



BAYWIDE WATER QUALITY MONITORING PROGRAM

PROGRESS REPORT No. 9 (SEPTEMBER 2008) EDITION 2

NOVEMBER 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 September 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.

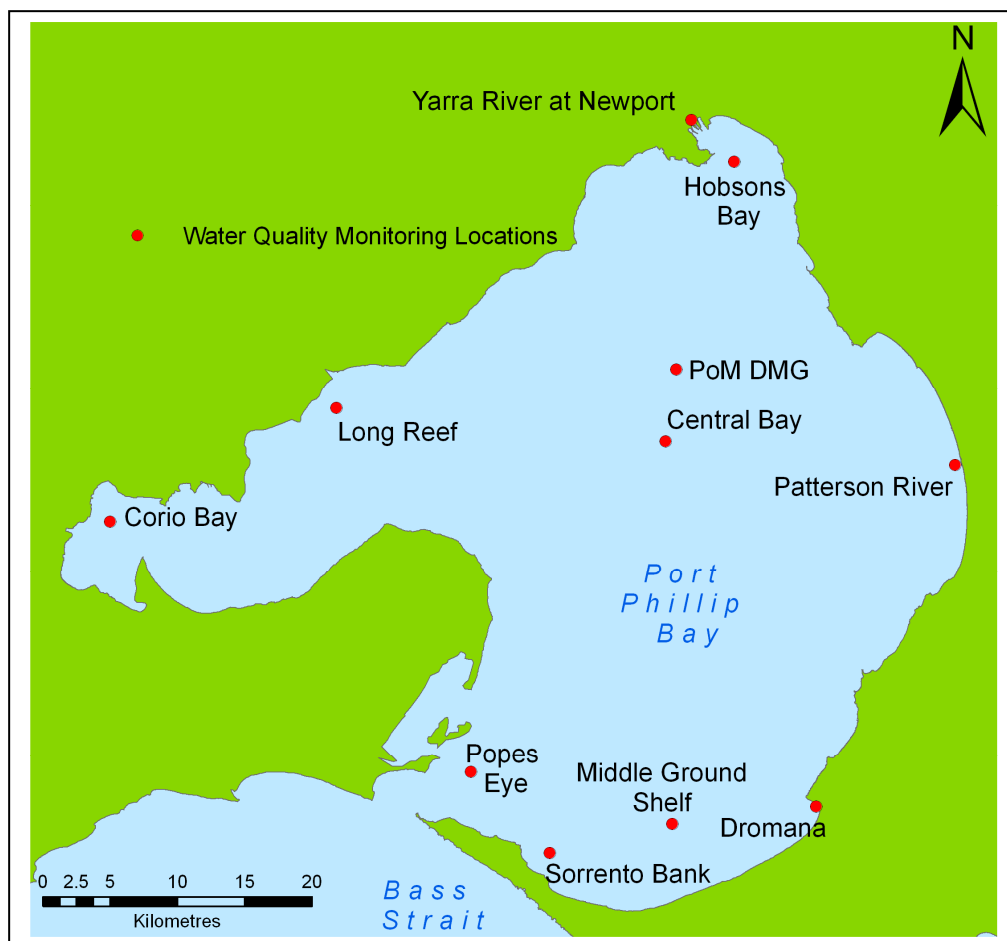


FIGURE 1 MAP OF SAMPLING SITES IN PORT PHILLIP BAY

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

The *Cornelis Zanen* dredge was operating on 18 September 2008 adjacent to the Hobsons Bay sampling site, where turbidity reached 21.1 NTU at 7.8m and reduced to 7.61 NTU at 10m. The presence of strong winds leading up to the sampling period may have also contributed to reduced water clarity at the Hobsons Bay, Yarra River at Newport and Patterson River sites during the field sampling event.

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.

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 two exceptions to the Water Quality detailed design document CDP_ENV_MD_023 Rev 0 during this reporting period. They are detailed in exception reports ER080901 and ER080902, and outlined respectively as follows:

- A variation in the Limit of Reporting (LOR) for various parameters.
- For the Central Bay site, no data is available for dissolved organic nitrogen.

The following previously issued exception report still applies to this progress report:

- ER080702: A variation in the LOR for chlorophyll-*a* and phaeophytin-*a*.

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 ⁴ mg/L	PAR micro Einsteins/m ² /sec
			mg/L	% saturation						
18/09/08	Yarra River at Newport	0.5	7.7	87	32.8	1.6	11.7	2.75	5.4	906.9
18/09/08	Yarra River at Newport	10.0	NST	NST	NST		NST	7.61	NST	0.1
18/09/08	Hobsons Bay	0.5	8.0	92	36.5	0.6	11.2	12.37 ³	22.2	62.2
16/09/08	Central Bay	0.5	8.3	95	36.9	6.0	10.9	2.13	< 1.5	339.8
16/09/08	PoM DMG	0.5	8.3	95	36.9	4.5	11.1	0.67	< 1.5	638.8
16/09/08	Corio Bay	0.5	7.9	92	37.5	3.7	11.6	1.98	3.8	78.4
16/09/08	Long Reef	0.5	8.1	94	37.0	3.2	11.6	1.37	2.1	179.9
17/09/08	Patterson River	0.5	7.8	90	36.8	2.8	11.4	2.01	1.9	189.6
17/09/08	Dromana	0.5	8.2	94	36.2	4.3	11.4	0.94	< 1.5	1247.1
17/09/08	Middle Ground Shelf	0.5	8.2	95	36.6	4.6	11.6	0.75	< 1.5	1460.1
17/09/08	Sorrento Bank	0.5	8.1	94	36.2	>3.0 ¹	12.0	0.90	< 1.5	1411.5
17/09/08	Popes Eye	0.5	8.1	94	36.0	NVR ²	12.1	0.75	< 1.5	1544.3

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 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).

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 valid result due to the tide impact on secchi disc trajectory.
3. ANZECC guidelines recommend a turbidity range of 0.5-10 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.
4. Limit of Reporting (LOR) has been amended where previously reported as Limit of Detection (LOD) (see Exception Report ER080901).

TABLE 2A NUTRIENTS (NDA – No Data Available)

Date	Sampling Site	Depth m	Ammonium µg/L		Nitrate µg/L	Nitrite ¹ µg/L	Nitrate plus Nitrite ¹ µg/L		Dissolved Organic Nitrogen µg/L	Total Nitrogen µg/L	
			Measured Value	EWMA			Measured Value	EWMA		Measured Value	EWMA
18/09/08	Yarra River at Newport	0.5	43.6	26.0	84.4	1.4	85.8	53.0	148	309	255
18/09/08	Hobsons Bay	0.5	20.4	9.6	14.1	<1.2	14.1	10.8	104	185	174
16/09/08	Central Bay	0.5	5.0	5.8	2.8	<1.2	2.8	1.9	NDA ²	146	142
16/09/08	PoM DMG	0.5	5.4	5.2	2.7	<1.2	2.7	3.1	116	150	145
16/09/08	Corio Bay	0.5	6.5	5.5	2.1	<1.2	< 2.4	2.0	148	187	182
16/09/08	Long Reef	0.5	9.3	23.5	16.7	<1.2	16.7	52.6	129	194	251
17/09/08	Patterson River	0.5	6.4	6.8	2.7	<1.2	2.7	8.7	120	164	170
17/09/08	Dromana	0.5	5.5	6.7	1.6	<1.2	< 2.4	6.1	92	120 ³	139
17/09/08	Middle Ground Shelf	0.5	5.2	5.0	1.6	<1.2	< 2.4	2.2	102	128	131
17/09/08	Sorrento Bank	0.5	5.4	5.7	2.5	<1.2	2.5	6.0	83	112	121
17/09/08	Popes Eye	0.5	7.3	6.6	4.3	<1.2	4.3	9.6	76	101	109

NOTES:

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).

1. Limit of Reporting (LOR) has been amended where previously reported as Limit of Detection (LOD) (see Exception Report ER080901).
2. See Exception Report ER080902.
3. Value rounded up to 120 µg/L (no exceedance of ANZECC trigger value).

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

Date	Sampling Site	Depth m	Phosphate µg/L		Organic Phosphorus ¹ µg/L	Total Phosphorus µg/L		Silicate µg/L
			Measured Value	EWMA		Measured Value	EWMA	
18/09/08	Yarra River at Newport	0.5	56	62	18.4	75	83	343
18/09/08	Hobsons Bay	0.5	53	68	26.6	80	87	140
16/09/08	Central Bay	0.5	52	57	< 18.0	70	70	57
16/09/08	PoM DMG	0.5	53	54	< 18.0	70	70	57
16/09/08	Corio Bay	0.5	64	74	< 18.0	82	91	89
16/09/08	Long Reef	0.5	80	119	18.8	99	138	37
17/09/08	Patterson River	0.5	61	61	< 18.0	78	77	74
17/09/08	Dromana	0.5	25	44	< 18.0	37	56	48
17/09/08	Middle Ground Shelf	0.5	40	44	< 18.0	56	57	52
17/09/08	Sorrento Bank	0.5	24	30	< 18.0	36	39	48
17/09/08	Popes Eye	0.5	14	21	< 18.0	27	31	37

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).

1. Limit of Reporting (LOR) has been amended where previously reported as Limit of Detection (LOD) (see Exception Report ER080901).



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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								
18/09/08	Yarra River at Newport - total	0.5	2.3	2.3	<2	<0.2	<0.5	2	<0.1	1.0	<0.2	10
18/09/08	Yarra River at Newport - dissolved	0.5	NAR	-	NST	NAR	NAR	<1	NAR	NAR	NAR	9
18/09/08	Hobsons Bay - total	0.5	2.6	2.9	<2	<0.2	<0.5	2	<0.1	1.4	0.4	<5
18/09/08	Hobsons Bay - dissolved	0.5	NAR	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR
16/09/08	Central Bay - total	0.5	3.0	3.0	NST	<0.2	<0.5	<1	<0.1	0.8	<0.2	<5
16/09/08	Central Bay - dissolved	0.5	3.0	-	NST	NAR	NAR	NAR	NAR	NAR	NAR	NAR
16/09/08	PoM DMG - total	0.5	3.0	3.0	NST	<0.2	<0.5	1	<0.1	0.6	<0.2	<5
16/09/08	PoM DMG - dissolved	0.5	2.8	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR
16/09/08	Corio Bay - total	0.5	2.8	3.1	NST	0.2	<0.5	1	<0.1	1.3	<0.2	<5
16/09/08	Long Reef - total	0.5	2.8	3.2 ²	NST	<0.2	<0.5	1	<0.1	0.8	2.2	<5
17/09/08	Patterson River - total	0.5	2.6	2.8	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5
17/09/08	Dromana - total	0.5	2.6	2.7	NST	<0.2	<0.5	1	<0.1	<0.5	<0.2	<5
17/09/08	Dromana - dissolved	0.5	NAR	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR
17/09/08	Middle Ground Shelf - total	0.5	2.4	2.7	NST	<0.2	<0.5	1	<0.1	<0.5	<0.2	<5
17/09/08	Middle Ground Shelf - dissolved	0.5	NAR	-	NST	NAR	NAR	<1	NAR	NAR	NAR	NAR
17/09/08	Sorrento Bank - total	0.5	2.4	2.5	NST	<0.2	<0.5	<1	<0.1	0.5	<0.2	<5
17/09/08	Popes Eye - total	0.5	2.2	2.3	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5

NOTES:

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

Yellow coloured cells indicate measured results above the Shewhart control limit (for 'total' fraction). See Appendix 1 and Table 5 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. Value rounded up to 3.2 µg/L (no EWMA exceedance).





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						
18/09/08	Yarra River at Newport	0.5	0.72	1.62	<0.18	0.34	2.2E+05	1.0E+05	2.2E+04	1.0E+05
18/09/08	Yarra River at Newport	10.0	NST ¹	NST ¹	NST ¹	0.48				
18/09/08	Hobsons Bay	0.5	0.97	1.29	<0.18	0.51	2.2E+05	5.8E+04	1.4E+04	1.4E+05
16/09/08	Central Bay	0.5	1.45	0.93	<0.18	0.49	2.2E+05	1.5E+05	1.8E+04	5.0E+04
16/09/08	PoM DMG	0.5	1.25	0.78	<0.18	0.30	2.6E+05	1.6E+05	1.8E+04	8.0E+04
16/09/08	Corio Bay	0.5	1.03	0.86	<0.18	0.43	1.3E+05	6.4E+04	1.5E+04	4.8E+04
16/09/08	Long Reef	0.5	1.01	1.19	<0.18	0.35	4.4E+05	3.5E+05	1.6E+04	7.2E+04
17/09/08	Patterson River	0.5	1.33	1.20	<0.18	0.53	4.0E+05	2.0E+05	3.6E+04	1.6E+05
17/09/08	Dromana	0.5	0.67	0.77	<0.18	0.21	2.7E+05	1.4E+05	1.6E+04	1.1E+05
17/09/08	Middle Ground Shelf	0.5	0.70	0.78	<0.18	0.12	2.4E+05	1.2E+05	2.2E+04	1.0E+05
17/09/08	Sorrento Bank	0.5	0.73	0.74	<0.18	0.21	2.1E+05	1.1E+05	1.4E+04	8.7E+04
17/09/08	Popes Eye	0.5	0.47	0.63	<0.18	0.33	1.5E+05	4.3E+04	5.0E+03	1.1E+05

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.

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). 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); 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); 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	Policy Categories		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)	
	SEPP (WoV) schedule & segment	ANZECC Level of Protection	Min for 1m below surface	Min 1m above bottom	Lower limit for 90th percentile	Min percentage concentration					Annual 90th percentile	NTU	Annual 50th percentile	Annual 90th percentile	Annual 50th percentile	Annual 90th percentile															Chlorophyll-a (ug/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	0.006
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		>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

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	18/09/08	18/09/08	16/09/08	16/09/08	16/09/08	16/09/08	17/09/08	17/09/08	17/09/08	17/09/08	17/09/08	
Count Method	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	
Genus	estimate Cells/L											
Species												
Total Phytoplankton	2.2E+05	2.2E+05	2.2E+05	2.6E+05	1.3E+05	4.4E+05	4.0E+05	2.7E+05	2.4E+05	2.1E+05	1.5E+05	
Diatoms	1.0E+05	5.8E+04	1.5E+05	1.6E+05	6.4E+04	3.5E+05	2.0E+05	1.4E+05	1.2E+05	1.1E+05	4.3E+04	
Dinoflagellates	2.2E+04	1.4E+04	1.8E+04	1.8E+04	1.5E+04	1.6E+04	3.6E+04	1.6E+04	2.2E+04	1.4E+04	5.0E+03	
Other flagellates	1.0E+05	1.4E+05	5.0E+04	8.0E+04	4.8E+04	7.2E+04	1.6E+05	1.1E+05	1.0E+05	8.7E+04	1.1E+05	
Diatoms												
<i>Amphora</i>	sp.	x	x			2.0E+03	6.0E+03	8.0E+03	2.0E+03	2.0E+03	4.0E+03	x
<i>Asterionellopsis</i>	<i>glacialis</i>								2.0E+04		1.6E+04	1.2E+04
<i>Attheya</i>	sp.								2.0E+03			
<i>Biddulphia</i>	sp.	x										
<i>Cerataulina</i>	<i>pelagica</i>	x										
<i>Chaetoceros</i>	spp.			3.0E+03	4.0E+03	2.0E+03	4.0E+03	x	2.0E+04	8.0E+03	1.7E+04	5.0E+03
<i>Cocconeis</i>	spp.	9.0E+03	6.0E+03	3.0E+03	4.0E+03	9.0E+03	1.2E+04	2.8E+04	2.0E+04	2.0E+03	9.0E+03	6.0E+03
<i>Coscinodiscus</i>	spp.		x		x	x	2.0E+03	4.0E+03	x		x	x
<i>Cylindrotheca</i>	<i>closterium</i>	1.0E+03		1.0E+03	3.0E+03	1.4E+04	3.0E+04	2.0E+04	1.4E+04	x	7.0E+03	2.0E+03
<i>Dactyliosolen</i>	<i>blavyanus</i>									x		
<i>Dactyliosolen</i>	<i>fragilissimus</i>	1.0E+03	x	5.0E+03	6.0E+03	1.0E+03	2.2E+04		x	6.0E+03	1.0E+03	2.0E+03
<i>Diploneis</i>	sp.				1.0E+03			x		2.0E+03	1.0E+03	
<i>Entomoneis</i>	sp.	1.0E+03	x	x	1.0E+03		4.0E+03			x	1.0E+03	
<i>Fragilaria</i>	sp.	1.0E+03				1.0E+03		x	2.0E+03		1.0E+03	
<i>Grammotophora</i>	<i>marina</i>	1.0E+03	x				2.0E+03				1.0E+03	
<i>Guinardia</i>	<i>flaccida</i>	x	2.0E+03	x	3.0E+03		2.0E+03	4.0E+03	x	x	x	x
<i>Hemiaulus</i>	<i>hauckii</i>	4.1E+04	2.2E+04	1.1E+05	7.5E+04	x	1.5E+05	4.2E+04	2.2E+04	5.8E+04	1.1E+04	9.0E+03
<i>Leptocylindrus</i>	<i>danicus</i>	3.0E+03	x	2.1E+04	3.6E+04			8.0E+03	6.0E+03	3.4E+04	4.0E+03	x
<i>Licmophora</i>	sp.	1.0E+03				7.0E+03	6.0E+03	4.0E+03	6.0E+03		6.0E+03	x
<i>Naviculoid</i>	spp.	7.0E+03	4.0E+03	2.0E+03	1.0E+03	3.0E+03	2.2E+04	1.8E+04	1.0E+04	4.0E+03	9.0E+03	2.0E+03
<i>Nitzschia</i>	spp.	6.0E+03		x		1.1E+04	8.0E+03	1.2E+04	4.0E+03	x		1.0E+03
<i>Pleurosigma</i>	sp.			6.0E+03	5.0E+03	x	x	2.0E+03	x	x	1.0E+03	x
<i>Proboscia</i>	<i>alata</i>			x	1.0E+03							x
<i>Pseudo-nitzschia</i>	<i>delicatissima</i> group						x			x		
<i>Pseudo-nitzschia</i>	<i>pungens/multiseriis</i>			2.0E+02	x							
<i>Rhizosolenia</i>	spp.		x	x	x	x		x				x
<i>Skeletonema</i>	<i>japonica/pseudocostatum</i>			x	1.2E+04		6.0E+04	8.0E+03	x		3.0E+03	x
<i>Striatella</i>	<i>unipunctata</i>						x					
<i>Thalassionema</i>	sp.					x		x				
<i>Thalassiosira</i>	sp.	2.0E+03	2.0E+03			x	1.0E+04	4.0E+03	4.0E+03	x	3.0E+03	
<i>Thalassiosira</i>	<i>cf. mala</i>	2.7E+04	2.2E+04	7.0E+03	7.0E+03	1.4E+04	8.0E+03	4.0E+04	8.0E+03	2.0E+03	1.1E+04	4.0E+03
Dinoflagellates												
<i>Alexandrium</i>	<i>concaevum</i>											x
<i>Alexandrium</i>	<i>margalefi</i>		x									
<i>Alexandrium</i>	<i>pseudogonyaulax</i>	x	x	x	2.0E+02					x	x	
<i>Alexandrium</i>	<i>tamarense</i>											x
<i>Ceratium</i>	<i>tenue</i>	x	5.0E+01	x	x		x	x	x	x	x	x
<i>Ceratium</i>	<i>tripos</i>									x		
<i>Dinophysis</i>	<i>acuminata</i>				x						x	x
<i>Gonyaulax</i>	spp.			x	x					x	x	
<i>Gymnodinioid</i>	spp.	1.4E+04	8.0E+03	1.3E+04	1.2E+04	1.0E+04	1.0E+04	2.2E+04	8.0E+03	1.6E+04	9.0E+03	3.0E+03
<i>Gyrodinium</i>	spp.	x	x		2.0E+03	1.0E+03		2.0E+03		4.0E+03		
<i>Heterocapsa</i>	<i>rotundata</i>	6.0E+03	6.0E+03	3.0E+03	2.0E+03	4.0E+03	4.0E+03	8.0E+03	8.0E+03		2.0E+03	1.0E+03
<i>Heterocapsa</i>	<i>triquetra</i>							x				
<i>Noctiluca</i>	<i>scintillans</i>		x	x	2.0E+02	x	x	x		x		x
<i>Oblea</i>	sp.							x				
<i>Peridinium</i>	sp.	1.0E+03				x					x	
<i>Polykrykos</i>	<i>schwartzii</i>							x				
<i>Prorocentrum</i>	<i>gracile</i>			x								
<i>Prorocentrum</i>	<i>lima</i>										x	
<i>Protoceratium</i>	<i>reticulatum</i>			1.0E+03	5.0E+01				1.5E+02	5.0E+01		
<i>Protoperdinium</i>	spp.	1.0E+03	x	1.0E+03	1.0E+03	x	2.0E+03	4.0E+03	x	2.0E+03		x
<i>Pyrocystis</i>	<i>lunula</i>						x					
<i>Scrippsiella</i>	spp.				1.0E+03	x	x	x			3.0E+03	1.0E+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	
Collection Date	18/09/08	18/09/08	16/09/08	16/09/08	16/09/08	16/09/08	17/09/08	17/09/08	17/09/08	17/09/08	17/09/08	
Count Method	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	
Genus	Estimate Cells/L											
Total Phytoplankton	2.2E+05	2.2E+05	2.2E+05	2.6E+05	1.3E+05	4.4E+05	4.0E+05	2.7E+05	2.4E+05	2.1E+05	1.5E+05	
Diatoms	1.0E+05	5.8E+04	1.5E+05	1.6E+05	6.4E+04	3.5E+05	2.0E+05	1.4E+05	1.2E+05	1.1E+05	4.3E+04	
Dinoflagellates	2.2E+04	1.4E+04	1.8E+04	1.8E+04	1.5E+04	1.6E+04	3.6E+04	1.6E+04	2.2E+04	1.4E+04	5.0E+03	
Other flagellates	1.0E+05	1.4E+05	5.0E+04	8.0E+04	4.8E+04	7.2E+04	1.6E+05	1.1E+05	1.0E+05	8.7E+04	1.1E+05	
Chrysophytes												
<i>Calycomonas</i>	<i>sp.</i>		1.0E+03	3.0E+03	1.0E+03		6.0E+03				1.0E+03	
<i>Dinobryon</i>	<i>spp.</i>			8.0E+03			4.0E+03		x	5.0E+03		
Prymnesiophytes												
<i>Chrysochromulina</i>	<i>spp.</i>	1.0E+03	1.2E+04	7.0E+03	9.0E+03	5.0E+03	1.0E+04	2.0E+04	2.0E+04	1.0E+04	5.0E+03	1.4E+04
<i>Emiliania</i>	<i>huxleyi</i>			1.0E+04	1.5E+04	1.0E+03	8.0E+03	4.0E+03	3.0E+04	3.6E+04	2.8E+04	2.8E+04
<i>Gephyrocapsa</i>	<i>oceanica</i>									2.0E+03	1.0E+03	3.0E+03
Cryptophytes												
<i>Hemiselmis</i>	<i>sp.</i>	2.0E+04	3.2E+04	6.0E+03	7.0E+03	8.0E+03	4.0E+03	1.6E+04	1.0E+04	6.0E+03	7.0E+03	1.4E+04
<i>Leucocryptos</i>	<i>marina</i>		2.0E+03				2.0E+03		2.0E+03		1.0E+03	
<i>Plagioselmis</i>	<i>prolonga</i>	3.4E+04	4.2E+04	9.0E+03	1.3E+04	1.4E+04	1.8E+04	4.8E+04	2.2E+04	1.8E+04	1.4E+04	2.5E+04
<i>Teleaulax</i>	<i>acuta</i>	1.4E+04	1.0E+04	4.0E+03	6.0E+03	6.0E+03	1.0E+04	1.2E+04	6.0E+03	4.0E+03	6.0E+03	3.0E+03
Prasinophytes												
<i>Pyramimonas</i>	<i>spp.</i>	2.6E+04	2.2E+04	1.3E+04	1.5E+04	7.0E+03	1.6E+04	3.2E+04	1.6E+04	1.6E+04	1.3E+04	1.1E+04
<i>Tetraselmis</i>	<i>spp.</i>	6.0E+03	1.8E+04		3.0E+03	5.0E+03	2.0E+03	1.0E+04		2.0E+03	4.0E+03	1.0E+03
Euglenophyta												
<i>Eutreptiella</i>	<i>spp.</i>		4.0E+03	x	1.0E+03		2.0E+03	6.0E+03	4.0E+03	6.0E+03	3.0E+03	5.0E+03
Other												
<i>Apedinella</i>	<i>spinifera</i>		2.0E+03			1.0E+03						
Comparative data in the report												
VSQAP Phytoplankton action levels in cells per litre (DPI, 2008)	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</i> spp.	50 000		200	x		x			x			
<i>Rhizosolenia cf chunii</i>	10 000	x	x	x	x		x				x	
<i>Alexandrium catenella</i>	100											
<i>Alexandrium minutum</i>	100											
<i>Alexandrium tamarense</i>	100										x	
<i>Dinophysis acuminata</i>	1 000			x						x	x	
<i>Dinophysis caudata</i>	1 000											
<i>Dinophysis fortii</i>	1 000											
<i>Gymnodinium catenatum</i>	100											
<i>Karenia mikimotoi</i>	1 000											
<i>Karenia brevis</i>	1 000											
<i>Prorocentrum lima</i>	1 000									x		

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.