Dredging Operations* for October 2009. Detailed results will be discussed in the relevant *Quarterly Reports*.

1.5.1 Water Column Profiling for CMP IV during July 2009

Results of *Water Column Profiling* for July 2009 show that salinity, pH and Dissolved Oxygen (DO) all compiled with the Water Quality Objectives (WQOs) at both Upstream and Downstream stations (*Figures 2* to *4* of *Annex B*). However, levels of Total Suspended Solids (TSS) exceeded the WQO at both Upstream and Downstream stations (*Figure 1* of *Annex B*).

1.5.2 Water Column Profiling for CMP IV during August 2009

Results of *Water Column Profiling* for August 2009 show that salinity and pH complied with the WQOs at both Upstream and Downstream stations (*Figures 6* and *7* of *Annex B*). However, levels of DO and TSS at both the Upstream and Downstream stations did not comply with the WQOs (*Figure 5* and *8* of *Annex B*).

1.5.3 Routine Water Quality Monitoring for CMP IV during August 2009

In-situ Measurements

Levels of pH, DO and Salinity complied with the WQOs at all stations during *Routine Water Quality Monitoring* in August 2009 (*Figures 9, 12* and *13* of *Annex B*). All *in-situ* water quality measurements showed relatively minor variations between Impact, Intermediate and Reference stations (*Figures 9* to *14* of *Annex B*).

Laboratory Measurements

Concentrations of Arsenic, Cadmium, Chromium, Mercury and Silver were all below the limits of detection. Whereas, Copper, Lead, Nickel and Zinc were detected in water samples and their concentrations were relatively similar among the Impact, Intermediate and Reference stations (*Figure 15* of *Annex B*). Similarly, concentrations of Total Inorganic Nitrogen and Ammoniacal-Nitrogen showed only minor differences between the Impact, Intermediate and Reference stations (*Figure 16* of *Annex B*). Levels of TSS complied with the WQO (10.0mg L^{-1}) at the Intermediate station, however, exceedances of the WQO were observed at both the Impact and Reference stations (*Figure 17* of *Annex B*). Levels of BOD_5 were below detection limits at all stations.

1.5.4 *Sediment Chemistry after a Major Storm Event for CMP IV (Molave)*

Sampling for *Sediment Chemistry after a Major Storm Event* was conducted on 22 July 2009 after the visit of Tropical Cyclone *Molave*, which led to the issue of *No. 8 Gale or Storm Signal* on 18 July 2009 and *No. 9 Gale or Storm Signal* on 19 July 2009. The track of *Molave* is shown in *Figure 1.4.1*.

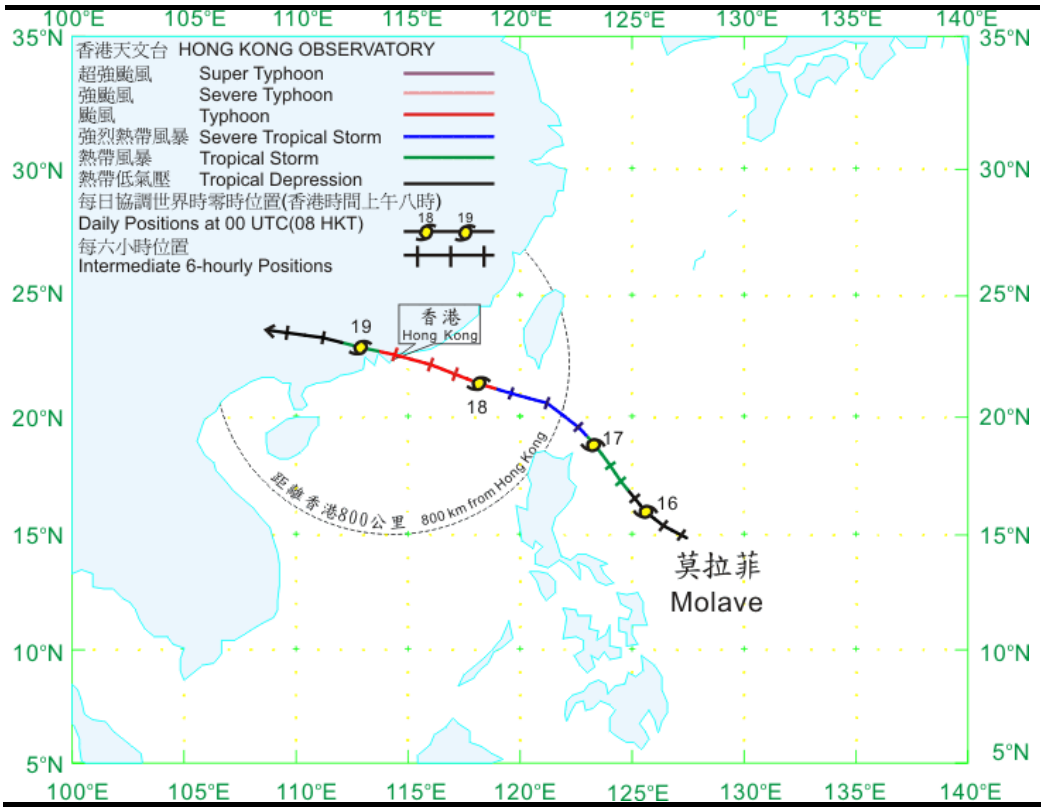


Figure 1.4.1 ***Track of Tropical Cyclone Molave from 15-19 July 2009*** ***(Source: Hong Kong Observatory)***

Concentrations of all metals, except Arsenic, were below the *Lower Chemical Exceedance Limit* (*LCEL*) and *Upper Chemical Exceedance Limit* (*UCEL*) (*Figures 18* and *19* of *Annex B*). Concentrations of Arsenic in sediments from all stations exceeded *LCEL* (12 mg/kg), but remained below *UCEL* (42 mg/kg).

Moisture content in the sediments from all stations ranged between 42.2 - 60.6% (*Figure 20* of *Annex B*). Data for Particle Size Distribution of sediment samples remains outstanding from the Contractor.

1.5.5 *Sediment Chemistry after a Major Storm Event for CMP IV (Goni)*

Sampling for *Sediment Chemistry after a Major Storm Event* was conducted on 7 August 2009 after the visit of Tropical Cyclone *Goni*, which led to the issue of *No. 8 Gale or Storm Signal* on 5 August 2009. The track of *Goni* is shown in *Figure 1.4.2*.

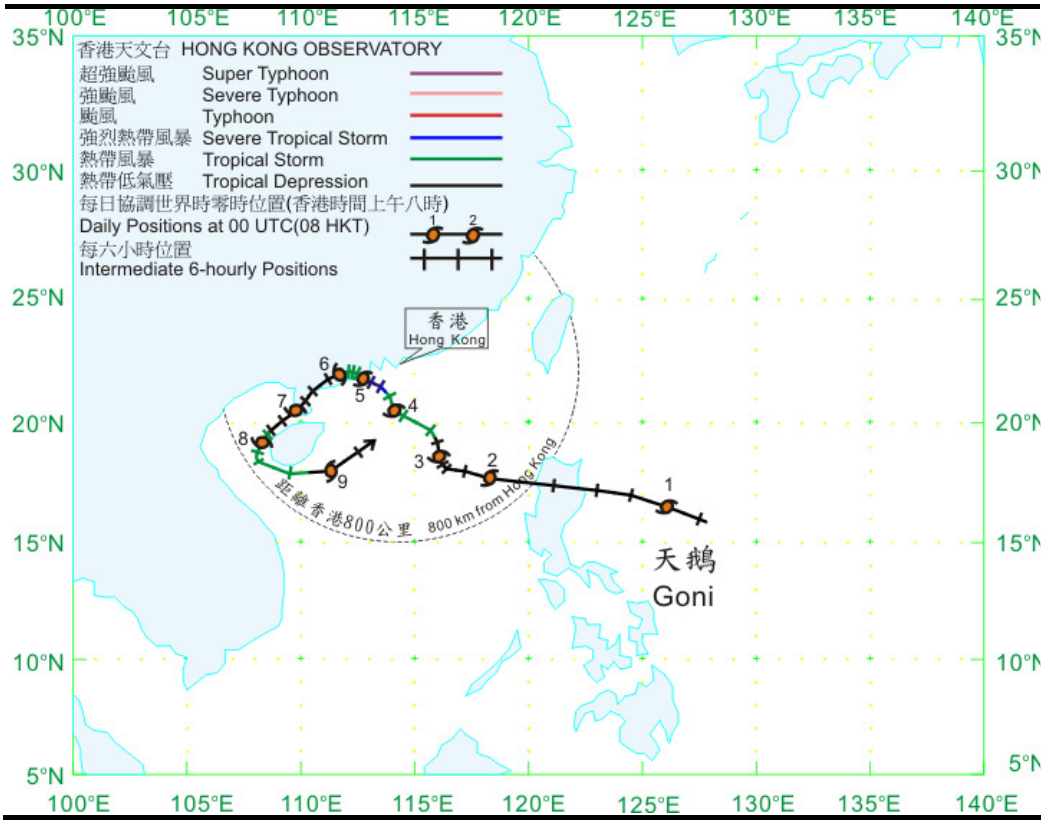


Figure 1.4.2 ***Track of Tropical Cyclone Goni from 1-9 August 2009 (Source: Hong Kong Observatory)***

Concentrations of all metals, except Arsenic, were below the *LCEL* and *UCEL* (*Figures 21* and *22* of *Annex B*). Concentrations of Arsenic in sediments from all stations exceeded *LCEL* (12 mg/kg), but remained below *UCEL* (42 mg/kg).

Moisture content in the sediments from all stations ranged between 45.4 - 57.5% (*Figure 23* of *Annex B*). Sediments were mainly composed of sand (35.9 – 65.1 %) and gravel (25.4 – 30.8 %) materials (*Figure 24* of *Annex B*).

1.5.6 Benthic Macro-Infauna and Taxonomic Identification

A benthic survey was conducted at the Capped Mud Pit stations and at the Reference stations to the south of Sha Chau in August 2009. A total of 73 individuals, belonging to eight animal phyla were obtained from the monitoring stations. *Table 1.4.1* summarises the results of the benthic survey.

Table 1.4.1 Summary of Benthic Survey Results during August 2009 Monitoring

Area	Station	No. of individuals (Total)	Biomass (g) (Total)	No. of Individuals (Per Station)	Biomass (g) (Per Station)	Average Biomass per individual (mg)	Average Number of Genera
Capped Stations							
CPA	3	7	0.23	2.33	0.08	0.03	5
CPB	3	16	9.07	5.33	3.02	0.57	8
CPC	3	8	3.29	2.67	1.10	0.41	6
(Total)		*31*	*12.59*	*10.33*	*4.20*	*1.01*	*19*
Reference Stations							
RBA	3	14	21.11	4.67	7.04	1.51	8
RBB	3	7	0.32	2.33	0.11	0.05	6
RBC	3	21	12.43	7.00	4.14	0.59	12
(Total)		*42*	*33.86*	*14.00*	*11.29*	*2.15*	*26*
Total	**18**	**73**	**46.45**				

Total number of individuals, total biomass, average biomass per individual and average number of genera were lower at the Capped stations than at the Reference stations.

1.5.7 Demersal Trawling for July and August 2009

Abundance and Biomass

The average number of species collected during the July and August 2009 sampling is presented in *Table 1.4.2*. In the July and August 2009 sampling, species richness was relatively similar between the Impact and Reference stations.

Table 1.4.2 Summary of the Mean Number of Faunal Species Caught during July and August 2009 Monitoring

Date of	IMPACT STATIONS		REFERENCE STATIONS			
Sampling	INA	INB	TNA	TNB	TSA	TSB
Jul 2009	37.2	41.0	38.0	35.8	42.4	38.8
Aug 2009	37.0	40.4	41.2	36.2	36.0	35.2

During July 2009, the number of individuals per station, total biomass per station, mean Catch per Unit Effort (CPUE) and mean Yield per Unit Effort (YPUE) of the catch were higher at the Reference stations TSA and TSB compared to all other stations (*Table 1.4.3*). During August 2009, total biomass per station and mean YPUE were higher at the Impact station INA and the Reference station TSA, whereas the number of individuals per station and the mean CPUE were highest at the Reference station TSA compared with all other stations (*Table 1.4.3*).

Table 1.4.3 Summary of CPUE and YPUE during July and August 2009 Monitoring

Date	Stations	Impact / Reference Stations	No. of Individuals per Station	Total Biomass per Station (g)	Mean CPUE[#1] per Tow	Mean YPUE[#2] per Tow (g)
Jul 2009	INA	Impact	12,196.0	82,073.3	2,439.2	16,414.7
Jul 2009	INB	Impact	11,055.0	71,573.6	2211	14,314.7
Jul 2009	TNA	Reference	10,036.0	63,738.1	2,007.2	12,747.6
Jul 2009	TNB	Reference	11,171.6	73,785.4	2,234.3	14,757.1
Jul 2009	TSA	Reference	18,343.0	104,439.1	3,668.6	20,887.8
Jul 2009	TSB	Reference	24,836.0	215,796.0	4,967.2	43,159.2
Aug 2009	INA	Impact	12,360.0	97,890.8	2,472.0	19,578.2
Aug 2009	INB	Impact	11,363.0	71,961.9	2,272.6	14,392.4
Aug 2009	TNA	Reference	8,896.0	67,743.5	1,779.2	13,548.7
Aug 2009	TNB	Reference	9,422.0	69,373.3	1,884.4	13,874.7
Aug 2009	TSA	Reference	24,240.0	102,574.9	4,848.0	20,515.0
Aug 2009	TSB	Reference	8,771.0	56,648.1	1,754.2	11,329.6

[#1] CPUE is calculated by dividing the number of individuals with the trawling time and number of nets (in hour and number of nets)

[#2] YPUE is calculated by dividing the weight (g) of fish with trawling effort (in hour and number of nets)

1.5.8 Pit Specific Sediment Chemistry for CMP IV during August 2009

All metal concentrations at all stations were below the *LCEL Sediment Criteria*, with the exception of Arsenic (*Figures 25* and *26* of *Annex B*). Concentrations of Arsenic exceeded *LCEL* at all stations. No metal concentrations exceeded *UCEL* (*Figures 25* and *26* of *Annex B*). Overall, variation in the concentration of metals among stations was minor (*Figures 25* and *26* of *Annex B*).

Concentrations of Total DDT and 4,4" DDE were lower than detection limits at all stations except at the Near-Pit stations, where concentration remained relatively low (*Figure 27* of *Annex B*) Total Organic Carbon concentrations in the sediment were slightly higher at the Active-Pit stations relative to other stations (*Figure 28* of *Annex B*). Sediments were mainly composed of sand (30.0 – 63.0 %) and gravel (22.0 – 32.5 %) materials (*Figure 29* of *Annex B*).

Concentrations were below detection limit at all stations for Low Molecular Weight (LMW) PAHs, High Molecular Weight (HMW) PAHs and Polychlorinated biphenyls (PCBs). Results for Total PAHs of the sediment samples remain outstanding from the Contractor. Further, concentrations of Tributyltin (TBT) in interstitial water and in sediments are also outstanding from the Contractor.

1.5.9 Cumulative Impact Sediment Chemistry for August 2009

Concentrations of all metals, except Arsenic, were below *LCEL* (*Figures 30* and *31* of *Annex B*). Concentrations of Arsenic in sediments from all stations were above the *LCEL*. Overall, there were only minor differences in metal concentrations between the stations (*Figure 30* and *31* of *Annex B*). All metal concentrations remained below *UCEL* (*Figure 30* and *31* of *Annex B*).

The concentration of 4,4" DDE was higher at Mid-Field stations and Far-Field station RFA compared to all other stations, which were below detection limits (*Figure 32* of *Annex B*). Concentrations of Total DDT were below detection limits at all stations except Mid-Field station RMB (*Figure 32* of *Annex B*). Concentrations of Total Organic Carbon in sediments were relatively similar between stations (*Figure 33* of *Annex B*). Sediments were mainly composed of sand (31.8 – 56.4 %) and gravel (33.8 – 40.1 %) materials (*Figure 34* of *Annex B*).

Concentrations were below detection limit at all stations for Low Molecular Weight (LMW) PAHs, High Molecular Weight (HMW) PAHs and Polychlorinated biphenyls (PCBs). Results for Total PAHs of the sediment samples remain outstanding from the Contractor. Further, concentrations of Tributyltin (TBT) in interstitial water and in sediments are also outstanding from the Contractor.

1.5.10 Impact Monitoring during Dredging Operations of CMP V – October 2009

Impact Monitoring during Dredging Operations of CMP V was conducted on 8 October 2009. 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 V. Monitoring was also conducted at the Ma Wan station. At each station, *in-situ* measurements of water quality parameters and water samples were taken from three water depth levels of the water column which were surface (1m below sea surface), mid-depth and bottom (1m above the seabed).

Monitoring results are presented in *Figures 35* to *38* of *Annex B.* Levels of DO, depth-average Turbidity and TSS compiled with the Action and Limit Levels set in the *Baseline Monitoring Report* [1] (*Tables B1* and *B2* of *Annex B)*.

1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

Impact Monitoring during Dredging Operations and *Water Column Profiling* will be conducted for CMP V in the next monthly period. No sampling works will be conducted for CMP IV. The sampling schedule for the *Monitoring Contract* is presented in *Annex A*.

1.7 STUDY PROGRAMME

A summary of Study programme is presented in *Annex C*.

[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 CEDD.

Annex A

Sampling Schedule

Annex A1 - East of Sha Chau Environmental Monitoring and Audit Sampling Schedule for CMP IVc (July 2009 - February 2010)

			2009						2010	
Pit Specific Sediment Chemistry	**Code**	**Frequency**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Active-Pit										
	NCA 1 - 8	3 times per year		*				*		
	NCB 1 - 8	3 times per year		*				*		
Pit-Edge										
	CPA 1-8	3 times per year		*				*		
	CPB 1-8	3 times per year		*				*		
Near-Pit										
	CNA 1-8	3 times per year		*				*		
	CNB 1-8	3 times per year		*				*		

Cumulative Impact Sediment Chemistry			**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Near-field Stations										
	RNA 1-9	2 times per year		*				*		
	RNB 1-9	2 times per year		*				*		
Mid-field Stations										
	RMA 1-9	2 times per year		*				*		
	RMB 1-9	2 times per year		*				*		
Capped Pit Stations										
	RCA 1-9	2 times per year		*				*		
	RCB 1-9	2 times per year		*				*		
Far-Field Stations										
	RFA 1-9	2 times per year		*				*		
	RFB 1-9	2 times per year		*				*		

Sediment Toxicity Tests			**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Near-Field Stations										
	TCA	2 times per year		3				3		
	TCB	2 times per year		3				3		
Reference Stations										
	TRA	2 times per year		3				3		
	TRB	2 times per year		3				3		

Tissue/ Whole Body Sampling			**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Near-Pit Stations										
	INA	2 times per year		*						*
	INB	2 times per year		*						*
Reference North										
	TNA	2 times per year		*						*
	TNB	2 times per year		*						*
Reference South										
	TSA	2 times per year		*						*
	TSB	2 times per year		*						*

Demersal Trawling			**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Near Pit Stations										
	INA 1-5	4 times per year	5	5					5	5
	INB 1-5	4 times per year	5	5					5	5
Reference North										
	TNA 1-5	4 times per year	5	5					5	5
	TNB 1-5	4 times per year	5	5					5	5
Reference South										
	TSA 1-5	4 times per year	5	5					5	5
	TSB 1-5	4 times per year	5	5					5	5

Capping			**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Ebb Tide										
Impact Station Downcurrent										
	IPE1	4 times per year	3	3				3		3
	IPE2	4 times per year	3	3				3		3
	IPE3	4 times per year	3	3				3		3
	IPE4	4 times per year	3	3				3		3
	PFC1	4 times per year	3	3				3		3
Intermediate Station Downcurrent										
	INE1	4 times per year	3	3				3		3
	INE2	4 times per year	3	3				3		3
	INE3	4 times per year	3	3				3		3
	INE4	4 times per year	3	3				3		3
	INE5	4 times per year	3	3				3		3
Reference Station Upcurrent										
	RFE1	4 times per year	3	3				3		3
	RFE2	4 times per year	3	3				3		3
	RFE3	4 times per year	3	3				3		3
	RFE4	4 times per year	3	3				3		3
	RFE5	4 times per year	3	3				3		3
Flood Tide										
Impact Station Downcurrent										
	INF1	4 times per year	3	3				3		3
	PFC2	4 times per year	3	3				3		3
	INF3	4 times per year	3	3				3		3
Intermediate Station Downcurrent										
	IPF1	4 times per year	3	3				3		3
	IPF2	4 times per year	3	3				3		3
	IPF3	4 times per year	3	3				3		3
Reference Station Upcurrent										
	RFF1	4 times per year	3	3				3		3
	RFF2	4 times per year	3	3				3		3
	RFF3	4 times per year	3	3				3		3

Routine Water Quality Monitoring			**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Ebb Tide										
Impact Station Downcurrent										
	IPE1	2 times per year		*						*
	IPE2	2 times per year		*						*
	IPE3	2 times per year		*						*
	IPE4	2 times per year		*						*
	IPE5	2 times per year		*						*
Intermediate Station Downcurrent										
	INE1	2 times per year		*						*
	INE2	2 times per year		*						*
	INE3	2 times per year		*						*
	INE4	2 times per year		*						*
	INE5	2 times per year		*						*
Reference Station Upcurrent										
	RFE1	2 times per year		*						*
	RFE2	2 times per year		*						*
	RFE3	2 times per year		*						*
	RFE4	2 times per year		*						*
	RFE5	2 times per year		*						*
Flood Tide										
Impact Station Downcurrent										
	INF1	2 times per year		*						*
	INF2	2 times per year		*						*
	INF3	2 times per year		*						*
Intermediate Station Downcurrent										
	IPF1	2 times per year		*						*
	IPF2	2 times per year		*						*
	IPF3	2 times per year		*						*
Reference Station Upcurrent										
	RFF1	2 times per year		*						*
	RFF2	2 times per year		*						*
	RFF3	2 times per year		*						*

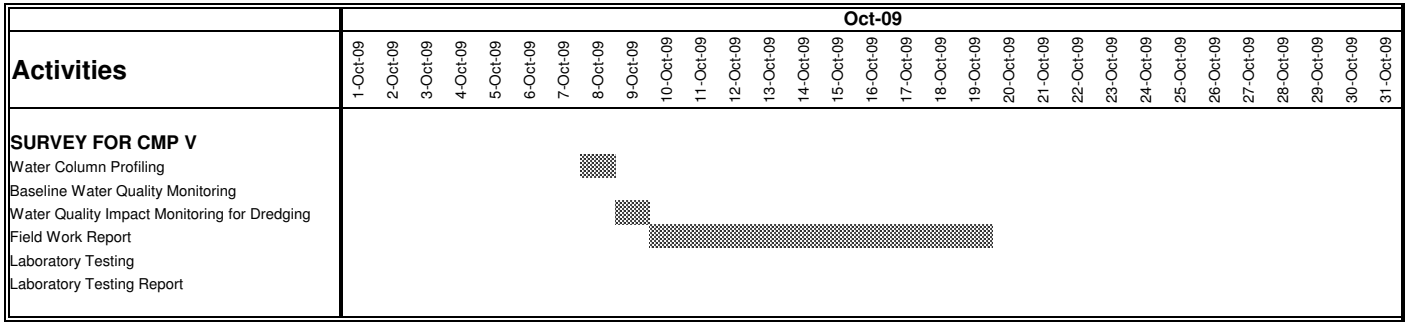
Water Column Profiling			**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Plume Stations	WCP1	6 times per year	2	2				2	2	2
	WCP2	6 times per year	2	2				2	2	2

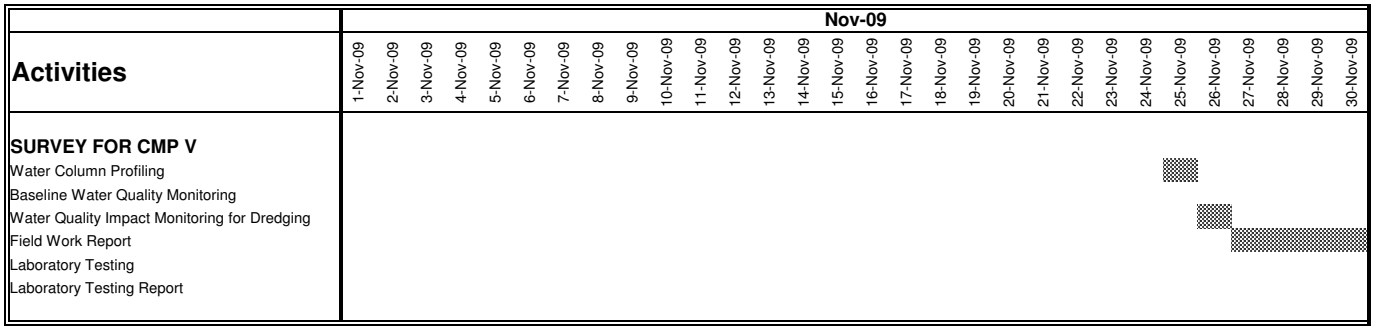
Benthic Recolonisation Studies			**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Capped Contaminated Mud Pits										
	CPA 1-3	2 times per year		3				3		
	CPB 1-3	2 times per year		3				3		
	CPC 1-3	2 times per year		3				3		
Reference Stations										
	RBA 1-3	2 times per year		3				3		
	RBB 1-3	2 times per year		3				3		
	RBC 1-3	2 times per year		3				3		

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

Annex A2 Contaminated Mud Pit V Sampling Schedule

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





Annex B

Monitoring Results

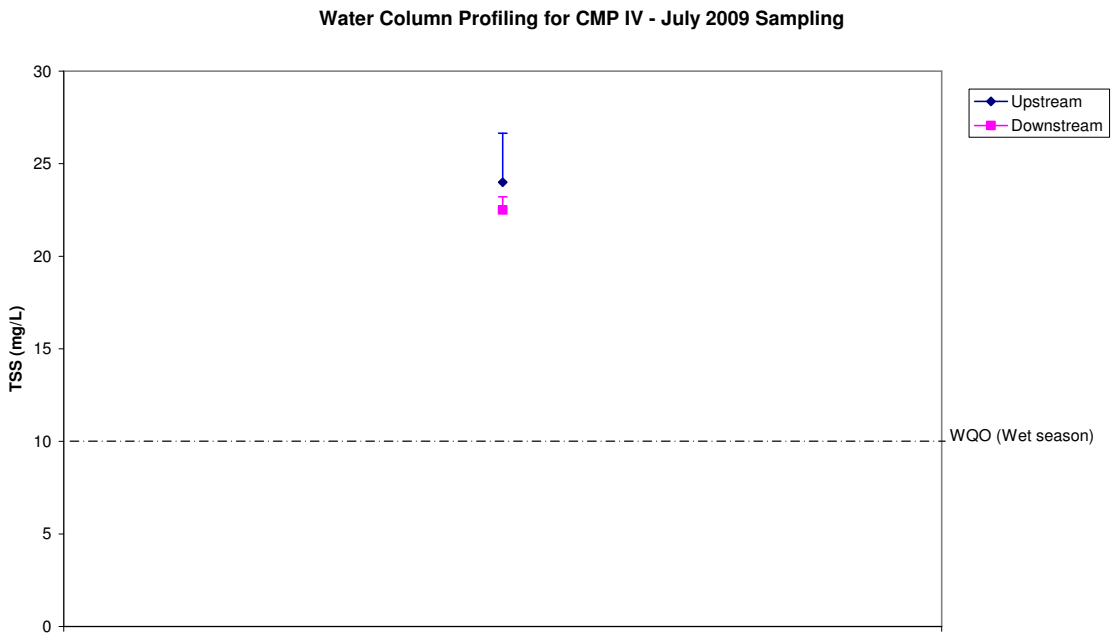


Figure 1: Total Suspended Solids (mean ± SD) during Water Column Profiling for CMP IV in July 2009.

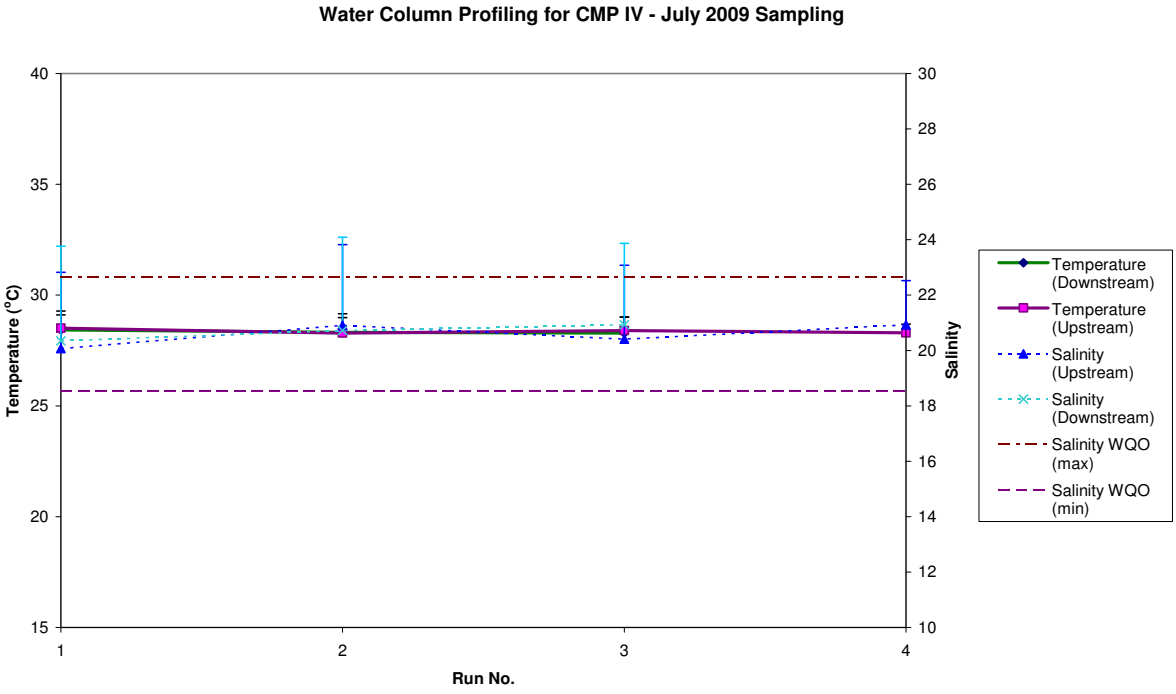


Figure 2: Salinity and Temperature (mean ± SD) during Water Column Profiling for CMP IV in July 2009.

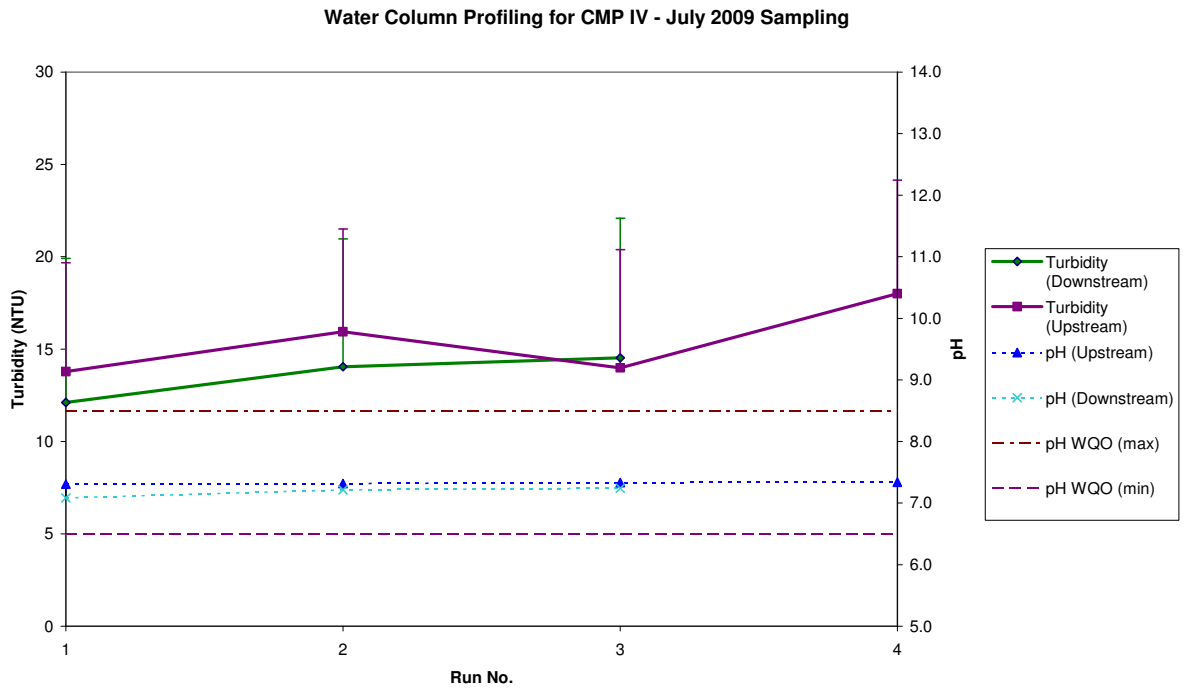


Figure 3: Turbidity and pH (mean ± SD) during Water Column Profiling for CMP IV in July 2009.

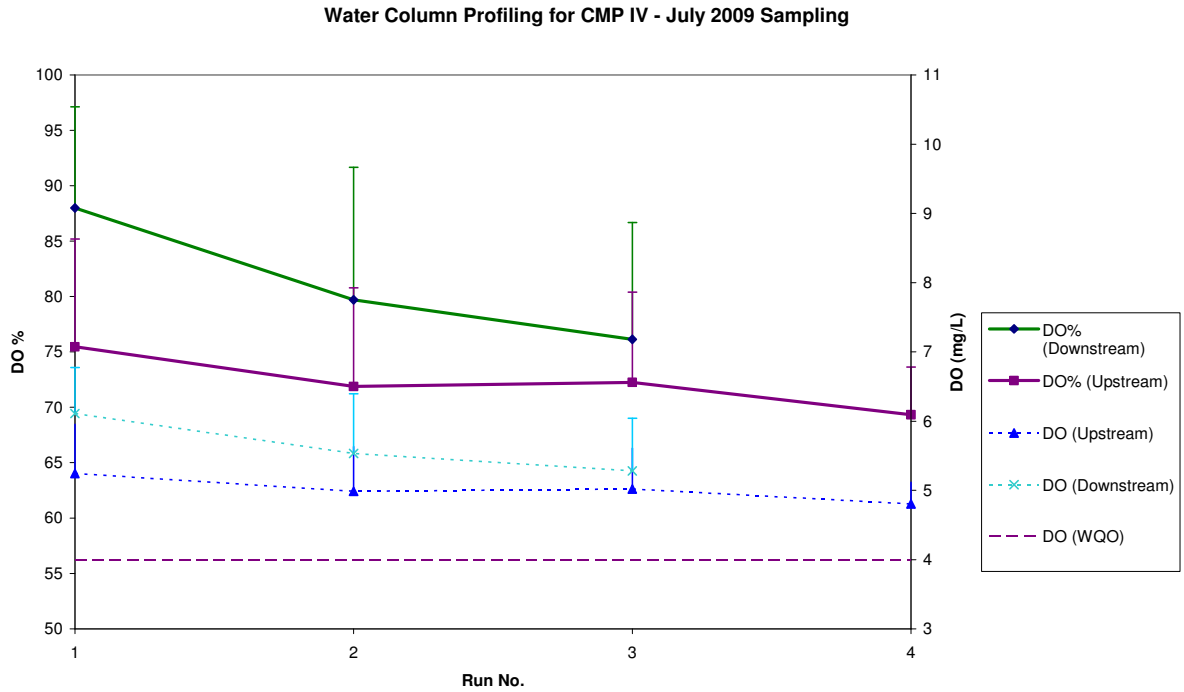


Figure 4: Dissolved Oxygen (mean ± SD) during Water Column Profiling for CMP IV in July 2009.

Source: H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau (2009 - 2013)\06 Contract Submission (LAM)\ 06.9 Water Column Profiling\July 2009

Date: 18/11/2009

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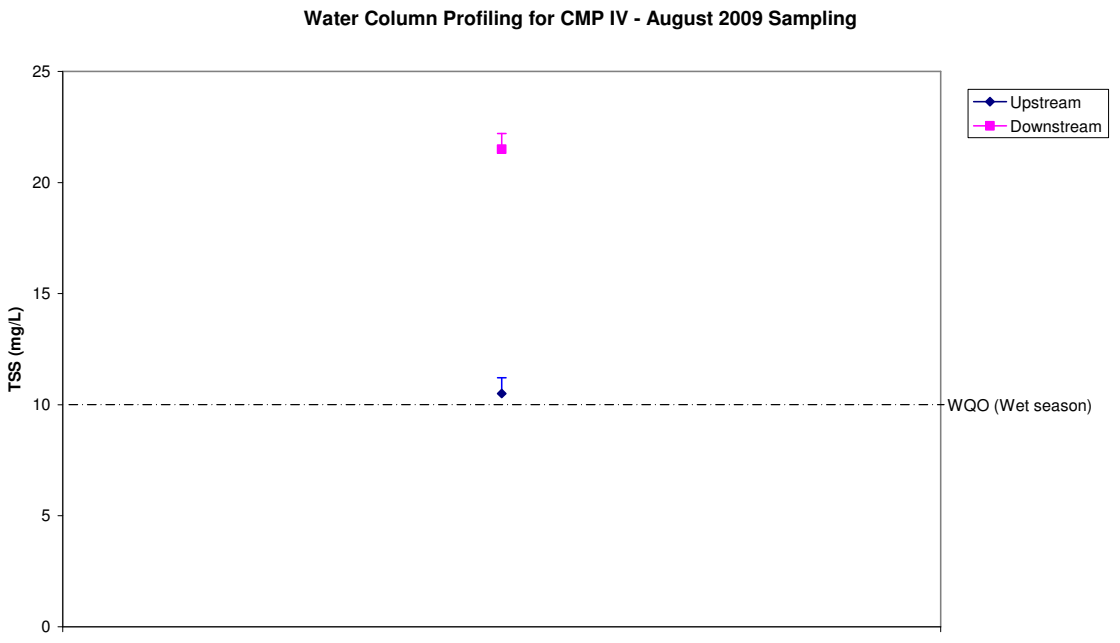

Figure 5: Total Suspended Solids (mean ± SD) during Water Column Profiling for CMP IV in August 2009.

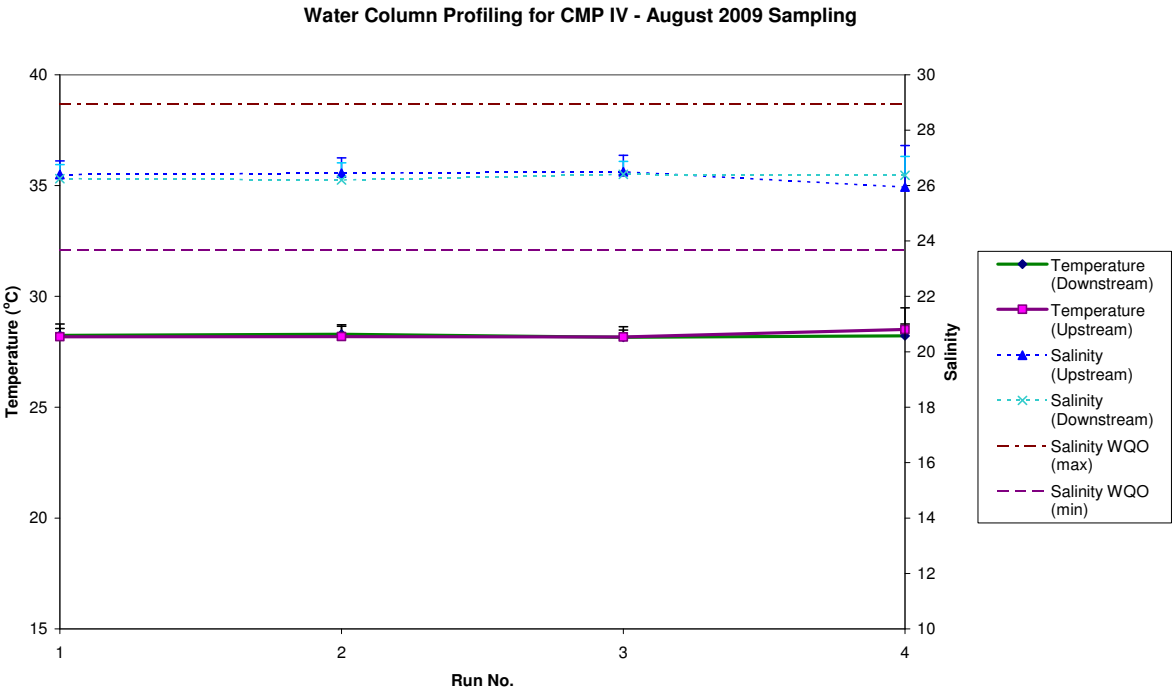

Figure 6: Salinity and Temperature (mean ± SD) during Water Column Profiling for CMP IV in August 2009.

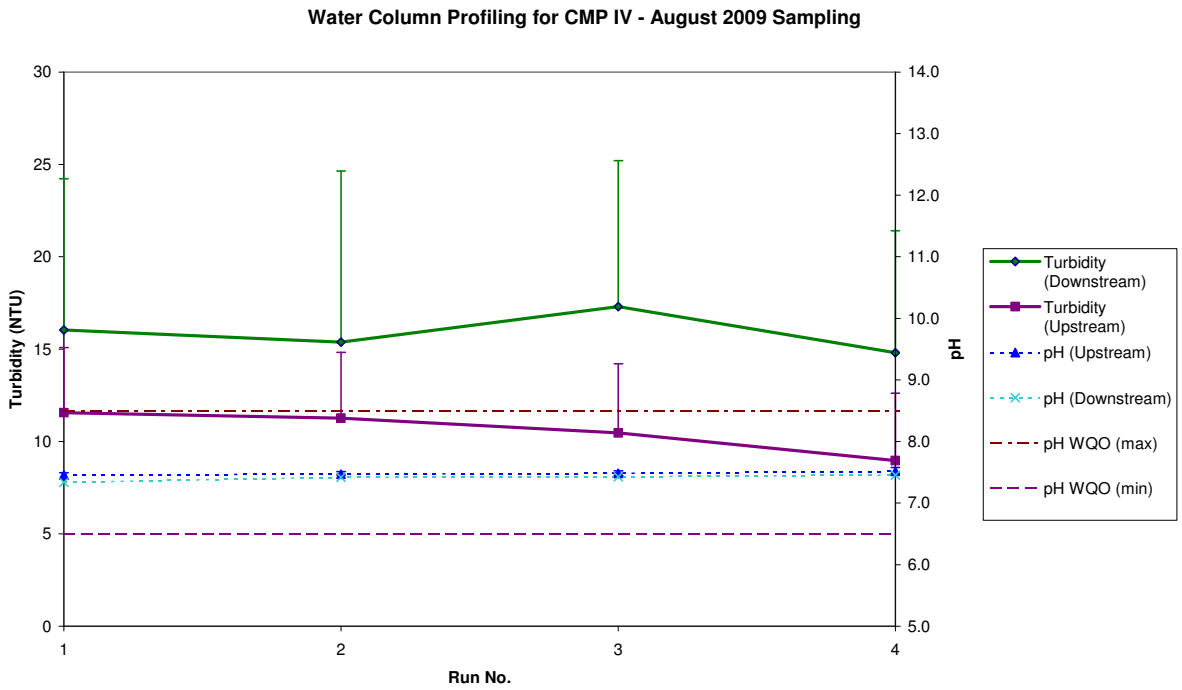

Figure 7: Turbidity and pH (mean ± SD) during Water Column Profiling for CMP IV in August 2009.

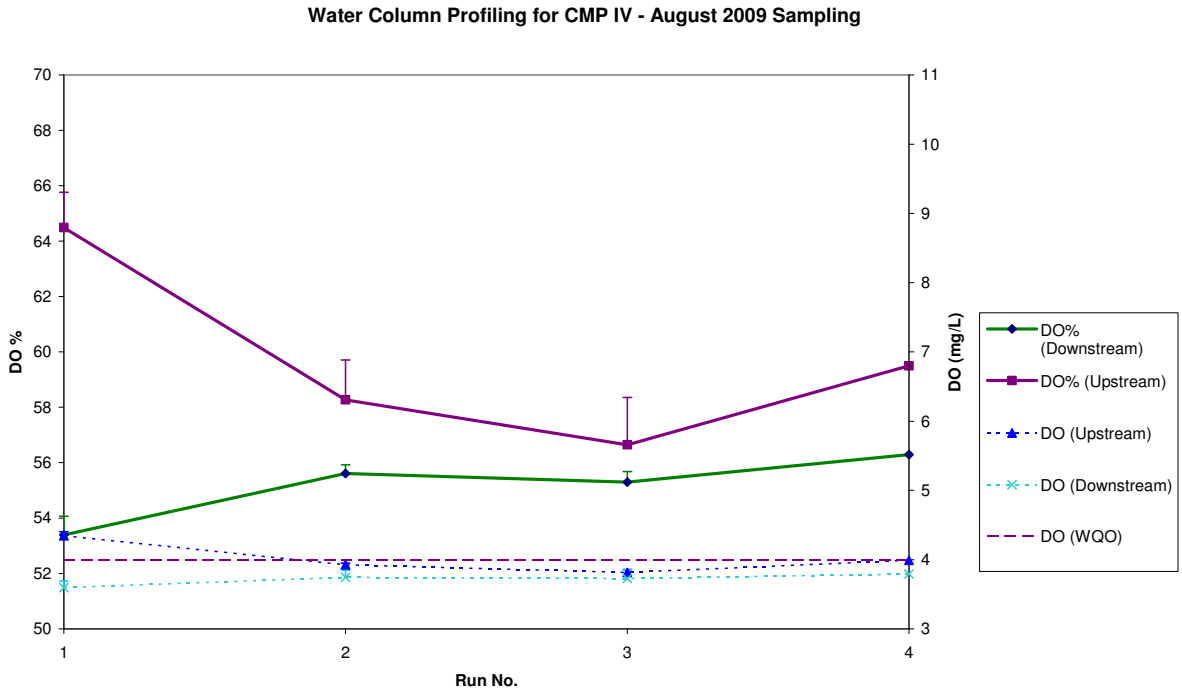

Figure 8: Dissolved Oxygen (mean ± SD) during Water Column Profiling for CMP IV in August 2009.

Source: H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau (2009 - 2013)\06 Contract Submission (LAM)\06.9 Water Column Profiling\August 2009

Date: 18/11/2009

Environmental Resources Management

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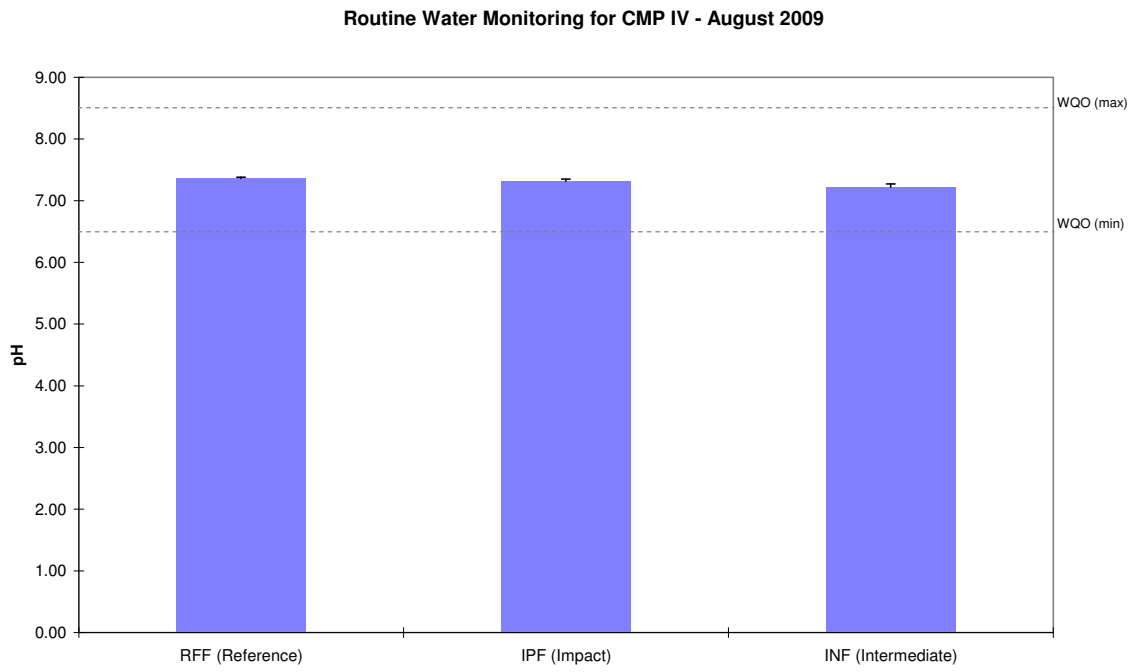


Figure 9: Level of pH (mean ± SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP IV in August 2009.

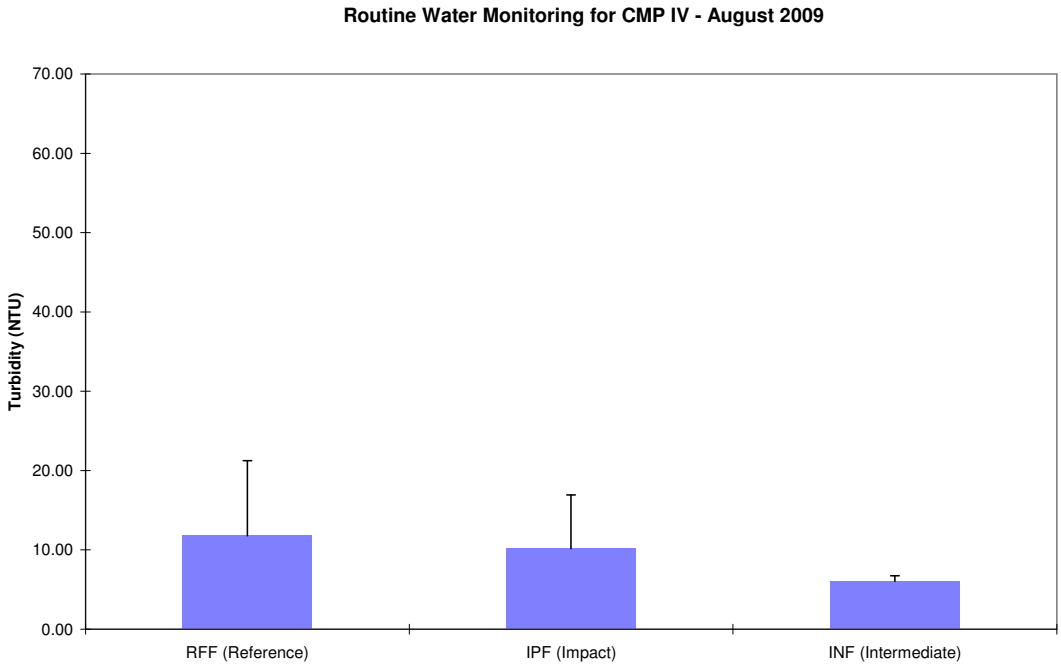


Figure 10: Level of Turbidity (mean ± SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP IV in August 2009.

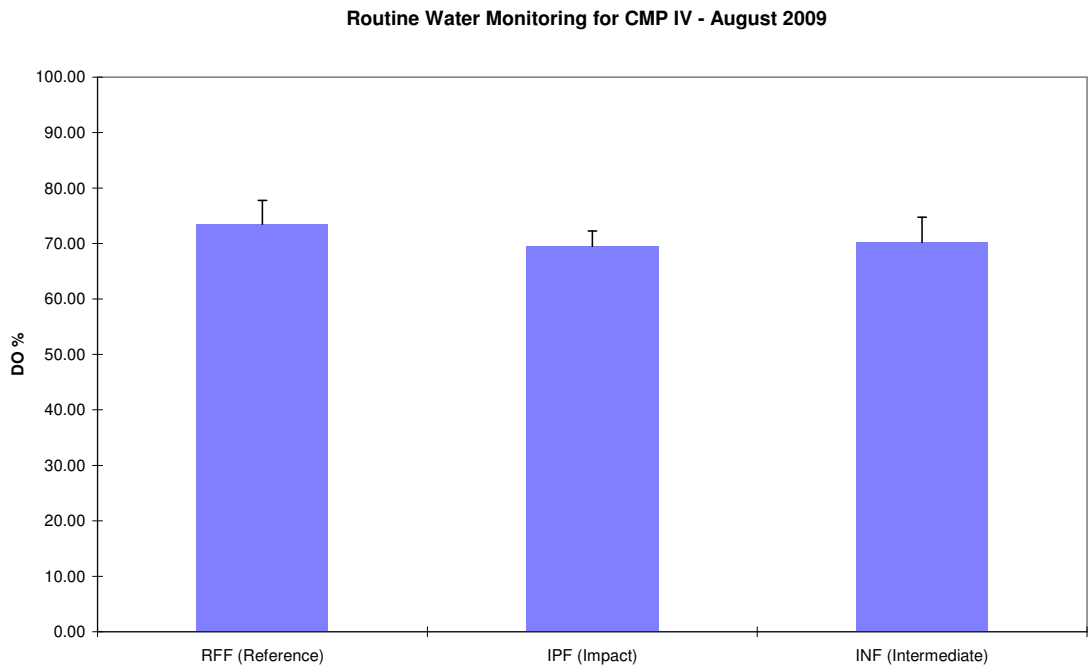


Figure 11: Level of Dissolved Oxygen (% mean ± SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP IV in August 2009.

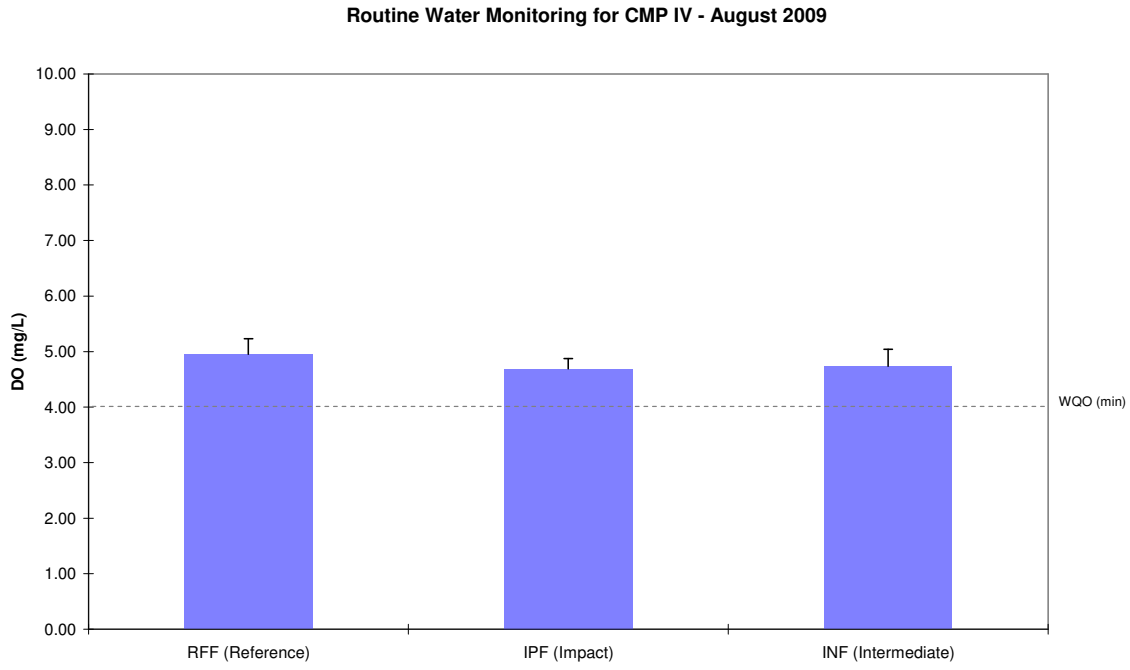


Figure 12: Concentration of Dissolved Oxygen (mg/L mean ± SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP IV in August 2009.

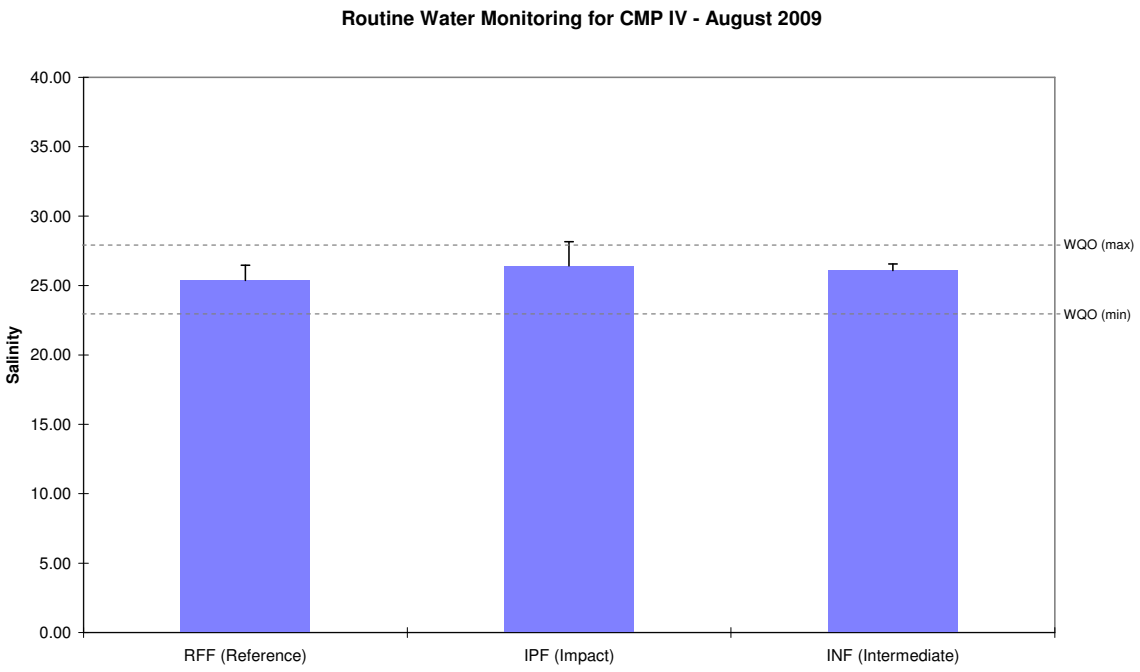


Figure 13: Level of Salinity (mean ± SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP IV in August 2009.

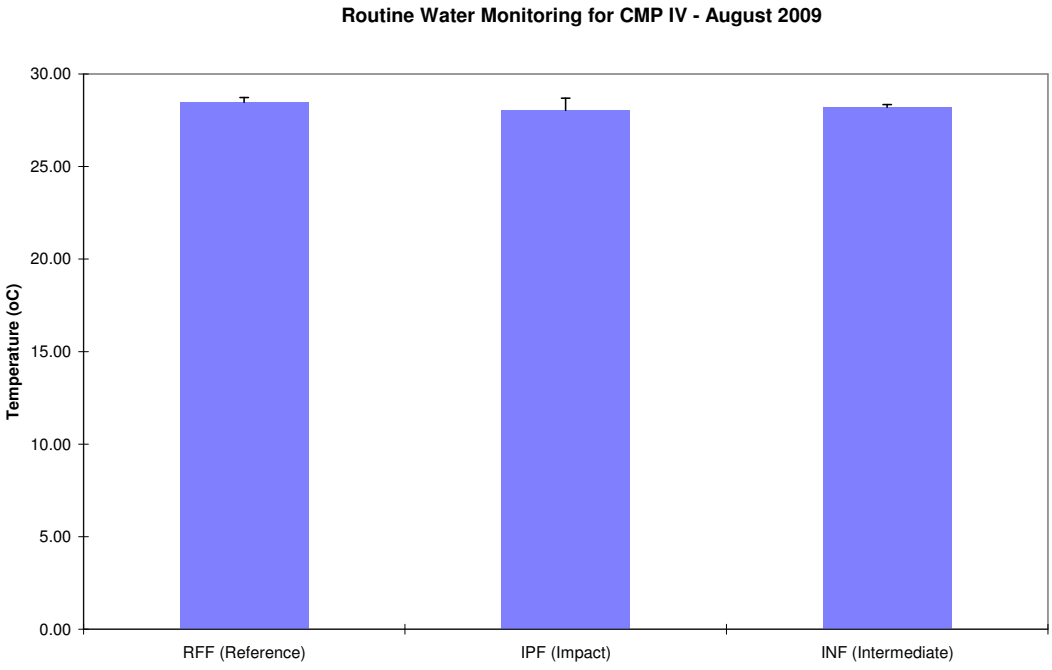


Figure 14: Temperature (mean ± SD) during *in-situ* measurements for Routine Water Quality Monitoring for CMP IV in August 2009.

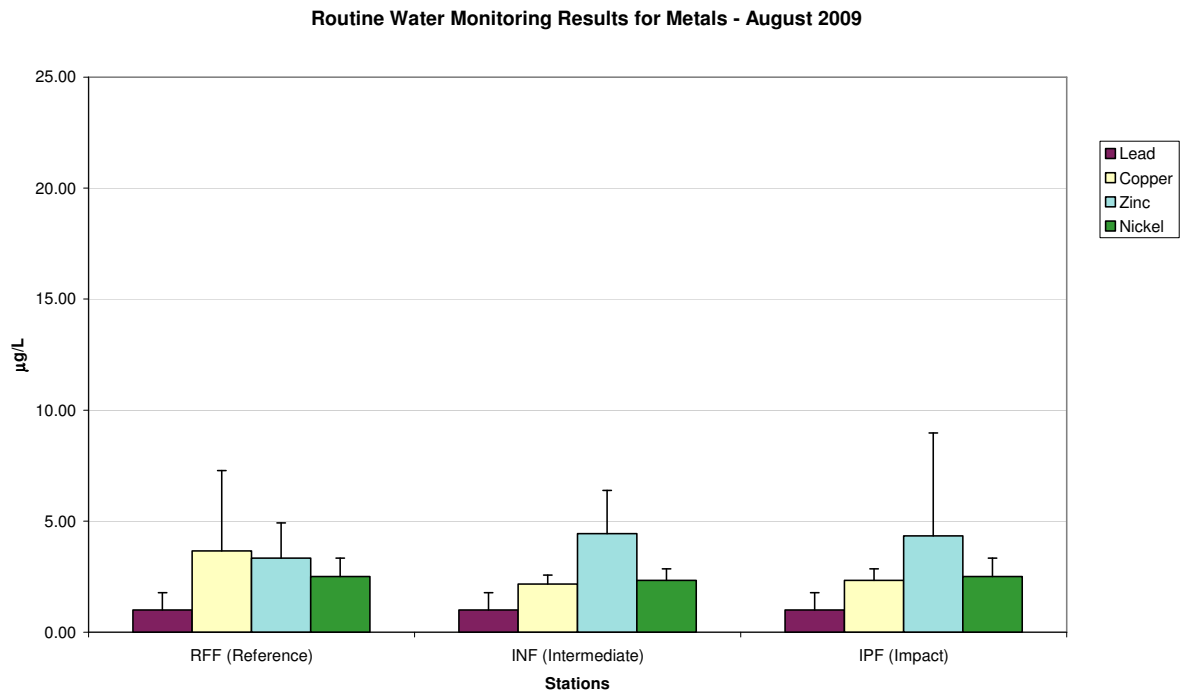


Figure 15: Concentration of Lead, Copper, Zinc and Nickel (mean ± SD) in water samples for Routine Water Quality Monitoringfor CMP IV in August 2009. Note: All other metals (As, Cd, Cr Hg and Ag) were below the limit of detection.

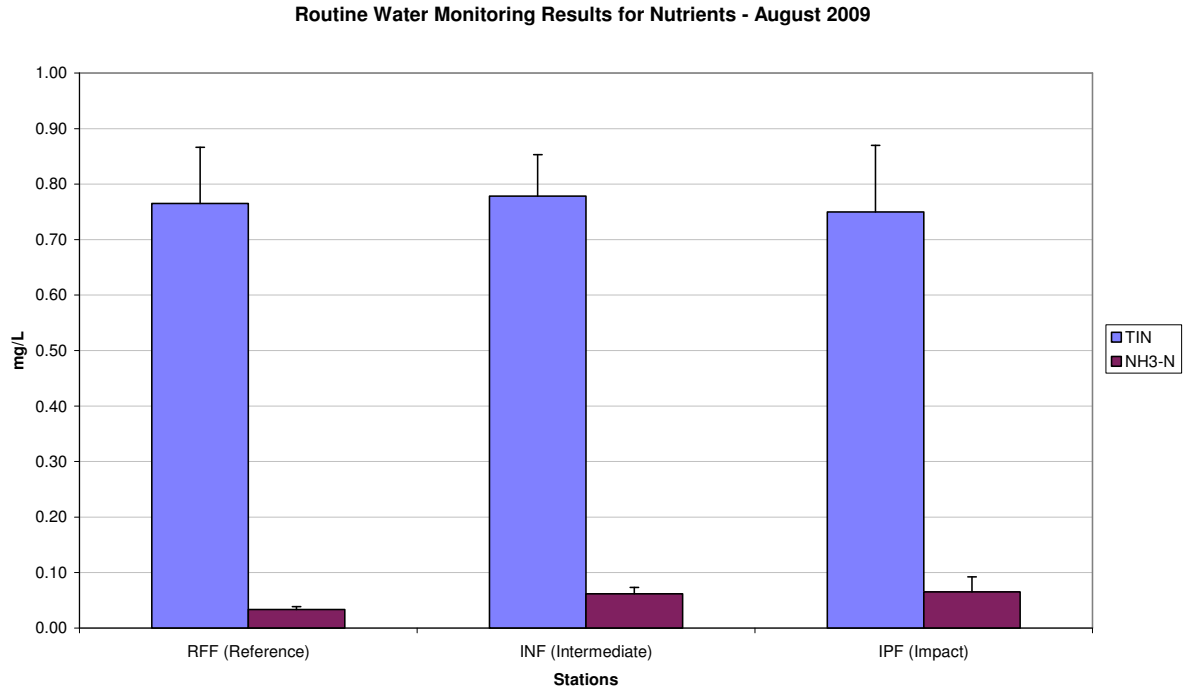


Figure 16: Concentration of Total Inorganic Nitrogen (mean ± SD) in water samples for Routine Water Quality Monitoring for CMP IV in August 2009.

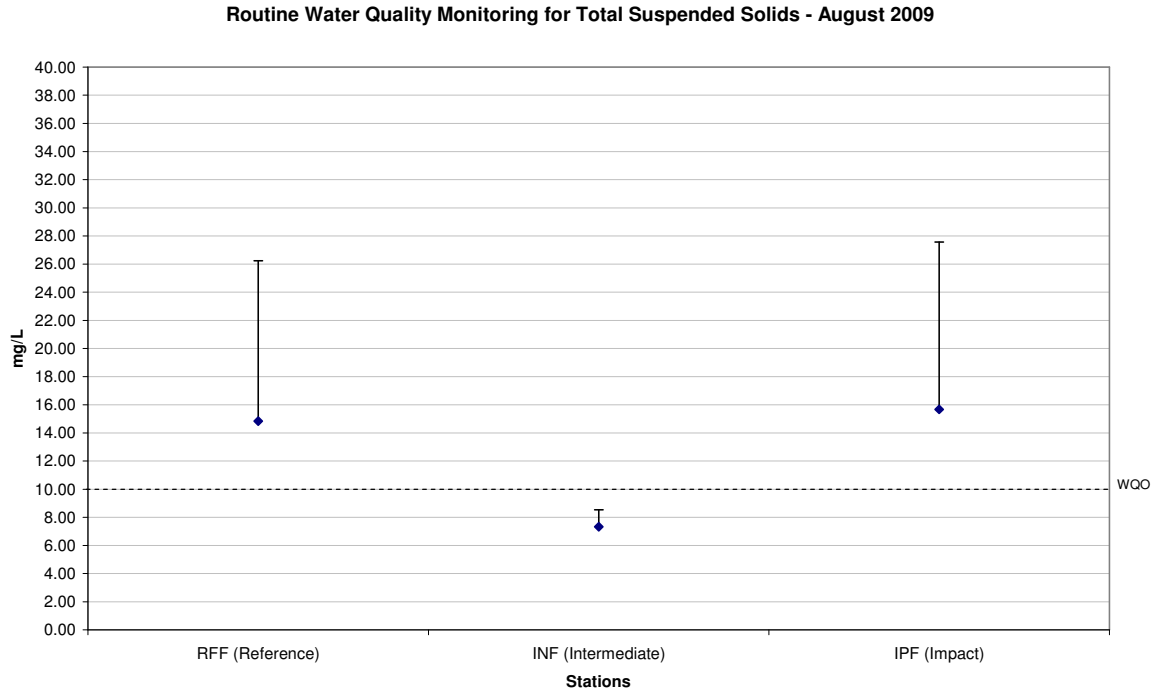


Figure 17: Concentration of Total Suspended Solids (mean ± SD) in water samples for Routine Water Quality Monitoring for CMP IV in August 2009.

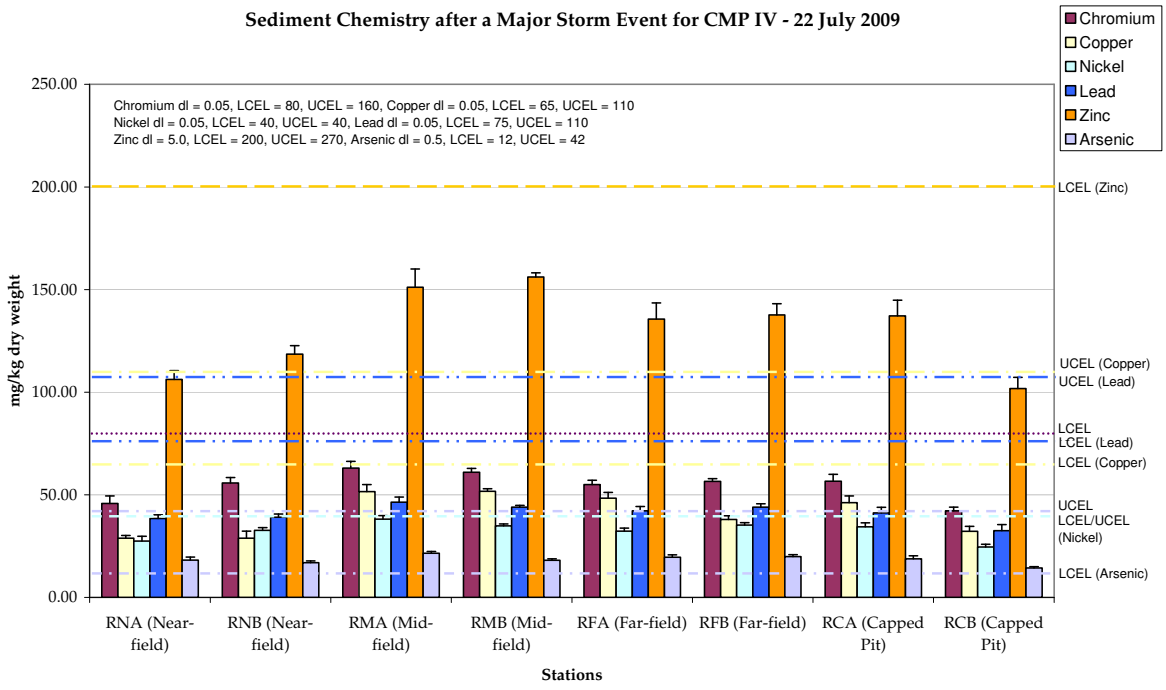


Figure 18: Concentrations of Metals (mean ± SD) during Sediment Chemistry after a Major Storm Event for CMP IV on 22 July 2009.

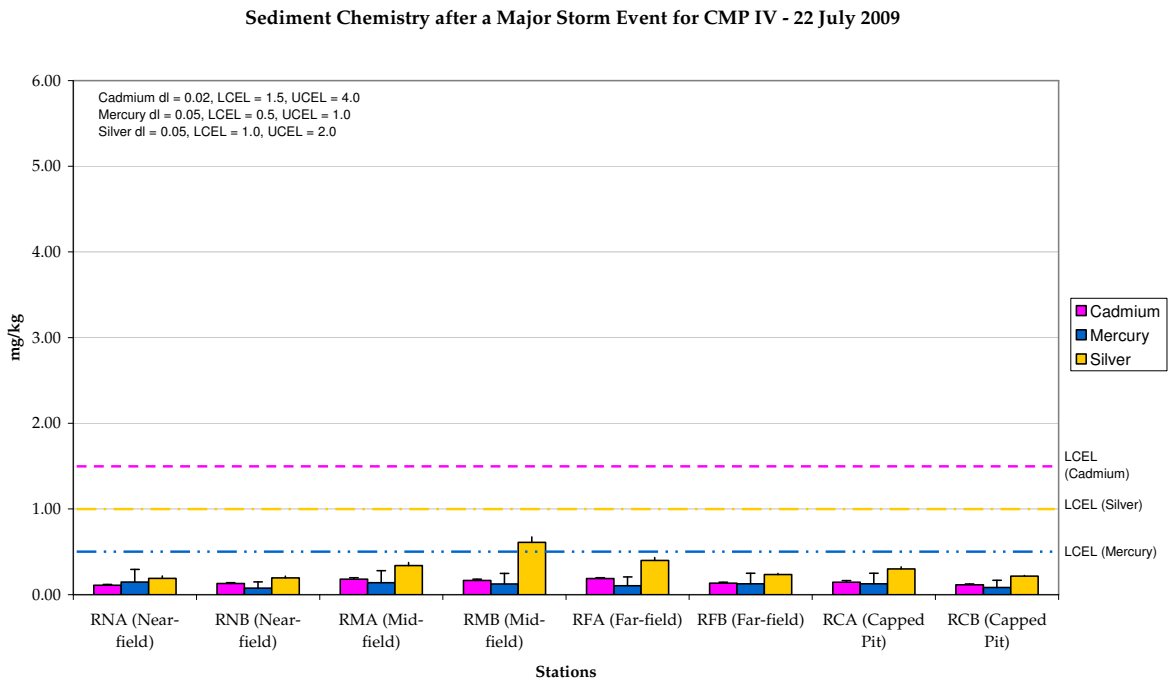


Figure 19: Concentrations of Metals (mean ± SD) during Sediment Chemistry after a Major Storm Event for CMP IV on 22 July 2009.

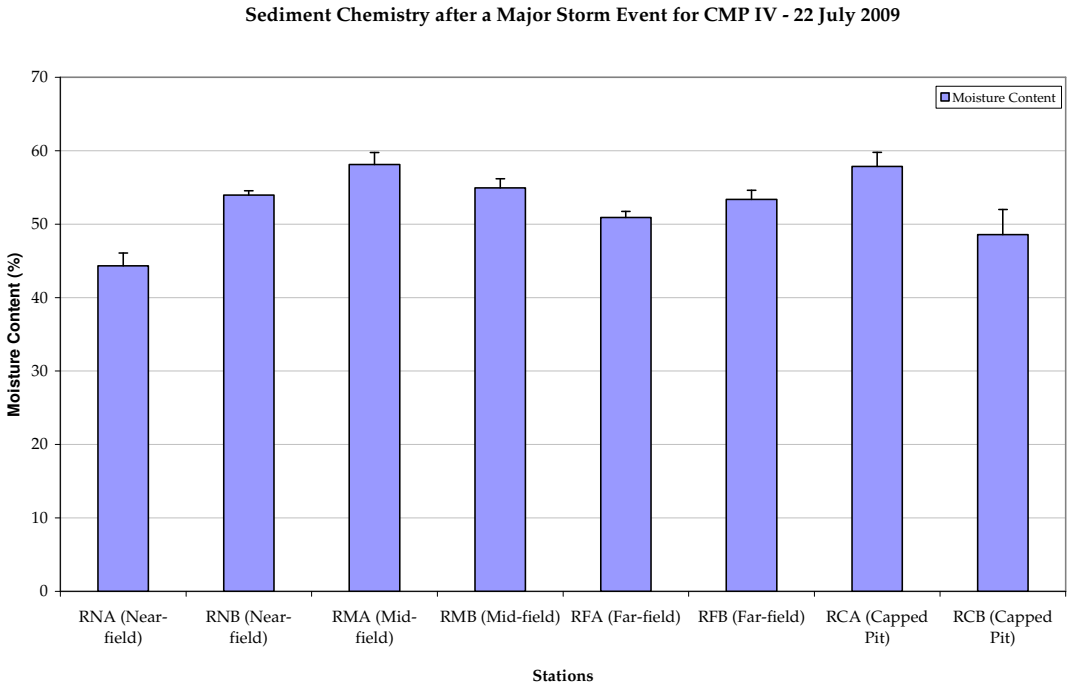


Figure 20: Moisture Content of Sediment (mean ± SD) during Sediment Chemistry after a Major Storm Event for CMP IV on 22 July 2009.

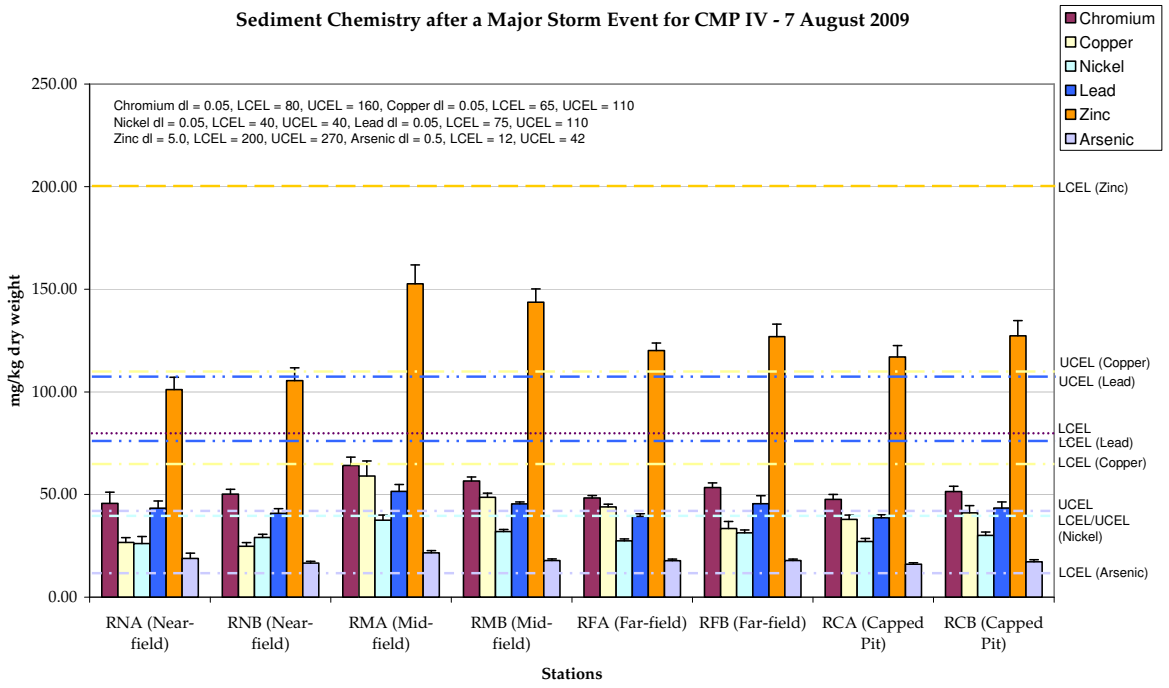


Figure 21: Concentrations of Metals (mean ± SD) during Sediment Chemistry after a Major Storm Event for CMP IV on 7 August 2009.

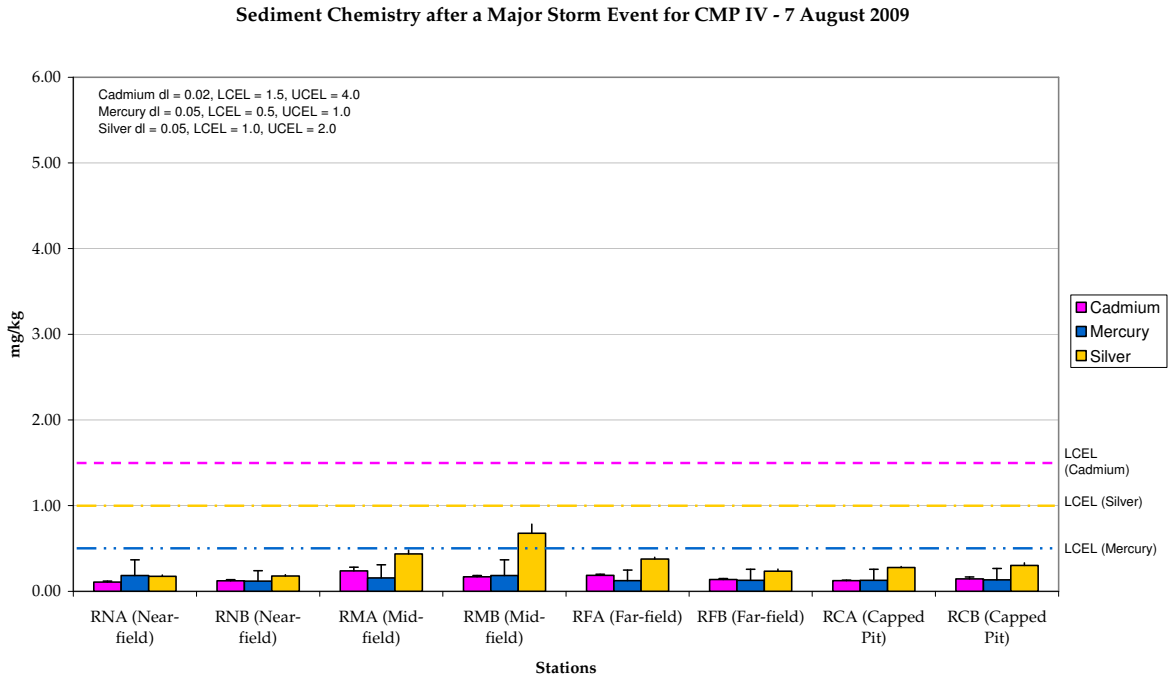


Figure 22: Concentrations of Metals (mean ± SD) during Sediment Chemistry after a Major Storm Event for CMP IV on 7 August 2009.

Source:	H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau (2009 - 2013)\06 Contract Submission (LAM)\06.11 Storm Sediment Chemistry\August 2009	**Environmental Resources Management**
Date:	18/11/2009	ERM

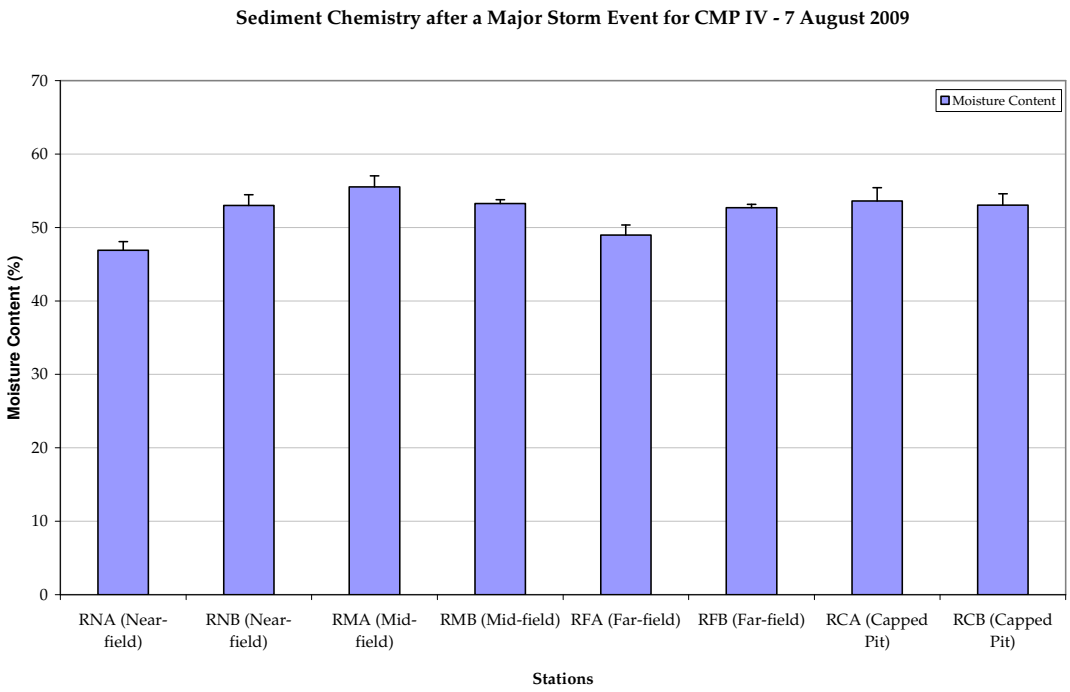


Figure 23: Moisture Content of Sediment (mean ± SD) during Sediment Chemistry after a Major Storm Event for CMP IV on 7 August 2009.

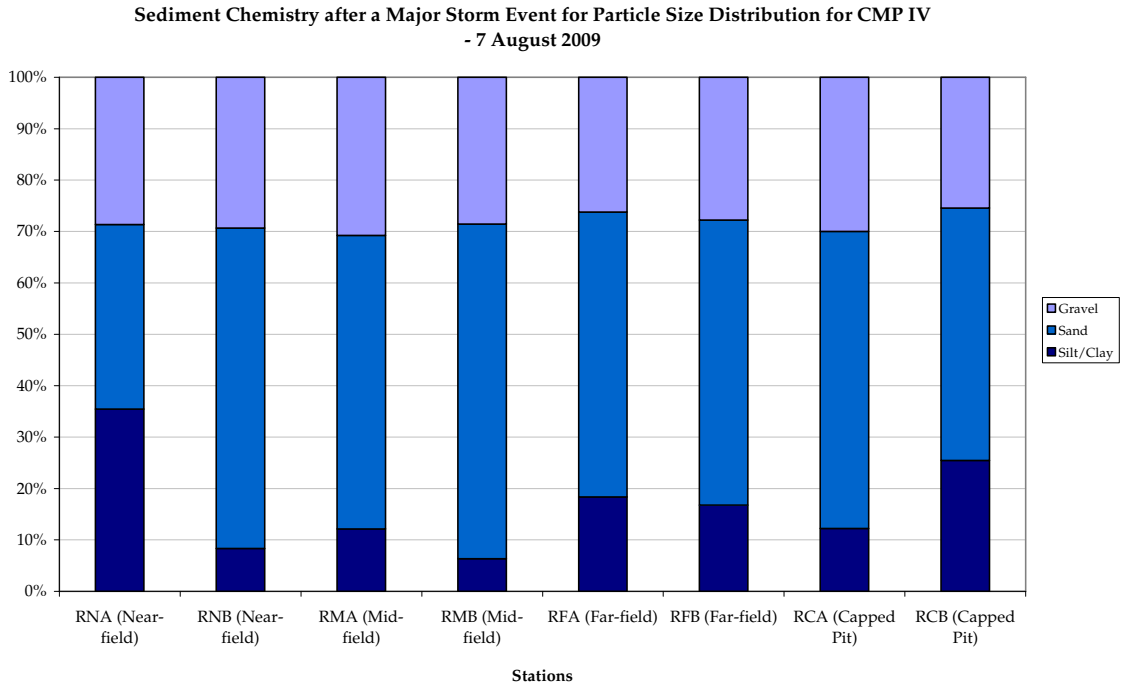


Figure 24: Particle Size Distribution (% mean) during Sediment Chemistry after a Major Storm Event for CMP IV on 7 August 2009.

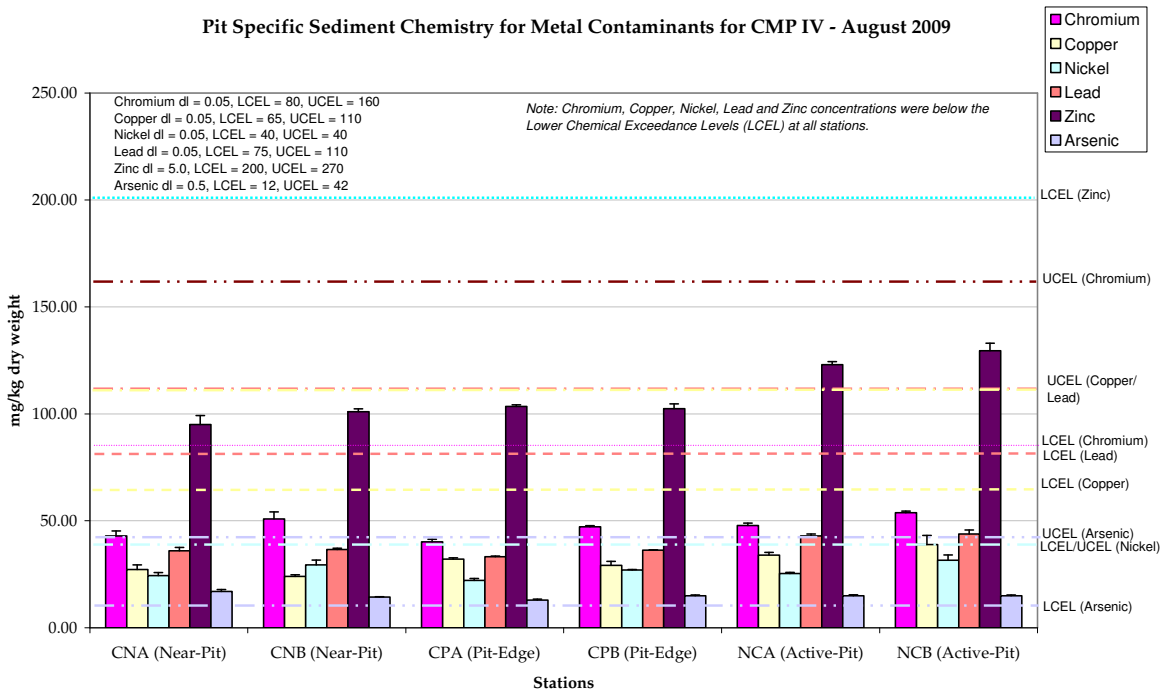


Figure 25: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As) in sediment samples for Pit Specific Sediment Chemistry for CMP IV during August 2009.

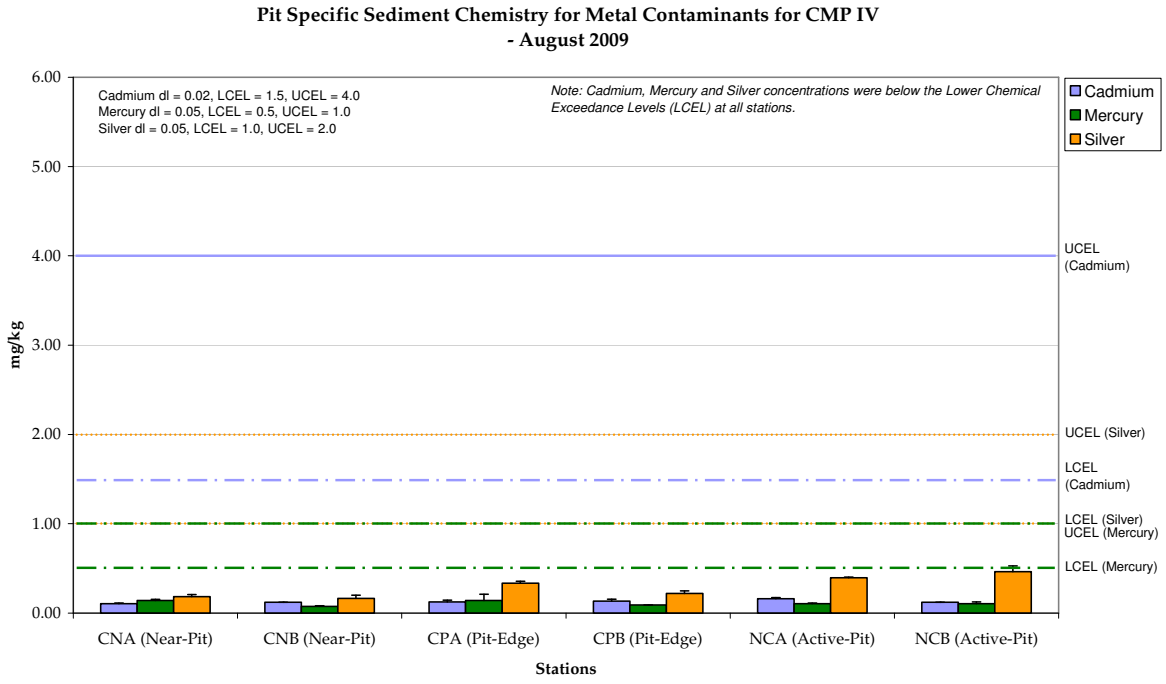


Figure 26: Concentration of Metals (Cd, Hg, Ag) in sediment samples for Pit Specific Sediment Chemistry for CMP IV during August 2009.

Source:	H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau (2009 - 2013)\06 Contract Submission (LAM)\06.3 Pit Specific Sediment Chemistry\August 2009	**Environmental Resources Management**
Date:	18/11/2009	ERM

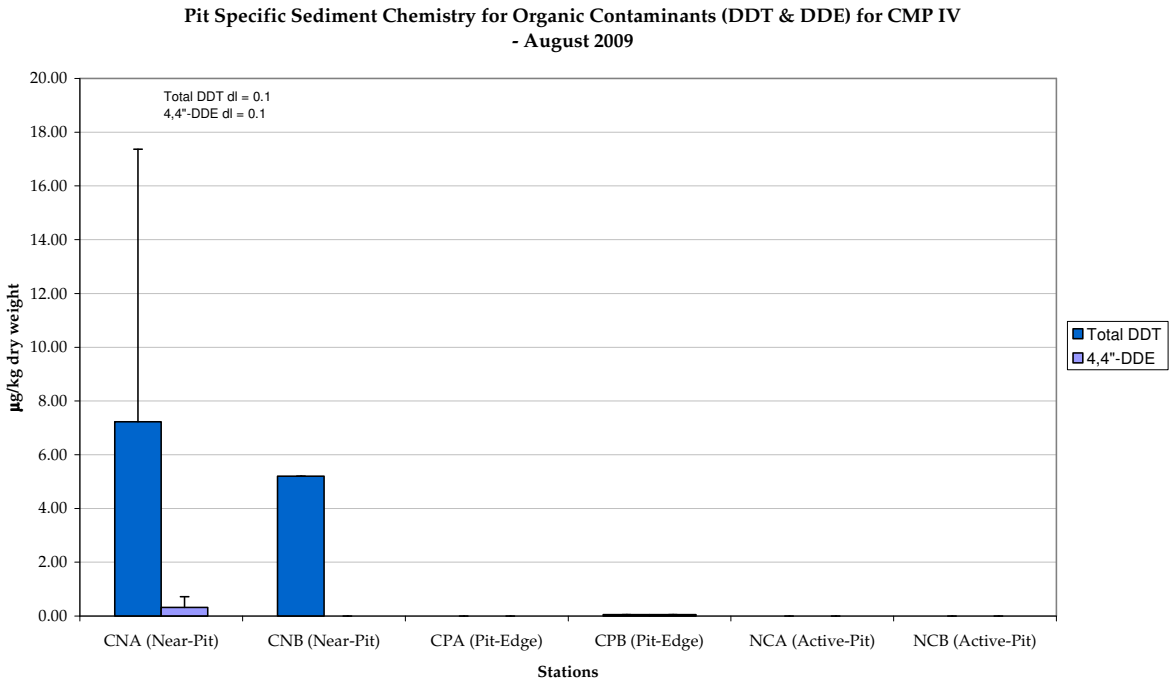


Figure 27: Concentration of DDT and DDE in sediment samples for Pit Specific Sediment Chemistry for CMP IV during August 2009.

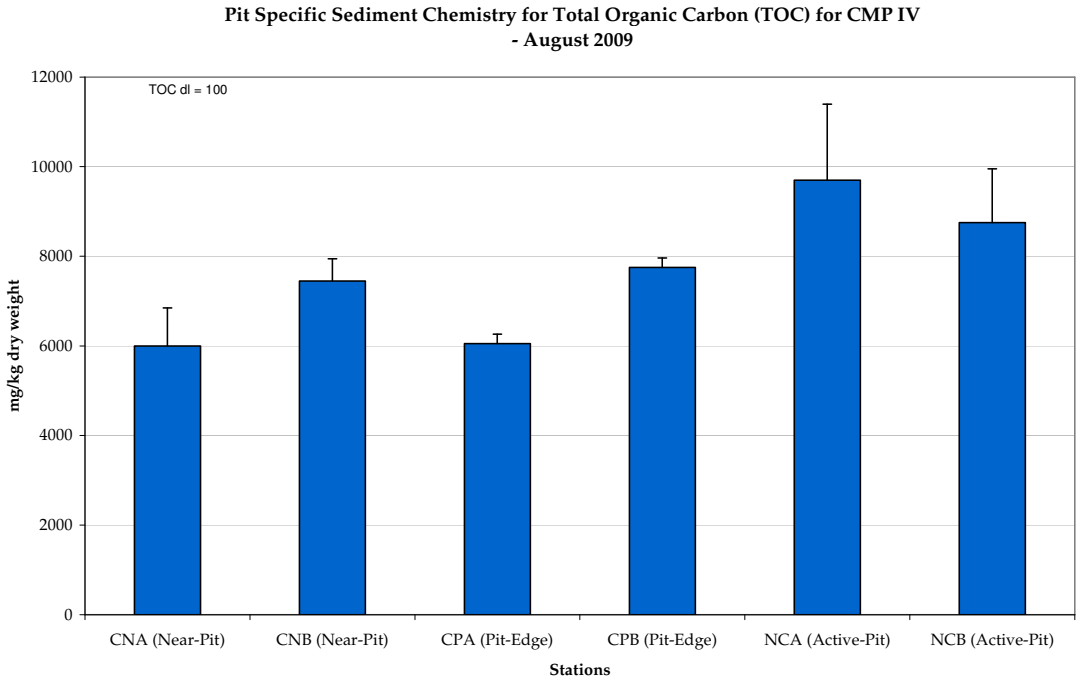


Figure 28: Concentration of Total Organic Carbon (TOC) in sediment samples for Pit Specific Sediment Chemistry during August 2009.

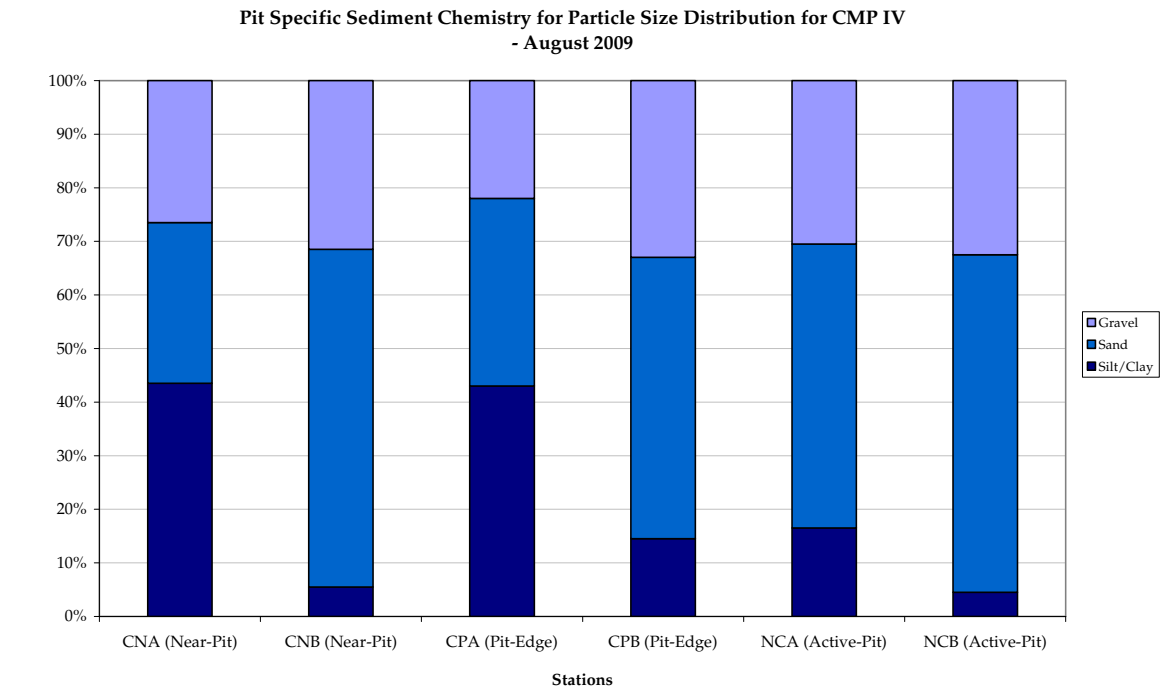


Figure 29: Particle Size Distribution (% mean) of sediment samples for Pit Specific Sediment Chemistry during August 2009.

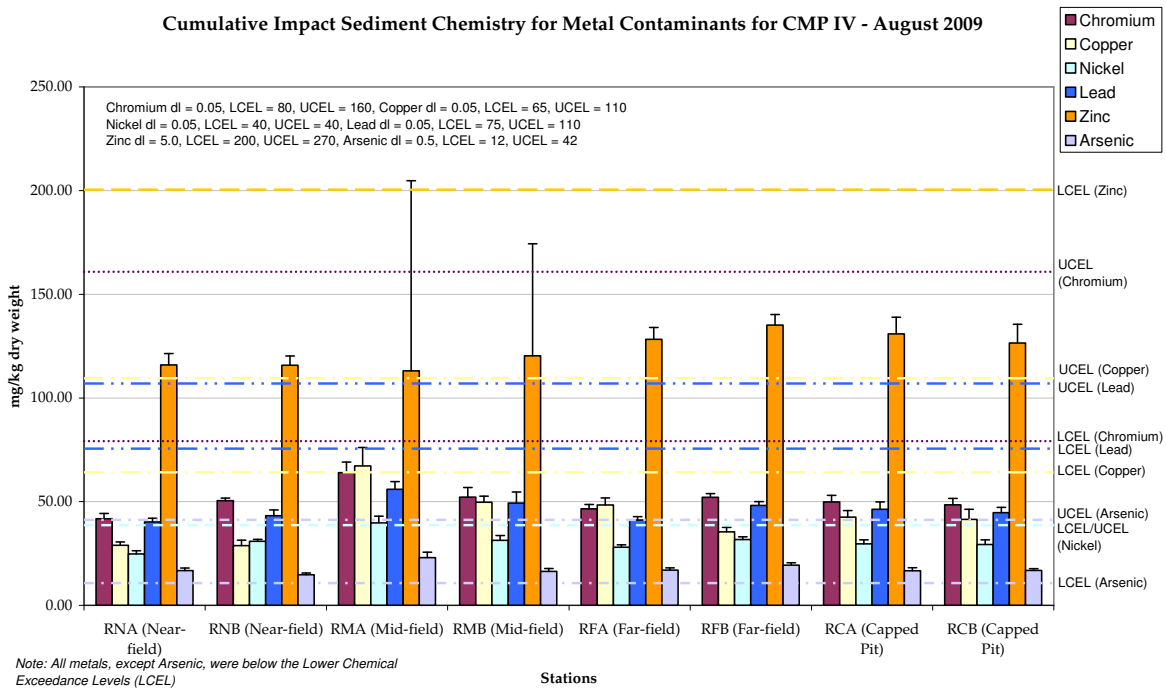


Figure 30: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As) in sediment samples for Cumulative Impact Sediment Analysis for CMP IV during August 2009.

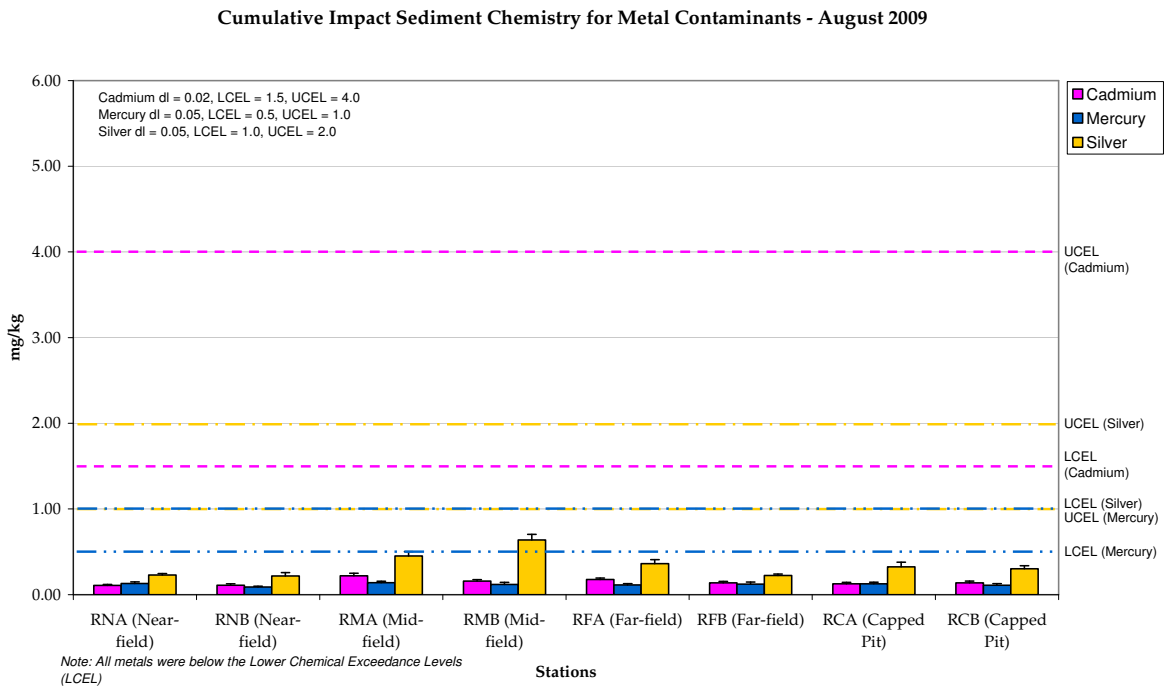


Figure 31: Concentration of Metals (Cd, Hg, Ag) in sediment samples for Cumulative Impact Sediment Analysis for CMP IV during August 2009.

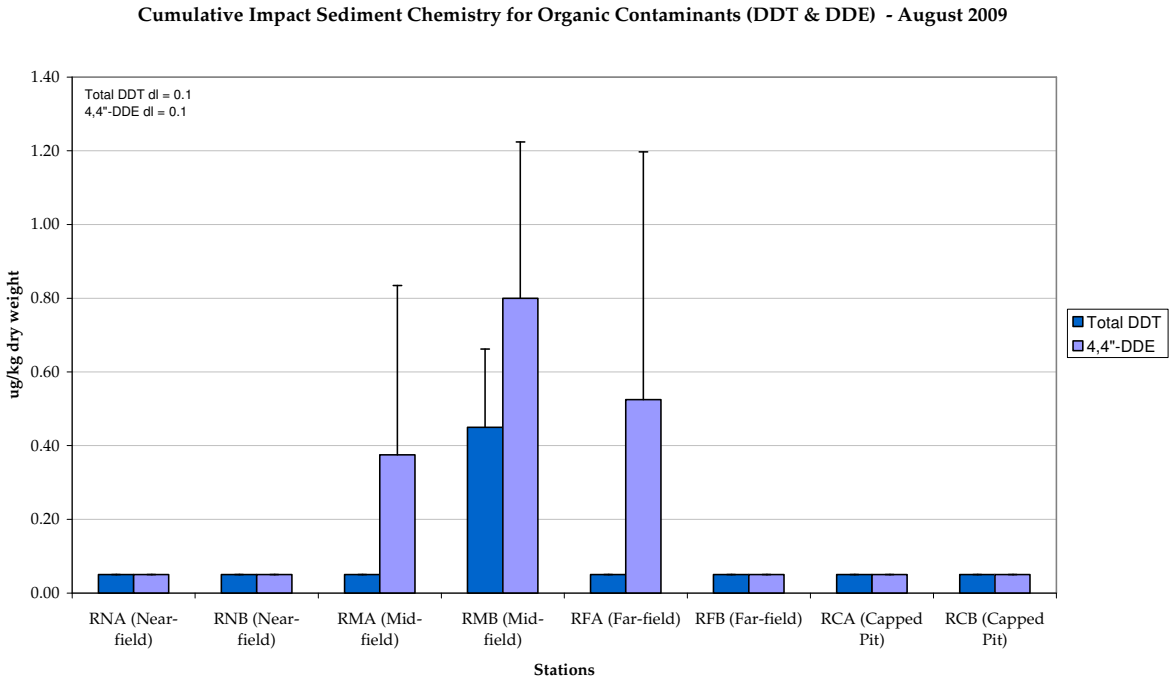


Figure 32: Concentration of DDT and DDE in sediment samples for Cumulative Impact Sediment Analysis for CMP IV during August 2009.

Source:	H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau (2009 - 2013)\06 Contract Submission (LAM)\06.4 Cumulative Impact Sediment Chemistry\August 2009	**Environmental Resources Management**
Date:	18/11/2009	ERM

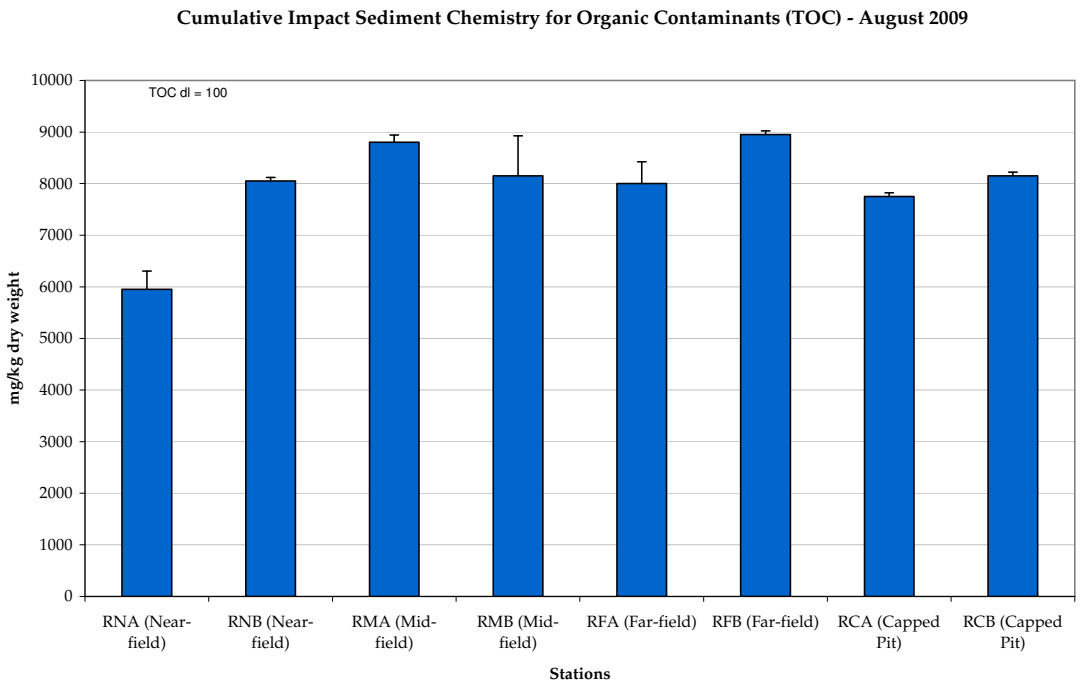


Figure 33: Concentration of Total Organic Carbon (TOC) in sediment samples for Cumulative Impact Sediment Analysis during August 2009.

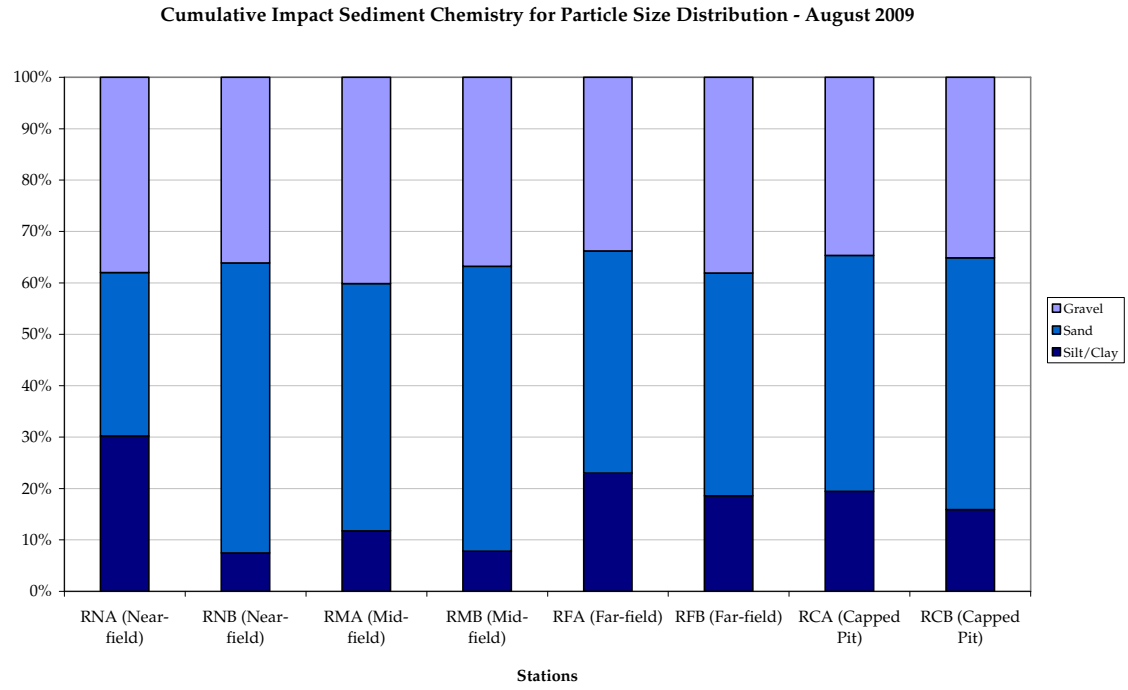


Figure 34: Particle Size Distribution (%) of sediment samples for Cumulative Impact Sediment Analysis during August 2009.

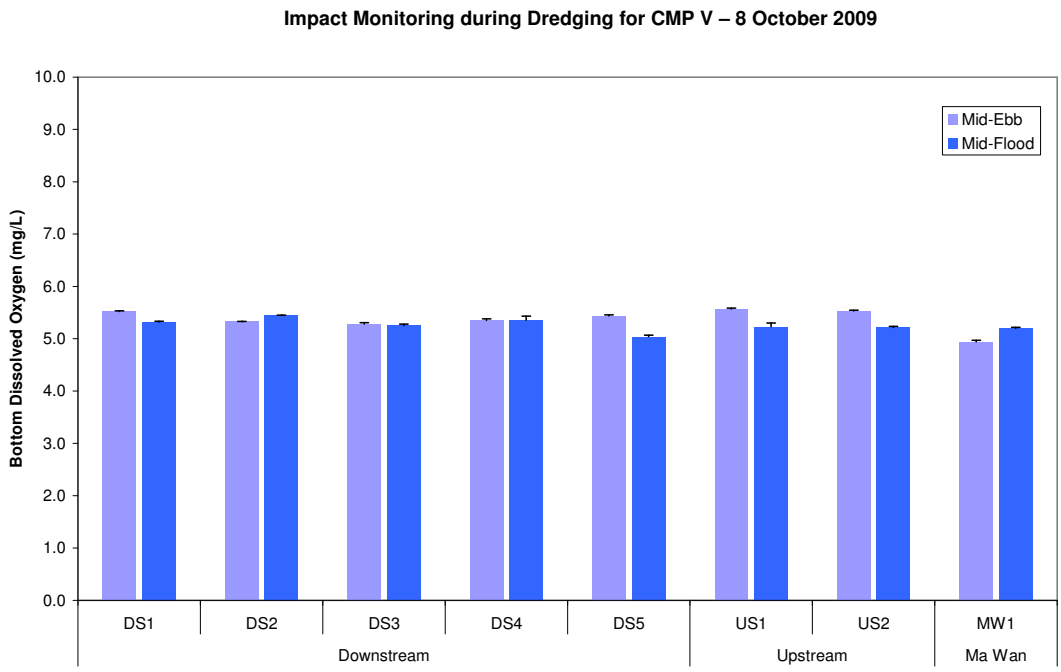


Figure 35: Bottom DO Level (mean ± SD) at Downstream (DS1, DS2, DS3, DS4 and DS5 stations), Upstream (US1 and US2 stations) and Ma Wan (MW1 station) during Impact Monitoring for Dredging on 8 October 2009.

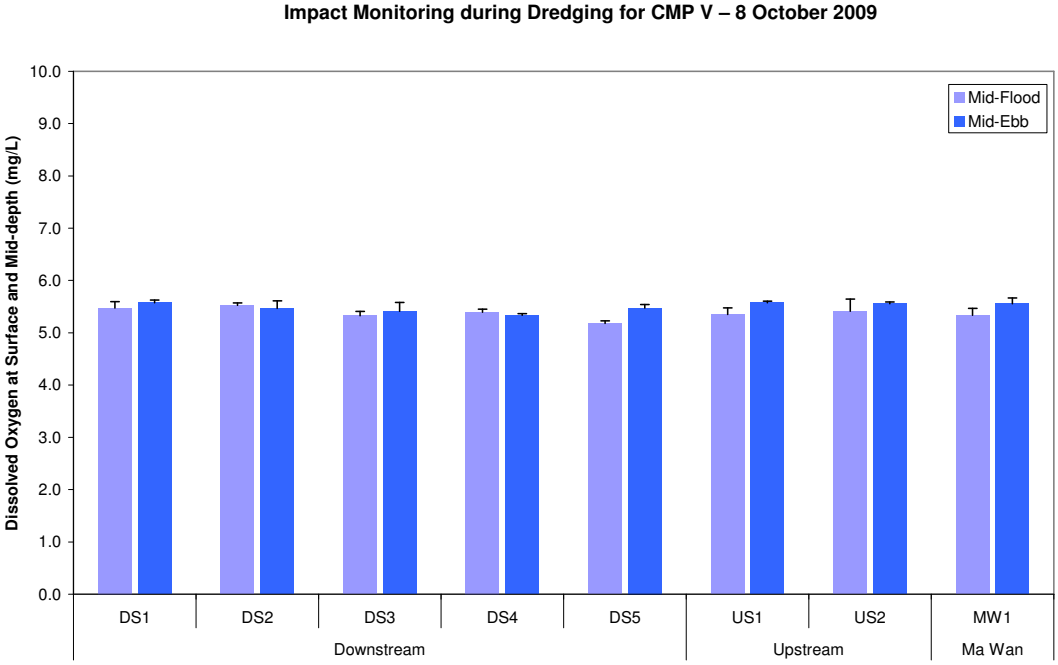


Figure 36: DO Level at Surface and Mid-depth (mean ± SD) at Downstream (DS1, DS2, DS3, DS4 and DS5 stations), Upstream (US1 and US2 stations) and Ma Wan (MW1 station) during Impact Monitoring for Dredging on 8 October 2009.

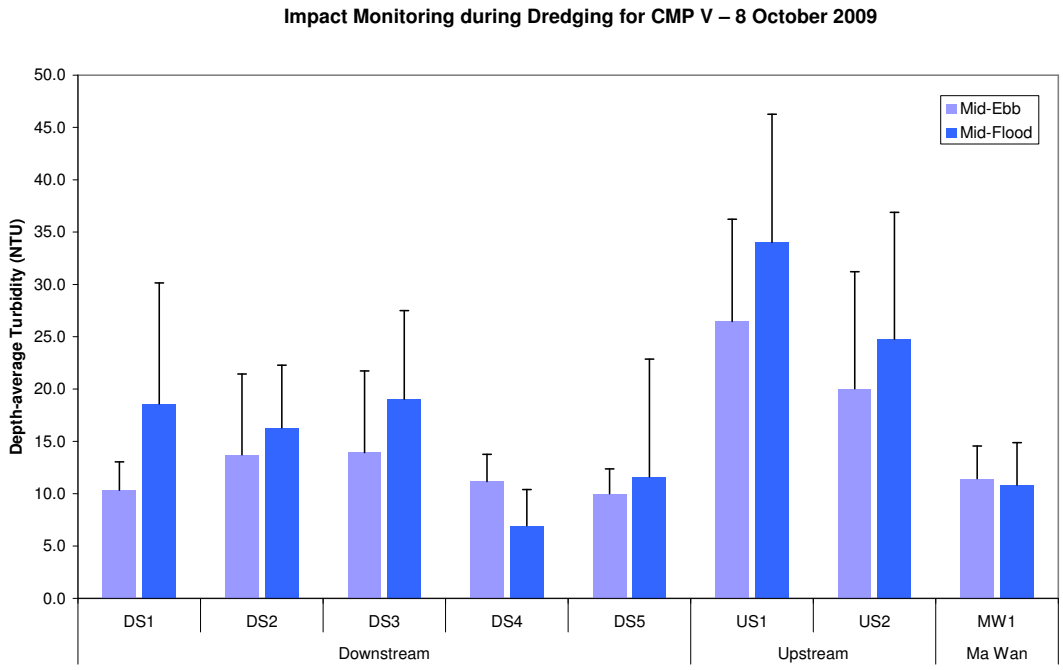


Figure 37: Depth-average Turbidity (mean ± SD) at Downstream (DS1, DS2, DS3, DS4 and DS5 stations), Upstream (US1 and US2 stations) and Ma Wan (MW1 station) during Impact Monitoring for Dredging on 8 October 2009.

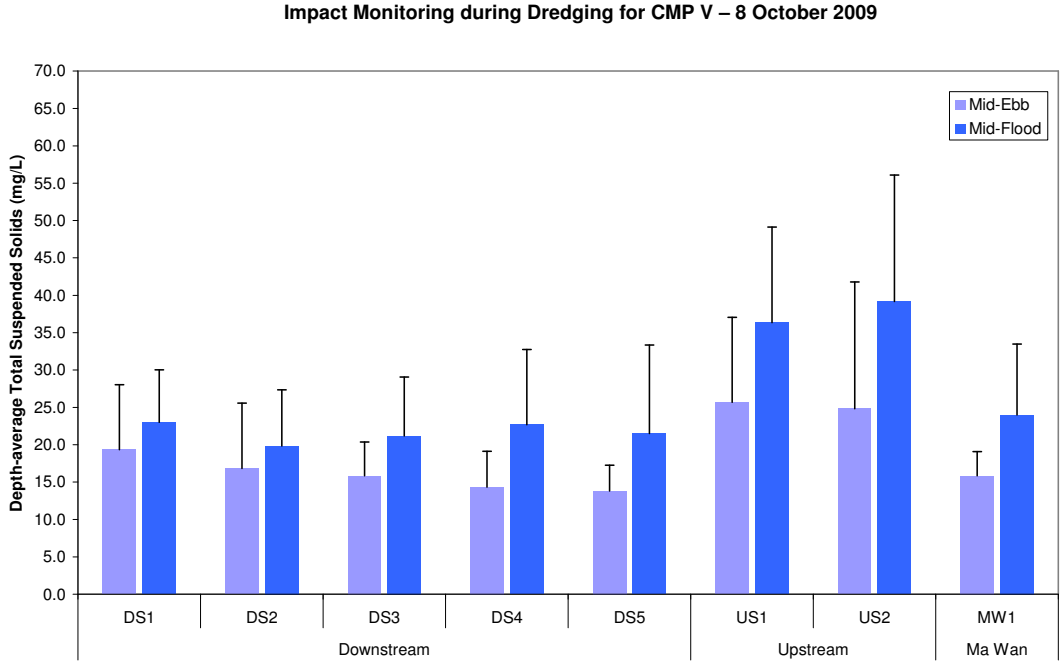


Figure 38: Depth-average Total Suspended Solids (mean ± SD) at Downstream (DS1, DS2, DS3, DS4 and DS5), Upstream (US1 and US2) and Ma Wan (MW1) stations during Impact Monitoring for Dredging on 8 October 2009.

Annex B1: Impact Water Quality Monitoring for Dredging Activities during Mid-ebb Tide for 8 October 2009

Station	Downstream (Impact)		
Time (hh:mm)	13:51-15:19		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	5.45	5.38
Turbidity (NTU)	11.84	N/A	N/A
SS (mg/L)	16.03	N/A	N/A
Remarks	Dredging works were observed.		

Station	Upstream (Reference)		
Time (hh:mm)	15:42-16:09		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	5.56	5.5
Turbidity (NTU)	21.21	N/A	N/A
SS (mg/L)	27.67	N/A	N/A
Remarks	Dredging works were observed.		

Station	Ma Wan		
Time (hh:mm)	17:11-17:14		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	5.04	4.94
Turbidity (NTU)	11.43	N/A	N/A
SS (mg/L)	16.17	N/A	N/A
Remarks			

Compliance with Action and Limit Levels

	Action Level		Limit Level					
Parameter	Impact Stations	Comparison between I and R [(a)]	Mean Value at Impact Stations	Comparison between I and R [(a)]	Mean Value at Impact Stations	Mean Value at Reference Stations	Compliance with Action level	Compliance with Limit Level
DO (Bottom)	< 2.96	R significantly greater than I (t-test, p < 0.05)	< 2.00	R significantly greater than I (t-test, p < 0.05)	5.38	5.5	Y	Y
DO (Surface and Mid Depth)	< 3.76	R significantly greater than I (t-test, p < 0.05)	< 3.11	R significantly greater than I (t-test, p < 0.05)	5.45	5.56	Y	Y
Turbidity (Depth-averaged)	> 28.14	I ≥ 1.2 R (25.45)	> 38.32	I ≥ 1.3 R (27.57)	11.84	21.21	Y	Y
SS (Depth-averaged)	> 37.88	I ≥ 1.2 R (33.20)	> 61.92	I ≥ 1.3 R (35.97)	16.03	27.67	Y	Y

Annex B2: Impact Water Quality Monitoring for Dredging Activities during Mid-flood Tide for 8 October 2009

Station	Downstream (Impact)		
Time (hh:mm)	07:50 - 10:54		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	5.12	5.14
Turbidity (NTU)	18.23	N/A	N/A
SS (mg/L)	22.27	N/A	N/A
Remarks	Dredging works were observed.		

Station	Upstream (Reference)		
Time (hh:mm)	07:50 - 10:54		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	5.42	5.4
Turbidity (NTU)	31.03	N/A	N/A
SS (mg/L)	40.67	N/A	N/A
Remarks	Dredging works were observed.		

Station	Ma Wan		
Time (hh:mm)	07:50 - 10:54		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	4.88	4.88
Turbidity (NTU)	18.17	N/A	N/A
SS (mg/L)	23.00	N/A	N/A
Remarks			

Compliance with Action and Limit Levels

	Action Level		Limit Level					
Parameter	Mean Value at Impact Stations	Comparison between I and R [(a)]	Mean Value at Impact Stations	Comparison between I and R [(a)]	Mean Value at Impact Stations	Mean Value at Reference Stations	Compliance with Action level	Compliance with Limit Level
DO (Bottom)	< 2.96	R significantly greater than I (t-test, p < 0.05)	< 2.00	R significantly greater than I (t-test, p < 0.05)	5.14	5.4	Y	Y
DO (Surface and Mid Depth)	< 3.76	R significantly greater than I (t-test, p < 0.05)	< 3.11	R significantly greater than I (t-test, p < 0.05)	5.12	5.42	Y	Y
Turbidity (Depth-averaged)	> 28.14	I ≥ 1.2 R (37.24)	> 38.32	I ≥ 1.3 R (40.34)	18.23	31.03	Y	Y
SS (Depth-averaged)	> 37.88	I ≥ 1.2 R (48.80)	> 61.92	I ≥ 1.3 R (52.87)	22.27	40.67	Y	Y

Note: (a) I = Impact; R = Reference Stations

Annex C

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

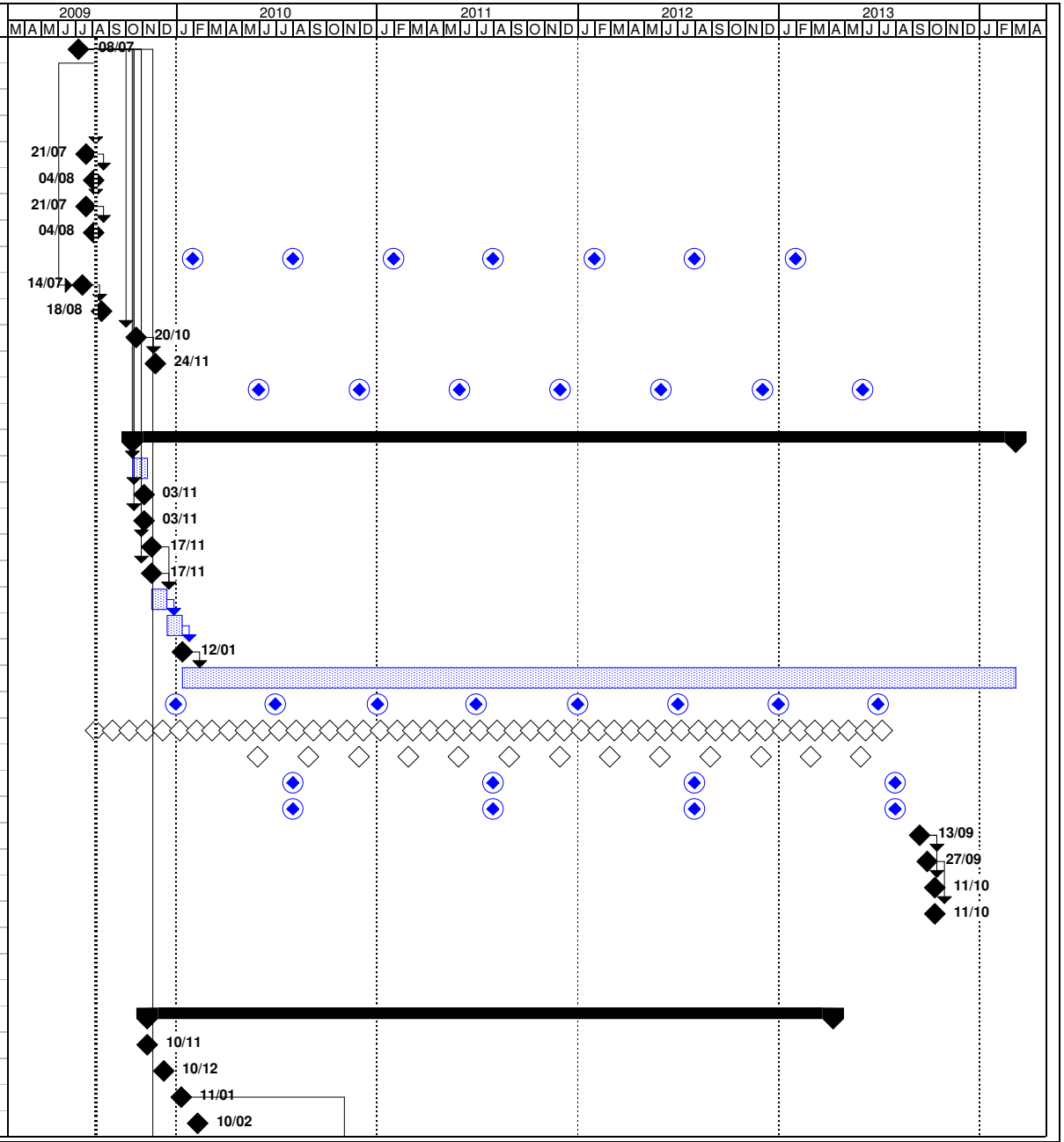
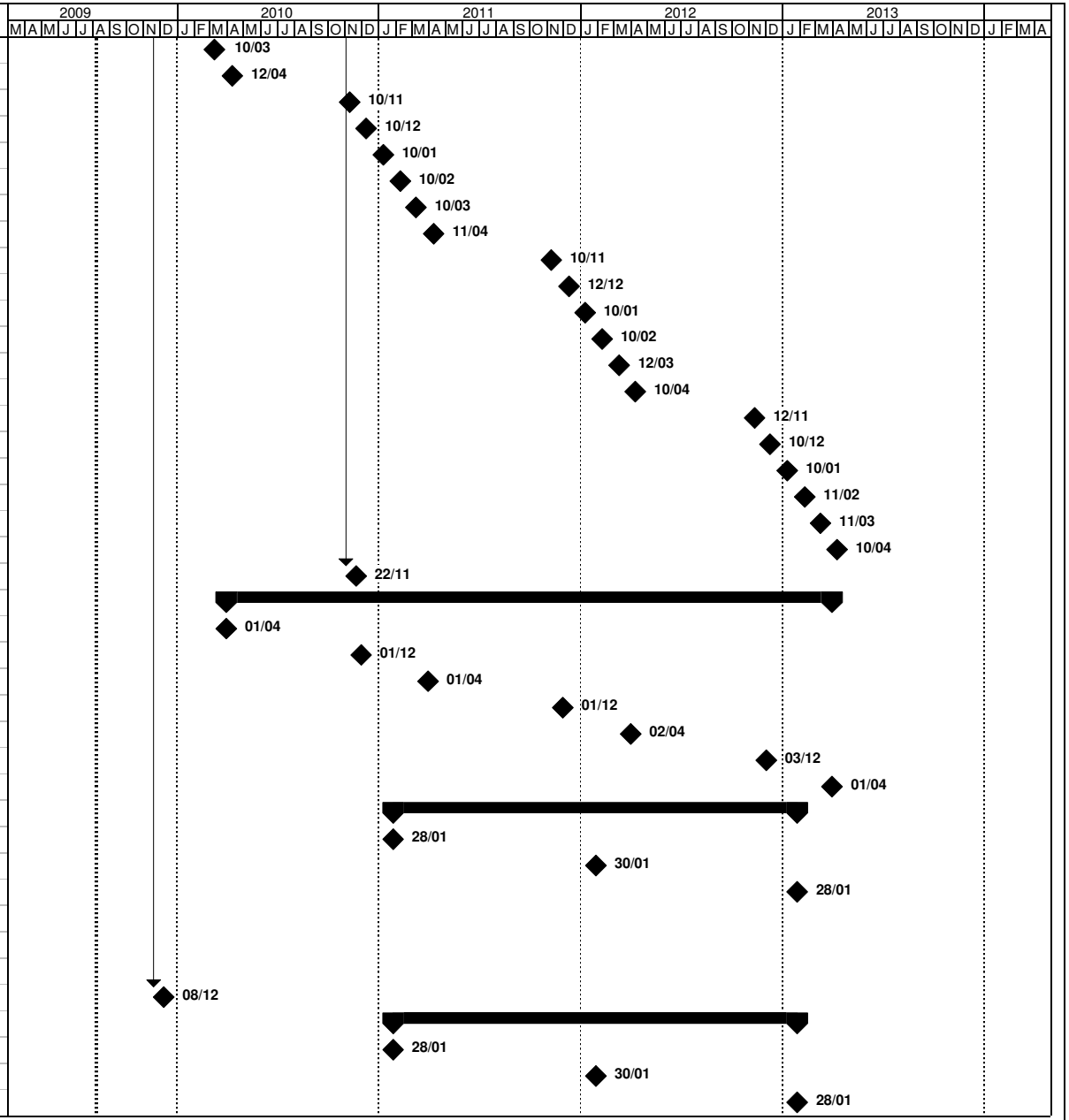


Figure 4.1 - Study Programme

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



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