

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

**9<sup>th</sup> Monthly Progress Report for  
Contaminated Mud Pits at Sha Chau –  
March 2010**

Revision 0

9 April 2010

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





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## 9<sup>th</sup> Monthly Progress Report for Contaminated Mud Pits at Sha Chau – March 2010

*Revision 0*

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Client: Civil Engineering and Development Department (CEDD)		Project No: 0103262			
Summary:  This document presents progress of monitoring works on contaminated mud pits at Sha Chau in March 2010 under Agreement No. CE 4/2009 (EP).		Date: 9 April 2010			
		Approved by:  ..... Dr Robin Kennish Director			
0	9 <sup>th</sup> Monthly Progress Report for CMP – Revision 0	JT	CAR	RK	09/04/10
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

9<sup>th</sup> MONTHLY PROGRESS REPORT FOR CONTAMINATED MUD PITS  
AT SHA CHAU - March 2010

**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 of March 2010.

**1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES**

No field sampling activities were scheduled for CMP IVc in this monthly period. For CMP V, sampling for *Impact Monitoring during Dredging Operations* was conducted on 15 March 2010. A summary of field activities are presented in *Annex A*.

A summary of laboratory analysis results submitted by the Contractor in this reporting month is presented on *Table 1.1*.

**Table 1.1** *Summary of laboratory analysis results submitted by the Contractor during the reporting month*

<b>Key Task</b>	<b>Monitoring Component</b>	<b>Results Received from the Contractor</b>
<b>CMP IV</b>		
Water Sampling and Chemical Analysis	Routine water quality monitoring	February's sampling: 30 March 2010
Sediment Sampling and Chemical Analysis	Sediment Toxicity Monitoring	December's sampling: 9 March 2010
Demersal Trawling and Tissue Analysis	Demersal Trawling	February's Sampling: 30 March 2010
<b>CMP V</b>		
Water Sampling and Chemical Analysis	Impact Monitoring during Dredging Operations	March's sampling: 23 March 2010

#### **1.4** *DETAILS OF OUTSTANDING SAMPLING AND / OR ANALYSIS*

No outstanding sampling and laboratory analysis remained from March 2010.

#### **1.5** *BRIEF DISCUSSION OF THE MONITORING RESULTS*

Results of *Sediment Toxicity Monitoring* for December 2009 and *Routine Water Quality Monitoring* for February 2010 are presented for CMP IV. Results of *Impact Monitoring during Dredging Operations* for March 2010 are presented for CMP V. Detailed results will be discussed in the relevant *Quarterly Reports*.

##### **1.5.1** *CMP IV*

###### *Sediment Toxicity Testing in December 2009*

Sediment ecotoxicology tests were done on three international species (burrowing amphipod *Leptocheirus plumulosus*, marine benthic polychaete *Neanthes arenaceodentata* and marine bivalve *Mytilus galloprovincialis*) and two local species (barnacle *Balanus amphitrite* and shrimp *Penaeus (Litopenaeus) vannamei*).

The survival rates of the amphipod, polychaete, bivalve, shrimp and barnacle were not significantly different between animals exposed to Near-Pit and Reference sediments. Other indicators i.e. individual & total dry weight and growth rate of the benthic polychaete were also not significantly different between animals exposed to Near-Pit and Reference sediments.

### Laboratory Analysis

Concentrations of copper, zinc and nickel were lower at the Impact stations than at the Intermediate and Reference stations. Lead concentrations were similar across the sampling stations (*Figure 1 of Annex B*). All other metals sampled were below the limits of detection. Mean Total Suspended Solids (TSS) level was the lowest at the Impact Stations. Mean TSS levels at the Intermediate and Reference stations exceeded the WQO (*Figure 3 of Annex B*). Nitrogenous nutrients (NH<sub>3</sub> and TIN) and BOD showed minor variation in concentrations between stations (*Figures 2 & 4 of Annex B*).

#### **1.5.2** *CMP V*

##### *Impact Monitoring during Dredging Operations of CMP V – March 2010*

*Impact Monitoring during Dredging Operations of CMP V* was conducted on 15 March 2010. 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 5 to 8 of Annex B*. Levels of DO, depth-average Turbidity and TSS complied with the Action and Limit Levels set in the *Baseline Monitoring Report* <sup>(1)</sup> (*Tables B1 and B2 of Annex B*).

#### **1.6** *ACTIVITIES SCHEDULED FOR THE NEXT MONTH*

*Pit Specific Sediment Chemistry Monitoring* for CMP IV and *Impact Monitoring during Dredging Operations* for CMP V are scheduled in the next monthly period of April 2010. The sampling schedule is presented in *Annex A*.

#### **1.7** *STUDY PROGRAMME*

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

<sup>(1)</sup> 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.

Annex A

## Sampling Schedule

			2009					2010				
Pit Specific Sediment Chemistry	Code	Frequency	J	A	S	O	N	D	J	F	M	A
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	*					*				*

			J	A	S	O	N	D	J	F	M	A
<b>Cumulative Impact Sediment Chemistry</b>												
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	*					*				

			J	A	S	O	N	D	J	F	M	A
<b>Sediment Toxicity Tests</b>												
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				

			J	A	S	O	N	D	J	F	M	A
<b>Tissue/Whole Body Sampling</b>												
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	*							*		

			J	A	S	O	N	D	J	F	M	A
<b>Demersal Trawling</b>												
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		

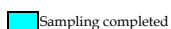
			J	A	S	O	N	D	J	F	M	A
<b>Capping</b>												
<i>Ebb Tide</i>												
Impact Station Downcurrent	IPE1	4 times per year	3	3				3	3			
	IPE2	4 times per year	3	3				3	3			
	IPE3	4 times per year	3	3				3	3			
	IPE4	4 times per year	3	3				3	3			
	IFC1	4 times per year	3	3				3	3			
Intermediate Station 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			
<i>Flood Tide</i>												
Impact Station Downcurrent	INF1	4 times per year	3	3				3	3			
	IFC2	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			

			J	A	S	O	N	D	J	F	M	A
<b>Routine Water Quality Monitoring</b>												
<i>Ebb Tide</i>												
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	*							*		
<i>Flood Tide</i>												
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	*							*		

			J	A	S	O	N	D	J	F	M	A
<b>Water Column Profiling</b>												
Plume Stations	WCP1	6 times per year	2	2				2	2	2		
	WCP2	6 times per year	2	2				2	2	2		



			J	A	S	O	N	D	J	F	M	A
<b>Benthic Recolonisation Studies</b>												
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 - East of Sha Chau Environmental Monitoring and Audit Sampling Schedule for CMP V (July 2009 - March 2010)

		2009					2010				
<b>Baseline Water Quality Monitoring</b>		J	A	S	O	N	D	J	F	M	A
Near Field	ESC-WNAA	*	*								
	ESC-WNAB	*	*								
	ESC-WNAC	*	*								
	ESC-WNAD	*	*								
	ESC-WNBA	*	*								
	ESC-WNBB	*	*								
	ESC-WNBC	*	*								
	ESC-WNBD	*	*								
Mid Field	ESC-WMB	*	*								
	ESC-WMA	*	*								
Far Field	ESC-WFA	*	*								
	ESC-WFB	*	*								
	MW1	*	*								
Reference Stations	NM1	*	*								
	NM2	*	*								
	NM3	*	*								
	NM5	*	*								
	NM6	*	*								
<b>Water Column Profiling</b>		J	A	S	O	N	D	J	F	M	A
Plume Stations	Upstream			2	2	2	2	2	2		
	Downstream			2	2	2	2	2	2		
<b>Water Quality Impact Monitoring for Dredging</b>		J	A	S	O	N	D	J	F	M	A
Downcurrent Impact Stations	1			*	*	*	*	*	*	*	*
	2			*	*	*	*	*	*	*	*
	3			*	*	*	*	*	*	*	*
	4			*	*	*	*	*	*	*	*
	5			*	*	*	*	*	*	*	*
Upcurrent Stations	1			*	*	*	*	*	*	*	*
	2			*	*	*	*	*	*	*	*
	MW1			*	*	*	*	*	*	*	*

 Sampling completed  
 Sampling to be completed



Annex B

## Monitoring Results

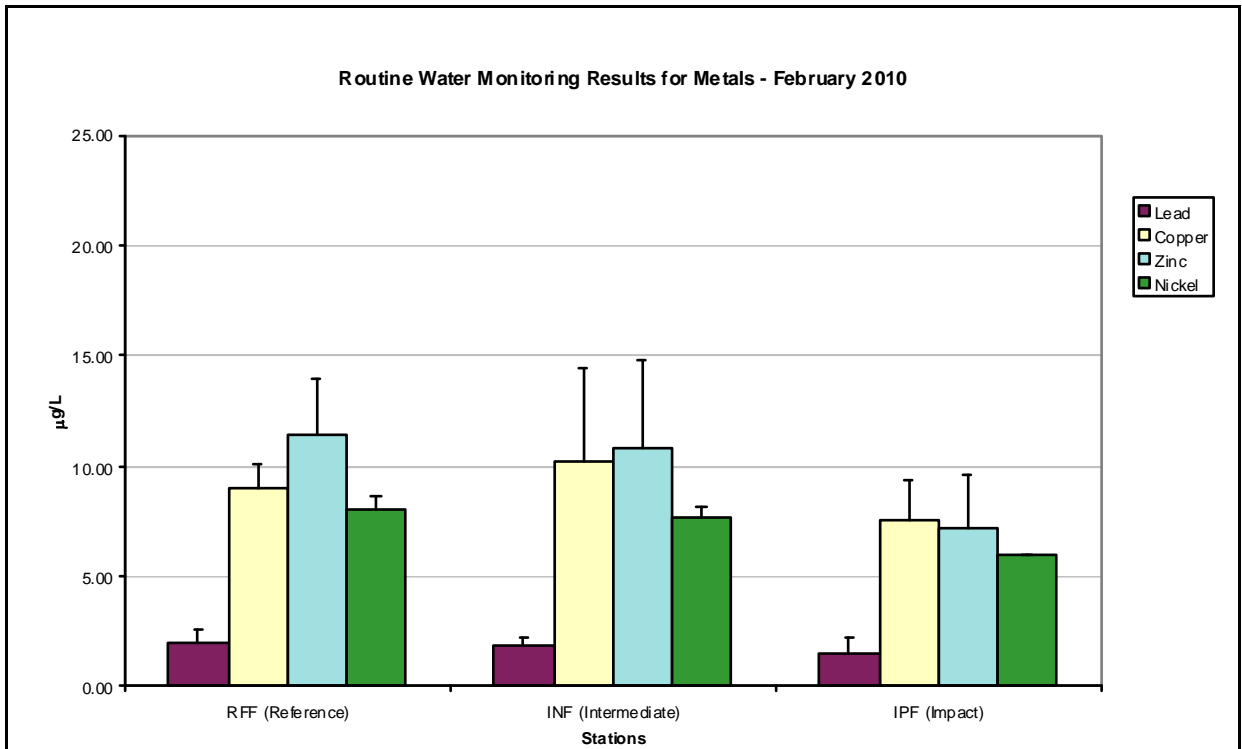


Figure 1: Concentration of Lead, Copper, Zinc and Nickel (mean ± SD) in water samples for Routine Water Quality Monitoring for CMP IV in February 2010. Note: All other metals (As, Cd, Cr, Hg and Ag) were below limit of detection.

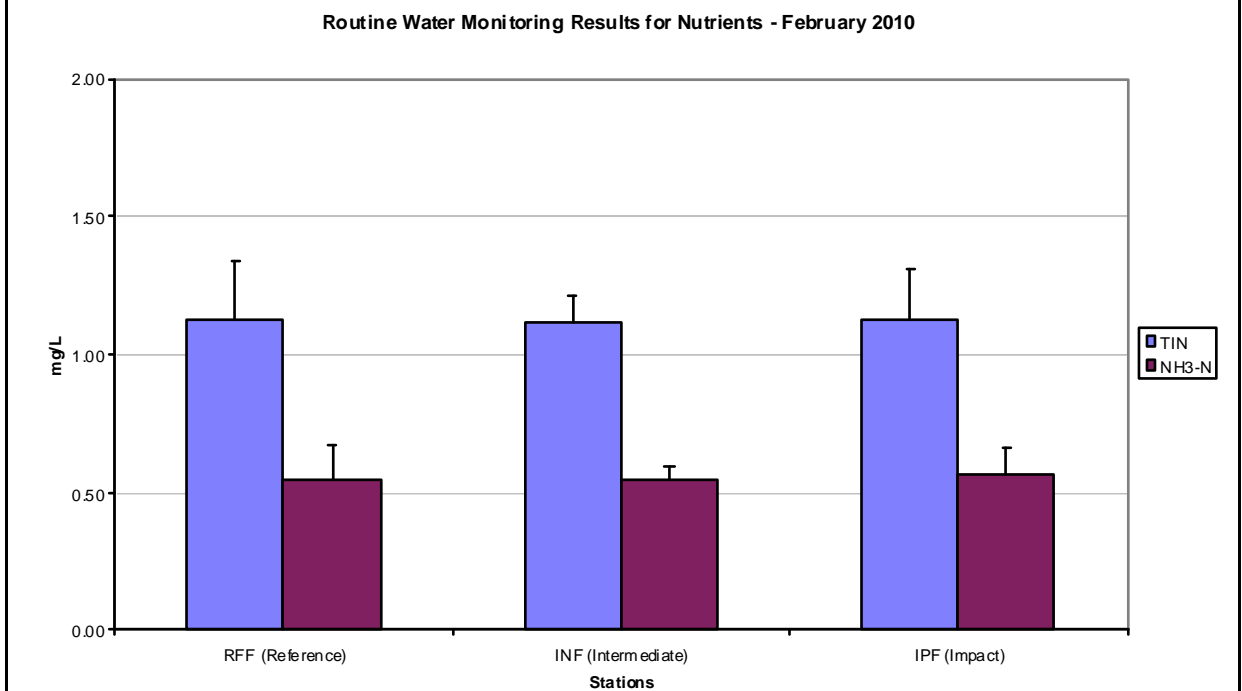


Figure 2: Concentration of Total Inorganic Nitrogen and Unionized Ammonia (mean ± SD) in water samples for Routine Water Quality Monitoring for CMP IV in February 2010.

Routine Water Quality Monitoring for Total Suspended Solids - February 2010

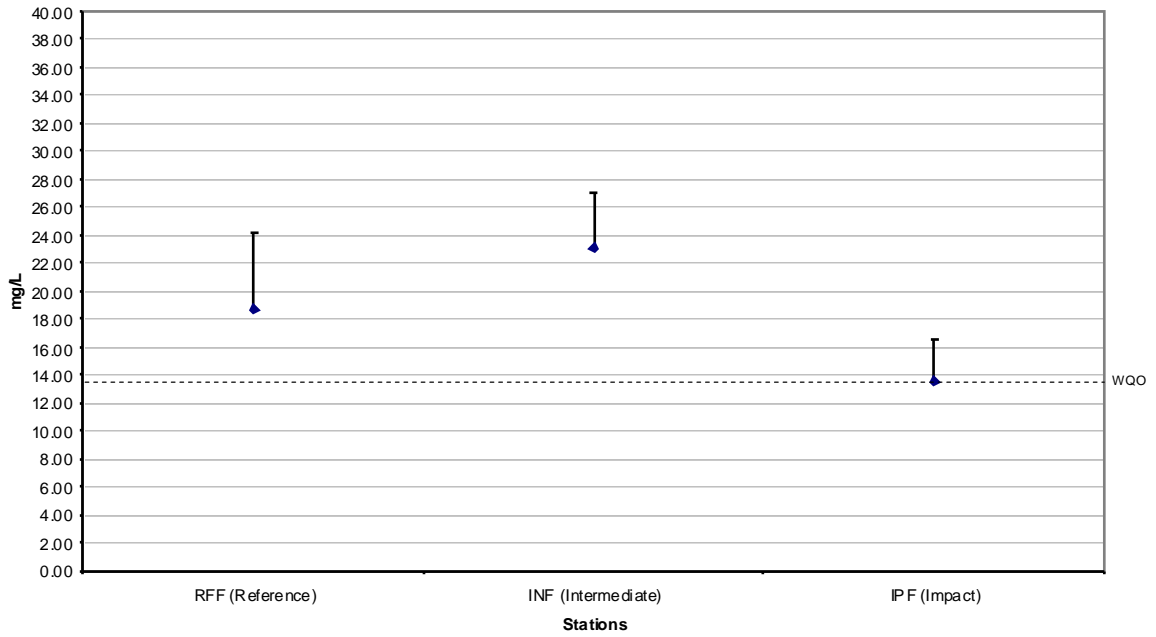


Figure 3: Concentration of Total Suspended Solids (mean  $\pm$  SD) in water samples for Routine Water Quality Monitoring for CMP IV in February 2010

Routine Water Monitoring Results for Biochemical Oxygen Demand (BOD<sub>5</sub>) - February 2010

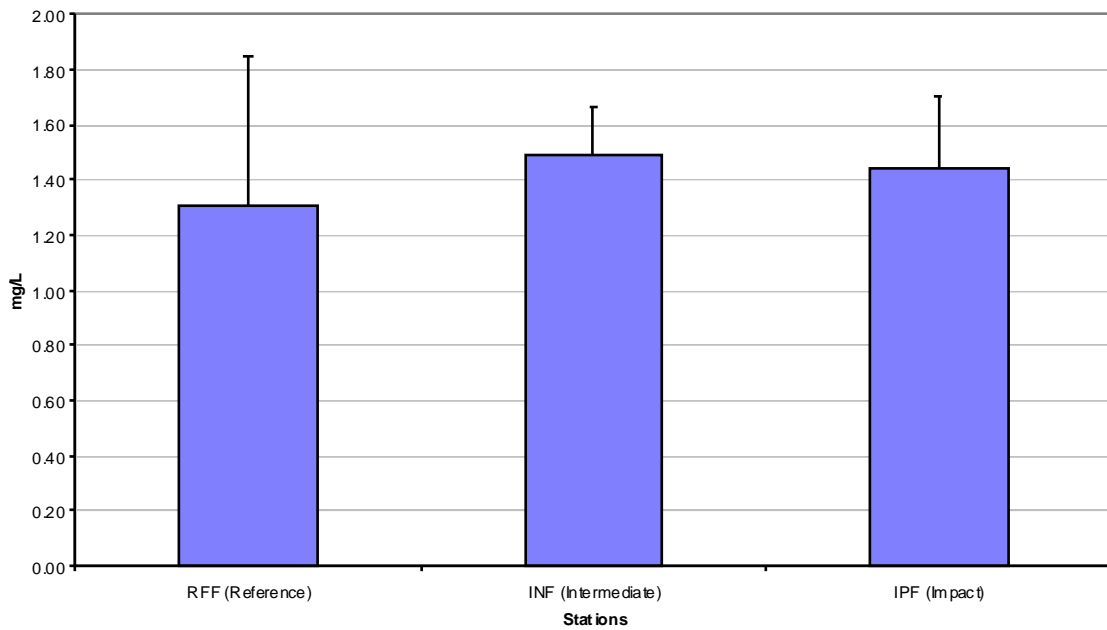


Figure 4: Concentration of Biological Oxygen Demand (mean  $\pm$  SD) during Routine Water Quality Monitoring for CMP IV in February 2010.

Source: H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau (2009 - 2013)\06 Contractor Submission (LAM)\06.8 Routine Water Quality Monitoring\Mar 10  
 Date: 31/03/2010

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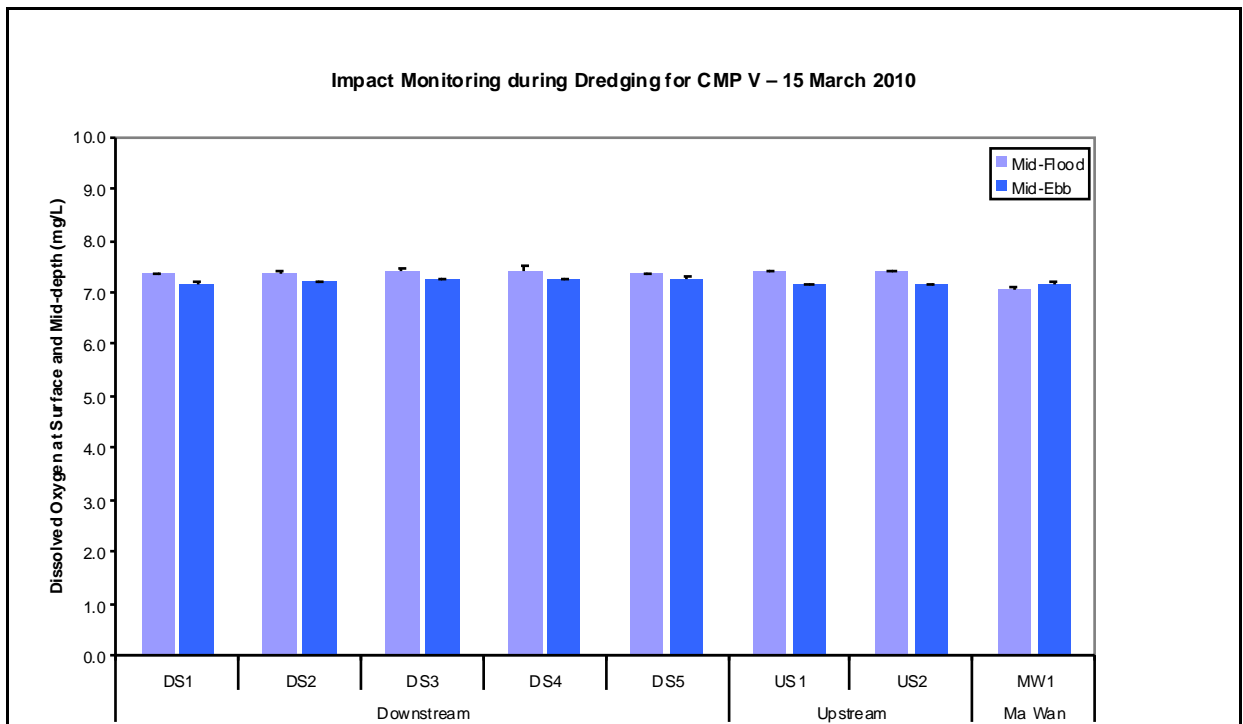


Figure 5: Depth-average DO Level (mean  $\pm$  SD) at Downstream (DS1, DS2, DS3, DS4 and DS5 stations), Upstream (US1 and US2 stations) and Ma Wan (MW1 station) during Impact Monitoring for Dredging on 15 March 2010.

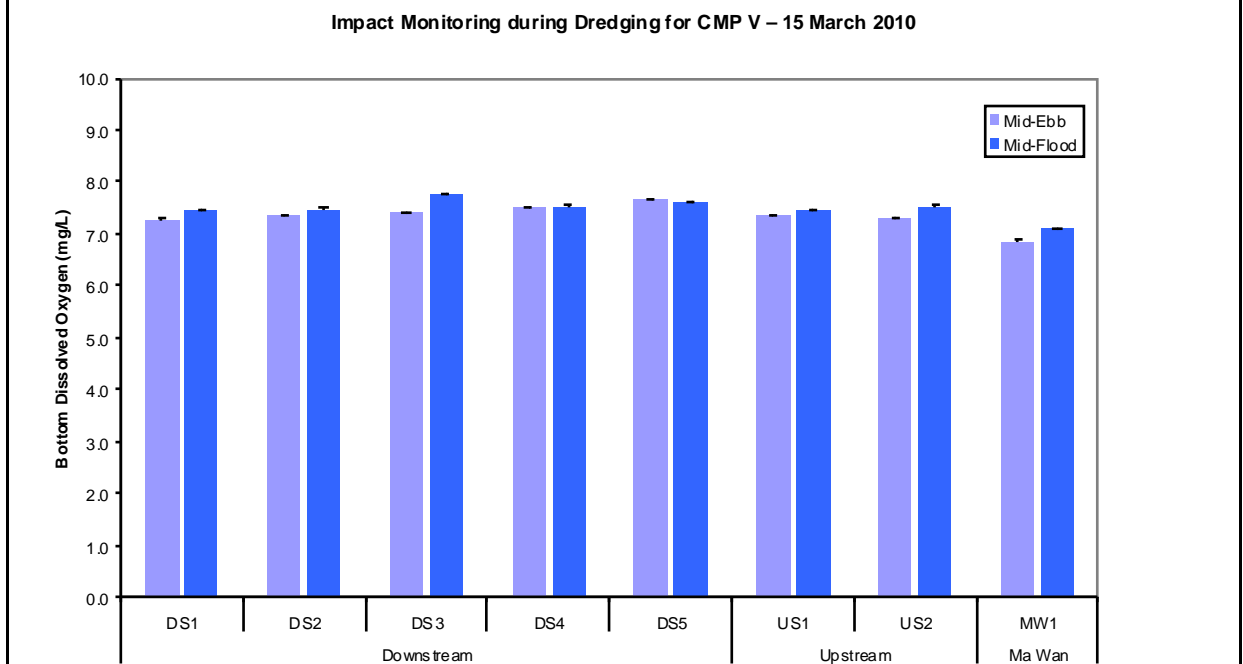


Figure 6: Bottom DO Level (mean  $\pm$  SD) at Downstream (DS1, DS2, DS3, DS4 and DS5 stations), Upstream (US1 and US2 stations) and Ma Wan (MW1 station) during Impact Monitoring for Dredging on 15 March 2010.

Impact Monitoring during Dredging for CMP V – 15 March 2010

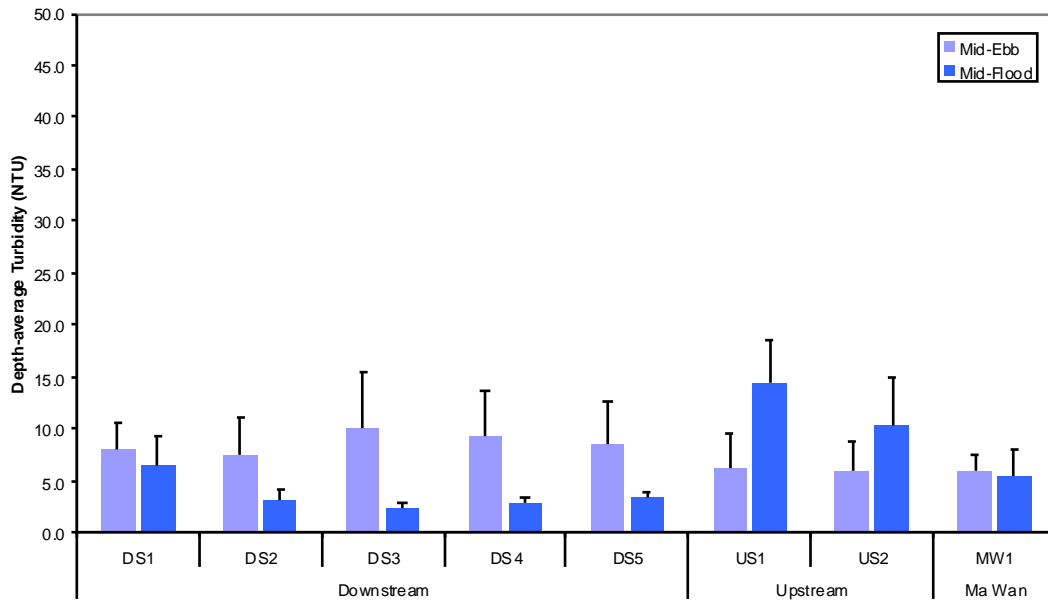


Figure 7: Depth-average Turbidity (mean ± SD) at Downstream (DS1, DS2, DS3, DS4 and DS5 stations), Upstream (US1 and US2 stations) and Ma Wan (MW1 station) during Impact Monitoring for Dredging on 15 March 2010.

Impact Monitoring during Dredging for CMP V – 15 March 2010

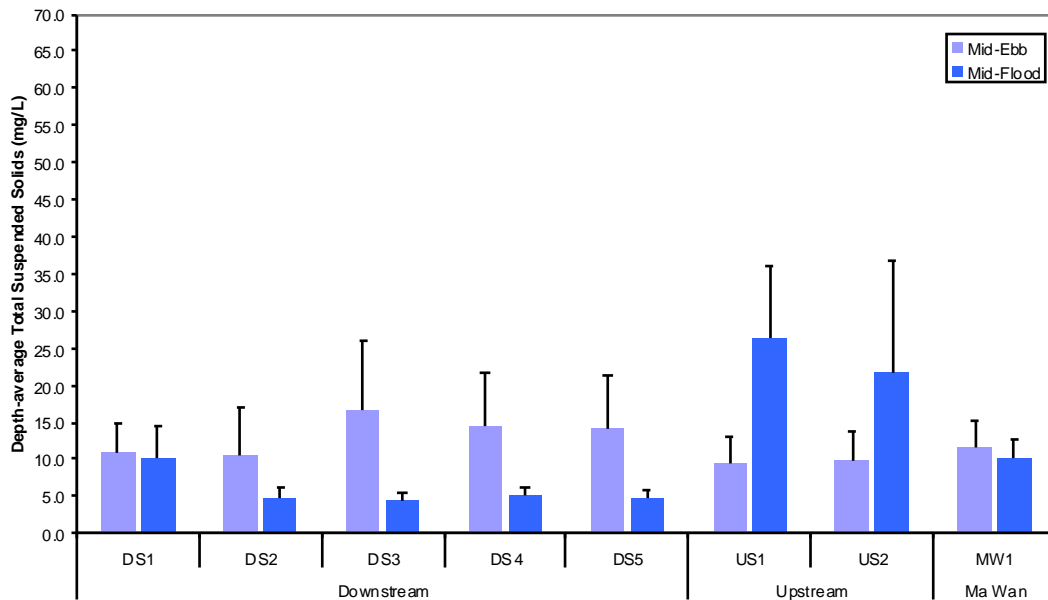


Figure 8: Depth-average Suspended Solids (mean ± SD) at Downstream (DS1, DS2, DS3, DS4 and DS5 stations), Upstream (US1 and US2 stations) and Ma Wan (MW1 station) during Impact Monitoring for Dredging on 15 March 2010.

Table B1: Impact Water Quality Monitoring for Dredging Activities during Mid-ebb Tide for 15 March 2010

Station	Downstream (Impact)		
Time (hh:mm)	13:34-14:16		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	7.22	7.43
Turbidity (NTU)	8.65	N/A	N/A
SS (mg/L)	13.30	N/A	N/A
Remarks	Dredging works were observed.		

Station	Upstream (Reference)		
Time (hh:mm)	13:13-13:39		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	7.14	7.33
Turbidity (NTU)	6.06	N/A	N/A
SS (mg/L)	9.58	N/A	N/A
Remarks	Dredging works were observed.		

Station	Ma Wan		
Time (hh:mm)	14:11-14:16		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	6.88	6.86
Turbidity (NTU)	6.07	N/A	N/A
SS (mg/L)	11.67	N/A	N/A
Remarks			

Compliance with Action and Limit Levels

Parameter	Action Level		Limit Level		Mean Value at Impact Stations	Mean Value at Reference Stations	Compliance with Action level	Compliance with Limit Level
	Impact Stations	Comparison between I and R <sup>(a)</sup>	Mean Value at Impact Stations	Comparison between I and R <sup>(a)</sup>				
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)	7.43	7.33	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)	7.22	7.14	Y	Y
Turbidity (Depth-averaged)	> 28.14	I ≥ 1.2 R ( 7.27 )	> 38.32	I ≥ 1.3 R ( 7.87 )	8.65	6.06	Y	Y
SS (Depth-averaged)	> 37.88	I ≥ 1.2 R ( 11.50 )	> 61.92	I ≥ 1.3 R ( 12.46 )	13.30	9.58	Y	Y

Table B2: Impact Water Quality Monitoring for Dredging Activities during Mid-flood Tide for 15 March 2010

Station	Downstream (Impact)		
Time (hh:mm)	17:34 - 18:54		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	7.38	7.57
Turbidity (NTU)	5.79	N/A	N/A
SS (mg/L)	5.83	N/A	N/A
Remarks	Dredging works were observed.		

Station	Upstream (Reference)		
Time (hh:mm)	18:42 - 19:07		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	7.41	7.50
Turbidity (NTU)	12.35	N/A	N/A
SS (mg/L)	24.00	N/A	N/A
Remarks	Dredging works were observed.		

Station	Ma Wan		
Time (hh:mm)	20:21 - 20:32		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	7.05	7.12
Turbidity (NTU)	5.38	N/A	N/A
SS (mg/L)	10.00	N/A	N/A
Remarks			

Compliance with Action and Limit Levels

Parameter	Action Level		Limit Level		Mean Value at Impact Stations	Mean Value at Reference Stations	Compliance with Action level	Compliance with Limit Level
	Mean Value at Impact Stations	Comparison between I and R <sup>(a)</sup>	Mean Value at Impact Stations	Comparison between I and R <sup>(a)</sup>				
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)	7.57	7.5	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)	7.38	7.41	Y	Y
Turbidity (Depth-averaged)	> 28.14	I ≥ 1.2 R ( 14.83 )	> 38.32	I ≥ 1.3 R ( 16.06 )	5.79	12.35	Y	Y
SS (Depth-averaged)	> 37.88	I ≥ 1.2 R ( 28.80 )	> 61.92	I ≥ 1.3 R ( 31.20 )	5.83	24.00	Y	Y

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

Annex C

## Study Programme



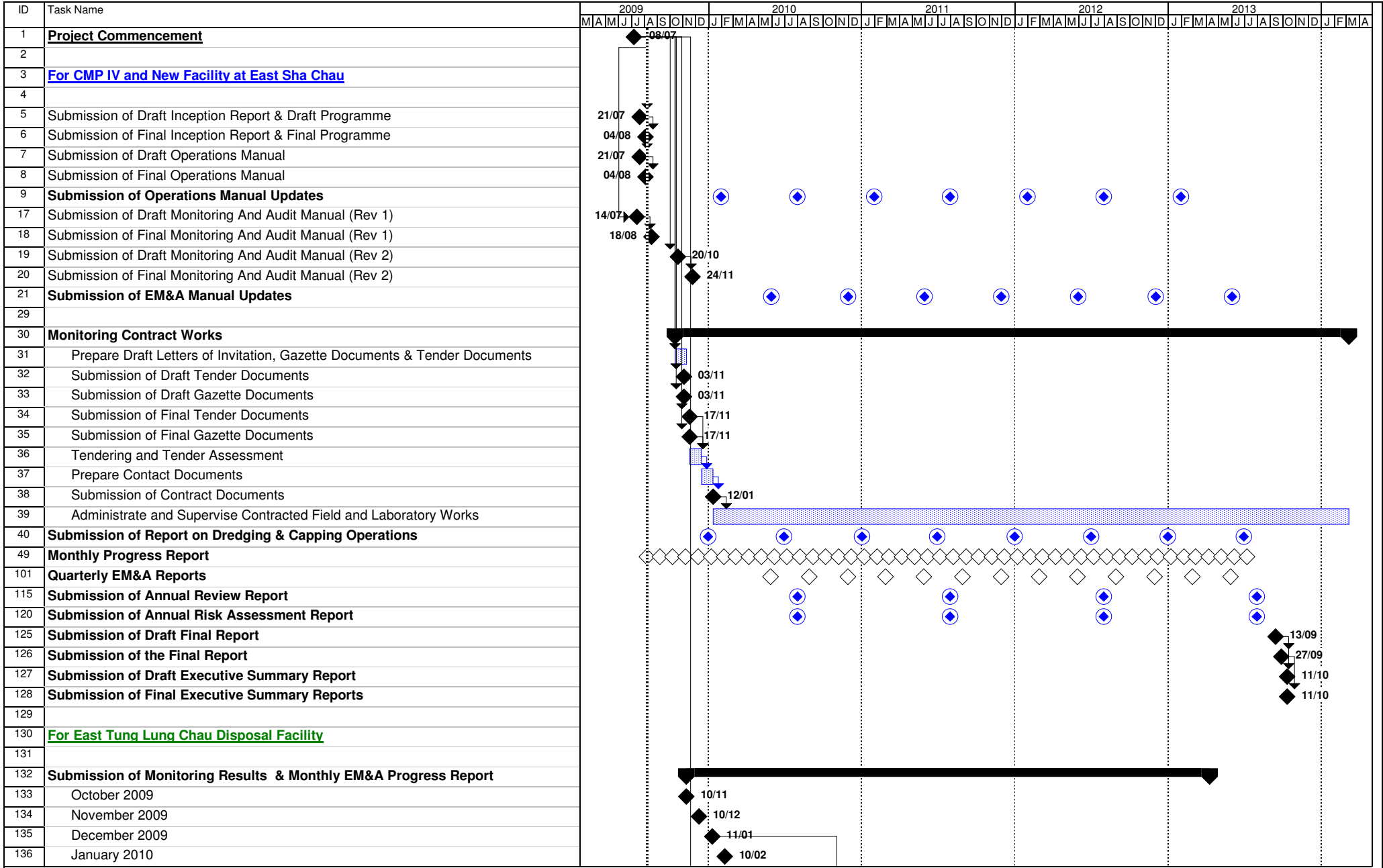


Figure 4.1 - Study Programme



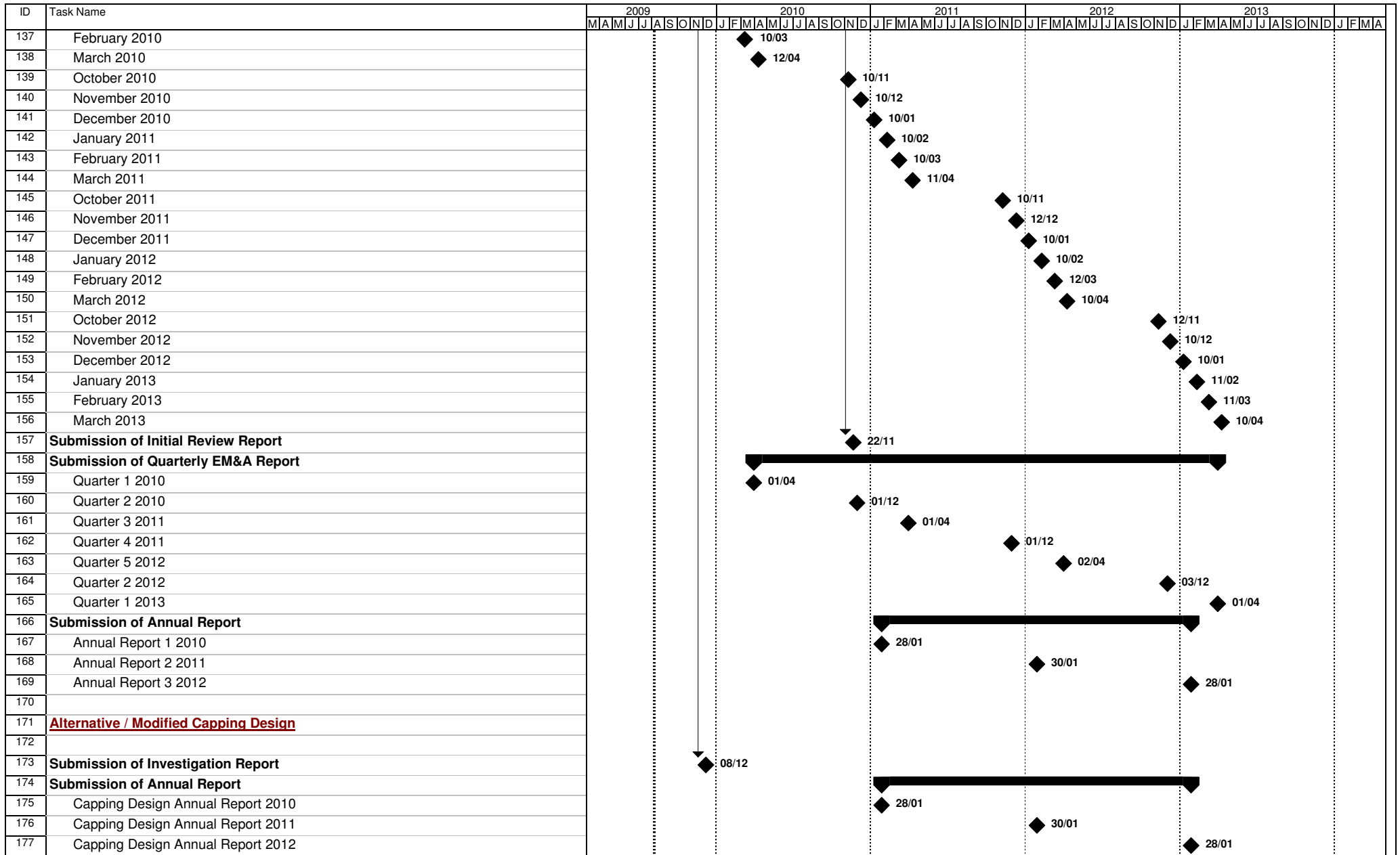


Figure 4.1 - Study Programme

