



# BAYWIDE WATER QUALITY MONITORING PROGRAM

## PROGRESS REPORT No. 7 (JULY 2008)

AUGUST 2008

### 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 July 2008. 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.

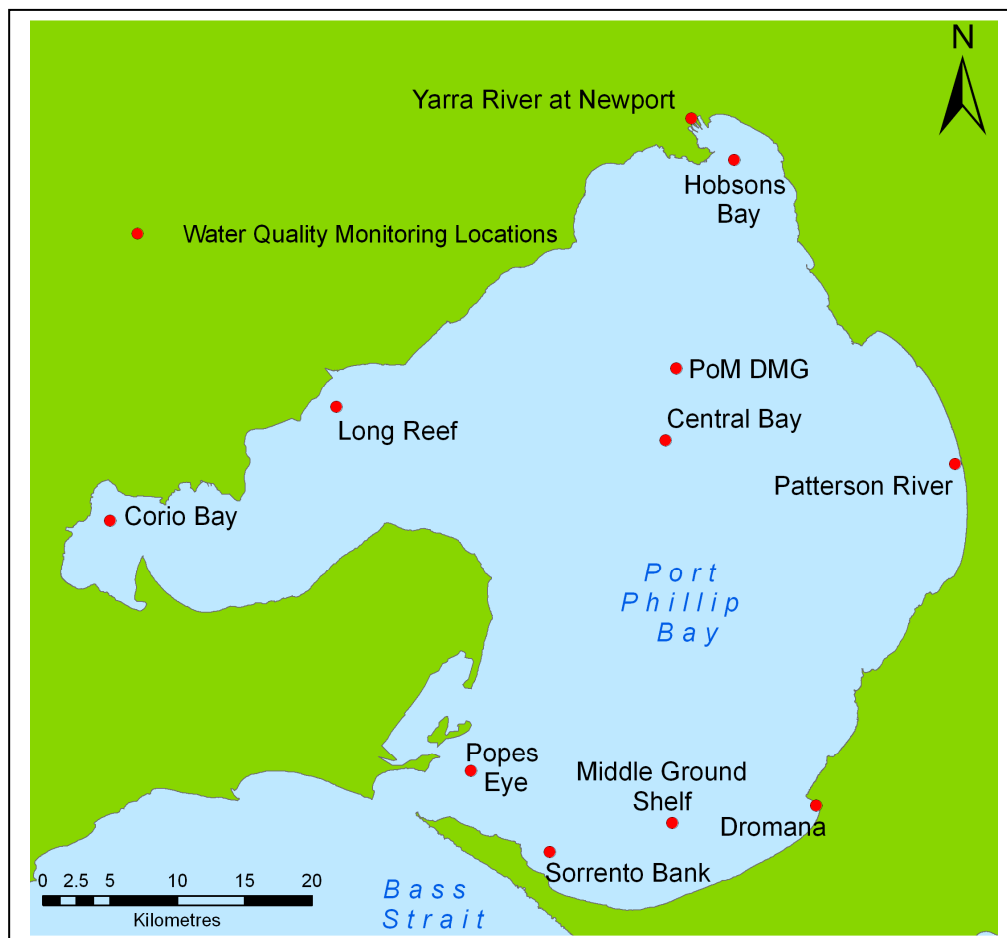


FIGURE 1 MAP OF SAMPLING SITES IN PORT PHILLIP BAY

## 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 seven times and the EWMA control limits were exceeded ten times (see Tables 1 - 4).

It was noted during the field-sampling event that there was significant clay sediment suspended within the water column when sampling the Yarra River site at Newport. From the near surface measurement of 7.46 NTU, the turbidity ranged from 10.00 to 13.30 NTU at a depth of between 2-4m, before returning to 7.05 NTU at 5.5m deep. Sampling at this site did not coincide with a rainfall event.

As described in section 4.1.3 in the Water Quality Detailed Design document CDP\_ENV\_MD\_023 Rev 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.

Where dissolved metal results exceeded total metal results, the results were within acceptable levels of inter-sample variation.

All data recorded in this report has been subject to internal quality assurance according to EPA standard operating procedures for field sampling and data assessment.

Three exception reports to the Water Quality Detailed Design document CDP\_ENV\_MD\_023 Rev 0 were noted for this reporting period. They are detailed in exception reports ER080701, ER080702 and ER080703, and outlined respectively as follows:

- The collection of previous field sampling quality control samples.
- A variation in the limit of reporting for chlorophyll-*a* and phaeophytin-*a*.
- A variation in the limit of reporting for Tri-butyl Tin.

TABLE 1 PHYSICO-CHEMICAL PARAMETERS (NST - No Sample Taken; NVR - No Valid Result)

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						
15/07/08	Yarra River at Newport	0.5	8.0	93	34.9	0.6	12.1	7.46	21.0	607.4
15/07/08	Yarra River at Newport	5.5	NST	NST	NST		NST	7.05	NST	0.6
15/07/08	Hobsons Bay	0.5	12.4	144	36.8	4.9	11.5	1.97	2.8	389.0
15/07/08	Central Bay	0.5	8.5	97	37.3	5.5	10.8	0.77	1.3	64.2
15/07/08	PoM DMG	0.5	8.5	98	37.3	6.4	11.0	0.55	0.8	136.5
17/07/08	Corio Bay	0.5	8.6	97	37.9	>5.9 <sup>1</sup>	9.7	0.67	5.9	173.8
17/07/08	Long Reef	0.5	8.9	100	37.0	>5.8 <sup>1</sup>	9.9	0.39	2.7	166.7
16/07/08	Patterson River	0.5	8.8	102	36.9	>5.6 <sup>1</sup>	11.3	0.65	1.3	82.5
16/07/08	Dromana	0.5	8.8	101	36.6	>6.3 <sup>1</sup>	11.0	0.55	0.2	789.7
16/07/08	Middle Ground Shelf	0.5	8.7	102	36.7	7.3	12.1	0.75	1.3	565.6
16/07/08	Sorrento Bank	0.5	8.7	100	36.5	>5.4 <sup>1</sup>	11.3	0.54	0.6	58.0
16/07/08	Popes Eye	0.5	8.4	98	36.6	NVR <sup>2</sup>	11.8	0.43	0.4	106.9

**NOTES:**

*In situ* data for 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 and Hobsons Bay where, if required, bottom samples are also collected.

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

1. Secchi disc visible on bottom.
2. No Valid Result due to the tide impact on secchi disc trajectory.

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
15/07/08	Yarra River at Newport	0.5	32.0	22.2	58.2	0.3	58.6	45.4	117	235	253
15/07/08	Hobsons Bay	0.5	10.2	6.6	14.9	<0.4	14.9	10.3	109	148	173
15/07/08	Central Bay	0.5	1.8	5.8	1.2	<0.4	1.2	1.6	108	129	145
15/07/08	PoM DMG	0.5	1.9	4.7	1.1	<0.4	1.1	3.5	103	121	147
17/07/08	Corio Bay	0.5	1.1	4.4	2.2	<0.4	2.2	1.7	135	154	187
17/07/08	Long Reef	0.5	61.0	31.5	213.4	2.0	215.4	76.0	141	438	294
16/07/08	Patterson River	0.5	2.6	6.6	6.6	<0.4	6.6	11.5	113	136	175
16/07/08	Dromana	0.5	2.5	7.0	3.7	<0.4	3.7	7.9	96	116	147
16/07/08	Middle Ground Shelf	0.5	2.5	4.4	6.0	0.3	6.3	2.5	86	112	132
16/07/08	Sorrento Bank	0.5	3.1	5.5	13.4	1.6	15.0	6.3	90	123	125
16/07/08	Popes Eye	0.5	2.5	6.0	9.2	1.6	10.8	7.9	85	113	115

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	
15/07/08	Yarra River at Newport	0.5	49	63	23	73	88	427
15/07/08	Hobsons Bay	0.5	54	64	12	66	82	211
15/07/08	Central Bay	0.5	57	59	13	70	73	147
15/07/08	PoM DMG	0.5	46	54	22	68	72	122
17/07/08	Corio Bay	0.5	77	77	16	92	95	140
17/07/08	Long Reef	0.5	201	141	28	229	162	185
16/07/08	Patterson River	0.5	57	62	12	69	77	171
16/07/08	Dromana	0.5	39	50	11	50	62	133
16/07/08	Middle Ground Shelf	0.5	39	44	12	51	58	124
16/07/08	Sorrento Bank	0.5	35	31	9	44	42	104
16/07/08	Popes Eye	0.5	37	26	9	46	36	105

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								
15/07/08	Yarra River at Newport - total	0.5	2.6	2.7	<5	<0.2	1.7	5	<0.1	2.9	0.6	14
15/07/08	Yarra River at Newport - dissolved	0.5	NAR	-	NST	NAR	NAR	<1	NAR	NAR	NAR	<5
15/07/08	Hobsons Bay - total	0.5	2.9	2.9	<5	<0.2	<0.5	<1	<0.1	1.1	<0.2	<5
15/07/08	Central Bay - total	0.5	3.3	3.0	NST	<0.2	0.7	3	<0.1	1.3	<0.2	<5
15/07/08	Central Bay - dissolved	0.5	3.4	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR
15/07/08	PoM DMG - total	0.5	3.0	3.0	NST	<0.2	<0.5	3	<0.1	1	<0.2	<5
15/07/08	PoM DMG - dissolved	0.5	2.9	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR
17/07/08	Corio Bay - total	0.5	3.1	3.1	NST	0.5	<0.5	3	<0.1	1.4	<0.2	6
17/07/08	Corio Bay - dissolved	0.5	3.3	-	NST	NAR	NAR	1	NAR	NAR	NAR	<5
17/07/08	Long Reef - total	0.5	5.0	3.4	NST	0.4	1.9	5	<0.1	3	0.8	7
17/07/08	Long Reef - dissolved	0.5	3.2	-	NST	NAR	NAR	<1	NAR	NAR	NAR	<5
16/07/08	Patterson River - total	0.5	3.0	2.9	NST	<0.2	<0.5	2	<0.1	0.8	<0.2	<5
16/07/08	Patterson River - dissolved	0.5	3.0	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR
16/07/08	Dromana - total	0.5	2.3	2.7	NST	<0.2	<0.5	<1	<0.1	0.6	<0.2	<5
16/07/08	Middle Ground Shelf - total	0.5	2.6	2.7	NST	<0.2	<0.5	1	<0.1	<0.5	<0.2	<5
16/07/08	Middle Ground Shelf - dissolved	0.5	NAR	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR
16/07/08	Sorrento Bank - total	0.5	2.5	2.4	NST	<0.2	<0.5	3	<0.1	0.6	<0.2	<5
16/07/08	Sorrento Bank - dissolved	0.5	NAR	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR
16/07/08	Popes Eye - total	0.5	2.4	2.3	NST	<0.2	<0.5	3	<0.1	0.8	<0.2	<5
16/07/08	Popes Eye - dissolved	0.5	NAR	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR



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### NOTES:

**Yellow** coloured cells indicate measured results above the Shewhart control limit (for total fractions). 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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 PHYTOPLANKTON AND ALGAL PIGMENTS (NST – No Sample Taken)

TABLE 4

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						
15/07/08	Yarra River at Newport	0.5	0.59	2.10	<0.18	0.28	2.1E+05	1.1E+04	2.3E+04	1.8E+05
15/07/08	Yarra River at Newport	5.5	NST <sup>1</sup>	NST <sup>1</sup>	NST <sup>1</sup>	0.30				
15/07/08	Hobsons Bay	0.5	0.41	1.40	<0.18	0.21	2.5E+05	6.4E+04	2.4E+04	1.6E+05
15/07/08	Central Bay	0.5	0.80	0.75	<0.18	0.45	1.2E+05	2.5E+04	1.5E+04	7.8E+04
15/07/08	PoM DMG	0.5	0.71	0.69	<0.18	0.41	9.6E+04	2.2E+04	1.6E+04	5.8E+04
17/07/08	Corio Bay	0.5	0.64	0.97	<0.18	0.30	7.7E+04	2.8E+04	1.3E+04	3.7E+04
17/07/08	Long Reef	0.5	0.94	1.43	<0.18	0.36	1.7E+05	5.9E+04	2.1E+04	8.8E+04
16/07/08	Patterson River	0.5	0.74	0.87	<0.18	0.39	1.2E+05	4.3E+04	1.6E+04	6.6E+04
16/07/08	Dromana	0.5	0.84	0.71	<0.18	0.24	2.4E+05	8.6E+04	3.4E+04	1.2E+05
16/07/08	Middle Ground Shelf	0.5	0.80	0.68	<0.18	0.10	1.5E+05	4.4E+04	1.9E+04	8.6E+04
16/07/08	Sorrento Bank	0.5	0.78	0.63	<0.18	0.23	1.0E+05	3.6E+04	2.1E+04	4.7E+04
16/07/08	Popes Eye	0.5	0.76	0.64	<0.18	0.30	1.1E+05	3.2E+04	1.4E+04	6.6E+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.

**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 1990 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) is 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 0 (available on the Channel Deepening Project website [www.channelproject.com](http://www.channelproject.com)). These control limits have since been amended and are as issued by the Port of Melbourne Corporation on January 28, 2008.

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, by comparing an EWMA calculated result to the respective limit.
- 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. For transparency, this report highlights all metals exceedences whether total or dissolved.



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 0 (available on the Channel Deepening Project website [www.channelproject.com](http://www.channelproject.com)); limits amended by Port of Melbourne Corporation on January 28, 2008.

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 0 (available on the Channel Deepening Project website [www.channelproject.com](http://www.channelproject.com)); limits amended by Port of Melbourne Corporation on January 28, 2008.

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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 Annual 90th percentile	Turbidity				Suspended Solids (mg/L)		Chlorophyll-a (µg/L)														
			Min for 1m below surface	Min 1m above bottom	Lower limit for 90th percentile	Min percentage concentration					NTU	Annual 50th percentile	Annual 90th percentile	Annual 50th percentile	Annual 90th percentile	Chlorophyll-a (µg/L)	Annual 90th percentile	Ammonium (µg/L)	Nitrate plus nitrite (µg/L)	Total nitrogen (µg/L)	Phosphate (µg/L)	Total Phosphorus (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	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
Hobsons Bay	F6 Hobsons		>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		99%	>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 is above SEPP objective

ANZECC trigger values not highlighted

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		15-Jul-08	15-Jul-08	15-Jul-08	15-Jul-08	17-Jul-08	17-Jul-08	16-Jul-08	16-Jul-08	16-Jul-08	16-Jul-08	16-Jul-08
Count Method		Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick
<b>Genus</b>	<b>Species</b>	<b>Estimate Cells/L</b>										
<b>Total Phytoplankton</b>		2.1E+05	2.5E+05	1.2E+05	9.6E+04	7.7E+04	1.7E+05	1.2E+05	2.4E+05	1.5E+05	1.0E+05	1.1E+05
<b>Diatoms</b>		1.1E+04	6.4E+04	2.5E+04	2.2E+04	2.8E+04	5.9E+04	4.3E+04	8.6E+04	4.4E+04	3.6E+04	3.2E+04
<b>Dinoflagellates</b>		2.3E+04	2.4E+04	1.5E+04	1.6E+04	1.3E+04	2.1E+04	1.6E+04	3.4E+04	1.9E+04	2.1E+04	1.4E+04
<b>Other flagellates</b>		1.8E+05	1.6E+05	7.8E+04	5.8E+04	3.7E+04	8.8E+04	6.6E+04	1.2E+05	8.6E+04	4.7E+04	6.6E+04
<b>Diatoms</b>												
<i>Amphora</i>	<i>sp.</i>					1.0E+03	3.0E+03	1.0E+03	2.0E+03	1.0E+03		
<i>Anaulus</i>	<i>australis</i>		x									
<i>Ardissonea</i>	<i>crystallina</i>									x		
<i>Asterionellopsis</i>	<i>glacialis</i>						x		x			
<i>Asteromphalus</i>	<i>sarcophagus</i>									x		
<i>Attheya</i>	<i>sp.</i>								2.0E+03			
<i>Auliscus</i>	<i>sp.</i>	x										
<i>Bacillaria</i>	<i>paxillifera</i>	1.5E+03				x						
<i>Chaetoceros</i>	<i>spp.</i>	x	1.2E+04	1.0E+04	1.1E+04	8.5E+03	1.0E+04	8.0E+03	4.0E+03	6.0E+03	1.8E+03	8.0E+03
<i>Climacospaenia</i>	<i>sp.</i>						x					
<i>Cocconeis</i>	<i>spp.</i>		8.0E+03	1.0E+03	1.3E+03	5.0E+02	2.0E+03	1.0E+03	1.0E+04	3.0E+03	3.6E+03	2.0E+03
<i>Corethron</i>	<i>criophilum</i>								x	x		
<i>Coscinodiscus</i>	<i>spp.</i>		x	x			x			x		
<i>Cylindrotheca</i>	<i>closterium</i>		2.0E+03	x		1.5E+03	1.0E+03	2.0E+03	x		3.6E+03	2.0E+03
<i>Dactylosolen</i>	<i>antarcticus</i>		x	x	x	x	x		x			x
<i>Dactylosolen</i>	<i>fragilisaimus</i>								x	3.0E+03	9.0E+02	
<i>Entomoneis</i>	<i>sp.</i>	x									9.0E+02	1.0E+03
<i>Eucampia</i>	<i>zodiacus</i>								x	x		
<i>Fallacia</i>	<i>sp.</i>							1.0E+03				x
<i>Fragilaria</i>	<i>sp.</i>		x									
<i>Grammotophora</i>	<i>serpentina</i>						x					
<i>Guinardia</i>	<i>flaccida</i>	3.0E+03	4.0E+03	1.0E+03	2.0E+03		x	3.0E+03	x	1.0E+03	x	x
<i>Helicotheca</i>	<i>tamesis</i>											x
<i>Hemiaulus</i>	<i>hauckii</i>	x	2.0E+03	5.0E+03	2.0E+03		x	1.0E+03	1.2E+04	7.0E+03	x	x
<i>Leptocylindrus</i>	<i>danicus</i>			x	x	x	x	5.0E+03		x	3.6E+03	
<i>Leptocylindrus</i>	<i>minimus</i>										9.0E+02	
<i>Licmophora</i>	<i>sp.</i>	1.5E+03				1.0E+03						
<i>Melosira</i>	<i>sp.</i>	1.5E+03										x
<i>Minidiscus</i>	<i>tricolatus</i>	1.5E+03	6.0E+03	1.0E+03	2.7E+03	2.5E+03	1.2E+04	6.0E+03	1.0E+04	3.0E+03		3.0E+03
<i>Minutocellus</i>	<i>sp.</i>						1.0E+03				9.0E+02	
<i>Naviculoid</i>	<i>spp.</i>	x	2.0E+03	1.0E+03	x	5.0E+02	4.0E+03	1.0E+03	2.0E+03		9.0E+02	2.0E+03
<i>Nitzschia</i>	<i>spp.</i>		4.0E+03	1.0E+03		2.5E+03	2.0E+03	2.0E+03	8.0E+03	3.0E+03	2.7E+03	5.0E+03
<i>Nitzschia</i>	<i>longissima</i>						x					
<i>Nitzschia</i>	<i>sigmoidea</i>					x						
<i>Pleurosigma</i>	<i>sp.</i>	x	x	x	x	x	x			x	x	x
<i>Proboscia</i>	<i>alata</i>	x	x	x	x							
<i>Pseudo-nitzschia</i>	<i>delicatissima</i> group						5.0E+01		1.0E+03	2.0E+03		5.0E+02
<i>Pseudo-nitzschia</i>	<i>fraudulenta/australis</i>								1.2E+03			
<i>Pseudo-nitzschia</i>	<i>galaxiae</i>										1.0E+03	
<i>Pseudo-nitzschia</i>	<i>pungens/multiseriis</i>		1.5E+03	1.0E+02	2.0E+03	x	1.0E+02	9.0E+02		1.6E+03	5.0E+02	5.0E+02
<i>Rhizosolenia</i>	<i>spp.</i>	x	4.0E+03	x				3.0E+03	x			x
<i>Rhizosolenia</i>	<i>setigera</i>	x		x		x	x		x	x		x
<i>Striatella</i>	<i>unipunctata</i>						x					
<i>Thalassionema</i>	<i>sp.</i>					x						
<i>Thalassiosira</i>	<i>sp.</i>	1.5E+03	x	2.0E+03	6.7E+02	6.0E+03	1.7E+04	7.0E+03	1.4E+04	1.0E+04	4.5E+03	3.0E+03
<i>Thalassiosira</i>	<i>cf. mala</i>		1.8E+04	3.0E+03		3.5E+03	7.0E+03	1.0E+03	2.0E+04	3.0E+03	1.0E+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 VSQAP Phytoplankton action levels refer to Algal Blooms – Detailed Design, CDP\_ENV\_MD\_012 Rev 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
<b>Dinoflagellates</b>												
<i>Alexandrium</i>	<i>margalefi</i>						x					
<i>Alexandrium</i>	<i>pseudogonyaulax</i>				x			x				
<i>Ceratium</i>	<i>sp.</i>			x								
<i>Ceratium</i>	<i>macroceros</i>		x	x	x						x	
<i>Ceratium</i>	<i>tenue</i>	1.5E+03	x	2.0E+03	x				x	x	x	x
<i>Ceratium</i>	<i>trijos</i>	x	x		x							
<i>Gonyaulax</i>	<i>spp.</i>		x				x		x	x	x	
<i>Gymnodinioid</i>	<i>spp.</i>	4.5E+03	1.0E+04	5.0E+03	6.0E+03	2.5E+03	6.0E+03	1.0E+03	8.0E+03	8.0E+03	7.3E+03	4.0E+03
<i>Gyrodinium</i>	<i>spp.</i>	6.0E+03	4.0E+03	3.0E+03	2.7E+03	1.5E+03	4.0E+03	7.0E+03	4.0E+03	5.0E+03	3.6E+03	2.0E+03
<i>Heterocapsa</i>	<i>rotundata</i>	1.1E+04	1.0E+04	5.0E+03	6.7E+03	6.0E+03	1.0E+04	7.0E+03	2.2E+04	5.0E+03	9.1E+03	7.0E+03
<i>Noctiluca</i>	<i>scintillans</i>		5.0E+01	5.0E+01	5.0E+01	x				5.0E+01		x
<i>Oblea</i>	<i>sp.</i>			x			x					
<i>Polykrykos</i>	<i>schwartzii</i>					x						
<i>Prependinium</i>	<i>meuneri</i>			x					x			
<i>Prorocentrum</i>	<i>gracile</i>			x	x					x		x
<i>Prorocentrum</i>	<i>triestinum</i>											1.0E+03
<i>Protoperidinium</i>	<i>spp.</i>	x	x	x	6.7E+02	x		x	x	1.0E+03		
<i>Protoperidinium</i>	<i>bipes</i>				x							
<i>Protoperidinium</i>	<i>pallidum/pellucidum</i>					x						
<i>Scrippsiella</i>	<i>spp.</i>			x		2.5E+03	1.0E+03	1.0E+03	x		9.0E+02	
<b>Chrysophytes</b>												
<i>Galycomonas</i>	<i>sp.</i>	1.5E+03	4.0E+03	1.0E+03	2.0E+03	2.0E+03	2.0E+03			1.0E+03		
<i>Ochromonas</i>	<i>spp.</i>	1.5E+03	2.0E+03		6.7E+02	1.0E+03	4.0E+03					
<b>Prymnesiophytes</b>												
<i>Chrysochromulina</i>	<i>spp.</i>	1.5E+03		2.0E+03	2.7E+03		8.0E+03		4.0E+03	3.0E+03	2.7E+03	1.0E+03
<i>Emiliania</i>	<i>huxleyi</i>	1.5E+03	1.6E+04	1.4E+04	8.0E+03	5.0E+03	1.2E+04	5.0E+03	1.2E+04	8.0E+03	1.0E+04	7.0E+03
<i>Gephyrocapsa</i>	<i>oceanica</i>		2.0E+03		6.7E+02							1.0E+03
<i>Syracosphaera</i>	<i>sp.</i>			1.0E+03	6.7E+02							
<b>Cryptophytes</b>												
<i>Hemiselmis</i>	<i>sp.</i>	6.0E+04	4.6E+04	1.0E+04	1.5E+04	7.5E+03	1.4E+04	1.1E+04	2.2E+04	1.9E+04	9.1E+03	1.8E+04
<i>Leucocryptos</i>	<i>marina</i>	1.4E+04	1.6E+04	4.0E+03	3.3E+03	2.5E+03	5.0E+03	5.0E+03	6.0E+03	9.0E+03	1.8E+03	2.0E+03
<i>Plagioselmis</i>	<i>prolonga</i>	7.8E+04	4.6E+04	2.0E+04	1.2E+04	1.2E+04	2.2E+04	3.2E+04	5.0E+04	3.1E+04	1.2E+04	2.2E+04
<i>Rhodomonas</i>	<i>salina</i>	1.5E+03	2.0E+03							1.0E+03		
<i>Teleaulax</i>	<i>acuta</i>	4.5E+03	6.0E+03	2.0E+03	1.3E+03	1.5E+03	7.0E+03	8.0E+03	8.0E+03		2.7E+03	1.0E+03
<b>Chlorophytes</b>												
<i>Pediastrum</i>	<i>sp.</i>						x					
<i>Staurastrum</i>	<i>sp.</i>											1.0E+03
<b>Prasinophytes</b>												
<i>Pyramimonas</i>	<i>spp.</i>	3.0E+03	8.0E+03	1.4E+04	3.3E+03		8.0E+03	1.0E+03	8.0E+03	9.0E+03	1.8E+03	6.0E+03
<i>Tetraselmis</i>	<i>spp.</i>			1.0E+03	1.3E+03	1.0E+03	2.0E+03	1.0E+03	8.0E+03		1.8E+03	2.0E+03
<b>Euglenophyta</b>												
<i>Eutreptiella</i>	<i>spp.</i>	3.0E+03	4.0E+03	1.0E+03		2.5E+03	x	2.0E+03	x	1.0E+03	9.0E+02	1.0E+03
<b>Other</b>												
<i>Apedinella</i>	<i>spinifera</i>		2.0E+03		2.7E+03						9.0E+02	1.0E+03
<i>Ebria</i>	<i>tripartita</i>					x			x			
<i>Dictyochoa</i>	<i>fibula</i>			x								
<i>Dictyochoa</i>	<i>octonaria</i>								x	x		
<i>Heterosigma</i>	<i>sp.</i>					5.0E+02	5.0E+02	5.0E+02				
<i>Haramonas</i>	<i>sp.</i>					5.0E+02						
<i>Unidentified</i>	<i>amoeba</i>					5.0E+02						
<i>Unidentified</i>	<i>bodonids</i>	9.0E+03	1.0E+04	8.0E+03	4.7E+03	1.0E+03	2.0E+03		2.0E+03	4.0E+03	3.6E+03	3.0E+03
<i>Mesodinium</i>	<i>rubrum</i>						1.0E+03					
Comparative data in the report												
<b>VSOAP Phytoplankton action levels in cells per litre (DPI, 2008)</b>		<b>Yarra River at Newport</b>	<b>Hobsons Bay</b>	<b>Central Bay</b>	<b>PoM DMG</b>	<b>Corio Bay</b>	<b>Long Reef</b>	<b>Patterson River</b>	<b>Dromana</b>	<b>Middle Ground Shelf</b>	<b>Sorrento Bank</b>	<b>Popes Eye</b>
<b>Taxa</b>	<b>Warning to growers</b>											
<i>Pseudo-nitzschia spp.</i>	50 000	0	1500	100	2000	x	150	900	2200	3600	1500	1000
<i>Rhizosolenia cf chunii</i>	10 000	0	0	0	0	0	0	0	0	0	0	0
<i>Alexandrium catenella</i>	100	0	0	0	0	0	0	0	0	0	0	0
<i>Alexandrium minutum</i>	100	0	0	0	0	0	0	0	0	0	0	0
<i>Alexandrium tamarense</i>	100	0	0	0	0	0	0	0	0	0	0	0
<i>Dinophysis acuminata</i>	1 000	0	0	0	0	0	0	0	0	0	0	0
<i>Dinophysis caudata</i>	1 000	0	0	0	0	0	0	0	0	0	0	0
<i>Dinophysis fortii</i>	1 000	0	0	0	0	0	0	0	0	0	0	0
<i>Gymnodinium catenatum</i>	100	0	0	0	0	0	0	0	0	0	0	0
<i>Karenia mikimotoi</i>	1 000	0	0	0	0	0	0	0	0	0	0	0
<i>Karenia brevis</i>	1 000	0	0	0	0	0	0	0	0	0	0	0
<i>Prorocentrum lima</i>	1 000	0	0	0	0	0	0	0	0	0	0	0



## NOTES

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

Blank cells denotes neither genus nor species were detected.

For table on VSQAP Phytoplankton action levels refer to Algal Blooms – Detailed Design, CDP\_ENV\_MD\_012 Rev 0.