



# BAYWIDE WATER QUALITY MONITORING PROGRAM

## PROGRESS REPORT No. 2 (FEBRUARY 2008)

APRIL 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 February 2008 and was collected after dredging commenced on 8<sup>th</sup> of February. The previous report summarised conditions prior to commencement of dredging. Progress reports will be prepared throughout the dredging program.

Where extensive local water quality data is available, control charts 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.

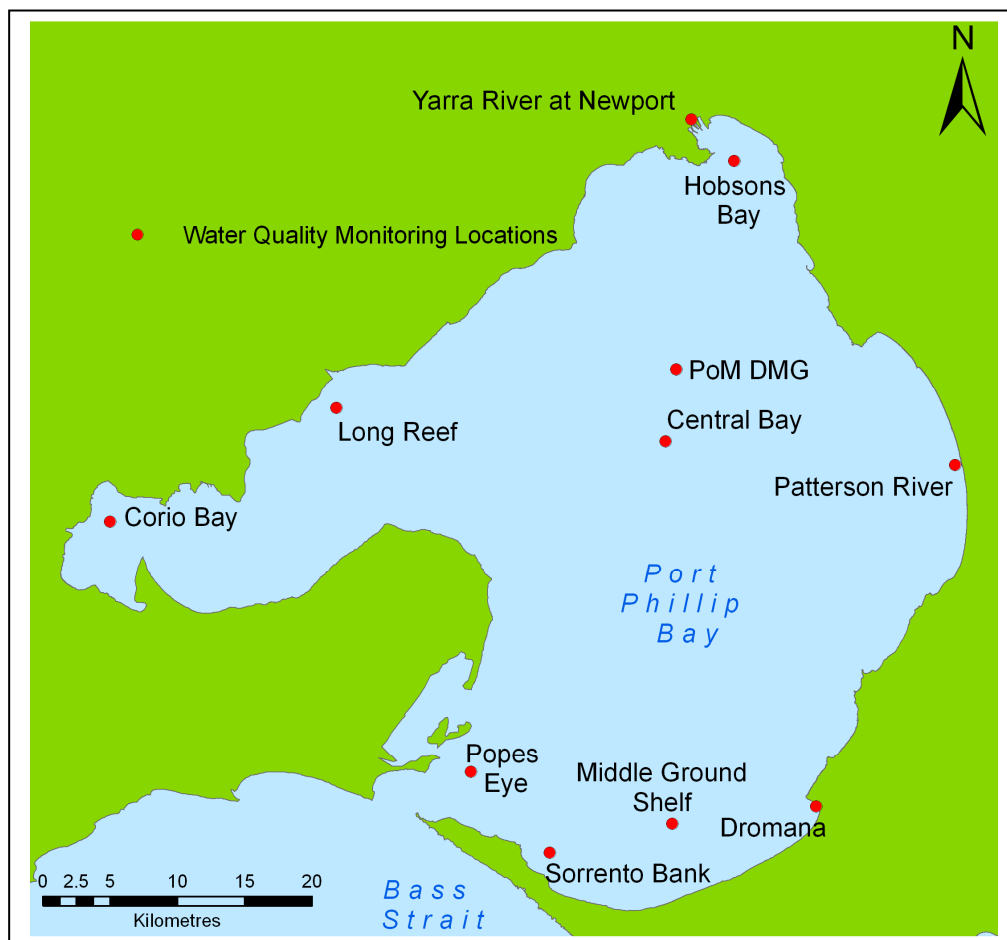


FIGURE 1 MAP OF SAMPLING SITES IN PORT PHILLIP BAY



### RESULTS AND DISCUSSION

This report documents water quality monitoring results for February 2008. All results presented in Tables 1 - 4 fall within the control limits where they exist (Appendix 1), or within the range of previous observations for Port Phillip Bay.

No significant events were observed during the field sampling that would affect these results. The February monthly rainfall was below average with the highest daily rainfall of 10.4 mm recorded at Cerberus on 21 February 2008. All other daily rainfall was 5 mm or less.

All data recorded in this report has been subject to internal quality assurance according to EPA standard operating procedures for field sampling and assessment (including consideration of rainfall and related information). During the reporting period there were no other quality assurance issues identified with the laboratory quality assurance data and the variation of the field blanks were within acceptable limits. Where dissolved metal results exceeded total metal results, the results were within acceptable levels of inter-sample variation, except for Corio Bay – dissolved (zinc) which is undergoing further investigation.

Three exceptions 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 ER080318, ER080319 and ER080321 respectively, and outlined as follows:

- For eight sites, no data could be reported for PAR, turbidity and fluorescence due to technical problems in the commissioning of the new PAR sensor.
- For the Yarra River at Newport site, no phytoplankton data could be recorded due to equipment failure.
- The specified ten-minute plankton tow method was not used. Instead, a vertical profile procedure was used.

The following previously issued Exception Reports still apply to this progress report:

- ER080227. Top and, where necessary, bottom samples were taken rather than an 'integrated' sample.
- ER080228. PAR sensors awaiting delivery and final commissioning (PAR sensor not received until 23 February 2008).
- ER080229. Monthly report data is not assessed against EWMA control limits as the charts remain under development.

TABLE 1 PHYSICO-CHEMICAL PARAMETERS (NDR – no data recorded)

| Date    | Sampling site          | Depth<br>m | Dissolved oxygen |              | Salinity<br>g/L | Secchi disc depth<br>m | Temperature<br>°C | Turbidity<br>NTU | Total Suspended Solids<br>mg/L | PAR <sup>1</sup><br>micromole/m <sup>2</sup> /sec |
|---------|------------------------|------------|------------------|--------------|-----------------|------------------------|-------------------|------------------|--------------------------------|---|
|         |                        |            | mg/L             | % saturation |                 |                        |                   |                  |                                |   |
| 13/2/08 | Yarra River at Newport | 0.5        | 7.1              | 98           | 35.55           | 2.2                    | 20.0              | 3.11             | 6.3                            | NDR   |
| 13/2/08 | Yarra River at Newport | 9.0        | 7.3              | 100          | 35.66           |                        | 20.5              | 3.44             | 6.2                            | NDR   |
| 21/2/08 | Dromana                | 0.5        | 7.5              | 100          | 37.12           | >4.6 <sup>2</sup>      | 20.5              | 3.55             | 2.5                            | NDR   |
| 21/2/08 | Patterson River        | 0.5        | 7.7              | 105          | 37.28           | >3.5 <sup>2</sup>      | 22.0              | 0.71             | 3.4                            | NDR   |
| 25/2/08 | Middle Ground Shelf    | 0.5        | 7.3              | 100          | 37.24           | 4.4                    | 19.5              | NDR <sup>1</sup> | 2.5                            | NDR   |
| 25/2/08 | Popes Eye              | 0.5        | 7.4              | 98           | 36.84           | 7.5                    | 18.1              | NDR <sup>1</sup> | 1.6                            | NDR   |
| 25/2/08 | Sorrento Bank          | 0.5        | 7.3              | 98           | 36.59           | >2.7 <sup>2</sup>      | 18.8              | NDR <sup>1</sup> | 1.8                            | NDR   |
| 27/2/08 | Central Bay            | 0.5        | 7.4              | 98           | 37.29           | 4.5                    | 19.0              | NDR <sup>1</sup> | 2.1                            | NDR   |
| 27/2/08 | PoM DMG                | 0.5        | 7.6              | 100          | 37.30           | 5.3                    | 19.5              | NDR <sup>1</sup> | 2.1                            | NDR   |
| 27/2/08 | Hobsons Bay            | 0.5        | 7.9              | 105          | 36.35           | 2.7                    | 20.2              | NDR <sup>1</sup> | 3.6                            | NDR   |
| 27/2/08 | Long Reef              | 0.5        | 7.8              | 103          | 37.56           | >5.0 <sup>2</sup>      | 20.5              | NDR <sup>1</sup> | 1.6                            | NDR   |
| 27/2/08 | Corio Bay              | 0.5        | 7.6              | 100          | 38.40           | 2.3                    | 19.5              | NDR <sup>1</sup> | 3.6                            | NDR   |

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 *in situ* samples are taken at 0.5 m from surface, except Yarra River at Newport and Hobsons Bay where bottom samples are also collected, if required.

Yellow coloured cell indicates a result outside SEPP objective (see Appendix 1 for details).

1. Equipment failure resulted in no data recorded for turbidity and PAR on 25 and 27 February over eight sites (see ER080228 and ER080318).
2. Secchi disc still clearly visible on the bottom.



## BAYWIDE WATER QUALITY MONITORING

TABLE 2 NUTRIENTS AND ALGAL PIGMENTS (NDR – no data recorded; NVR – no valid result)

| Date    | Sampling site          | Depth | Ammonium | Nitrate | Nitrite | Nitrate plus Nitrite | Dissolved Organic Nitrogen | Total Nitrogen | Phosphate | Dissolved Organic Phosphorus | Total Phosphorus | Silicate |
|---------|------------------------|-------|----------|---------|---------|----------------------|----------------------------|----------------|-----------|------------------------------|------------------|----------|
|         |                        | m     | µg/L     | µg/L    | µg/L    | µg/L                 | µg/L                       | µg/L           | µg/L      | µg/L                         | µg/L             | µg/L     |
| 13/2/08 | Yarra River at Newport | 0.5   | 4.0      | 2.3     | <0.4    | 2.3                  | 190                        | 241            | 65        | 22                           | 105              | 283      |
| 13/2/08 | Yarra River at Newport | 9.0   | 7.8      | 2.6     | <0.4    | 2.6                  | 172                        | 207            | 65        | 20                           | 97               | 279      |
| 21/2/08 | Dromana                | 0.5   | 8.2      | 2.6     | <0.4    | 2.6                  | NVR <sup>1</sup>           | 157            | 53        | 13                           | 71               | 126      |
| 21/2/08 | Patterson River        | 0.5   | 3.9      | 1.5     | <0.4    | 1.5                  | 140                        | 158            | 58        | 9                            | 78               | 43       |
| 25/2/08 | Middle Ground Shelf    | 0.5   | 0.7      | 1.0     | <0.4    | 1.0                  | 139                        | 149            | 38        | 29                           | 76               | 54       |
| 25/2/08 | Popes Eye              | 0.5   | 3.7      | 2.4     | <0.4    | 2.4                  | NVR <sup>1</sup>           | 123            | 40        | 12                           | 53               | 87       |
| 25/2/08 | Sorrento Bank          | 0.5   | 4.4      | 1.5     | <0.4    | 1.5                  | 124                        | 125            | 30        | 9                            | 46               | 79       |
| 27/2/08 | Central Bay            | 0.5   | 3.0      | 1.9     | <0.4    | 1.9                  | NVR <sup>1</sup>           | 157            | 56        | 17                           | 79               | 67       |
| 27/2/08 | PoM DMG                | 0.5   | 2.2      | 1.2     | <0.4    | 1.2                  | 140                        | 153            | 54        | 17                           | 77               | 56       |
| 27/2/08 | Hobsons Bay            | 0.5   | 1.5      | 1.1     | <0.4    | 1.1                  | 157                        | 191            | 65        | 20                           | 96               | 85       |
| 27/2/08 | Long Reef              | 0.5   | 2.0      | 1.4     | <0.4    | 1.4                  | 146                        | 163            | 61        | 15                           | 88               | 32       |
| 27/2/08 | Corio Bay              | 0.5   | 1.9      | 1.3     | <0.4    | 1.3                  | 177                        | 204            | 75        | 21                           | 106              | 87       |

### NOTES:

Green coloured cells indicate results above ANZECC trigger value (see Appendix 1 for details). These results are within natural variation in Port Phillip Bay (see Table 6, Shewhart Control Limits).

See “Table 4 Phytoplankton and Algal Pigments” for Chlorophyll-*a* and Phaeophytin-*a* data.

1. No valid result - data under further investigation.

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

| Date    | Sampling site                      | Depth<br>m | Arsenic<br>µg/L  | Tri-butyl tin <sup>1</sup><br>(TBT)<br>µg/Lx10 <sup>-3</sup> | Cadmium<br>µg/L | Chromium<br>µg/L | Copper<br>µg/L | Mercury<br>µg/L | Nickel<br>µg/L | Lead<br>µg/L | Zinc<br>µg/L     |
|---------|------------------------------------|------------|------------------|--|-----------------|------------------|----------------|-----------------|----------------|--------------|------------------|
| 13/2/08 | Yarra River at Newport - total     | 0.5        | 2.5              | <2   | <0.2            | <0.5             | 3              | <0.1            | 1.2            | <0.2         | 7                |
| 13/2/08 | Yarra River at Newport - dissolved | 0.5        | 2.6 <sup>3</sup> | NST  | <0.2            | <0.5             | 2              | <0.1            | 0.7            | <0.2         | 9 <sup>3</sup>   |
| 13/2/08 | Yarra River at Newport - total     | 9.0        | 2.9              | NST  | <0.2            | <0.5             | 2              | <0.1            | 1.1            | <0.2         | 7                |
| 13/2/08 | Yarra River at Newport - dissolved | 9.0        | 2.7              | NST  | <0.2            | <0.5             | 1              | <0.1            | 0.8            | <0.2         | 6                |
| 21/2/08 | Dromana - total                    | 0.5        | 3.1              | NST  | <0.2            | 0.6              | <1             | <0.1            | 0.6            | <0.2         | 7                |
| 21/2/08 | Dromana - dissolved                | 0.5        | 2.9              | NST  | NAR             | NAR              | NAR            | NAR             | NAR            | NAR          | NVR <sup>2</sup> |
| 21/2/08 | Patterson River - total            | 0.5        | 3.4              | NST  | <0.2            | 0.7              | <1             | <0.1            | 0.7            | <0.2         | <5               |
| 21/2/08 | Patterson River - dissolved        | 0.5        | 2.8              | NST  | NAR             | NAR              | NAR            | NAR             | NAR            | NAR          | NAR              |
| 25/2/08 | Middle Ground Shelf - total        | 0.5        | 3.3              | NST  | <0.2            | <0.5             | <1             | <0.1            | 0.6            | <0.2         | <5               |
| 25/2/08 | Middle Ground Shelf - dissolved    | 0.5        | 3.2              | NST  | NAR             | NAR              | NAR            | NAR             | NAR            | NAR          | NAR              |
| 25/2/08 | Popes Eye                          | 0.5        | 2.9              | NST  | <0.2            | <0.5             | <1             | <0.1            | <0.5           | <0.2         | <5               |
| 25/2/08 | Sorrento Bank                      | 0.5        | 2.9              | NST  | <0.2            | <0.5             | <1             | <0.1            | <0.5           | <0.2         | <5               |
| 27/2/08 | Central Bay - total                | 0.5        | 3.4              | NST  | <0.2            | 0.6              | <1             | <0.1            | 0.7            | <0.2         | <5               |
| 27/2/08 | Central Bay - dissolved            | 0.5        | 3.0              | NST  | NAR             | NAR              | NAR            | NAR             | NAR            | NAR          | NAR              |
| 27/2/08 | PoM DMG - total                    | 0.5        | 3.5              | NST  | <0.2            | <0.5             | <1             | <0.1            | 0.6            | <0.2         | <5               |
| 27/2/08 | PoM DMG - dissolved                | 0.5        | 2.7              | NST  | NAR             | NAR              | NAR            | NAR             | NAR            | NAR          | NAR              |
| 27/2/08 | Hobsons Bay - total                | 0.5        | 3.5              | <2   | <0.2            | <0.5             | <1             | <0.1            | 0.7            | <0.2         | <5               |
| 27/2/08 | Hobsons Bay - dissolved            | 0.5        | 3.0              | NST  | <0.2            | <0.5             | 1 <sup>3</sup> | <0.1            | 0.6            | <0.2         | 6 <sup>3</sup>   |
| 27/2/08 | Long Reef - total                  | 0.5        | 3.5              | NST  | <0.2            | <0.5             | <1             | <0.1            | 0.6            | <0.2         | <5               |
| 27/2/08 | Long Reef - dissolved              | 0.5        | 2.8              | NST  | NAR             | NAR              | NAR            | NAR             | NAR            | NAR          | NAR              |
| 27/2/08 | Corio Bay - total                  | 0.5        | 4.0              | NST  | <0.2            | <0.5             | <1             | <0.1            | 0.9            | <0.2         | <5               |
| 27/2/08 | Corio Bay - dissolved              | 0.5        | 3.6              | NST  | <0.2            | <0.5             | <1             | <0.1            | 0.8            | <0.2         | NVR <sup>2</sup> |

NOTES:

Yellow coloured cells indicate results above SEPP objectives (for metals, ANZECC triggers are the default objective when no SEPP value is specified; see Appendix 1 for details). These results are within natural variation in Port Phillip Bay (see Table 6, Shewhart Control Limits.)

1. TBT is only sampled from sub-surface levels at Yarra River at Newport and Hobsons Bay.
2. No valid result - data under further investigation.
3. Dissolved result greater than total results but within acceptable levels of inter-sample variation.



## BAYWIDE WATER QUALITY MONITORING

TABLE 4 PHYTOPLANKTON AND ALGAL PIGMENTS (NDR – no data recorded; NST – no sample taken)

| Date    | Sampling site          | Depth<br>m | Chlorophyll-a<br>µg/L | Phaeophytin-a<br>µg/L | Fluorescence<br>(as <i>in situ</i><br>chlorophyll-a)<br>µg/L | Total<br>Phytoplankton<br>cells/L | Diatoms<br>cells/L | Dinoflagellates<br>cells/L | Other flagellates<br>cells/L |
|---------|------------------------|------------|-----------------------|-----------------------|--|-----------------------------------|--------------------|----------------------------|------------------------------|
| 13/2/08 | Yarra River at Newport | 0.5        | 2.3                   | 0.73                  | 0.82   | NST <sup>1</sup>                  | NST <sup>1</sup>   | NST <sup>1</sup>           | NST <sup>1</sup>             |
| 13/2/08 | Yarra River at Newport | 9.0        | NST                   | NST                   | 0.69   | NST <sup>1</sup>                  | NST <sup>1</sup>   | NST <sup>1</sup>           | NST <sup>1</sup>             |
| 21/2/08 | Dromana                | 0.5        | 0.90                  | 0.12                  | 11.4 <sup>3</sup>  | 7.1 E+05                          | 5.3 E+05           | 3.0 E+04                   | 1.5 E+05                     |
| 21/2/08 | Patterson River        | 0.5        | 0.74                  | 0.08                  | 0.35   | 1.4 E+06                          | 1.3 E+06           | 3.3 E+04                   | 7.0 E+04                     |
| 25/2/08 | Middle Ground Shelf    | 0.5        | 1.70                  | 0.18                  | NDR <sup>2</sup>   | 9.7 E+05                          | 9.2 E+05           | 2.0 E+04                   | 3.0 E+04                     |
| 25/2/08 | Popes Eye              | 0.5        | 0.90                  | 0.31                  | NDR <sup>2</sup>   | 5.5 E+05                          | 5.0 E+05           | 1.0 E+04                   | 4.0 E+04                     |
| 25/2/08 | Sorrento Bank          | 0.5        | 0.77                  | 0.38                  | NDR <sup>2</sup>   | 2.2 E+05                          | 8.5 E+04           | 1.2 E+04                   | 1.2 E+05                     |
| 27/2/08 | Central Bay            | 0.5        | 0.99                  | 0.04                  | NDR <sup>2</sup>   | 7.7 E+05                          | 5.5 E+05           | 3.3 E+04                   | 1.9 E+05                     |
| 27/2/08 | PoM DMG                | 0.5        | 1.13                  | 0.18                  | NDR <sup>2</sup>   | 7.2 E+05                          | 6.0 E+05           | 1.3 E+04                   | 1.0 E+05                     |
| 27/2/08 | Hobsons Bay            | 0.5        | 2.25                  | 0.47                  | NDR <sup>2</sup>   | 1.1 E+06                          | 8.8 E+05           | 2.0 E+04                   | 1.5 E+05                     |
| 27/2/08 | Long Reef              | 0.5        | 0.41                  | 0.13                  | NDR <sup>2</sup>   | 6.8 E+05                          | 6.2 E+05           | 5.0 E+03                   | 5.8 E+04                     |
| 27/2/08 | Corio Bay              | 0.5        | 1.07                  | 0.17                  | NDR <sup>2</sup>   | 1.1 E+06                          | 8.2 E+05           | 5.3 E+04                   | 1.9 E+05                     |

### NOTES

Yellow coloured cell indicates result above SEPP objective (annual median)(see Appendix 1 for details).

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 sample taken at Yarra River at Newport site due to equipment failure (see ER080319).
2. Equipment failure resulted in no data recorded for fluorescence on 25 and 27 February 2008 over eight sites (see ER080318 and ER080228).
3. Data under further investigation.

## 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. 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).

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 5).

The derivation 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)).

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.
- A Shewhart control chart is used to compare short-term events.

As detailed in Exception Report ER080229, EWMA control charts were not available for comparison of results during this period.

The control limits listed in Table 6 are derived from Shewhart control charts and are appropriate for the assessment of short-term variations in water quality. The Shewhart control limits are as issued by the Port of Melbourne Corporation on January 28, 2008.

# BAYWIDE WATER QUALITY MONITORING

## APPENDIX 1 (CONT'D)

TABLE 5. SEPP OBJECTIVES AND ANZECC TRIGGER VALUES

|   | Yarra River at Newport | Hobsons Bay | Corio Bay | Long Reef   | Central Bay | PoM DMG    | Patterson River | Dromana    | Middle Ground Shelf | Sorrento Bank | Popes Eye  |
|---|------------------------|-------------|-----------|-------------|-------------|------------|-----------------|------------|---------------------|---------------|------------|
| <b>Policy categories</b>                                      |                        |             |           |             |             |            |                 |            |                     |               |            |
| State Environment Protection Policy (SEPP) schedule & segment | F6 Hobsons             | F6 Hobsons  | F6 Corio  | F6 Werribee | F6 General  | F6 General | F6 General      | F6 General | F6 General          | F6 General    | F6 General |
| ANZECC Level of Protection                                    | 95%                    |             |           |             | 99%         |            |                 |            |                     |               |            |
| <b>Channel Deepening PARAMETER</b>                            |                        |             |           |             |             |            |                 |            |                     |               |            |
| Dissolved oxygen (% saturation)                               |                        |             |           |             |             |            |                 |            |                     |               |            |
| min for 1m below surface                                      | >90%                   | >90%        | >90%      | >90%        | >90%        | >90%       | >90%            | >90%       | >90%                | >90%          | >90%       |
| min 1m above bottom   | >90%                   | >90%        |           |             |             |            |                 |            |                     |               |            |
| lower limit for 90th percentile                               |                        |             |           |             | >90%        | >90%       |                 |            | >90%                | >90%          | >90%       |
| Salinity variation  | N ± 5%                 | N ± 5%      | N ± 5%    | N ± 5%      | N ± 5%      | N ± 5%     | N ± 5%          | N ± 5%     | N ± 5%              | N ± 5%        | N ± 5%     |
| Temperature (°C)  | N ± 1                  | N ± 1       | N ± 1     | N ± 1       | N ± 1       | N ± 1      | N ± 1           | N ± 1      | N ± 1               | N ± 1         | N ± 1      |
| Secchi disc depth (m)   | >2                     | >2          | >3        | >3          | >4          | >4         | >4              | >4         | >4                  | >4            | >4         |
| Turbidity (NTU)   | 0.5 - 10               | 0.5 - 10    | 0.5 - 10  | 0.5 - 10    | 0.5 - 10    | 0.5 - 10   | 0.5 - 10        | 0.5 - 10   | 0.5 - 10            | 0.5 - 10      | 0.5 - 10   |
| Suspended Solids (mg/L)                                       |                        |             |           |             |             |            |                 |            |                     |               |            |
| Chlorophyll-a (µg/L) annual median                            | 2.5                    | 2.5         | 1.5       | 2.5         | 1.0         | 1.0        | 1.0             | 1.0        | 1.0                 | 1.0           | 1.0        |
| annual 90th percentile  | 4                      | 4           | 2.5       | 4           | 2           | 2          | 2               | 2          | 2                   | 2             | 2          |
| Phaeophytin-a (µg/L)  |                        |             |           |             |             |            |                 |            |                     |               |            |
| Ammonium (µg/L)   | 15                     | 15          | 15        | 15          | 15          | 15         | 15              | 15         | 15                  | 15            | 15         |
| Nitrate (µg/L)  |                        |             |           |             |             |            |                 |            |                     |               |            |
| Nitrite (µg/L)  |                        |             |           |             |             |            |                 |            |                     |               |            |
| Nitrate plus nitrite (µg/L)                                   | 5                      | 5           | 5         | 5           | 5           | 5          | 5               | 5          | 5                   | 5             | 5          |
| Total Nitrogen (µg/L)   | 120                    | 120         | 120       | 120         | 120         | 120        | 120             | 120        | 120                 | 120           | 120        |
| Dissolved organic nitrogen (µg/L)                             |                        |             |           |             |             |            |                 |            |                     |               |            |
| Phosphate (µg/L)  | 10                     | 10          | 10        | 10          | 10          | 10         | 10              | 10         | 10                  | 10            | 10         |
| Total Phosphorus (µg/L)                                       | 25                     | 25          | 25        | 25          | 25          | 25         | 25              | 25         | 25                  | 25            | 25         |
| Organic Phosphorus (µg/L)                                     |                        |             |           |             |             |            |                 |            |                     |               |            |
| Silicate (µg/L)   |                        |             |           |             |             |            |                 |            |                     |               |            |
| Arsenic (µg/L)  | <3                     | <3          | <3        | <3          | <3          | <3         | <3              | <3         | <3                  | <3            | <3         |
| Cadmium (µg/L)  | 5.5                    | 5.5         | 5.5       | 5.5         | <0.15       | <0.15      | <0.15           | <0.15      | <0.15               | <0.15         | <0.15      |
| Chromium (µg/L)   | <5                     | <5          | <5        | <5          | <5          | <5         | <5              | <5         | <5                  | <5            | <5         |
| Copper (µg/L)   | 1.3                    | 1.3         | 1.3       | 1.3         | 0.3         | 0.3        | 0.3             | 0.3        | 0.3                 | 0.3           | 0.3        |
| Lead (µg/L)   | 4.4                    | 4.4         | 4.4       | 4.4         | 2.2         | 2.2        | 2.2             | 2.2        | 2.2                 | 2.2           | 2.2        |
| Mercury (µg/L)  | 0.4                    | 0.4         | 0.1       | 0.1         | 0.1         | 0.1        | 0.1             | 0.1        | 0.1                 | 0.1           | 0.1        |
| Nickel (µg/L)   | 70                     | 70          | 70        | 70          | 7           | 7          | 7               | 7          | 7                   | 7             | 7          |
| Zinc (µg/L)   | <10                    | <10         | <5        | <5          | <5          | <5         | <5              | <5         | <5                  | <5            | <5         |
| TBT (µg/L)  | 0.006                  | 0.006       | 0.006     | 0.006       | 0.0004      | 0.0004     | 0.0004          | 0.0004     | 0.0004              | 0.0004        | 0.0004     |

N = natural background  
ANZECC trigger values not highlighted

SEPP Schedule F6 - Waters of Port Phillip Bay objectives  
Below limit of reporting

Cadmium limit of reporting is above SEPP F6 'general' segment's objective  
Empty cell denotes no SEPP objective or ANZECC trigger value exists

TABLE 6. SHEWHART CONTROL LIMITS FOR LISTED WATER QUALITY PARAMETERS

| Sampling site          | Total nitrogen | Ammonium | Nitrate plus Nitrite | Total phosphorus | Phosphate | Arsenic | Cadmium | Chromium | Copper | Lead | Mercury | Nickel | Zinc  | TBT  |
|------------------------|----------------|----------|----------------------|------------------|-----------|---------|---------|----------|--------|------|---------|--------|-------|------|
|                        | µg/L           | µg/L     | µg/L                 | µg/L             | µg/L      | µg/L    | µg/L    | µg/L     | µg/L   | µg/L | µg/L    | µg/L   | µg/L  | 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       | *      | *    | *       | 1.06   | *     | NA   |
| Dromana                | 222.84         | 11.03    | 5.71                 | 89.64            | 75.42     | 3.58    | *       | NA       | *      | *    | *       | 1.14   | *     | 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)).  
 Table 6 amended by Port of Melbourne Corporation on January 28, 2008.



# BAYWIDE WATER QUALITY MONITORING

## APPENDIX 2

### TABLE 7. PHYTOPLANKTON DATA (NST – No Sample Taken)

Analysis of phytoplankton species in water sample  
Feb-08

|                               |                                | Yarra<br>River at<br>Newport | Dromana   | Patterson<br>River | Middle<br>Ground<br>Shelf | Popes Eye | Sorrento<br>Bank | Central Bay | Corio Bay | Hobsons<br>Bay | Long Reef | POM DMG   |
|-------------------------------|--------------------------------|------------------------------|-----------|--------------------|---------------------------|-----------|------------------|-------------|-----------|----------------|-----------|-----------|
| Collection Date               |                                | 13-Feb-08                    | 21-Feb-08 | 21-Feb-08          | 25-Feb-08                 | 25-Feb-08 | 25-Feb-08        | 27-Feb-08   | 27-Feb-08 | 27-Feb-08      | 27-Feb-08 | 27-Feb-08 |
| Count Method                  |                                |                              | Sedgewick | Sedgewick          | Sedgewick                 | Sedgewick | Sedgewick        | Sedgewick   | Sedgewick | Sedgewick      | Sedgewick | Sedgewick |
| Genus                         | Species                        | Estimate Cells/L             |           |                    |                           |           |                  |             |           |                |           |           |
| <b>Total Phytoplankton</b>    |                                | NST                          | 7.1E+05   | 1.4E+06            | 9.7E+05                   | 5.5E+05   | 2.2E+05          | 7.7E+05     | 1.1E+06   | 1.1E+06        | 6.8E+05   | 7.2E+05   |
| <b>Diatoms</b>                |                                |                              | 5.3E+05   | 1.3E+06            | 9.2E+05                   | 5.0E+05   | 8.5E+04          | 5.5E+05     | 8.2E+05   | 8.8E+05        | 6.2E+05   | 6.0E+05   |
| <b>Dinoflagellates</b>        |                                |                              | 3.0E+04   | 3.3E+04            | 2.0E+04                   | 1.0E+04   | 1.2E+04          | 3.3E+04     | 5.3E+04   | 2.0E+04        | 5.0E+03   | 1.3E+04   |
| <b>Other flagellates</b>      |                                |                              | 1.5E+05   | 7.0E+04            | 3.0E+04                   | 4.0E+04   | 1.2E+05          | 1.9E+05     | 1.9E+05   | 1.5E+05        | 5.8E+04   | 1.0E+05   |
| <b>Diatoms</b>                |                                |                              |           |                    |                           |           |                  |             |           |                |           |           |
| <i>Amphora</i>                | <i>sp.</i>                     |                              | 6.7E+03   | 3.3E+03            |                           |           | x                |             | 3.3E+03   | 3.3E+03        | 2.5E+03   |           |
| <i>Anaulus</i>                | <i>australis</i>               |                              |           |                    | 6.7E+03                   |           |                  |             |           |                |           |           |
| <i>Asteromphalus</i>          | <i>sarcophagus</i>             |                              | x         | 6.7E+03            | 3.3E+03                   | x         | 2.0E+03          | 3.3E+03     | x         | x              | 2.5E+03   | 3.3E+03   |
| <i>Bacillaria</i>             | <i>paxillifera</i>             |                              |           | x                  |                           |           |                  |             |           |                |           |           |
| <i>Bacteriastrium</i>         | <i>elegans</i>                 |                              |           |                    | 1.7E+03                   | 1.3E+04   |                  |             |           |                |           |           |
| <i>Cerataulina</i>            | <i>sp.</i>                     |                              |           |                    | x                         |           |                  |             | x         |                | 2.5E+03   | x         |
| <i>Chaetoceros</i>            | <i>spp.</i>                    |                              | 4.4E+05   | 1.2E+06            | 8.3E+05                   | 4.4E+05   | 2.6E+04          | 4.4E+05     | 7.4E+05   | 6.7E+05        | 5.6E+05   | 5.1E+05   |
| <i>Cocconeis</i>              | <i>spp.</i>                    |                              | 1.0E+04   | 3.3E+03            | 3.3E+03                   | 5.0E+03   | 2.0E+04          | 6.7E+03     | 3.3E+03   | 3.3E+03        | 1.3E+04   | 6.7E+03   |
| <i>Cylindrotheca</i>          | <i>closterium</i>              |                              | 2.7E+04   | 4.0E+04            | 1.7E+04                   | 7.5E+03   | 8.0E+03          | 3.3E+04     | 6.7E+03   | 1.0E+04        | 1.0E+04   | 1.7E+04   |
| <i>Dactyliosolen</i>          | <i>antarcticus</i>             |                              |           |                    | x                         | x         |                  |             | 3.3E+03   | 6.7E+03        |           | 3.3E+03   |
| <i>Dactyliosolen</i>          | <i>fragilissimus</i>           |                              | 1.0E+04   |                    |                           | 7.5E+03   |                  |             |           | x              | x         | x         |
| <i>Ditylum</i>                | <i>brightwellii</i>            |                              |           |                    |                           |           |                  |             |           | x              |           |           |
| <i>Entomoneis</i>             | <i>sp.</i>                     |                              | x         |                    | 3.3E+03                   | x         | 4.0E+03          |             |           | x              |           | 6.7E+03   |
| <i>Eucampia</i>               | <i>zodiacus</i>                |                              | 3.3E+03   | 3.3E+03            | x                         |           |                  |             |           | x              |           |           |
| <i>Fragilaria</i>             | <i>sp.</i>                     |                              |           |                    |                           |           |                  |             |           |                | x         |           |
| <i>Guinardia</i>              | <i>flaccida</i>                |                              | x         | x                  | x                         | x         |                  | 1.0E+04     |           | x              | x         | x         |
| <i>Hemiaulus</i>              | <i>sp.</i>                     |                              | x         | 6.7E+03            | 6.7E+03                   | x         | x                | 1.3E+04     | 6.7E+03   | 3.3E+03        | 2.5E+03   | 1.7E+04   |
| <i>Leptocylindrus</i>         | <i>danicus</i>                 |                              | x         | x                  | 1.0E+04                   |           |                  | 1.0E+04     |           | x              | 5.0E+03   | 1.7E+04   |
| <i>Licmophora</i>             | <i>sp.</i>                     |                              |           |                    |                           | x         |                  |             | 3.3E+03   |                |           |           |
| <i>Minidiscus</i>             | <i>tricolatus</i>              |                              |           |                    |                           |           |                  | 1.7E+04     |           | 1.3E+04        |           |           |
| <i>Naviculoid</i>             | <i>spp.</i>                    |                              | 1.3E+04   | 1.0E+04            | 3.3E+03                   | 1.3E+04   | 4.0E+03          | 3.3E+03     | x         | 6.7E+03        |           | 3.3E+03   |
| <i>Nitzschia</i>              | <i>spp.</i>                    |                              | 6.7E+03   | 3.3E+03            |                           | 2.5E+03   | 6.0E+03          | 3.3E+03     | 1.3E+04   | 1.0E+04        | 7.5E+03   | 1.0E+04   |
| <i>Pleurosigma</i>            | <i>sp.</i>                     |                              | x         | x                  | 6.7E+03                   | x         | x                | x           | 3.3E+03   | x              | 2.5E+03   |           |
| <i>Proboscia</i>              | <i>alata</i>                   |                              | x         | 3.3E+03            | 3.3E+03                   | 5.0E+03   | 3.3E+03          | 3.3E+03     |           | x              | 2.5E+03   | x         |
| <i>Pseudo-nitzschia</i>       | <i>delicatissima group</i>     |                              | 4.6E+03   | 2.6E+03            |                           | 2.0E+02   | 6.0E+02          |             | 3.2E+03   | 5.0E+02        |           | 8.0E+02   |
| <i>Pseudo-nitzschia</i>       | <i>galaxiae</i>                |                              | 4.0E+02   | 4.0E+02            |                           |           | 4.0E+02          |             |           |                | 4.0E+02   |           |
| <i>Pseudo-nitzschia</i>       | <i>pungens/multiseriis</i>     |                              | 3.4E+03   | 5.6E+03            | 1.4E+03                   | 2.0E+02   |                  |             |           | 8.5E+02        |           | 8.0E+02   |
| <i>Pseudo-nitzschia</i>       | <i>turgidula/dolorosa</i>      |                              | 6.0E+02   | 4.0E+02            |                           |           |                  |             |           |                |           |           |
| <i>Rhizosolenia</i>           | <i>spp.</i>                    |                              |           | x                  | 6.7E+03                   |           |                  | 3.3E+03     |           | 3.3E+03        |           | 3.3E+03   |
| <i>Skeletonema</i>            | <i>costatum/pseudocostatum</i> |                              | 6.7E+03   | 5.7E+04            |                           |           |                  |             |           | 1.2E+05        |           |           |
| <i>Striatella</i>             | <i>unipunctata</i>             |                              |           | 6.7E+03            |                           |           |                  |             |           |                |           |           |
| <i>Surirella</i>              | <i>sp.</i>                     |                              |           | x                  |                           |           |                  |             |           |                |           |           |
| <i>Thalassiosira</i>          | <i>sp.</i>                     |                              | 3.3E+03   | x                  |                           |           |                  |             |           |                |           | 3.3E+03   |
| <i>Thalassiosira</i>          | <i>cf. mala</i>                |                              |           |                    | 2.3E+04                   | 7.5E+03   | 1.4E+04          | 3.3E+03     | 2.7E+04   | 3.0E+04        | 5.0E+03   | 6.7E+03   |
| <b>Dinoflagellates</b>        |                                |                              |           |                    |                           |           |                  |             |           |                |           |           |
| <i>Alexandrium</i>            | <i>sp.</i>                     |                              | x         | x                  |                           |           |                  |             |           |                |           |           |
| <i>Amphidiniopsis</i>         | <i>sp.</i>                     |                              | x         |                    |                           |           |                  |             |           |                |           |           |
| <i>Amphidinium</i>            | <i>sp.</i>                     |                              | 3.3E+03   |                    |                           |           |                  |             |           |                |           |           |
| <i>Ceratium</i>               | <i>tenue</i>                   |                              | x         | x                  | 6.7E+03                   | x         |                  |             |           |                | x         | x         |
| <i>Dinophysis/Phalochroma</i> | <i>rotundatum</i>              |                              | x         |                    |                           |           |                  |             |           |                |           |           |
| <i>Gonyaulax</i>              | <i>spp.</i>                    |                              |           | x                  |                           |           |                  |             |           |                |           |           |
| <i>Gymnodinioid</i>           | <i>spp.</i>                    |                              | 2.0E+04   | 2.3E+04            | 1.0E+04                   | 7.5E+03   | 1.0E+04          | 2.7E+04     | 4.0E+04   | 1.7E+04        | 5.0E+03   | 1.3E+04   |
| <i>Gyrodinium</i>             | <i>spp.</i>                    |                              | x         |                    |                           | 2.5E+03   |                  |             |           |                |           | x         |
| <i>Heterocapsa</i>            | <i>rotundata</i>               |                              | 3.3E+03   | 3.3E+03            |                           |           | 2.0E+03          | 6.7E+03     | 6.7E+03   | 3.3E+03        |           |           |
| <i>Peridinium</i>             | <i>sp.</i>                     |                              | x         | 6.7E+03            |                           |           | x                |             |           |                |           |           |
| <i>Prorocentrum</i>           | <i>gracile</i>                 |                              |           |                    |                           | x         |                  |             | 3.3E+03   |                | x         | x         |
| <i>Prorocentrum</i>           | <i>triestinum</i>              |                              | 3.3E+03   |                    |                           |           |                  |             |           |                |           |           |
| <i>Protoceratium</i>          | <i>reticulatum</i>             |                              | x         | x                  |                           |           |                  |             |           |                |           |           |
| <i>Protoperdinium</i>         | <i>spp.</i>                    |                              | x         | x                  | 3.3E+03                   |           |                  |             | x         |                | x         |           |
| <i>Scrippsiella</i>           | <i>spp.</i>                    |                              | x         | x                  |                           |           |                  |             | 3.3E+03   |                |           |           |
| <i>Takayama</i>               | <i>pulchella</i>               |                              | 2.5E+02   |                    |                           |           |                  |             |           |                |           |           |

TABLE 7 (CONT'D). PHYTOPLANKTON DATA CONTINUED (NST – no sample taken)

Analysis of phytoplankton species in water sample  
Feb-08

|                         |                   | Yarra River at Newport | Dromana   | Patterson River | Middle Ground Shelf | Popes Eye | Sorrento Bank | Central Bay | Corio Bay | Hobsons Bay | Long Reef | POM DMG   |
|-------------------------|-------------------|------------------------|-----------|-----------------|---------------------|-----------|---------------|-------------|-----------|-------------|-----------|-----------|
| Collection Date         |                   | 13-Feb-08              | 21-Feb-08 | 21-Feb-08       | 25-Feb-08           | 25-Feb-08 | 25-Feb-08     | 27-Feb-08   | 27-Feb-08 | 27-Feb-08   | 27-Feb-08 | 27-Feb-08 |
| Count Method            |                   |                        | Sedgewick | Sedgewick       | Sedgewick           | Sedgewick | Sedgewick     | Sedgewick   | Sedgewick | Sedgewick   | Sedgewick | Sedgewick |
| <b>Chrysophytes</b>     |                   |                        |           |                 |                     |           |               |             |           |             |           |           |
| <i>Calycomonas</i>      | sp.               | NST                    |           |                 |                     |           |               |             | 3.3E+03   | 3.3E+03     |           |           |
| <b>Prymnesiophytes</b>  |                   |                        |           |                 |                     |           |               |             |           |             |           |           |
| <i>Calciopappus</i>     | <i>caudatus</i>   | NST                    |           |                 |                     |           |               |             |           |             | 5.0E+03   |           |
| <i>Chrysochromulina</i> | spp.              |                        | 1.0E+04   | 3.3E+03         | 3.3E+03             |           | 4.0E+03       | 3.3E+03     | 6.7E+03   | 6.7E+03     | 2.5E+03   | 1.3E+04   |
| <i>Emiliania</i>        | <i>huxleyi</i>    |                        |           |                 |                     |           |               |             | 6.7E+03   |             |           |           |
| <i>Gephyrocapsa</i>     | <i>oceanica</i>   |                        |           |                 |                     |           | x             | 1.0E+04     | 2.3E+04   | 6.7E+03     |           |           |
| <b>Cryptophytes</b>     |                   |                        |           |                 |                     |           |               |             |           |             |           |           |
| <i>Hemiselmis</i>       | sp.               | NST                    | 2.7E+04   | 1.7E+04         | 3.3E+03             | 2.5E+03   | 1.6E+04       | 7.0E+04     | 7.0E+04   | 5.7E+04     | 2.0E+04   | 1.3E+04   |
| <i>Leucocryptos</i>     | <i>marina</i>     |                        | 6.7E+03   | 1.3E+04         |                     | 2.5E+03   | 2.0E+03       |             |           |             |           |           |
| <i>Plagioselmis</i>     | <i>prolonga</i>   |                        | 5.0E+04   | 1.3E+04         | 1.3E+04             | 1.8E+04   | 4.4E+04       | 4.7E+04     | 7.0E+04   | 3.3E+04     | 1.8E+04   | 3.0E+04   |
| <i>Teleaulax</i>        | <i>acuta</i>      |                        | 1.0E+04   |                 | 3.3E+03             | 5.0E+03   | 8.0E+03       | 6.7E+03     | 6.7E+03   | 3.3E+03     |           | 6.7E+03   |
| <b>Prasinophytes</b>    |                   |                        |           |                 |                     |           |               |             |           |             |           |           |
| <i>Micromonas</i>       | <i>pusilla</i>    | NST                    |           |                 |                     |           |               |             |           |             |           |           |
| <i>Nephroselmis</i>     | sp.               |                        |           |                 |                     |           |               |             |           |             |           |           |
| <i>Pterosperma</i>      | sp.               |                        |           | 6.7E+03         |                     |           |               |             |           |             |           |           |
| <i>Pyramimonas</i>      | spp.              |                        | 4.3E+04   | 1.3E+04         | 6.7E+03             | 1.0E+04   | 2.2E+04       | 3.7E+04     | 1.7E+04   | 3.7E+04     | 1.3E+04   | 2.7E+04   |
| <i>Tetraselmis</i>      | spp.              |                        |           | 3.3E+03         |                     |           | 1.0E+04       | 3.3E+03     | 3.3E+03   | 6.7E+03     |           |           |
| <b>Euglenophyta</b>     |                   |                        |           |                 |                     |           |               |             |           |             |           |           |
| <i>Eutreptiella</i>     | spp.              | NST                    |           |                 |                     |           | x             |             |           | 3.3E+03     |           | x         |
| <b>Other</b>            |                   |                        |           |                 |                     |           |               |             |           |             |           |           |
| <i>Apedinella</i>       | <i>spinifera</i>  | NST                    |           |                 |                     |           | 2.0E+03       |             |           |             |           |           |
| <i>Ebria</i>            | <i>tripartita</i> |                        | x         | x               |                     | 2.5E+03   |               |             |           | x           |           |           |
| <i>Dictyocha</i>        | <i>fibula</i>     |                        | x         | x               |                     |           |               |             |           |             |           |           |

| VQSAP Phytoplankton action levels in cells per litre (DPI, 2004) | Warning to growers | Comparative data in the report |         |                 |                     |           |               |             |           |             |           |         |
|--|--------------------|--------------------------------|---------|-----------------|---------------------|-----------|---------------|-------------|-----------|-------------|-----------|---------|
|  |                    | Yarra River at Newport         | Dromana | Patterson River | Middle Ground Shelf | Popes Eye | Sorrento Bank | Central Bay | Corio Bay | Hobsons Bay | Long Reef | POM DMG |
| <i>Pseudo-nitzschia</i> spp.                                     | 50 000             | NST                            | 9 000   | 9 000           | 1 400               | 400       | 1 000         | 0           | 3 200     | 1 350       | 400       | 1 600   |
| <i>Rhizosolenia cf chunii</i>                                    | 10 000             |                                |         |                 |                     |           |               |             |           |             |           |         |
| <i>Alexandrium catenella</i>                                     | 100                |                                | 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       |
| <i>Alexandrium tamarense</i>                                     | 100                |                                | 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       |
| <i>Dinophysis caudata</i>  | 1 000              |                                | 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       |
| <i>Gymnodinium catenatum</i>                                     | 100                |                                |         |                 |                     |           |               |             |           |             |           |         |
| <i>Karenia mikimotoi</i>   | 1 000              |                                | 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       |
| <i>Prorocentrum lima</i>   | 1 000              |                                |         |                 |                     |           |               |             |           |             |           |         |

NOTES

Sampling method of phytoplankton consisted of a qualitative sample using a net tow vertically through the water column enabling species identification, and a quantitative grab sample using a water column hosepipe sampler enabling enumeration of phytoplankton. A ten minute net tow was not used – see Exception Report ER080321

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

Blank cells denotes neither genus nor species were detected.

For table on VQSAP 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.

