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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)

6th Monthly Progress Report for Contaminated Mud Pits at Sha Chau – December 2009

Revision 0

26 January 2010

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**Environmental Resources
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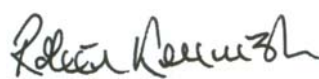



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Revision 0

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Client: Civil Engineering and Development Department (CEDD)		Proposal No: 0103262			
Summary: This document presents progress of monitoring works on contaminated mud pits at Sha Chau in December 2009 under Agreement No. CE 4/2009 (EP).		Date: 26 January 2010			
		Approved by:  Dr Robin Kennish Director			
0	6 th Monthly Progress Report for CMP – Revision 0	JT	CAR	RK	26/01/10
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

6th MONTHLY PROGRESS REPORT FOR CONTAMINATED MUD PITS
AT SHA CHAU - December 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 of December 2009.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

Field sampling activities conducted in this monthly period for CMP IVc are listed below:

- *Benthic Macro In-fauna Monitoring* was conducted on 7 December 2009;
- *Cumulative Impact Sediment Chemistry* and *Sediment Toxicity Monitoring* were conducted on 8 December 2009; and,
- *Pit Specific Sediment Chemistry Monitoring* and *Water Column Profiling* were conducted on 9 December 2009.

For CMP V, samplings for *Impact Monitoring during Dredging Operations* and *Water Column Profiling* were conducted on 10 and 11 December 2009, respectively. 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*

Key Task	Monitoring Component	Results Received from the Contractor
CMP IV		
Sediment Sampling and Chemical Analysis	Sediment Chemistry after a Major Storm Event	September's sampling: 15 December 2009
Sediment Toxicity Testing		August's sampling: 15 December 2009
CMP V		
Water Sampling and Chemical Analysis	a) Water Column Profiling	September's sampling: 15 December 2009 November's sampling: 15 December 2009
	b) Impact Monitoring during Dredging Operations	September's sampling: 15 December 2009 October's sampling: 15 December 2009 November's sampling: 15 December 2009

1.4 *DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS*

No outstanding sampling remained from December 2009, however, *Water Quality Monitoring during Capping* of CMP IV was not conducted as capping activities were not scheduled in this monthly period. Data for *Tissue/Whole Body Contaminant Testing* remained outstanding from the Contractor.

1.5 *BRIEF DISCUSSION OF THE MONITORING RESULTS*

Results of *Sediment Toxicity Testing* for August 2009 are presented for CMP IVc. For CMP V, monitoring results are presented for *Water Column Profiling* and *Impact Monitoring during Dredging Operations* for December 2009. Detailed results will be discussed in the relevant *Quarterly Reports*.

1.5.1 *CMP IV*

Sediment Toxicity Testing in August 2009

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

The survival rates of the burrowing amphipod, bivalve, shrimp and barnacle were not significantly different between animals exposed to Near-Pit and

Reference sediments. The total dry weight of the benthic polychaete was also not significantly different between Near-Pit and Reference sediments.

1.5.2 *CMP V*

Water Column Profiling for CMP V during December 2009

Results of *Water Column Profiling* for December 2009 show that levels of salinity, pH and DO complied with the WQOs at both Upstream and Downstream stations (*Figures 2 to 4 of Annex B*). Levels of TSS exceeded the WQO at both Upstream and Downstream stations (*Figure 1 of Annex B*).

Impact Monitoring during Dredging Operations of CMP V – December 2009

Impact Monitoring during Dredging Operations of CMP V was conducted on 10 December 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 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* ⁽¹⁾ (*Tables B1 and B2 of Annex B*).

1.6 *ACTIVITIES SCHEDULED FOR THE NEXT MONTH*

The following monitoring activities will be conducted in the next monthly period of January 2010:

- *Demersal Trawling* for CMP IV;
- *Impact Monitoring during Dredging Operations* for CMP V; and,
- *Water Column Profiling* for both CMP IV and CMP V.

The sampling schedule 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

Pit Specific Sediment Chemistry	Code	Frequency	2009					2010	
			J	A	S	O	N	D	J
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
<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

Routine Water Quality Monitoring			J	A	S	O	N	D	J	F
<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	*							*



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

		2009						2010	
		J	A	S	O	N	D	J	F
Baseline Water Quality Monitoring									
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	*	*						
Water Column Profiling									
Plume Stations	Upstream			2	2	2	2	2	2
	Downstream			2	2	2	2	2	2
Water Quality Impact Monitoring for Dredging									
Downcurrent Impact Stations	1			*	*	*	*	*	*
	2			*	*	*	*	*	*
	3			*	*	*	*	*	*
	4			*	*	*	*	*	*
	5			*	*	*	*	*	*
Upcurrent Stations	1			*	*	*	*	*	*
	2			*	*	*	*	*	*
	MW1			*	*	*	*	*	*

 Sampling completed
 Sampling to be completed

Annex B

Monitoring Results

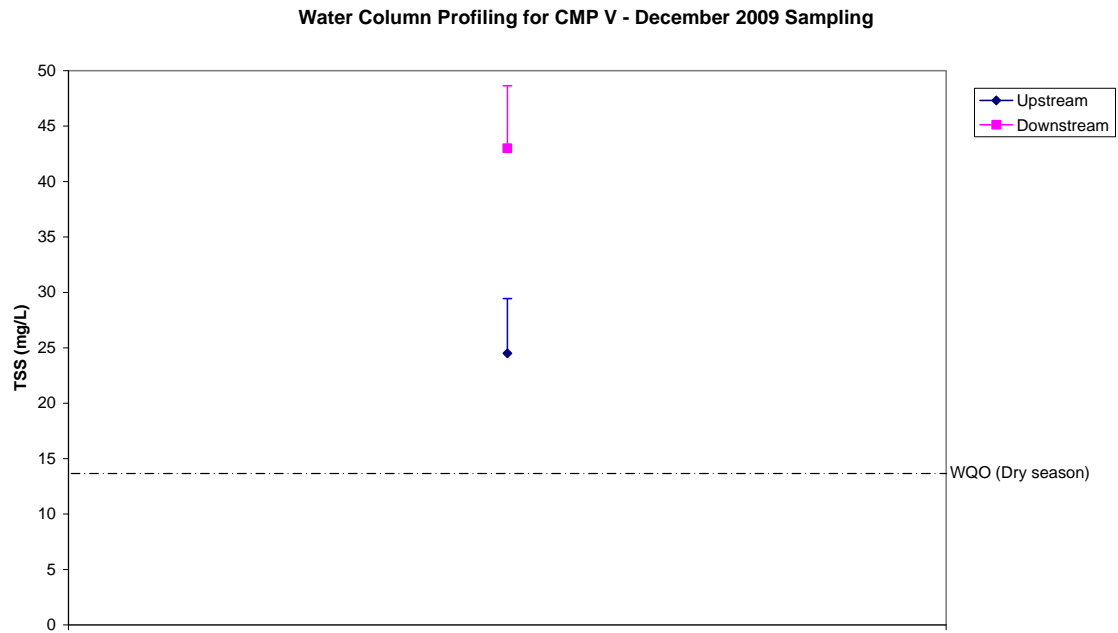


Figure 1: Levels of Total Suspended Solids (mean \pm SD) during Water Column Profiling for CMP V in December 2009.

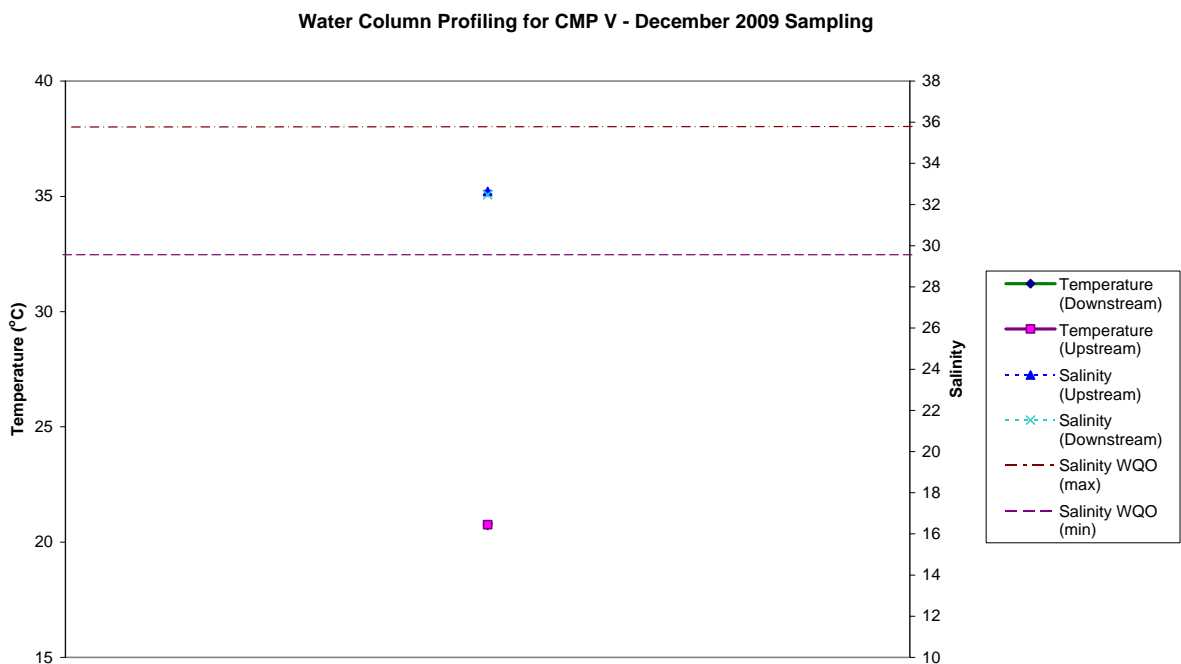


Figure 2: Salinity and Temperature (mean \pm SD) during Water Column Profiling for CMP V in December 2009.

Source: H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau (2009 - 2013)\06 Contract Submission (LAM)\06. 12 Water Column Profiling CMP V\Dec 2009

Date: 10/01/2010

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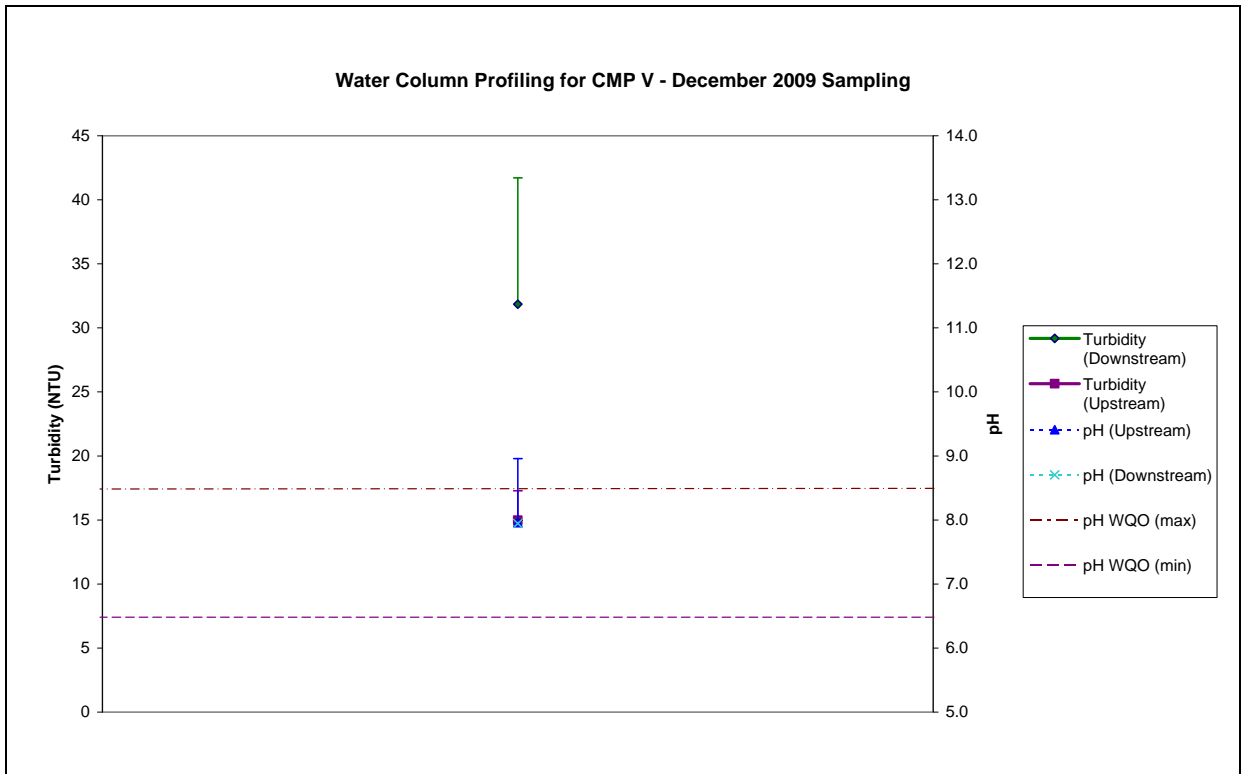


Figure 3: Turbidity and pH (mean \pm SD) during Water Column Profiling for CMP V in December 2009.

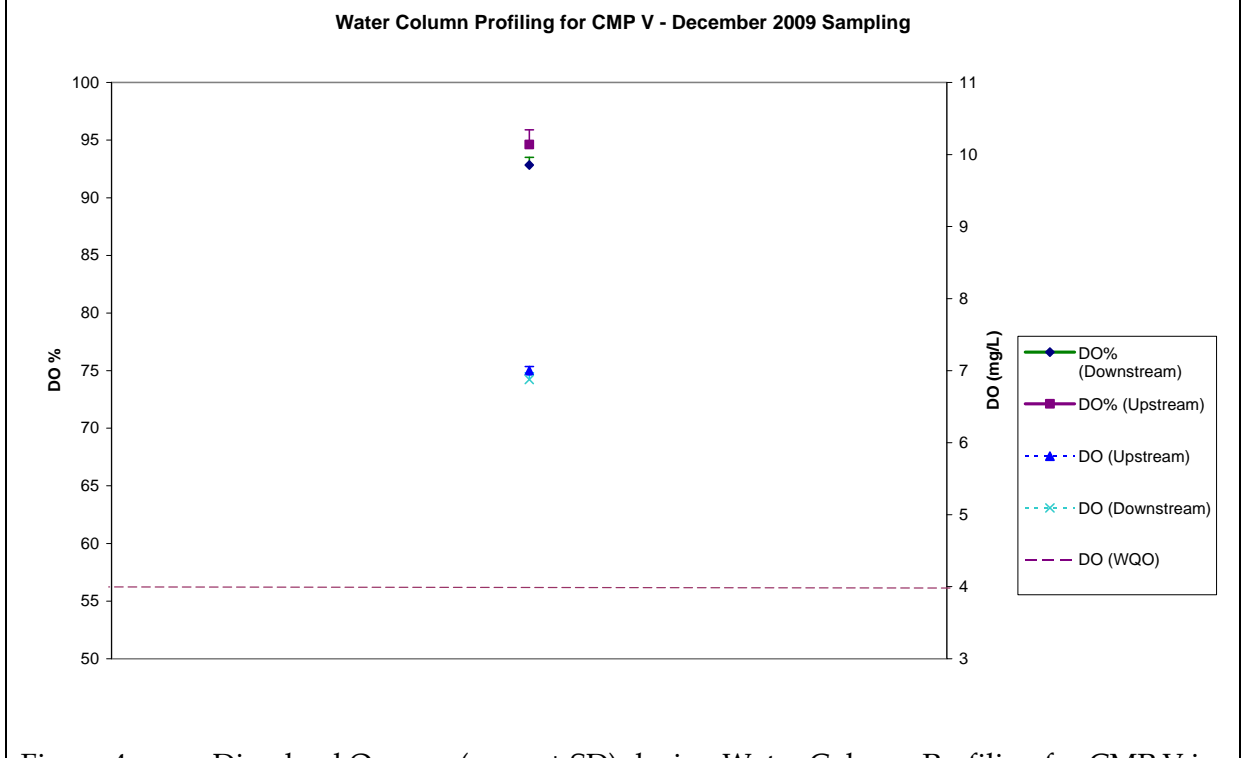


Figure 4: Dissolved Oxygen (mean \pm SD) during Water Column Profiling for CMP V in December 2009.

Source: H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau (2009 - 2013)\06 Contract Submission (LAM)\06. 12 Water Column Profiling CMP V\Dec 2009
 Date: 10/01/2010

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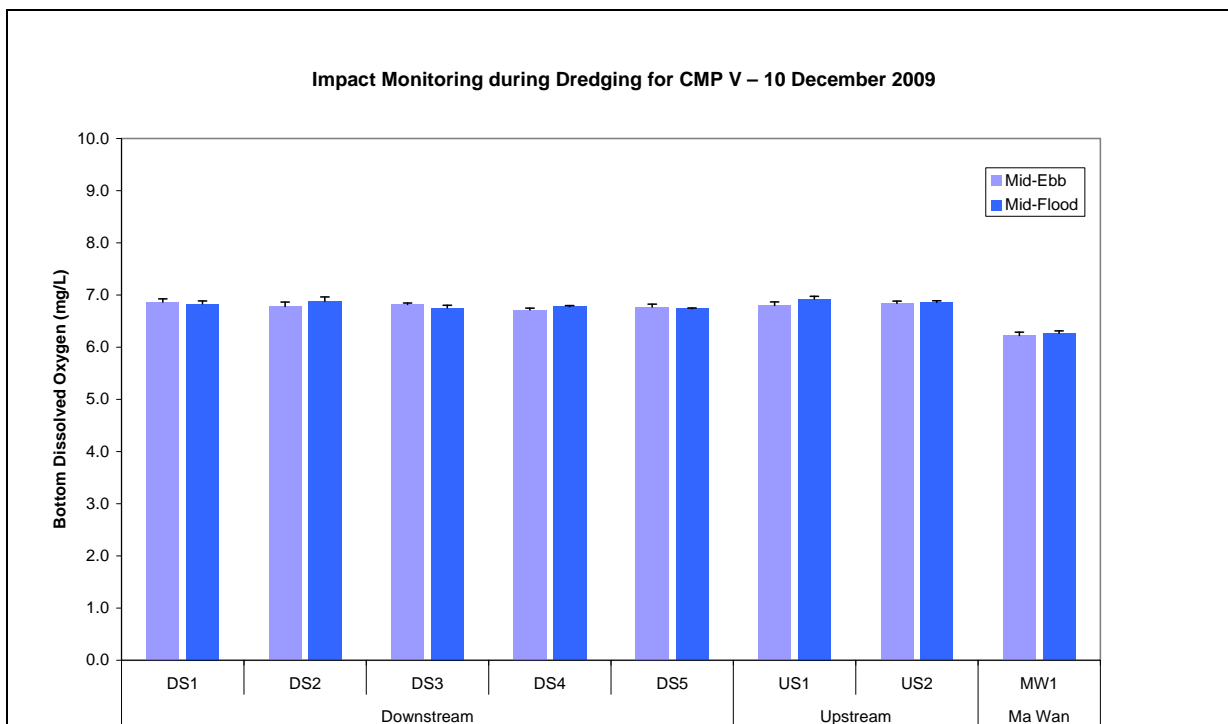


Figure 5: Bottom DO Level (mean \pm SD) at Downstream (DS1, DS2, DS3, DS4 and DS5 stations), Upstream (US1 and US2 stations) and Ma Wan (MW1 station) during Impact Monitoring for Dredging on 10 December 2009.

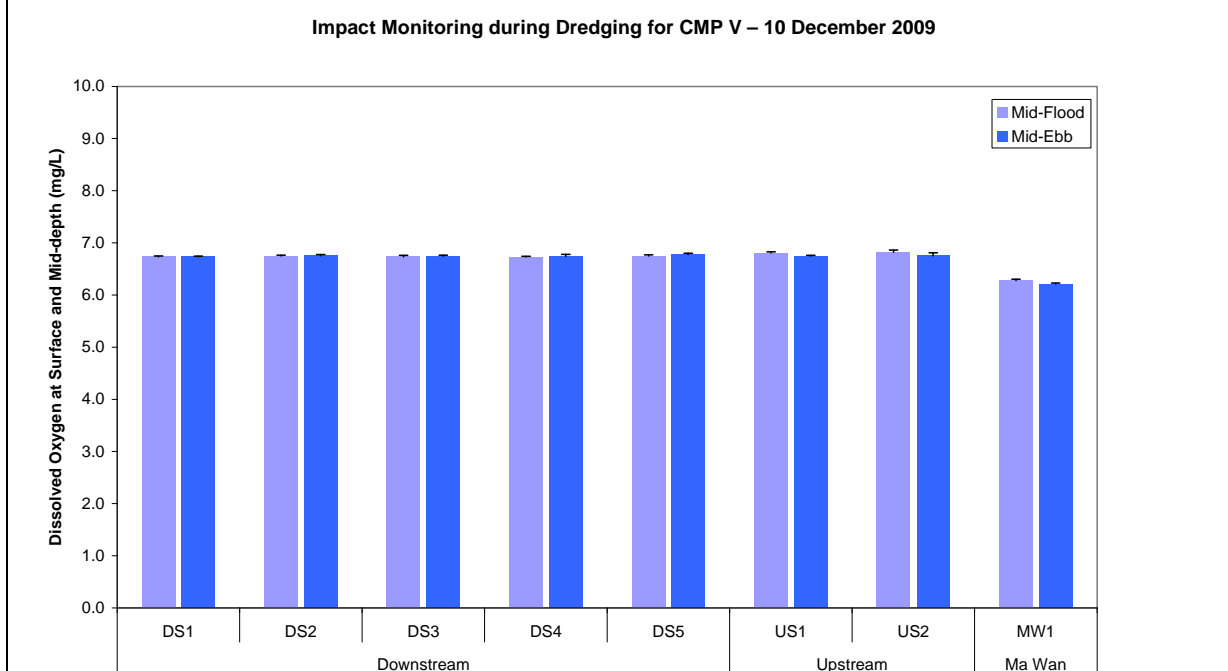


Figure 6: DO Level at Surface and Mid-depth (mean \pm SD) at Downstream (DS1, DS2, DS3, DS4 and DS5 stations), Upstream (US1 and US2 stations) and Ma Wan (MW1 station) during Impact Monitoring for Dredging on 10 December 2009.

Source: H:\Team\EM\GMS Projects\0103262 CEDD EM&A for CMP at Sha Chau (2009 - 2013)\06 Contract Submission (LAM)\06.2 Impact Monitoring during Dredging\Dec 2009

Date: 10/01/2010

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Impact Monitoring during Dredging for CMP V – 10 December 2009

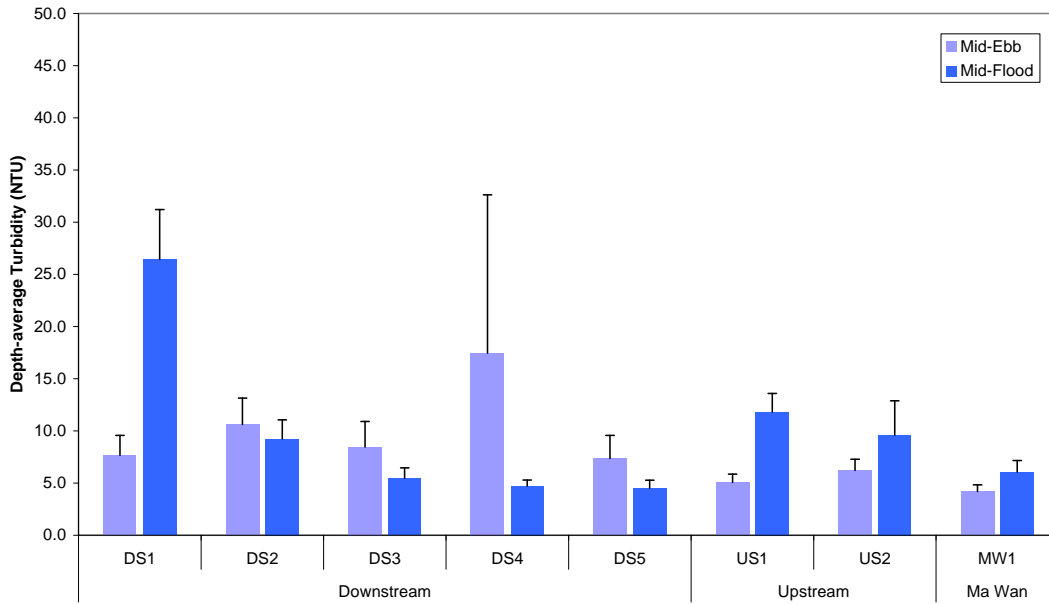


Figure 7: Depth-average Turbidity (mean \pm SD) at Downstream (DS1, DS2, DS3, DS4 and DS5 stations), Upstream (US1 and US2 stations) and Ma Wan (MW1 station) during Impact Monitoring for Dredging on 10 December 2009.

Impact Monitoring during Dredging for CMP V – 10 December 2009

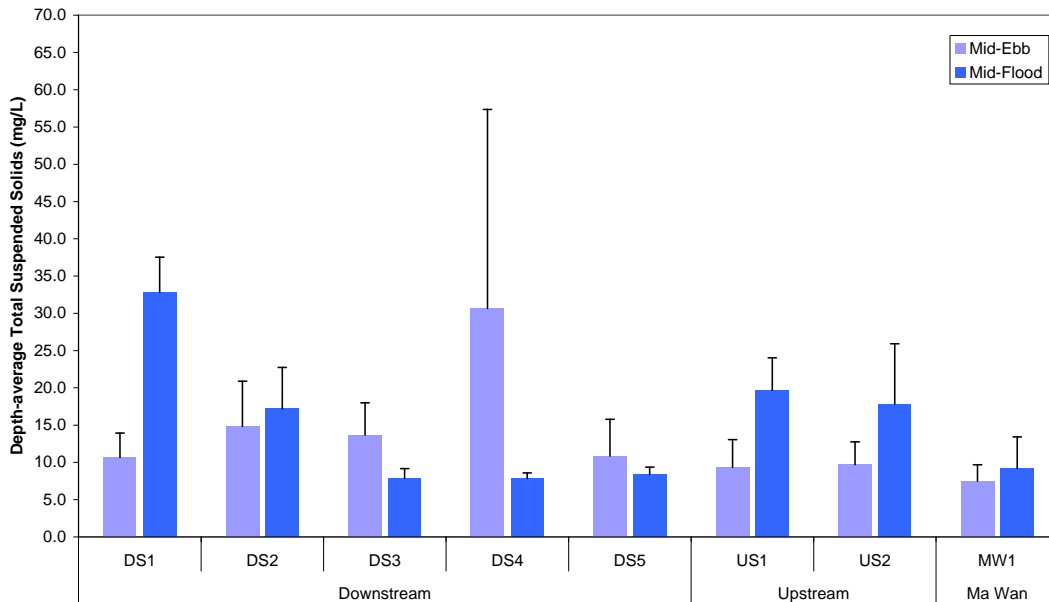


Figure 8: Depth-average Total Suspended Solids (mean \pm SD) at Downstream (DS1, DS2, DS3, DS4 and DS5), Upstream (US1 and US2) and Ma Wan (MW1) stations during Impact Monitoring for Dredging on 10 December 2009.

Table B1: Impact Water Quality Monitoring for Dredging Activities during Mid-ebb Tide for 10 December 2009

Station	Downstream (Impact)		
Time (hh:mm)	06:07 - 08:35		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	6.74	6.79
Turbidity (NTU)	10.30	N/A	N/A
SS (mg/L)	16.13	N/A	N/A
Remarks	Dredging works were observed.		

Station	Upstream (Reference)		
Time (hh:mm)	06:07 - 08:35		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	6.75	6.8
Turbidity (NTU)	5.63	N/A	N/A
SS (mg/L)	9.50	N/A	N/A
Remarks	Dredging works were observed.		

Station	Ma Wan		
Time (hh:mm)	06:07 - 08:35		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	6.21	6.23
Turbidity (NTU)	4.19	N/A	N/A
SS (mg/L)	7.50	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 ^(a)	Mean Value at Impact Stations	Comparison between I and R ^(a)				
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)	6.79	6.82	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)	6.74	6.75	Y	Y
Turbidity (Depth-averaged)	> 28.14	I ≥ 1.2 R (6.76)	> 38.32	I ≥ 1.3 R (7.32)	10.30	5.63	Y	Y
SS (Depth-averaged)	> 37.88	I ≥ 1.2 R (11.40)	> 61.92	I ≥ 1.3 R (12.35)	16.13	9.50	Y	Y

Table B2: Impact Water Quality Monitoring for Dredging Activities during Mid-flood Tide for 10 December 2009

Station	Downstream (Impact)		
Time (hh:mm)	12:55 - 15:06		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	6.74	6.80
Turbidity (NTU)	10.06	N/A	N/A
SS (mg/L)	14.80	N/A	N/A
Remarks	Dredging works were observed.		

Station	Upstream (Reference)		
Time (hh:mm)	12:55 - 15:06		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	6.82	6.9
Turbidity (NTU)	10.70	N/A	N/A
SS (mg/L)	18.75	N/A	N/A
Remarks	Dredging works were observed.		

Station	Ma Wan		
Time (hh:mm)	12:55 - 15:06		
Monitoring Depth (m)	Depth Average	Surface and Middle	Bottom
D.O. (mg/L)	N/A	6.28	6.27
Turbidity (NTU)	6.07	N/A	N/A
SS (mg/L)	9.17	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 ^(a)	Mean Value at Impact Stations	Comparison between I and R ^(a)				
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)	6.80	6.89	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)	6.74	6.82	Y	Y
Turbidity (Depth-averaged)	> 28.14	I ≥ 1.2 R (12.83)	> 38.32	I ≥ 1.3 R (13.90)	10.06	10.70	Y	Y
SS (Depth-averaged)	> 37.88	I ≥ 1.2 R (22.50)	> 61.92	I ≥ 1.3 R (24.38)	14.80	18.75	Y	Y

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

Annex C

Study Programme

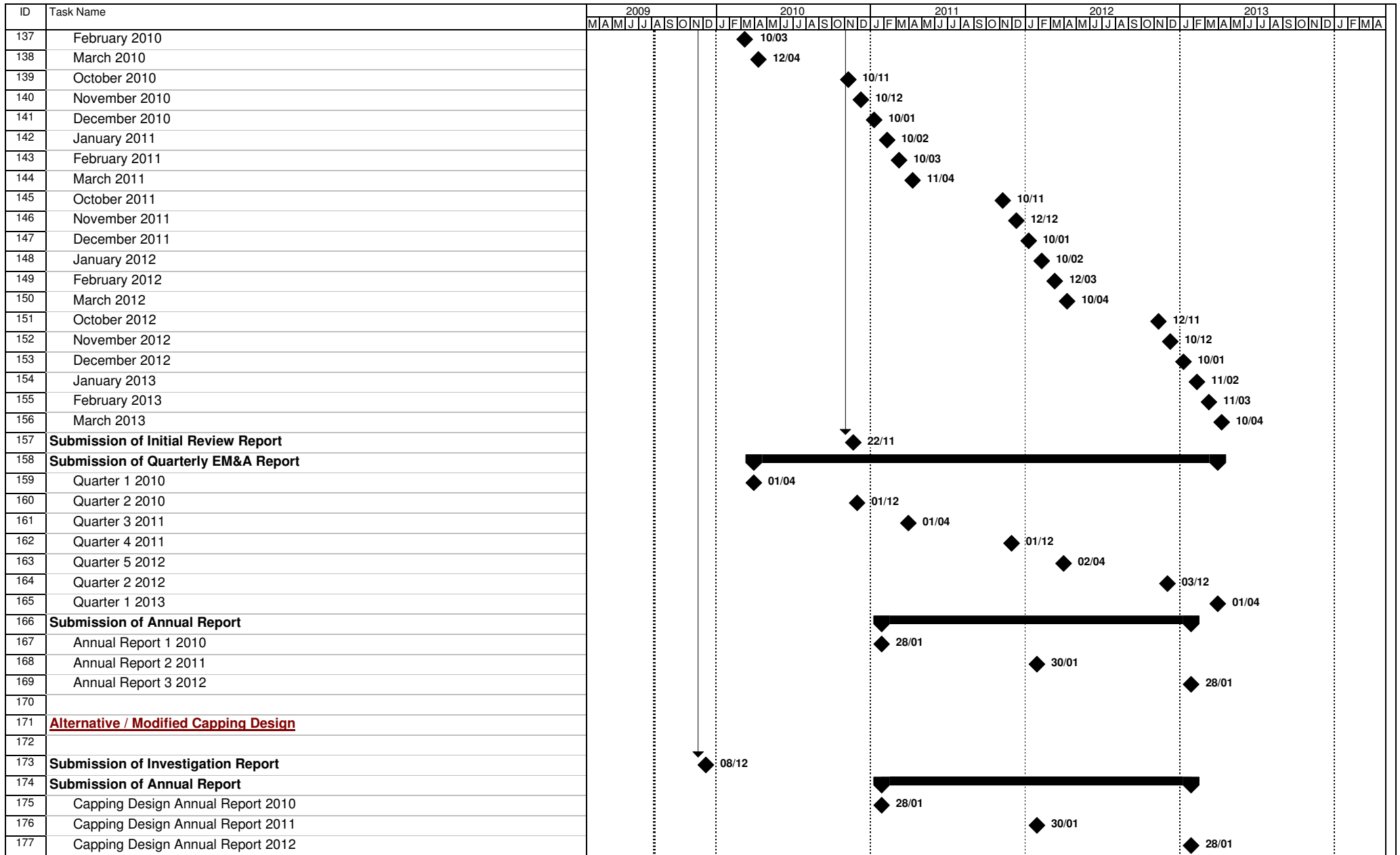


Figure 4.1 - Study Programme

