



# BAYWIDE WATER QUALITY MONITORING PROGRAM

## PROGRESS REPORT No. 18 (JUNE 2009)

JULY 2009

### INTRODUCTION TO THE PROGRAM

This report summarises water quality data obtained for the Channel Deepening Project (CDP) Baywide Water Quality Monitoring Program at 11 sampling sites in Port Phillip Bay. Data is for June 2009. Monthly Progress Reports will be prepared throughout the dredging program and for two years thereafter.

Where extensive local water quality data is available, control charts (Shewhart and EWMA) have been developed (see Appendix 1). These charts provide a guide against which data can be compared. Where data is recorded beyond natural or expected variation, further investigation will be undertaken.

The information contained in this report is correct as available to EPA Victoria at the time of publication.

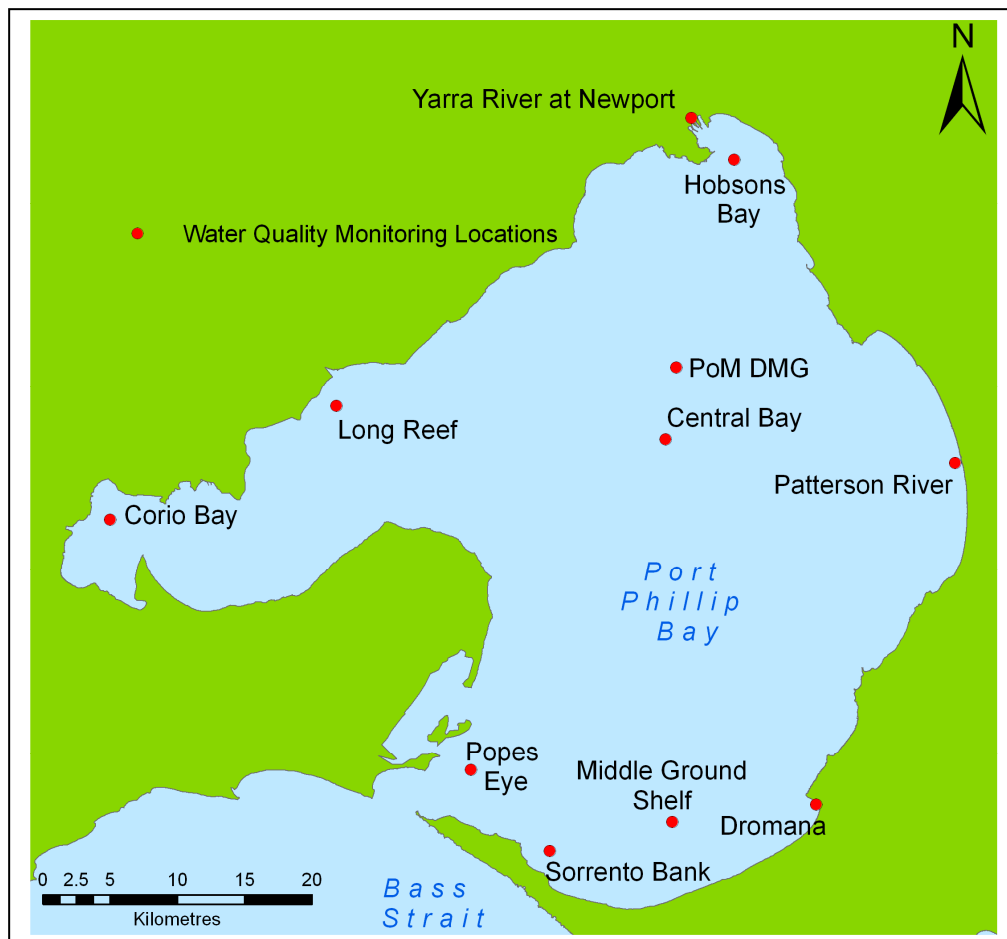


FIGURE 1 MAP OF SAMPLING SITES IN PORT PHILLIP BAY

## MATERIALS AND METHODS

The materials and methods for this program are described in the CDP Water Quality Detailed Design document CDP\_ENV\_MD\_023 Rev 2.0 (PoMC 2009).

## EXCEPTIONS

There were no exceptions to the Detailed Design (PoMC 2009) during this reporting period.

## RESULTS AND DISCUSSION

All results presented in Tables 1 - 4 were assessed against the control limits listed in Tables 5 and 6 and where appropriate, compared to the SEPP objectives and ANZECC trigger levels of Table 7 (Appendix 1). Phytoplankton data is presented in Table 8 (Appendix 2).

Within this reporting period the Shewhart control limits were exceeded six times and the EWMA control limits were exceeded eight times (see Tables 1 - 4).

The presence of strong winds and rough conditions during the sampling period may have contributed to the reduced water clarity and the accuracy of the results for secchi disc depth at some sites.

As detailed in section 4.1.3 in the Water Quality detailed design document CDP\_ENV\_MD\_023 Rev 2.0, samples were not taken at depth at the Yarra River site as the salinity difference between the near surface and depth was less than 10 ppt.

## REFERENCES

PoMC 2009, Water Quality Detailed Design CDP\_ENV\_MD\_023 Rev 2.0, Port of Melbourne Corporation, May 2009.

TABLE 1 PHYSICO-CHEMICAL PARAMETERS (NST – No Sample Taken)

Date	Sampling Site	Depth m	Dissolved Oxygen		Salinity g/L	Secchi disc depth m	Temperature °C	Turbidity NTU	Total Suspended Solids mg/L	PAR micro Einsteins/m <sup>2</sup> /sec
			mg/L	% saturation						
10/06/09	Yarra River at Newport	0.5	7.4	88	35.5	0.4	12.8	16.07 <sup>3</sup>	29.0	57.4
10/06/09	Yarra River at Newport	9.0	NST <sup>2</sup>	NST <sup>2</sup>	NST <sup>2</sup>		NST <sup>2</sup>	24.29 <sup>3</sup>	NST <sup>2</sup>	<0.1
10/06/09	Hobsons Bay	0.5	7.7	92	37.0	0.3	12.6	13.17 <sup>3</sup>	21.7	30.2
09/06/09	Central Bay	0.5	7.7	93	37.4	7.0	13.4	0.41	<1.5	22.2
09/06/09	PoM DMG	0.5	7.8	94	37.4	2.4	13.3	1.86	2.1	22.2
10/06/09	Corio Bay	0.5	7.9	92	38.0	4.5	11.4	0.78	<1.5	11.7
10/06/09	Long Reef	0.5	8.1	95	37.6	>5.7 <sup>1</sup>	11.7	0.61	<1.5	466.6
09/06/09	Patterson River	0.5	7.8	93	37.4	5.5	12.8	0.32	<1.5	98.4
09/06/09	Dromana	0.5	7.9	94	36.7	2.9	12.9	1.53	2.8	185.6
09/06/09	Middle Ground Shelf	0.5	7.8	94	37.1	6.0	13.4	0.54	<1.5	79.3
09/06/09	Sorrento Bank	0.5	7.8	94	35.9	>4.0 <sup>1</sup>	14.2	0.32	<1.5	23.1
09/06/09	Popes Eye	0.5	7.7	95	35.7	7.5	14.7	0.18	<1.5	30.0

**NOTES:**

*In situ* data for temperature, turbidity and PAR are recorded across the depth profile. The result presented is for the specific depth noted. All other physico-chemical samples are taken at 0.5 m from surface, except Yarra River at Newport where, if required, bottom samples are also collected.

Blue coloured cells indicate a result outside SEPP objectives (see Appendix 1, Table 7 for details).

Green coloured cells indicate results above ANZECC trigger value only (see Appendix 1, Table 7 for details).

1. Secchi disc visible on bottom.
2. No sample taken at depth as the salinity difference between the near surface and depth was less than 10 ppt.
3. ANZECC guidelines recommend a turbidity range of 0.5-10 NTU for estuarine and marine waters but acknowledge that higher values may be found in estuarine and inshore coastal waters due to wind-induced re-suspension or to the input of turbid water from the catchment.

TABLE 2A NUTRIENTS

Date	Sampling Site	Depth m	Ammonium µg/L		Nitrate µg/L	Nitrite µg/L	Nitrate plus Nitrite µg/L		Dissolved Organic Nitrogen µg/L	Total Nitrogen µg/L	
			Measured Value	EWMA			Measured Value	EWMA		Measured Value	EWMA
10/06/09	Yarra River at Newport	0.5	44.9	24.5	37.8	<1.2	37.8	26.0	175	311	249
10/06/09	Hobsons Bay	0.5	17.9	9.2	10.9	<1.2	10.9	6.2	114	198	180
09/06/09	Central Bay	0.5	6.4	5.8	2.4	<1.2	2.4	2.3	107	136	144
09/06/09	PoM DMG	0.5	7.0	6.0	2.1	<1.2	2.1	2.7	103	134	144
10/06/09	Corio Bay	0.5	7.8	6.1	2.1	<1.2	2.1	2.8	147	175	195
10/06/09	Long Reef	0.5	6.6	11.9	2.2	<1.2	2.2	16.3	132	168	212
09/06/09	Patterson River	0.5	8.3	6.4	2.2	<1.2	2.2	3.8	114	147	156
09/06/09	Dromana	0.5	6.1	5.9	8.3	<1.2	8.3	4.2	90	130	137
09/06/09	Middle Ground Shelf	0.5	6.6	5.8	4.6	<1.2	4.6	2.6	114	144	139
09/06/09	Sorrento Bank	0.5	7.2	5.7	11.2	5.0	16.2	5.8	66	102	112
09/06/09	Popes Eye	0.5	6.5	6.4	9.7	7.7	17.5	7.3	61	93	105

NOTES:

**Yellow** coloured cells indicate measured results above the Shewhart control limit. (See Appendix 1, and Table 5 for details).

**Orange** coloured cells indicate EWMA calculated results above EWMA control limits (see Appendix 1, Table 6 for details).

**Green** coloured cells indicate results above ANZECC trigger value only (see Appendix 1, Table 7 for details). These results are within natural variation for Port Phillip Bay (see control limits, Appendix 1, Tables 5 and 6).

TABLE 2B NUTRIENTS (CONT'D) – PHOSPHORUS AND SILICATE

Date	Sampling Site	Depth m	Phosphate µg/L		Organic Phosphorus µg/L	Total Phosphorus µg/L		Silicate µg/L
			Measured Value	EWMA		Measured Value	EWMA	
10/06/09	Yarra River at Newport	0.5	58.6	59.8	29	88	86	290
10/06/09	Hobsons Bay	0.5	57.5	60.6	24	82	81	161
09/06/09	Central Bay	0.5	43.1	46.1	<18	51	59	46
09/06/09	PoM DMG	0.5	42.8	47.2	<18	51	61	49
10/06/09	Corio Bay	0.5	61.8	62.9	<18	74	81	109
10/06/09	Long Reef	0.5	66.5	108.5	<18	81	131	69
09/06/09	Patterson River	0.5	52.4	51.2	<18	63	66	85
09/06/09	Dromana	0.5	27.1	36.1	<18	37	49	44
09/06/09	Middle Ground Shelf	0.5	37.0	39.4	<18	48	51	64
09/06/09	Sorrento Bank	0.5	10.6	17.4	<18	21	28	40
09/06/09	Popes Eye	0.5	<7.5	12.0	<18	<18	22	35

NOTES:

Green coloured cells indicate results above ANZECC trigger value (see Appendix 1, Table 7 for details). These results are within natural variation for Port Phillip Bay (see control limits, Appendix 1, Tables 5 and 6).



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TABLE 3 METALS, METALLOIDS AND ORGANOMETALLICS (NST – No Sample Taken; NAR - No Analysis Required)

Date	Sampling Site	Depth m	Arsenic µg/L		Tri-butyl Tin <sup>1</sup> (TBT) µg/Lx10 <sup>-3</sup>	Cadmium µg/L	Chromium µg/L	Copper µg/L	Mercury µg/L	Nickel µg/L	Lead µg/L	Zinc µg/L
			Measured Value	EWMA								
10/06/09	Yarra River at Newport - total	0.5	2.8	2.7	<2	0.2	1.7	1	<0.1	1.5	1.2	8
10/06/09	Yarra River at Newport - dissolved	0.5	NAR	-	NAR	<0.2	<0.5	NAR	NAR	NAR	<0.2	<5
10/06/09	Hobsons Bay - total	0.5	2.8	2.7	<2	0.2	1.4	<1	<0.1	1.2	0.9	<5
10/06/09	Hobsons Bay - dissolved	0.5	NAR	-	NAR	NAR	<0.5	NAR	NAR	NAR	NAR	NAR
09/06/09	Central Bay - total	0.5	2.5	2.7	NST	0.2	<0.5	<1	<0.1	0.6	<0.2	<5
09/06/09	Central Bay - dissolved	0.5	NAR	-	NAR	<0.2	NAR	NAR	NAR	NAR	NAR	NAR
09/06/09	PoM DMG - total	0.5	2.4	2.6	NST	0.2	<0.5	<1	<0.1	0.6	<0.2	<5
09/06/09	PoM DMG - dissolved	0.5	NAR	-	NAR	<0.2	NAR	NAR	NAR	NAR	NAR	NAR
10/06/09	Corio Bay - total	0.5	2.5	2.9	NST	0.2	<0.5	<1	<0.1	0.8	0.3	<5
10/06/09	Long Reef - total	0.5	2.4	2.7	NST	0.2	<0.5	<1	0.1	0.7	<0.2	<5
09/06/09	Patterson River - total	0.5	2.5	2.6	NST	0.2	<0.5	<1	<0.1	0.7	0.3	8
09/06/09	Patterson River - dissolved	0.5	NAR	-	NAR	<0.2	NAR	NAR	NAR	NAR	NAR	<5
09/06/09	Dromana - total	0.5	2.2	2.5	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5
09/06/09	Middle Ground Shelf - total	0.5	2.4	2.6	NST	0.2	<0.5	<1	<0.1	0.5	0.2	<5
09/06/09	Middle Ground Shelf - dissolved	0.5	NAR	-	NAR	<0.2	NAR	NAR	NAR	NAR	NAR	NAR
09/06/09	Sorrento Bank - total	0.5	1.9	2.1	NST	0.2	<0.5	<1	<0.1	<0.5	<0.2	<5
09/06/09	Sorrento Bank - dissolved	0.5	NAR	-	NAR	<0.2	NAR	NAR	NAR	NAR	NAR	NAR
09/06/09	Popes Eye - total	0.5	1.9	2.0	NST	0.2	<0.5	<1	0.1	<0.5	0.3	<5
09/06/09	Popes Eye - dissolved	0.5	NAR	-	NAR	<0.2	NAR	NAR	<0.1	NAR	NAR	NAR

NOTES:

**Yellow** coloured cells indicate measured results above the Shewhart control limit (for 'total' fraction) (see Appendix 1, Table 5 for details).

**Orange** coloured cells indicate EWMA calculated results above EWMA control limits (see Appendix 1, Table 6 for details).

**Blue** coloured cells indicate results above SEPP objectives (for metals, ANZECC triggers are the default objective when no SEPP value is specified; see Appendix 1, Table 7 for details). These results are within natural variation for Port Phillip Bay (see control limits, Appendix 1, Tables 5 and 6), unless **bolded** to indicate that no Shewhart control limit exists for metals at these sites.

1. TBT is only sampled from sub-surface levels at Yarra River at Newport and Hobsons Bay.



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TABLE 4 PHYTOPLANKTON AND ALGAL PIGMENTS (NST – No Sample Taken)

Date	Sampling Site	Depth m	Chlorophyll-a µg/L		Phaeophytin-a µg/L	Fluorescence (as <i>in situ</i> chlorophyll-a) mg/m <sup>3</sup>	Total Phytoplankton cells/L	Diatoms cells/L	Dinoflagellates cells/L	Other Flagellates cells/L
			Measured Value	EWMA						
10/06/09	Yarra River at Newport	0.5	1.10	2.47	<0.18	0.29	1.1E+06	2.8E+05	1.4E+05	6.6E+05
10/06/09	Yarra River at Newport	9.0	NST <sup>1</sup>	-	NST <sup>1</sup>	0.44				
10/06/09	Hobsons Bay	0.5	2.20	1.56	0.27	0.45	1.1E+06	2.1E+05	1.2E+05	7.7E+05
09/06/09	Central Bay	0.5	0.97	0.77	<0.18	0.26	3.3E+05	2.3E+05	1.4E+04	8.9E+04
09/06/09	PoM DMG	0.5	1.11	0.82	<0.18	0.31	4.1E+05	1.9E+05	3.5E+04	1.9E+05
10/06/09	Corio Bay	0.5	0.90	1.30	<0.18	0.26	5.7E+05	3.1E+05	3.6E+04	2.2E+05
10/06/09	Long Reef	0.5	1.57	1.29	<0.18	0.28	1.4E+06	9.0E+05	4.9E+04	4.6E+05
09/06/09	Patterson River	0.5	0.59	0.78	<0.18	0.17	8.9E+04	3.3E+04	1.6E+04	4.1E+04
09/06/09	Dromana	0.5	1.52	0.84	0.45	0.26	4.5E+05	1.9E+05	3.1E+04	2.3E+05
09/06/09	Middle Ground Shelf	0.5	0.97	0.75	<0.18	0.33	2.7E+05	1.9E+05	1.5E+04	6.4E+04
09/06/09	Sorrento Bank	0.5	0.81	0.82	<0.18	0.30	1.1E+05	3.1E+04	8.0E+03	7.2E+04
09/06/09	Popes Eye	0.5	0.50	0.62	<0.18	0.17	7.5E+04	1.3E+04	6.6E+03	5.6E+04

NOTES

Sedgewick count method for phytoplankton, diatoms, dinoflagellates, and other flagellates undertaken by using a vertical profile grab sample. For detailed cell counts based on individual species see Appendix 2.

The chlorophyll a values are assessed against the 90<sup>th</sup> percentile objective in SEPP (WoV) Schedule F6.

**Orange** coloured cells indicate EWMA calculated results above EWMA control limits (see Appendix 1, Table 6 for details).

1. No algal pigment sample taken at Yarra River at Newport bottom waters.



## APPENDIX 1

### DERIVATION OF CONTROL LIMITS AND GUIDANCE VALUES

To define changes outside expected natural variability ('control limit'), control charts have been generated for all parameters where an extensive body of locally relevant water quality data exists (see Tables 5 and 6). The data used in developing control charts is validated data from 1994 onwards.

For other parameters where sufficient background data is not available, comparison is made to water quality objectives in State Environment Protection Policy (SEPP) Schedules F6 (Waters of Port Phillip Bay) and Schedule F7 (Waters of the Yarra Catchment).

Where no specific objective is listed in SEPP, the Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters (2001) are identified (see Table 7).

The derivation and application of the control limits and comparison values is set out in more detail in the Water Quality detailed design document CDP\_ENV\_MD\_023 Rev 2.0 (available on the Channel Deepening Project website [www.channelproject.com](http://www.channelproject.com)).

Specifically, two control charting techniques have been developed and employed in the analysis of water quality results:

- An Exponentially Weighted Moving Average (EWMA) control chart is used for assessment of longer-term changes in baseline results.  
The EWMA is a statistic that averages the data in a way that gives less weight to data as they are further removed in time. To do this EWMA applies weighting factors which decrease exponentially over time. This gives relatively greater importance to recent observations while still not discarding older observations entirely.  
EWMA is being used in this context to detect persistent changes from a baseline 'target' concentration, usually the historical mean of the data, which may reflect long term changes in water quality. An upper control limit for the EWMA has been calculated to assist in deciding whether a persistent change from the target value may have occurred.
- A Shewhart control chart is used to compare short-term events, by comparing the measured result directly against the respective limit.

In the case of metals, EWMA and Shewhart control limits apply to the 'total' fraction, since the historical data they are derived from are 'total' metals. Conversely SEPP objectives and ANZECC guidelines apply to the 'dissolved' metal fraction.



APPENDIX 1 (CONT'D)

TABLE 5. SHEWHART CONTROL LIMITS FOR LISTED WATER QUALITY PARAMETERS

Sampling site	Total Nitrogen µg/L	Ammonium µg/L	Nitrate plus Nitrite µg/L	Total Phosphorus µg/L	Phosphate µg/L	Arsenic µg/L	Cadmium µg/L	Chromium µg/L	Copper µg/L	Lead µg/L	Mercury µg/L	Nickel µg/L	Zinc µg/L	TBT µg/L
Yarra River at Newport	383.31	88.78	182.90	138.91	107.54	4.75	0.20	0.58	3.08	2.79	0.10	4.29	12.77	0.02
Hobsons Bay	382.82	50.61	257.50	135.51	129.08	4.43	0.25	1.17	1.70	0.95	0.13	2.28	9.13	0.01
Central Bay	206.91	21.50	7.43	106.48	112.50	4.66	*	*	*	*	*	1.95	*	*
PoM DMG	217.07	7.81	28.33	107.98	76.61	4.73	*	*	*	*	*	2.82	*	0.02
Corio Bay	275.74	25.37	5.00	140.27	127.68	5.57	*	NA	*	*	*	1.90	*	NA
Long Reef	1035.88	999.28	512.03	536.16	445.31	4.56	*	NA	*	*	*	2.17	*	NA
Patterson River	367.57	30.57	366.52	111.81	87.58	3.56	*	NA	*	*	*	1.14	*	NA
Dromana	222.84	11.03	5.71	89.64	75.42	3.58	*	NA	*	*	*	1.06	*	NA
Middle Ground Shelf	185.93	10.66	2.71	96.82	65.33	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sorrento Bank	168.74	11.54	9.50	63.20	48.44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Popes Eye	209.84	14.74	42.71	471.38	148.04	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES

NA - No limit, as no historical data is available.

\* - No limit, as greater than half historical data is below limits of reporting.

Source: Table 5 CDP\_ENV\_MD\_023 Rev 2.0 (available on the Channel Deepening Project website [www.channelproject.com](http://www.channelproject.com)).



TABLE 6. EWMA CONTROL LIMITS FOR LISTED WATER QUALITY PARAMETERS (Exponentially Weighted Moving Average)

Sampling site	Ammonium µg/L	Nitrate plus Nitrite µg/L	Total Nitrogen µg/L	Phosphate µg/L	Total Phosphorus µg/L	Chlorophyll-a µg/L	Arsenic µg/L
Yarra River at Newport	32.42	39.52	278.39	86.19	108.01	2.0	3.23
Hobsons Bay	19.45	39.53	266.22	85.72	105.32	3.9	2.98
Central Bay	9.90	3.61	168.10	72.32	84.08	1.1	2.86
PoM DMG	6.16	9.92	176.47	66.31	83.99	1.0	3.10
Corio Bay	10.70	2.31	224.48	100.12	115.66	1.4	3.66
Long Reef	219.05	83.74	629.12	238.83	305.50	6.8	3.20
Patterson River	13.65	42.75	243.10	69.75	89.34	2.2	2.59
Dromana	5.00	4.29	170.20	56.93	70.12	1.6	2.52
Middle Ground Shelf	7.02	2.29	156.09	50.94	63.85	0.8	N/A
Sorrento Bank	8.16	4.93	143.10	36.40	45.74	0.8	N/A
Popes Eye	8.20	12.73	145.12	36.75	120.94	0.8	N/A

NOTES

NA - No limit, as no historical data is available.

Source: Table 4 CDP\_ENV\_MD\_023 Rev 2.0 (available on the Channel Deepening Project website [www.channelproject.com](http://www.channelproject.com)).

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TABLE 7. SEPP OBJECTIVES AND ANZECC TRIGGER VALUES (N = NATURAL)

		Channel Deepening PARAMETER																													
Sampling Site	SEPP (WoV) schedule & segment	ANZECC Level of Protection	Dissolved Oxygen (% saturation)				Salinity variation	Temperature (°C)	Secchi disc depth (m)	Attenuation of PAR	Turbidity	Suspended Solids (mg/L)				Chlorophyll-a (ug/L)		Ammonium (ug/L)	Nitrate plus nitrite (ug/L)	Total nitrogen (ug/L)	Phosphate (ug/L)	Total Phosphorus (ug/L)	Arsenic (ug/L)	Cadmium (ug/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Zinc (ug/L)	TBT (ug/L)
			Min for 1m below surface	Min 1m above bottom	Lower limit for 90th percentile	Min percentage concentration						Annual 90th percentile	Annual 50th percentile	Annual 90th percentile	Annual 50th percentile	Annual 90th percentile	Annual 50th percentile														
Yarra River at Newport	F6 Hobsons	95%	>90%	>90%			N ± 5%	N ± 1	>2	0.5	0.5 - 10					2.5	4.0	15	5	120	10	25	<3	5.5	<5	1.3	4.4	0.4	70	<10	0.006
	F7 Yarra Port					>60%		N ± 2				<20	<50	<25	<60			15	5	120	10	25	50	0.2	10	3	1	0.05	15	5	0.006
Hobsons Bay	F6 Hobsons	99%	>90%	>90%			N ± 5%	N ± 1	>2	0.5	0.5 - 10				2.5	4.0	15	5	120	10	25	<3	5.5	<5	1.3	4.4	0.4	70	<10	0.006	
Corio Bay	F6 Corio		>90%	>90%			N ± 5%	N ± 1	>3	0.45	0.5 - 10				1.5	2.5	15	5	120	10	25	<3	5.5	<5	1.3	4.4	0.4	70	<5	0.006	
Long Reef	F6 Werribee		>90%	>90%			N ± 5%	N ± 1	>3	0.45	0.5 - 10				2.5	4.0	15	5	120	10	25	<3	5.5	<5	1.3	4.4	0.4	70	<5	0.006	
Central Bay	F6 General		>90%		>90%		N ± 5%	N ± 1	>4	0.35	0.5 - 10				1.0	2.0	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004	
PoM DMG	F6 General		>90%		>90%		N ± 5%	N ± 1	>4	0.35	0.5 - 10				1.0	2.0	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004	
Patterson River	F6 Inshore	>90%	>90%			N ± 5%	N ± 1	>3	0.45	0.5 - 10				1.5	2.5	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004		
Dromana	F6 Inshore	>90%	>90%			N ± 5%	N ± 1	>3	0.45	0.5 - 10				1.5	2.5	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004		
Middle Ground Shelf	F6 General	>90%		>90%		N ± 5%	N ± 1	>4	0.35	0.5 - 10				1.0	2.0	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004		
Sorrento Bank	F6 General	>90%		>90%		N ± 5%	N ± 1	>4	0.35	0.5 - 10				1.0	2.0	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004		
Popes Eye	F6 General	>90%		>90%		N ± 5%	N ± 1	>4	0.35	0.5 - 10				1.0	2.0	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004		

SEPP Waters of Victoria

N=natural background

SEPP Schedule F6 - Waters of Port Phillip Bay, and SEPP Schedule F7 - Waters of the Yarra Catchment objectives

Limit of reporting above objective

NOTES

Schedule F7 (Waters of the Yarra Catchment) is included for comparison of water quality objectives at the Yarra River at Newport site, as this site has been determined to be in a crossover area between schedules F6 and F7. Both schedule segments can be applicable to the site dependent on tide cycle and flow conditions in the Yarra mouth.



APPENDIX 2

TABLE 8. PHYTOPLANKTON DATA

	Yarra River at Newport	Hobsons Bay	Central Bay	PoM DMG	Corio Bay	Long Reef	Patterson River	Dromana	Middle Ground Shelf	Sorrento Bank	Popes Eye
Collection Date	10/06/2009	10/06/2009	10/06/2009	9/06/2009	9/06/2009	10/06/2009	9/06/2009	9/06/2009	9/06/2009	9/06/2009	9/06/2009
Count Method	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick
<b>Genus</b>	<b>Estimate Cells/L</b>										
<b>Total Phytoplankton</b>	1.1E+06	1.1E+06	3.3E+05	4.1E+05	5.7E+05	1.4E+06	8.9E+04	4.5E+05	2.7E+05	1.1E+05	7.5E+04
<b>Diatoms</b>	2.8E+05	2.1E+05	2.3E+05	1.9E+05	3.1E+05	9.0E+05	3.3E+04	1.9E+05	1.9E+05	3.1E+04	1.3E+04
<b>Dinoflagellates</b>	1.4E+05	1.2E+05	1.4E+04	3.5E+04	3.6E+04	4.9E+04	1.6E+04	3.1E+04	1.5E+04	8.0E+03	6.6E+03
<b>Other flagellates</b>	6.6E+05	7.7E+05	8.9E+04	1.9E+05	2.2E+05	4.6E+05	4.1E+04	2.3E+05	6.4E+04	7.2E+04	5.6E+04
<b>Diatoms</b>											
<i>Amphora</i> sp.	x	x		x	x			6.7E+03	x	x	
<i>Asteromphalus sarcophagus</i>			2.5E+03	3.3E+03		1.3E+04		6.7E+03			
<i>Attheya</i> sp.								6.7E+03			
<i>Bacillaria paxillifera</i>		x									
<i>Bacteriastrium elegans</i>			5.0E+03								
<i>Campylodiscus</i> sp.			x					x			
<i>Chaetoceros</i> spp.	x	x	6.3E+04	8.7E+04	2.0E+05	4.7E+05	4.0E+03	2.7E+04	5.0E+04	3.0E+03	
<i>Cocconeis</i> spp.		3.0E+04						2.3E+04	6.0E+03	1.0E+03	1.5E+03
<i>Coscinodiscus</i> spp.	x	5.0E+02	x	x		x				x	x
<i>Cylindrotheca closterium</i>		1.0E+04			6.7E+03	1.3E+04	2.7E+03	1.0E+04	6.0E+03	3.0E+03	1.0E+03
<i>Cymbella</i> sp.							x	x			
<i>Dactyliosolen</i> sp.		x	x		x	x		x			
<i>Dactyliosolen fragilissimus</i>								x		x	
<i>Dactyliosolen phuketensis</i>											x
<i>Diploneis</i> sp.									2.0E+03		
<i>Ditylum brightwellii</i>				x				x	x		
<i>Entomoneis</i> sp.		5.0E+02	x	3.3E+03			7.0E+02	3.3E+03	x	1.0E+03	x
<i>Eucampia</i> sp.			x				7.0E+02		x	1.0E+03	
<i>Fallacia</i> sp.							x	x			
<i>Fragilaria</i> sp.	8.0E+03	x			x			3.3E+03			
<i>Grammotophora marina</i>	8.0E+03										
<i>Guinardia flaccida</i>	x	x		x		x			x		
<i>Helicotheca tamesis</i>								x	x		x
<i>Hemiaulus hauckii</i>			1.1E+05	4.7E+04		2.7E+04	1.3E+03	4.3E+04	4.4E+04	3.0E+03	
<i>Leptocylindrus danicus</i>	4.0E+04	2.0E+04	1.0E+04	2.0E+04	x	x	3.3E+03	1.0E+03	3.0E+04	x	x
<i>Leptocylindrus minimus</i>					1.0E+04						
<i>Licmophora</i> sp.									x		
<i>Minidiscus trioculatus</i>		1.0E+04	7.5E+03		1.3E+04	1.3E+04	7.0E+02	1.0E+03	2.0E+03	2.0E+03	2.5E+03
<i>Naviculoid</i> spp.						x	2.0E+03	x	x	2.0E+03	5.0E+02
<i>Nitzschia</i> spp.	8.0E+03	3.0E+04			3.3E+03		2.7E+03	2.3E+04	2.0E+04	1.0E+03	5.0E+02
<i>Odontella</i> sp.	x				x						
<i>Pleurosigma</i> sp.	x	x	x	x	x	x	7.0E+02	x	x	x	
<i>Proboscia alata</i>	x	5.0E+02	x	x	x			3.3E+03	2.0E+03	x	
<i>Pseudo-nitzschia delicatissima</i> group		1.5E+03	2.0E+03	2.0E+03	x	2.0E+03		5.0E+03			
<i>Pseudo-nitzschia pungens/multiseriata</i>	4.0E+03	7.0E+02	5.5E+03	1.5E+04	x	8.7E+03	2.5E+03		8.0E+03	2.0E+03	1.0E+02
<i>Rhizosolenia</i> spp.	x	1.5E+03	5.0E+03	x	x	x	x	x	2.0E+03	x	x
<i>Rhizosolenia setigera</i>	5.0E+02	x	x	x	x	x	x		x	x	
<i>Skeletonema japonicum/pseudocostatum</i>	1.9E+05	8.0E+04	2.5E+03		4.0E+04	3.3E+05	5.3E+03				
<i>Striatella unipunctata</i>							x				
<i>Synedra</i> sp.	x										
<i>Thalassionema</i> sp.		2.0E+03	x	x	1.5E+03	x	1.3E+03	x	x	x	
<i>Thalassiosira</i> sp.	x	1.0E+04	2.5E+03	x	x	6.7E+03	7.0E+02	6.7E+03		1.0E+03	1.5E+03
<i>Thalassiosira cf. mala</i>	1.6E+04	1.0E+04	1.8E+04	1.0E+04	2.3E+04	3.3E+04	4.0E+03	3.0E+04	1.4E+04	1.1E+04	5.0E+03

NOTES

“X” denotes genus identified, but species not determined in sample.

Blank cells denotes neither genus nor species were detected.

For table on VSOM Phytoplankton action levels refer to Algal Blooms – Detailed Design, CDP\_ENV\_MD\_012 Rev 2.0.

TABLE 8. PHYTOPLANKTON DATA (CONT'D)

	Yarra River at Newport	Hobsons Bay	Central Bay	PoM DMG	Corio Bay	Long Reef	Patterson River	Dromana	Middle Ground Shelf	Sorrento Bank	Popes Eye	
Collection Date	10/06/2009	10/06/2009	10/06/2009	9/06/2009	9/06/2009	10/06/2009	9/06/2009	9/06/2009	9/06/2009	9/06/2009	9/06/2009	
Count Method	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	
<b>Genus</b>	<b>Estimate Cells/L</b>											
<b>Total Phytoplankton</b>	1.1E+06	1.1E+06	3.3E+05	4.1E+05	5.7E+05	1.4E+06	8.9E+04	4.5E+05	2.7E+05	1.1E+05	7.5E+04	
<b>Diatoms</b>	2.8E+05	2.1E+05	2.3E+05	1.9E+05	3.1E+05	9.0E+05	3.3E+04	1.9E+05	1.9E+05	3.1E+04	1.3E+04	
<b>Dinoflagellates</b>	1.4E+05	1.2E+05	1.4E+04	3.5E+04	3.6E+04	4.9E+04	1.6E+04	3.1E+04	1.5E+04	8.0E+03	6.6E+03	
<b>Other flagellates</b>	6.6E+05	7.7E+05	8.9E+04	1.9E+05	2.2E+05	4.6E+05	4.1E+04	2.3E+05	6.4E+04	7.2E+04	5.6E+04	
<b>Dinoflagellates</b>												
<i>Akashiwo sanguinea</i>												
<i>Alexandrium catenella/fundyense</i>		x										
<i>Alexandrium marqalefi</i>							x					
<i>Alexandrium minutum</i>								5.0E+01				
<i>Alexandrium pseudogonyaulax</i>						x						
<i>Alexandrium tamarense</i>						x						
<i>Ceratium furca</i>											x	
<i>Ceratium fusus</i>				x								
<i>Ceratium macroceros</i>		7.5E+01	1.0E+03	5.0E+02		7.0E+02	1.0E+02	1.0E+02	5.0E+01			
<i>Ceratium pentagonum</i>											x	
<i>Ceratium tenue</i>	7.5E+01	5.0E+02	5.0E+02	5.0E+02	x	7.0E+01	1.0E+02	5.0E+02	1.0E+03	x	5.0E+01	
<i>Ceratium tripos</i>				x								
<i>Fragilidium subglobosum</i>							x					
<i>Gonyaulax spp.</i>						x	7.0E+02			x		
<i>Gymnodinium spp.</i>	5.6E+04	5.0E+04	2.5E+03	6.7E+03	1.0E+04	2.7E+04	8.7E+03	1.7E+04	4.0E+03	4.0E+03	3.0E+03	
<i>Gyrodinium spp.</i>	1.6E+04	1.0E+04	2.5E+03	6.7E+03	3.3E+03		2.0E+03	6.7E+03	2.0E+03		1.0E+03	
<i>Heterocapsa rotundata</i>	7.2E+04	6.0E+04	7.5E+03	1.7E+04	6.7E+03	2.0E+04	2.7E+03	6.7E+03	6.0E+03	4.0E+03	2.5E+03	
<i>Noctiluca scintillans</i>		x	x	x		5.0E+01	1.3E+02	x				
<i>Obolus sp.</i>								x				
<i>Phalacroma rotundatum</i>									x		x	
<i>Prorocentrum gracile</i>				x	3.3E+03			x				
<i>Prorocentrum fhathymum</i>										x		
<i>Protoperidinium spp.</i>	5.0E+02	x	x	x	x	x	7.0E+02	x	x	x	x	
<i>Scripsiella spp.</i>		5.0E+02	x	3.3E+03	1.3E+04	x	7.0E+02		2.0E+03	x		
<i>Takayama pulchella</i>						7.0E+02						
<b>Chrysophytes</b>												
<i>Calycomonas sp.</i>	8.0E+03	5.0E+04		3.3E+03	3.3E+03	6.7E+03	1.3E+03	3.3E+03		1.0E+03	5.0E+02	
<i>Ochromonas spp.</i>	8.0E+03	2.0E+04			3.3E+03			6.7E+03	2.0E+03		1.0E+03	
<b>Prymnesiophytes</b>												
<i>Acanthoica sp.</i>									2.0E+03			
<i>Chrysochromulina spp.</i>	8.0E+03		2.5E+03	6.7E+03			2.0E+03		4.0E+03	9.0E+03	4.0E+03	
<i>Emiliania huxleyi</i>	1.6E+04	2.0E+04	1.5E+04		2.7E+04	1.3E+04	8.0E+03	6.7E+03	2.0E+03	2.1E+04	1.8E+04	
<i>Gephyrocapsa oceanica</i>		3.0E+04			3.3E+03	2.7E+04	7.0E+02	2.0E+04		5.0E+03	3.0E+03	
<b>Cryptophytes</b>												
<i>Hemiselmis sp.</i>	2.0E+05	2.0E+05	1.8E+04	4.0E+04	1.7E+04	8.0E+04	6.7E+03	4.7E+04	1.2E+04	1.2E+04	1.1E+04	
<i>Leucocryptos marina</i>	7.2E+04	8.0E+04	1.3E+04	6.7E+03	2.0E+04	2.0E+04	3.3E+03	2.0E+04	6.0E+03	5.0E+03	2.5E+03	
<i>Plagioselmis prolonga</i>	2.6E+05	2.8E+05	2.5E+04	7.0E+04	8.7E+04	2.5E+05	1.4E+04	8.7E+04	2.4E+04	1.0E+04	1.2E+04	
<i>Rhodomonas salina</i>	8.0E+03											
<i>Teleaulax acuta</i>	8.0E+03	2.0E+04	2.5E+03	6.7E+03	3.3E+03	6.7E+03		2.0E+04	2.0E+03	1.0E+03		
<b>Prasinophytes</b>												
<i>Pyramimonas spp.</i>	1.6E+04	3.0E+04	2.5E+03	2.7E+04	2.0E+04			6.7E+03	8.0E+03	3.0E+03	1.5E+03	
<i>Tetraselmis spp.</i>		2.0E+04			1.0E+04	2.0E+04	2.0E+03			2.0E+03	5.0E+02	
<b>Euglenophyta</b>												
<i>Eutreptiella spp.</i>	4.0E+04	1.0E+04		3.3E+03	1.3E+04	1.3E+04		1.0E+04	2.0E+03	1.0E+03	1.0E+03	
<i>Trachelomonas spp.</i>						6.7E+03						
<b>Other</b>												
<i>Apedinella spinifera</i>	8.0E+03		2.5E+03	3.3E+03								
<i>Fibrocapsa sp.</i>								5.0E+02	5.0E+02			
<i>Heterosigma sp.</i>												
<i>Stephanoeca sp.</i>					3.3E+03							
<i>Mesodinium rubrum</i>				3.3E+03	6.7E+03	1.3E+04						
<i>Unidentified amoeba</i>				5.0E+02				7.0E+02				
<i>Unidentified bodonids</i>		1.0E+04	7.5E+03	1.7E+04	3.3E+03			1.3E+03		2.0E+03	2.0E+03	
<b>VSOM Phytoplankton action</b>												
		Comparative data in the report										
		Yarra River at Newport	Hobsons Bay	Central Bay	PoM DMG	Corio Bay	Long Reef	Patterson River	Dromana	Middle Ground Shelf	Sorrento Bank	Popes Eye
<b>Taxa</b>	<b>Warning to growers</b>											
<i>Pseudo-nitzschia spp.</i>	100 000	4000	2200	7500	17000	x	10700	2500	5000	8000	2000	100
<i>Rhizosolenia cf chunii</i>	10 000		x									
<i>Alexandrium catenella</i>	200											
<i>Alexandrium minutum</i>	200								50			
<i>Alexandrium tamarense</i>	200						x					
<i>Dinophysis acuminata</i>	1 000											
<i>Dinophysis caudata</i>	1 000											
<i>Dinophysis fortii</i>	1 000											
<i>Gymnodinium catenatum</i>	1000											
<i>Karenia mikimotoi</i>	100 000											
<i>Karenia brevis</i>	1 000											
<i>Prorocentrum lima</i>	1 000											

NOTES

“X” denotes genus identified, but species not determined in sample.

Blank cells denotes neither genus nor species were detected.

For table on VSOM Phytoplankton action levels refer to Algal Blooms – Detailed Design, CDP\_ENV\_MD\_012 Rev 2.0