



BAYWIDE WATER QUALITY MONITORING PROGRAM

PROGRESS REPORT No. 5 (MAY 2008)

JUNE 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 May 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.

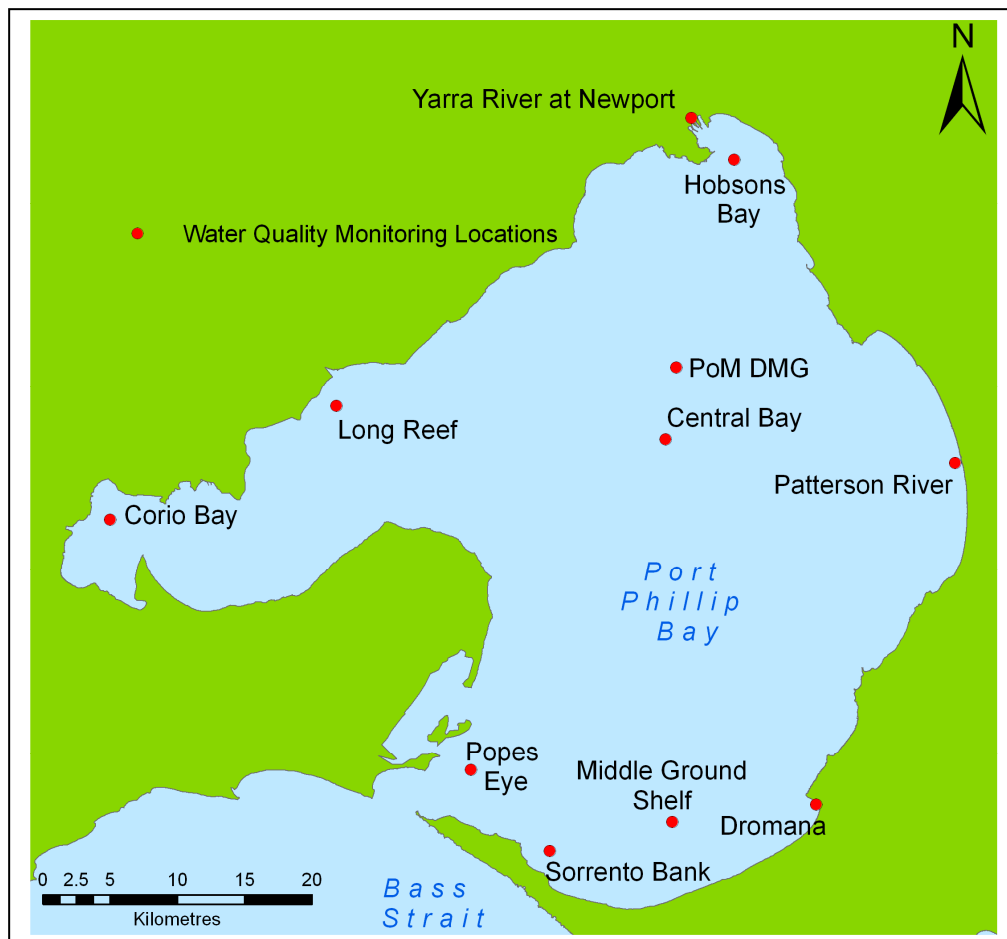


FIGURE 1 MAP OF SAMPLING SITES IN PORT PHILLIP BAY

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 three times and the EWMA control limits were exceeded four times (see Tables 1 - 4).

No significant events were observed during the field sampling that would affect these results.

As detailed 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.

There were no exceptions to the Water Quality detailed design document CDP_ENV_MD_023 Rev 0 during this reporting period.



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 ² /sec
			mg/L	% saturation						
13/05/08	Yarra River at Newport	0.5	7.5	93	35.9	1.6	15.2	2.60	3.8	173.5
13/05/08	Yarra River at Newport	8.0	NST	NST	NST		NST	3.26 ¹	NST	1.6 ¹
13/05/08	Hobsons Bay	0.5	7.8	98	37.4	2.2	15.4	1.72	2.5	129.0
13/05/08	Central Bay	0.5	7.8	100	37.6	11.5	16.4	0.36	0.4	78.0
13/05/08	PoM DMG	0.5	7.8	98	37.6	6.8	15.3	0.55	0.8	771.2
13/05/08	Corio Bay	0.5	7.8	96	38.5	>5.0 ²	14.2	2.18	1.9	304.3
13/05/08	Long Reef	0.5	8.0	99	37.8	>5.9 ²	14.6	0.54	1.2	583.8
14/05/08	Patterson River	0.5	8.3	106	37.1	>3.7 ²	16.5	0.97	3.2	261.6
14/05/08	Dromana	0.5	7.9	103	37.4	>3.8 ²	17.1	0.36	1.6	740.5
14/05/08	Middle Ground Shelf	0.5	8.2	106	37.1	9.8	17.0	0.39	1.0	175.1
14/05/08	Sorrento Bank	0.5	8.1	104	36.3	>2.7 ²	16.7	0.39	1.5	351.8
14/05/08	Popes Eye	0.5	8.2	101	35.7	10.3	14.8	2.18	1.2	304.3

NOTES:

Data for turbidity and PAR are recorded *in situ* across the depth profile, although the results presented are for the specific depth noted. All other physico-chemical samples are taken and data recorded specifically at 0.5 m from surface, except Yarra River at Newport and Hobsons Bay where if required, bottom samples are also collected and data recorded.

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

1. Measurements taken at 8.0m (to avoid damage to profiler).
2. Secchi disc visible on bottom.

TABLE 2A NUTRIENTS (NDA – No Data Available)

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
13/05/08	Yarra River at Newport	0.5	32.2	17.0	32.5	0.5	33.0	14.6	137	236	233
13/05/08	Hobsons Bay	0.5	6.0	5.8	29.2	<0.4	29.2	10.7	122	203	188
13/05/08	Central Bay	0.5	6.5	5.6	4.1	<0.4	4.1	1.8	130	157	153
13/05/08	PoM DMG	0.5	6.6	5.5	17.9	<0.4	17.9	4.6	135	180	157
13/05/08	Corio Bay	0.5	6.3	5.0	1.5	<0.4	1.5	1.3	165	198	198
13/05/08	Long Reef	0.5	9.2	23.4	7.7	<0.4	7.7	19.7	140	178	239
14/05/08	Patterson River	0.5	5.9	6.5	4.9	<0.4	4.9	6.2	132	174	179
14/05/08	Dromana	0.5	7.5	6.6	2.7	<0.4	2.7	1.8	133	155	147
14/05/08	Middle Ground Shelf	0.5	4.4	4.9	2.1	<0.4	2.1	1.3	129	144	139
14/05/08	Sorrento Bank	0.5	6.1	6.3	11.0	4.5	15.5	4.1	93	128	126
14/05/08	Popes Eye	0.5	8.5	6.6	16.2	9.1	25.3	7.1	80	126	113

NOTES:

Yellow coloured cells indicate measured results above the Shewhart control limit (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).

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).



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	
13/05/08	Yarra River at Newport	0.5	72	67	16	89	94	292
13/05/08	Hobsons Bay	0.5	67	68	15	81	88	123
13/05/08	Central Bay	0.5	63	61	11	74	74	69
13/05/08	PoM DMG	0.5	64	56	10	75	74	92
13/05/08	Corio Bay	0.5	76	78	20	96	98	124
13/05/08	Long Reef	0.5	77	117	13	91	135	81
14/05/08	Patterson River	0.5	66	64	13	78	80	120
14/05/08	Dromana	0.5	61	51	8.2	69	64	143
14/05/08	Middle Ground Shelf	0.5	48	45	7.5	56	61	83
14/05/08	Sorrento Bank	0.5	23	28	5.8	28	39	61
14/05/08	Popes Eye	0.5	6.8	20	4.7	12	29	42

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 ¹ (TBT) µg/Lx10 ⁻³	Cadmium µg/L	Chromium µg/L	Copper µg/L	Mercury µg/L	Nickel µg/L	Lead µg/L	Zinc µg/L
			Measured Value	EWMA								
13/05/08	Yarra River at Newport - total	0.5	2.1	2.7	<2	<0.2	<0.5	<1	<0.1	0.6	<0.2	15
13/05/08	Yarra River at Newport - dissolved	0.5	2.3 ²	-	NST	NAR	NAR	NAR	NAR	NAR	NAR	15
13/05/08	Hobsons Bay - total	0.5	2.5	2.8	<2	<0.2	<0.5	5	<0.1	0.7	<0.2	<5
13/05/08	Hobsons Bay - dissolved	0.5	2.7 ²	-	NST	NAR	NAR	5	NAR	NAR	NAR	NAR
13/05/08	Central Bay - total	0.5	2.5	2.8	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5
13/05/08	PoM DMG - total	0.5	2.5	2.9	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5
13/05/08	Corio Bay - total	0.5	2.6	3.3	NST	<0.2	<0.5	<1	<0.1	0.9	<0.2	<5
13/05/08	Long Reef - total	0.5	2.5	3.0	NST	<0.2	<0.5	21	<0.1	<0.5	<0.2	<5
13/05/08	Long Reef - dissolved	0.5	2.5	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR
14/05/08	Patterson River - total	0.5	2.9	2.8	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	6
14/05/08	Patterson River - dissolved	0.5	2.8	-	NST	NAR	NAR	NAR	NAR	NAR	NAR	11²
14/05/08	Dromana - total	0.5	2.9	2.7	NST	<0.2	<0.5	<1	<0.1	0.7	<0.2	5
14/05/08	Dromana - dissolved	0.5	2.8	-	NST	NAR	NAR	NAR	NAR	NAR	NAR	5
14/05/08	Middle Ground Shelf - total	0.5	2.5	2.8	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5
14/05/08	Sorrento Bank - total	0.5	2.2	2.2	NST	<0.2	0.6	<1	<0.1	0.6	<0.2	<5
14/05/08	Popes Eye - total	0.5	1.6	2.3	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5

NOTES:

Yellow coloured cells indicate measured results above the Shewhart control limit (for 'total' fraction). See Appendix 1, p.8 and 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.
2. Dissolved result greater than total results but within acceptable levels of inter-sample variation.



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 ³	Total Phytoplankton cells/L	Diatoms cells/L	Dinoflagellates cells/L	Other Flagellates cells/L
			Measured Value	EWMA						
13/05/08	Yarra River at Newport	0.5	1.44	2.85	0.08	0.70	2.9E+05	7.6E+04	2.4E+04	1.9E+05
13/05/08	Yarra River at Newport	8.0	NST ¹	NST ¹	NST ¹	0.49				
13/05/08	Hobsons Bay	0.5	2.22	1.84	0.15	0.84	2.3E+05	1.3E+05	7.6E+03	9.1E+04
13/05/08	Central Bay	0.5	0.58	0.80	0.02	0.24	1.5E+05	8.8E+04	1.4E+04	4.7E+04
13/05/08	PoM DMG	0.5	0.63	0.65	0.05	0.24	2.2E+05	1.5E+05	2.1E+04	5.4E+04
13/05/08	Corio Bay	0.5	0.50	1.02	0.10	0.27	1.4E+05	9.1E+04	5.1E+03	4.3E+04
13/05/08	Long Reef	0.5	0.90	1.67	0.07	0.42	4.9E+05	4.2E+05	1.2E+04	5.8E+04
14/05/08	Patterson River	0.5	1.32	0.95	<0.02	0.68	2.8E+05	1.7E+05	4.0E+04	6.3E+04
14/05/08	Dromana	0.5	0.63	0.65	0.05	0.33	2.0E+05	1.1E+05	1.8E+04	7.4E+04
14/05/08	Middle Ground Shelf	0.5	0.54	0.65	0.08	0.25	1.9E+05	1.0E+05	1.2E+04	7.1E+04
14/05/08	Sorrento Bank	0.5	0.72	0.61	0.11	0.38	1.3E+05	5.4E+04	4.2E+03	7.6E+04
14/05/08	Popes Eye	0.5	0.70	0.64	0.23	0.27	1.1E+05	6.2E+03	3.0E+03	9.7E+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) 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 0 (available on the Channel Deepening Project website 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, 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.

The control limits are as issued by the Port of Melbourne Corporation on January 28, 2008.



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). 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 5 CDP_ENV_MD_023 Rev 0, available on the Channel Deepening Project website www.channelproject.com). Limits amended by Port of Melbourne Corporation on January 28, 2008.



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

Sampling Site	Policy Categories		Channel Deepening PARAMETER																												
			Dissolved Oxygen (% saturation)				Salinity variation	Temperature (°C)	Secchi disc depth (m)	Attenuation of PAR	Annual 90th percentile	Turbidity (NTU)		Suspended Solids (mg/L)		Chlorophyll-a (µg/L)		Other Parameters													
			Min for 1m below surface	Min 1m above bottom	Lower limit for 90th percentile	Minimum percentage concentration						Annual 50th percentile	Annual 90th percentile	Annual 50th percentile	Annual 90th percentile	Annual median	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	ANZECC Level of Protection	>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	2	1	0.05	15	5	0.006
Hobsons Bay	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	
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 Schedule F7 Waters of Yarra Catchment objectives

ANZECC trigger values not highlighted

Cadmium limit of reporting is above SEPP F6 'general' segment's objective

Below limit of reporting

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.



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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	13/05/2008	13/05/2008	13/05/2008	13/05/2008	13/05/2008	13/05/2008	14/05/2008	14/05/2008	14/05/2008	14/05/2008	14/05/2008
Count Method	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick
Genus	Species										
	Estimate Cells/L										
Total Phytoplankton	2.9E+05	2.3E+05	1.5E+05	2.2E+05	1.4E+05	4.9E+05	2.8E+05	2.0E+05	1.9E+05	1.3E+05	1.1E+05
Diatoms	7.6E+04	1.3E+05	8.8E+04	1.5E+05	9.1E+04	4.2E+05	1.7E+05	1.1E+05	1.0E+05	5.4E+04	6.2E+03
Dinoflagellates	2.4E+04	7.6E+03	1.4E+04	2.1E+04	5.1E+03	1.2E+04	4.0E+04	1.8E+04	1.2E+04	4.2E+03	3.0E+03
Other flagellates	1.9E+05	9.1E+04	4.7E+04	5.4E+04	4.3E+04	5.8E+04	6.3E+04	7.4E+04	7.1E+04	7.6E+04	9.7E+04

Diatoms

<i>Amphora</i>	sp.		1.3E+03		1.3E+03	x	1.0E+03	1.3E+03			x	
<i>Asterionellopsis</i>	<i>glacialis</i>	2.0E+03	1.1E+04	2.0E+03	6.3E+03		2.0E+03	2.5E+03	2.5E+03	7.5E+03	6.0E+03	1.0E+03
<i>Asteromphalus</i>	<i>sarcophagus</i>		1.3E+03	x	5.0E+03			1.3E+03	3.8E+03	1.3E+03		
<i>Bacillaria</i>	<i>paxillifera</i>	x										
<i>Cerataulina</i>	<i>pelagica</i>		x	1.0E+03	1.3E+03	x		x	x	1.3E+03		
<i>Chaetoceros</i>	spp.	2.4E+04	6.4E+04	5.4E+04	6.5E+04	5.8E+04	3.7E+05	6.5E+04	4.5E+04	3.6E+04	1.1E+04	x
<i>Cocconeis</i>	spp.	2.0E+03	2.5E+03	1.0E+03	7.5E+03	2.0E+03	2.0E+03	3.8E+03	7.5E+03	2.5E+03	7.0E+03	1.0E+03
<i>Corethron</i>	<i>criophilum</i>									x		
<i>Cylindrotheca</i>	<i>closterium</i>	6.0E+03	6.3E+03	2.0E+03	2.5E+03	1.2E+04	1.0E+04	2.5E+03	6.3E+03	5.0E+03	4.0E+03	1.0E+03
<i>Dactyliosolen</i>	<i>antarcticus</i>	x	1.3E+03	1.0E+03	5.0E+03	2.0E+03		x	1.3E+03	3.8E+03		
<i>Dactyliosolen</i>	<i>fragilissimus</i>				x					x		
<i>Dactyliosolen</i>	<i>phukutensis</i>								x	x		
<i>Diploneis</i>	sp.		1.3E+03	x	2.5E+03			x	1.3E+03	1.3E+03	1.0E+03	
<i>Ditylum</i>	<i>brightwellii</i>	x		2.0E+03	x			1.3E+03	x		x	
<i>Encyonema</i>	sp.	2.0E+03										
<i>Entomoneis</i>	sp.	2.0E+03	5.0E+03		1.3E+03	x		1.3E+03	1.3E+03	1.3E+03	x	1.0E+03
<i>Eucampia</i>	<i>zodiacus</i>		1.3E+03		2.5E+03			x		x		
<i>Fallacia</i>	sp.						x					
<i>Fragilaria</i>	sp.						x					
<i>Grammotophora</i>	<i>serpentina</i>		x				1.0E+03					
<i>Guinardia</i>	<i>delicatula</i>					1.0E+03						
<i>Guinardia</i>	<i>flaccida</i>	x		2.0E+03	x			x		x		
<i>Haslea</i>	<i>wawriake</i>			1.0E+03								
<i>Hemiaulus</i>	<i>hauckii</i>	6.0E+03	6.3E+03	2.0E+03	2.0E+04	x	1.0E+03	8.8E+03	1.1E+04	1.6E+04	x	x
<i>Leptocylindrus</i>	<i>danicus</i>	x	8.8E+03	1.0E+03	7.5E+03	x		2.5E+03	x	5.0E+03	x	
<i>Licmophora</i>	sp.			1.0E+03	1.3E+03	5.0E+03		1.3E+03				
<i>Lithodesmium</i>	sp.		x									
<i>Melosira</i>	sp.	x										
<i>Minidiscus</i>	<i>tricolatus</i>	6.0E+03		5.0E+03		2.0E+03	1.0E+04		5.0E+03	5.0E+03		
<i>Minutocellus</i>	sp.					1.0E+03						
<i>Naviculoid</i>	spp.	2.0E+03	3.8E+03	1.0E+03	1.3E+03	x	6.0E+03	7.5E+03	3.8E+03	2.5E+03	6.0E+03	
<i>Nitzschia</i>	spp.				2.5E+03	4.0E+03	5.0E+03	2.5E+03	2.5E+03	1.3E+03	4.0E+03	x
<i>Nitzschia</i>	<i>longissima</i>			x			x					
<i>Nitzschia</i>	<i>sigmoidea</i>						x					
<i>Pleurosigma</i>	sp.	x		x	2.5E+03	1.0E+03		x	x	2.5E+03	x	x
<i>Proboscia</i>	<i>alata</i>	x	1.3E+03					x	x	x	x	
<i>Pseudo-nitzschia</i>	<i>delicatissima</i> group	1.0E+03	9.0E+02	1.5E+03	1.8E+03	5.0E+02	2.0E+03	2.0E+02	3.5E+02	1.1E+03	6.0E+02	2.0E+02
<i>Pseudo-nitzschia</i>	<i>pungens/multiseriis</i>	1.0E+03	4.0E+02	3.0E+03	8.0E+02		x	2.6E+03	4.0E+02	2.0E+02		
<i>Pseudo-nitzschia</i>	<i>turgidula</i>			5.0E+02				x				
<i>Rhizosolenia</i>	spp.	x	1.3E+03	x	1.3E+03			8.8E+03	3.8E+03	1.3E+03	2.0E+03	x
<i>Rhizosolenia</i>	<i>setigera</i>	x				x						
<i>Skeletonema</i>	<i>japonicum/pseudocostatum</i>	8.0E+03					6.0E+03	5.4E+04				
<i>Striatella</i>	<i>unipunctata</i>	x										
<i>Surirella</i>	sp.	x					1.0E+03					
<i>Thalassionema</i>	sp.	8.0E+03	1.4E+04	4.0E+03	1.5E+03		1.0E+03	3.8E+03	1.3E+03	1.3E+03	x	x
<i>Thalassiosira</i>	sp.	4.0E+03				1.0E+03				x		
<i>Thalassiosira</i>	<i>cf. mala</i>	2.0E+03	2.5E+03	3.0E+03	7.5E+03	1.0E+03		3.8E+03	1.5E+04	6.3E+03	1.2E+04	2.0E+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
Dinoflagellates												
<i>Alexandrium</i>	<i>margalefi</i>			x								
<i>Alexandrium</i>	<i>pseudogonyaulax</i>			x		x	x					
<i>Ceratium</i>	<i>macroceros</i>	x		x								
<i>Ceratium</i>	<i>tenue</i>	x	x	1.0E+03	x		x			x	x	x
<i>Ceratium</i>	<i>tripos</i>	x	x	x			x		x	x		
<i>Gonyaulax</i>	<i>spp.</i>		x			x		x				
<i>Gymnodinium</i>	<i>spp.</i>	1.2E+04	5.0E+03	1.1E+04	1.1E+04	1.0E+03	3.0E+03	2.1E+04	1.5E+04	7.5E+03	1.0E+03	1.0E+03
<i>Gyrodinium</i>	<i>spp.</i>	4.0E+03	1.3E+03	1.0E+03	1.3E+03	1.0E+03	2.0E+03		1.3E+03	x	x	x
<i>Heterocapsa</i>	<i>rotundata</i>	8.0E+03	1.3E+03	1.0E+03	8.8E+03	1.0E+03	6.0E+03	1.4E+04	1.3E+03	2.5E+03	3.0E+03	2.0E+03
<i>Karenia</i>	<i>mikimotoi</i>						5.0E+01					
<i>Noctiluca</i>	<i>scintillans</i>	x	x	5.0E+01		x	x					
<i>Ostreopsis</i>	<i>sp.</i>						x					
<i>Peridinium</i>	<i>sp.</i>							2.5E+03				
<i>Polykrykos</i>	<i>schwartzii</i>		x				x					
<i>Prorocentrum</i>	<i>cordatum</i>							1.0E+03	5.0E+01	4.5E+02	2.0E+02	
<i>Prorocentrum</i>	<i>gracile</i>				x	x			x			
<i>Prorocentrum</i>	<i>rhathymum</i>							x				
<i>Prorocentrum</i>	<i>triestinum</i>					2.0E+03		x				
<i>Protoceratium</i>	<i>reticulatum</i>			x								
<i>Protoperidinium</i>	<i>spp.</i>		x	x	x	x	x		x	1.3E+03		
<i>Protoperidinium</i>	<i>pallidum/pellucidum</i>			x			x					
<i>Scrippsiella</i>	<i>spp.</i>	x			x	x	1.0E+03	1.3E+03	x	x		
<i>Takayama</i>	<i>pulchella</i>				1.5E+02	5.0E+01	5.0E+01		5.0E+01			
Chrysophytes												
<i>Calycomonas</i>	<i>sp.</i>	1.0E+04		3.0E+03		1.0E+03						
<i>Dinobryon</i>	<i>sp.</i>							2.5E+03	2.5E+03		1.0E+03	
<i>Ochromonas</i>	<i>spp.</i>			1.0E+03			1.0E+03					
Prymnesiophytes												
<i>Calciopappus</i>	<i>caudatus</i>				1.3E+03							
<i>Chrysochromulina</i>	<i>spp.</i>	8.0E+03	1.5E+03	1.0E+03	1.3E+03		5.0E+03	6.3E+03	5.0E+03	5.0E+03	1.0E+03	2.0E+03
<i>Emiliania</i>	<i>huxleyi</i>	2.0E+03	5.0E+03	5.0E+03	6.3E+03	4.0E+03	9.0E+03	5.0E+03	8.8E+03	1.8E+04	4.3E+04	5.0E+04
<i>Gephyrocapsa</i>	<i>oceanica</i>			3.0E+03	1.3E+03				2.5E+03		1.0E+03	3.0E+03
<i>Syracosphaera</i>	<i>sp.</i>			1.0E+03								
Cryptophytes												
<i>Hemiselmis</i>	<i>sp.</i>	4.2E+04	3.5E+04	3.0E+03	1.4E+04	5.0E+03	6.0E+03	1.1E+04	8.8E+03	1.6E+04	7.0E+03	1.8E+04
<i>Leucocryptos</i>	<i>marina</i>	2.6E+04		7.0E+03		4.0E+03	7.0E+03					
<i>Plagioselmis</i>	<i>prolonga</i>	8.2E+04	2.5E+04	1.3E+04	1.4E+04	2.1E+04	1.8E+04	2.0E+04	1.5E+04	1.6E+04	1.0E+04	1.1E+04
<i>Rhodomonas</i>	<i>salina</i>	2.0E+03										
<i>Teleaulax</i>	<i>acuta</i>	2.0E+03					1.0E+03	3.8E+03			x	
Chlorophytes												
<i>Staurodesmus</i>	<i>sp.</i>					1.0E+03						
Prasinophytes												
<i>Pterosperma</i>	<i>sp.</i>								x			
<i>Pyramimonas</i>	<i>spp.</i>	6.0E+03	2.3E+04	5.0E+03	1.3E+04	3.0E+03	7.0E+03	1.1E+04	3.0E+04	1.6E+04	1.2E+04	1.2E+04
<i>Tetraselmis</i>	<i>spp.</i>	6.0E+03		1.0E+03		2.0E+03						
Euglenophyta												
<i>Eutreptiella</i>	<i>spp.</i>	4.0E+03		2.0E+03	2.5E+03	x	3.0E+03	3.8E+03	1.3E+03		1.0E+03	1.0E+03
Other												
<i>Ebria</i>	<i>tripartita</i>							x				
<i>Unidentified</i>	<i>amoeba</i>		1.3E+03	1.0E+03								
<i>Unidentified</i>	<i>bodonids</i>			1.0E+03		2.0E+03	1.0E+03					

VSQAP Phytoplankton action levels in cells per litre (DPI, 2008)		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
Taxa	Warning to growers											
<i>Pseudo-nitzschia spp.</i>	50 000	2000	1300	5000	2600	500	2000	2800	750	1300	600	200
<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	50	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.

1. While phytoplankton of the same genus were present, the listed species was not identified.