Victorian Water Quality Monitoring
Annual Report: 2002

Report prepared for

Department of Sustainability and Environment

By
WATER ECOscience Pty Ltd

WATER ECOscience Pty Ltd
ACN 067 477 989

68 Ricketts Road Mt Waverley Victoria Australia 3149
Private Bag 1 Mt Waverley Victoria Australia 3149
telephone +61 3 9550 1000
facsimile +61 3 9543 7372

Report Number:

Project Number: 3041

AUGUST 2003

"Victorian Water Quality Monitoring Annual Report: 2002"
ISSN No: 1445-1646

Table of Contents

List of Tables

List of Figures

Executive Summary

The Victorian Water Quality Monitoring Annual Report for 2002 provides a summary of the water quality for Victorian waters during 2002. It is the latest of a series of reports covering the period 1992 to 2002. Along with the summary of water quality throughout the state, this report provides information on the policy framework under which the water quality is assessed and an overview of the current water quality monitoring programs and their respective status.

The water quality data for 2002 has been sourced from the following monitoring programs:

- Victorian Water Quality Monitoring Network;
- Environment Protection Authority Fixed Site Network (including some Melbourne Water sites);
- Melbourne Water Corporation;
- Major Storages Operational Monitoring Program; and
- Murray-Darling Basin Commission's Water Quality Monitoring Program.

Water quality throughout the state has been summarised and assessed in the light of the objectives and guidelines outlined in the relevant State Environment Protection Policies (SEPPs) and the National Water Quality Management Strategy: Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters (ANZECC).

Assessment was undertaken in three ways, through:

- year 2002 data summarised on a statewide basis, comparing the overall percentage attainment of water quality against the objectives and guidelines in each Catchment Management Authority (CMA) and Catchment and Land Protection Board (CaLP) region;
- year 2002 water quality data summarised on a regional basis, determining the range of water qualities throughout the CMA or CaLP region by calculating the percent attainment for each site against the objectives and guidelines; and
- interpretation of long term water quality for a selection of sites (a monitoring station was selected for each region).

The water quality across the state varied significantly with dry conditions in 2002, and several years preceeding. As per previous reports, water quality with respect to the physical parameters (DO, EC, pH) and nutrients tended to deteriorate from the northeast to the southwest of the state, with attainment of the oxygen, nutrient and salinity objectives and guidelines decreasing to the west of the state. The attainment levels observed in 2002 for the physical parameters (DO, EC, pH) were generally similar to those of 2001.

Attainment of the turbidity objectives and guidelines was lower in the south west of the state and the urban region, indicating poorer water quality with respect to light availability for aquatic life. Attainment of the suspended solids objectives was good throughout the state, with all regions having high overall attainment of both the SEPP objectives and ANZECC guidelines.

Chlorophyll-*a* was only sampled in six of the ten regions as in previous years. For the regions monitored the attainment ranged from 55% to 86%. Attainment against Chlorophyll-*a* has decreased since 2001.

Heavy Metals were analysed in seven regions, with attainment of the SEPP objectives generally high for all metals in all regions, however attainment of the ANZECC guidelines was low for copper and zinc particularly in the southwest and Port Phillip CaLP regions. The toxicity, and therefore guideline level, varies for both of these metals depending on hardness. In order to accurately gauge the water quality with respect to these metals, testing for hardness needs to be included as part of the metals monitoring procedure.

Determining the causes of variation in water quality over time is complex, with a number of factors influencing long term changes in water quality. These can include implementation of strategies and policies, flow conditions, and droughts, among other causes. An attempt has been made to explain the temporal variation for one station in each region.

1 Introduction

The hydrology of catchments in Victoria has been profoundly altered by human activities such as land clearing, water harvesting and storage, and wetland reclamation. These practices have led to changes in the structure and function of aquatic and terrestrial ecosystems and ultimately to a decline in water quality (OCE, 1988). Our changing requirements for domestic, agricultural and industrial water have also taken their toll on the inland waters of Australia and, in many instances, continue to do so. Increased public awareness of environmental issues has seen the need for governments to implement on-going water quality monitoring programs. Such programs are conducted on a regional, statewide and national basis.

On-going water quality monitoring programs provide a basis for managing the state's water resources. Such programs enable long-term trends to be identified and form a framework for predictive model development (Harris, 1994). Monitoring programs may highlght precursors for long-term problems and enable the early implementation of ameliorative measures. Long-term water quality data sets can be used to develop and benchmark the effectiveness of management strategies for land and water use. Moreover, the integration of physico-chemical water quality data with bio-monitoring programs (macroinvertebrate and algae) allows the opportunity to develop a greater understanding of aquatic community ecology in relation to stream health.

Water quality monitoring programs also present the opportunity to assess the status of water resources throughout the state in terms of beneficial uses and environmental values as set out in existing policies. Requirements under such a policy framework vary from achieving best management practice in terms of strategies and guidelines to legal responsibilities under statutory legislation.

This annual report presents a summary of water quality monitoring activities throughout Victoria for the period January 2002 to December 2002. Data contained in this report has been sourced from the following five primary water quality monitoring programs operating throughout the state:

- the Victorian Water Quality Monitoring Program;
- the Environment Protection Authority Fixed Site Network (which includes some Melbourne Water sites);
- Melbourne Water Water Quality Monitoring Network Program;
- the Major Storages Operational Monitoring Program; and
- the Murray-Darling Basin Commission's Water Quality Monitoring Program.

A summary of these programs is presented in Section 1.2. Previous reports have covered the period of monitoring from 1992 to 2000 (Hunter 1993; 1996, Hunter & Zampatti 1994a; 1994b; Hunter & Hedger 1995; WATER ECOscience 1997a; 1997b; 1998, AWT Victoria 1999a; 2000, WATER ECOscience 2001).

The aim of this report is to provide an overview of results from these five water quality monitoring programs operating throughout Victoria in 2002. Specifically, the report summarises water quality data within, and between, the nine Catchment Management Authority (CMA) and one Catchment and Land Protection Board (CaLP) regions in the context of attainment of State Environment Protection Policy (SEPP) objectives and the ANZECC guidelines (ANZECC & ARMCANZ 2000), and identifies those parameters that consistently presented problems during 2002. The statewide and overall CMA and CaLP regional water quality is discussed, along with

specific sites, in terms of reasons for their water quality status. Background information on relevant water quality objectives and guidelines, the current water quality networks and their respective status have also been included.

1.1 Water Quality Legislation and Guidelines

The policy framework, for which water quality throughout the state is assessed, varies from legally enforceable and regionally specific State Environment Protection Policy objectives, to national guidelines which provide performance objectives for best management practice. A list of the State Environment Protection Policies (SEPP) objectives relevant to each CMA and CaLP region throughout the state is presented in Table 1. Compliance for the National Water Quality Management Strategy: Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters (ANZECC) is broken down into lakes, upland rivers and lowland rivers.

1.1.1 State Environment Protection Policies (SEPPs)

The Environment Protection Authority, Victoria (EPA), established under the Environment Protection Act 1970 (Victorian Government 1970), is responsible for the control and prevention of pollution. One of the tools the Authority uses to carry out this function includes the implementation of SEPPs and Industrial Waste Management Policies (IWMPs). The EPA may adopt a SEPP for any portion, element or segment of the environment (Environment Protection Act subsections 16 and 19). SEPP objectives are legally enforceable and regionally specific. In the year 2002, there were six regional SEPPs (W-15A, W-21, W-28A, W-34A, W-34B, and W-36A), a statewide SEPP (Waters of Victoria) and eight regionally specific amendments to the statewide SEPP (Schedules F1–F8). Where regionally specific SEPPs are defined, these take precedence over the Waters of Victoria. Where the relevant SEPP has a qualitative objective or indicator, this takes precedence over the more general ANZECC guidelines.

SEPPs include the following components:

Part I	Preliminary (definitions)
Part II	Boundaries of the Area Affected
Part III	Beneficial Uses to be Protected
Part IV	Water Quality Indicators and Objectives
Part V	Attainment Program
Schedules	Water quality indicators and objectives are prescribed in schedules.

Three of these components are particularly important and deserve elaboration in the context of this report:

- **Beneficial uses to be protected**

Detailed within Part III of each SEPP is a list of the segments, within the area affected by that SEPP, which have been identified as having particular beneficial uses requiring protection with respect to water quality. Examples of beneficial uses include the protection of natural ecosystems, potable water supply, agricultural water supply, stock watering, industrial use, recreational uses and building and structures.

- **Indicators and objectives**

Each segment identified in Part III as having particular beneficial uses requiring protection is identified with a 'Schedule' for water quality in Part IV. For each Schedule, each relevant indicator (eg. pH, temperature) is given a guideline level or objective based on the requirements of the most sensitive beneficial use of that segment of the environment. The guideline level or objective must be met so that beneficial use can occur. The objective is based upon published

standards and research results. Part IV of each SEPP (Water Quality Indicators and Objectives) details the segments within the Policy area to which the water quality indicators and objectives apply and the schedule in which the indicators and objectives are prescribed. These objectives are summarised in Tables AI.1-12. It should be noted that these tables are a summary for the purposes of this report, and the original SEPP's should be referred to for greater detail and interpretation.

- **Attainment program**

An attainment program outlines the mechanisms by which environmental objectives are to be achieved. The attainment program is detailed in Part V of a SEPP. The attainment program may detail general or specific plans to achieve stated water quality objectives. A timetable for the development and implementation of plans may also be included in Part V of the SEPP.

It should be noted that the revised SEPP: Waters of Victoria was gazetted in June 2003. As this SEPP was published in 2003, it has not been applied to 2002 data in this report, although the older SEPP's have been revoked. The revised SEPP's will be applied to 2003 data.

Table 1. List of documents that cover the Water Quality Objectives (SEPP) relevant to each CMA and CaLP region across the state.

The relevant ANZECC guidelines are listed as upland river, lowland river or lake. W.o.V. = Waters of Victoria.

CMA/CaLP Region	Relevant State Environment Protection Policies (SEPPs)
Corangamite	The Waters of Lake Colac and Catchment W-34A (1982) The Waters of the Western District Lakes W-34B (1982) Waters of Victoria (1988)
East Gippsland	The Waters of Far East Gippsland W-21 (1985) Waters of Victoria (1988) W.o.V. Schedule F3 (1988) - Gippsland Lakes and Catchment W.o.V. Schedule F5 (1996) - Waters of the Latrobe and Thomson River Basins and Merriman Ck Catchment
Glenelg-Hopkins	The Waters of Lake Burrumbeet and Catchment W-36A (1983) Waters of Victoria (1988)
Goulburn-Broken	Waters of Victoria (1988)
Mallee	Waters of Victoria (1988)
North Central	Waters of Victoria (1988)
North East	Waters of Victoria (1988)
Port Phillip	The Waters of the Dandenong Valley W-28A (1988) Waters of Victoria (1988) W.o.V. Schedule F1 (1988) - Waters of the Werribee and Little River Catchments W.o.V. Schedule F2 (1988) - Waters of the Maribrynong River and Tributaries W.o.V. Schedule F6 (1997) - Waters of Port Phillip Bay W.o.V. Schedule F7 (1999) - Waters of the Yarra Catchment W.o.V. Schedule F8 (2001) - Waters of Western Port and Catchment
West Gippsland	Waters of Victoria (1988) W.o.V. Schedule F5 (1996) - Waters of the Latrobe and Thomson River Basins and Merriman Ck Catchment
Wimmera	The Waters of the Wimmera River and Catchment W-15A (1985) Waters of Victoria (1988)

1.1.2 Water Quality Guidelines

Guidelines for physical, chemical and biological indicators were used to determine the water quality required to maintain specific environmental values, including industrial uses. Water quality targets set by the relevant guidelines vary depending on the intended environmental value of water. Environmental values also differ from state to state as local climate, geology, flora and fauna will also impact upon the natural condition of a water-body and the economics of maintaining it appropriately. Various sets of guidelines have been established for a number of environmental values including the protection of aquatic ecosystems, recreational water quality, agricultural and industrial use. Of particular relevance to this report is the *National Water Quality Management Strategy: Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC & ARMCANZ 2000; Tables AI.13-17). It should be noted that these tables are a summary for the purposes of this report, and the original guidelines should be referred to for greater detail and interpretation.

The National Water Quality Management Strategy (ANZECC) guidelines were established using data generated by a large number of organisations from throughout Australia and New Zealand. The guidelines provide the framework for achieving ecologically sustainable development and contain numerical and narrative criteria to assist in managing water resources in a sustainable manner (ANZECC & ARMCANZ 2000).

The ANZECC Guidelines use a risk based approach, which is expected to lead to more effective management and protection of the aquatic ecosystem. The guidelines:

- are ecosystem based - more specific and focussed on six ecosystem types (lowland river, upland river, freshwater lakes, wetlands, estuaries and coastal and marine) as opposed to two (freshwater and marine);
- include management targets;
- are issue based; and
- adopt a risk based approach to produce a guideline package developed for specific issues related to each ecosystem type.

Whilst the guidelines are ecosystem based and involve a risk assessment approach to determining threshold limits, a range of interim guidelines has been included for use when the risk assessment approach is not feasible. These interim guidelines are presented as either guideline ranges, median threshold limits, acceptable deviations from the annual or seasonal mean or guidelines for percentile values.

1.1.3 Commonly Assessed Water Quality Parameters

Commonly assessed water quality parameters are summarised in Appendix IV. Although not an exhaustive list, these parameters are commonly monitored in water quality monitoring programs and a large database for these parameters exists. The water quality objectives and guidelines presented in Appendix I are those which are likely to have the greatest impact on the beneficial use under consideration, whether it be maintenance of natural ecosystems or the provision of potable water supply.

1.2 Current Water Quality Networks and their Respective Status

Water quality information for rivers, streams and static water bodies throughout Victoria is primarily based on five databases. These are based on the Victorian Water Quality Monitoring Network (VWQMN), the Environment Protection Authority's Fixed Site Network (EPA FSN) which, in the Port Phillip region, is conducted by Melbourne Water on behalf of the EPA, the Major Storage's Operational Monitoring Program (MSOMP) and the Murray Darling Basin Commission's (MDBC) program.

In November 1993, the Minister for Natural Resources initiated a review of the Victorian water quality monitoring programs, which was undertaken in 1996. This review of the state surface water quality monitoring was completed by a committee convened by the Catchment Management Authority Council (CMAC), with representation from the Department of Sustainability and Environment[1] (DSE) and EPA. The overall objective was to develop a more integrated, coordinated and resource efficient approach to water quality monitoring in Victoria by:

- removal of duplication between monitoring programs;
- statewide coordination of methodologies;
- a change to the annual report format to provide interpretation and management information instead of raw data; and
- provision of a statewide database of water quality information on the internet.

All of the recommendations from the 1996 review have now been implemented.

1.2.1 Victorian Water Quality Monitoring Network

The Australian Water Resources Council (now the Agriculture and Resource Management Council of Australia and New Zealand) initiated a Victorian Water Quality Assessment Program (WQAP) in 1975 as part of its National Water Quality Assessment Program. Subsequent to this, the VWQMN was established to collect water quality data for all major streams and their tributaries in Victoria. From 1975 to 1991, the VWQMN was re-defined through a number of reviews.

Following the 1990 review, the overall objective of the VWQMN was modified as:

> *"to provide the information needed for the future management of the state's water resources, which would include the management and protection of the conservation values of the resources"*

In order to meet this objective it is necessary to provide data:

- to characterise water quality in aquatic environments;
- for the preparation of regular reports on these issues;
- to evaluate the need to design and implement special investigations/monitoring programs;
- to determine temporal trends and their influence; and

[1] Until December 2002, the Department of Sustainability and Environment (DSE) was recognised as the Department of Natural Resources and Environment (DNRE).

- to determine present and emerging water quality problems.

Prior to the 1990 review of the VWQMN, only major streams and their tributaries had been monitored for water quality. This monitoring did not provide information on all the hydrological and limnological processes occurring in Victorian aquatic ecosystems. The 1990 review (RWC 1991) highlighted the need for monitoring of other aquatic systems.

In 1993, monitoring of lakes and wetlands was included in the VWQMN to enable the overall objective of the VWQMN to be fulfilled. This was then halted at the end of 1997, pending the redesign of the sampling methodology. Some of these lake and wetlands stations had been duplicated by the EPA FSN or the MDBC programs, and these continued to be monitored as part of those programs.

All data collected under the VWQMN is held on a relational database system. The VWQMN database is a valuable resource, which has historical data from 1975 for most sites. Data from the VWQMN can be used to:

- provide descriptive data of the water quality of Victorian rivers and streams;
- review other monitoring programs;
- characterise water-bodies (including nutrients and other primary productivity indicators);
- identify areas of degradation;
- monitor the impact of seasonality, flow regime and catchment land use on aquatic ecosystems;
- determine the vulnerability of aquatic ecosystems to natural and anthropogenic influences;
- identify changes in both space and time;
- assist in determining the value of water resources for any nominated use; and
- assist in determining attainment of water quality guidelines.

In an effort to facilitate the orderly publication of nation-wide stream gauging data, the AWRC adopted the *National Gauging Stations Numbering System*. This system designates a unique six digit number (Station Index Number - SI No) to each gauging station within Australia. There are 244 drainage basins within 12 drainage divisions in Australia. Victoria has 30 drainage basins within 2 drainage divisions (Division 2 and Division 4; Figure AII.2). Each basin has a number of stream gauging stations and the six digit number assigned to each station contains a string of detailed information. For example, SI No 401211 denotes Drainage Division 4, Basin 01, Station 211.

Each station is also designated by an alpha character (eg. A, B, C). This character is referred to as the site indicator. The site indicator changes if the recorder installation is relocated (eg. 401211A can become 401211B). If the relocation of the recorder installation results in a significant change to the catchment area monitored, the station index number is also changed, otherwise the station index number should remain the same.

Rivers and Streams Program

In 2002, the VWQMN included 148 river and stream stations throughout Victoria. Eleven of these stations were monitored monthly for field (*in situ*) parameters only, with the remaining 137 monitored monthly for both field (*in situ*) and laboratory parameters. Of these 137, 11 stations were monitored for major ions and 13 stations were monitored for metals. A detailed summary of the parameters monitored as part of the VWQMN Rivers and Streams program is presented in Table AIV.1. Samples were collected and field parameters analysed by Thiess Environmental Services Hydrographic field staff. WATER ECOscience's (formerly AWT Victoria) Environmental Chemistry Laboratory conducted analysis of laboratory parameters, major ions and metals. A list of rivers and streams monitored during the period January 2002 to December 2002, including station descriptions, is presented in Table AIII.2.

The detection of temporal trends is one of the primary objectives of the VWQMN and, therefore, it is essential that the frequency of sampling is sufficient to detect significant trends by acceptable statistical techniques. CMAC, DNRE & EPA (1996) assessed the statistical power of the Network to detect trends and concluded that "with the current monitoring frequency, linear trends in water quality equivalent in magnitude to one standard deviation of the detrended data should be detectable at the 95% level of confidence and 80 - 90% power after 8-10 years of monitoring."

1.2.2 Environment Protection Authority Fixed Site Network

The EPA FSN was established in 1984 to complement the VWQMN. From 1984 to 1994, the EPA FSN monitored 46 stations across the state. In 1994, the EPA integrated its urban monitoring sites into Melbourne Water and Melbourne Parks and Waterways StreamWatch program (CMAC, DNRE & EPA, 1996), which subsequently became Melbourne Water's Water Quality Monitoring Network. In October 1997, the EPA integrated its inland water quality monitoring stations with the VWQMN.

The primary objective of the EPA FSN is to determine trends in water quality over time. Secondary objectives of the Network are to:

- assess compliance with water quality objectives as prescribed in State Environment Protection Policies; and
- identify emerging water quality issues.

Initially, the nominal frequency of sampling was fortnightly at metropolitan stations and monthly at rural stations. Since 1998, all stations have been monitored on a monthly basis. The EPA FSN uses a six digit coding system for station numbering, (Table AIII.3), however, traditionally the '00' portion of the station number is omitted and the remaining 4 digits are quoted. A detailed summary of the parameters monitored as part of the EPA FSN is presented in Table AIV.3.

Environment Protection Authority Program

In 2002, the EPA monitored seven river and stream stations and four Western District Lakes throughout Victoria (Table AIII.3). The quarterly sampling of Western District Lakes, previously undertaken by the VWQMN, has been incorporated into the EPA sampling program. This includes depth profiles and monitoring for zooplankton at all lake sites.

Melbourne Water Program

In 1994, the EPA integrated its urban monitoring sites into the Melbourne Water and Melbourne Parks and Waterways StreamWatch Program. From 1996, these sites have been managed solely by Melbourne Water as the Melbourne Water Quality Monitoring Network, endorsed by the EPA. The main objective of the Melbourne Water program is to determine broad scale, long term trends in water quality (typically over 10 years) within the Port Phillip and Western Port Region. For many sites, data from the Melborne Water program also date back to the 1970's (formally the MMBW and Dandenong Valley Authority programs). Melbourne Water currently monitors water quality at 72 sites in the Melbourne metropolitan region, 14 of these as part of the EPA FSN (Table AIII.4).

In addition to long-term monitoring sites, monitoring is undertaken at key recreational locations during summer for *E.coli* (20 sites) and blue-green algae (30 sites). Water quality data and various stream health reports are available from the Melbourne Water web site (www.melbournewater.com.au).

1.2.3 Major Storages Operational Monitoring Program

During 2002, a total of 29 stations within 28 major storages were monitored as part of the MSOMP. The MSOMP was initiated in January 1992 with the aim of developing an understanding of the limnology of the 24 storages involved at that stage. The Rural Water Authorities and the Murray-Darling Basin Commission jointly funded the program. Specific objectives of the MSOMP were to:

- provide rapid feedback to storage managers on algal populations within storages, particularly on levels of potentially toxic blue-green algae;
- establish a database of physical and chemical parameters from each storage to monitor possible changes which may occur before, during and after periods of algal abundance, in addition to any long term trends;
- establish a database of the common algal types and their population dynamics over time within each storage; and
- identify those storages most susceptible to blue-green algal blooms.

Two water samples were collected from each storage, one from the outlet and one from the leeward shore. Water quality parameters and detailed algal counts were analysed on the outlet station sample. An algal scan was performed on both samples. Blue green algal counts were undertaken immediately on scan samples when significant numbers of blue-green algae were detected (>500 cells/mL). A detailed summary of the parameters monitored as part of the MSOMP is presented in Table AIV.2.

All storages in the MSOMP were sampled fortnightly from November to June and monthly from July to October, with the exception of Lake Buffalo, Lake Dartmouth, Greens Lake, Waranga Basin and Lake William Hovell, which were sampled monthly throughout the December to March period. Lake Batyo Catyo, Dock Lake. Lake Lonsdale, Pine Lake, Bonnie Doon at Lake Eildon and Green Lake were dry during 2002.

A list of the MSOMP stations monitored during the period January 2002 to December 2002, including station descriptions, is presented in Table AIII.5.

1.2.4 Murray-Darling Basin Commission Water Quality Monitoring Program

The MDBC initiated a Water Quality Monitoring Program in July 1978 to meet the data requirements for its new responsibilities in relation to the water quality of the River Murray. The aim of the program is to provide the necessary data for an improved understanding and enhanced management of water quality in the River. In 2002, water quality data was collected from 35 stations along the Murray and the lower reaches of its tributary streams, 18 in Victoria, 7 in New South Wales and 10 in South Australia. A list of the MDBC stations monitored from January 2002 to December 2002, including site descriptions, is presented in (Table AIII.6).

Stations were sampled for a number of physical and chemical characteristics. In 1980, the program was expanded to monitor phytoplankton and macroinvertebrates at a number of stations. A detailed summary of the parameters monitored as part of the MDBC program is presented in Table AIV.4.

In 1998, the MDBC initiated a three-stage review of its Water Quality Monitoring Program. This involved an assessment of the Commission's water quality monitoring data, including the determination of any trends; a description of the ecological condition of the River Murray; and a review of the design and implementation of the water quality monitoring program, in relation to the Commission's needs for water quality and river health information. Stage 1 of the review involved an analysis of the macroinvertebrate data and an overview of the physico-chemical water quality and algal monitoring data (AWT Victoria, 1999c). A detailed temporal trend analysis of selected physico-chemical water quality parameters and algal data has been undertaken during Stage 2 of the review process (AWT Victoria, 2000). The review and assessment of the Commission's Water Quality Monitoring Program originally planned for Stage 3 has now been expanded to include all water monitoring within the Commission. This may result in changes to the existing design of the program.

2 Methods

2.1 Water Quality Characterisation

This report addresses two levels of objective or guideline attainment, attainment of individual stations within each CMA and CaLP region (percent attainment per station) and overall attainment for each CMA and CaLP region (percent attainment per region).

Water quality has been characterised according to levels of attainment with the relevant water quality objectives and guidelines across the state. This level of attainment was determined by calculating the percentage of samples within the limits as defined by the objectives or guidelines.

2.1.1 Percent attainment per station

Percent attainment was calculated and tabulated for the SEPP objectives and the ANZECC (2000) guidelines. Where no regional SEPP objectives existed, the Waters of Victoria SEPP objectives were applied. Water quality objectives exist in three forms, as limits (either maximum or minimum) or percentiles. Percentiles differ from limits only in that the limits require 100% attainment, while the percentiles require that a set percentage of samples attain the objective (ie. 50%, 80% or 90%, depending on the objective). Where objectives are listed as percentiles, a minimum of ten sampling events at a given station was required to determine the percent attainment. For less than ten sampling events, attainment was not determined (designated as *). Where the water quality guidelines and objectives must fall within a range (eg. pH between 6 and 9), non-attainment is due to the results falling either below the minimum or above the maximum values for the range.

The percent attainment at each station was determined for each parameter by pooling the data, counting the total number of sampling events and the number of samples which did not comply with the objective or guideline and applying Equation 1.

$$\%\ attainment = \frac{100 \times \left(Total\ no.\ of\ samples - no.\ of\ Non\text{–}attaining\ samples\right)}{Total\ no.\ of\ samples} \qquad \textbf{\textit{Equation 1}}$$

As discussed above, limits require that the % attainment calculated in Equation 1 is 100%, while percentiles require that the % attainment calculated in Equation *1* meet the percentile value of 50%, 80% or 90%, depending on the objective.

These were tabulated in the regional water quality sections (Sections 5.2.1 – 5.2.10).

2.1.2 Percent attainment per region

The percent attainment for each CMA or CaLP region was determined using the average percent attainment for all of the stations within that CMA or CaLP region.

The percent attainment with SEPP water quality objectives and the ANZECC guidelines was listed and from these an attainment rating determined for the statewide plots.

These were plotted in the statewide overview of water condition section (Section 5.1).

2.2 Mapping Attainment within Regions

A rating was applied to summarise attainment of water quality objectives and guidelines within CMA and CaLP regions. Each station within the region was given a rating of high, medium or low, based on the percent compliance with the objective or guideline limit, for the following groups of parameters:

- Physical (Dissolved Oxygen, pH, Electrical Conductivity);
- Suspended Solids/Turbidity;
- Nutrients (Total Phosphorus, Total Nitrogen); and
- Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc).

The method adopted for calculating the rating varied according to the indicator and the objective. Essentially, the two objectives are absolute limits and percentiles, and for each parameter, a combination of these was used to determine a water quality rating at each station.

The majority of the absolute objective limits are applicable to base flows rather than storm events. Separation of base flow values was beyond the scope of this report. Therefore, the rating applied allowed for a small percentage of samples to exceed the objective or guideline limit (the tail of the distribution).

For each parameter, the rating was determined using the SEPP objective limit. Attainment was classified as:

- High (>95% attainment of SEPP objective);
- Medium (90-95% attainment of SEPP objective); and
- Low (<90% attainment of SEPP objective).

Where there were no SEPP objectives, the ANZECC 80th percentile guideline attainment rating was applied:

- High (>85% attainment of ANZECC guideline);
- Medium (75-85% attainment of ANZECC guideline); and
- Low (<75% attainment of ANZECC guideline).

In addition to applying a rating based on the above-mentioned method, all percent attainment values that failed to meet the percentile guideline or objective are highlighted in bold throughout this report.

For each of the physical parameters (DO, EC and pH), the rating value was determined using the SEPP limit objective. Dissolved oxygen ratings were applied by using DO saturation percent attainment. In the event of there being no SEPP objective (this occurred for electrical conductivity only), only the ANZECC guideline was used. The lowest rating value of the three parameters was used to provide the mapped attainment score, thus indicating where a potential problem had been identified.

The SEPP objectives for suspended solids and turbidity were percentile objectives, that is having both median (50th percentile) and 90th percentile objective limits. Rating was determined by taking the higher percentile limit. Therefore the rating would be applied using the 90th percentile value over the 50th percentile value. Where SEPP objectives were not available, the

ANZECC guidelines were used to determine the rating. As turbidity and suspended solids are measurements of similar aspects of water quality, the map attainment score was determined by taking the lowest rating value for turbidity or suspended solids.

The nutrient rating values for each station were determined using a combination of the SEPP objective limits (depending on whether the station had a quantitative SEPP objective) and the ANZECC 80th percentile guideline. A number of stations in West Gippsland CMA region had SEPP percentile objectives, requiring the station to meet both median (50th percentile) and 90th percentile objective limits, so the SEPP objectives were used solely for these stations. Rating was applied using the higher percentile value. As for the physical parameters, the lowest rating value of the all nutrients was used to provide the mapped attainment score, thus indicating where a potential problem had been identified.

The rating value for each of the metals was determined using a combination of the SEPP limit objective and the ANZECC guideline. The map attainment score for metals was calculated using the lowest rating value to highlight potential problems.

These ratings were mapped for each station on the CMA and CaLP regional maps (Sections 5.2.1 – 5.2.10).

2.3 Station Specific Water Quality

A station in each region was chosen for detailed investigation and interpretation. This station had been identified as having very low attainment levels for a number of water quality parameters. The station chosen has not been reported in recent VWQMN Annual Reports.

3 Data Requests

VWQMN data is widely used. The number of direct requests made during 2002 was significantly lower than previous years, with many organisations obtaining the data directly from the website based State Water Resources Data Warehouse (www.vicwaterdata.net). Over 54,600 visits have been recorded since the launch of the website in June 2000. The data from each of the Victorian water quality monitoring programs is made available on the State Water Resources Data Warehouse and these are updated monthly. During 2002 only five data requests were received (see table 2). Of the 5 requests received in 2002, all required field information and data on nutrients, while 3 required data on major ions.

Table 2. Organisations requesting water quality data in 2002, including their respective number of requests

	January - December 2002		
Group	**Number of Requests**	**Number of Stations Total (Per Request)**	
Water Authorities	2	8	(4)
Universities/Research Centres	1	1	(1)
Dept. Natural Resources & Environment	1	2	(2)
Environment Protection Authority	1	20	(20)
TOTAL	**5**	**31**	

Data used from the VWQMN should be cited, for all users, as follows:

VWQMN, (Year). Victorian Water Quality Monitoring Network Database. Govt of Victoria.

Information gathered from each of the monitoring programs is available via the State Water Resources Data Warehouse on the DSE website www.vicwaterdata.net, or may be obtained from the following organisations:

Victorian Water Quality Monitoring Network
WATER ECOscience
68 Ricketts Rd
Mt Waverley VIC 3149
Telephone: 9550 1000

Note: Once written permission has been obtained from the Department of Sustainability and Environment, data may be extracted. Charges may apply for data extraction.

Major Storages Operational Monitoring Program
Contact the Rural Water Authority responsible for the storage:

Wimmera Mallee Water
Gary Harper
PO Box 19
Horsham VIC 3400
Ph: (03) 5362 0200

Goulburn Murray Water, Murray Headworks
David Jeffery
Private Bag 2
Wodonga VIC 3691
Ph: (02) 6026 4320

Goulburn Murray Water, Goulburn Headworks
Bob Klos
High St
Eildon VIC 3713
Ph: (03) 57742303

Goulburn Murray Water, Loddon Headworks
Ivan Smith
Cairn Curran
Maldon VIC 3463
Ph: (03) 5475 2121

Once written permission has been obtained from the Rural Water Authority, data may be obtained from:

WATER ECOscience
68 Ricketts Rd
Mt Waverley VIC 3149
Telephone: 9550 1000

Note: Charges may apply for data extraction

Environment Protection Authority: Fixed Site Monitoring Network
Environment Protection Authority – Centre for Environmental Sciences
Ernest Jones Drive
Bundoora VIC 3083
Michael Hunter:- Telephone: (03) 8458 2351 Email: Michael.Hunter@epa.vic.gov.au

Murray-Darling Basin Commission: Phys-Chem Baseline Monitoring
Murray-Darling Basin Commission : Water Quality Monitoring Program
Murray-Darling Basin Commission
15 Moore Street, Canberra City
GPO Box 409 Canberra ACT 2601
Email: datarequests@mdbc.gov.au

3.1 State Water Resources Data Warehouse (www.vicwaterdata.net)

The Victorian Water Resources Data Warehouse is a site dedicated to disseminating up-to-date information on Victoria's water resources through the World Wide Web. The site provides access to raw and summary data on both water quality and quantity throughout Victoria, and is a central repository for published documents produced from this data. Water quality data from the VWQMN, EPA FSN, MSOMP and MDBC have been incorporated into the Data Warehouse as well as statewide hydrographic, groundwater and community monitoring data.

The site offers a number of choices for access to the information; a short description of each is included below:

Maps for Site Selection

A new mapping interface allows the user to zoom in to the region and sites of interest, overlaying various types of information such as satellite imagery and road networks. Information and hotlink tools then allow the user to interrogate the data warehouse for data on the sites selected.

Standard Warehouse Reports

This link provides access to summary information for sites such as average monthly flows, annual summary statistics and active site lists.

Individual Site Information

This link is used if the site name or number is already known and information about the site such as parameters measured, location, contractor, rating table, etc is required.

Extract Data from Warehouse

This link allows development of a query to narrow down the data of interest. For example, a site list for sites that are both in the West Gippsland CMA and that have phosphorus results greater than 1 mg/L could be extracted. There is a range of parameters, which can be adjusted to match the query requirements.

Browse Statistics and Data

This link allows the user to browse through summary statistics and 'drill down' into the data. For example, annual flows for a range of sites could be selected and the monthly flows for a particular site chosen by clicking on the annual flow result.

Measure by Measure Analysis

This link is similar to the Extract Data from Warehouse page but it allows creation of a graph of one measure vs. another. For example, stream flow vs. total phosphorus results for a site *could be examined or both parameters graphed as a time series.*

DSE Published Documents

This link provides access to documents published as part of the water resources monitoring program of DSE including each VWQMN Annual Report, and trend analysis carried out in 1998 for the whole state.

Send Comments/Requests to Warehouse Manager

This link allows comments and/or data requests to be sent to the warehouse manager. This option allows users to order a CD-ROM copy of data for a very large data request.

4 Quality Assurance and Quality Control

Both Quality Assurance (QA) and Quality Control (QC) form an essential element of any monitoring program. Quality Assurance comprises of a set of protocols designed to ensure that the quality control activities are being properly implemented. Quality Control is provided by planned activities designed to ensure that the data collected and measurements made are accurate and precise, and are recorded and reported correctly.

The VWQMN is managed by WATER ECOscience for DSE and the Rural Water Authorities. The sample collection and field water quality component of the VWQMN rivers and streams is managed by WATER ECOscience and undertaken by Thiess Environmental Services. The WATER ECOscience quality control procedures are documented in the DSE's *Victorian Water Quality Monitoring Network and State Biological Monitoring Program Manual of Procedures* (AWT Victoria, 1999b). WATER ECOscience also undertake the field and laboratory assessment component of Melbourne Waters monitoring program, which is part of the EPA FSN. EPA Operations or Freshwater Sciences staff undertake the field assessment component for the regional EPA sites. The EPA quality control procedures are documented in the EPA's *Guide to Sampling and Analysis of Waters and Wastewaters* (EPA, 2000).

4.1 Thiess Environmental Services Quality System

Thiess' Environmental Services Quality System ISO 9002 relates to hydrological and environmental monitoring, including data management. Of particular relevance to the VWQMN is the derivation of flow data, which is a critical parameter. Flow is derived from flow gauging, calibration is determined by measurement of flows corresponding to actual gauge heights over a range of flows. Calibration is required on a regular basis as control structures are subject to change. These elements are carried out in accordance with AS3778 and supported by other relevant work procedures including Inspection and Test Plans (ITPs) and Inspection Checklist Reports (ICRs). Ten percent of all field activities including flow measurement are subject to ICRs, which are also subject to internal and third party audits. Refer to section 4.2.1 for quality assurance relating to sample collection and field water quality monitoring undertaken by Thiess Environmental Services.

4.2 WATER ECOscience's Quality Management System

The WATER ECOscience Quality Management System is structured and documented in terms of:

- A Quality Policy Manual, which details overall policy;
- Management Manuals, which describe how the individual disciplines (chemistry, microbiology, and biology) manage their respective areas (eg., team structure, training, sample handling, etc.);
- Quality Assurance Manuals, which describe the quality control procedures used to control standards, standard reference materials, replicates, etc.); and
- Detailed Procedure Manuals, which contain Standard Operating Procedures (SOPs).

WATER ECOscience has been accredited and certified by the National Association of Testing Authorities (NATA) and NATA Certification Services International (NCSI) to:

AS/NZS/ISO 9001:2000 Quality system, contract review, document and data control, quality records, quality audits, corrective action and training (**Certification No. 6593**).

ISO 17025 Equipment calibration, validity of methods, traceability of results and records, verification of data, analyst competence, quality control and NATA proficiency for Chemical and Biological Testing (**Reg. No. 992**).

4.2.1 Field Sample Collection

The quality assurance program for the sample collection and field measurement component of the VWQMN is detailed in the Manual of Water Quality Monitoring Procedures, VWQMN (AWT Victoria, 1999b). Examples of quality control procedures include:

- sample collection in unused disposable HDPE plastic bottles;
- batches of filters used in field filtration for FRP are analysed for extractable phosphorus; only batches that are shown not to contaminate the sample or otherwise modify the composition of the sample are used (Table AV.1);
- all field sampling and monitoring parties are provided with fresh standards for pH and electrical conductivity every three months;
- procedures and a timetable for the calibration of each field instrument are included in the Procedures Manual (Table AV.2); and
- all field instruments are independently calibrated and checked every three months (Table AV.4).

Twice a year each field party participates in a proficiency testing comparison exercise for pH, turbidity and electrical conductivity (EC). An example of the test results performed in 2002 is presented in Table AV.3. Samples of known pH, turbidity and electrical conductivity are supplied to each field party without divulging the concentration. Results obtained are compared against the known values. Where results fall outside the acceptable range, testing procedures are reviewed and equipment is tested. The acceptable ranges of values are noted in Standards Methods (Greenberg *et al*. 1992).

Following each round of proficiency testing, an inspection of all instruments was conducted. Particular attention was given to those centres that did not meet the required standard. Remedial action included site inspection, calibration and, if required, additional staff training.

4.2.2 Biological Analysis

The quality assurance program of WATER ECOscience's Biology Laboratory is detailed in the *Analytical Services-Biology Quality Assurance Manual*. This manual describes the quality control and assurance practices including procedures relating to materials and preparation, analytical results review, intra-laboratory performance checks and proficiency testing.

4.2.3 Chemical Analysis

The Chemistry Laboratory of WATER ECOscience performed all chemical analyses for the VWQMN, EPA FSN and MDBC programs. The quality assurance program is detailed in the

Analytical Services - Chemistry Quality Assurance Manual. This manual describes the quality control and assurance practices including procedures relating to analytical method performance, including specifications for the limit of detection, numbers of controls and replicates, checking of control stock solutions, summary of control data, action on controls during routine analysis and external quality control. An example of quality control used by the laboratory is the use of control solutions that are analysed with each batch of VWQMN samples. The results of the controls are expected to fall within certain limits (limits are based on long term data using a 95 percent confidence limit). In the event that controls do not fall within the accepted limits, the analysis for the entire analytical batch is repeated.

4.2.4 Data Entry and Retrieval

The procedures for entering and retrieving data on the VWQMN database at WATER ECOscience are detailed in a *Manual of Procedures*. This manual provides all users of the VWQMN database with step-by-step procedures for updating the database and data retrieval. The manual is also structured to contain a multi-tiered quality assurance system to ensure data integrity.

Field data is submitted on pre-printed duplicate pro-formas, a further copy of the proforma is retained by the regional office. Every week, a report is produced (*VWQMN Samples Received List*) containing a complete listing of all samples received. Before any data entry procedures commence, the following checks are performed to ensure that:

- the station index number (SI No) on the field data sheet is cross referenced to a current station (ie, a station which is included on the *VWQMN Current Station List*);
- both the field data sheet and the *VWQMN Current Station List* are marked accordingly, to record receipt of data for each station, as they arrive;
- the station number, sample date and time on the *Laboratory Samples Received List* correspond with those on the field data sheet;
- the *Laboratory Samples Received List* is marked to indicate that these entries have been checked; and
- the *VWQMN Chemistry Samples Received List* is marked to indicate that each sample received has a corresponding field sheet.

Data from the field data sheets are first entered onto a transition file. After all data has been entered, a hard copy is printed and manually checked against the original data on the field sheets. Any errors made during data entry are corrected on the transition file. The corrected data on the transition file are then transferred to the core database. Only one month's data is entered at a time.

Throughout this process, the data entry checks ensure that the database stream and site description corresponds with that on the field data sheet. When entering the station index number and letter for the first field data sheet, the entry program automatically displays the stream and site description.

The transfer of data from the transition file to the core database is performed automatically on completion of all of the above-mentioned checks. During the course of data transfer, a statistical validation against past results is performed. The new results must fall within an acceptable range (ie, median $\pm$ 1.96 SD). Any results falling outside this range are displayed and require confirmation before being accepted into the database.

Also, checks are performed to ensure that all laboratory data correspond to the associated field data in terms of station numbers and sampling dates.

4.2.5 Data Upload to the Data Warehouse

The data files are uploaded on a regular basis by WATER ECOscience to the State Water Resources Data Warehouse. The administrator then incorporates them into the State Water Resources Data Warehouse where they can be accessed.

5 Results and Discussion

Water quality condition and trends throughout Victoria have been summarised in the context of variation throughout the state as indicated by CMA and CaLP regions, and as variation within these regions as indicated by individual monitoring sites. Water quality is categorised using ratings based on the SEPP water quality objectives and ANZECC water quality guidelines as outlined in Section 2: Methods (see Appendix 1 for objectives and guidelines).

The statewide overview of water condition is presented in Section 5.1. In Section 5.2 the variation in attainment of the relevant objective or guideline within each CMA and CaLP region has been discussed, with particular sites described in detail.

5.1 Statewide Overview of Water Quality – 2002

Water quality condition is expressed as attainment with each set of objectives and guidelines, and has been summarised to identify patterns across Victoria with respect to these objectives and guidelines. Note that several SEPPs can relate to a given CMA and CaLP region but only one will relate to a given station. Where SEPP objectives relate to a station, these objectives normally override the ANZECC guidelines.

There was considerable variation in water quality indicators between the CMA and CaLP regions. However, some statewide patterns were evident for some of these indicators, as indicated in Figures 1–4.

As in previous reports, water quality with respect to the physical parameters (DO, EC, pH) and nutrients tended to deteriorate from the northeast to the southwest of the state, with attainment of the oxygen, nutrient and salinity objectives and guidelines decreasing to the west of the state. Attainment of the turbidity objectives and guidelines was lower in the northern half of the state and the urban region, indicating poorer water quality with respect to light availability for aquatic life. Attainment of the suspended solids objectives was good throughout the state, with all regions having high overall attainment of both the SEPP objectives and ANZECC guidelines. Poorest attainment of the metals objectives and guidelines occurred in the southwest and urban regions, also suggesting poorer water quality with respect to the metals, particularly copper and zinc.

5.1.1 Physical Parameters

Dissolved Oxygen

All ten regions had SEPP objectives for DO. There was insufficient data to permit DO analysis for the Mallee CMA. The minimum attainment occurred in the Port Phillip CaLP (83%) followed by North Central (88%), Wimmera (90%) and Corangamite CMA (93%) regions. As in 2001, the North East CMA achieved 100% attainment, followed by the West Gippsland CMA (99%). The other three regions were high, ranging from 94% in the East Gippsland, 95% for Glenelg-Hopkins and 96% for the Goulburn-Broken CMA's. There were no CMA's which achieved the required 80% attainment of the ANZECC guideline. East Gippsland CMA region obtained the highest attainment 78%, West Gippsland obtained 72%, all other CMA's fell well below this guideline.

Electrical Conductivity

Four of the ten CMA and CaLP regions had SEPP objectives for EC, the remaining regions only had ANZECC compliance guidelines. The Wimmera CMA had SEPP objectives for EC, however the objective required 90% attainment as opposed to 100% attainment. Attainment against the SEPP objectives was highest for the West Gippsland CMA region (100%), followed by Port Phillip CaLP (86%) Wimmera 81% and Corangamite CMA region (50%). As in previous years, the CMAs exhibiting the maximum attainment with the ANZECC guidelines were East Gippsland, Mallee, North East and West Gippsland, each with greater than 90% attainment. The Glenelg-Hopkins CMA exhibited the lowest attainment of 21% followed by the Wimmera CMA (24%). EC attainment with SEPP's and ANZECC guidelines are very similar to those of previous years.

The continued dry conditions are expected to have an impact on Electrical Conductivity (EC) throughout Victoria. West Gippsland was the only CMA to achieve the 100% objective. When utilizing the ANZECC guidelines, the south-western regions generally achieved lower attainment, with Corangamite, Glenelg-Hopkins and Wimmera achieving low attainment. It has been previously recognized that the combination of past farming practices and basaltic soils have aggravated the salinity problem within the western region of Victoria. The Mallee sites sampled were on the River Murray, and so do not truly indicate the water quality within the CMA region (Figure 1).

pH

All ten regions had SEPP objectives for pH. The lowest attainment of 90% occurred within the Corangamite region, followed by Glenelg-Hopkins and North Central CMA's. The Corangamite and Glenelg-Hopkins CMA's also exhibited the lowest pH attainment in 2001. The Goulburn-Broken and Mallee CMA's achieved 100% attainment with the SEPP objective. The remaining CMA's exhibited attainment in excess of 98%.

The lowest attainment of the ANZECC pH guideline was exhibited by the North Central CMA (47%), followed by Corangamite and Glenelg-Hopkins CMA's both on 74%.

In summary, North Central CMA and the southwestern regions of the state, Corangamite and Glenelg-Hopkins, were found to have a higher percentage of pH values outside the acceptable range according to the SEPP objectives than occurred in the other regions. pH levels throughout the rest of the state were generally within the acceptable SEPP range (Figure 1). For details on the direction of the exceedences, see Section 5.2 CMA regional water quality.

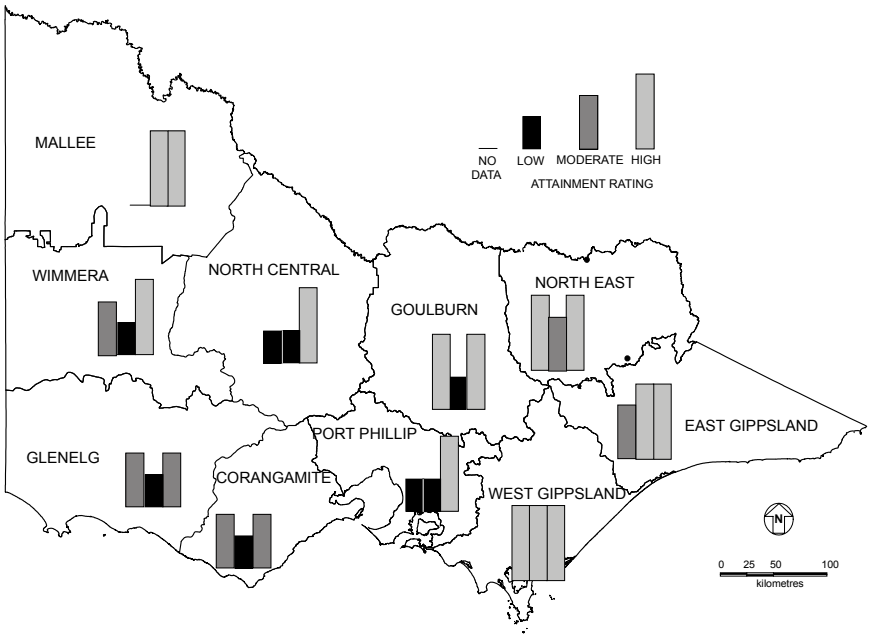


Figure 1. Attainment rating for Dissolved Oxygen, Electrical Conductivity and pH (from left to right) in each CMA and CaLP region during 2002.

Table 3. Percent attainment of SEPP objectives and ANZECC guidelines for Dissolved Oxygen, Electrical Conductivity and pH in CMA and CaLP regions during 2002.

	Dissolved Oxygen (% Sat)		Electrical Conductivity		pH	
Region	SEPP (requires 100% attainment)	ANZECC (requires 80% attainment)	SEPP (requires 100% attainment)	ANZECC (requires 80% attainment)	SEPP (requires 100% attainment)	ANZECC (requires 80% attainment)
Corangamite	93	55	50	78	90	74
East Gippsland	94	78	*	100	98	87
Glenelg-Hopkins	95	56	*	21	94	74
Goulburn-Broken	96	36	*	67	100	94
Mallee	--	--	*	100	100	100
North Central	88	33	*	25	97	47
North East	100	60	*	92	99	77
Port Phillip	83	40	86	83	97	82
West Gippsland	99	72	100	100	99	97
Wimmera	90	35	81	24	98	87

-- = no data
* = no objective
Where SEPP objectives exist, the SEPP objectives override the ANZECC guidelines

5.1.2 Turbidity/Suspended Solids

Turbidity

Half of the CaLP and CMA regions had SEPP objectives for turbidity. all of which achieved attainment greater than the 90% SEPP objective. All CMA's exhibited attainment greater than the required 90% of the ANZECC guideline with the exception of 75% for Goulburn-Broken CMA (Figure 2).

Turbidity varies according to the condition of the stream, flow rates and catchment condition; as a result the ANZECC guidelines have a range of default trigger values. Due to the overview nature of this report, the higher ANZECC guideline has been used without modification for stream or catchment condition or flow rates (Table A1.13).

Suspended Solids

All of the ten regions had SEPP objectives for suspended solids, however, data was not collected for the three stations in the Mallee CMA region (Table 4). As per the previous year, all of the regions attained the relevant percentile requirements for SEPP attainment. The maximum attainment was observed in the Glenelg-Hopkins, Wimmera and North Central CMA regions (100% attainment of the 90^{th} percentile). Minimum attainment was exhibited in the West Gippsland CMA region (97%). All regions achieved attainment of the ANZECC guidelines. The minimum attainment was exhibited by the Port Phillip CaLP (90%) and Goulburn-Broken CMA (93%).

In general, attainment of the suspended solids objectives was good throughout the state, with all regions having high overall attainment of both the SEPP objectives and ANZECC guidelines (Figure 2). It should be noted that attainment has generally improved overall from previous years, this high attainment could possibly be due to the drought.

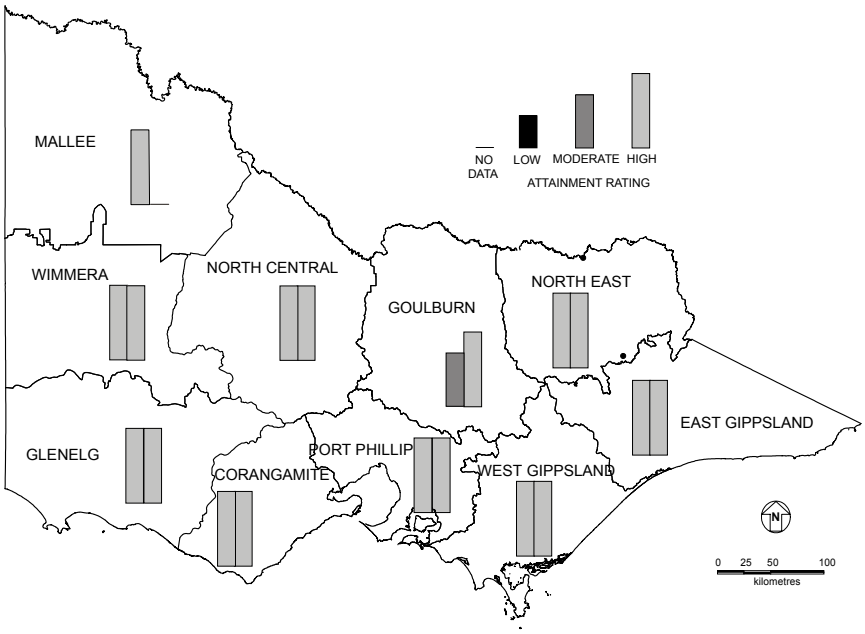


Figure 2. Attainment rating for Turbidity and Suspended Solids (from left to right) in each CMA and CaLP region during 2002.

Table 4. Percent attainment of SEPP objectives and ANZECC guidelines for Turbidity and Suspended Solids in CMA and CaLP regions during 2002.

	Turbidity			Suspended Solids		
Region	SEPP (requires 50% attainment)	SEPP (requires 90% attainment)	ANZECC (requires 80% attainment)	SEPP (requires 50% attainment)	SEPP (requires 90% attainment)	ANZECC (requires 80% attainment)
Corangamite	--	*	99	93	99	98
East Gippsland	84	96	99	97	99	99
Glenelg-Hopkins	100	*	98	99	100	100
Goulburn-Broken	*	*	75	89	98	93
Mallee	*	*	100	--	--	--
North Central	*	*	94	97	100	94
North East	*	*	100	97	99	97
Port Phillip	74	96	91	82	98	90
West Gippsland	75	96	100	86	97	98
Wimmera	*	*	91	100	100	100

-- = no data
* = no objective
Where SEPP objectives exist, the SEPP objectives override the ANZECC guidelines

5.1.3 Nutrients

Total Nitrogen & Oxidised Nitrogen (NO_x)

Three of the ten CMA and CaLP regions had SEPP objectives for total nitrogen but only the West Gippsland CMA had a sufficient number of sites with SEPP objectives for a regional comparison. West Gippsland CMA achieved the attainment required of the SEPP objectives. All CMA and CaLP regions failed to achieve the required 80% ANZECC attainment guideline. Of these regions, the maximum attainment of 78% was exhibited by Mallee CMA then North East CMA at 76%. The minimum attainment of 8% was recorded by Port Phillip CaLP. Attainment of all other regions fell within these percentages (Figure 3, Table 5).

In general, attainment of the objectives and guidelines for total nitrogen was greater in eastern Victoria and was lower in the Port Phillip CaLP and western regions of the state (Figure 3).

ANZECC Guidelines existed for oxidised nitrogen (NO_x) for all ten regions. Only one station in the Mallee had sufficient data for NO_x analysis, and it achieved 94% attainment. All other regions failed to comply with the ANZECC 80% guideline level.

Total Phosphorus & Filtered Reactive Phosphorus (FRP)

Four of the ten CMA and CaLP regions had SEPP objectives for total phosphorus, although only two, West Gippsland (87% SEPP attainment) and Wimmera (100% SEPP attainment), had a sufficient number of sites with SEPP objectives for use in regional classification. All other regions exhibited low attainment for total phosphorus against ANZECC guidelines. In the eastern part of the state, East Gippsland had 69% ANZECC attainment, North East had 58% and West Gippsland had 48% ANZECC attainment. Minimum attainment was observed in the northern part of the state, with 21% (Mallee), 22% (North Central) and 25% (Goulburn) attainment of the ANZECC guidelines. The three southwestern regions, Glenelg-Hopkins, Corangamite and Port Phillip, all had ANZECC attainment levels between 48 and 33% (Figure 3, Table 5).

ANZECC guidelines existed for Filtered Reactive Phosphorus (FRP). With the exception of the Corangamite, North Central and Glenelg-Hopkins CMA's and the Port Phillip CaLP, all regions achieved the minimum 80% attainment of the ANZECC guidelines.

Chlorophyll-a

Six of the ten CMA and CaLP regions have waterbodies that are sampled for Chlorophyll-*a*. Attainment of the ANZECC guidelines ranged from 86% in the North East to a minimum of 55% in the Goulburn CMA. Attainment has reduced in all areas compared to the year 2001 (Figure 3, Table 5).

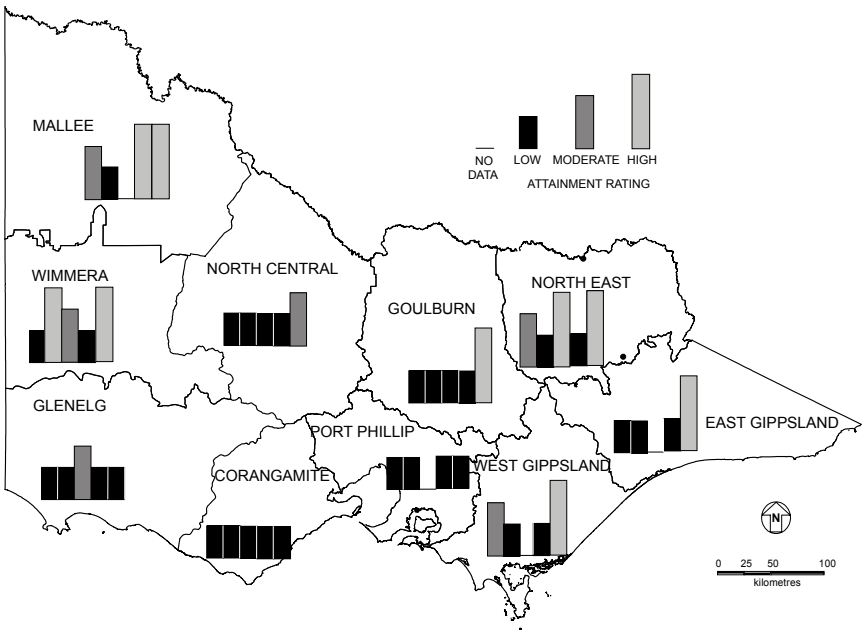


Figure 3. Attainment rating for Total Nitrogen, Total Phosphorus, Chlorophyll-a, NO_x and FRP (from left to right) in each CMA and CaLP region during 2002.

Table 5. Percent attainment of SEPP objectives and ANZECC guidelines for Total Nitrogen, Total Phosphorus and Chlorophyll-a in CMA and CaLP regions during 2002.

Region	Total Nitrogen			Total Phosphorus			Chlorophyll-*a*	NO_x	FRP
	SEPP (requires 50% attainment)	SEPP (requires 90% attainment)	ANZECC (requires 80% attainment)	SEPP (requires 50% attainment)	SEPP (requires 90% attainment)	ANZECC (requires 80% attainment)	ANZECC (requires 80% attainment)	ANZECC (requires 80% attainment)	ANZECC (requires 80% attainment)
Corangamite	*	*	12	*	*	33	70	31	68
East Gippsland	*	*	63	*	*	69	--	37	98
Glenelg-Hopkins	*	*	14	*	*	48	80	49	71
Goulburn-Broken	*	*	28	*	*	25	55	25	88
Mallee	*	*	78	*	*	21	--	94	100
North Central	*	*	25	*	*	22	61	53	78
North East	*	*	76	*	*	58	86	32	100
Port Phillip	*	*	8	*	*	37	--	16	62
West Gippsland	76	92	28	51	87	48	--	13	86
Wimmera	*	*	16	*	100	48	77	47	96

-- = no data

* = no objective

Where SEPP objectives exist, the SEPP objectives override the ANZECC guidelines

5.1.4 Metals

Metals were sampled in seven of the ten CMA and CaLP regions, with no stations sampled for metals in the Mallee, East Gippsland and West Gippsland CMA regions. All regions had SEPP objectives for maximum concentrations of each metal, as well as ANZECC guidelines. Attainment ratings were determined using a combination of the SEPP objectives and ANZECC guidelines as outlined in Section 2: Methods.

Arsenic

All regions achieved 100% attainment of the SEPP objectives and ANZECC guidelines, with the exception of the Corangamite CMA (with attainment ANZECC 97%) and Port Phillip CaLP (99% SEPP attainment). Similar results have been shown in previous reports (Table 6).

Water quality throughout the state was generally good with respect to arsenic (Figure 4). The Corangamite CMA achieved SEPP 100% and ANZECC 97% which were an improvement on SEPP 97% and ANZECC 82% in 2001.

Cadmium

Three of the seven regions monitored for cadmium failed to achieve the required 100% attainment against their SEPP objective. These were the North Central, Glenelg-Hopkins and Wimmera CMA's. When considering the ANZECC guidelines for Cadmium, North Central region displayed the lowest attainment (87%), and Corangamite, Goulburn-Broken and North East CMA's achieving 100% attainment (Figure 4).

Chromium

Of the seven regions, the lowest attainment was observed in the Port Phillip CaLP region (98% SEPP attainment). All other regions observed maximum SEPP attainments of 100%. Earlier ANZECC guidelines have made available guidelines for Chromium. The ANZECC (2000) guidelines have values for Chromium (Cr VI), however insufficient data is available for Chromium (Cr III). Further analysis has determined that the latter should be used, and as a result, there are no ANZECC guidelines in this report for Chromium. However, SEPP objectives are available in most cases and are regionally relevant than the general ANZECC guidelines (Table 6).

High attainment (>95%) of the SEPP objectives was exhibited throughout the state (Figure 4).

Copper

Corangamite, Goulburn-Broken and North East CMA achieved 100% attainment of the SEPP objective for copper. The Port Phillip CaLP achieved the lowest attainment of 57%, followed by the North Central and Wimmera CMA's (85% and 88% respectively), with the remaining regions achieving attainment greater than 90% (Table 6). ANZECC attainment for all of the regions was very low, with a maximum attainment of 16% in the Corangamite CMA region. The remaining regions exhibited attainment of between 0 and 12% attainment (Figure 4).

As per the 2001 report, the low ANZECC attainment may indicate that there is a risk of copper toxicity. However, the higher attainment of the SEPP objectives suggests that, taking into account local factors, this risk has not been realised. Copper toxicity is dependent upon the hardness of the water and, as hardness has not been monitored in conjunction with the metals, the ANZECC attainment levels shown may not be indicative of the true water conditions with respect to copper.

Nickel

All regions achieved 100% attainment against the SEPP objectives in 2002 (Table 6). All regions had greater than 80% attainment of the ANZECC guidelines, with Glenelg-Hopkins having the lowest at 83% and Wimmera, Goulburn-Broken and North East regions achieving 100% attainment (Figure 4).

Lead

Except for Port Phillip CaLP, all regions achieved 100% attainment against the SEPP objectives for lead. Port Phillip CaLP achieved 94% attainment of the SEPP objective. In contrast, the Port Phillip CaLP exhibited the lowest attainment of 67% of the ANZECC guideline. All other regions achieved attainments in excess of the required 80% ANZECC guideline, with the Corangamite and Glen Hopkins CMA achieving 100% attainment. (Figure 4).

Zinc

Two of the seven regions achieved 100% attainment against the SEPP objectives for zinc. These were the Goulburn-Broken and Corangamite CMA regions. The Port Phillip region exhibited the lowest attainment of 82%. All regions observed low attainment results of the ANZECC guidelines for zinc, with the Corangamite CMA achieving the maximum at 74% attainment, and the Glenelg-Hopkins CMA exhibiting the lowest at 22%.

Water quality with respect to zinc generally was lower through the majority the state compared to 2001 (Figure 4).

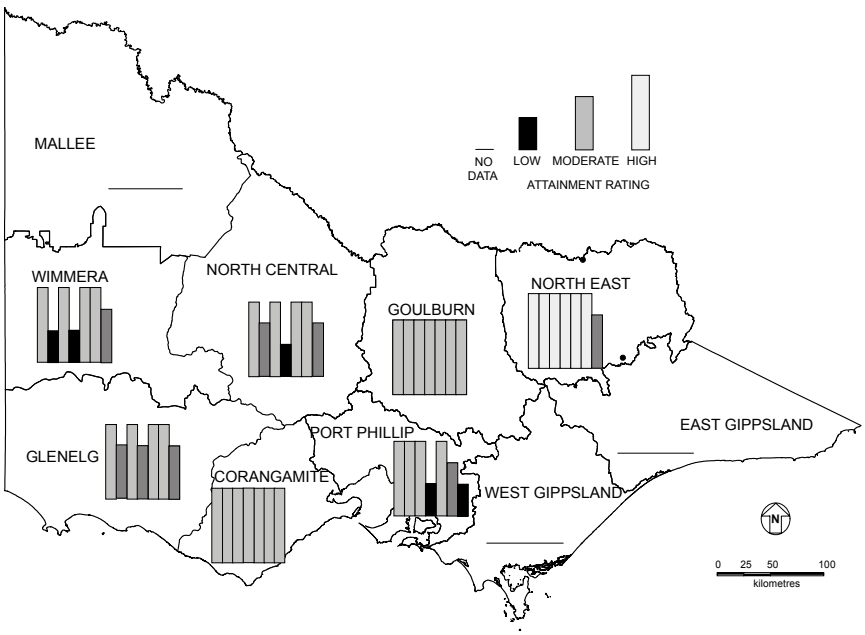


Figure 4. Attainment rating for Arsenic, Cadmium, Chromium, Copper, Nickel, Lead and Zinc (from left to right) in each CMA and CaLP region during 2002.

Table 6. Percent attainment of SEPP objectives and ANZECC guidelines for Arsenic, Cadmium, Chromium, Copper, Nickel, Lead and Zinc in CMA and CaLP regions during 2002. SEPP objectives require 100% attainment, ANZECC guidelines require 80% attainment.

	Arsenic		Cadmium		Chromium		Copper		Nickel		Lead		Zinc	
Region	SEPP	ANZECC	SEPP	ANZECC	SEPP	ANZECC	SEPP	ANZECC	SEPP	ANZECC	SEPP	ANZECC	SEPP	ANZECC
Corangamite	100	97	100	100	100	-	100	16	100	97	100	100	100	74
East Gippsland	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Glenelg-Hopkins	100	100	95	95	100	-	90	2	100	83	100	100	95	22
Goulburn-Broken	100	100	100	100	100	-	100	0	100	100	100	83	100	67
Mallee	--	--	--	--	--	--	--	--	--	--	--	--	--	--
North Central	100	100	87	87	100	-	85	2	100	90	100	98	90	56
North East	100	100	100	100	100	-	100	12	100	100	100	96	92	47
Port Phillip	99	100	100	99	98	-	57	1	100	93	94	67	82	41
West Gippsland	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Wimmera	100	100	88	88	100	-	88	4	100	100	100	96	92	71

-- = no data
* = no objective
Where SEPP objectives exist, the SEPP objectives override the ANZECC guidelines

5.2 CMA Regional Water Quality

5.2.1 Corangamite CMA Region

Water Quality Characterisation

The Corangamite CMA region incorporates four drainage basins: Barwon River (Basin 233 containing 8 stations), Moorabool River (Basin 232 incorporating 3 stations), Lake Corangamite (Basin 234 incorporating 5 stations including 3 lakes) and Otway Coast (Basin 235 incorporating 11 stations including 1 lake). Water quality was characterised for each station in the Corangamite CMA region according to percent attainment with the relevant water quality objectives and guidelines (Tables 7-10). A graphical representation of this data is presented on an attainment map for all of the stations in the region (Figure 5). Water quality characterisation was according to attainment of the SEPP objectives or, in the absence of SEPP objectives, the ANZECC guidelines as outlined in Section 2: Methods.

Water quality within the Corangamite CMA region generally exhibited high attainment of the pH electrical conductivity and turbidity/suspended solids guidelines and objectives. Attainment of the objectives and guidelines for nutrients was generally very poor.

The overall average attainment for pH over the catchment is moderate and this lower overall rating is due to the 8% pH attainment for Boundary Creek at Yeodene (233228) and 0% attainment for Lake Bullen Merri (1707). SEPP attainment for dissolved oxygen (DO) was high at all sites except Lake Bullen Merri (1707), Lake Purrumbete (1810), Moorabool River at Batesford (232202), Boundary Creek at Yeodene (233228) and Scotts Creek at Curdie (235237). Generally at each of these stations, the water level was very low for part of the year, with high water temperatures, and resultant low concentrations of dissolved oxygen.

There were SEPP objectives for electrical conductivity (EC) at only two lakes in this region. For the rest of the sites, ANZECC guidelines applied. EC attainment was low at the Moorabool River at Batesford (232202), Moorabool River at Lal Lal (232210), Barwon River at Pollocksford (233200) and Woady Yaloak River at Cressy (234201). Lake Purrumbete (1810) also had low attainment of the SEPP objectives for salinity. It is interesting to note that this site had low attainment for dissolved oxygen, pH and electrical conductivity. This possibly reflects low water levels at these stations due to drought conditions leading to higher temperatures and concentration effects consequently a reduction in water quality.

SEPP attainment for pH was low for two of the western lakes in the region Lakes Purrumbete: (1810) and Bullen Merri: (1707), with pH levels above the guidelines (slightly alkaline). This was also the case at Lake Colac (220), (slightly alkaline), due to insufficient data points the SEPP attainment was not derived. At Boundary Creek at Yeodene (233228) the pH fell below minimum limits (slightly acidic) consequently the site had low attainment of SEPP objectives. Three sites, Gellibrand River at Upper Gellibrand (235202), Aire River at Beech Forest (235209) and Cumberland River at Lorne (235216) had moderate attainment levels for the SEPP pH objectives. Apart from these sites, all other stations across the catchment had high attainment of SEPP objectives for pH

There were SEPP objectives for turbidity at only one site, Lake Colac (220), but due to insufficient sampling events attainment levels were not applied. All other stations were assessed against ANZECC guidelines. Attainment was generally high at all sites. As would be expected there is a fair degree of correlation between attainment for turbidity and suspended

solids. Two sites - Boundary Creek at Yeodene (233218) and Kennedy's Creek (235211) recorded moderate SEPP attainment for suspended solids (SS).

There were no SEPP objectives for nitrogen or phosphorus at any of the sites and ANZECC guidelines were applied to all stations. Attainment of the total nitrogen (TN) guidelines was low for all stations in the Corangamite CMA region except for the Cumberland River (235216) at which attainment was moderate. This is the third year in a row in which this station has been the only exception to the low attainment of TN guidelines. Attainment for oxidised nitrogen (NO_x) was low at all stations except the Moorabool River at Batesford (232202), Moorabool River at Morrisons (232204) and Woady Yaloak River at Cressy (234201) which had moderate attainment of the guidelines.

Total phosphorus (TP) attainment was low at almost all stations. The notable exceptions were the Moorabool River at Morrisons (232204), Woady Yaloak River at Cressy (234201) and Cumberland River (235216) which had 100% attainment of the ANZECC guidelines for Total Phosphorus. Sites at Moorabool River at Batesford (232202) and Boundary Creek at Yeodene (233228) had moderate attainment of the guideline.

Attainment of the guidelines for filterable reactive phosphorus (FRP) was much more variable across the catchment. All of the sites in the Moorabool River basin (232202, 232204 and 232210) achieved high attainment as did some of the Barwon River stations (233218, 233224 and 233228) and the Woady Yalloak River at Cressy (234201). Most sites located south of the Otway Basin also had high (235227, 235205, 235202, 235209, 235216) or moderate (235224,) attainment of FRP guidelines. Attainment was low at sites (235203, 235211, 235234 and 235237) and at all of the lake stations.

Insufficient samples were taken from all sites to allow assessment of chlorophyll-*a* against ANZECC guidelines.

Three sites were sampled for metals and SEPP objectives were applicable to all sites. All sites achieved high attainment for arsenic, cadmium, chromium, nickel and lead where applicable. Lake Bullen Merri (1707) recorded low attainment for copper and zinc and Lake Purrumbete (1810) recorded low attainment for copper.

The water quality data and summary statistics relating to the water quality, water quantity and river health in the Corangamite CMA region have been made available on the Internet. See www.vicwaterdata.net for this information.

Table 7. Percent attainment of SEPP and ANZECC objectives and guidelines for physical parameters at stations within the Corangamite CMA region during 2002.

Basin	Program	SINO	SEPP				ANZECC			Rating		
			DO	DO%sat	EC	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	pH
	Rivers											
232	V	232202	**75**	**75**	-	100	**17**	**42**	100	L	L	H
	V	232204	100	100	-	100	**33**	**92**	100	H	H	H
	V	232210	100	100	-	100	**58**	**8**	**33**[a]	H	L	H
233	E	3361	*	*	-	*	*	*	*	*	*	*
	V	233200	100	100	-	100	**67**	**67**	**83**[a]	H	L	H
	V	233211	*	*	-	*	*	*	*	*	*	*
	V	233214	100	100	-	100	**67**	100	**83**[b]	H	H	H
	V	233215	100	100	-	100	100	100	**17**[a]	H	H	H
	V	233218	100	100	-	100	**58**	**75**	**92**[a]	H	M	H
	V	233224	100	100	-	100	**58**	100	100	H	H	H
	V	233228	**75**	**75**	-	**8**[b]	**25**	100	**0**[b]	L	H	L
234	V	234201	100	100	-	100	**42**	**0**	100	H	L	H
	V	234203	**92**	**92**	-	100	**8**	100	**92**[a]	M	H	H
235	V	235202	100	100	-	**92**	**67**	100	**92**[b]	H	H	M
	V	235203	100	100	-	100	**42**	100	**92**[b]	H	H	H
	V	235204	100	100	-	100	100	100	**58**[a] [b]	H	H	H
	V	235205	100	100	-	100	**92**	100	**83**[a] [b]	H	H	H
	V	235209	100	100	-	**92**[b]	**75**	100	**92**[b]	H	H	M
	V	235211	100	100	-	100	**0**	100	**92**[b]	H	H	H
	V	235216	100	100	-	**92**[b]	100	100	**75**[a] [b]	H	H	M
	V	235224	100	100	-	100	**75**	100	**92**[b]	H	H	H
	V	235227	100	100	-	100	**67**	100	**92**[b]	H	H	H
	V	235234	100	100	-	100	**75**	100	**92**[b]	H	H	H
	V	235237	**67**	**75**	-	100	**8**	**92**	**92**[b]	L	H	H
	Lakes											
234	E	220	*	*	-	*	*	*	*	*	*	*
	E	1707	**75**	**61**	100	**0**[a]	**39**	**0**	**0**[b]	L	H	L
235	E	1810	**68**	**58**	**89**	**74**[a]	**53**	**0**	**26**[a]	L	L	L

[a] = pH outside objective range, above maximum limit
[b] = pH outside objective range, below minimum limit
* = Insufficient data (<10 samples)
- = No guideline
E = EPA FSN
V = VWQMN
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 8. Percent attainment of SEPP and ANZECC objectives for turbidity and suspended solids at stations within the Corangamite CMA region during 2002.

Basin	Program	SINO	SEPP			ANZECC		Rating	
			$Turb_{50}$	SS_{50}	SS_{90}	$Turb_{80}$	SS_{80}	Turb	SS
	Rivers								
232	V	232202	-	100	100	100	100	H	H
	V	232204	-	100	100	100	100	H	H
	V	232210	-	100	100	100	100	H	H
233	E	3361	-	*	*	*	*	*	*
	V	233200	-	100	100	100	100	H	H
	V	233211	-	*	*	*	*	*	*
	V	233214	-	100	100	100	100	H	H
	V	233215	-	100	100	100	100	H	H
	V	233218	-	100	100	100	100	H	H
	V	233224	-	**83**	100	100	100	H	H
	V	233228	-	**58**	**92**	100	**92**	H	M
234	V	234201	-	100	100	100	100	H	H
	V	234203	-	100	100	100	100	H	H
235	V	235202	-	100	100	100	100	H	H
	V	235203	-	**92**	100	100	100	H	H
	V	235204	-	*	*	100	*	H	*
	V	235205	-	100	100	100	100	H	H
	V	235209	-	**92**	100	**92**	**92**	H	H
	V	235211	-	**92**	**92**	**92**	**92**	H	M
	V	235216	-	100	100	100	100	H	H
	V	235224	-	**92**	100	100	100	H	H
	V	235227	-	**75**	100	100	**92**	H	H
	V	235234	-	**83**	100	100	100	H	H
	V	235237	-	**92**	100	100	100	H	H
	Lakes								
234	E	220	*	*	-	*	*	*	*
	E	1707	-	-	-	100	100	H	H
235	E	1810	-	-	-	100	*100	H	H

* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 9. Percent attainment of ANZECC objectives for nutrients at stations within the Corangamite CMA region during 2002.

Basin	Program	SINO	ANZECC						Rating					
			TN_{80}	NO_{x80}	NH_{480}	TP_{80}	FRP_{80}	Chl-a_{80}	TN	NO_x	NH_4	TP	FRP	Chl-a
	Rivers													
232	V	232202	**0**	**75**	*	**83**	100	*	L	M	*	M	H	*
	V	232204	**25**	**83**	*	100	100	*	L	M	*	H	H	*
	V	232210	**0**	**8**	*	**0**	100	*	L	L	*	L	H	*
233	E	3361	*	*	*	*	*	*						
	V	233200	**0**	**50**	*	**0**	**25**	*	L	L	*	L	L	*
	V	233211	*	*	*	*	*	*	*	*	*	*	*	*
	V	233214	**67**	**33**	*	**8**	**67**	*	L	L	*	L	L	*
	V	233215	**0**	**42**	*	**0**	**0**	*	L	L	*	L	L	*
	V	233218	**8**	**58**	*	**58**	**92**	*	L	L	*	L	H	*
	V	233224	**18**	**67**	*	**67**	100	*	L	L	*	L	H	*
	V	233228	**0**	**17**	*	**83**	100	*	L	L	*	M	H	*
234	V	234201	**0**	**83**	*	**92**	**92**	*	L	M	*	H	H	*
	V	234203	**0**	**67**	*	**17**	**67**	*	L	L	*	L	L	*
235	V	235202	**0**	**0**	*	**17**	100	*	L	L	*	L	H	*
	V	235203	**0**	**0**	*	**8**	**33**	*	L	L	*	L	L	*
	V	235204	*	*	*	*	*	*	*	*	*	*	*	*
	V	235205	**0**	**0**	*	**50**	100	*	L	L	*	L	H	*
	V	235209	**0**	**0**	*	**17**	100	*	L	L	*	L	H	*
	V	235211	**0**	**0**	*	**0**	**8**	*	L	L	*	L	L	*
	V	235216	**83**	**42**	*	100	100	*	M	L	*	H	H	*
	V	235224	**8**	**0**	*	**0**	**75**	*	L	L	*	L	M	*
	V	235227	**33**	**17**	*	**67**	100	*	L	L	*	L	H	*
	V	235234	**25**	**25**	*	**0**	**58**	*	L	L	*	L	L	*
	V	235237	**0**	**17**	*	**0**	**25**	*	L	L	*	L	L	*
	Lakes													
234	E	220	*	*	*	*	*	*	*	*	*	*	*	*
	E	1707	**0**	**15**	*	**0**	**20**	**50**	L	L	*	L	L	
235	E	1810	**0**	**11**	*	**0**	**0**	**90**	L	L	*	L	L	

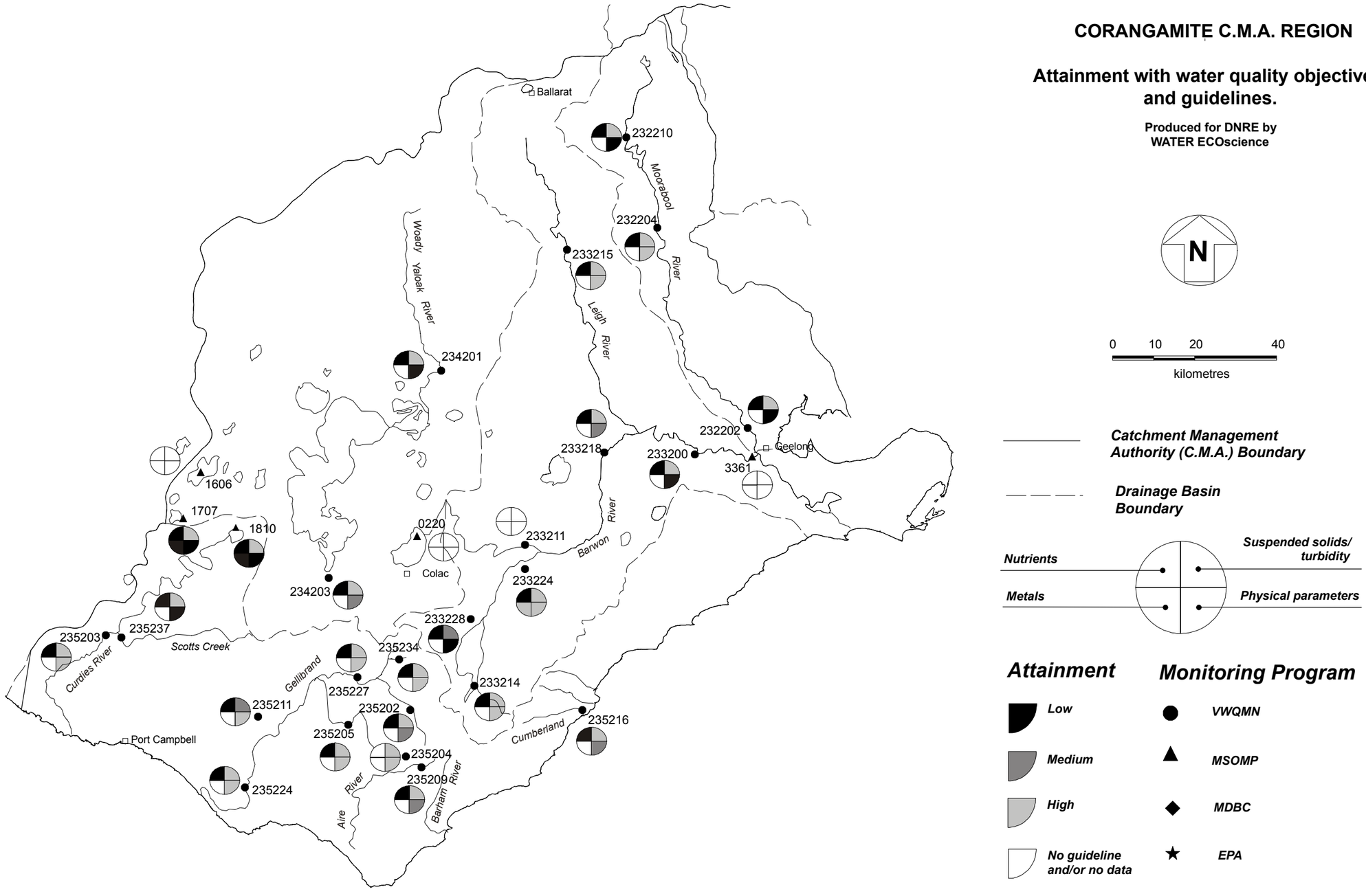
* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 10. Percent attainment of SEPP and ANZECC objectives for metals at stations within the Corangamite CMA region during 2002.

Basin	Program	SINO	SEPP							ANZECC						
			As	**Cd**	**Cr**	**Cu**	**Ni**	**Pb**	**Zn**	**As_{80}**	**Cd_{80}**	**Cr_{80}**	**Cu_{80}**	**Ni_{80}**	**Pb_{80}**	**Zn_{80}**
	Rivers															
232	V	232202	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	232204	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	232210	*	*	*	*	*	*	*	*	*	-	*	*	*	*
233	E	3361	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	233200	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	233211	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	233214	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	233215	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	233218	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	233224	100	100	100	100	100	100	100	100	100	-	**17**	**92**	100	**83**
	V	233228	*	*	*	*	*	*	*	*	*	-	*	*	*	*
234	V	234201	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	234203	*	*	*	*	*	*	*	*	*	-	*	*	*	*
235	V	235202	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	235203	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	235204	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	235205	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	235209	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	235211	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	235216	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	235224	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	235227	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	235234	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	235237	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	Lakes															
234	E	220	-	*	*	*	*	*	*	*	*	-	*	*	*	*
	E	1707	-	d	100	**20**	100	100	**40**	**90**	100	-	**10**	100	100	**40**
235	E	1810	-	d	100	**30**	100	100	100	100	100	-	**20**	100	100	100

Basin	Program	SINO	Rating						
			As	Cd	Cr	Cu	Ni	Pb	Zn
233	V	233224	H	H	H	H	H	H	H
234	E	1707	-	D	H	L	H	H	L
235	E	1810	-	D	H	L	H	H	H

* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
d = detection limits above guideline value.
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.



CORANGAMITE C.M.A. REGION

Attainment with water quality objectives and guidelines.

Produced for DNRE by WATER ECOscience

N

0 10 20 40

kilometres

Catchment Management Authority (C.M.A.) Boundary

Drainage Basin Boundary

Nutrients — ***Suspended solids/ turbidity***

Metals — ***Physical parameters***

Attainment	***Monitoring Program***
Low	***VWQMN***
Medium	***MSOMP***
High	***MDBC***
No guideline and/or no data	***EPA***

Figure 5. Corangamite CMA region. Attainment with water quality objectives and guidelines.

Station Specific Water Quality: Boundary Creek at Yeodene

Station 233228 (Boundary Creek at Yeodene) was identified as having poor water quality with respect to dissolved oxygen, pH, suspended solids and nutrients, and high water quality with respect to turbidity.

The station has been characterized with a highly variable discharge, with clear seasonal peaks in winter. The remainder of the year has been characterized by relatively low discharge rates, often well below 20 ML/day. Flow has ceased during each summer since 1998.

Peaks in turbidity, suspended solids and nutrients quite often accompanied winter peaks in discharge. This is most likely due to increased runoff from surrounding lands as well as increased disturbance of the bottom sediments, introducing more suspended matter into the stream system.

Dissolved oxygen has displayed a typical seasonal pattern with peaks in winter and troughs in summer. For most of the year, observations are generally above the SEPP objective minimum of 5 mg/L. However in the summer months since 1998, dissolved oxygen levels have tended to reduce to below this minimum objective. During periods of minimal or zero troughs in dissolved oxygen below 5 mg/L oxygen were observed.

EC levels have varied over the entire monitoring period between 350 and 1000 μS/cm. An upward trend appears to have started about 1998. Since 2000, EC values have risen above 1000 uS/cm regularly and on one occasion, exceedence of the ANZECC guideline of EC <2200 μS/cm was measured in May 2000.

Similarly to EC, pH has consistently varied over the entire monitoring period, with the majority of observations recorded well below the recommended minimum guideline values. The ANZECC guidelines of 6.5 to 8.0 pH units have been breached on many occasions. A large downward trend has been observed in pH levels for many years. Large changes in the flow may be a major contributing factor with pH variation.

Peaks in suspended solids were often associated with peaks in phosphorus and nitrogen concentrations, both of which received poor water quality rating in the guideline attainment in 2002. Disregarding the seasonal pattern, concentrations appear to have remained steady for both nutrients since monitoring began in 1993. Total nitrogen and oxidised nitrogen (NO_x) follow the same pattern and were present at elevated concentrations in 2002 therefore recording low attainment.

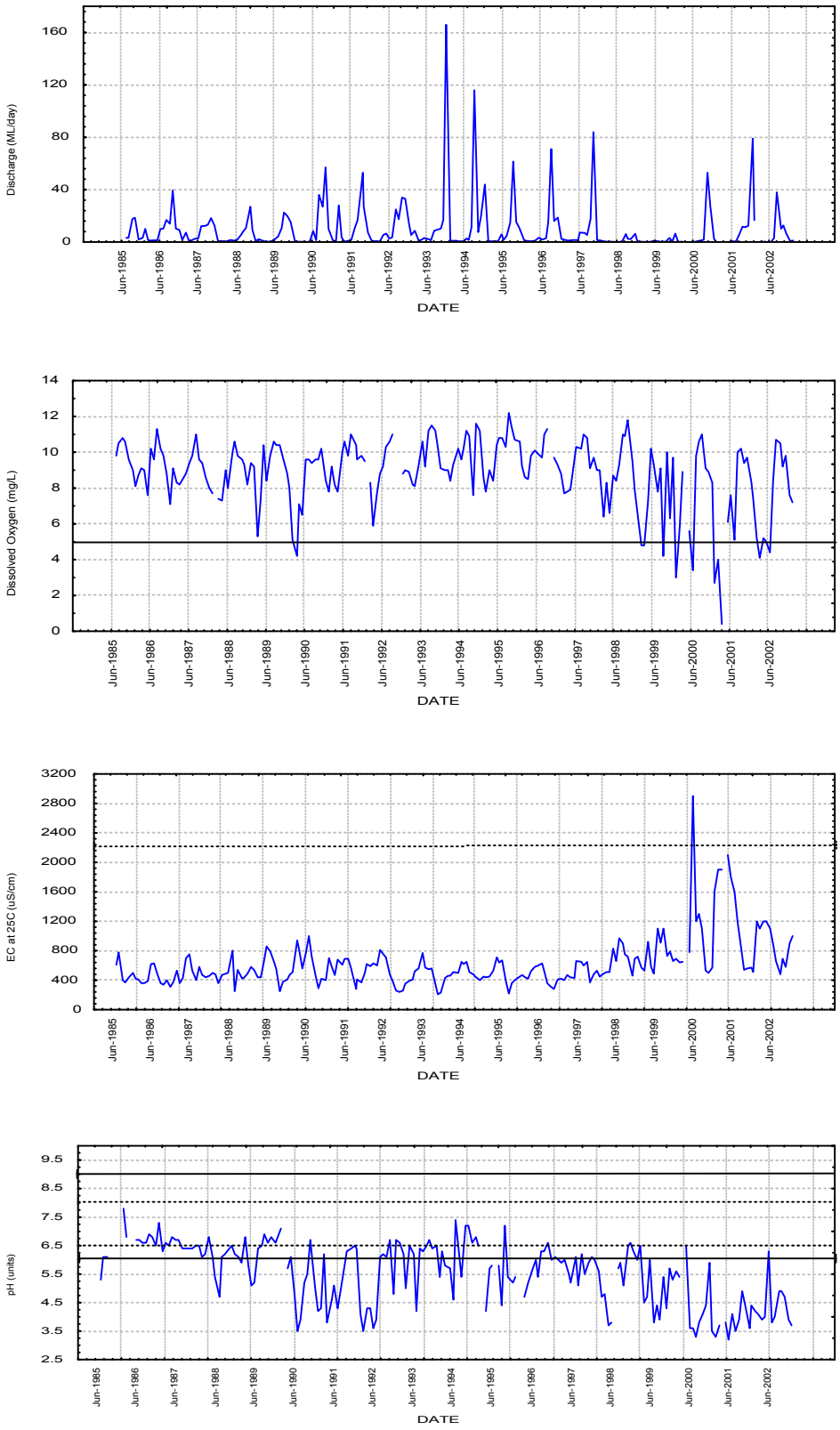


Figure 6. Variation on water quality over time in Boundary Creek at Yeodene, 1985 – 2002.

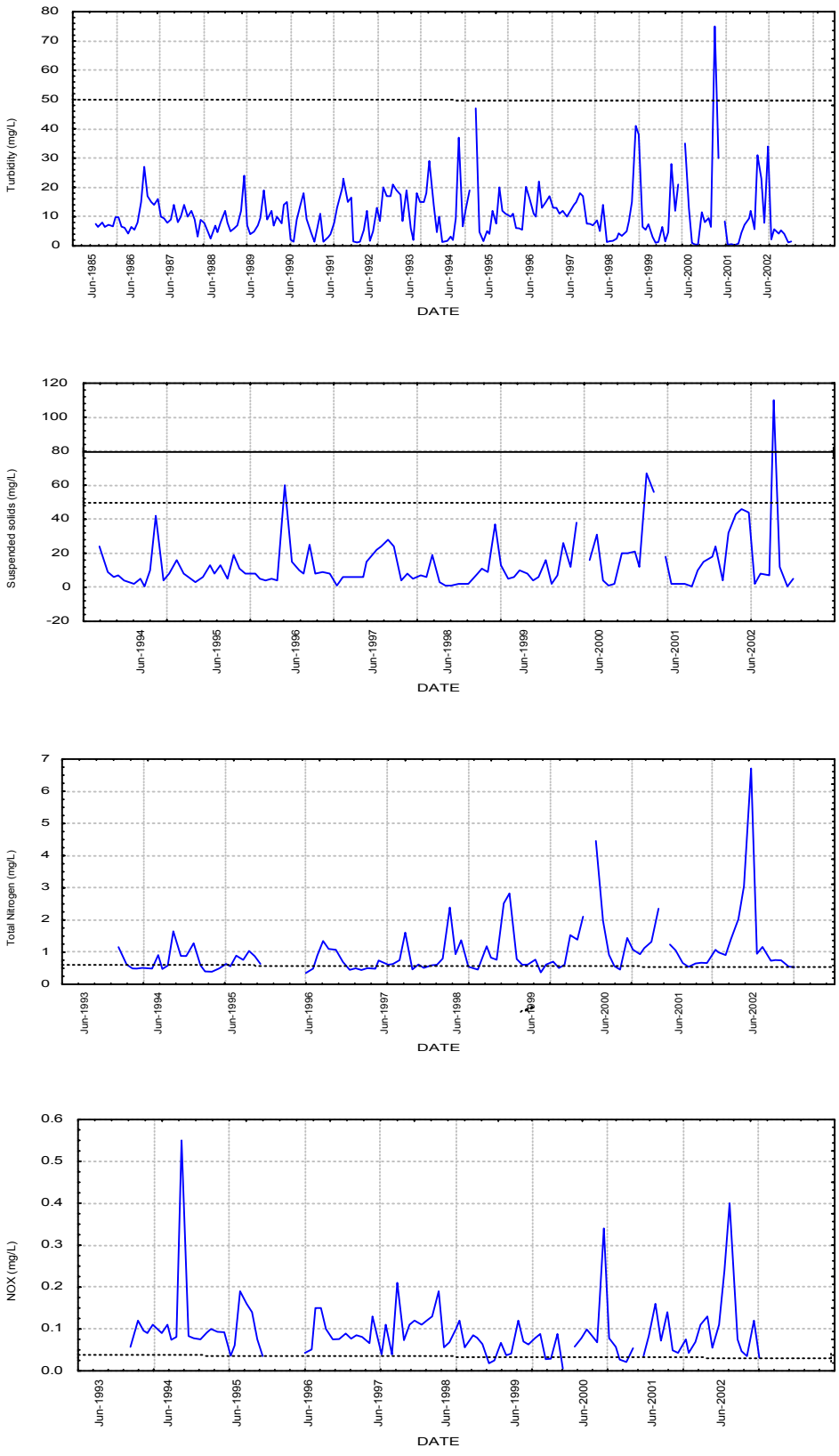


Figure 7. Variation on water quality over time in Boundary Creek at Yeodene, 1985 – 2002.

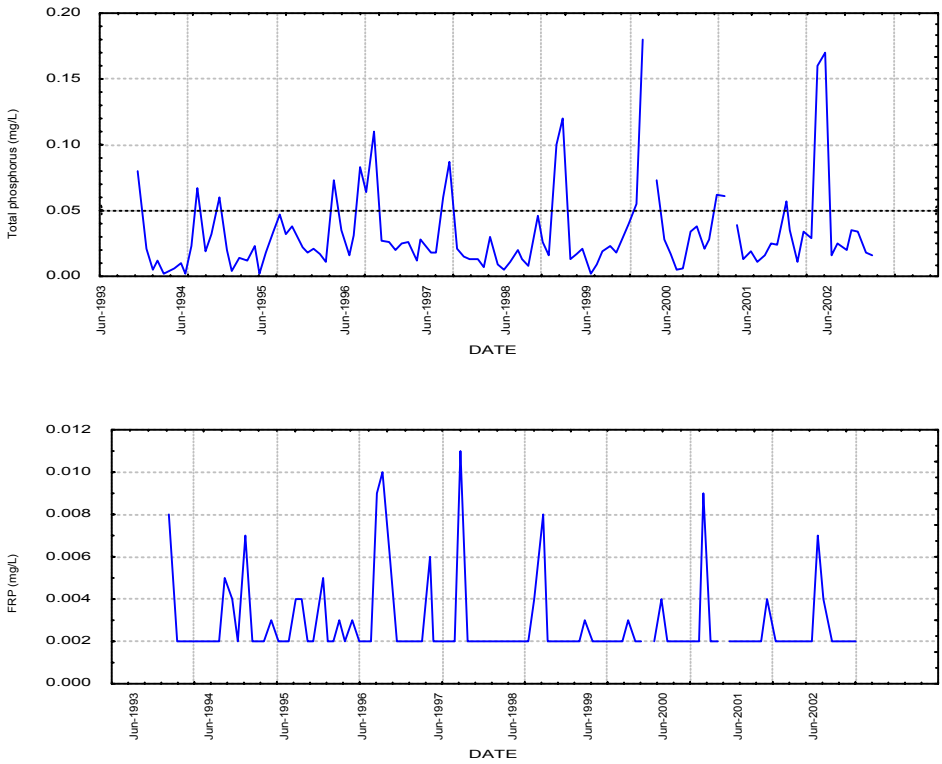


Figure 8. Variation on water quality over time in Boundary Creek at Yeodene, 1985 – 2002.

Black line indicates SEPP objective limit and dashed line indicates ANZECC guideline limit. Limits are minimum for DO, range for pH, maximum for other parameters.

It should be recognized that in many cases the dates on the x axis on the graph do not line up on all graphs. This is due to the change in time when monitoring started for some parameters.

5.2.2 East Gippsland CMA Region

Water Quality Characterisation

The East Gippsland CMA region incorporates five drainage basins; East Gippsland (Basin 221 incorporating 7 stations), Snowy River (Basin 222 incorporating 4 stations), Tambo River (Basin 223 incorporating 4 stations), Mitchell River (Basin 224 incorporating 3 stations) and Upper Murray River (Basin 401 incorporating 3 stations). Water quality was characterised for each station in the East Gippsland CMA region according to percent attainment with the relevant water quality objectives and guidelines (Tables 11-13). A graphical representation of this data is presented on an attainment map for all of the stations in the region (Figure 9). Water quality characterisation was according to attainment of the SEPP objectives or, in the absence of SEPP objectives, the ANZECC guidelines as outlined in Section 2.

Water quality within the East Gippsland CMA region generally exhibited high attainment for pH, turbidity, suspended solids, dissolved oxygen and electrical conductivity. Attainment of the objectives and guidelines for nutrients was generally lower except for filterable reactive phosphorus (FRP), which recorded high attainment at all stations.

Attainment of the dissolved oxygen objectives and guidelines was high in the Upper Murray Basin (401), the Snowy River Basin (222), the Dargo and Mitchell Rivers (224213 and 224203) and Nicholson River at Deptford (223204). For the upland river stations in the East Gippsland Basin (221) including site 221001, 221201 and 221212 attainment was also high. DO levels in the water deteriorated downstream in the 221 Basin. Generally the moderate to low attainment found in the Tambo River Basin (223) was also exhibited at the Wonnangatta River (224206) site.

There were no SEPP objectives for electrical conductivity (EC), therefore ANZECC guidelines applied. All stations had high attainment of the ANZECC guidelines.

SEPP attainment for pH throughout the CMA region was generally high. The only exceptions achieved moderate attainment. Namely, Errinundra River at Errinundra (221207), Bemm River at Princess Highway (221212), Snowy River at Jarrahmond (222200), Nicholson River at Deptford (223204) and Dargo River at Lower Dargo Road (224213).

SEPP attainment for suspended solids was generally high across the East Gippsland CMA region. The exceptions were Combienbar River at Combiebar (221211) and Tambo River u/s of Smith Creek (223214) which recorded moderate attainment for this objective.

SEPP attainment for turbidity was high for all of the stations, except at Tambo River upstream of Swifts Creek (223214), which had low attainment and the Combienbar River at Combiebar (221211) which had moderate attainment.

There were no SEPP objectives for total nitrogen (TN) in the East Gippsland CMA region, therefore ANZECC guidelines applied. Generally attainment of these guidelines was low, but results were variable across the catchment. High attainment occurred at the Genoa River at the Gorge (221210) the Mitchell River at Glenaladale (224203) the Wonnangatta River at Crooked Creek (224206) the Dargo River at Lower Dargo Road (224213) and the Mitta Mitta River at Hinnomunjie (401203). Moderate attainment was recorded at the Genoa River at Rockton (221001), the Snowy River at Jarrahmond (222200), the Brodribb River at Sardine Creek

(222202), the Tambo River at Swifts Creek (223202), and the Nicholson River at Deptford (223204).

Low attainment for oxidised nitrogen (NO_x) was recorded at almost all stations except at the Genoa River at the Gorge (221210) and the Dargo River at Lower Dargo Road (224213) which achieved moderate attainment. The Tambo River u/s of Smith Creek (223214), and the Mitta Mitta River at Hinnomunjie (401203) which were also exceptions with high attainment.

There were no SEPP objectives for total phosphorus (TP) in the East Gippsland CMA region, therefore ANZECC guidelines applied. The Genoa River at the Gorge (221210), Snowy River at Jarrahmond (222200), the Brodribb River at Sardine Creek (222202), Nicholson River at Deptford (223204) and the Mitchell River at Glenaladale (224203) all had high attainment. Moderate to low attainment was obtained for all other sites. All stations recorded high attainment for filterable reactive phosphorus (FRP).

No sites were sampled for either chlorophyll-*a* or for metals in the East Gippsland CMA region.

The water quality data and summary statistics relating to the water quality, water quantity and river health in the East Gippsland CMA region have been made available on the Internet. See www.vicwaterdata.net for this information.

Table 11. Percent attainment of SEPP and ANZECC objectives for physical parameters at stations within the East Gippsland CMA region during 2002.

Basin	Program	SINO	SEPP				ANZECC			Rating		
			DO	DO%sat	EC	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	PH
	Rivers											
221	V	221001	100	100	-	100	100	100	100	H	H	H
	V	221201	100	100	-	100	100	100	**83**[a]	H	H	H
	V	221207	**92**	**92**	-	**92**[b]	**92**	100	**92**[b]	M	H	M
	V	221208	**75**	**83**	-	100	**83**	100	100	L	H	H
	V	221210	**75**	**92**	-	100	**92**	100	100	M	H	H
	V	221211	**91**	**91**	-	100	**91**	100	100	M	H	H
	V	221212	100	100	-	**92**[b]	100	100	**92**[b]	H	H	M
222	V	222200	100	100	-	**92**[b]	100	100	**92**[b]	H	H	M
	V	222202	100	100	-	100	100	100	**92**[b]	H	H	H
	V	222209	100	100	-	100	100	100	**75**[a]	H	H	H
	V	222217	100	100	-	100	100	100	**92**[b]	H	H	H
223	V	223202	100	**92**	-	100	**75**	100	**67**[a]	M	H	H
	V	223204	100	100	-	**91**	100	100	**91**[b]	H	H	M
	V	223213	**64**	**27**	-	100	**18**	100	**64**[a]	L	H	H
	V	223214	**83**	**42**	-	100	**25**	100	**50**[a]	L	H	H
224	V	224203	100	100	-	100	100	100	100	H	H	H
	V	224206	**92**	**92**	-	100	**67**	100	100	M	H	H
	V	224213	100	100	-	**92**[b]	**92**	100	**75**[a]	H	H	M
401	V	401203	100	100	-	100	**58**	100	100	H	H	H
	V	401215	100	100	-	100	**0**	100	**92**[a]	H	H	H
	V	401226	100	100	-	100	**45**	100	**75**[a] [b]	H	H	H

[a] = pH outside objective range, above maximum limit
[b] = pH outside objective range, below minimum limit
* = Insufficient data (<10 samples)
\- = No guideline
V = VWQMN
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 12. Percent attainment of SEPP and ANZECC objectives for turbidity and suspended solids at stations within the East Gippsland CMA region during 2002.

Basin	Program	SINO	SEPP				ANZECC		Rating	
			$Turb_{50}$	$Turb_{90}$	SS_{50}	SS_{90}	$Turb_{80}$	SS_{80}	Turb	SS
	Rivers									
221	V	221001	-	-	100	100	100	100	H	H
	V	221201	-	-	100	100	100	100	H	H
	V	221207	-	-	**83**	100	100	**92**	H	H
	V	221208	-	-	*	*	100	*	H	*
	V	221210	-	-	100	100	100	100	H	H
	V	221211	-	-	**82**	**82**	**82**	**82**	M	M
	V	221212	-	-	100	100	100	100	H	H
222	V	222200	-	-	100	100	100	100	H	H
	V	222202	-	-	100	100	100	100	H	H
	V	222209	-	-	100	100	100	100	H	H
	V	222217	-	-	100	100	100	100	H	H
223	V	223202	100	100	100	100	100	100	H	H
	V	223204	**83**	100	100	100	100	100	H	H
	V	223213	**73**	100	100	100	100	100	H	H
	V	223214	**42**	**75**	**83**	**92**	100	100	L	M
224	V	224203	100	100	100	100	100	100	H	H
	V	224206	100	100	100	100	100	100	H	H
	V	224213	**92**	100	100	100	100	100	H	H
401	V	401203	-	-	100	100	100	100	H	H
	V	401215	-	-	*	*	100	*	H	*
	V	401226	-	-	100	100	100	100	H	H

* = Insufficient data (<10 samples)
\- = No guideline
V = VWQMN
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 13. Percent attainment of ANZECC objectives for nutrients at stations within the East Gippsland CMA region during 2002.

Basin	Program	SINO	ANZECC						Rating					
			TN_{80}	NO_{x80}	NH_{480}	TP_{80}	FRP_{80}	Chl-a_{80}	TN	NO_x	NH_4	TP	FRP	Chl-a
	Rivers													
221	V	221001	**83**	**8**	*	**83**	100	*	M	L	*	M	H	-
	V	221201	**17**	**0**	*	**33**	**92**	*	L	L	*	L	H	-
	V	221207	**67**	**0**	*	**83**	**92**	*	L	L	*	M	H	*
	V	221208	*	*	*	*	*	*	*	*	*	*	*	*
	V	221210	**92**	**83**	*	100	100	*	H	M	*	H	H	*
	V	221211	**55**	**9**	*	**82**	100	*	L	L	*	M	H	*
	V	221212	**0**	**0**	*	**42**	100	*	L	L	*	L	H	-
222	V	222200	**83**	**17**	*	100	100	*	M	L	*	H	H	*
	V	222202	**83**	**0**	*	100	100	*	M	L	*	H	H	*
	V	222209	**17**	**0**	*	**83**	100	*	L	L	*	M	H	-
	V	222217	**0**	**0**	*	**83**	100	*	L	L	*	M	H	-
223	V	223202	**75**	**58**	*	**67**	100	*	M	L	*	L	H	-
	V	223204	**75**	**17**	*	100	100	*	M	L	*	H	H	*
	V	223213	**55**	**64**	*	**55**	100	*	L	L	*	L	H	-
	V	223214	**50**	**92**	*	**8**	**92**	*	L	H	*	L	H	-
224	V	224203	**92**	**67**	*	100	100	*	H	L	*	H	H	*
	V	224206	**91**	**58**	*	**58**	**92**	*	H	L	*	L	H	-
	V	224213	100	**83**	*	**75**	100	*	H	M	*	M	H	-
401	V	401203	**92**	**92**	*	**58**	100	*	H	H	*	L	H	-
	V	401215	*	*	*	*	*	*	*	*	*	*	*	-
	V	401226	**67**	**58**	*	**8**	100	*	L	L	*	L	H	

* = Insufficient data (<10 samples)
- = No guideline
V = VWQMN
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.
No sites were sampled for metals in the East Gippsland CMA region.

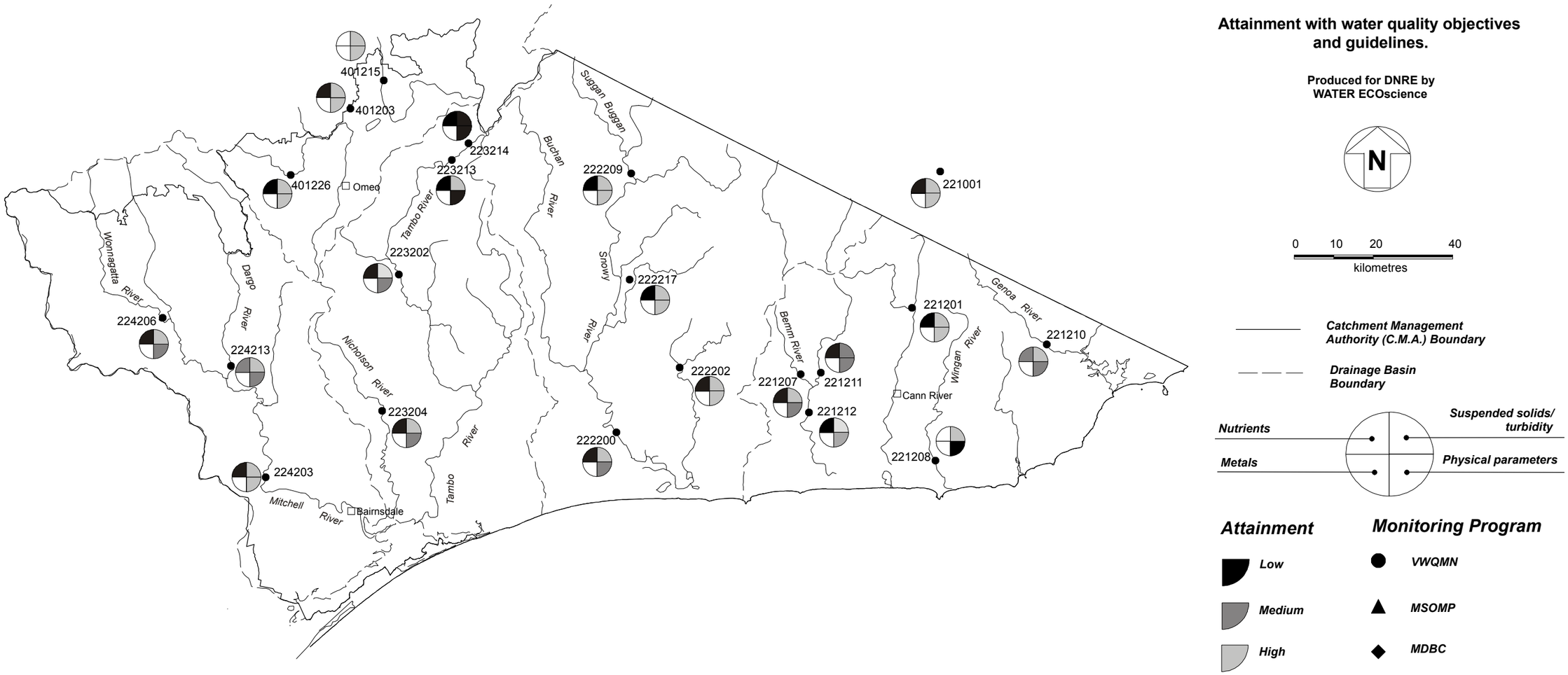


Figure 9. East Gippsland CMA region. Attainment of water quality objectives and guidelines

.

Station Specific Water Quality: Tambo River u/s of Smith Creek

The Tambo River u/s of Smith Creek (station 223214) was identified as having low attainment for dissolved oxygen, turbidity, total nitrogen and total phosphorus and moderate attainment for suspended solids during 2002. Electrical conductivity, pH, oxidised nitrogen (NOx) and filterable reactive phosphorus (FRP) achieved high attainment against these objectives.

Discharge of the Tambo River is generally low with the majority of the records below 30 ML/day. Peaks in flow appear to have no seasonal correlation. During 2002 the majority of the flows measured were below 2.5 ML/day.

A low attainment of SEPP objectives for dissolved oxygen (DO) was recorded for this site in 2002. Dissolved oxygen fell below the low attainment level of 8 mg/L on two occasions. Over the monitoring period, DO generally shows a regular pattern of high values over the cooler months and lower values over the warmer months.

Although pH varies (with a slight upward trend) at this site and exceeded the ANZECC guideline limits it was within the SEPP guidelines during 2002. During this period the attainment was high for pH.

Electrical conductivity is typically low at this site (less than 250 μS/cm with the maximum recorded level at 350 μS/cm). Attainment for electrical conductivity has therefore always been high and 2002 is no exception.

Peaks in turbidity often accompanied winter peaks in discharge. This is most likely due to increased runoff from surrounding lands as well as increased disturbance of the bottom sediments. The attainment for turbidity was found to be low during 2002. Moderate attainment was observed for suspended solids, generally the levels were low (especially after 1996).

There are no SEPP objectives for nutrients at this site and so ANZECC guidelines have been applied. Nutrients have only been monitored in the Tambo River u/s of Smith Creek since November 1990 and have generally shown low attainment of the guidelines for both total nitrogen and total phosphorus over this period.

Total nitrogen and total phosphorus levels both exceeded the ANZECC guidelines in 2002. Levels of filterable reactive phosphorus (FRP) remained below guideline limits resulting in high attainment for this parameter. The station also recorded high attainment for oxidised nitrogen (nitrates plus nitrites - NOx) during this period.

Metals are not monitored at Tambo River u/s of Smith Creek.

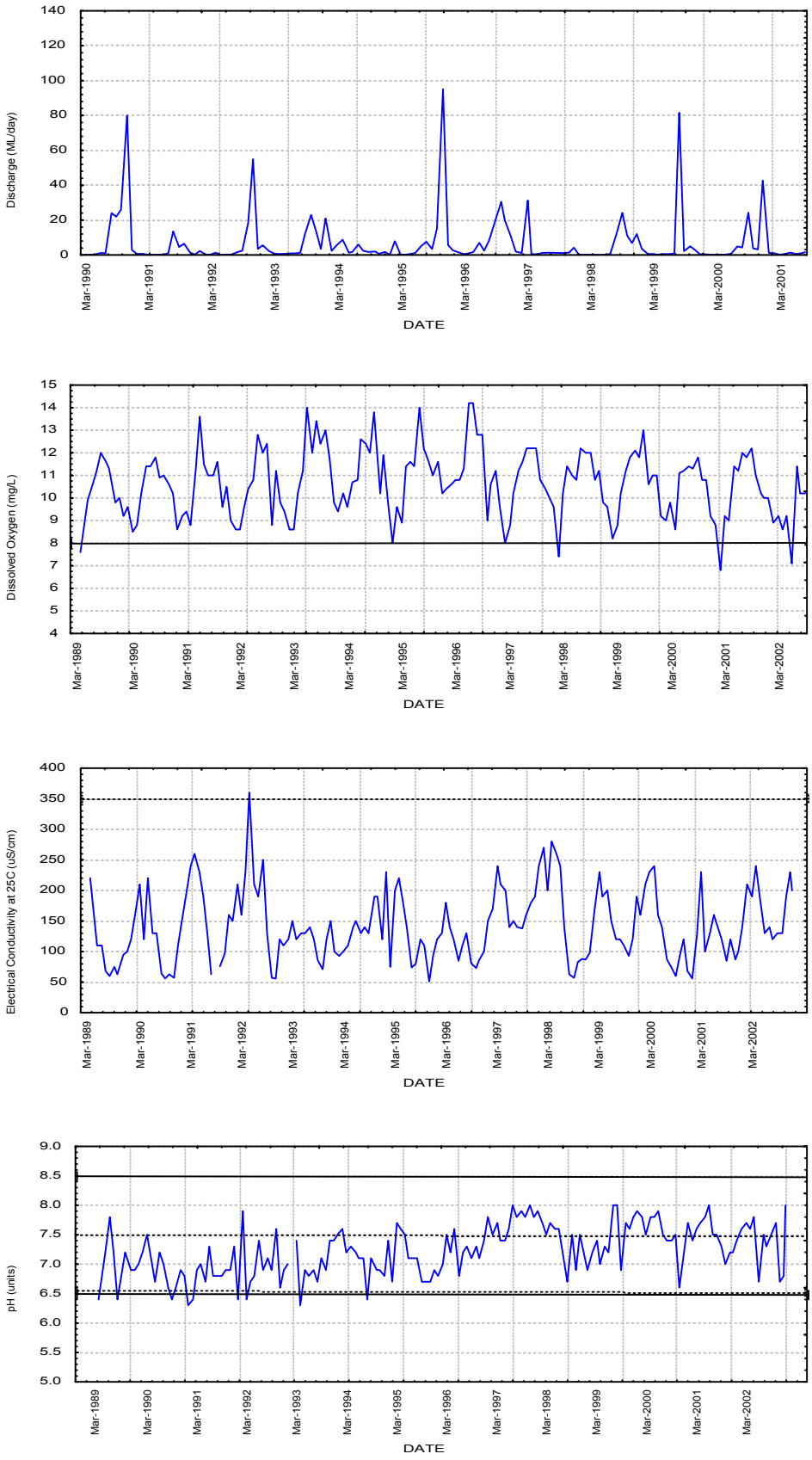


Figure 10. Variation on water quality over time in the Tambo River u/s of Smith Creek, 1989 – 2002 (1990 to 2002 for nutrients).

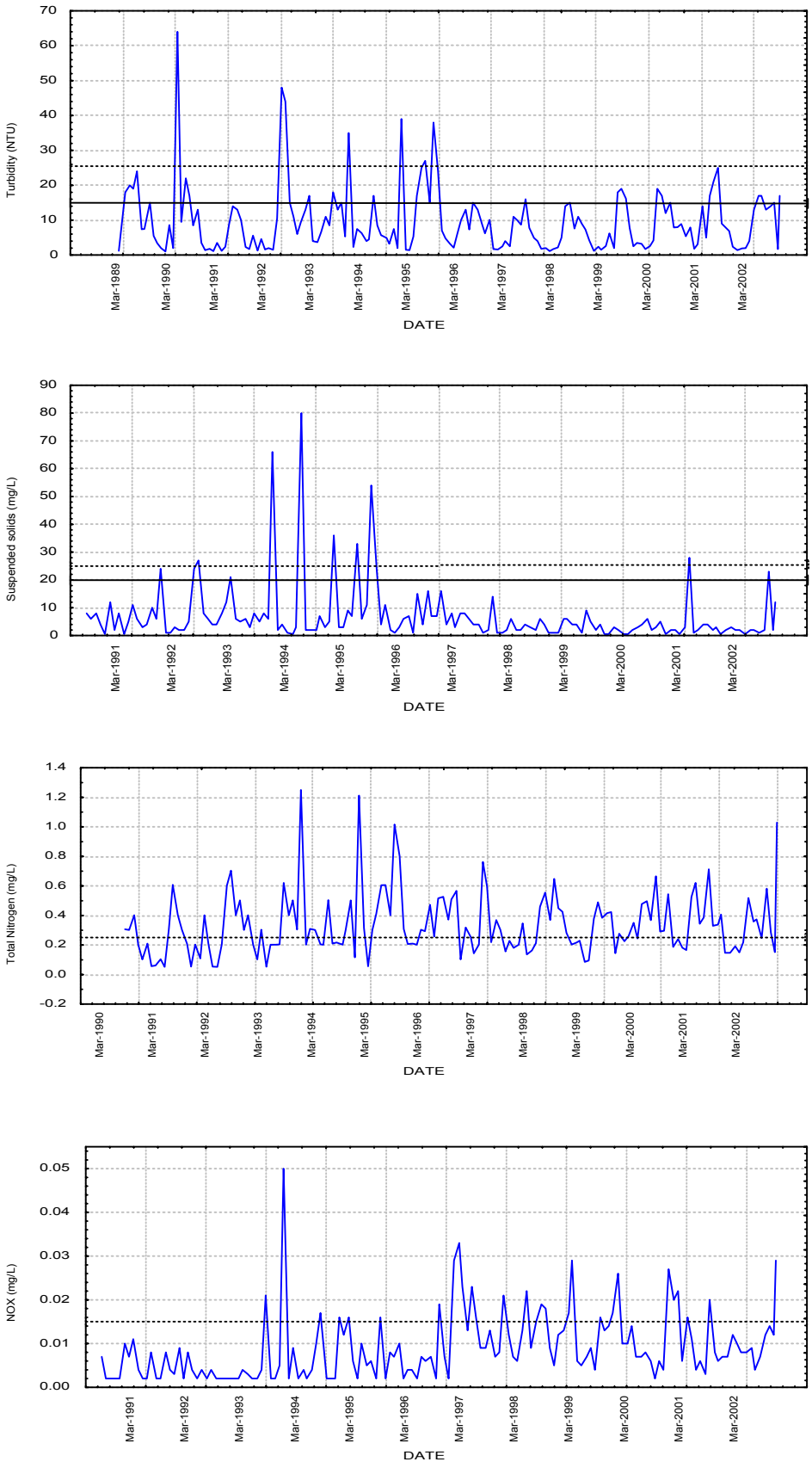


Figure 11. Variation on water quality over time in the Tambo River u/s of Smith Creek, 1989 – 2002 (1990 to 2002 for nutrients).

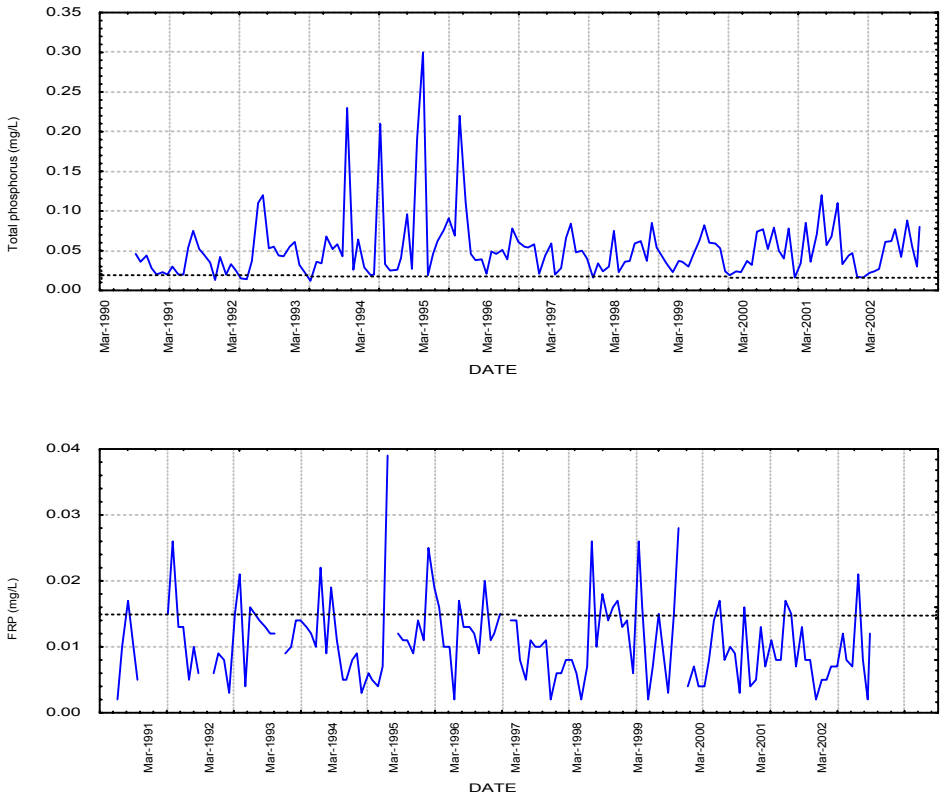


Figure 12. Variation on water quality over time in the Tambo River u/s of Smith Creek, 1989 – 2002 (1990 to 2002 for nutrients).

Black line indicates SEPP objective limit and dashed line indicates ANZECC guideline limit. Limits are minimum for DO, range for pH, maximum for other parameters.

It should be recognized that in many cases the dates on the x axis on the graph do not line up on all graphs. This is due to the change in time when monitoring started for some parameters.

5.2.3 Glenelg-Hopkins CMA Region

Water Quality Characterisation

The Glenelg-Hopkins CMA region incorporates three drainage basins; Hopkins River (Basin 236 incorporating 5 stations including 1 lake), Portland Coast (Basin 237 incorporating 2 stations) and Glenelg River (Basin 238 incorporating 11 stations including 2 lakes). Water quality was characterised for each station in the Glenelg-Hopkins CMA region according to percent attainment with the relevant water quality objectives and guidelines (Tables 14-17). A graphical depiction of this data is presented on an attainment map for all of the stations in the region (Figure 13). Water quality characterisation was according to attainment of the SEPP objectives or, in the absence of SEPP objectives, the ANZECC guidelines as outlined in Section 2: Methods.

Water quality within the Glenelg-Hopkins CMA region generally exhibited high attainment for pH except for Lake Moora Moora (238237) and Glenelg River at Big Cord (238231) which recorded low attainment for this objective.

SEPP attainment for dissolved oxygen (DO) was high throughout the CMA region. The exceptions were Burrumbeet Creek at Lake Burrumbeet (236215) and Wannon River at Dunkeld (238204) which recorded low attainment and Glenelg River at Rocklands Reservoir (238205) and Glenelg River at Fulhams Bridge (238224) which recorded moderate attainment for dissolved oxygen.

There were no SEPP objectives for electrical conductivity (EC), therefore the ANZECC guidelines applied. Only the Surry River at Heathmere (237207), Jimmy Creek (238208) and the Glenelg River at Big Cord (238231) achieved greater than the required 80% attainment of the guideline. All other stations had low attainment.

All stations with sufficient data for suspended solids (SS) and turbidity assessment achieved high SEPP and/or ANZECC attainment.

There were no SEPP objectives for total nitrogen in the Glenelg-Hopkins CMA region, therefore the ANZECC guidelines applied. Every station in the Glenelg-Hopkins CMA region had low attainment for total nitrogen (TN) except Surry River at Heathmere (237207) which recorded moderate attainment and Jimmy Creek at Jimmy Creek (238208) which recorded high attainment. The majority of stations achieved low attainment for oxidised nitrogen (NO_x) except the Moyne River at Toolong (237200) and Surry River at Heathmere (237207) which achieved high attaimnent and Wannon River at Henty (238228) which achieved moderate attainment. Ammonia (NH_4) was not measured at any sites in the CMA region in 2002.

In the absence of SEPP objectives for total phosphorus (TP) the ANZECC guidelines applied. All stations had low attainment of these guidelines except for the Moyne River at Toolong (237200) and Glenelg River at Sandford (238202) which all had moderate attainment. Also four other stations Surry River at Heathmere (237207), Glenelg River at Dartmoor (238206), Wando River at Wando Vale (238223) and Glenelg River at Big Cord (238231), had high attainment for total phosphorus. For filterable reactive phosphorus (FRP), attainment was high at all of the sites except Hopkins River at Framlingham (3685), Burrumbeet Creek at Lake Burrumbeet (236215), Mount Emu Creek at Taroon (236216) and Jimmy Creek (238208) where low attainment was achieved. Surry River at Heathmere (237207) and Wannon River at Dunkeld (238204) were also exceptions with moderate attainment.

Two lake sites in the Glenelg-Hopkins CMA were monitored for chlorophyll-a, Rocklands Reservoir 2338236 had low attainment and Moora Moora Reservoir 238237 had high ANZECC attainment for this parameter.

Five sites were sampled for metals in the Glenelg-Hopkins CMA region. All stations achieved 100% SEPP attainment for arsenic, chromium, nickel and lead. The Hopkins River at Hopkins Falls (3676) had low attainment and the Glenelg River at Sandford (238202) had moderate attainment for cadmium. Hopkins River at Framlingham (3685) had moderate attainment and Mount Emu Creek at Taroon (236216) and Glenelg River at Sandford (238202) had low attaiment for copper. Sites at Hopkins River at Framlingham (3685), Mount Emu Creek at Taroon (236216) and Wannon River at Henty (238228) achieved moderate attainment for zinc.

Every station had less than 10% ANZECC attainment for copper, for which the guideline levels are dependent upon water hardness. This suggests that the water hardness may need to be monitored to ensure an accurate guide to water quality with respect to these metals.

The water quality data and summary statistics relating to the water quality, water quantity and river health in the Glenelg-Hopkins CMA region have been made available on the Internet. See www.vicwaterdata.net for this information.

Table 14. Percent attainment of SEPP and ANZECC objectives for physical parameters at stations within the Glenelg-Hopkins CMA Region during 2002.

Basin	Program	SINO	SEPP				ANZECC			Rating		
			DO	DO%sat	EC	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	pH
	Rivers											
236	E	3676	*	*	-	*	*	*	*			
	E	3685	100	100	-	100	**92**	**0**	**58**[(a)]	H	L	H
	V	236215	**83**	**83**	-	100	**8**	**0**	**64**[(a)]	L	L	H
	V	236216	100	100	-	100	**75**	**0**	**67**[(a)]	H	L	H
237	V	237200	100	100	-	100	**92**	**17**	**92**[(a)]	H	L	H
	V	237207	100	100	-	100	**42**	100	**83**[(b)]	H	H	H
238	V	238202	100	100	-	100	100	**0**	100	H	L	H
	V	238204	**58**	**67**	-	100	**8**	**0**	**67**[(a)]	L	L	H
	V	238205	**92**	**92**	-	100	**42**	**0**	100	M	L	H
	V	238206	100	100	-	100	**67**	**17**	**92**[(b)]	H	L	H
	V	238208	100	100	-	100	**58**	100	**67**[(a) (b)]	H	H	H
	V	238223	100	100	-	100	**91**	**0**	**83**[(a) (b)]	H	L	H
	V	238224	**92**	**92**	-	100	**8**	**0**	**92**[(a)]	M	L	H
	V	238228	100	100	-	100	100	**8**	**92**[(a)]	H	L	H
	V	238231	100	100	-	**50**[(b)]	**0**	**92**	**17**[(a) (b)]	H	H	L
	Lakes											
236	E	1234	*	*	-	*	*	*	*	*	*	*
238	S	238236	*	*	-	100	*	**0**	100	*	L	H
	S	238237	*	*	-	**53**[(b)]	*	**0**	**7**[(b)]	*	L	L

[(a)] = pH outside objective range above maximum limit
[(b)] = pH outside objective range below minimum limit
* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 15. Percent attainment of SEPP and ANZECC objectives for turbidity and suspended solids at stations within the Glenelg-Hopkins CMA Region during 2002.

Basin	Program	SINO	SEPP			ANZECC		Rating	
			$Turb_{50}$	SS_{50}	SS_{90}	$Turb_{80}$	SS_{80}	Turb	SS
	Rivers								
236	E	3676	-	*	*	*	*	H	*
	E	3685	-	*	*	100	*	H	*
	V	236215	100	100	-	**92**	100	H	H
	V	236216	-	100	100	100	100	H	H
237	V	237200	-	100	100	100	100	H	H
	V	237207	-	100	100	100	100	H	H
238	V	238202	-	**92**	100	100	100	H	H
	V	238204	-	100	100	**83**	100	H	H
	V	238205	-	*	*	100	*	H	*
	V	238206	-	100	100	100	100	H	H
	V	238208	-	100	100	100	100	H	H
	V	238223	-	100	100	100	100	H	H
	V	238224	-	100	100	100	100	H	H
	V	238228	-	**92**	100	100	100	H	H
	V	238231	-	100	100	100	100	H	H
	Lakes								
236	E	1234	*	*	-	*	*	*	*
238	S	238236	-	*	*	100	*	H	*
	S	238237	-	*	*	**93**	*	H	*

* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 16. Percent attainment of ANZECC objectives for nutrients at stations within the Glenelg-Hopkins CMA Region during 2002.

Basin	Program	SINO	ANZECC						Rating					
			TN_{80}	NO_{x80}	NH_{480}	TP_{80}	FRP^{80}	Chl-a_{80}	TN	NO_x	NH_4	TP	FRP	Chl-a
	Rivers													
236	E	3676	*	*	*	*	*	*	*	*	*	*	*	*
	E	3685	**0**	**67**	*	**0**	**8**	*	L	L	*	L	L	*
	V	236215	**0**	**0**	*	**0**	**0**	*	L	L	*	L	L	*
	V	236216	**0**	**42**	*	**0**	**0**	*	L	L	*	L	L	*
237	V	237200	18	92	*	**83**	100	*	L	H	*	M	H	*
	V	237207	82	92	*	**92**	**83**	*	M	H	*	H	M	*
238	V	238202	**0**	**67**	*	**83**	100	*	L	L	*	M	H	*
	V	238204	**0**	**50**	*	**0**	**75**	*	L	L	*	L	M	*
	V	238205	*	*	*	*	*	*	*	*	*	*	*	*
	V	238206	**0**	**8**	*	100	100	*	L	L	*	H	H	*
	V	238208	**91**	**42**	*	**0**	**0**	*	H	L	*	L	L	*
	V	238223	**0**	**50**	*	100	100	*	L	L	*	H	H	*
	V	238224	**0**	**42**	*	**58**	100	*	L	L	*	L	H	*
	V	238228	**0**	**75**	*	**67**	**92**	*	L	M	*	L	H	*
	V	238231	**18**	**67**	*	**92**	100	*	L	L	*	H	H	*
	Lakes													
236	E	1234	*	*	*	*	*	*	*	*	*	*	*	*
238	S	238236	**0**	**7**	*	**0**	100	**67**	L	L	*	L	H	L
	S	238237	**0**	**40**	*	**47**	100	**93**	L	L	*	L	H	H

* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 17. Percent attainment of SEPP and ANZECC objectives metals at stations within the Glenelg-Hopkins CMA Region during 2002.

Basin	Program	SINO	SEPP							ANZECC						
			As	Cd	Cr	Cu	Ni	Pb	Zn	As_{80}	Cd_{80}	Cr_{80}	Cu_{80}	Ni_{80}	Pb_{80}	Zn_{80}
	Rivers															
236	E	3676	*	**83**	100	100	100	100	100	*	**83**	-	**0**	**75**	100	**58**
	E	3685	100	100	100	**92**	100	100	**92**	100	100	-	**0**	**83**	100	**25**
	V	236215	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	236216	100	100	100	**83**	100	100	**92**	100	100	-	**8**	**75**	100	**8**
237	V	237200	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	237207	*	*	*	*	*	*	*	*	*	-	*	*	*	*
238	V	238202	100	**92**	100	**75**	100	100	100	100	**92**	-	**0**	**92**	100	**8**
	V	238204	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	238205	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	238206	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	238208	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	238223	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	238224	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	238228	100	100	100	100	100	100	**92**	100	100	-	**0**	**92**	100	**8**
	V	238231	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	Lakes															
236	E	1234	*	*	*	*	*	*	*	*	*	-	*	*	*	*
238	S	238236	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	238237	*	*	*	*	*	*	*	*	*	-	*	*	*	*

Basin	Program	SINO	Rating						
			As	Cd	Cr	Cu	Ni	Pb	Zn
236	E	1234	*	*	*	*	*	*	*
	E	3676	*	L	H	H	H	H	H
	E	3685	H	H	H	M	H	H	M
	V	236216	H	H	H	L	H	H	M
238	V	238202	H	M	H	L	H	H	H
	V	238228	H	H	H	H	H	H	M

* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

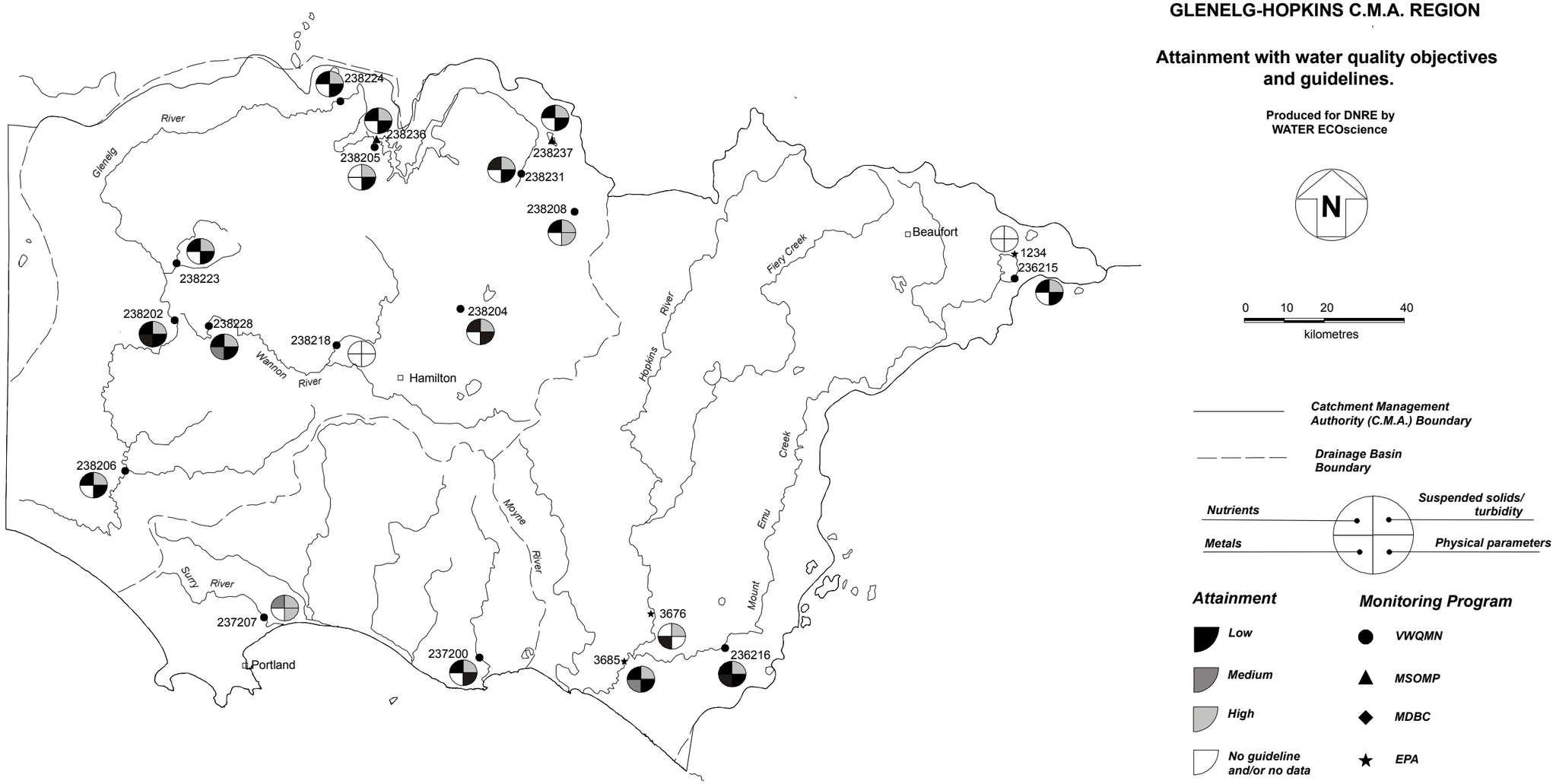


Figure 13. Glenelg-Hopkins CMA region. Attainment of water quality objectives and guidelines

.

Station Specific Water Quality: Mount Emu Creek at Taroon (Ayrford Road)

Station 236216 (Mount Emu Creek at Taroon) was identified as having high salinity and nutrient concentrations during 2002.

Flow at this station is highly variable with flows varying from 3.5 ML/day to 107 ML/day during 2002. Extreme peaks (>1000 ML/day) have not occurred since November 1996.

Dissolved oxygen has generally displayed typical seasonal variation, with peaks in winter and troughs in summer. Observations for dissolved oxygen are all above the SEPP objective of 5 mg/L for 2002.

Electrical conductivity is high at this site and generally above the ANZECC guideline value of 2200 uS/cm. During 2002 electrical conductivity values ranged from 3000 – 5800 uS/cm.

At this site pH achieved a high attainment result of the applicable SEPP objective. In 2002 pH was found to be reasonably consistent throughout the year with observations ranging from pH 6.8 to pH 8.3.

High attainment with ANZECC guidelines was obtained for suspended solids and turbidity. The levels of suspended solids and turbidity correlate reasonably well with the discharge rate at this site, although turbidity appears more responsive to changes in flow.

Nutrients have been monitored at this site since November, 1993. No SEPP guidelines were available for nutrients and so the ANZECC guidelines have been used. Total phosphorus has remained above the guideline level, during 2002. Filterable reactive phosphorus (FRP) levels also exhibited a low attainment against its objectives and also showing an upward trend since 1996.

Nitrogen has remained above the guideline levels during the entire monitoring period and 2002 was no exception. This year, total nitrogen concentrations attained zero compliance with ANZECC guidelines. The maximum nitrogen observed in January 2002 was 2.2 mg/L. This peak correlates with the peak in flow which occurred at this time and it is possible that this event washed nitrogen-rich organic material into the river thereby further increasing nitrogen loads. A peak in NO_x was also recorded at this time and attainment levels were low at this station.

High attainment with ANZECC guidelines was obtained for the majority of metals, except for low attainment for copper and moderate attainment for zinc.

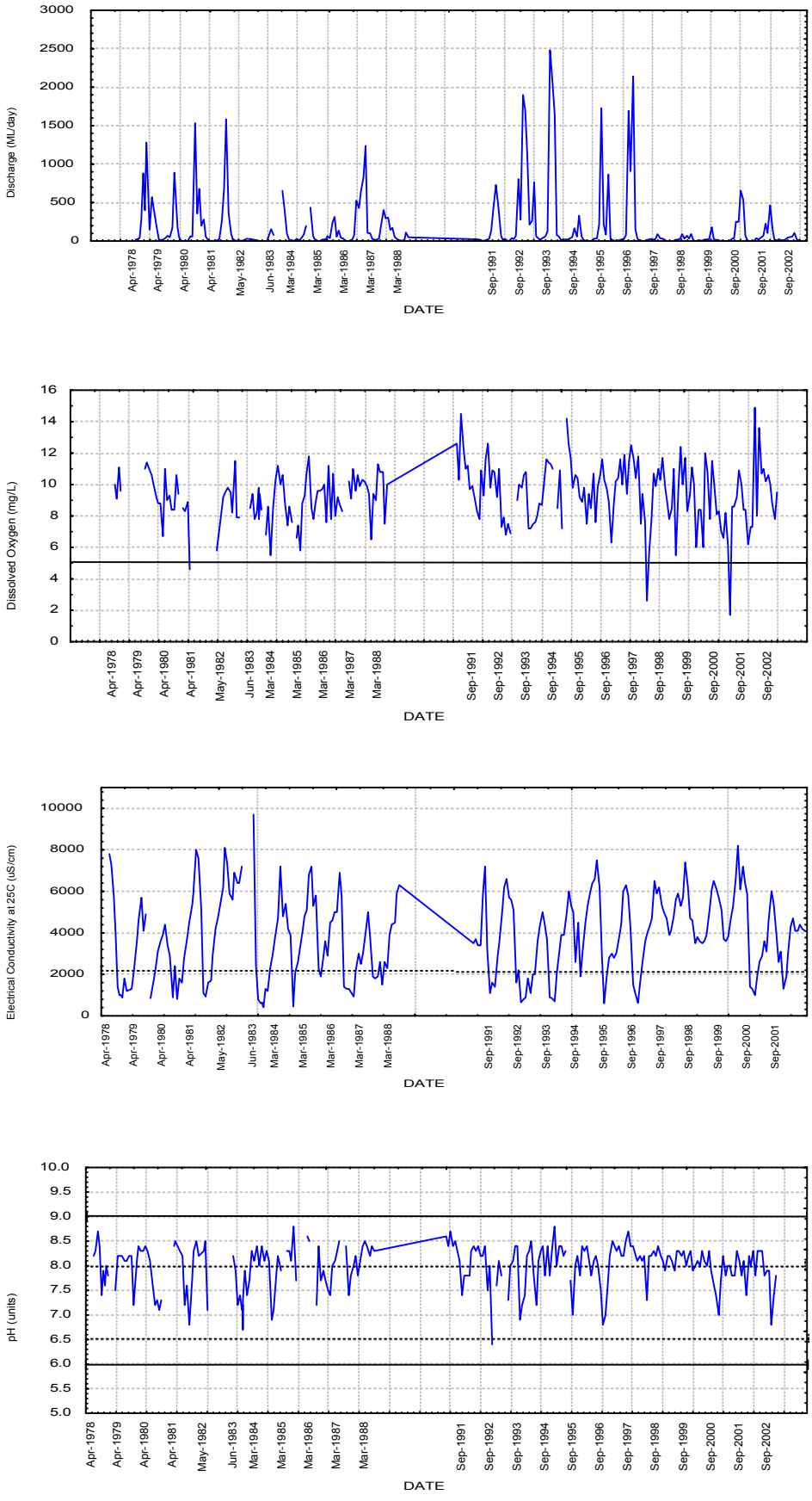


Figure 14. Variation in water quality over time in the Mount Emu Creek at Taroon 1978-2002 (1993 – 2002 for nutrients).

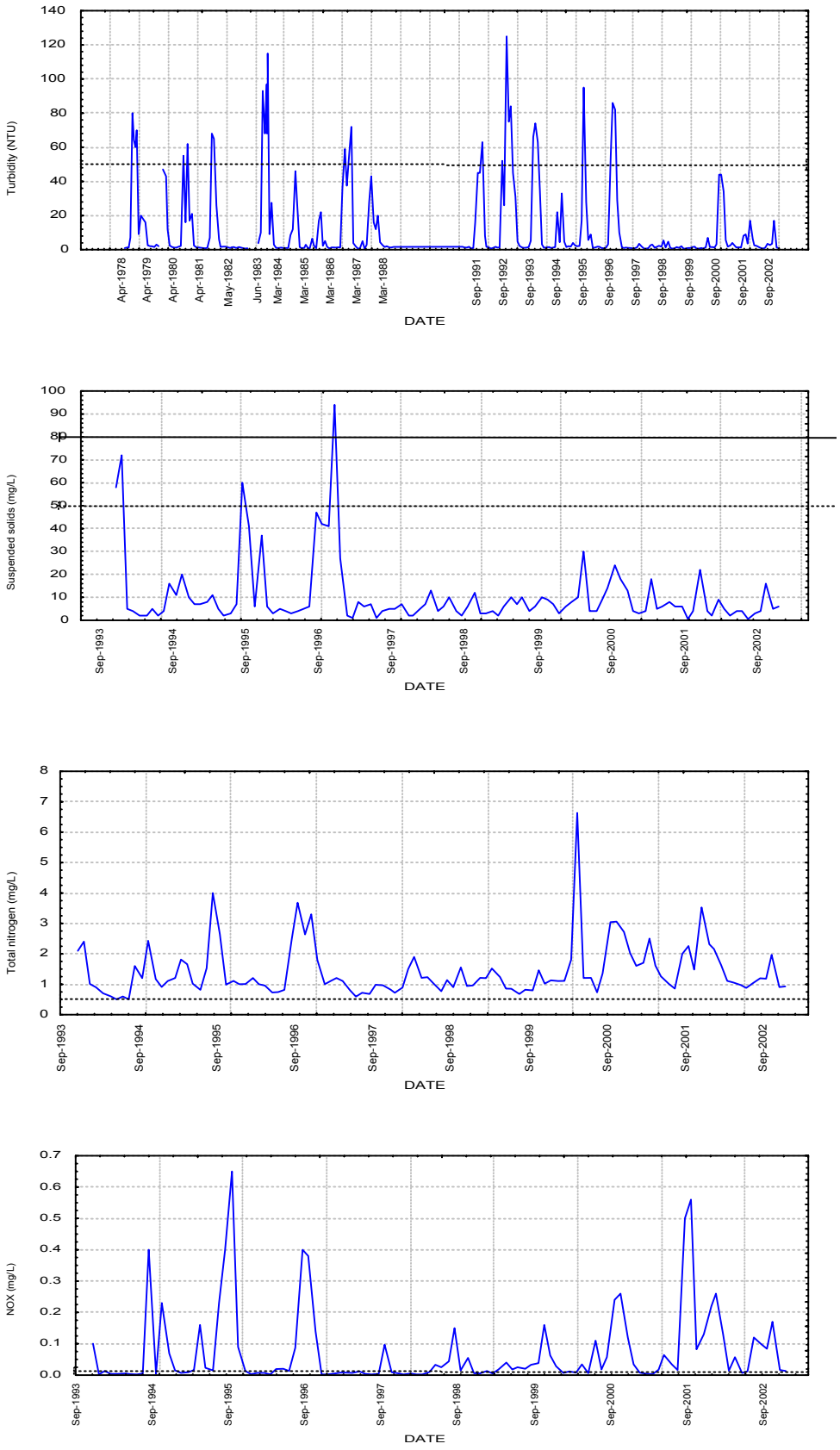


Figure 15. Variation in water quality over time in the Mount Emu Creek at Taroon 1978-2002 (1993 – 2002 for nutrients).

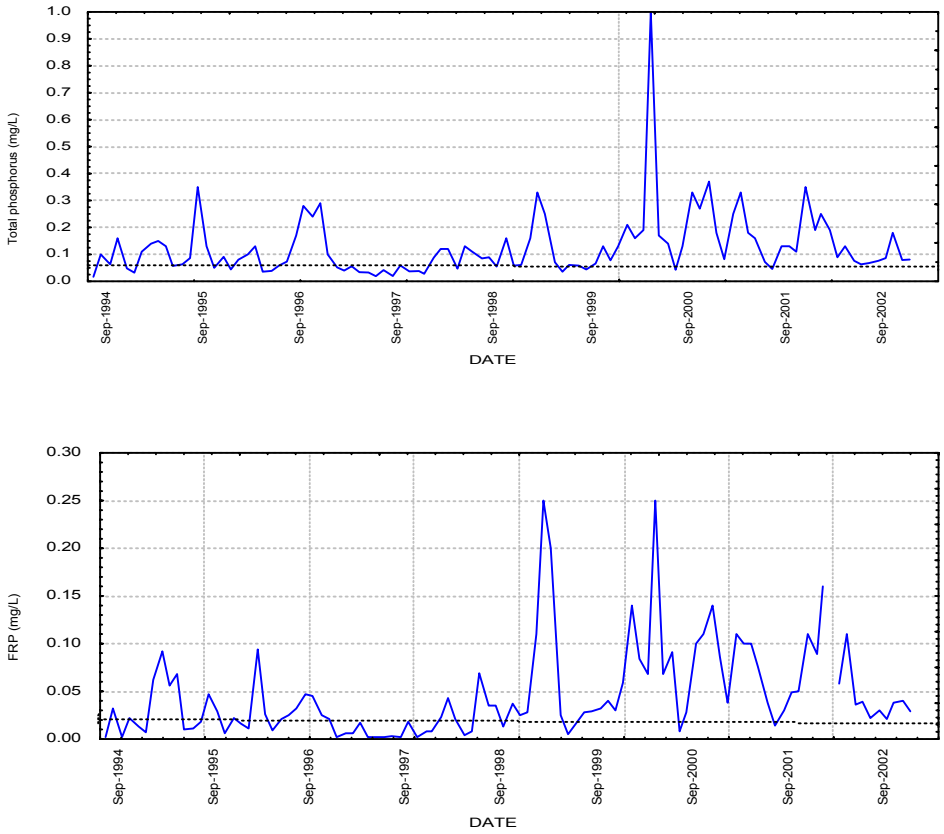


Figure 16. Variation in water quality over time in the Mount Emu Creek at Taroon 1978-2002 (1993 – 2002 for nutrients).

Black line indicates SEPP objective limit and dashed line indicates ANZECC guideline limit. Limits are minimum for DO, range for pH, maximum for other parameters.

It should be recognized that in many cases the dates on the x axis on the graph do not line up on all graphs. This is due to the change in time when monitoring started for some parameters.

*Note: Data was not available at this site for the period between July 1988 and January 1991.

5.2.4 Goulburn-Broken CMA Region

Water Quality Characterisation

The Goulburn-Broken CMA region incorporates two drainage basins: Broken River (Basin 404 incorporating 8 stations including 2 lakes) and Goulburn River (Basin 405 incorporating 22 stations including 5 lakes) and also has one station located in the Murray Riverine Basin (Basin 409). Water quality was characterised for each station in the Goulburn-Broken CMA region according to percent attainment with the relevant water quality objectives and guidelines (Tables 18-21). A graphical depiction of this data is presented on an attainment map for all of the stations in the region (Figure 17). Water quality characterisation was according to attainment of the SEPP objectives or, in the absence of SEPP objectives, the ANZECC guidelines as outlined in Section 2: Methods.

Water quality within the Goulburn-Broken CMA region generally exhibited high attainment for dissolved oxygen, pH, electrical conductivity, turbidity, suspended solids and metals and low attainment for nutrients.

SEPP attainment for dissolved oxygen (DO) was high for the majority of stations. Holland Creek at Kelfeera (404207), Broken Creek at Katamatite (404214), Sunday Creek at Tallarook (405212) and Sugarloaf Creek at Ash Bridge (405240) recorded low attainment. Broken River at Casey Weir (404216), Goulburn River at Dohertys (405219) and Sevens Creek downstream of Euroa (405237) achieved moderate attainment against its objectives.

There were no SEPP objectives for electrical conductivity (EC), therefore the ANZECC guidelines applied. All but three of the river sites achieved high attainment of the guidelines. Holland Creek at Kelfeera (404207), Sunday Creek at Tallarook (405212) and Sugarloaf Creek at Ash Bridge (405240) had low attainment. Elevated salinity levels in this location may be due to dry conditions, land use influences or recharge in this area. All of the lake sites had low attainment for EC.

All of the sites monitored achieved 100% attainment of the SEPP objectives for pH. Attainment of the more stringent ANZECC guidelines was not as high. Several stations in the south of the catchment occasionally recorded slightly more alkaline values than the guideline limits and several stations in the north of the catchment recorded slightly acidic pH.

All stations recorded high attainment of the SEPP objectives for suspended solids except for Broken Creek at Katamatite (404214), which had low attainment. There were no SEPP objectives for turbidity and so ANZECC guidelines were used. Attainment was generally high for this parameter. Exceptions were Broken River at Moorngag and Holland Creek at Kelfeera (404207) which achieved moderate attainment. Further exceptions with low attainment were Broken Creek at Rices Weir (404210), Broken Creek at Katamatite (404214), Broken River at Goorambat (404216) and Broken River at Gowangardie (404224). Attainment was also low at Lake Nillahcootie (404218), Lake Mokoan (404219) and Greens Lake (405601). Attainment was moderate at Waranga Basin (405260).

There were no SEPP objectives for nitrogen in the Goulburn Broken CMA region, therefore the ANZECC guidelines applied. The majority of stations had low attainment for total nitrogen (TN). Only three stations achieved high attainment, Lake Eildon (405258), Goulburn River upstream of Lake Eildon (405219)and Goulburn River at Murchison (405200). The Goulburn River at Eildon (405203), Lake Nagambie (405259) and Waranga Basin (405260) achieved moderate attainment of the objectives.

All sites except for the Broken Creek at Katamatite (404214), Goulburn River at McCoys Bridge (405232) and Yarrawonga Weir (409216) recorded low attainment of the ANZECC guidelines for oxidised nitrogen (NO_x). The low level of dissolved oxygen present in Broken Creek in 2002 may have inhibited the formation of nitrates and nitrites. Ammonia (NH_4) is another form of bioavailable nitrogen, which is important for plant and algal growth. Ammonia was only sampled at the lake sites and had low attainment of the ANZECC guidelines except at Waranga Basin (405258) and Lake Eildon at the outlet tower (405260) which achieved high attainment and Lake Nagambie (405259) achieved moderate attainment.

In the absence of SEPP objectives for phosphorus in the Goulburn-Broken CMA region, the ANZECC guidelines applied. As with TN the majority of sites had low attainment for TP. The exceptions were all in the Goulburn River Basin. At Murchison (405200) and Eildon (405203) attainment was high whilst at Lake Eildon (405219) and Big River at Frenchman Creek Junction (405264) attainment for Total Phosphorus was moderate. Attainment for filterable reactive phosphorus (FRP) was generally high throughout the catchment. Broken Creek at Rices Weir (404210), Broken River at Gowangardie (404224) and Lake Mokoan (404219) achieved low attainment and Broken River at Goorambat (404216), Sundat Creek at Tallarook (405212) and Lake Nillahcootie (404218) achieved moderate attainment.

All of the sites with sufficient data had low attainment of the ANZECC guidelines for chlorophyll-*a,* except Lake Eildon Outlet Tower (405258) which obtained high attainment and Waranga Basin (405260) which obtained moderate attainment.

One site was sampled for metals in the Goulburn-Broken CMA region. McCoys Bridge (405232) recorded 100% attainment of the SEPP objectives for all the metals monitored. However, this site recorded low attainment of the ANZECC guidelines for copper and zinc and moderate attainment for lead.

The water quality data and summary statistics relating to the water quality, water quantity and river health in the Goulburn-Broken CMA region have been made available on the Internet. See www.vicwaterdata.net for this information.

Table 18. Percent attainment of SEPP and ANZECC objectives for physical parameters at stations within the Goulburn-Broken CMA region during 2002.

Basin	Program	SINO	SEPP				ANZECC			Rating		
			DO	DO%sat	EC	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	pH
	Rivers											
404	V	404206	100	100	-	100	**50**	100	100	H	H	H
	V	404207	**83**	**83**	-	100	**8**	**67**	100	L	L	H
	M	404210	*	*	-	**97**[(b)]	*	100	**95**[(b)]	*	H	H
	V	404214	**83**	**83**	-	100	**0**	100	100	L	H	H
	V	404216	**92**	100	-	100	**17**	100	100	M	H	H
	V	404224	100	100	-	100	**33**	100	100	H	H	H
405	E	0529	*	*	-	*	*	*	*	*	*	*
	V	405200	100	100	-	100	**42**	100	100	H	H	H
	V	405203	100	100	-	100	**42**	100	**92**[(b)]	H	H	H
	V	405204	100	100	-	100	**58**	100	100	H	H	H
	V	405205	100	100	-	100	**75**	100	**92**[(b)]	H	H	H
	V	405209	100	100	-	100	**67**	100	**83**[(b)]	H	H	H
	V	405212	**75**	**83**	-	100	**8**	**0**	100	L	L	H
	V	405214	100	100	-	100	**25**	100	**92**[(a)]	H	H	H
	V	405219	**92**	**92**	-	100	**25**	100	**92**[(b)]	M	H	H
	V	405231	100	100	-	100	**17**	100	100	H	H	H
	M	405232	100	100	-	100	100	100	100	H	H	H
	V	405234	100	100	-	100	**50**	100	100	H	H	H
	V	405237	**92**	100	-	100	**0**	100	**83**[(b)]	M	H	H
	V	405240	**60**	**80**	-	100	**10**	**0**	**80**[(a)]	L	L	H
	V	405246	*	*	-	*	*	*	*	*	*	*
	V	405251	100	100	-	100	**33**	100	**75**[(a)]	H	H	H
	V	405264	100	100	-	100	**67**	100	100	H	H	H
	Lakes											
404	S	404218	*	*	-	100	*	**0**	100	*	L	H
	S	404219	*	*	-	100	*	**0**	**77**[(a)]	*	L	H
405	S	405254	*	*	-	*	*	*	*	*	*	*
	S	405258	*	*	-	100	*	**0**	100	*	L	H
	S	405259	*	*	-	100	*	**0**	100	*	L	H
	S	405260	*	*	-	100	*	**0**	100	*	L	H
	S	405601	*	*	-	100	*	**0**	**75**[(a)]	*	L	H
409	S	409216	*	*	-	100	*	**0**	100	*	L	H

[(a)] = pH outside objective range above maximum limit
[(b)] = pH outside objective range below minimum limit
* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
M = MDBC
S = MSOMP
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 19. Percent attainment of SEPP and ANZECC objectives for turbidity and suspended solids at stations within the Goulburn-Broken CMA region during 2002.

Basin	Program	SINO	SEPP			ANZECC		Rating	
			$Turb_{50}$	SS_{50}	SS_{90}	$Turb_{80}$	SS_{80}	Turb	SS
	Rivers								
404	V	404206	-	100	100	**82**	100	M	H
	V	404207	-	**92**	100	**83**	**92**	M	H
	M	404210	-	*	*	**13**	*	L	*
	V	404214	-	**0**	**50**	**0**	**8**	L	L
	V	404216	-	**75**	100	**36**	**75**	L	H
	V	404224	-	100	100	**25**	100	L	H
405	E	0529	-	*	*	*	*	*	*
	V	405200	-	**92**	100	100	100	H	H
	V	405203	-	100	100	100	100	H	H
	V	405204	-	**92**	100	**92**	100	H	H
	V	405205	-	**92**	100	100	**92**	H	H
	V	405209	-	100	100	100	100	H	H
	V	405212	-	100	100	100	100	H	H
	V	405214	-	**92**	100	100	**92**	H	H
	V	405219	-	**92**	100	100	**92**	H	H
	V	405231	-	100	100	100	100	H	H
	M	405232	-	**50**	100	**90**	100	H	H
	V	405234	-	100	100	100	100	H	H
	V	405237	-	100	100	100	100	H	H
	V	405240	-	100	100	**90**	100	H	H
	V	405246	-	*	*	*	*	*	*
	V	405251	-	100	100	100	100	H	H
	V	405264	-	100	100	100	100	H	H
	Lakes								
404	S	404218	-	*	*	**19**	*	L	*
	S	404219	-	*	*	**0**	*	L	*
	S	405254	-	*	*	*	*	*	*
405	S	405258	-	*	*	100	*	H	*
	S	405259	-	*	*	100	*	H	*
	S	405260	-	*	*	**75**	*	M	*
	S	405601	-	*	*	**8**	*	L	*
409	S	409216	-	*	*	100	*	H	*

* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
M = MDBC
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 20. Percent attainment of ANZECC objectives for nutrients at stations within the Goulburn-Broken CMA region during 2002.

Basin	Program	SINO	ANZECC						Rating					
			TN_{80}	NO_{x80}	NH_{480}	TP_{80}	FRP_{80}	Chl-a_{80}	TN	NO_x	NH_4	TP	FRP	Chl-a
	Rivers													
404	V	404206	**0**	**0**	*	**0**	100	*	L	L	*	L	H	*
	V	404207	**0**	**8**	*	**0**	**92**	*	L	L	*	L	H	*
	M	404210	**0**	**68**	*	**0**	**3**	*	L	L	*	L	L	*
	V	404214	**0**	**83**	*	**0**	**92**	*	L	M	*	L	H	*
	V	404216	**0**	**0**	*	**0**	**83**	*	L	L	*	L	M	*
	V	404224	**0**	**33**	*	**0**	**58**	*	L	L	*	L	L	*
405	E	0529	*	*	*	*	*	*	*	*	*	*	*	*
	V	405200	100	**25**	*	100	100	*	H	L	*	H	H	*
	V	405203	**83**	**0**	*	100	100	*	M	L	*	H	H	*
	V	405204	**55**	**42**	*	**42**	100	*	L	L	*	L	H	*
	V	405205	**0**	**0**	*	**50**	100	*	L	L	*	L	H	*
	V	405209	**0**	**0**	*	**33**	100	*	L	L	*	L	H	*
	V	405212	**0**	**33**	*	**8**	**83**	*	L	L	*	L	M	*
	V	405214	**42**	**50**	*	**58**	100	*	L	L	*	L	H	*
	V	405219	**92**	**58**	*	**75**	100	*	H	L	*	M	H	*
	V	405231	**0**	**0**	*	**42**	100	*	L	L	*	L	H	*
	M	405232	**38**	**75**	*	**15**	100	*	L	M	*	L	H	*
	V	405234	**0**	**0**	*	**0**	100	*	L	L	*	L	H	*
	V	405237	**0**	**8**	*	**0**	100	*	L	L	*	L	H	*
	V	405240	**0**	**60**	*	**40**	100	-	L	L	*	L	H	*
	V	405246	*	*	*	*	*	*	*	*	*	*	*	*
	V	405251	**0**	**0**	*	**0**	**92**	*	L	L	*	L	H	*
	V	405264	**58**	**0**	*	**83**	100	*	L	L	*	M	H	*
	Lakes													
404	S	404218	**0**	**6**	**56**	**0**	**75**	**69**	L	L	L	L	M	L
	S	404219	**0**	**0**	**50**	**0**	**5**	**54**	L	L	L	L	L	L
405	S	405254	*	*	*	*	*	*	*	*	*	*	*	*
	S	405258	100	**24**	**94**	**41**	100	**88**	H	L	H	L	H	H
	S	405259	**79**	**33**	**80**	**0**	100	**20**	M	L	M	L	H	L
	S	405260	**83**	**25**	**92**	**0**	**92**	**83**	M	L	H	L	H	M
	S	405601	**8**	**0**	**25**	**0**	100	**58**	L	L	L	L	H	L
409	S	409216	**38**	**81**	**50**	**0**	100	**12**	L	M	L	L	H	L

* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
M = MDBC
S = $MSOMP_{80}$
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 21. Percent attainment of SEPP and ANZECC objectives for metals at stations within the Goulburn-Broken CMA region during 2002.

Basin	Program	SINO	SEPP							ANZECC						
			As	Cd	Cr	Cu	Ni	Pb	Zn	As_{80}	Cd_{80}	Cr_{80}	Cu_{80}	Ni_{80}	Pb_{80}	Zn_{80}
	Rivers															
404	V	404206	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	404207	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	M	404210	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	404214	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	404216	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	404224	*	*	*	*	*	*	*	*	*	-	*	*	*	*
405	E	0529														
	V	405200	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405203	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405204	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405205	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405209	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405212	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405214	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405219	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405231	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	M	405232	100	100	100	100	100	100	100	100	100	-	**0**	100	**83**	**67**
	V	405234	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405237	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405240	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405246	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405251	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	405264	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	Lakes															
404	S	404218	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	404219	*	*	*	*	*	*	*	*	*	-	*	*	*	*
405	S	405254	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	405258	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	405259	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	405260	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	405601	*	*	*	*	*	*	*	*	*	-	*	*	*	*
409	S	409216	*	*	*	*	*	*	*	*	*	-	*	*	*	*

Basin	Program	SINO	Rating						
			As	Cd	Cr	Cu	Ni	Pb	Zn
405	V	405232	H	H	H	H	H	H	H

* = Insufficient data (<10 samples) - = No guideline
E = EPA FSN V = VWQMN
M = MDBC S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

GOULBURN BROKEN C.M.A. REGION

Attainment with water quality objectives and guidelines.

Produced for DNRE by WATER ECOscience

N

0 10 20 40

kilometres

Catchment Management Authority (C.M.A.) Boundary

Drainage Basin Boundary

Nutrients

Suspended solids/ turbidity

Metals

Physical parameters

Attainment	*Monitoring Program*
Low	*VWQMN*
Medium	*MSOMP*
High	*MDBC*
No guideline and/or no data	*EPA*

Figure 17. Goulburn-Broken CMA region. Attainment of water quality objectives and guidelines

.

Station Specific Water Quality: Broken Creek at Katamatite

Broken Creek at Katamatite (404214) was identified as having low attainment for all parameters except pH, electrical conductivity and FRP for which attainment was high and oxidised nitrogen which achieved moderate attainment.

Discharge at Broken Creek at Katamatite is generally low with all readings over the past two years being below 20 ML/day. During 2002 discharge peaked in September with a flow of 14.2 ML/day. The majority of the flow measurements were below 3.0 ML/day.

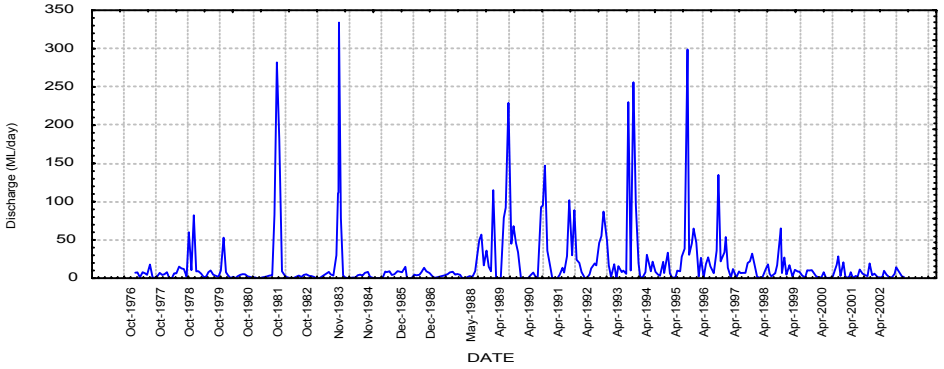
A low attainment of the SEPP objective for dissolved oxygen (DO) was recorded for this site in 2002. The majority of the observations for dissolved oxygen were below 7 mg/L. Low discharge and high levels of suspended solids, turbidity and nutrients would have been major factors in contributing to the low dissolved oxygen readings.

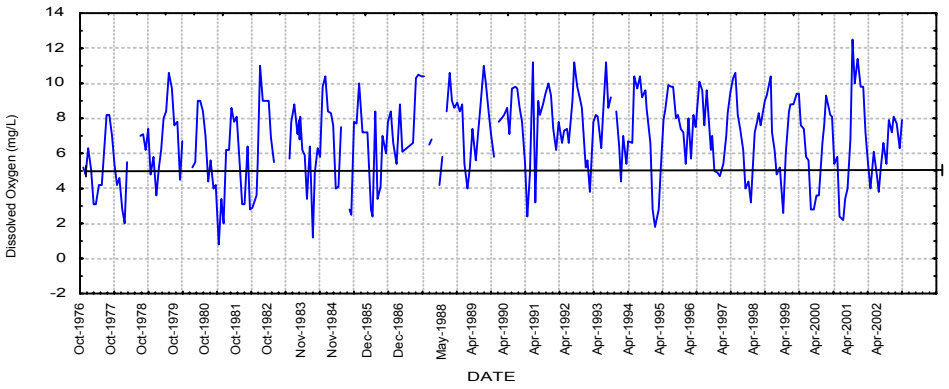
Electrical conductivity and pH obtained high levels of attainment against the objectives. pH shows a slight downward trend over the monitoring period.

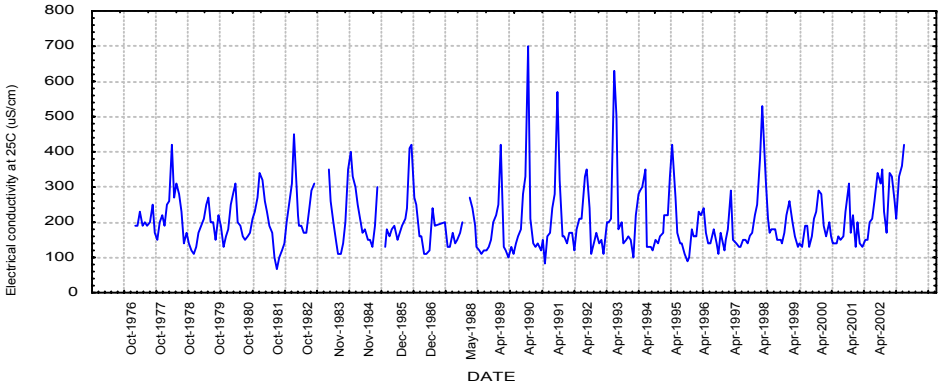
Suspended solids and turbidity obtained low attainment against the objectives for this site. Suspended solids results were high with the majority of the readings between 90 mg/L and 120 mg/L. Turbidity attainment was also low with readings ranging from 88 NTU to 520 NTU. For turbidity a strong upward trend was observed since the beginning of the monitoring period.

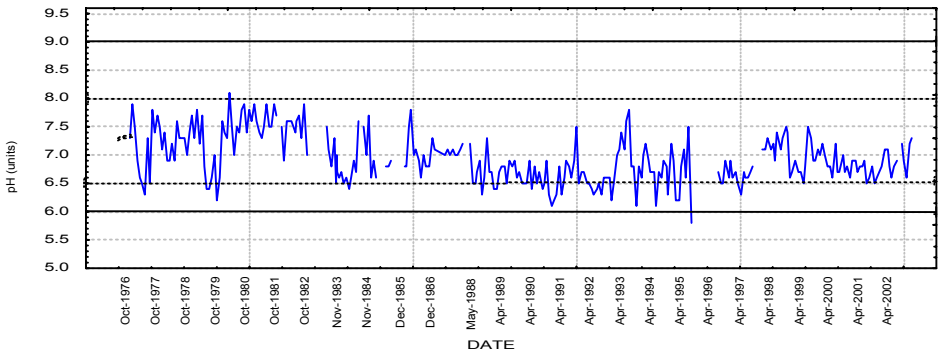
Both total nitrogen and total phosphorous have been well above ANZECC guideline maximum limits at Broken Creek at Katamatite during the entire monitoring period. Total phosphorus readings ranged from 0.13 mg/L to 0.35 mg/L.

Total nitrogen levels peaked at over 2.7 mg/L in November 2002. Other observations ranged from 0.91 mg/L upwards. Moderate attainment was observed for oxidised nitrogen (NOx) in 2002.


Discharge (ML/day)
350
300
250
200
150
100
50
0
Oct-1976
Oct-1977
Oct-1978
Oct-1979
Oct-1980
Oct-1981
Oct-1982
Nov-1983
Nov-1984
Dec-1985
Dec-1986
May-1988
Apr-1989
Apr-1990
Apr-1991
Apr-1992
Apr-1993
Apr-1994
Apr-1995
Apr-1996
Apr-1997
Apr-1998
Apr-1999
Apr-2000
Apr-2001
Apr-2002
DATE


Dissolved Oxygen (mg/L)
14
12
10
8
6
4
2
0
-2
Oct-1976
Oct-1977
Oct-1978
Oct-1979
Oct-1980
Oct-1981
Oct-1982
Nov-1983
Nov-1984
Dec-1985
Dec-1986
May-1988
Apr-1989
Apr-1990
Apr-1991
Apr-1992
Apr-1993
Apr-1994
Apr-1995
Apr-1996
Apr-1997
Apr-1998
Apr-1999
Apr-2000
Apr-2001
Apr-2002
DATE


Electrical conductivity at 25C (uS/cm)
800
700
600
500
400
300
200
100
0
Oct-1976
Oct-1977
Oct-1978
Oct-1979
Oct-1980
Oct-1981
Oct-1982
Nov-1983
Nov-1984
Dec-1985
Dec-1986
May-1988
Apr-1989
Apr-1990
Apr-1991
Apr-1992
Apr-1993
Apr-1994
Apr-1995
Apr-1996
Apr-1997
Apr-1998
Apr-1999
Apr-2000
Apr-2001
Apr-2002
DATE


pH (units)
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
Oct-1976
Oct-1977
Oct-1978
Oct-1979
Oct-1980
Oct-1981
Oct-1982
Nov-1983
Nov-1984
Dec-1985
Dec-1986
May-1988
Apr-1989
Apr-1990
Apr-1991
Apr-1992
Apr-1993
Apr-1994
Apr-1995
Apr-1996
Apr-1997
Apr-1998
Apr-1999
Apr-2000
Apr-2001
Apr-2002
DATE

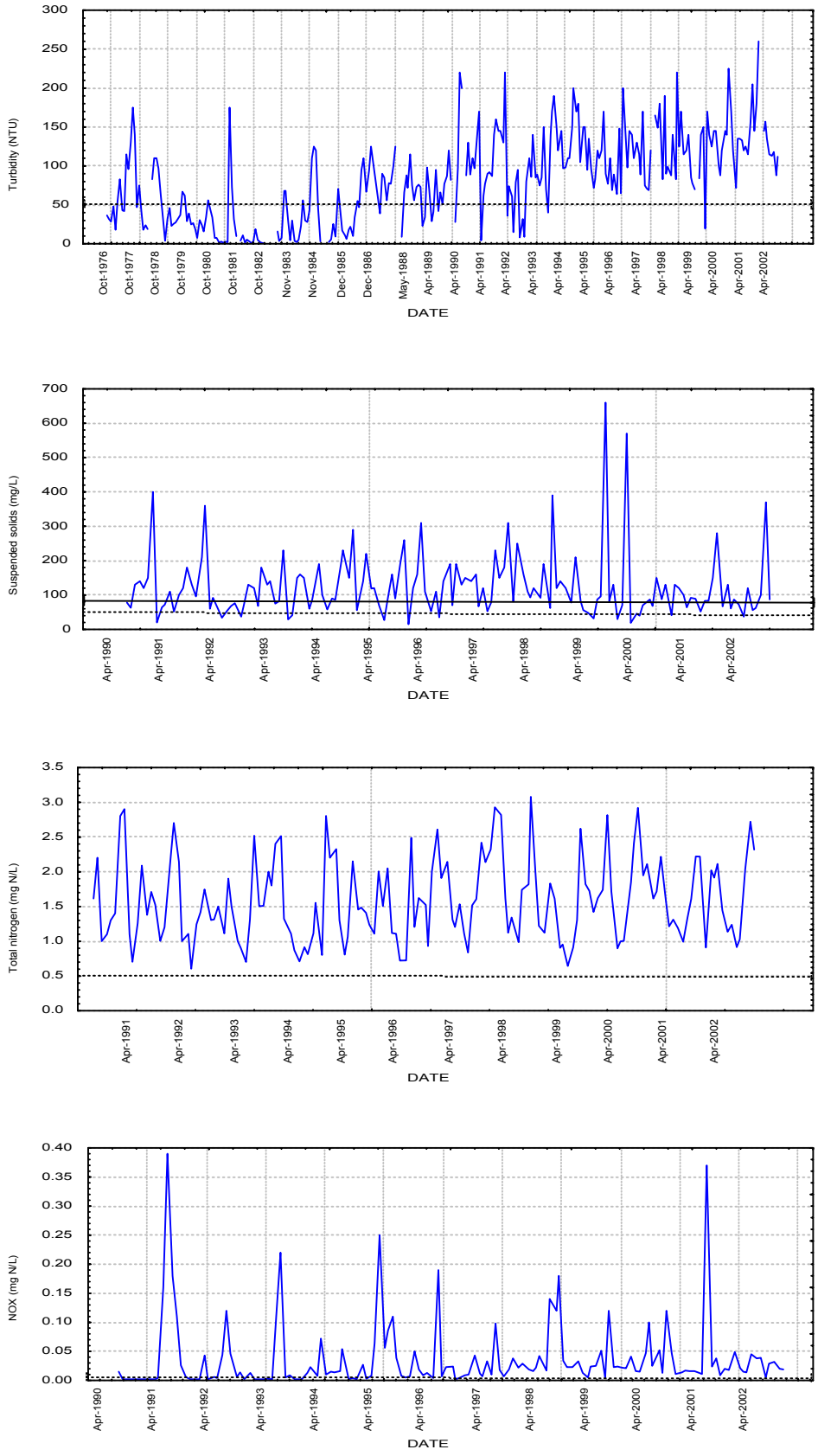


Figure 18. Variation in water quality over time in Broken Creek at Katamatite (404214) 1992-2002. (September 1990 2002 Nutrients)

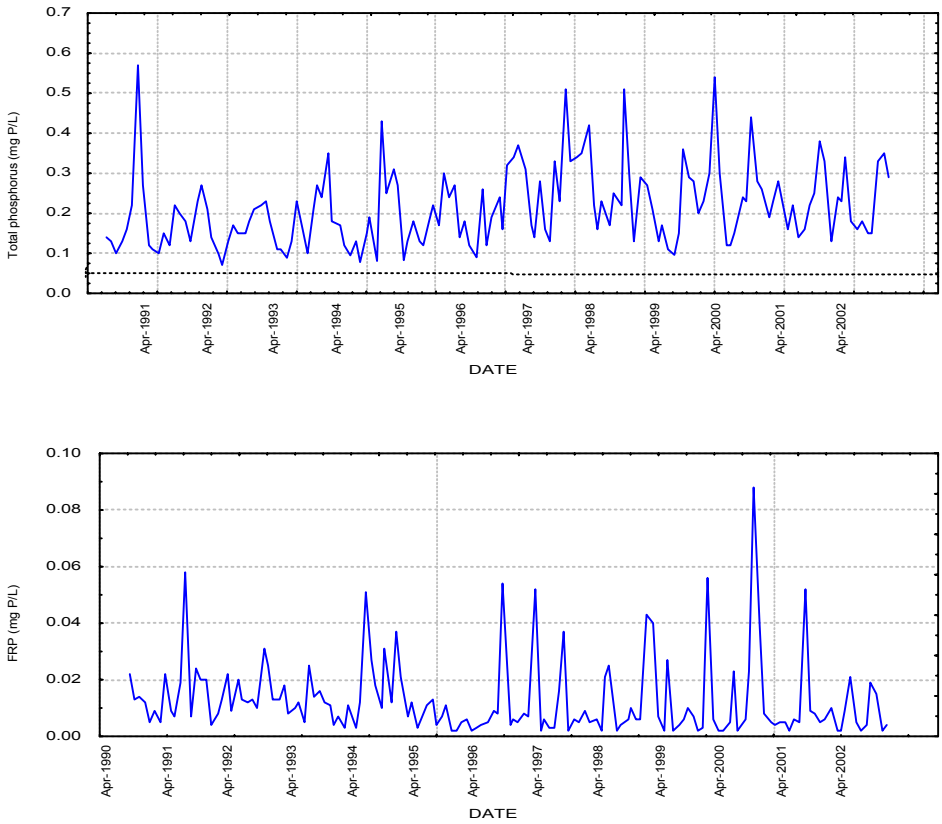


Figure 19. Variation in water quality over time in Broken Creek at Katamatite (404214) 1992-2002.

(September 1990 2002 Nutrients)

Black line indicates SEPP objective limit and dashed line indicates ANZECC guideline limit. Limits are minimum for DO, range for pH, maximum for other parameters.

It should be recognized that in many cases the dates on the x axis on the graph do not line up on all graphs. This is due to the change in time when monitoring started for some parameters.

5.2.5 Mallee CMA Region

Water Quality Characterisation

The Mallee CMA region incorporates two drainage basins: Murray-Riverina (Basin 409 incorporating 1 station) and Mallee (Basin 414 incorporating 2 stations). Water quality was characterised for each station in the Mallee CMA region according to percent attainment with the relevant water quality objectives and guidelines (Tables 22-24). A summary of this data is presented on an attainment map for all of the stations in the region (Figure 13). Water quality characterisation was according to attainment of the SEPP objectives or, in the absence of SEPP objectives, the ANZECC guidelines as outlined in Section 2: Methods.

Water quality attainment in the Mallee CMA was high for pH, electrical conductivity, turbidity, oxidised nitrogen and filtered reactive phosphorus (FRP) and low for phosphorus and moderate for total nitrogen.

All three sites achieved 100% attainment for pH both for the SEPP objectives and the ANZECC guidelines.

As there were no SEPP objectives for EC, ANZECC guidelines were applied. Each of the sites achieved 100% attainment of the ANZECC guideline for electrical conductivity.

There were no SEPP objectives for nutrients in the Mallee CMA region so the ANZECC guidelines applied for the one station at which nutrients were monitored (Wakool River at Kyalite: 409034). Attainment of the ANZECC guidelines for total phosphorus guideline was low (21%) and moderate attainment for total nitrogen (78%). However this station did achieve high attainment for filtered reactive phosphorus (FRP) and Oxidised Nitrogen (NO_x).

No sites were sampled for dissolved oxygen, suspended solids, chlorophyll-*a* or metals in the Mallee CMA region.

The water quality data and summary statistics relating to the water quality, water quantity and river health in the Mallee CMA region have been made available on the Internet. See www.vicwaterdata.net for this information.

Table 22. Percent attainment of SEPP and ANZECC objectives for physical parameters at stations within the Mallee CMA region during 2002.

Basin	Program	SINO	SEPP				ANZECC			Rating		
			DO	DO%sat	EC	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	pH
	Rivers											
409	M	409034	*	*	-	100	*	100	100	*	H	H
414	M	414200	*	*	-	100	*	100	100	*	H	H
	M	414204	*	*	-	100	*	100	100	*	H	H

(a) = pH outside objective range above maximum limit
(b) = pH outside objective range below minimum limit
* = Insufficient data (<10 samples)
- = No guideline
M = MDBC
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 23. Percent attainment of SEPP and ANZECC objectives for turbidity and suspended solids at stations within the Mallee CMA region during 2002.

Basin	Program	SINO	SEPP			ANZECC		Rating	
			Turb	SS_{50}	SS_{90}	$Turb_{80}$	SS_{80}	Turb	SS
	Rivers								
409	M	409034	-	*	*	100	*	H	*
414	M	414200	-	*	*	100	*	H	*
	M	414204	-	*	*	100	*	H	*

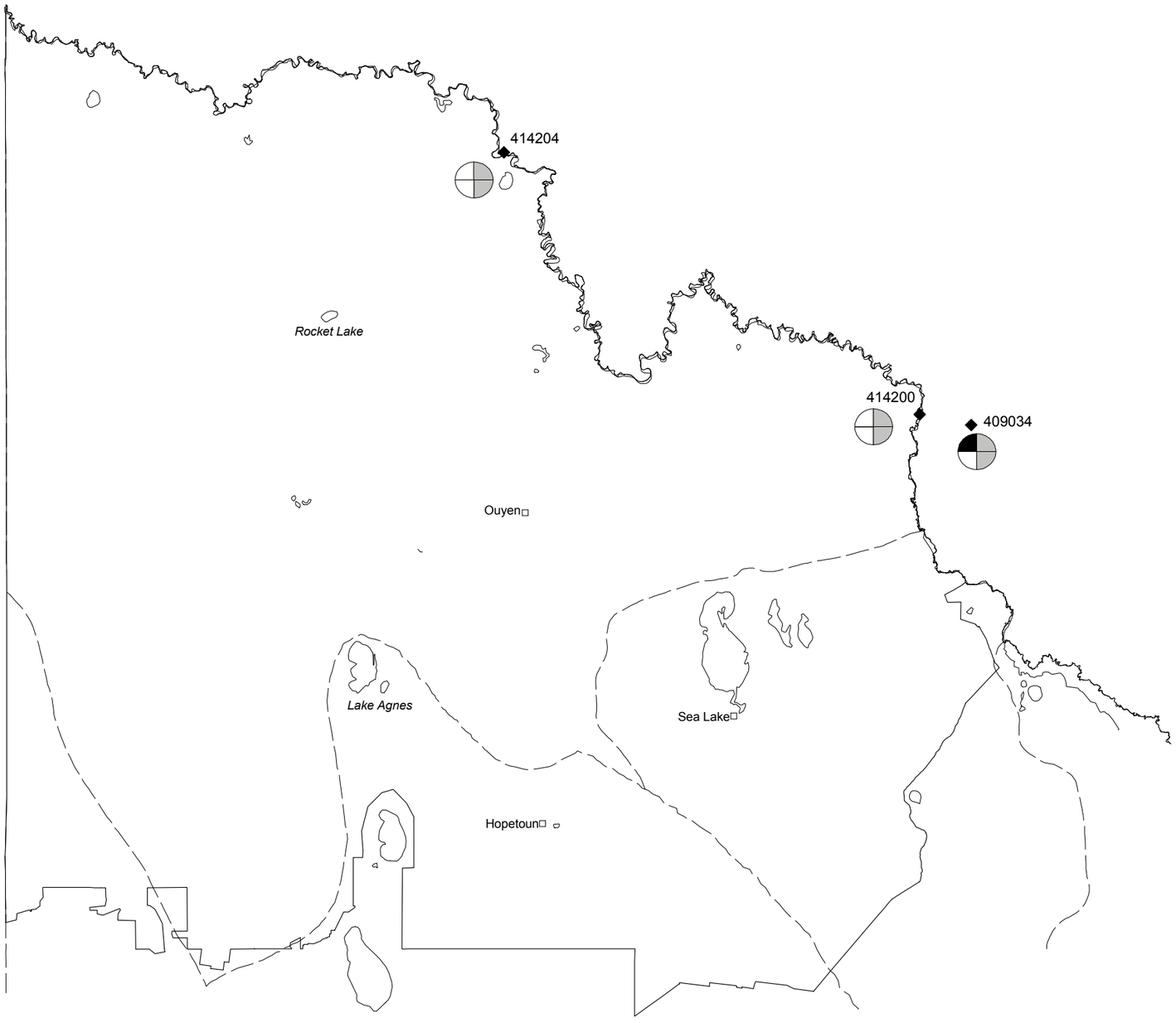
* = Insufficient data (<10 samples)
- = No guideline
M = MDBC
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 24. Percent attainment of ANZECC objectives for nutrients at stations within the Mallee CMA region during 2002.

Basin	Program	SINO	ANZECC						Rating					
			TN_{80}	NOx	NH4	TP_{80}	FRP	Chl-a_{80}	TN_{80}	NOx	NH4	TP_{80}	FRP	Chl-a_{80}
	Rivers													
409	M	409034	**78**	**94**	*	**21**	100	*	M	H	*	L	H	*
414	M	414200	*	*	*	*	*	*	*	*	*	*	*	*
	M	414204	*	*	*	*	*	*	*	*	*	*	*	*

* = Insufficient data (<10 samples)
- = No guideline
M = MDBC
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

No sites were sampled for metals in the Mallee CMA region.



MALLEE C.M.A. REGION

Attainment with water quality objectives and guidelines.

Produced for DNRE by WATER ECOscience

N

0 12.5 25 50
kilometres

Catchment Management Authority (C.M.A.) Boundary

Drainage Basin Boundary

Nutrients

Suspended solids/ turbidity

Metals

Other Indicators

Attainment

Low

Medium

High

No guideline and/or no data

Monitoring Program

VWQMN

MSOMP

MDBC

EPA

Figure 20. Mallee CMA region. Attainment with water quality objectives and guidelines.

Station Specific Water Quality: Wakool River at Kyalite

Station (409034) Wakool River at Kyalite was identified as having high attainment of the turbidity, electrical conductivity and pH guidelines during 2002. Reasonably high flow rates have been observed with flows ranging from 950 ML/day to 4500 ML/day during 2002.

Electrical conductivity during 2002 ranged from 80 uS/cm to 660 uS/cm. High attainment values were obtained against ANZECC objectives of 2200 uS/cm. The elevated high result of 660 uS/cm was recorded after a long period of low flow. Run-off and salt build up appears to have been flushed through the system by the initial flows. Subsequent observations show the levels levels dropping to 80 uS/cm.

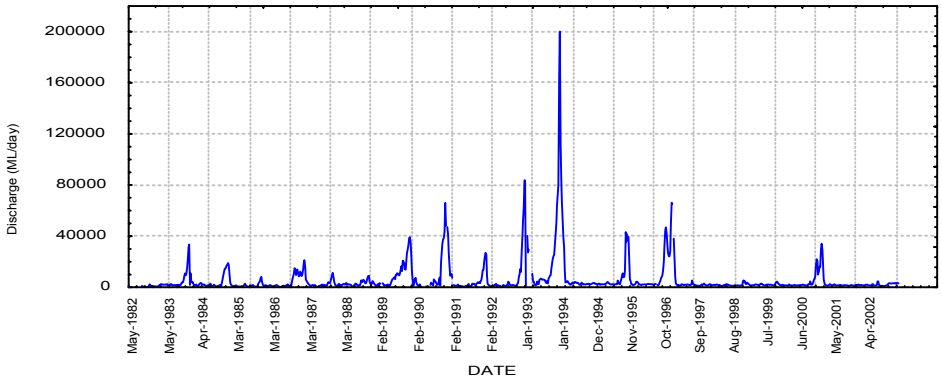
The site had 100% attainment of both the SEPP and ANZECC objectives for pH in 2002.

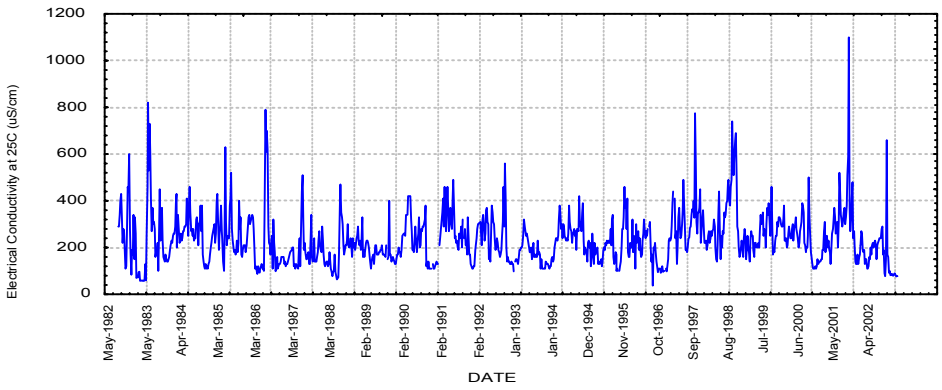
This site recorded high attainment of the ANZECC guideline for turbidity. The guideline at this site is 50 NTU. Turbidity ranged between 18 NTU and 40 NTU. A downward trend for turbidity was observed over the monitoring period. Suspended solids was not monitored at this site.

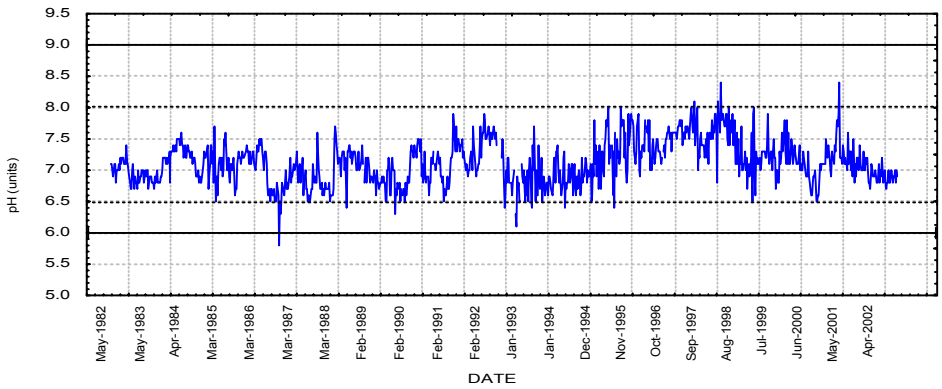
There are no SEPP objectives for nutrients at this site and so ANZECC guidelines have been applied. Nutrients have been monitored in the Wakool River at Kyalite Creek since 1981 and have generally shown low attainment of the guidelines for both total nitrogen and total phosphorus over this period.

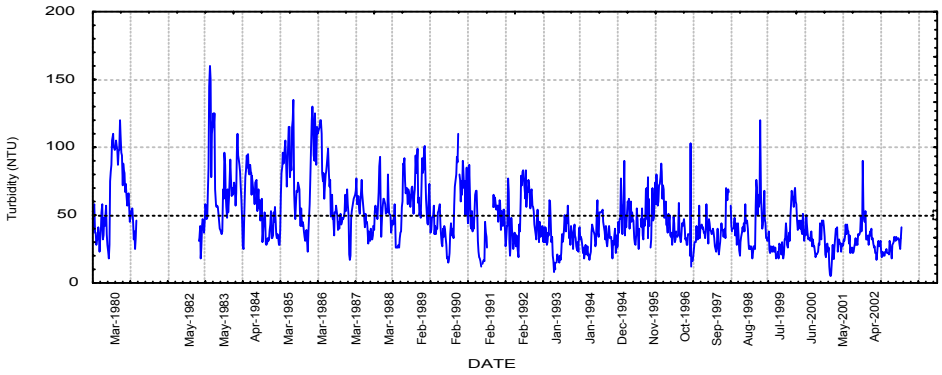
During 2002 both total nitrogen and total phosphorus levels exceeded the ANZECC guidelines. Levels of filterable reactive phosphorus (FRP) remained below guideline limits resulting in high attainment for this parameter. The station also recorded high attainment for nitrates and nitrites (NOx) during this period.

Figure 14


Discharge (ML/day)
200000
160000
120000
80000
40000
0
May-1982
May-1983
Apr-1984
Mar-1985
Mar-1986
Mar-1987
Mar-1988
Feb-1989
Feb-1990
Feb-1991
Feb-1992
Jan-1993
Jan-1994
Dec-1994
Nov-1995
Oct-1996
Sep-1997
Aug-1998
Jul-1999
Jun-2000
May-2001
Apr-2002
DATE


Electrical Conductivity at 25C (uS/cm)
1200
1000
800
600
400
200
0
May-1982
May-1983
Apr-1984
Mar-1985
Mar-1986
Mar-1987
Mar-1988
Feb-1989
Feb-1990
Feb-1991
Feb-1992
Jan-1993
Jan-1994
Dec-1994
Nov-1995
Oct-1996
Sep-1997
Aug-1998
Jul-1999
Jun-2000
May-2001
Apr-2002
DATE


pH (units)
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
May-1982
May-1983
Apr-1984
Mar-1985
Mar-1986
Mar-1987
Mar-1988
Feb-1989
Feb-1990
Feb-1991
Feb-1992
Jan-1993
Jan-1994
Dec-1994
Nov-1995
Oct-1996
Sep-1997
Aug-1998
Jul-1999
Jun-2000
May-2001
Apr-2002
DATE


Turbidity (NTU)
200
150
100
50
0
Mar-1980
May-1982
May-1983
Apr-1984
Mar-1985
Mar-1986
Mar-1987
Mar-1988
Feb-1989
Feb-1990
Feb-1991
Feb-1992
Jan-1993
Jan-1994
Dec-1994
Nov-1995
Oct-1996
Sep-1997
Aug-1998
Jul-1999
Jun-2000
May-2001
Apr-2002
DATE

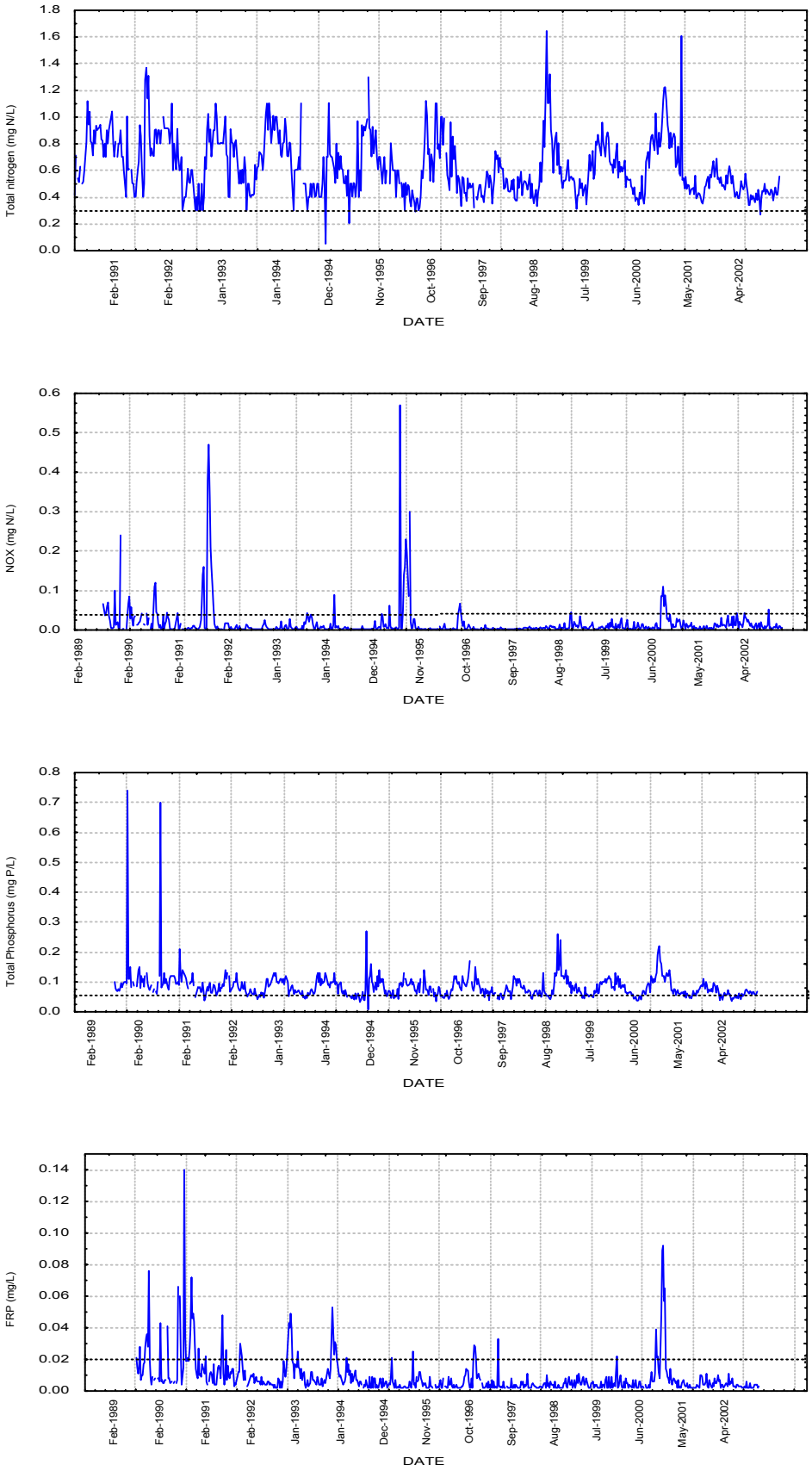


Figure 14. Variation in water quality over time in the Wakool River at Kyalite (409034), 1978–2002. (1981 – 2002 Nutrients).

Black line indicates SEPP objective limit and dashed line indicates ANZECC guideline limit. Limits are minimum for DO, range for pH, maximum for other parameters.

It should be recognized that in many cases the dates on the x axis on the graph do not line up on all graphs. This is due to the change in time when monitoring started for some parameters.

5.2.6 North Central CMA Region

Water Quality Characterisation

The North Central CMA region is composed of four drainage basins. Campaspe River (Basin 406 incorporating 9 stations including 1 lake), Loddon River (Basin 407 incorporating 17 stations including 5 lakes), Avoca River (Basin 408 incorporating 3 stations) and the Avon-Richardson section of the Wimmera-Avon Basin (Basin 415 incorporating 4 stations including 1 lake). The following discussion will be centered around these four basins where appropriate. Water quality was characterised for each station in the North Central CMA region according to percent attainment with the relevant water quality objectives and guidelines (Tables 25-28). A summary of this data is presented on an attainment map for all stations in the region (Figure 21). Water quality characterisation was according to attainment of the SEPP objectives or, in the absence of SEPP objectives, the ANZECC guidelines as outlined in Section 2: Methods.

Water quality within the North Central CMA region generally exhibited high attainment for pH, suspended solids and turbidity. The attainment rating for dissolved oxygen, electrical conductivity and metals varied throughout the region. Total nitrogen and Total Phosphorus generally exhibited low attainment, and chlorophyll-*a* attainment was also generally low across the lakes.

SEPP attainment for dissolved oxygen (DO) varied through out the North Central region. In the Campaspe Basin, three stations achieved high DO attainment. The Campaspe River at Eppalock (406207) achieved moderate attainment. Varied attainment for DO was achieved for sites in the Loddon Basin. Loddon River at Laanecoorie (407203), Loddon River at Newstead (407215) and Loddon River at Serpentine Weir (407229) achieved high attainment. Jim Crow Creek at Yandoit (407221) achieved moderate attainment whilst other sites in the Loddon Basin had low attainment. High attainment for DO was achieved at the most upstream station in the Avoca Basin, Avoca River at Amphitheatre (408202) and moderate attainment was recorded at the Avoca River at Coonooer (408200). Attainment was not available for the Avon Richardson Basin as a result of insufficient data.

Attainment for EC varied throughout the North Central CMA. All lake stations achieved low attainment, as did stations in the Avoca Basin. Stations on or close to the Murray River achieved high attainment for EC. Half of the stations in the Loddon Basin achieved high attainment with the remaining half achieving low attainment. During 2002, flows were generally low and this likely to contributed to the low EC attainment levels.

Percent attainment of SEPP objectives for pH was high at the majority of stations across the North Central CMA region with only 2 stations failing to achieve 100% attainment based on SEPP objectives. These were Bendigo Creek at Huntly (407255) and Hepburn Lagoon (407603) in the Loddon Basin.

Turbidity and suspended solids (SS) generally achieved high attainment in the North Central CMA. The Campaspe and Avoca Basins exhibited the highest attainment with all sites achieving high attainment for SS and turbidity. In the Loddon Basin, all sites achieved high turbidity attainment, with the exception of Loddon River at Kerang (407202) where low attainment was exhibited. Sites monitored along the Murray River recorded high turbidity attainment.

Every station in the North Central CMA region had low attainment of the ANZECC guideline for total nitrogen (TN) except the sites monitored along the Murray River which recorded high attainment.

Two sites achieved high attainment of the ANZECC guideline for total phosphorus (TP). These sites were Loddon River at Serpentine Weir (407229) and Campaspe River at Rochester (406202). Avoca River at Coonooer (408200) achieved moderate attainment. All other stations in the North Central CMA region had low TP attainment. All sites within the Campaspe Basin recorded low oxidised nitrogen (NO_x) attainment, as did all lakes in the Loddon Basin. Only five sites within the CMA region achieved high attainment for NO_x: Loddon River at Kerang (407202), Loddon River at Laanecoorie (407203), Gunbower Creek at Koondrook (407209), Loddon River at Serpentine Weir (407229) and Avoca River at Coonooer (408200). Filterable Reactive Phosphorus (FRP) attainment was generally moderate to high at all sites, with 3 stations recording low attainment in the Loddon Basin.

The attainment level for the chlorophyll-*a* ANZECC guideline was moderate for Lake Eppalock (406219) and Newlyns Reservoir (407604). Chlorophyll-*a* attainment was low for Lake Laanecoorie (407240) Hepburns Lagoon (407603), Tullaroop Reservoir (407244) and Cairn Curran Reservoir (407241

Five stations were sampled for metals in the North Central CMA region, two stations in each of the Campaspe and Avoca Basins and one in the Loddon Basin. Campaspe River at Rochester achieved high attainment for all metals. Loddon River at Newstead (407215) had high attainment for all metals except for low attainment for copper. The other sites varied with low or moderate attainment for cadmium, copper and zinc.

The water quality data and summary statistics relating to the water quality, water quantity and river health in the North Central CMA region have been made available on the Internet. See www.vicwaterdata.net for this information.

Table 25. Percent attainment of SEPP and ANZECC objectives for physical parameters at stations within the North Central CMA region during 2002.

Basin	Program	SINO	SEPP				ANZECC			Rating		
			DO	DO%sat	EC	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	pH
	Rivers											
406	M	406202	100	100	-	100	100	100	100	H	H	H
	V	406207	**92**	**92**	-	100	**17**	**0**	**33**[(a)]	M	L	H
	V	406208	*	*	-	*	*	*	*	*	*	*
	V	406213	100	100	-	100	**25**	**0**	**0**[(a)]	H	L	H
	V	406214	*	*	-	*	*	*	*	*	*	*
	V	406215	**92**	100	-	100	**25**	**0**	**8**[(a)]	H	L	H
	V	406224	*	*	-	*	*	*	*	*	*	*
	V	406235	*	*	-	*	*	*	*	*	*	*
407	E	0705	*	*	-	*	*	*	*	*	*	*
	M	407202	*	*	-	100	*	100	100	*	H	H
	V	407203	100	100	-	100	**83**	100	100	H	H	H
	M	407209	*	*	-	100	*	100	100	*	H	H
	V	407214	**92**	**83**	-	100	**0**	**0**	**58**[(a)]	L	L	H
	V	407215	**92**	100	-	100	**0**	**0**	**50**[(a)]	H	L	H
	V	407220	**58**	**58**	-	100	**8**	**0**	**17**[(a)]	L	L	H
	V	407221	**83**	**92**	-	100	**17**	**33**	**58**[(a)]	M	L	H
	V	407229	100	100	-	100	**58**	100	**83**[(a)]	H	H	H
	V	407236	*	*	-	*	*	*	*	*	*	*
	M	407252	*	*	-	100	*	**0**	**67**[(a)]	*	L	H
	V	407255	**83**	**83**	-	**83**[(a)]	**58**	**0**	**8**[(a)]	L	L	L
408	V	408200	**92**	**92**	-	100	**17**	**0**	**33**[(a)]	M	L	H
	V	408202	100	100	-	100	**25**	**0**	**8**[(a)]	H	L	H
	V	408203	*	*	-	*	*	*	*	*	*	*
409	M	409005	*	*	-	100	*	100	100	*	H	H
	M	409204	*	*	-	100	*	100	100	*	H	H
	M	409207	*	*	-	100	*	100	100	*	H	H
415	V	415220	*	*	-	*	*	*	*	*	*	*
	V	415257	*	*	-	*	*	*	*	*	*	*
	V	415259	*	*	-	*	*	*	*	*	*	*
	Lakes											
406	S	406219	*	*	-	100	*	**0**	**44**[(a)]	*	L	H
407	S	407240	*	*	-	100	*	**0**	**28**[(a)]	*	L	H
	S	407241	*	*	-	100	*	**0**	**17**[(a)]	*	L	H
	S	407244	*	*	-	100	*	**0**	**0**[(a)]	*	L	H
	S	407603	*	*	-	**71**[(a)]	*	**0**	**53**[(a)]	*	L	L
	S	407604	*	*	-	100	*	**0**	**47**[(a)]	*	L	H
415	S	415609	*	*	-	*	*	*	*	*	*	*

[(a)] = pH outside objective range, above maximum limit
[(b)] = pH outside objective range, below minimum limit
* = Insufficient data (<10 samples)
\- = No guideline

E = EPA FSN
V = VWQMN
M = MDBC
S = MSOMP

Parameters marked 80, 50 or 90 require 80%, 50% or 90% of samples to comply with the guideline

Table 26. Percent attainment of SEPP and ANZECC objectives for turbidity and suspended solids at stations within the North Central CMA region during 2002.

Basin	Program	SINO	SEPP			ANZECC		Rating	
			$Turb_{50}$	SS_{50}	SS_{90}	$Turb_{80}$	SS_{80}	Turb	SS
	Rivers								
406	M	406202	-	100	100	100	100	H	H
	V	406207	-	100	100	100	100	H	H
	V	406208	-	*	*	*	*	*	*
	V	406213	-	100	100	100	100	H	H
	V	406214	-	*	*	*	*	*	*
	V	406215	-	100	100	100	100	H	H
	V	406224	-	*	*	*	*	*	*
	V	406235	-	*	*	*	*	*	*
407	E	0705	-	*	*	*	*	*	*
	M	407202	-	*	*	**58**	*	L	*
	V	407203	-	**67**	100	100	100	H	H
	M	407209	-	*	*	100	*	H	*
	V	407214	-	*	*	100	*	H	*
	V	407215	-	100	100	100	100	H	H
	V	407220	-	*	*	100	*	H	*
	V	407221	-	100	100	100	100	H	H
	V	407229	-	100	100	100	100	H	H
	V	407236	-	*	*	*	*	*	*
	M	407252	-	*	*	**98**	*	H	*
	V	407255	-	**92**	100	**92**	**92**	H	H
408	V	408200	-	**92**	100	100	**92**	H	H
	V	408202	-	100	100	100	100	H	H
	V	408203	-	*	*	*	*	*	*
409	V	409005	-	*	*	100	*	H	*
	V	409204	-	*	*	100	*	H	*
	V	409207	-	*	*	100	*	H	*
415	M	415220	-	*	*	*	*	*	*
	M	415257	-	*	*	*	*	*	*
	M	415259	-	*	*	*	*	*	*
	Lakes								
406	S	406219	-	*	*	100	*	H	*
407	S	407240	-	*	*	**67**	*	L	*
	S	407241	-	*	*	100	*	H	*
	S	407244	-	*	*	100	*	H	*
	S	407603	-	*	*	**71**	*	L	*
	S	407604	-	*	*	100	*	H	*
415	S	415609	-	*	*	*	*	*	*

* = Insufficient data (<10 samples)
E = EPA FSN
M = MDBC
- = No guideline
V = VWQMN
S = MSOMP
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 27. Percent attainment of ANZECC objectives for nutrients at stations within the North Central CMA region during 2002.

Basin	Program	SINO	ANZECC						Rating					
			TN_{80}	NO_{x80}	$NH4_{80}$	TP_{80}	FRP_{80}	Chl-a_{80}	TN	NO_x	NH4	TP	FRP	Chl-a
	Rivers													
406	M	406202	**14**	**44**	*	**96**	**98**	*	L	L	*	H	H	*
	V	406207	**0**	**0**	*	**8**	100	*	L	L	*	L	H	*
	V	406208	*	*	*	*	*	*	*	*	*	*	*	*
	V	406213	**0**	**42**	*	**0**	**83**	*	L	L	*	L	M	*
	V	406214	*	*	*	*	*	*	*	*	*	*	*	*
	V	406215	**0**	**17**	*	**25**	**92**	*	L	L	*	L	H	*
	V	406224	*	*	*	*	*	*	*	*	*	*	*	*
	V	406235	*	*	*	*	*	*	*	*	*	*	*	*
407	E	0705	*	*	*	*	*	*	*	*	*	*	*	*
	M	407202	**34**	**98**	*	**15**	**98**	*	L	H	*	L	H	*
	V	407203	**0**	100	*	**58**	100	*	L	H	*	L	H	*
	M	407209	**16**	**94**	*	**8**	100	*	L	H	*	L	H	*
	V	407214	*	*	*	*	*	*	*	*	*	*	*	*
	V	407215	**0**	**58**	*	**0**	**83**	*	L	L	*	L	H	*
	V	407220	*	*	*	*	*	*	*	*	*	*	*	*
	V	407221	**0**	**50**	*	**25**	100	*	L	L	*	L	H	*
	V	407229	**0**	100	*	100	100	*	L	H	*	H	H	*
	V	407236	*	*	*	*	*	*	*	*	*	*	*	*
	M	407252	**0**	**66**	*	**0**	**0**	*	L	L	*	L	L	*
	V	407255	**0**	**17**	*	**0**	**0**	*	L	L	*	L	L	*
408	V	408200	**8**	100	*	**75**	100	*	L	H	*	M	H	*
	V	408202	**0**	**8**	*	**33**	100	*	L	L	*	L	H	*
	V	408203	*	*	*	*	*	*	*	*	*	*	*	*
409	V	409005	100	**94**	*	**55**	100	*	H	H	*	L	H	*
	V	409204	**90**	**98**	*	**23**	**98**	*	H	H	*	L	H	*
	V	409207	**98**	**87**	*	**73**	**98**	*	H	H	*	L	H	*
415	M	415220	*	*	*	*	*	*	*	*	*	*	*	*
	M	415257	*	*	*	*	*	*	*	*	*	*	*	*
	M	415259	*	*	*	*	*	*	*	*	*	*	*	*
	Lakes													
406	S	406219	**0**	**0**	**38**	**0**	100	**81**	L	L	L	L	H	M
407	S	407240	**6**	**50**	**44**	**0**	100	**28**	L	L	L	L	H	L
	S	407241	**0**	**28**	**28**	**0**	**50**	**66**	L	L	L	L	L	L
	S	407244	**0**	**22**	**50**	**6**	**100**	**72**	L	L	L	L	H	L
	S	407603	**0**	**24**	**29**	**0**	**88**	**35**	L	L	L	L	H	L
	S	407604	**0**	**47**	**47**	**0**	100	**82**	L	L	L	L	H	M
415	S	415609	*	*	*	*	*	*	*	*	*	*	*	*

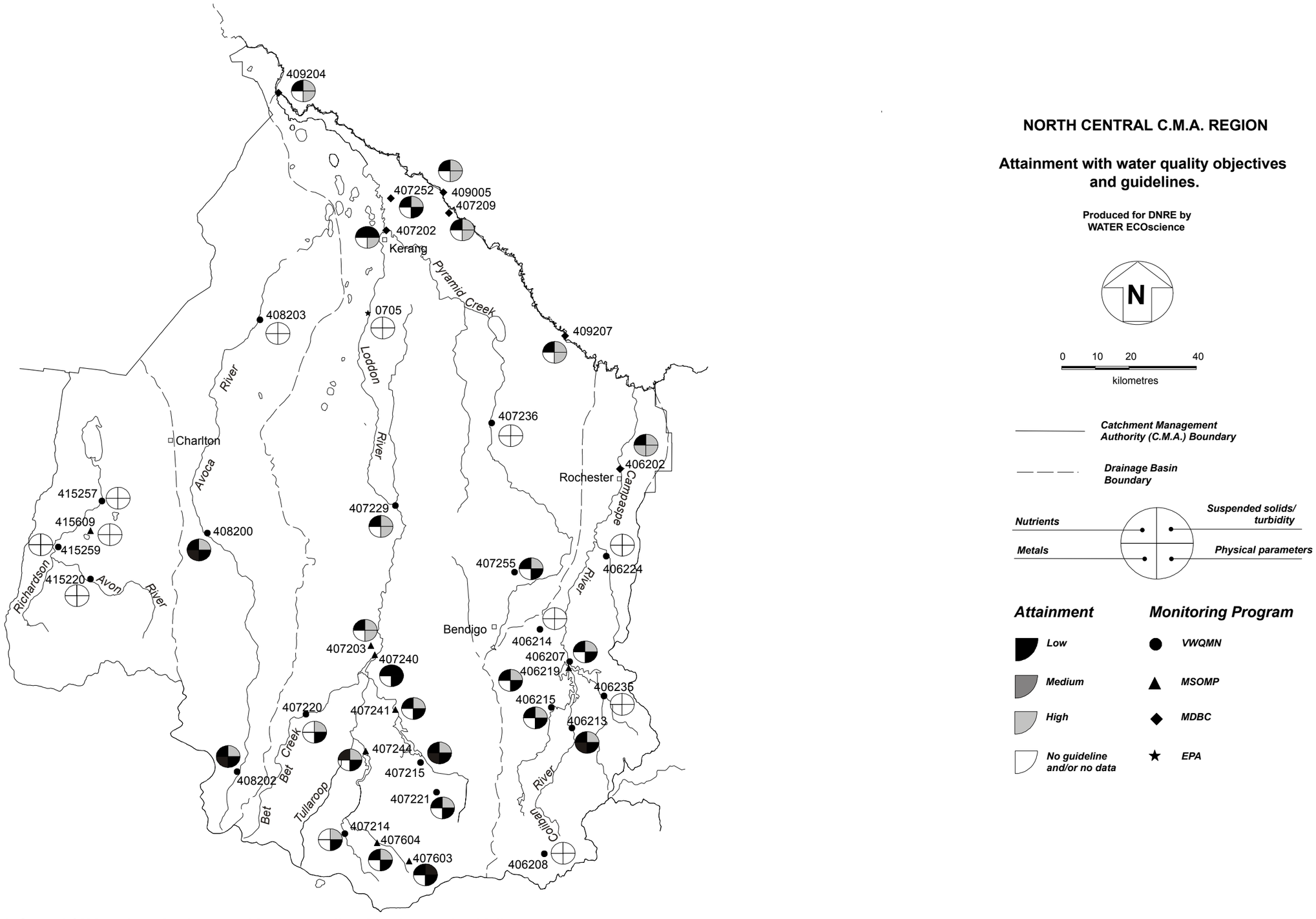
* = Insufficient data (<10 samples)
E = EPA FSN
V = VWQMN
M = MDBC
- = No guideline
S = MSOMP
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 28. Percent attainment of SEPP and ANZECC objectives for metals at stations within the North Central CMA region during 2002.

Basin	Program	SINO	SEPP							ANZECC						
			As	Cd	Cr	Cu	Ni	Pb	Zn	As_{80}	Cd_{80}	Cr_{80}	Cu_{80}	Ni_{80}	Pb_{80}	Zn_{80}
	Rivers															
406	M	406202	100	100	100	100	100	100	100	100	100	-	**0**	100	**92**	**83**
	V	406207	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	406208	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	406213	100	**92**	100	**83**	100	100	**92**	100	**92**	-	**0**	100	100	**33**
	V	406214	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	406215	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	406224	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	406235	*	*	*	*	*	*	*	*	*	-	*	*	*	*
407	E	0705	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	M	407202	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	407203	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	M	407209	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	407214	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	407215	100	100	100	**83**	100	100	100	100	100	-	**8**	100	100	**67**
	V	407220	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	407221	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	407229	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	407236	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	M	407252	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	407255	*	*	*	*	*	*	*	*	*	-	*	*	*	*
408	V	408200	100	**58**	100	**67**	100	100	**58**	100	**58**	-	**0**	**58**	100	**42**
	V	408202	100	**83**	100	**92**	100	100	100	100	**83**	-	**0**	**92**	100	**58**
	V	408203	*	*	*	*	*	*	*	*	*	-	*	*	*	*
409	M	409005	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	M	409204	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	M	409207	*	*	*	*	*	*	*	*	*	-	*	*	*	*
415	V	415220	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	415257	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	415259	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	Lakes															
406	S	406219	*	*	*	*	*	*	*	*	*	-	*	*	*	*
407	S	407240	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	407241	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	407244	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	407603	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	407604	*	*	*	*	*	*	*	*	*	-	*	*	*	*
415	S	415609	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Basin	Program	SINO	Rating						
			As	Cd	Cr	Cu	Ni	Pb	Zn
406	M	406202	H	H	H	H	H	H	H
	V	406213	H	M	H	L	H	H	M
407	V	407215	H	H	H	L	H	H	H
408	V	408200	H	L	H	L	H	H	L
	V	408202	H	L	H	M	H	H	H

* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
M = MDBC
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.



NORTH CENTRAL C.M.A. REGION

Attainment with water quality objectives and guidelines.

Produced for DNRE by WATER ECOscience

N

0 10 20 40

kilometres

Catchment Management Authority (C.M.A.) Boundary

Drainage Basin Boundary

Nutrients — *Suspended solids/ turbidity*

Metals — *Physical parameters*

Attainment	*Monitoring Program*
Low	*VWQMN*
Medium	*MSOMP*
High	*MDBC*
No guideline and/or no data	*EPA*

Figure 21. North Central CMA region. Attainment with water quality objectives and guidelines.

Station Specific Water Quality: Avoca River at Coonooer

Avoca River at Coonooer (station 408200) is located within the Avoca basin and was identified as having poor water quality in relation to dissolved oxygen, electrical conductivity (EC), total nitrogen and phosphorus in 2002. The site has been monitored since 1976.

Avoca River at Coonooer shows a seasonal pattern of falling water levels during summer and autumn, before peaking again in winter. Dissolved oxygen obtained moderate attainment against the SEPP objectives in 2002. During the past 20 years there appears to be a slow downward trend of dissolved oxygen at this site. This is most likely partially due to the decrease in average flow over that period.

The maximum ANZECC guideline level for EC in lowland rivers is less than 2200 μS/cm and at no time during the monitoring period has the EC level dropped below this value.

pH have shown a slight increase since the commencement of monitoring at the Avoca River station. pH have generally met SEPP attainment levels, but have risen above ANZECC guideline levels in recent years.

Suspended solids and turbidity have obtained high attainment against the objectives.

Total Nitrogen obtained low attainment against the guidelines and has exhibited concentrations well in excess of the recommended guideline since the commencement of monitoring. Oxidised nitrogen (NO_x) results are well below the recommended guideline and consequently obtained high attainment against the objectives.

Total phosphorus obtained moderate attainment against the objectives and filterable reactive phosphorus (FRP) obtained high attainment against the objectives.

Heavy metals obtained high attainment at this site against the objectives, except for low attainment for cadmium, copper and zinc.

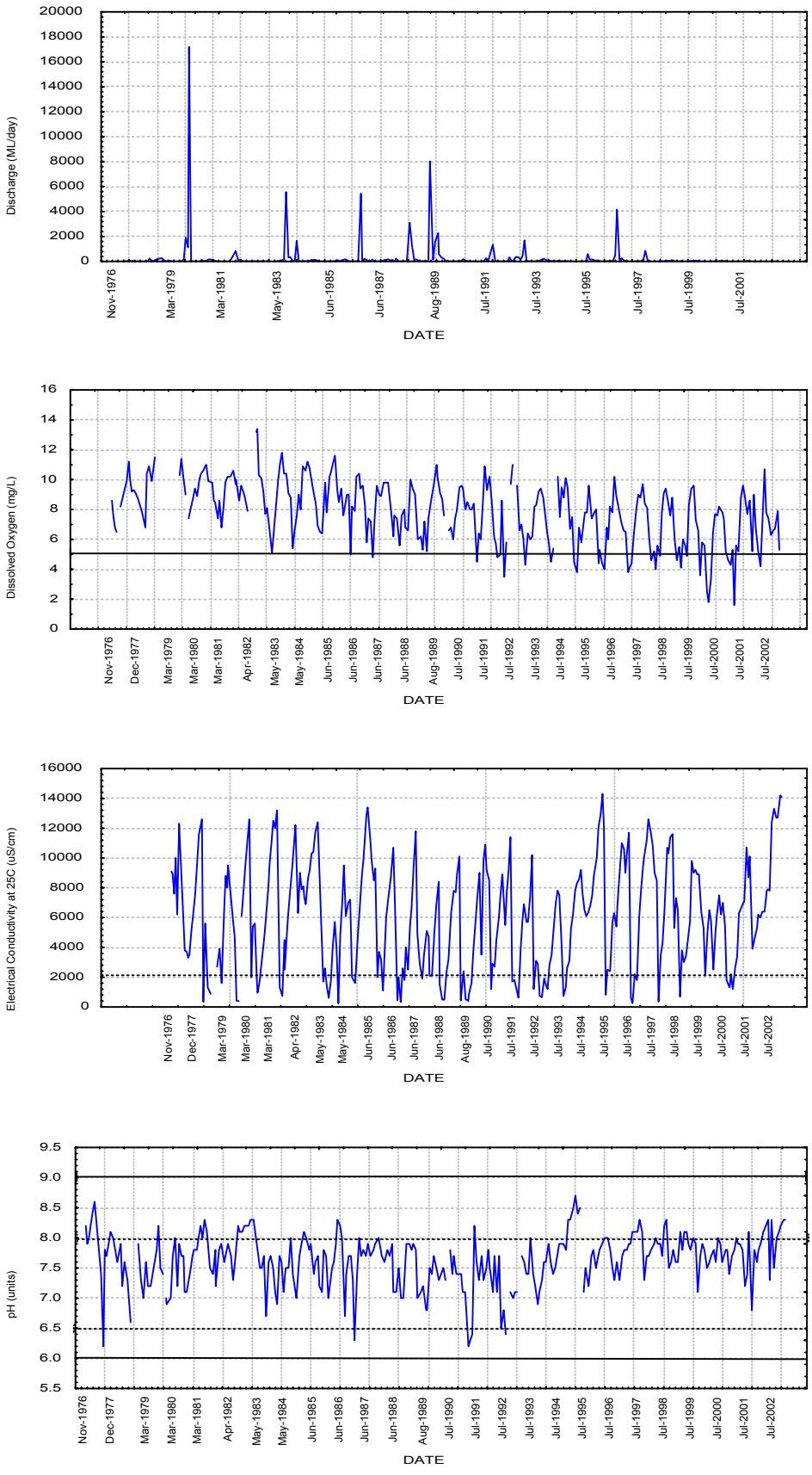


Figure 22. Variation of water quality in Avoca River at Coonooer (station 408200), 1975-2002.

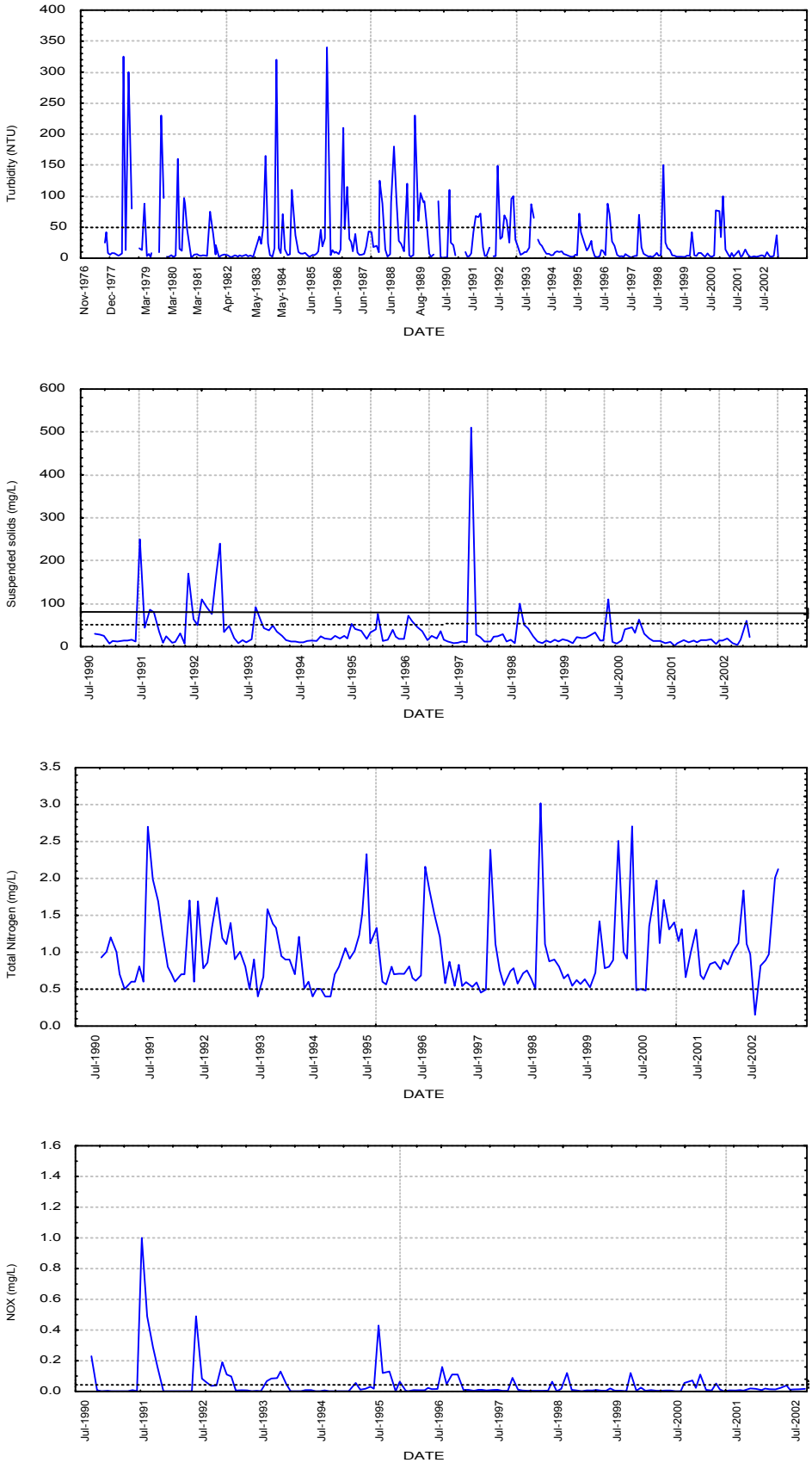


Figure 23. Variation of water quality in Avoca River at Coonooer (station 408200), 1975-2002.

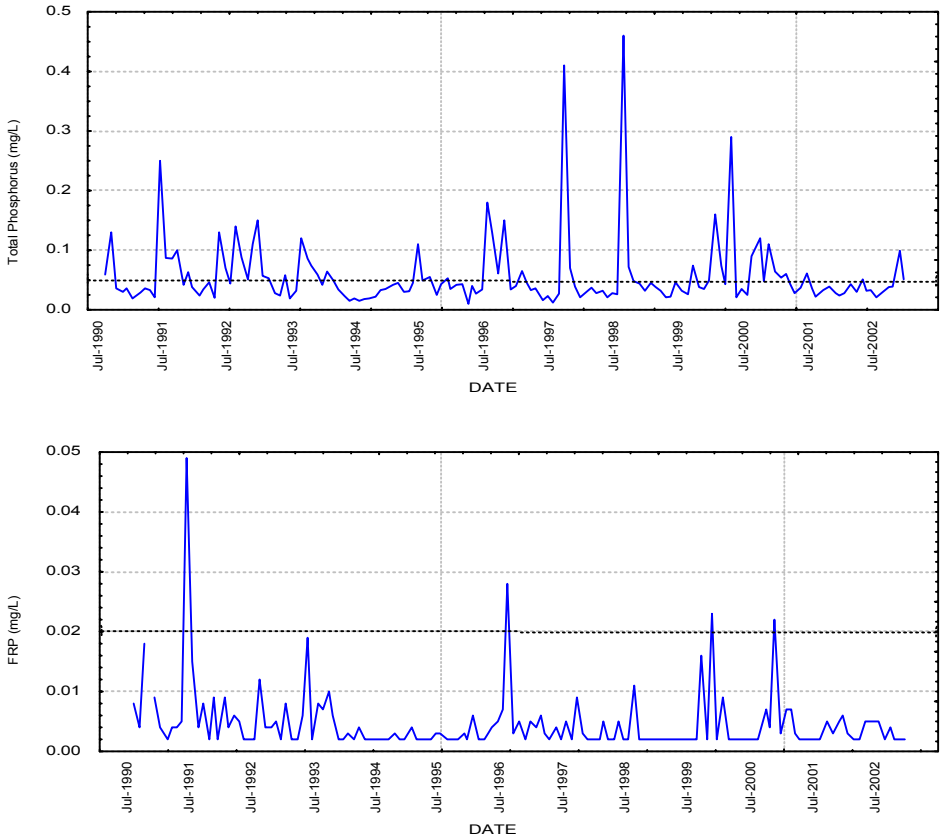


Figure 24. Variation of water quality in Avoca River at Coonooer (station 408200), 1975-2002.

Black line indicates SEPP objective limit and dashed line indicates ANZECC guideline limit. Limits are minimum for DO, range for pH, maximum for other parameters.

It should be recognized that in many cases the dates on the x axis on the graph do not line up on all graphs. This is due to the change in time when monitoring started for some parameters.

5.2.7 North East CMA Region

Water Quality Characterisation

The North East CMA region incorporates four drainage basins: Upper Murray River (Basin 401 incorporating 6 stations including 1 lake), Kiewa River (Basin 402 incorporating 5 stations), Ovens River (Basin 403 incorporating 11 stations including 2 lakes) and Murray-Riverina (Basin 409 incorporating 2 stations). Water quality will be discussed according to these basins where appropriate. Water quality was characterised for each station in the North East CMA region according to percent attainment with the relevant water quality objectives and guidelines (Tables 29-32). A summary of this data is presented on an attainment map for the stations in the region (Figure 25). Water quality characterisation was according to attainment of the SEPP objectives or, in the absence of SEPP objectives, the ANZECC guidelines as outlined in Section 2: Methods.

Water quality within the North East CMA region generally exhibited high attainment for dissolved oxygen, electrical conductivity, pH, turbidity and suspended solids and low attainment for nutrients.

Attainment of the SEPP objectives for dissolved oxygen (DO) was high throughout the North East CMA region, but achieved an even spread of high, moderate and low against the ANZECC guideline. Fifteen Mile Creek at Greta South (403213) was the only site in the region that recorded a moderate attainment againt the objective for DO in the North East CMA region.

There were no SEPP objectives for electrical conductivity (EC) in the North East CMA region so the ANZECC guidelines applied. EC obtained high attainment of the ANZECC guideline throughout the region. Three stations recorded low EC attainment. These were the three lakes in the region, Dartmouth Dam (401224), Lake William Hovell (403234) and Lake Buffalo (403235).

SEPP attainment for pH was generally high throughout the region, with the exception of one station: Ovens River at Myrtelford (403210) which recorded moderate attainment.

For turbidity, no SEPP objectives were applicable thus ANZECC guidelines applied. All of the stations monitored for turbidity in the North East CMA region achieved high attainment of the ANZEC guidelines. This was also the case in 2001.

Generally all of the stations monitored for suspended solids (SS) in the North East CMA region achieved high attainment of the SEPP objectives. King River at Docker Road Bridge (403223) and Ovens River at Peechelba East (403241) recorded moderate attainment against the SEPP objectives.

As no SEPP objectives for total phosphorus (TP) were applicable , ANZECC guidelines applied. There was generally low attainment with phosphorus guidelines throughout the region. Two sites obtained moderate attainment whilst six sites obtained high attainment. The Ovens River (403) and Kiewa River (402) Basins were the two that contained the lowest attainment with ANZECC guidelines.

There were no SEPP objectives for total nitrogen (TN) in the North East CMA region so ANZECC guidelines applied. All of the sites in the Mitta Mitta Basin had high attainment for nitrogen except Mitta Mitta River at Tallandoon (401204) which recorded moderate attainment. All sites in the Kiewa Basin recorded low attainment except for one site, Kiewa River (west branch) upstream of offtake (402223) which recorded high attainment. Stations in the Ovens River Basin recorded low attainment except for high attainment at Ovens River at Peechelba East (403241) and Ovens River at Harrietville (403244) and moderate attainment at Ovens River at Myrtlford (403210) Moderate attainment for total nitrogen was also recorded at Lake Buffalo (403235).

Attainments of chlorophyll-*a* to the ANZECC guidelines were high for the lake sites that were monitored except Lake Bufalo (403235) recorded low attainment.

Two sites in the Ovens River Basin were sampled for metals in the North East CMA region (403205, 403241). High attainment was obtained for arsenic, cadmium, chromium, nickel and lead at both sites. High attainment was also obtained for copper in the Ovens River at Peechelba East (site 403241). Low attainment was obtained for zinc and moderate attainment for copper at Ovens River at Bright (403205)

The water quality data and summary statistics relating to the water quality, water quantity and river health in the North East CMA region have been made available on the Internet. See www.vicwaterdata.net for this information.

Table 29. Percent attainment of SEPP and ANZECC objectives for physical parameters at stations within the North-East CMA region during 2002.

Basin	Program	SINO	SEPP				ANZECC			Rating		
			DO	DO%sat	EC	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	PH
	Rivers											
401	M	401201	*	*	-	100	*	100	**81**	*	H	H
	M	401204	100	100	-	100	**87**	100	**92**	H	H	H
	V	401211	100	100	-	100	100	100	**58**[(b)]	H	H	H
	V	401212	100	100	-	100	**42**	100	100	H	H	H
	V	401216	100	100	-	100	**67**	100	**91**[(b)]	H	H	H
402	V	402203	100	100	-	100	**83**	100	**50**[(b)]	H	H	H
	V	402204	100	100	-	100	**42**	100	**75**[(b)]	H	H	H
	M	402205	100	100	-	**98**[(b)]	**45**	100	**68**[(b)]	H	H	H
	V	402222	100	100	-	100	**58**	100	**83**[(b)]	H	H	H
	V	402223	100	100	-	100	**83**	100	**67**[(b)]	H	H	H
403	V	403205	100	100	-	100	**75**	100	100	H	H	H
	V	403210	100	100	-	**92**[(b)]	**75**	100	**33**[(b)]	H	H	M
	V	403213	**92**	**92**	-	100	**17**	100	**83**[(b)]	M	H	H
	V	403217	100	100	-	100	**42**	100	**58**[(b)]	H	H	H
	V	403223	100	100	-	100	**33**	100	**83**[(b)]	H	H	H
	V	403228	100	100	-	100	**42**	100	**50**[(b)]	H	H	H
	V	403230	100	100	-	100	**67**	100	**42**[(b)]	H	H	H
	M	403241	100	100	-	**96**[(b)]	**64**	100	**70**[(b)]	H	H	H
	V	403244	100	100	-	100	**50**	100	**75**[(b)]	H	H	H
409	M	409011	*	*	-	100	*	100	**96**[(b)]	*	H	H
	M	409016	*	*	-	100	*	100	**85**[(b)]	*	H	H
	Lakes											
401	S	401224	*	*	-	100	*	**0**	100	*	L	H
403	S	403234	*	*	-	100	*	**73**	100	*	L	H
	S	403235	*	*	-	100	*	**25**	100	*	L	H

[(a)] = pH outside objective range above maximum limit
[(b)] = pH outside objective range below minimum limit
* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
M = MDBC
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 30. Percent attainment of SEPP and ANZECC objectives for turbidity and suspended solids at stations within the North East CMA region during 2002.

Basin	Program	SINO	SEPP			ANZECC		Rating	
			Turb	SS_{50}	SS_{90}	$Turb_{80}$	SS_{80}	Turb	SS
	Rivers								
401	M	401201	-	*	*	100	*	H	*
	M	401204	-	*	*	100	*	H	*
	V	401211	-	100	100	100	100	H	H
	V	401212	-	100	100	100	100	H	H
	V	401216	-	100	100	100	100	H	H
402	V	402203	-	100	100	100	100	H	H
	V	402204	-	100	100	100	100	H	H
	M	402205	-	*	*	100	*	H	*
	V	402222	-	100	100	100	100	H	H
	V	402223	-	100	100	100	100	H	H
403	V	403205	-	**83**	100	**91**	**83**	H	H
	V	403210	-	**92**	100	100	**92**	H	H
	V	403213	-	100	100	100	100	H	H
	V	403217	-	100	100	100	100	H	H
	V	403223	-	**92**	**92**	100	**92**	H	M
	V	403228	-	*	*	100	*	H	*
	V	403230	-	**92**	100	100	**92**	H	H
	M	403241	-	**92**	**92**	100	**92**	H	M
	V	403244	-	100	100	100	100	H	H
409	M	409011	-	*	*	**98**	*	H	*
	M	409016	-	*	*	100	*	H	*
	Lakes								
401	S	401224	-	*	*	100	*	H	*
403	S	403234	-	*	*	100	*	H	*
	S	403235	-	*	*	100	*	H	*

* = Insufficient data (<10 samples)
\- = No guideline
V = VWQMN
M = MDBC
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 31. Percent attainment of SEPP and ANZECC objectives for nutrients at stations within the North East CMA region during 2002.

Basin	Program	SINO	ANZECC						Rating					
			TN_{80}	NO_{x80}	$NH4_{80}$	TP_{80}	FRP_{80}	Chl-a_{80}	TN	NO_x	NH4	TP	FRP	Chl-a
	Rivers													
401	M	401201	**98**	**70**	*	**96**	100	*	H	L		H	H	
	M	401204	**79**	**0**	*	**87**	100	*	M	L		H	H	
	V	401211	100	**0**	*	100	100	*	H	L		H	H	
	V	401212	100	**83**	*	**25**	100	*	H	M		L	H	
	V	401216	**92**	**83**	*	**67**	100	*	H	M		L	H	
402	V	402203	**50**	**0**	*	**58**	100	*	L	L		L	H	
	V	402204	**42**	**33**	*	**0**	100	*	L	L		L	H	
	M	402205	**58**	**2**	*	**30**	100	*	L	L		L	H	
	V	402222	**42**	**0**	*	**42**	100	*	L	L		L	H	
	V	402223	100	**58**	*	**92**	100	*	H	L		H	H	
403	V	403205	**67**	**0**	*	**42**	**92**	*	L	L		L	H	
	V	403210	**83**	**0**	*	**67**	100	*	M	L		L	H	
	V	403213	**50**	**33**	*	**33**	100	*	L	L		L	H	
	V	403217	**25**	**8**	*	**67**	100	*	L	L		L	H	
	V	403223	**50**	**0**	*	**42**	100	*	L	L		L	H	
	V	403228	*	*	*	*	*	*						
	V	403230	**33**	**0**	*	**58**	100	*	L	L		L	H	
	M	403241	**96**	**36**	*	**91**	100	*	H	L		H	H	
	V	403244	100	**8**	*	**42**	100	*	H	L		L	H	
409	M	409011	100	**79**	*	**85**	100	*	H	M		M	H	
	M	409016	100	**64**	*	100	100	*	H	L		H	H	
	Lakes													
401	S	401224	100	**58**	**92**	**75**	100	100	H	L	H	M	H	H
403	S	403234	100	**64**	**91**	**18**	100	100	H	L	H	L	H	H
	S	403235	**75**	**50**	**67**	**8**	100	**58**	M	L	L	L	H	L

* = Insufficient data (<10 samples)
\- = No guideline
V = VWQMN
M = MDBC
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 32. Percent attainment of SEPP and ANZECC objectives for metals at stations within the North East CMA region during 2002.

Basin	Program	SINO	SEPP							ANZECC						
			As	Cd	Cr	Cu	Ni	Pb	Zn	As_{80}	Cd_{80}	Cr_{80}	Cu_{80}	Ni_{80}	Pb_{80}	Zn_{80}
	Rivers															
401	M	401201	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	M	401204	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	401211	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	401212	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	401216	*	*	*	*	*	*	*	*	*	*	*	*	*	*
402	V	402203	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	402204	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	M	402205	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	402222	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	402223	*	*	*	*	*	*	*	*	*	*	*	*	*	*
403	V	403205	100	100	100	100	100	100	**83**	100	100	-	**17**	100	**92**	**25**
	V	403210	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	403213	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	403217	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	403223	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	403228	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	V	403230	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	M	403241	100	100	100	100	100	100	100	100	100	-	**8**	100	100	**69**
	V	403244	*	*	*	*	*	*	*	*	*	*	*	*	*	*
409	M	409011	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	M	409016	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Lakes															
401	S	401224	*	*	*	*	*	*	*	*	*	*	*	*	*	*
403	S	403234	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	S	403235	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Basin	Program	SINO	Rating						
			As	Cd	Cr	Cu	Ni	Pb	Zn
403	V	403205	H	H	H	M	H	H	L
	M	403241	H	H	H	H	H	H	H

* = Insufficient data (<10 samples)
\- = No guideline
V = VWQMN
M = MDBC
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

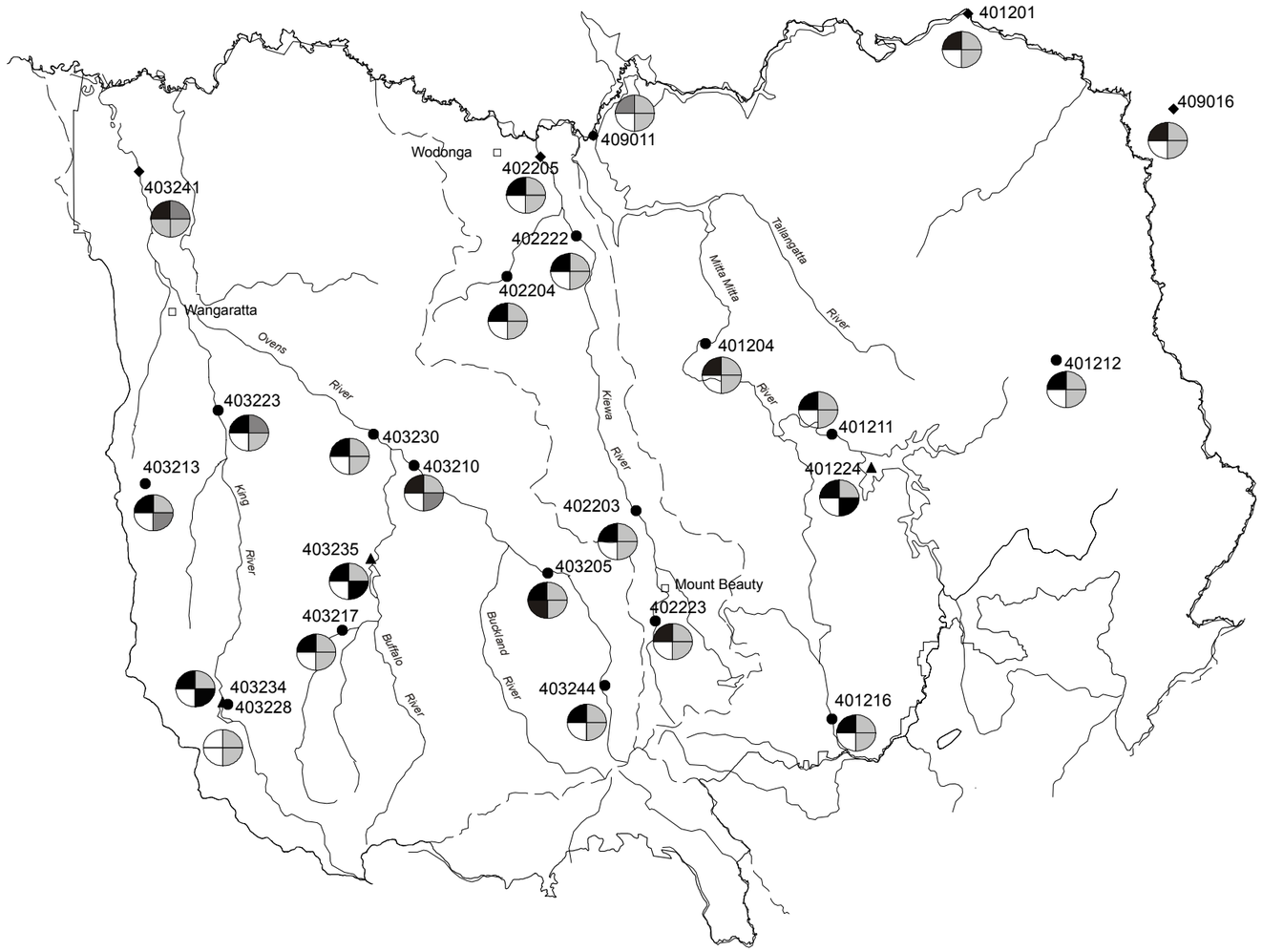


Figure 25. North East CMA region. Attainment with water quality objectives and guidelines

.

NORTH EAST C.M.A. REGION

Attainment with water quality objectives and guidelines.

Produced for DNRE by WATER ECOscience

N

0 10 20 40
kilometres

Catchment Management Authority (C.M.A.) Boundary

Drainage Basin Boundary

Nutrients

Suspended solids/ turbidity

Metals

Physical parameters

Attainment

- *Low*
- *Medium*
- *High*
- *No guideline and/or no data*

Monitoring Program

- *VWQMN*
- *MSOMP*
- *MDBC*
- *EPA*

Station Specific Water Quality: Kiewa River at Mongans Bridge.

Kiewa River at Mongans Bridge (station 403203) was identified as having low attainment for nutrients, with nitrogen achieving a lower attainment rate than phosphorus. High attainment was obtained for the other indicators DO, EC, pH, Turbidity and Suspended Solids in 2002.

Indicators DO, EC, pH, Suspended solids and Turbidity all achieved high attainment with guidelines. DO remained well above the minimum guideline of 5.0 mg/L for SEPP attainment throughout the monitoring period. Seasonal changes in DO levels can be observed, with peaks occurring during winter and troughs in summer. One notable pattern since 1993 has been the increasing difference between these maximums and minimums. Maximum levels have remained relatively constant, while minimum levels have steadily decreased.

pH have generally remained within SEPP guideline values of 6.0 – 9.0 for the entire sampling period. The trend in the last ten years has been for pH to drop, falling frequently below the ANZECC lower limit in recent years.

Electrical conductivity remained well below guideline levels of 350 μS/cm for ANZECC guideline attainment for the entire period of monitoring. The highest peak recorded during 2002 was 46 μS/cm.

Suspended solids and turbidity had high attainment with SEPP guidelines at Kiewa River at Mongans Bridge, as did all sites within Kiewa Basin.

Low attainment was obtained for nutrients at this site, which appears to be a common occurrence with all sites located in the Kiewa River catchment. The highest record for nitrogen at this water quality station during 2002 was 0.43 mg/L. This was well above the guideline limit of 0.25 mg/L.

Phosphorus has been monitored at Kiewa River at Mongans Bridge since 1978 and has constantly been above the ANZECC guideline of 0.02 mg/L during this time.

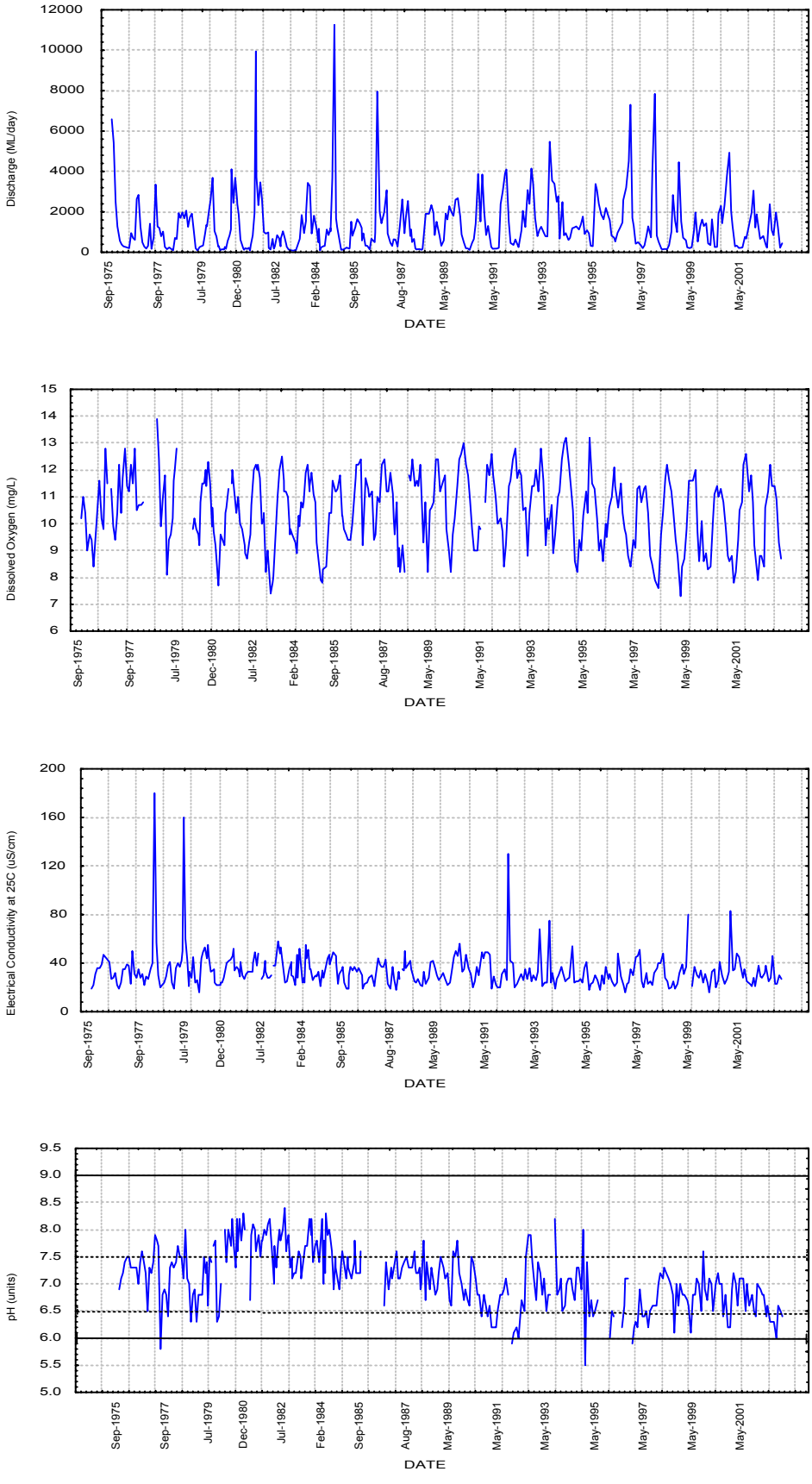


Figure 26. Variation in water quality over time in Kiewa River at Mongans Bridge 1975–2001.

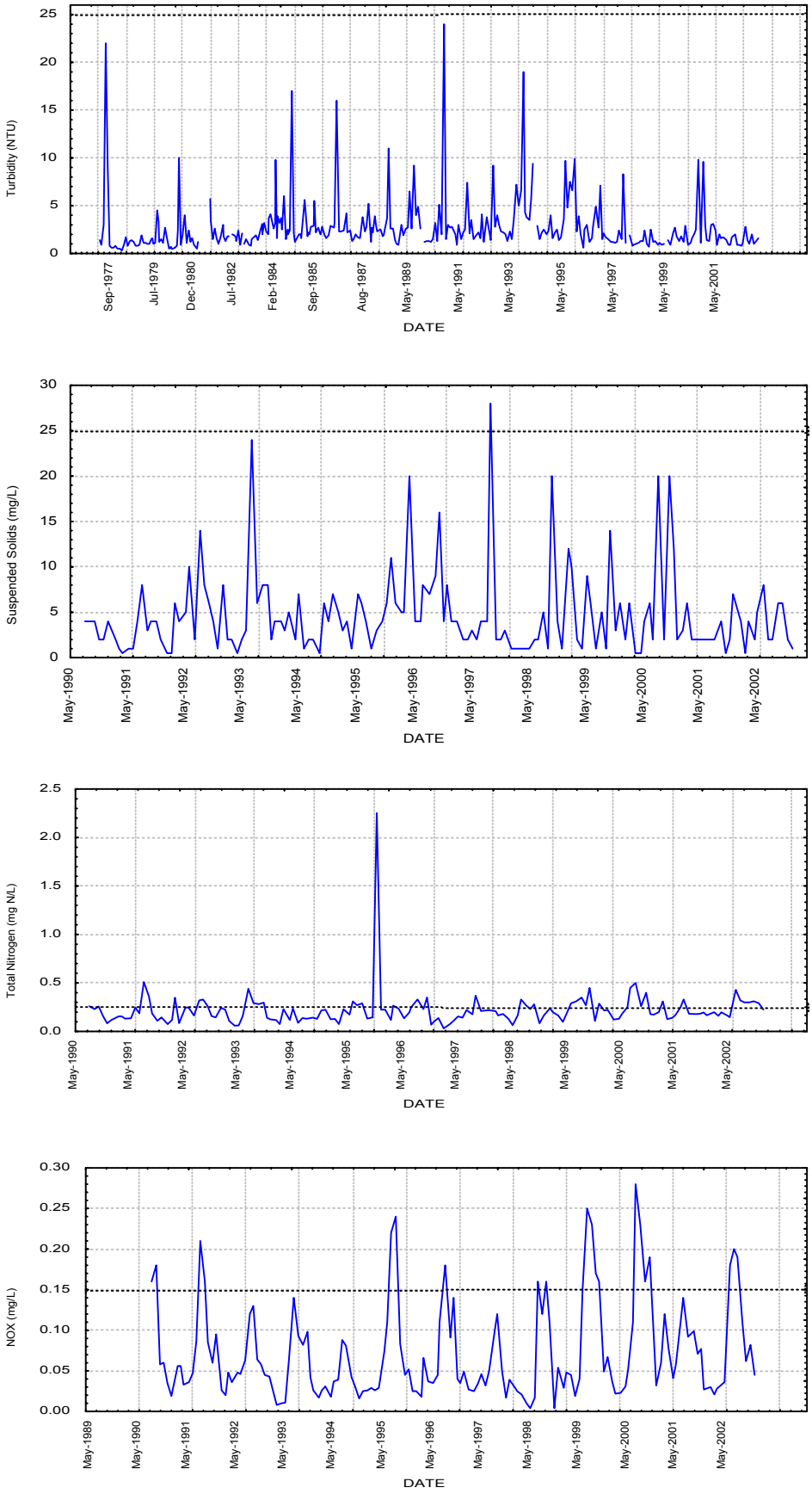


Figure 27. Variation in water quality over time in Kiewa River at Mongans Bridge 1975–2001.

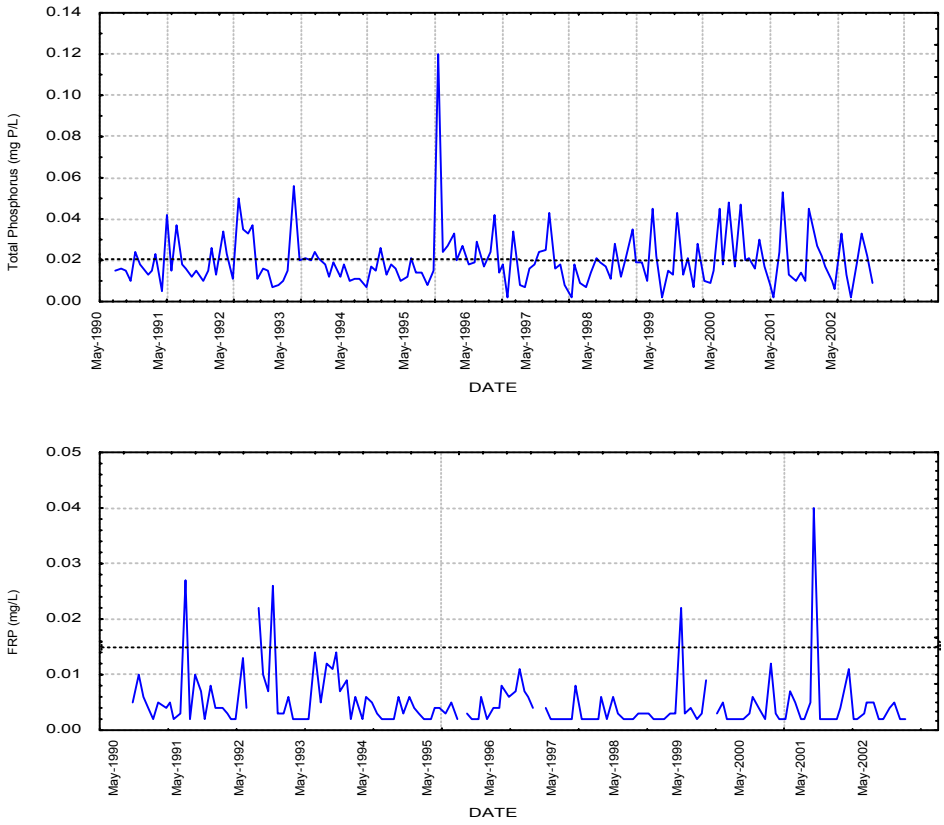


Figure 28. Variation in water quality over time in Kiewa River at Mongans Bridge 1975–2001.

Black line indicates SEPP objective limit and dashed line indicates ANZECC guideline limit. Limits are minimum for DO, range for pH, maximum for other parameters.

It should be recognized that in many cases the dates on the x axis on the graph do not line up on all graphs. This is due to the change in time when monitoring started for some parameters.

5.2.8 Port Phillip CaLP Region

Water Quality Characterisation

The Port Phillip CaLP region is comprised of six drainage basins : - Moorabool River (Basin 232 incorporating 1 station), Werribee River (Basin 231 incorporating 10 stations), Maribyrnong River (Basin 230 incorporating 8 stations), Yarra River (Basin 229 incorporating 33 stations), Bunyip River, including Dandenong Valley (Basin 228 incorporating 32 stations), and South Gippsland (Basin 227 incorporating 1 station). Water quality was characterized for each station in the Port Phillip CaLP region according to percent attainment with the respective water quality objectives and guidelines (Tables 33-36). A graphical depiction of water quality is presented on an attainment map of the stations in the region (Figures 19 and 20). Water quality characterization was according to attainment of the SEPP objectives or, in the absence of SEPP objectives, the ANZECC guidelines as outlined in Section 2: Methods.

Water quality within the Port Phillip CaLP region generally exhibited low attainment for total nitrogen, oxidised nitrogen, ammonia and total phosphorus, and was variable throughout the region for dissolved oxygen, electrical conductivity, pH, turbidity, suspended solids and metals.

SEPP attainment for dissolved oxygen (DO) varied considerably throughout the Port Phillip CaLP region. The majority of the Dandenong Valley (Basin 228) had low SEPP attainment, the Yarra River (Basin 229) stations generally also had low attainment. The Maribynong River (Basin 230) and the Werribee River (Basin 231) generally had varied attainment throughout there respective catchment.

Attainment of the EC objectives and guidelines was mostly high although exceptions were scattered throughout the region. Stations within Basin 227 (South Gippsland) and Basin 232 (Moorabool) recorded low attainment of EC guidelines. Of the thirty-two stations in the Bunyip River / Dandenong Valley Basin, eleven stations exhibited low EC attainment. In the Yarra Basin six of the thirty-three stations exhibited low EC attainment. The Maribynong River and the Werribee River Basin both exhibited varied attainments.

Percentage attainment of SEPP objectives for pH was generally high for stations located throughout the Port Phillip CaLP region. Bunyip River / Dandenong Valley Basin recorded low to moderate pH attainment for several sites. Four stations within Yarra Basin achieved low pH attainment. Watts River at Healesville-Kinglake Road (UY01), Woori Yallock Creek at Warburton Hwy (UY09), Little Yarra River at Corduroy Road (UY35) and Yarra River at Dee Road Bridge Basin achieved low pH attainment. The Moorabool River Basin (232) site also achieved low pH attainment.

The stations within the South Gippsland, Bunyip and Yarra River Basins had SEPP objectives for turbidity. For the other stations, the ANZECC guidelines applied. Attainment varied in the Bunyip River Basin, with 9 of the 32 stations achieving high attainment, 7 achieving moderate attainment and 16 achieving low attainment. Attainment within the Yarra Basin was generally higher, with 23 of the 32 stations achieved high attainment. Elsewhere attainment was generally high and all of the stations in the Werribee River Basin (231) achieved high attainment for turbidity.

There were SEPP objectives for suspended solids for most of the region except some stations in the Werribee River Basin where ANZECC guidelines were applied. Almost all of the sites monitored for suspended solids (SS) in the Port Phillip CaLP region exhibited moderate to high attainment. Low attainment was recorded for fifteen stations in the Bunyip River Basin.

All of the stations sampled for Total Nitrogen in the Port Phillip CaLP had low attainment of the SEPP objectives and ANZECC guidelines. Only ANZECC guidelines for oxidised nitrogen (NO_x) exist for the region. All stations had low attainment for this parameter except for Little River (232200) which exhibited high attainment. Deep Creek d/s of Emu Creek Junction (230205) and Werribee River at Werribee Diversion Weir (231204) exhibited moderate attainment.

Similarly, TP attainment was poor across the Port Phillip CaLP. Almost all stations had low attainment of their respective TP objective or guideline. Exceptions included Cockatoo Creek at Tschampions Road (UY12), Little River at Corduroy Road (UY35), Yarra River at Dee Road Bridge (UY38), Deep Creek at Bulla (230205) and Werribee River at Werribee Diversion Weir (231204) with high attainment. For filterable reactive phosphorus (FRP) ANZECC guidelines applied for all sites. This bioavailable form of phosphorus had much more variable attainment than TP. In the Maribyrnong, Moorabool and Werribee River Basins (Basins 230, 232 and 231) attainment was generally high. In the Yarra River and Bunyip River Basins (Basins 229 and 228) attainment varied throughout the respective basins.

No lakes were sampled for chlorophyll-*a* in the Port Phillip CaLP region during 2002.

Seventy-two stations were sampled for metals in the Port Phillip CaLP region, thirty-two in the Bunyip River Basin, thirty-two in the Yarra River Basin, four in the Maribyrnong River Basin and four in the Werribee River Basin. Metals attainment in the Bunyip River Basin was generally moderate to high, with low zinc and copper attainment at several sites. In the Yarra Basin copper attainment was low for the majority of sites. Lead, zinc and chromium also had low attainment for a number of sites in the Yarra River Basin. With the exception of copper, attainment was generally high in the Maribyrnong Basin, except for two sites (MA1081) and (ST01) which had varied attainments for various metals. Metals attainment was generally high in the Werribee River Basin except for copper which exhibited low attainment.

The water quality data and summary statistics relating to the water quality, water quantity and river health in the Port Phillip CaLP region have been made available on the Internet. See www.vicwaterdata.net for this information. Water quality information for the 72 Melbourne Water sites can be accessed on the Melbourne Water website www.melbournewater.com.au, along with additional stream health information.

Table 33. Percent attainment of SEPP and ANZECC objectives for physical parameters at stations within the Port Phillip CaLP Board region during 2002.

Basin	Program	SINO	SEPP					ANZECC			Rating		
			DO	DO%sat	EC	EC_{90}	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	pH
	Rivers												
227	V	227231	-	**45**	**64**	-	100	**36**	100	100	L	L	H
228	E	5254	**77**	**77**	-	-	100	**23**	**31**	100	L	L	H
	E	5635	**77**	**85**	-	**69**	100	**0**	**92**	100	L	L	H
	E	5652	100	100	-	100	100	**27**	100	**83**	H	H	H
	E	5654	100	100	-	100	100	**23**	100	100	H	H	H
	E	5681	100	100	-	**69**	**92**	**38**	**69**	**92**	H	L	M
	MW	AM007	100	100	-	100	**92**	**25**	100	**83**	H	H	M
	MW	AM010	**67**	**67**	-	-	100	**33**	-	**67**	L	H	H
	MW	AM014	**83**	**92**	-	100	100	**8**	100	100	L	H	H
	MW	AM032	**92**	**92**	-	**92**	100	**33**	100	100	M	H	H
	MW	AM055	**92**	**92**	-	100	100	**25**	100	100	M	H	H
	MW	AM085	**75**	**67**	-	-	**67**	**58**	100	**42**	L	H	L
	MW	AM094	-	**42**	**17**	-	**83**	**42**	100	**83**	L	L	L
	MW	AM119	-	**75**	-	-	**92**	**58**	100	**83**	L	H	M
	MW	AM120	-	**25**	-	-	100	**25**	100	100	L	H	H
	MW	AM121	-	**33**	-	-	**92**	**33**	**8**	**92**	L	L	M
	MW	AM122	-	**50**	-	-	**92**	**42**	**50**	**83**	L	L	M
	MW	AM124	-	**58**	-	-	**92**	**50**	**42**	**92**	L	L	M
	MW	AM127	-	**33**	100	-	100	**25**	100	100	L	H	H
	MW	AM129	-	**92**	100	-	100	**75**	100	100	M	H	H
	MW	AM131	-	**33**	**58**	-	100	**33**	100	100	L	L	H
	MW	AM148	-	**50**	**75**	-	100	**42**	100	100	L	L	H
	MW	AM150	-	**30**	**0**	-	100	**30**	-	**80**	L	L	H
	MW	AM151	**75**	**75**	-	-	100	**67**	-	**92**	L	H	H
	MW	AM161	**17**	**8**	-	-	100	**8**	-	**92**	L	H	H
	MW	AM162	100	100	-	-	100	**83**	-	**92**	H	H	H
	MW	AM166	100	100	-	-	**92**	**83**	100	**42**	H	H	M
	MW	AM177	100	**83**	-	-	100	**50**	-	**92**	H	H	H
	MW	WPBR01	-	**75**	100	-	100	**75**	100	100	L	H	H
	MW	WPBR02	-	**92**	**92**	-	100	**92**	100	100	M	M	H
	MW	WPBR04	-	**75**	100	-	100	**75**	-	**83**	L	H	H
	MW	WPCC01	-	**58**	**83**	-	**67**	**58**	100	**67**	L	L	L
	MW	WPTC02	-	**8**	-	-	**92**	**8**	100	**92**	L	H	M
229	E	2904	**92**	**50**	100	-	100	**33**	100	100	L	H	H
	E	2916	100	**83**	100	-	100	**58**	100	**92**	L	H	H
	E	4940	**67**	100	100	-	100	**25**	100	**92**	H	H	H
	E	4991	**91**	100	100	-	100	**36**	100	**91**	H	H	H
	E	4992	*	*	100	-	*	*	*	*	*	H	*
	MW	LY06	100	100	100	-	100	**83**	100	**75**	H	H	H
	MW	LY07	**75**	**75**	**42**	-	100	**33**	**83**	**67**	L	L	H
	MW	LY08	**73**	**91**	-	-	100	**9**	-	**82**	L	H	H
	MW	UY01	**75**	**42**	100	-	**83**	**25**	100	**83**	L	H	L
	MW	UY04	**75**	**42**	100	-	100	**42**	100	100	L	H	H

Basin	Program	SINO	SEPP					ANZECC			Rating		
			DO	DO%sat	EC	EC_{90}	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	pH
	MW	UY09	**92**	**58**	100	-	**75**	**50**	100	**75**	M	H	L
	MW	UY11	100	**67**	100	-	100	**50**	100	100	H	H	H
	MW	UY12	100	**83**	100	-	100	**50**	100	100	H	H	H
	MW	UY35	100	**83**	100	-	75	**75**	100	**75**	H	H	L
	MW	UY38	100	**92**	100	-	83	**75**	100	**83**	H	H	L
	MW	MD05	100	100	100	-	100	**83**	100	**67**	H	H	H
	MW	MY02	100	100	100	-	100	**75**	100	100	H	H	H
	MW	MY05	**67**	**75**	100	-	100	**17**	100	100	L	H	H
	MW	MY07	**67**	**67**	100	-	100	**8**	100	100	L	H	H
	MW	MY10	**50**	**58**	100	-	100	**25**	100	100	L	H	H
	MW	MY12	**67**	**58**	100	-	100	**42**	100	100	L	H	H
	MW	MY15	**58**	**50**	100	-	100	**33**	100	100	L	H	H
	MW	MY18	**92**	100	100	-	100	**8**	100	100	M	H	H
	MW	MY19	**92**	**92**	100	-	100	**42**	100	100	M	H	H
	MW	MY21	**83**	**58**	**25**	-	100	**50**	100	**92**	L	L	H
	MW	MY25	100	100	100	-	100	**50**	100	100	H	H	H
	MW	MY26	**33**	**25**	**8**	-	100	**0**	**0**	**0**	L	L	H
	MW	MY27	**42**	**50**	100	-	100	**0**	**0**	**25**	L	H	H
	MW	MY28	**67**	**17**	**83**	-	100	**17**	100	100	L	L	H
	MW	MY29	**20**	**0**	100	-	100	**0**	100	100	L	H	H
	MW	MY30	**67**	**75**	100	-	100	**17**	100	100	L	H	H
	MW	MY31	**83**	**25**	**75**	-	100	**25**	100	100	L	L	H
	MW	MY32	**86**	**14**	**71**	-	100	**14**	100	100	L	L	H
230	E	3030	**75**	**75**	-	-	100	**17**	**92**	**83**	L	H	H
	E	6070	**83**	**92**	-	-	100	**17**	**75**	**83**	M	M	H
	V	230202	**83**	**83**	-	-	100	**25**	**0**	**58**	L	L	H
	V	230205	100	100	-	-	100	**82**	**8**	**0**	L	L	H
	V	230209	100	100	-	-	92	100	100	**67**	L	H	M
	V	230232	100	100	-	-	100	**50**	**0**	**25**	L	L	H
	MW	MA1081	**92**	**92**	-	-	100	**25**	100	**83**	M	H	H
	MW	ST01	100	100	-	-	100	**67**	**92**	**75**	H	H	H
231	E	3120	*	*	-	-	*	*	*	*	*	*	*
	E	3133	*	*	-	-	*	*	*	*	*	*	*
	E	3135	-	-	-	-	-	*	*	*	*	*	*
	E	5502	**75**	**83**	-	-	100	**17**	**25**	**67**	L	L	H
	E	5509	**83**	**92**	-	-	100	**0**	**83**	100	M	M	H
	V	231204	100	100	-	-	100	**70**	**83**	**92**	H	M	H
	V	231213	100	100	-	-	92	**42**	100	**58**	H	H	M
	V	231231	**82**	**82**	-	-	100	**27**	**58**	**83**	L	L	H
	V	231234	*	*	-	-	*	*	*	*	*	*	*
	MW	SK5828	**58**	**58**	-	-	100	**8**	**8**	100	L	L	H
232	V	232200	100	100	-	-	100	100	**0**	**8**	H	L	L

(a) = pH outside objective range above maximum limit
(b) = pH outside objective range below minimum limit
* = Insufficient data (<10 samples)
MW = Melbourne Water
E = EPA FSN
V = VWQMN
- = No guideline
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 34. Percent attainment of SEPP and ANZECC objectives for turbidity and suspended solids at stations within the Port Phillip CaLP region during 2002.

Basin	Program	SINO	SEPP						ANZECC		Rating	
			$Turb_{50}$	$Turb_{75}$	$Turb_{90}$	SS_{50}	SS_{75}	SS_{90}	$Turb_{80}$	SS_{80}	Turb	SS
	Rivers											
227	V	227231	100	100	-	**92**	*	-	100	100	H	H
228	E	5254	**46**	-	**92**	**38**		100	100	100	M	H
	E	5635	100	-	100	100		100	100	100	H	H
	E	5652	**58**	-	**92**	**75**		100	**92**	**83**	M	H
	E	5654	**54**	-	**85**	**62**		100	**85**	**85**	L	H
	E	5681	**54**	-	**92**	**46**		100	**92**	100	M	H
	MW	AM007	**75**	-	100	**92**	-	100	100	**92**	H	H
	MW	AM010	100	-	100	**33**	-	100	100	**17**	H	H
	MW	AM014	**83**	-	**92**	**83**	-	100	**92**	**92**	M	H
	MW	AM032	**83**	-	100	100	-	100	100	100	H	H
	MW	AM055	**75**	-	100	**92**	-	100	100	100	H	H
	MW	AM085	**75**	-	**75**	**75**	-	**83**	**75**	**75**	L	L
	MW	AM094	**58**	-	-	**92**	**92**	-	**83**	100	L	M
	MW	AM119	**75**	-	-	**83**	-	-	**83**	**92**	L	L
	MW	AM120	**0**	-	-	**0**	-	-	**42**	**42**	L	L
	MW	AM121	**92**	-	-	**83**	**83**	-	**92**	**83**	M	L
	MW	AM122	**92**	-	-	**92**	-	-	**92**	**92**	M	M
	MW	AM124	100	-	-	**83**	-	-	100	**92**	H	L
	MW	AM127	**8**	-	-	**17**	**67**	-	100	**92**	L	L
	MW	AM129	**83**	-	-	**92**	**92**	-	**92**	**92**	L	M
	MW	AM131	**83**	-	-	**83**	**92**	-	**92**	**92**	L	M
	MW	AM148	**25**	-	-	**58**	**58**	-	**58**	**67**	L	L
	MW	AM150	**0**	-	-	**0**	**0**	-	**0**	**0**	L	L
	MW	AM151	-	-	-	**75**	-	**83**	**50**	**58**	L	L
	MW	AM161	-	-	-	**83**	-	100	100	**83**	H	H
	MW	AM162	-	-	-	**92**	-	**92**	**83**	**83**	M	M
	MW	AM166	-	-	-	**92**	-	**92**	**92**	**92**	H	M
	MW	AM177	-	-	-	**92**	-	100	**92**	**92**	H	H
	MW	WPBR01	**58**	-	-	**83**	**83**	-	**92**	**92**	L	L
	MW	WPBR02	**83**	-	-	**83**	**83**	-	100	**83**	L	L
	MW	WPBR04	**58**	-	-	**73**	**73**	-	**17**	**36**	L	L
	MW	WPCC01	**83**	-	-	**91**	**91**	-	100	100	L	M
	MW	WPTC02	**50**	-	-	**42**	-	-	**83**	**83**	L	L
229	E	2904	**75**	-	100	**92**	-	100	100	100	H	H
	E	2916	**83**	-	**92**	**92**	-	**92**	100	100	M	M
	E	4940	**83**	-	100	100	-	100	100	100	H	H
	E	4991	**91**	-	100	100	-	100	**91**	100	H	H
	E	4992	*	-	*	*	-	*	*	*	*	*
	MW	LY06	**92**	-	100	**83**	-	**92**	100	**92**	H	M
	MW	LY07	**92**	-	100	**92**	-	**92**	**92**	**92**	H	M
	MW	LY08	**91**	-	100	**91**	-	100	**64**	**9**	H	H
	MW	UY01	**83**	-	100	**83**	-	100	100	100	H	H
	MW	UY04	**83**	-	100	**92**	-	**92**	100	**92**	H	M
	MW	UY09	**50**	-	100	**83**	-	100	100	100	H	H

Basin	Program	SINO	SEPP						ANZECC		Rating	
			$Turb_{50}$	$Turb_{75}$	$Turb_{90}$	SS_{50}	SS_{75}	SS_{90}	$Turb_{80}$	SS_{80}	Turb	SS
	MW	UY11	**75**	-	100	**92**	-	100	100	100	H	H
	MW	UY12	**75**	-	100	**83**	-	100	100	100	H	H
	MW	UY35	**75**	-	100	**83**	-	100	100	100	H	H
	MW	UY38	100	-	100	100	-	100	100	100	H	H
	MW	MD05	**67**	-	**92**	**75**	-	**92**	**92**	**92**	M	M
	MW	MY02	100	-	100	**83**	-	100	100	100	H	H
	MW	MY05	**83**	-	100	**83**	-	100	**83**	**92**	H	H
	MW	MY07	**83**	-	100	**92**	-	100	**92**	100	H	H
	MW	MY10	**75**	-	100	**92**	-	100	**83**	100	H	H
	MW	MY12	**83**	-	**92**	**83**	-	92	**92**	**92**	M	M
	MW	MY15	**83**	-	**92**	**92**	-	100	**83**	**92**	M	H
	MW	MY18	**83**	-	100	**83**	-	100	100	100	H	H
	MW	MY19	**92**	-	100	100	-	100	100	100	H	H
	MW	MY21	**83**	-	**92**	**92**	-	100	**92**	100	M	H
	MW	MY25	**83**	-	100	**92**	-	100	100	100	H	H
	MW	MY26	100	-	100	**75**	-	**92**	100	**75**	H	M
	MW	MY27	**91**	-	100	100	-	100	**91**	100	H	H
	MW	MY28	**67**	-	**83**	**83**	-	100	**83**	100	L	H
	MW	MY29	**80**	-	**80**	100	-	100	**80**	100	L	H
	MW	MY30	**83**	-	100	**83**	-	100	**92**	100	H	H
	MW	MY31	**75**	-	**92**	**92**	-	100	100	100	M	H
	MW	MY32	**57**	-	**71**	100	-	100	**86**	100	L	H
230	E	3030	-	-	-	**92**	-	100	100	100	H	H
	E	6070	-	-	-	100	-	100	100	100	H	H
	V	230202	-	-	-	100	-	100	100	100	H	H
	V	230205	-	-	-	100	-	100	100	100	H	H
	V	230209	-	-	-	**92**	-	**92**	100	**92**	H	M
	V	230232	-	-	-	100	-	100	100	100	H	H
	MW	MA1081	-	-	-	**67**	-	**92**	**83**	**83**	M	M
	MW	ST01	-	-	-	**92**	-	100	100	100	H	H
231	E	3120	-	-	-	-	-	-	*	*	*	*
	E	3133	-	-	-	-	-	-	*	*	*	*
	E	3135	-	-	-	-	-	--	*	*	*	*
	E	5502	-	-	-	**17**	-	100	**83**	**75**	M	H
	E	5509	-	-	-	**92**	-	100	100	100	H	H
	V	231204	-	-	-	-	-	-	100	100	H	H
	V	231213	-	-	-	-	-	-	100	100	H	H
	V	231231	-	-	-	-	-	-	100	100	H	H
	V	231234	-	-	-	-	-	-	*	*		
	MW	SK5828	-	-	-	100	-	100	100	100	H	H
232	V	232200	-	-	-	-	-	-	100	100	H	H

(a) = pH outside objective range above maximum limit
(b) = pH outside objective range below minimum limit
* = Insufficient data (<10 samples)
- = No guideline
E = EPA FSN
V = VWQMN
MW = Melbourne Water
Parameters marked 80, 50 or 90 require 80%, 50% or 90% of samples to comply with the guideline.

Table 35. Percent attainment of SEPP and ANZECC objectives for nutrients at stations within the Port Phillip CaLP region during 2002.

Basin	Program	SINO	SEPP		ANZECC						Rating					
			TN	TP	TN_{80}	NO_{x80}	NH_{480}	TP_{80}	FRP_{80}	$Chl\text{-}a_{80}$	TN	NO_x	NH_4	TP	FRP	Chl-a
	Rivers															
227	V	227231	**0**	**0**	**0**	**33**	*	**0**	**25**	*	L	L	*	L	L	*
228	E	5254	-	-	**15**	**0**	*	**0**	**0**	*	L	L	*	L	L	*
	E	5635	-	-	**0**	**0**	*	**0**	**46**	*	L	L	*	L	L	*
	E	5652	-	-	**0**	**0**	*	**0**	**58**	*	L	L	*	L	L	*
	E	5654	-	-	**8**	**0**	*	**0**	**54**	*	L	L	*	L	L	*
	E	5681	-	-	**8**	**0**	*	**0**	**15**	*	L	L	*	L	L	*
	MW	AM007	-	-	**0**	**33**	**33**	**0**	**17**	-	L	L	L	L	L	-
	MW	AM010	-	-	**0**	**56**	**8**	**0**	**0**	-	L	L	L	L	L	-
	MW	AM014	-	-	**11**	**8**	**50**	**8**	**42**	-	L	L	L	L	L	-
	MW	AM032	-	-	**0**	**0**	**50**	**50**	**92**	-	L	L	L	L	H	-
	MW	AM055	-	-	**0**	**0**	**33**	**0**	**67**	-	L	L	L	L	L	-
	MW	AM085	-	-	**0**	**0**	**25**	**8**	100	-	L	L	L	L	H	-
	MW	AM094	**22**	**33**	**0**	**17**	**50**	**33**	**83**	-	L	L	L	L	M	-
	MW	AM119	**44**	**67**	**33**	**25**	**75**	**67**	**92**	-	L	L	L	L	H	-
	MW	AM120	**0**	**0**	**0**	**17**	**17**	**0**	**8**	-	L	L	L	L	L	-
	MW	AM121	**33**	**75**	**0**	**25**	**42**	**42**	**75**	-	L	L	L	L	L	-
	MW	AM122	**33**	**83**	**0**	**0**	**42**	**75**	100	-	L	L	L	L	H	-
	MW	AM124	**0**	**25**	**0**	**0**	**0**	**8**	**8**	-	L	L	L	L	L	-
	MW	AM127	**11**	**8**	**11**	**0**	**8**	**8**	**17**	-	L	L	L	L	L	-
	MW	AM129	**33**	**92**	**22**	**0**	**67**	**92**	100	-	L	L	L	M	H	-
	MW	AM131	**56**	**83**	**33**	**0**	**33**	**83**	**92**	-	L	L	L	L	H	-
	MW	AM148	**0**	**0**	**0**	**0**	**42**	**0**	**42**	-	L	L	L	L	L	-
	MW	AM150	**0**	**0**	**0**	**0**	**0**	**0**	**40**	-	L	L	L	L	L	-
	MW	AM151	-	-	**0**	**8**	**25**	**0**	**50**	-	L	L	L	L	L	-
	MW	AM161	-	-	**0**	**8**	**0**	**17**	**0**	-	L	L	L	L	L	-
	MW	AM162	-	-	**0**	**25**	**50**	**83**	**58**	-	L	L	L	M	L	-
	MW	AM166	-	-	**0**	**0**	**67**	**0**	**17**	-	L	L	L	L	L	-
	MW	AM177	-	-	**0**	**17**	**33**	**25**	**42**	-	L	L	L	L	L	-
	MW	WPBR01	**0**	**92**	**0**	**0**	**58**	**92**	100	-	L	L	L	M	H	-
	MW	WPBR02	**44**	**92**	**22**	**0**	**67**	**92**	100	-	L	L	L	M	H	-
	MW	WPBR04	**33**	**75**	**0**	**0**	**33**	**33**	**50**	-	L	L	L	L	L	-
	MW	WPCC01	**67**	**92**	**56**	**0**	**67**	**92**	100	-	L	L	L	M	H	-
	MW	WPTC02	**0**	**42**	**0**	**25**	**67**	**42**	100	-	L	L	L	L	H	-
229	E	2904	**17**	**92**	**0**	**0**	*	**92**	100	*	L	L	-	M	H	*
	E	2916	**42**	**83**	**17**	**0**	*	**83**	100	*	L	L	-	L	H	*
	E	4940	**33**	**58**	**0**	**0**	*	**0**	**67**	*	L	L	-	L	L	*
	E	4991	**27**	**91**	**0**	**0**	*	**55**	**82**	*	L	L	-	M	M	*
	E	4992	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	MW	LY06	**33**	**25**	**0**	**0**	**8**	**0**	**0**	-	L	L	L	L	L	-
	MW	LY07	**0**	**50**	**0**	**0**	**0**	**0**	**8**	-	L	L	L	L	L	-
	MW	LY08	**25**	**18**	**0**	**52**	**0**	**0**	**0**	-	L	L	L	L	L	-
	MW	UY01	**44**	**75**	**11**	**0**	**50**	**75**	100	-	L	L	L	L	H	-
	MW	UY04	**11**	**83**	**11**	**0**	**50**	**83**	100	-	L	L	L	L	H	-
	MW	UY09	**0**	**92**	**0**	**0**	**50**	**92**	100	-	L	L	L	M	H	-

			SEPP		ANZECC						Rating					
Basin	Program	SINO	TN	TP	TN_{80}	NO_{x80}	NH_{480}	TP_{80}	FRP_{80}	Chl-a_{80}	TN	NO_x	NH_4	TP	FRP	Chl-a
	MW	UY11	**0**	**92**	**0**	**0**	**75**	**92**	100	-	L	L	L	M	H	-
	MW	UY12	**0**	100	**0**	**0**	**50**	100	100	-	L	L	L	H	H	-
	MW	UY35	**22**	100	**0**	**0**	**92**	100	100	-	L	L	H	H	H	-
	MW	UY38	**78**	100	**44**	**8**	100	100	100	-	L	L	H	H	H	-
	MW	MD05	**0**	**42**	**0**	**0**	**8**	**0**	**33**	-	L	L	L	L	L	-
	MW	MY02	**11**	**50**	**0**	**0**	**50**	**8**	**17**	-	L	L	L	L	L	-
	MW	MY05	**22**	**58**	**0**	**0**	**8**	**0**	**8**	-	L	L	L	L	L	-
	MW	MY07	**56**	**75**	**0**	**17**	**25**	**8**	**83**	-	L	L	L	L	M	-
	MW	MY10	**33**	**67**	**0**	**8**	**8**	**0**	**83**	-	L	L	L	L	M	-
	MW	MY12	**0**	**0**	**0**	**0**	**0**	**0**	**0**	-	L	L	L	L	L	-
	MW	MY15	**11**	**0**	**0**	**8**	**25**	**0**	**8**	-	L	L	L	L	L	-
	MW	MY18	**0**	**0**	**0**	**0**	**17**	**0**	**0**	-	L	L	L	L	L	-
	MW	MY19	**33**	**83**	**0**	**0**	**50**	**50**	**75**	-	L	L	L	L	L	-
	MW	MY21	**67**	**92**	**67**	**42**	**75**	**92**	100	-	L	L	L	M	H	-
	MW	MY25	**0**	**0**	**0**	**0**	**25**	**0**	**0**	-	L	L	L	L	L	-
	MW	MY26	**44**	**58**	**0**	**25**	**17**	**0**	**50**	-	L	L	L	L	L	-
	MW	MY27	**11**	**83**	**0**	**42**	**42**	**8**	100	-	L	L	L	L	H	-
	MW	MY28	**50**	**67**	**50**	**67**	**67**	**67**	100	-	L	L	L	L	H	-
	MW	MY29	**0**	**40**	**0**	**60**	**40**	**40**	100	-	L	L	L	L	H	-
	MW	MY30	**0**	**0**	**0**	**0**	**17**	**0**	**0**	-	L	L	L	L	L	-
	MW	MY31	**22**	**75**	**22**	**8**	**83**	**75**	100	-	L	L	M	L	H	-
	MW	MY32	**20**	**71**	**20**	**14**	**86**	**71**	100	-	L	L	H	L	H	-
230	E	3030	-	-	**0**	**42**	*	**50**	100	*	L	L	*	L	H	*
	E	6070	-	-	**0**	**42**	*	**67**	100	*	L	L	*	L	H	*
	V	230202	-	-	**0**	**17**	*	**0**	100	*	L	L	*	L	H	*
	V	230205	-	-	**0**	**83**	*	**92**	100	*	L	M	*	H	H	*
	V	230209	-	-	**67**	**42**	*	**58**	100	*	L	L	*	L	H	*
	V	230232	-	-	**0**	**67**	*	**42**	100	*	L	L	*	L	H	*
	MW	MA1081	-	-	**0**	**0**	**75**	**17**	**50**	-	L	L	L	L	L	-
	MW	ST01	-	-	**0**	**0**	**8**	**0**	**0**	-	L	L	L	L	L	-
231	E	3120	-	-	*	*	*	*	*	*	*	*	*	*	*	*
	E	3133	-	-	*	*	*	*	*	*	*	*	*	*	*	*
	E	3135	-	-	*	*	*	*	*	*	*	*	*	*	*	*
	E	5502	-	-	**0**	**17**	*	**0**	**17**	*	L	L	*	L	L	*
	E	5509	-	-	**0**	**42**	*	**75**	**92**	*	L	L	*	M	H	*
	V	231204	-	-	**73**	**83**	*	**92**	100	*	L	M	*	H	H	*
	V	231213	-	-	**33**	**8**	*	**75**	100	*	L	L	*	M	H	*
	V	231231	-	-	**25**	**42**	*	**50**	100	*	L	L	*	L	H	*
	V	231234	-	-	*	*	*	*	*	*	*	*	*	*	*	*
	MW	SK5828	-	-	**0**	**75**	**25**	**0**	**0**	-	L	L	L	L	L	-
232	V	232200			*	100	*	100	100	*	*	H	*	H	H	*

(a) = pH outside objective range above maximum limit
(b) = pH outside objective range below minimum limit
* = Insufficient data (<10 samples)
\- = No guideline
E = EPA FSN
V = VWQMN
MW = Melbourne Water
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 36. Percent attainment of SEPP and ANZECC objectives for metals at stations within the Port Phillip CaLP region during 2002.

Basin	Program	SINO	SEPP							ANZECC						
			As	Cd	Cr	Cu	Ni	Pb	Zn	As_{80}	Cd_{80}	Cr_{80}	Cu_{80}	Ni_{80}	Pb_{80}	Zn_{80}
	Rivers															
227	V	227231	*	*	-	*	*	*	*	*	*	-	*	*	*	*
228	E	5254	100	100	100	77	100	100	**31**	100	100	-	**0**	**92**	**15**	**0**
	E	5635	100	100	100	100	100	100	**62**	100	100	-	**0**	100	**54**	**0**
	E	5652	100	100	100	100	100	100	100	100	100	-	**0**	100	**17**	**0**
	E	5654	100	100	100	100	100	100	100	100	100	-	**0**	100	**15**	**0**
	E	5681	100	100	100	100	100	100	**92**	100	100	-	**0**	**92**	**8**	**0**
	MW	AM007	100	100	100	100	100	100	100	100	100	-	**0**	100	**67**	**0**
	MW	AM010	**83**	100	100	**33**	**92**	100	**33**	100	100	100	**0**	**17**	**50**	**0**
	MW	AM014	100	**92**	**92**	**92**	100	100	**83**	**92**	**92**	-	**0**	**92**	**58**	**0**
	MW	AM032	100	100	100	100	100	100	100	100	100	-	**8**	100	100	**17**
	MW	AM055	100	100	100	100	100	100	100	100	100	-	**0**	100	**83**	**0**
	MW	AM085	100	100	**92**	100	100	100	100	100	100	-	**0**	100	**83**	**67**
	MW	AM094	100	100	100	**50**	100	100	**83**	100	100	-	**0**	100	**92**	**17**
	MW	AM119	100	100	100	**67**	100	100	100	100	100	-	**0**	100	**83**	**75**
	MW	AM120	100	100	100	**8**	100	100	**75**	100	100	-	**0**	100	**42**	**8**
	MW	AM121	100	100	100	**25**	100	100	**92**	100	**92**	-	**0**	**83**	**67**	**8**
	MW	AM122	100	100	100	**25**	100	100	**50**	100	100	-	**0**	**92**	**50**	**0**
	MW	AM124	100	**92**	**92**	**0**	100	**92**	**42**	**92**	**92**	-	**0**	**42**	**42**	**0**
	MW	AM127	100	100	100	**58**	100	100	100	100	100	-	**0**	100	**92**	**67**
	MW	AM129	100	100	100	**50**	100	100	100	100	100	-	**0**	100	**83**	**75**
	MW	AM131	100	100	100	**83**	100	100	100	100	100	-	**8**	100	**83**	**83**
	MW	AM148	100	100	100	**75**	100	100	100	100	100	-	**0**	100	**75**	**58**
	MW	AM150	100	100	100	**50**	100	100	100	100	100	100	**0**	**70**	**70**	100
	MW	AM151	**92**	100	**92**	**17**	100	100	**33**	100	100	100	**0**	**92**	**75**	**17**
	MW	AM161	**92**	100	100	**83**	100	100	**58**	100	100	100	**0**	**58**	100	**50**
	MW	AM162	100	100	**92**	**75**	100	100	100	100	100	100	**8**	**83**	**92**	100
	MW	AM166	100	100	**92**	**0**	100	**92**	**0**	100	100	-	**0**	**92**	**42**	**0**
	MW	AM177	100	100	100	**83**	100	100	**92**	100	100	100	**0**	100	**92**	**83**
	MW	WPBR01	100	100	100	**75**	100	100	100	100	100	-	**8**	100	**83**	**75**
	MW	WPBR02	100	100	100	**83**	100	100	100	100	100	-	**0**	100	**83**	100
	MW	WPBR04	100	100	100	**58**	100	100	100	100	100	100	**8**	100	**83**	100
	MW	WPCC01	100	100	100	**58**	100	100	100	100	100	-	**0**	100	100	**75**
	MW	WPTC02	100	100	100	**42**	100	100	100	100	100	-	**0**	100	**83**	**67**
229	E	2904	100	100	100	**75**	100	100	100	100	100	-	**0**	100	100	**92**
	E	2916	100	100	100	**83**	100	100	100	100	100	-	**0**	100	**92**	**83**
	E	4940	100	100	100	**33**	100	**75**	**92**	100	100	-	**0**	100	**25**	**0**
	E	4991	100	100	100	**73**	100	100	100	100	100	-	**0**	100	**91**	**73**
	E	4992	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	MW	LY06	100	100	100	**25**	100	**83**	**42**	100	**92**	-	**0**	100	**50**	**0**
	MW	LY07	100	100	**92**	**8**	100	**50**	**42**	100	**92**	-	**0**	100	**17**	**0**
	MW	LY08	100	100	100	**9**	100	**64**	**82**	100	100	100	**0**	**45**	**45**	**9**
	MW	UY01	100	100	100	**92**	100	100	100	100	100	-	**0**	100	100	**42**
	MW	UY04	100	100	100	**75**	100	100	100	100	100	-	**0**	100	100	**92**
	MW	UY09	100	100	100	**75**	100	100	100	100	100	-	**0**	100	100	100

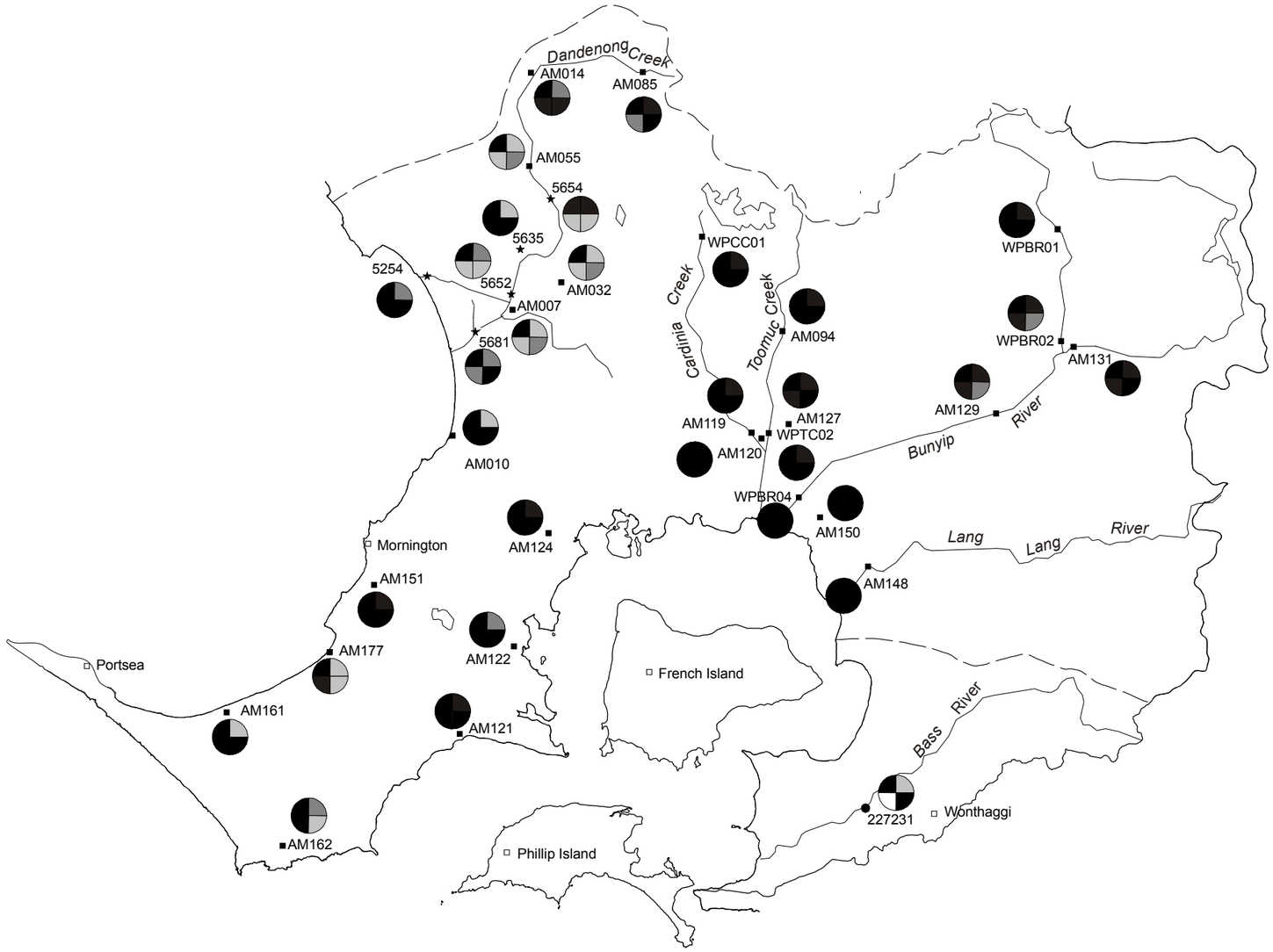
Basin	Program	SINO	SEPP							ANZECC						
			As	Cd	Cr	Cu	Ni	Pb	Zn	As_{80}	Cd_{80}	Cr_{80}	Cu_{80}	Ni_{80}	Pb_{80}	Zn_{80}
	MW	UY11	100	100	100	92	100	100	100	100	100	-	**0**	100	100	100
	MW	UY12	100	100	100	100	100	100	100	100	100	-	**0**	100	100	100
	MW	UY35	100	100	100	100	100	100	100	100	100	-	**0**	100	100	100
	MW	UY38	100	100	100	**67**	100	100	100	100	100	-	**0**	100	100	100
	MW	MD05	100	100	**92**	**0**	100	**67**	**17**	100	**92**	-	**0**	**67**	**25**	**0**
	MW	MY02	100	100	100	**0**	100	**75**	**17**	100	100	-	**0**	**42**	**50**	**0**
	MW	MY05	100	100	100	**0**	100	**58**	**33**	100	100	-	**0**	100	**42**	**0**
	MW	MY07	100	100	100	**50**	100	**67**	**92**	100	**92**	-	**0**	100	**17**	**0**
	MW	MY10	100	100	100	**17**	100	**58**	**92**	100	100	-	**0**	100	**33**	**0**
	MW	MY12	100	100	**92**	**0**	100	**67**	**83**	100	100	-	**0**	100	**33**	**0**
	MW	MY15	100	100	100	**8**	100	**75**	**83**	100	100	-	**0**	100	**50**	**0**
	MW	MY18	100	100	100	**8**	100	100	**83**	100	100	-	**0**	100	100	**0**
	MW	MY19	100	100	100	**58**	100	100	100	100	100	-	**0**	100	**92**	**42**
	MW	MY21	100	100	100	**50**	100	**92**	100	100	100	-	**0**	100	**67**	**75**
	MW	MY25	100	100	100	**0**	100	**67**	**50**	100	100	-	**0**	100	**33**	**0**
	MW	MY26	100	100	100	**75**	100	100	100	100	100	-	**0**	100	**75**	**83**
	MW	MY27	100	100	100	58	100	**92**	100	100	100	-	**0**	100	**58**	**75**
	MW	MY28	100	100	**83**	**50**	100	**83**	100	100	100	-	**17**	**83**	**67**	**50**
	MW	MY29	100	100	**80**	**80**	100	100	100	100	100	-	**0**	100	**40**	**60**
	MW	MY30	100	100	100	**25**	100	100	100	100	100	-	**0**	100	**92**	**42**
	MW	MY31	100	100	100	**67**	100	100	100	100	100	-	**0**	100	100	**83**
	MW	MY32	100	100	**86**	**71**	100	100	100	100	100	-	**0**	100	100	**57**
230	E	3030	100	100	100	100	100	100	100	100	100	-	**0**	100	**92**	**50**
	E	6070	100	100	100	100	100	100	100	100	100	-	**0**	100	100	**67**
	V	230202	*	*	*	*	*	*	*	*	*	_	*	*	*	*
	V	230205	*	*	*	*	*	*	*	*	*	_	*	*	*	*
	V	230209	*	*	*	*	*	*	*	*	*	_	*	*	*	*
	V	230232	*	*	*	*	*	*	*	*	*	_	*	*	*	*
	MW	MA1081	100	100	**67**	**8**	**92**	**83**	**0**	100	100	-	**0**	**75**	**25**	**0**
	MW	ST01	**67**	100	100	**17**	100	100	**0**	100	100	-	**0**	100	**8**	**0**
231	E	3120	*	*	*	*	*	*	*	*	*	_	*	*	*	*
	E	3133	*	*	*	*	*	*	*	*	*	_	*	*	*	*
	E	3135	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	E	5502	100	100	100	**67**	**92**	100	100	100	100	-	**0**	**67**	**8**	**0**
	E	5509	100	**92**	100	**83**	100	100	100	100	**92**	-	**0**	100	**67**	**8**
	V	231204	100	100	100	100	100	100	100	100	100	-	**8**	100	100	**83**
	V	231213	*	*	*	*	*	*	*	*	*	_	*	*	*	*
	MW	SK5828	100	100	100	**67**	100	100	**58**	100	100	-	**0**	100	**58**	**17**
	V	231231	*	*	*	*	*	*	*	*	*	_	*	*	*	*
	V	231234	*	*	*	*	*	*	*	*	*	_	*	*	*	*
232	V	232200	*	*	*	*	*	*	*	*	*	_	*	*	*	*

Basin	Program	SINO	Rating						
			As	Cd	Cr	Cu	Ni	Pb	Zn
228	E	5254	H	H	H	L	H	H	L
	E	5635	H	H	H	H	H	H	L
	E	5652	H	H	H	H	H	H	H
	E	5654	H	H	H	H	H	H	H
	E	5681	H	H	H	H	H	H	M
	MW	AM007	H	H	H	H	H	H	H
	MW	AM010	L	H	H	L	M	H	L
	MW	AM014	H	M	M	M	H	H	L
	MW	AM032	H	H	H	H	H	H	H
	MW	AM055	H	H	H	H	H	H	H
	MW	AM085	H	H	M	H	H	H	H
	MW	AM094	H	H	H	L	H	H	L
	MW	AM119	H	H	H	L	H	H	H
	MW	AM120	H	H	H	L	H	H	L
	MW	AM121	H	H	H	L	H	H	M
	MW	AM122	H	H	H	L	H	H	L
	MW	AM124	H	M	M	L	H	M	L
	MW	AM127	H	H	H	L	H	H	H
	MW	AM129	H	H	H	L	H	H	H
	MW	AM131	H	H	H	L	H	H	H
	MW	AM148	H	H	H	L	H	H	H
	MW	AM150	H	H	H	L	H	H	H
	MW	AM151	M	H	M	L	H	H	L
	MW	AM161	M	H	H	L	H	H	L
	MW	AM162	H	H	M	L	H	H	H
	MW	AM166	H	H	M	L	H	M	L
	MW	AM177	H	H	H	L	H	H	M
	MW	WPBR01	H	H	H	L	H	H	H
	MW	WPBR02	H	H	H	L	H	H	H
	MW	WPBR04	H	H	H	L	H	H	H
	MW	WPCC01	H	H	H	L	H	H	H
	MW	WPTC02	H	H	H	L	H	H	H
229	E	2904	H	H	H	L	H	H	H
	E	2916	H	H	H	L	H	H	H
	E	4940	H	H	H	L	H	L	M
	E	4991	H	H	H	L	H	H	H
	MW	LY06	H	H	H	L	H	L	L
	MW	LY07	H	H	M	L	H	L	L
	MW	LY08	H	H	H	L	H	L	L
	MW	UY01	H	H	H	M	H	H	H
	MW	UY04	H	H	H	L	H	H	H
	MW	UY09	H	H	H	L	H	H	H
	MW	UY11	H	H	H	M	H	H	H
	MW	UY12	H	H	H	H	H	H	H
	MW	UY35	H	H	H	H	H	H	H
	MW	UY38	H	H	H	L	H	H	H
	MW	MD05	H	H	M	L	H	L	L
	MW	MY02	H	H	H	L	H	L	L
	MW	MY05	H	H	H	L	H	L	L
	MW	MY07	H	H	H	L	H	L	M
	MW	MY10	H	H	H	L	H	L	M

Basin	Program	SINO	Rating						
			As	Cd	Cr	Cu	Ni	Pb	Zn
	MW	MY12	H	H	M	L	H	L	L
	MW	MY15	H	H	H	L	H	L	L
	MW	MY18	H	H	H	L	H	H	L
	MW	MY19	H	H	H	L	H	H	H
	MW	MY21	H	H	H	L	H	M	H
	MW	MY25	H	H	H	L	H	L	L
	MW	MY26	H	H	H	L	H	H	H
	MW	MY27	H	H	H	L	H	M	H
	MW	MY28	H	H	L	L	H	L	H
	MW	MY29	H	H	L	L	H	H	H
	MW	MY30	H	H	H	L	H	H	H
	MW	MY31	H	H	H	L	H	H	H
	MW	MY32	H	H	L	L	H	H	H
230	E	3030	H	H	H	H	H	H	H
	E	6070	H	H	H	H	H	H	H
	MW	MA1081	H	H	L	L	M	L	L
	MW	ST01	L	H	H	L	H	H	L
231	E	3120	*	*	*	*	*	*	*
	E	3133	*	*	*	*	*	*	*
	E	3135	*	*	*	*	*	*	*
	E	5502	H	H	H	L	M	H	H
	E	5509	H	M	H	L	H	H	H
	V	231204	H	H	H	H	H	H	H
	MW	SK5828	H	H	H	L	H	H	L

(a) = pH outside objective range above maximum limit
(b) = pH outside objective range below minimum limit
* = Insufficient data (<10 samples)
- = No guideline
E = EPA FSN
V = VWQMN
MW = Melbourne Water (attainment and rating figures were supplied by Melbourne Water)
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Figure 29. Port Phillip CaLP region Basins 29, 30 and 31. Attainment with water quality objectives and guideline



PORT PHILLIP CaLP REGION
Bunyip River Basin (Basin 28)

Attainment with water quality objectives and guidelines.

Produced for DSE by
WATER ECOscience Pty Ltd

N

Catchment Management Authority (C.M.A.)

Drainage Basin Boundary

Nutrients
Suspended solids/ turbidity
Metals
Physical Parameters

Attainment

- *Low*
- *Moderate*
- *High*
- *No guideline and/or no data*

Monitoring Program

- *VWQMN*
- *EPA*
- *Melbourne Water*

Figure 30. Port Phillip CaLP region Basins 28. Attainment with water quality objectives and guidelines

Station Specific Water Quality: Toolern Creek at Melton South

In this report, Toolern Creek at Melton South (Station 231231) was identified as having low attainment for dissolved oxygen, electrical conductivity, total nitrogen, oxidised nitrogen and total phosphorus. The station had high attainment of the water quality objectives for pH, turbidity, suspended solids and filterable reactive phosphorus based on the 2002 data. Metals and chlorophyll-*a* were not tested for at Toolern Creek at Melton South.

Flow is generally low at this station and has not exceeded 10 ML per day since August 1996 and only on twelve occasions during the entire sampling period. The maximum peak in discharge occurred during spring 1983 when a flow rate of over 200 ML/day occurred. There is a distinct seasonal pattern to the flow regime with inflows occuring in spring of each year.

Dissolved oxygen (DO) displays a clear seasonal pattern with peaks in winter and troughs in summer. DO at this station has generally been above minimum SEPP objective levels throughout the monitoring period with troughs occasionally falling below the objective. In 2002 this occurred from January to April, hence the low attainment for DO this year.

Electrical conductivity (EC) is very variable at this site but is generally high. Levels have been well above the ANZECC maximum guideline of 2,200 μS/cm for the majority of the monitoring period. The high salinity may be a result of low flows in Toolern Creek at Melton South. There is an apparent trend of increasing EC from about 1992.

pH has been fairly stable since about 1996 with values generally in the mid to high range of the ANZECC guidelines (6.5–7.5) and well within the SEPP objective limits (6.0–9.0). However in July 2002 the pH fell to the minimum SEPP objective limit of 6.0. This occurred at the same time as a peak in discharge which suggests that acidic runoff may have been responsible for this temprorary drop in pH. Prior to 1996 pH was more variable (although still generally within both SEPP objective and ANZECC guideline limits). This is likely to be related to more variable flows during this period.

Both turbidity and suspended solids exhibit a trend of decreasing variablility in recent years. Turbidity has generally been below guideline levels at this site except for occasional peaks. Suspended solids have not exceeded the guidelines since 1996. Both parameters had 100% attainment of both the SEPP objectives and the ANZECC guidelines in 2002

Total nitrogen (TN) levels have been high throughout the monitoring period at Toolern Creek at Melton Southand and have rarely fallen below the maximum guideline limits. In 2002 total nitrogen did fall below the maximum guideline limit in September and October. Attainment of the guideline for oxidised nitrogen (NO_x) has also been low throughout the entire monitoring period with samples only occasionally falling below guideline limits.

Concentration of total phosphorus (TP) has been variable at this site but attainment has generally been low. Conversely, filterable reactive phosphorus (FRP) has generally had high attainment of the guidelines and in 2002 had 100% attainment.

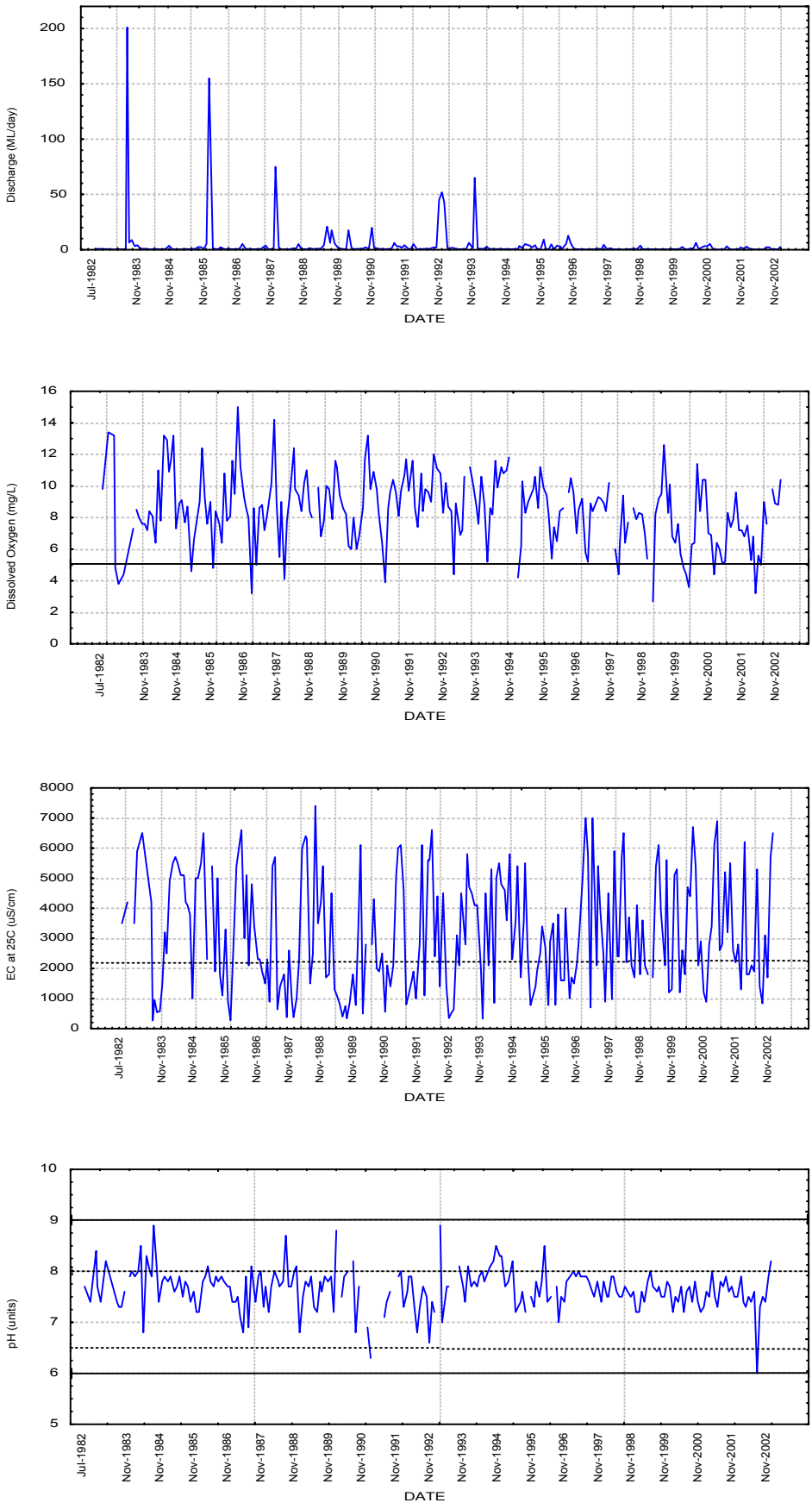


Figure 31. Variation in water quality over time in the Toolern Creek at Melton South 1995–2002

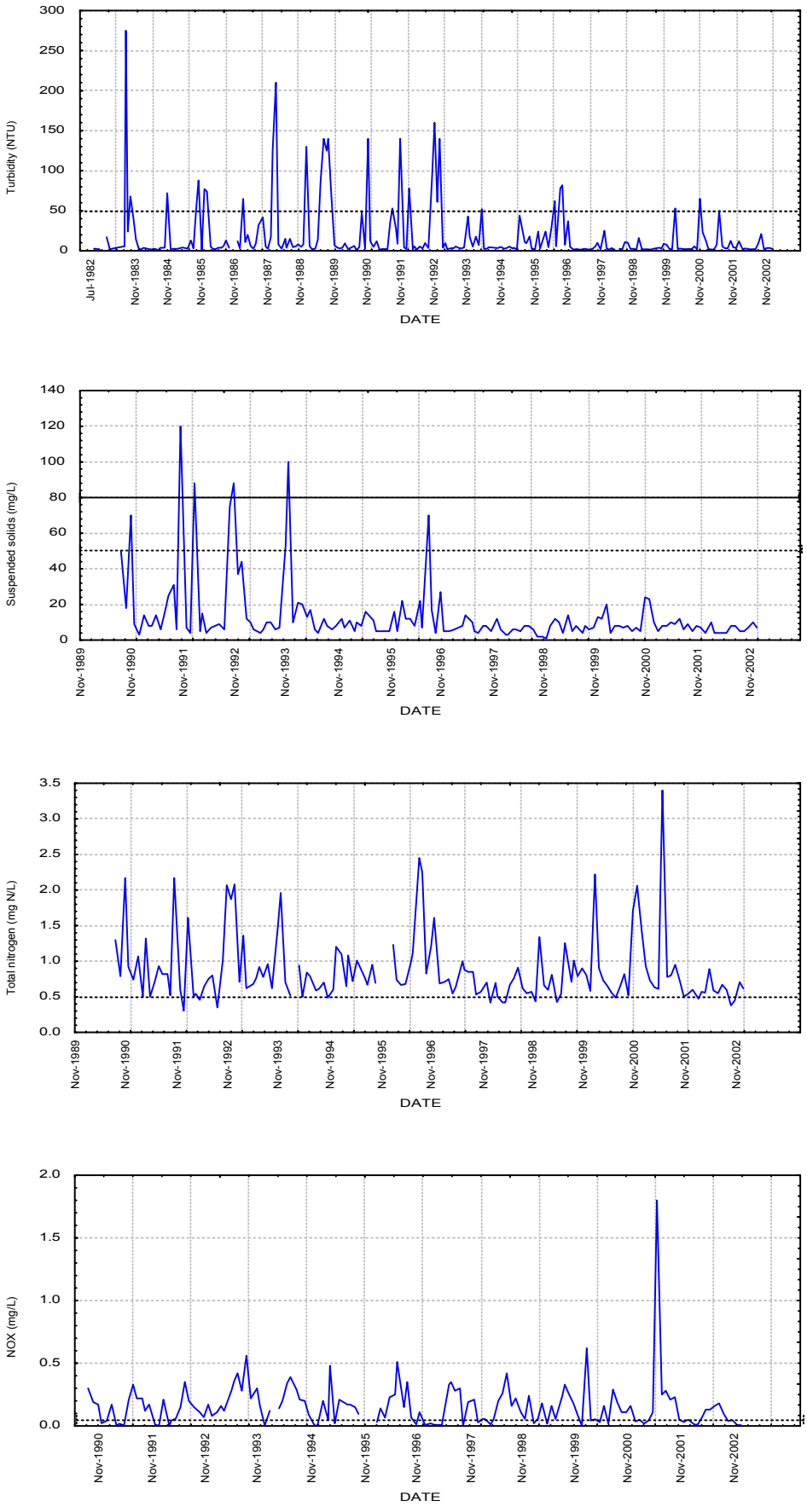


Figure 32. Variation in water quality over time in the Toolern Creek at Melton South 1995–2002

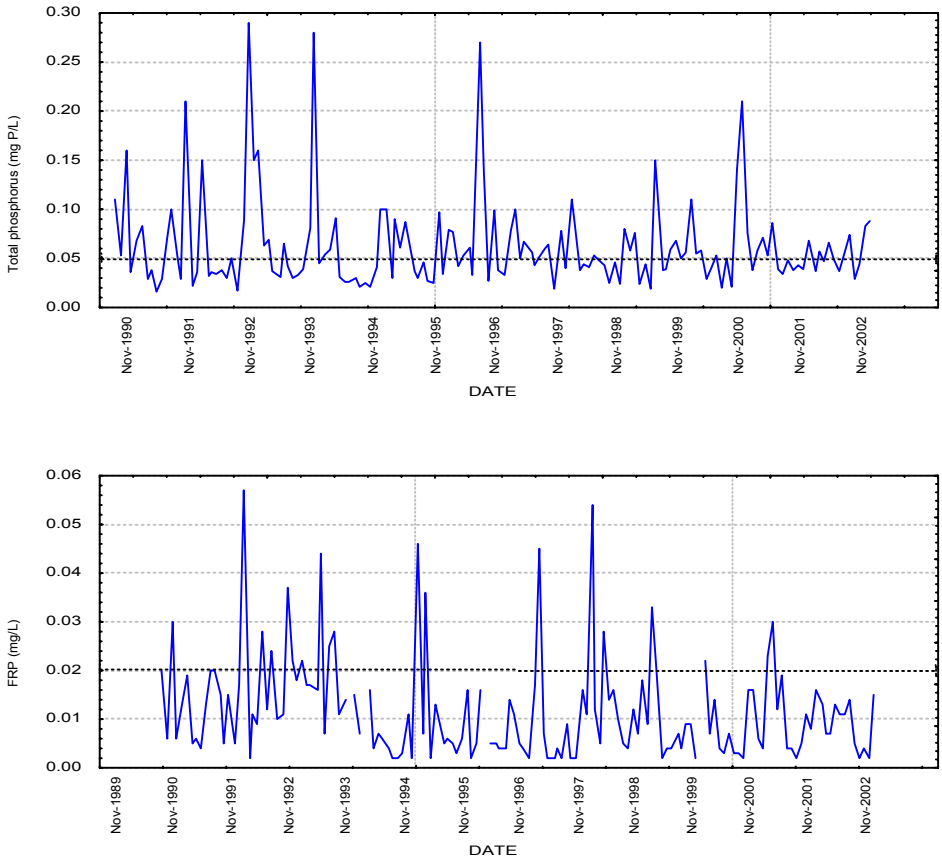


Figure 33. Variation in water quality over time in the Toolern Creek at Melton South 1995–2002

Black line indicates SEPP objective limit and dashed line indicates ANZECC guideline limit. Limits are minimum for DO, range for pH, maximum for other parameters.

It should be recognized that in many cases the dates on the x axis on the graph do not line up on all graphs. This is due to the change in time when monitoring started for some parameters.

5.2.9 West Gippsland CMA Region

Water Quality Characterisation

The West Gippsland CMA region incorporates three drainage basins: Thomson River (Basin 225 incorporating 5 stations), LaTrobe River (Basin 226 incorporating 6 stations) and South Gippsland (Basin 227 incorporating 6 stations) and will be discussed according to these basins where appropriate. Water quality was characterised for each station in the West Gippsland CMA region according to percent attainment with the relevant water quality objectives and guidelines (Tables 37-39). A summary of this data is presented on an attainment map for the region (Figure 34). Water quality characterisation was according to attainment of the SEPP objectives or, in the absence of SEPP objectives, the ANZECC guidelines as outlined in Section 2: Methods.

Water quality within the West Gippsland CMA region generally exhibited high attainment of the pH, electrical conductivity, dissolved oxygen, and turbidity objectives and guidelines. Moderate to high attainment was generally achieved throughout the West Gippsland CMA for suspended solids. Water quality with respect to nutrients was generally low for Oxidised Nitrogen (NO_x), low to moderate for Total Phosphorus and varied from low to high for Total Nitrogen (TN) and Filterable Phosphate

SEPP attainment for dissolved oxygen (DO) was high for all water quality monitoring stations in the West Gippsland CMA, with the exception of the Thomson River at The Narrows (225210) and the Tanjil River at Tanjil Junction (226226) which both obtained moderate attainment.

There were SEPP objectives for electrical conductivity (EC) in the Thomson River and LaTrobe River Basins of the West Gippsland CMA region, however there were no SEPP objectives for sites in the South Gippsland Basin (except station 227240). All stations achieved high attainment for Electrical Conductivity against SEPP objectives and ANZECC guidelines.

The water quality for stations in the West Gippsland CMA was characterised by high attainment of the objectives for pH for all sites.

All South Gippsland Basin sites achieved high attainment of the ANZECC guidelines for Turbidity. SEPP objectives existed for Turbidity for Thomson and LaTrobe Basin sites and attainment was generally high. Sites, Tanjil River at Tanjil Junction (226226) and Merriman Creek at Prospect Rd (227240) obtained moderate attainment and Moe Drain at Trafalgar East (226402) obtained low attainment. Attainment of the SEPP objective for suspended solids (SS) varied throughout the West Gippsland CMA. The Thomson River at Whitelaws (225114), Macalister River at Glenmaggie (225204), Thomson River at the Narrows (225210) and Tarra River at Yarram (227200) exhibited moderate attainment and Moe Drain at Trafalgar East (226402) obtained low attainment for suspended solids. All other sites recorded high attainment.

There were SEPP objectives for total nitrogen (TN) in the Thomson River and La Trobe River Basins. There were no SEPP objectives for sites in the South Gippsland Basin so ANZECC guidelines applied. Water quality attainment of the SEPP total nitrogen objectives was high at all stations in the Thomson River Basin. In the Latrobe Basin site Moe Drain at Trafalgar East (226402) obtained low attainment and sites the LaTrobe River at Thoms Bridge (226005) and Morwell River at Yallourn (226408) obtained moderate attainment. All stations in the South Gippsland Basin had low attainment of the ANZECC guideline.

All sites recorded low attainment for the ANZECC oxidised nitrogen (NO_x) guidelines except the Macalister River at Licola (225209) obtained moderate attainment.

There were SEPP objectives for total phosphorus (TP) in the Thomson River and LaTrobe River Basins of the West Gippsland CMA region. There were no SEPP objectives for sites in the South Gippsland Basin so ANZECC guidelines applied. Water quality attainment of the SEPP phosphorus objectives varied from medium to high in the Thomson River Basin, with MaCalister River at Licola (225209) and Thomson River at The Narrows (225210) recording high attainment. In the Latrobe Basin, Moe Drain at Trafalgar East (226402) obtained low attainment and Morwell River at Yallourn (226408) obtained moderate attainment.

All stations in the South Gippsland Basin recorded low attainment of the ANZECC guideline for Total Phosphorus, except for Tarra River at Fischers (227225) which obtained high attainment. Attainment of the ANZECC guideline for FRP varied from low to high in all basins

No sites were sampled for chlorophyll-*a* or for metals in the West Gippsland CMA region.

The water quality data and summary statistics relating to the water quality, water quantity and river health in the West Gippsland CMA region have been made available on the Internet. See www.vicwaterdata.net for this information.

Table 37. Percent attainment of SEPP and ANZECC objectives for physical parameters at stations within the West Gippsland CMA region during 2002.

Basin	Program	SINO	SEPP					ANZECC			Rating		
			DO	DO%sat	EC	EC_{90}	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	pH
	Rivers												
225	V	225114	100	**83**	100	100	100	**67**	100	**58**	H	H	H
	V	225201	**92**	100	100	100	100	**67**	100	100	H	H	H
	V	225204	100	100	100	100	100	100	100	**92**	H	H	H
	V	225209	100	100	100	100	100	**92**	100	100	H	H	H
	V	225210	**92**	**83**	100	100	100	**75**	100	**92**	M	H	H
226	V	226005	100	100	100	100	100	100	100	100	H	H	H
	V	226222	100	100	100	100	100	**36**	100	100	H	H	H
	V	226226	**92**	**45**	100	100	100	**45**	100	100	M	H	H
	V	226228	100	100	100	100	100	**92**	100	100	H	H	H
	V	226402	100	100	100	100	100	**45**	100	100	H	H	H
	V	226408	100	100	100	100	100	100	100	100	H	H	H
227	V	227200	100	100	-	-	100	**75**	100	100	H	H	H
	V	227202	100	100	-	-	100	**55**	100	100	H	H	H
	V	227211	100	100	-	-	100	**36**	100	100	H	H	H
	V	227225	100	100	-	-	100	100	100	100	H	H	H
	V	227237	100	100	-	-	100	**36**	100	100	H	H	H
	V	227240	100	100	100	**92**	100	100	100	100	H	H	H

(a) = pH outside objective range above maximum limit
(b) = pH outside objective range below minimum limit
* = Insufficient data (<10 samples)
\- = No guideline
V = VWQMN
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 38. Percent attainment of SEPP and ANZECC objectives for suspended solids and turbidity at stations within the West Gippsland CMA region during 2002.

Basin	Program	SINO	SEPP				ANZECC		Rating	
			$Turb_{50}$	$Turb_{90}$	SS_{50}	SS_{90}	$Turb_{80}$	SS_{80}	Turb	SS
	Rivers									
225	V	225114	**92**	100	**83**	**92**	100	**92**	H	M
	V	225201	100	100	100	100	100	100	H	H
	V	225204	**8**	100	**58**	**92**	100	100	H	M
	V	225209	**92**	100	100	100	100	100	H	H
	V	225210	**92**	100	**83**	**92**	100	100	H	M
226	V	226005	**91**	100	100	100	100	100	H	H
	V	226222	**73**	100	100	100	100	100	H	H
	V	226226	**91**	**91**	*	*	100	*	M	*
	V	226228	100	100	100	100	100	100	H	H
	V	226402	**0**	**73**	**17**	**83**	100	100	L	L
	V	226408	**83**	100	100	100	100	100	H	H
227	V	227200	-	-	**83**	**92**	**92**	**92**	H	M
	V	227202	-	-	**67**	100	100	**92**	H	H
	V	227211	-	-	100	100	100	100	H	H
	V	227225	-	-	**92**	100	100	100	H	H
	V	227237	-	-	100	100	100	100	H	H
	V	227240	**83**	**92**	*	*	100	*	M	*

* = Insufficient data (<10 samples)
\- = No guideline
V = VWQMN
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 39. Percent attainment of SEPP and ANZECC objectives for nutrients at stations within the West Gippsland CMA region during 2002.

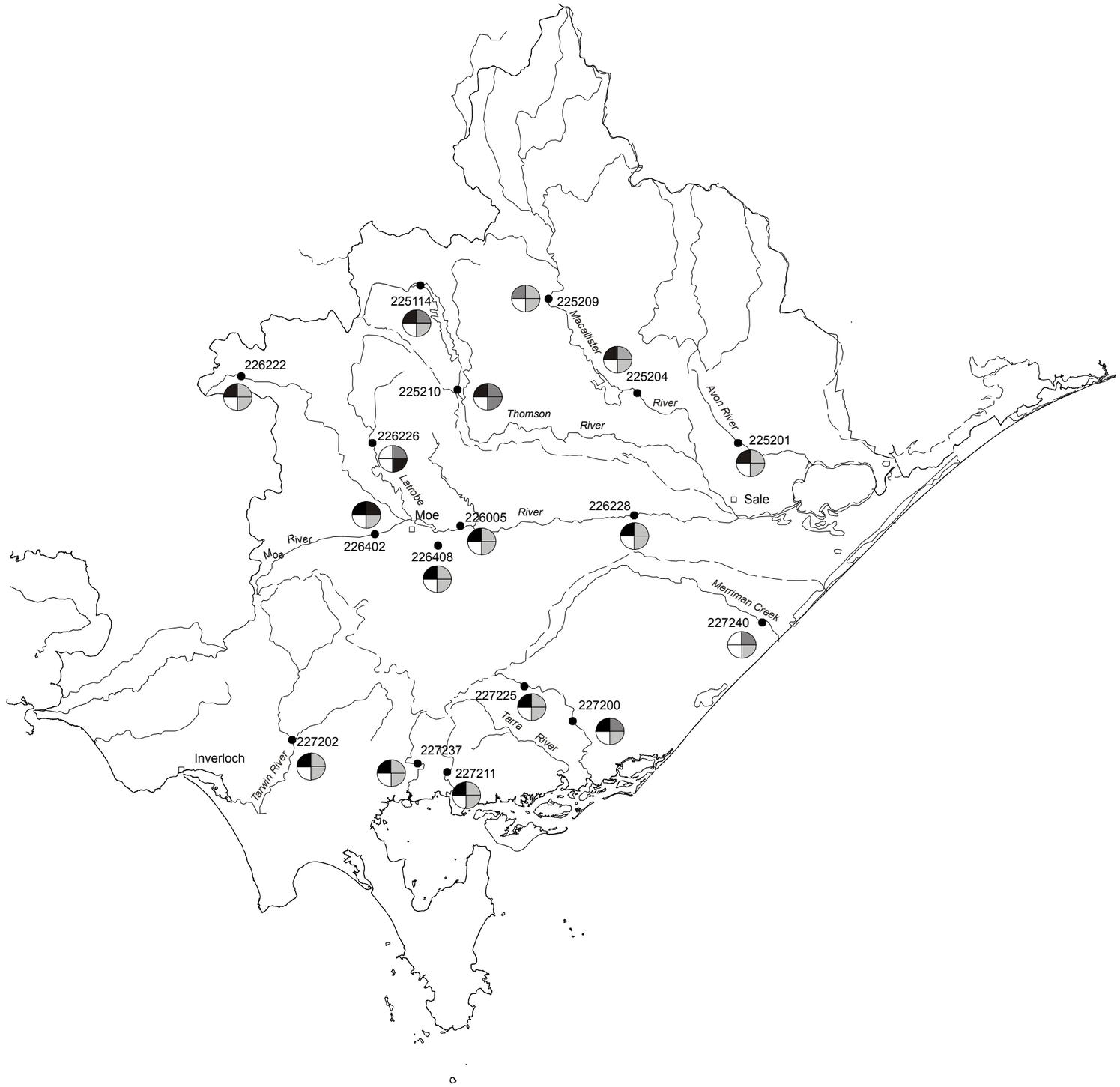
Basin	Program	SINO	SEPP				ANZECC					
			TN_{50}	TN_{90}	TP_{50}	TP_{90}	TN_{80}	NO_{x80}	$NH4_{80}$	TP_{80}	FRP_{80}	Chl-a_{80}
	Rivers											
225	V	225114	**92**	100	**50**	**92**	**67**	**0**	*	**58**	100	*
	V	225201	100	100	**42**	**92**	**92**	**33**	*	100	100	*
	V	225204	**92**	100	**42**	**92**	**92**	**67**	*	100	100	*
	V	225209	100	100	**58**	100	**83**	**75**	*	**75**	100	*
	V	225210	100	100	**67**	100	**25**	**0**	*	100	100	*
226	V	226005	**73**	**91**	**73**	100	**18**	**0**	*	**45**	100	*
	V	226222	**92**	100	**92**	100	**0**	**0**	*	**42**	**83**	*
	V	226226	*	*	*	*	*	*	*	*	*	*
	V	226228	**67**	100	**42**	100	**0**	**0**	*	**8**	100	*
	V	226402	**0**	**33**	**0**	**0**	**0**	**0**	*	**0**	**58**	*
	V	226408	**50**	**92**	**42**	**92**	**0**	**0**	*	**25**	**92**	*
227	V	227200	-	-	-	-	**33**	**17**	*	**50**	**83**	*
	V	227202	-	-	-	-	**0**	**0**	*	**0**	**0**	*
	V	227211	-	-	-	-	**0**	**0**	*	**0**	**92**	*
	V	227225	-	-	-	-	**17**	**0**	*	**92**	100	*
	V	227237	-	-	-	-	**0**	**0**	*	**25**	**75**	*
	V	227240	*	*	*	*	*	*	*	*	*	*

*

Basin	Program	SINO	Rating					
			TN	NO_x	NH4	TP	FRP	Chl-a_{80}
	Rivers							
225	V	225114	H	L	*	M	H	*
	V	225201	H	L	*	M	H	*
	V	225204	H	L	*	M	H	*
	V	225209	H	M	*	H	H	*
	V	225210	H	L	*	H	H	*
226	V	226005	M	L	*	H	H	*
	V	226222	H	L	*	H	M	*
	V	226226	*	*	*	*	*	*
	V	226228	H	L	*	H	H	*
	V	226402	L	L	*	L	L	*
	V	226408	M	L	*	M	H	*
227	V	227200	L	L	*	L	M	*
	V	227202	L	L	*	L	L	*
	V	227211	L	L	*	L	H	*
	V	227225	L	L	*	H	H	*
	V	227237	L	L	*	L	M	*
	V	227240	*	*	*	*	*	*

* = Insufficient data (<10 samples)
\- = No guideline
V = VWQMN
Parameters marked $_{80, 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

No sites were sampled for metals in the West Gippsland CMA region



WEST GIPPSLAND C.M.A. REGION

Attainment with water quality objectives and guidelines.

Produced for DNRE by WATER ECOscience

N

0 10 20 40
kilometres

Catchment Management Authority (C.M.A.) Boundary

Drainage Basin Boundary

Nutrients
Suspended solids/ turbidity
Metals
Physical parameters

Attainment

- *Low*
- *Medium*
- *High*
- *No guideline and/or no data*

Monitoring Program

- *VWQMN*
- *MSOMP*
- *MDBC*
- *EPA*

Figure 34. West Gippsland CMA region. Attainment with water quality objectives and guidelines.

Station Specific Water Quality: Thomson River at Whitelaws

Station 225114 Thomson River at Whitelaws in the Thomson River Basin was identified as having low attainment for oxidised nitrogen and moderate attainment for suspended solids and total phosphorus.

Flow rates have generally remained steady throughout the monitoring period, with the exception of a small number of peaks during winter/spring. Elevated dissolved oxygen levels appear to coincide with slightly higher flows in the Thomson River where observations have exhibited a clear seasonal pattern, with characteristic winter peaks and summer troughs.

Salinity (measured as EC) remained below the SEPP guideline value of 500 uS/cm and also the ANZECC guideline of 350 μS/cm throughout 2002 monitoring period. EC remained at around 50μS/cm for the whole year.

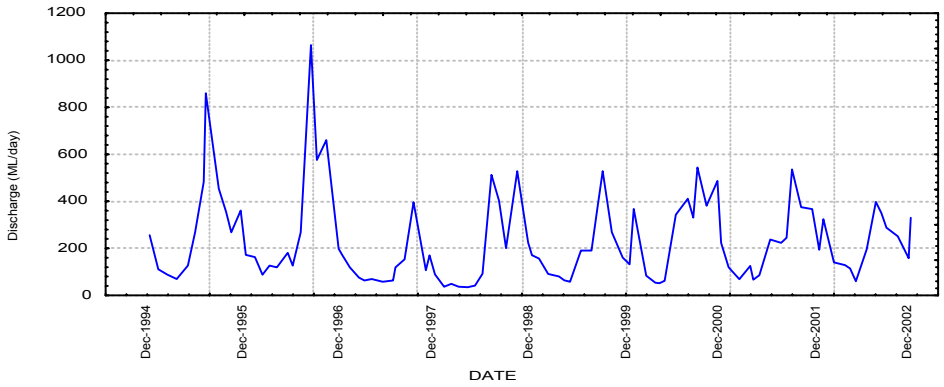
pH generally remained above the SEPP minimum value of 5.5 throughout the monitoring period. The pH has not exceeded the maximum SEPP objective of 8.0 but has shown a steady decrease during the monitoring period.

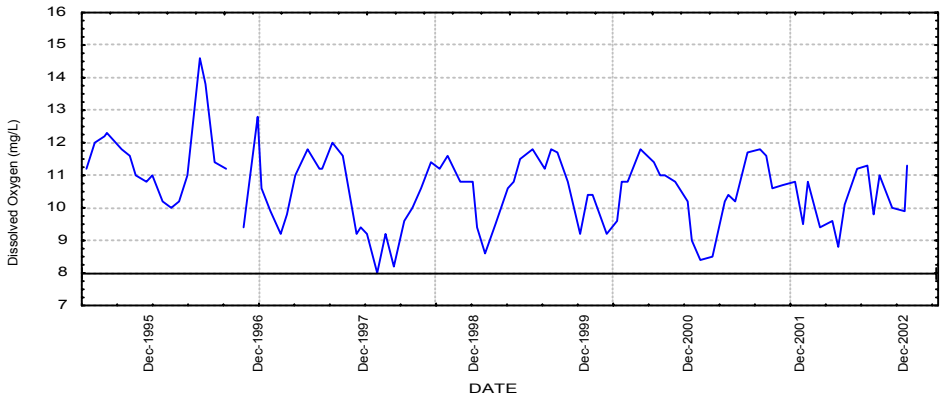
Turbidity has never breached the guideline during the entire monitoring period and has thus achieved high attainment with guidelines, with the majority of the results below 5 NTU.

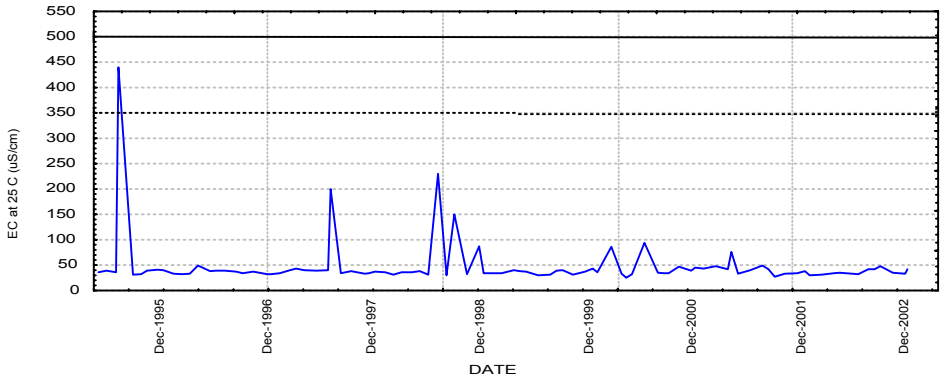
Total nitrogen obtained high attainment against the SEPP objectives with an average level of approximately 0.3 mg/L for the 2002 monitoring period. Oxidised nitrogen had a low attainment result based on the ANZECC guideline value of 0.015 mg/L with results exhibiting a clear seasonal pattern, with characteristic winter peaks and summer troughs.

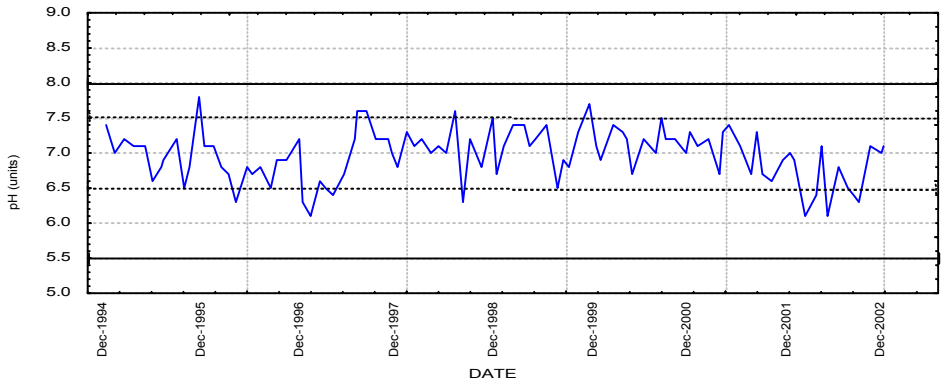
Total phosphorus concentrations observed moderate attainment against the objectives. The SEPP objectives for total phosphorus at the site was 0.03 mg/L.

FRP concentrations have generally remained below the ANZECC recommended guideline level since the commencement of monitoring.


Discharge (ML/day)
1200
1000
800
600
400
200
0
Dec-1994
Dec-1995
Dec-1996
Dec-1997
Dec-1998
Dec-1999
Dec-2000
Dec-2001
Dec-2002
DATE


Dissolved Oxygen (mg/L)
16
15
14
13
12
11
10
9
8
7
Dec-1995
Dec-1996
Dec-1997
Dec-1998
Dec-1999
Dec-2000
Dec-2001
Dec-2002
DATE


EC at 25 C (uS/cm)
550
500
450
400
350
300
250
200
150
100
50
0
Dec-1995
Dec-1996
Dec-1997
Dec-1998
Dec-1999
Dec-2000
Dec-2001
Dec-2002
DATE


pH (units)
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
Dec-1994
Dec-1995
Dec-1996
Dec-1997
Dec-1998
Dec-1999
Dec-2000
Dec-2001
Dec-2002
DATE

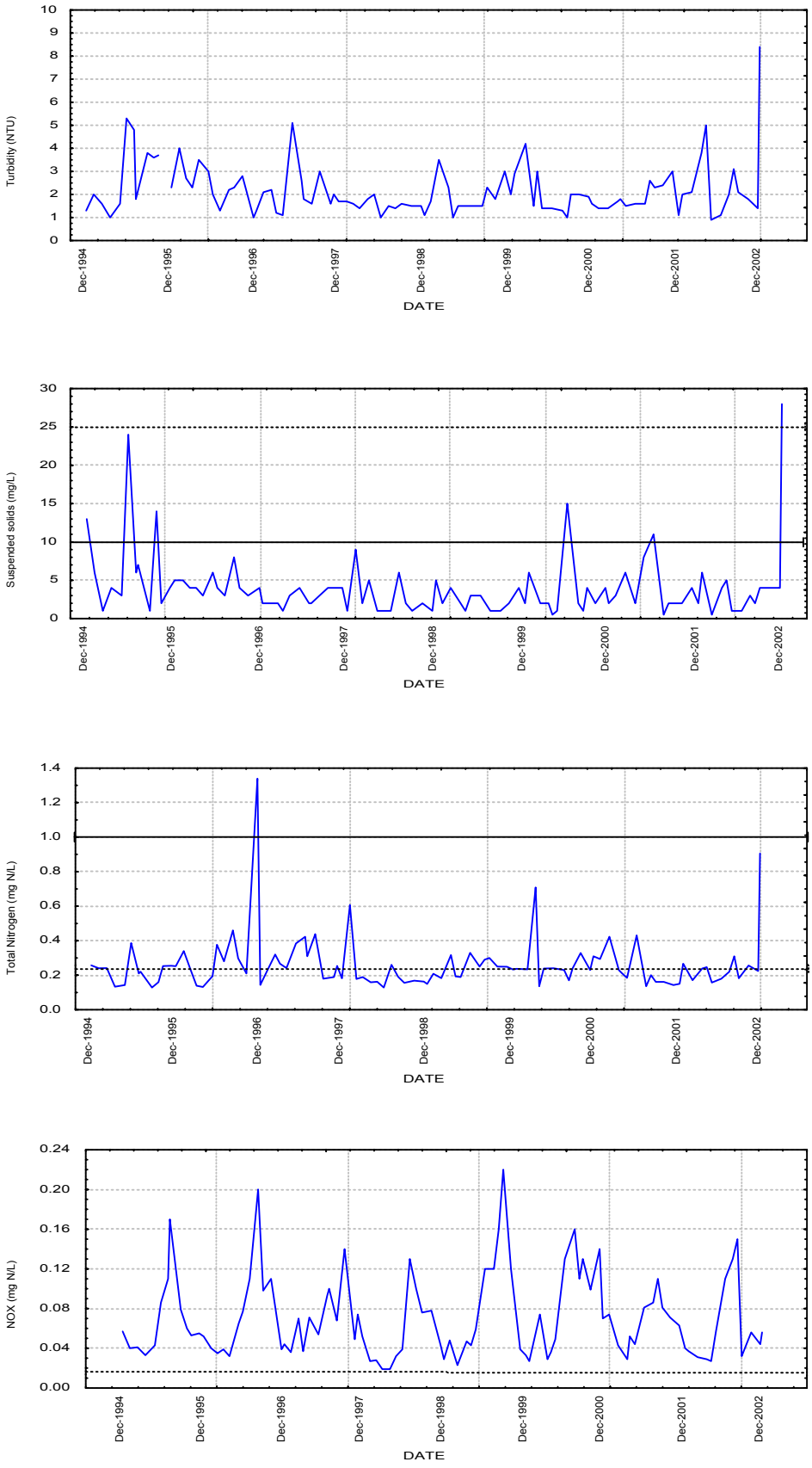


Figure 35. Variability in water quality in the Thomson River at Whitelaws, 1995-2002.

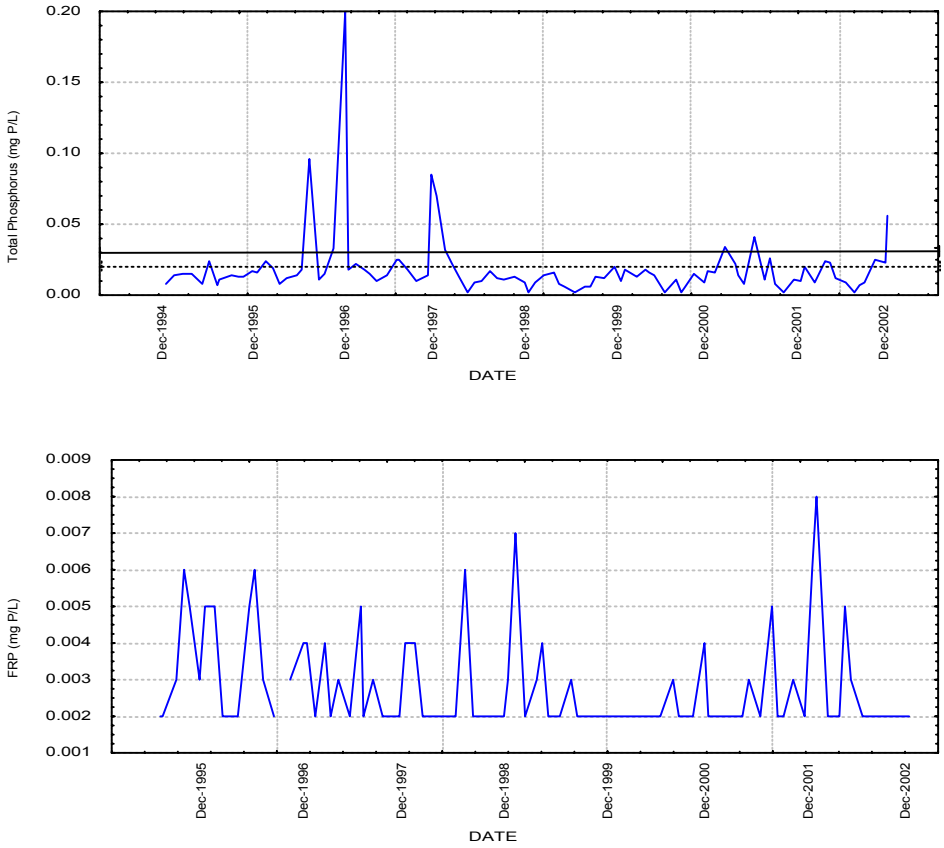


Figure 36. Variability in water quality in the Thomson River at Whitelaws, 1995-2002.

Black line indicates SEPP objective limit and dashed line indicates ANZECC guideline limit. Limits are minimum for DO, range for pH, maximum for other parameters.

It should be recognized that in many cases the dates on the x axis on the graph do not line up on all graphs. This is due to the change in time when monitoring started for some parameters.

5.2.10 Wimmera CMA Region

Water Quality Characterisation

The Wimmera CMA region incorporates parts of three drainage basins but only has sample sites in one drainage Basin, the Wimmera-Avon Rivers Basin (Basin 415 incorporating 16 stations including 9 lakes). The other two Basins are the Glenelg and Millicent Coast Basins. Water quality was characterised for each station in the Wimmera CMA region according to percent attainment with the relevant water quality objectives and guidelines (Tables 40-42). A summary of this data is presented on an attainment map for the region (Figure 37). Water quality characterisation was according to attainment of the SEPP objectives or, in the absence of SEPP objectives, the ANZECC guidelines as outlined in Section 2: Methods.

Dry conditions continued in the Wimmera CMA region in 2002. Three lake sites were dry - Dock Lake (415606), Pine Lake (415607) and Green Lake (415612) and a number of other sites were dry at various stages throughout the year. This resulted in insufficient data to perform an analysis for this report for dissolved oxygen, suspended solids, and nutrients for several lake sites and a small number of river sites.

SEPP attainment for pH was high for all river stations in the Wimmera CMA region. Two lake sites recorded moderate attainment for the SEPP pH objective, namely Lake Fyans (415610) and Toolondo Reservoir (415620

Dissolved oxygen (DO) was only monitored at river sites, thus only 7 of the 16 stations in the CMA region are routinely monitored for DO. Of these, five stations had sufficient data in 2002 for water quality assessment. All river sites had high attainment except for Wimmera River at Horsham (415200) which had low attainment and Wimmera River at Glenorchy (415201) which achieved moderate attainment with the SEPP DO objective.

There were SEPP objectives for electrical conductivity (EC) in the Wimmera CMA region. All but five stations in the Wimmera CMA achieved high attainment with the SEPP EC objective. The one site that recorded moderate attainment was the Wimmera River at Lochiel Railway Bridge Crossing (415246). Three sites that recorded low attainment were the Wimmera River at Glenorchy (415201), Concongella Creek at Stawell (415237) and Lake Lonsdale (415227).

Turbidity and suspended solids attainment was also high with the exception of two lakes, Taylors Lake (415608) and Toolondo Reservoir (415620) which obtained low attainment for turbidity. Only four river sites had sufficient suspended solids data collected during 2002 to calculate attainment. All of these river sites exhibited high SEPP attainment for suspended solids.

There were no SEPP objectives for total nitrogen (TN) in the Wimmera CMA region, therefore ANZECC guidelines applied. Lake Bellfield (415229) achieved high attainment with the ANZECC guideline. All other river and lake stations achieved low attainment of the ANZECC guidelines for total nitrogen.

There were SEPP objectives for total phosphorus (TP) for the four river sites in the Wimmera CMA region, for the lake sites ANZECC guidelines applied. All of the river sites achieved high SEPP attainment. All of the lake stations exhibited low ANZECC attainment for total phosphorus.

All of the lake sites achieved high attainment of the ANZECC guideline for chlorophyll-*a*, except for Toolondo Reservoir (415620) which obtained low attainment and Taylors Lake (415608) which obtained moderate attainment.

Two sites on the Wimmera River were sampled for metals in the Wimmera CMA region. The Wimmera River at Horsham (415200) achieved high attainment for six of the seven metals, having low SEPP attainment for cadmium. The station at Dimboola (415246) had high attainment for most metals except moderate attainment for cadmium and low attainment for copper and zinc.

The water quality data and summary statistics relating to the water quality, water quantity and river health in the Wimmera CMA region have been made available on the Internet. See www.vicwaterdata.net for this information.

Table 40. Percent attainment of SEPP and ANZECC objectives for physical parameters at stations within the Wimmera CMA region during 2002.

Basin	Program	SINO	SEPP				ANZECC			Rating		
			DO	DO%sat	EC_{90}	pH	$DO\%sat_{80}$	EC_{80}	pH	DO	EC	pH
	Rivers											
415	V	415200	**75**	**58**	100	100	**0**	100	100	L	H	H
	V	415201	**92**	**92**	**83**	100	**58**	**67**	100	M	L	H
	V	415203	100	100	100	100	**50**	**60**	100	H	H	H
	V	415207	100	100	100	100	**33**	**0**	**33**[(a)]	H	H	H
	V	415237	*	*	**0**	*	*	*	*	*	L	*
	V	415246	100	100	**92**	100	**33**	**17**	**83**[(a)]	H	M	H
	V	415251	*	*	100	*	*	*	*	*	H	*
	Lakes											
	S	415202	*	*	100	100	*	**0**	**80**[(a)]	*	H	H
	S	415227	*	*	**0**	*	*	*	*	*	L	*
	S	415229	*	*	100	100	*	**0**	**100**	*	H	H
	S	415606	*	*	*	*	*	*	*	*	*	*
	S	415607	*	*	*	*	*	*	*	*	*	*
	S	415608	*	*	100	100	*	**0**	100	*	H	H
	S	415610	*	*	100	**94**[(a)]	*	**0**	**88**[(a)]	*	H	M
	S	415612	*	*	*	*	*	*	*	*	*	*
	S	415620	*	*	-	**81**[(a)]	*	**0**	**81**[(a)]	*	*	M

[(a)] = pH outside objective range above maximum limit
[(b)] = pH outside objective range below minimum limit
* = Insufficient data (<10 samples)
\- = No guideline
V = VWQMN
S = MSOMP

Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 41. Percent attainment with SEPP and ANZECC objectives for turbidity and suspended solids at stations within the Wimmera CMA region during 2002.

			SEPP			ANZECC		Rating	
Basin	**Program**	**SINO**	**Turb**	**SS_{50}**	**SS_{90}**	**$Turb_{80}$**	**SS_{80}**	**Turb**	**SS**
	Rivers								
415	V	415200	-	100	100	100	100	H	H
	V	415201	-	100	100	100	100	H	H
	V	415203	-	*	*	90	*	H	*
	V	415207	-	100	100	100	100	H	H
	V	415237	-	*	*	*	*	*	*
	V	415246	-	100	100	100	100	H	H
	V	415251	-	*	*	*	*	*	*
	Lakes								
	S	415202	-	*	*	100	*	H	*
	S	415227	-	*	*	*	*	*	*
	S	415229	-	*	*	100	*	H	*
	S	415606	*	*	*	*	*	*	*
	S	415607	*	*	*	*	*	*	*
	S	415608	-	*	*	**73**	*	L	*
	S	415610	-	*	*	100	*	H	*
	S	415612	*	*	*	*	*	*	*
	S	415620	-	*	*	**50**	*	L	*

* = Insufficient data (<10 samples)
\- = No guideline
V = VWQMN
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 42. Percent attainment with SEPP and ANZECC objectives for nutrients at stations within the Wimmera CMA region during 2002.

Basin	Program	SINO	SEPP				ANZECC					
			TN_{50}	TN_{90}	TP_{50}	TP_{90}	TN_{80}	NO_{x80}	$NH4_{80}$	TP_{80}	FRP_{80}	Chl-a_{80}
	Rivers											
415	V	415200	-	-	-	100	**0**	**75**	*	**92**	100	*
	V	415201	-	-	-	100	**50**	**67**	*	100	100	*
	V	415203	-	-	-	-	*	*	*	*	*	*
	V	415207	-	-	-	100	**8**	**33**	*	**50**	**92**	*
	V	415237	-	-	-	-	*	*	*	*	*	*
	V	415246	-	-	-	100	**0**	100	*	100	100	*
	V	415251	-	-	-	-	*	*	*	*	*	*
	Lakes											*
	S	415202	-	-	-	-	**0**	**47**	*	**53**	100	**87**
	S	415227	-	-	-	-	*	*	*	*	*	*
	S	415229	-	-	-	-	**87**	**0**	*	**40**	100	100
	S	415606	-	-	-	-	*	*	*	*	*	*
	S	415607	-	-	-	-	*	*	*	*	*	*
	S	415608	-	-	-	-	**0**	**0**	*	**0**	100	**73**
	S	415610	-	-	-	-	**0**	**81**	*	**0**	100	**88**
	S	415612	-	-	-	-	*	*	*	*	*	*
	S	415620	-	-	-	-	**0**	**19**	*	**0**	**75**	**38**

Basin	Program	SINO	Rating					
			TN	NO_x	NH4	TP	FRP	Chl-*a*
	Rivers				*			
415	V	415200	L	M	*	H	H	*
	V	415201	L	L	*	H	H	*
	V	415203	*	*	*	*	*	*
	V	415207	L	L	*	H	H	*
	V	415237	*	*	*	*	*	*
	V	415246	L	H	*	H	H	*
	V	415251	*	*	*	*	*	*
	Lakes							
	S	415202	L	L	*	L	H	H
	S	415227	*	*	*	*	*	*
	S	415229	H	L	*	L	H	H
	S	415606	*	*	*	*	*	*
	S	415607	*	*	*	*	*	*
	S	415608	L	L	*	L	H	M
	S	415610	L	M	*	L	H	H
	S	415612	*	*	*	*	*	*
	S	415620	L	L	*	L	M	L

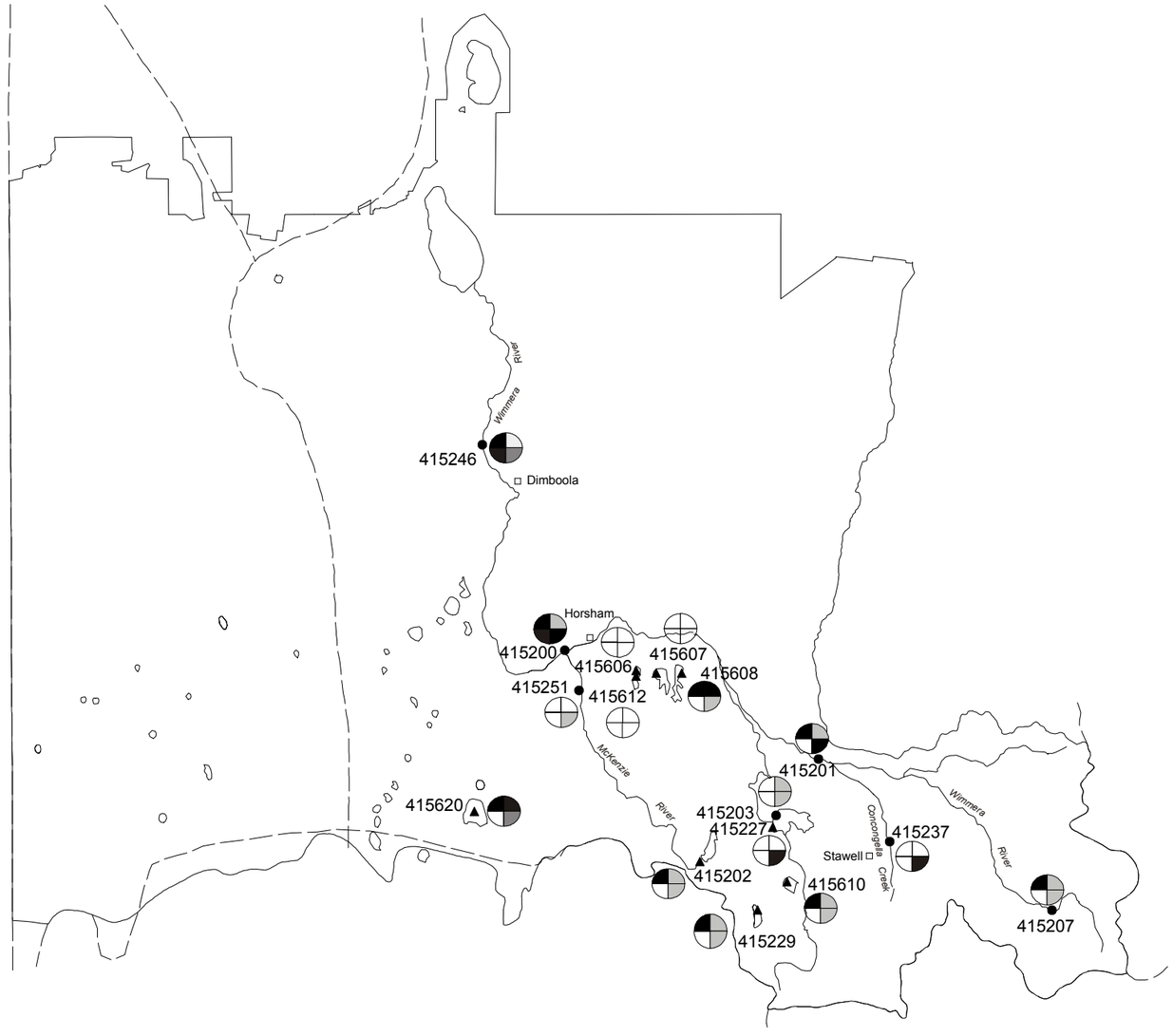
* = Insufficient data (<10 samples)
V = VWQMN
-- = No guideline
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.

Table 43. Percent attainment of SEPP and ANZECC objectives for metals at stations within the Wimmera CMA region during 2002.

			SEPP							ANZECC						
Basin	**Program**	**SINO**	**As**	**Cd**	**Cr**	**Cu**	**Ni**	**Pb**	**Zn**	**As_{80}**	**Cd_{80}**	**Cr_{80}**	**Cu_{80}**	**Ni_{80}**	**Pb_{80}**	**Zn_{80}**
	Rivers															
415	V	415200	100	**83**	100	100	100	100	100	100	**83**	-	**0**	100	**92**	**67**
	V	415201	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	415203	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	415207	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	415237	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	V	415246	100	**92**	100	**75**	100	100	**83**	100	**92**	-	**8**	100	100	**75**
	V	415251	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	Lakes															
	S	415202	-	-	-	-	-	-	-	*	*	-	*	*	*	*
	S	415227	-	-	-	-	-	-	-	*	*	-	*	*	*	*
	S	415229	-	-	-	-	-	-	-	*	*	-	*	*	*	*
	S	415606	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	415607	-	-	-	-	-	-	-	*	*	-	*	*	*	*
	S	415608	-	-	-	-	-	-	-	*	*	-	*	*	*	*
	S	415610	-	-	-	-	-	-	-	*	*	-	*	*	*	*
	S	415612	*	*	*	*	*	*	*	*	*	-	*	*	*	*
	S	415620	*	*	*	*	*	*	*	*	*	-	*	*	*	*

Basin	Program	SINO	Rating						
			As	Cd	Cr	Cu	Ni	Pb	Zn
415	V	415200	H	L	H	H	H	H	H
	V	415246	H	M	H	L	H	H	L

* -= Insufficient data (<10 samples)
V =VWQMN
- = No guideline
S = MSOMP
Parameters marked $_{80,\ 50}$ or $_{90}$ require 80%, 50% or 90% of samples to comply with the guideline.



WIMMERA C.M.A. REGION

Attainment with water quality objectives and guidelines.

Produced for DNRE by WATER ECOscience

N

0 10 20 40

kilometres

Catchment Management Authority (C.M.A.) Boundary

Drainage Basin Boundary

Nutrients

Suspended solids/ turbidity

Metals

Physical parameters

Attainment

- *Low*
- *Medium*
- *High*
- *No guideline and/or no data*

Monitoring Program

- *VWQMN*
- *MSOMP*
- *MDBC*
- *EPA*

Figure 37. Wimmera CMA region. Attainment with water quality objectives and guidelines

.

Station Specific Water Quality: Wimmera River at Lochiel Railway Bridge Crossing

Station 415246 (Wimmera River at Lochiel Railway Bridge Crossing) was identified as having low attainment of water quality objectives for total nitrogen, copper and zinc based on 2002 monitoring results. This station had moderate attainment for Electrical Conductivity (EC) and cadmium and high attainment for all remaining parameters during 2002. Chlorophyll-*a* was not analysed for this station during 2002.

Flow in the Wimmera River at Lochiel Railway Bridge shows a strong seasonal pattern with peaks in discharge generally occurring over the winter months. Due to the exceptionally dry conditions there have been no major peaks in discharge recorded since 1997. A trend of rising salinity is apparent from about this time and EC levels have been consistently above ANZECC guideline limits since 1999 (although generally below SEPP objective limits). A major peak of around 6,900 μS/cm occurred in March 2002.

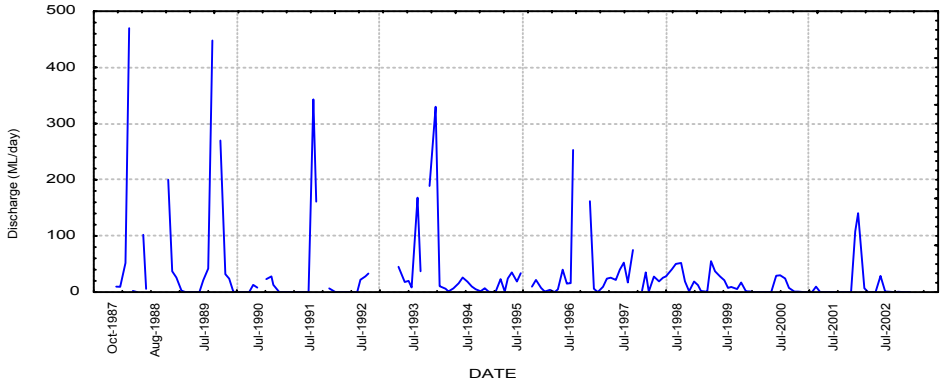
Dissolved oxygen (DO) shows a strong seasonal pattern, as would be expected, with levels rising in the colder months and falling as the water temperature increases. DO concentration at the Wimmera River at Lochiel Railway Bridge has generally been above the SEPP objective since monitoring commenced at this station in 1987.

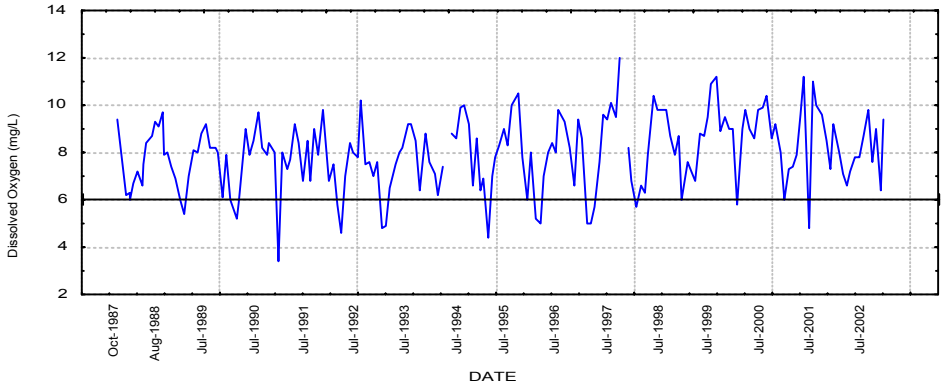
pH is variable at this station but exhibits a trend of increasing since 1992. Levels have generally been within both SEPP and ANZECC limits.

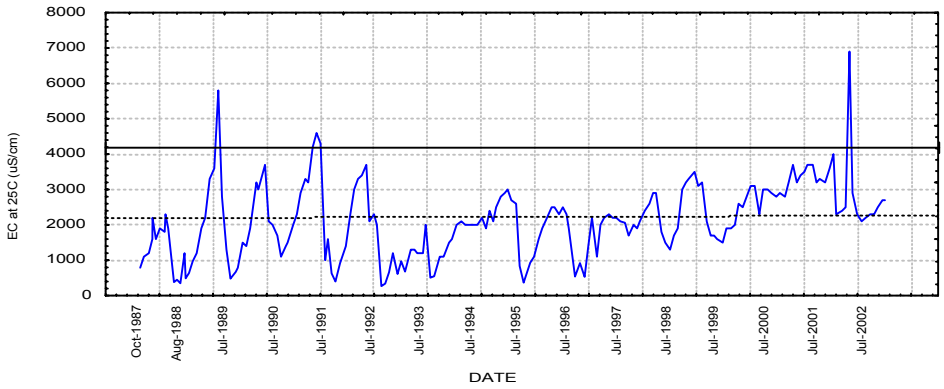
Both turbidity and suspended solids have been well below ANZECC guideline limits for the majority of the monitoring period. Turbidity has actually shown a decline since 1997 and both parameters exhibit a marked decrease in variability from this time. This is most likely due to the limited inflows.

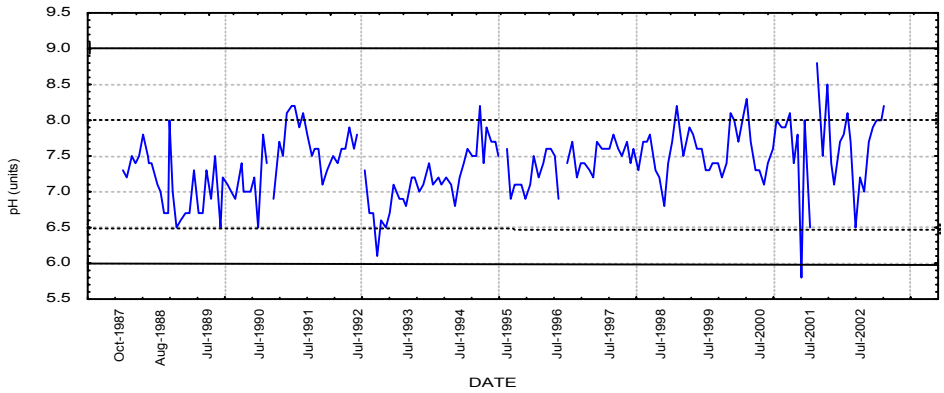
No sample for total nitrogen concentration has been below the ANZECC guideline of 0.5 mg/L since monitoring began for this parameter at this station in 1990. The oxidised nitrogen ($NO_{x)}$ proportion has generally remained below the ANZECC guideline of 0.040 mg/L, since 1998.

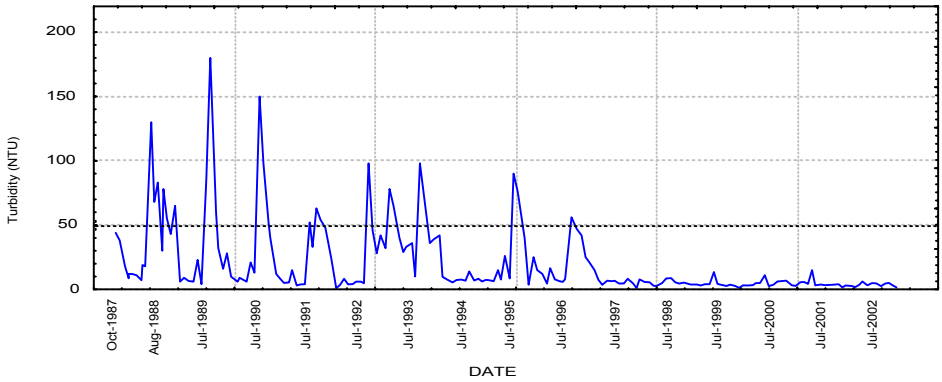
Total phosphorus has remained below the ANZECC guideline of 0.050mg/L since 1999. Before this time, peaks above this level were frequently recorded. The SEPP objective of 0.20 mg/L was also exceeded on 3 occasions. Filterable reactive phosphorus has remained below the ANZECC FRP guideline of 0.020 mg/L for almost the entire monitoring period.

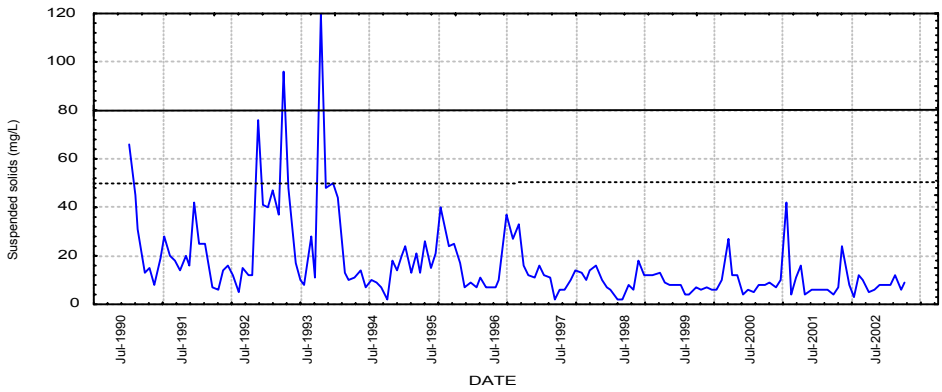

Discharge (ML/day)
500
400
300
200
100
0
Oct-1987
Aug-1988
Jul-1989
Jul-1990
Jul-1991
Jul-1992
Jul-1993
Jul-1994
Jul-1995
Jul-1996
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
DATE

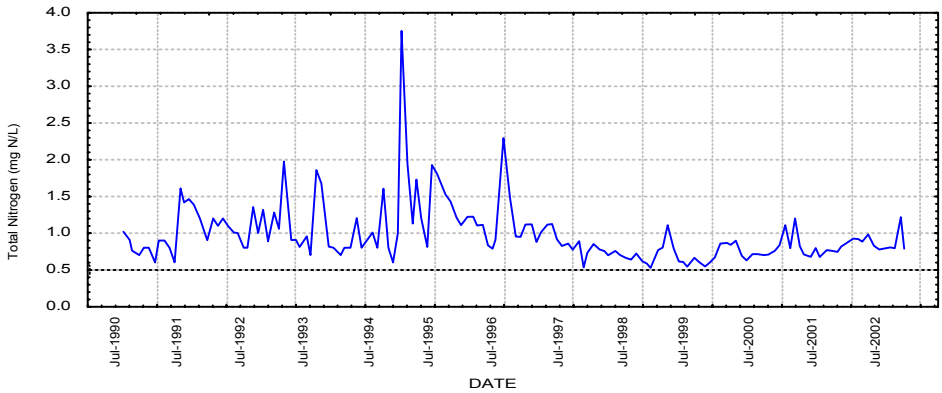

Dissolved Oxygen (mg/L)
14
12
10
8
6
4
2
Oct-1987
Aug-1988
Jul-1989
Jul-1990
Jul-1991
Jul-1992
Jul-1993
Jul-1994
Jul-1995
Jul-1996
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
DATE

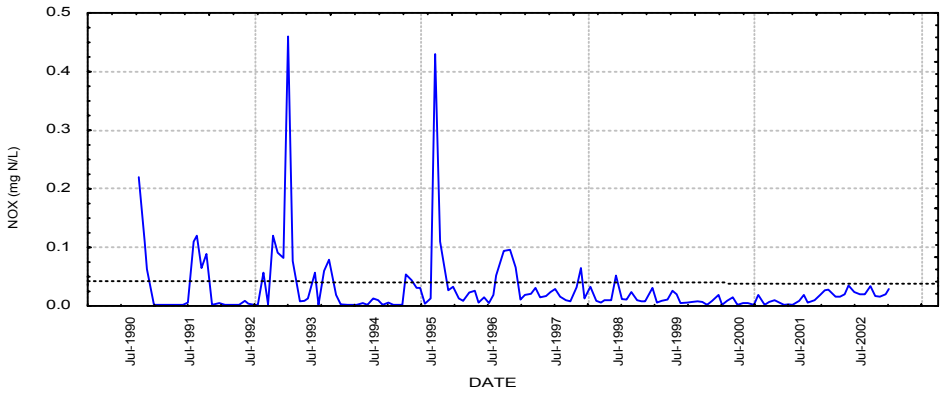

EC at 25C (uS/cm)
8000
7000
6000
5000
4000
3000
2000
1000
0
Oct-1987
Aug-1988
Jul-1989
Jul-1990
Jul-1991
Jul-1992
Jul-1993
Jul-1994
Jul-1995
Jul-1996
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
DATE


pH (units)
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
Oct-1987
Aug-1988
Jul-1989
Jul-1990
Jul-1991
Jul-1992
Jul-1993
Jul-1994
Jul-1995
Jul-1996
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
DATE


Turbidity (NTU)
200
150
100
50
0
Oct-1987
Aug-1988
Jul-1989
Jul-1990
Jul-1991
Jul-1992
Jul-1993
Jul-1994
Jul-1995
Jul-1996
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
DATE


Suspended solids (mg/L)
120
100
80
60
40
20
0
Jul-1990
Jul-1991
Jul-1992
Jul-1993
Jul-1994
Jul-1995
Jul-1996
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
DATE


Total Nitrogen (mg N/L)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jul-1990
Jul-1991
Jul-1992
Jul-1993
Jul-1994
Jul-1995
Jul-1996
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
DATE


NOX (mg N/L)
0.5
0.4
0.3
0.2
0.1
0.0
Jul-1990
Jul-1991
Jul-1992
Jul-1993
Jul-1994
Jul-1995
Jul-1996
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
DATE

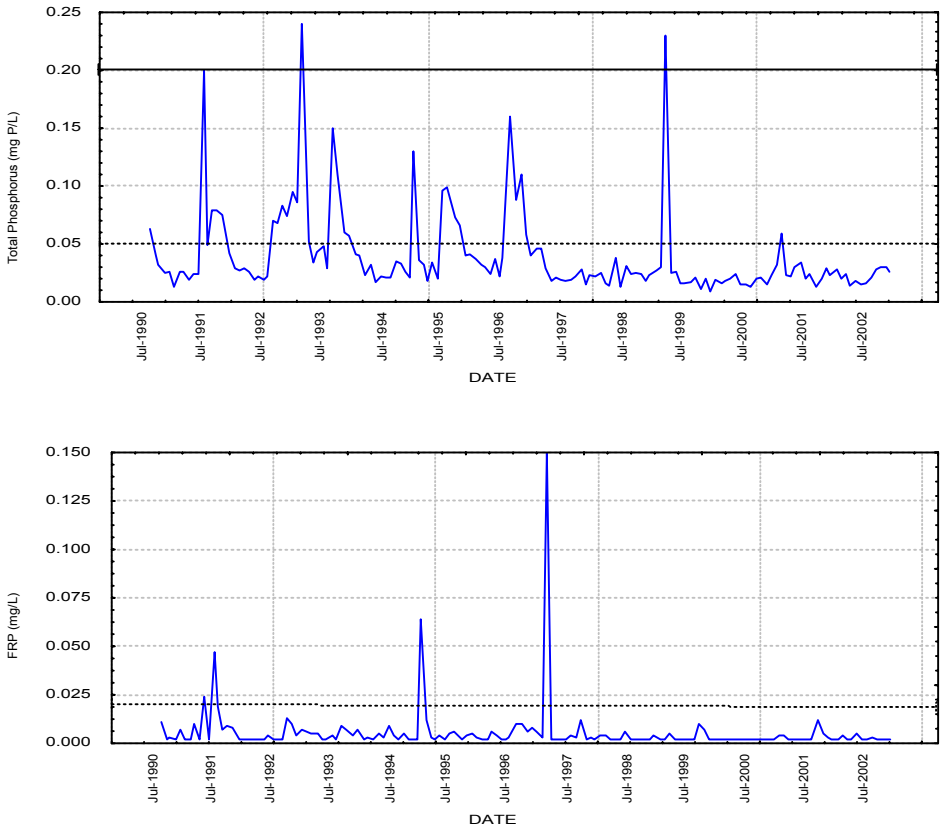


Figure 38. Variation in water quality in Wimmera River at Lochiel Railway Bridge Crossing, 1987 to 2002.

Black line indicates SEPP objective limit and dashed line indicates ANZECC guideline limit. Limits are minimum for DO, range for pH, maximum for other parameters.

It should be recognized that in many cases the dates on the x axis on the graph do not line up on all graphs. This is due to the change in time when monitoring started for some parameters.

6 References

ANZECC, 1992. National Water Quality Management Strategy: The Australian Water Quality Guidelines for Fresh and Marine Waters. Australian and New Zealand Environment and Conservation Council.

ANZECC & ARMCANZ, 2000. National Water Quality Management Strategy: Paper No. 4: Australia and New Zealand guidelines for fresh and marine water quality. Australia and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

AWT Victoria, 1999a. Victorian Water Quality Monitoring Annual Report: 1998. Report prepared for the Department of Natural Resources and Environment by AWT Victoria. Report No. 401/99.

AWT Victoria, 1999b. Victorian Water Quality Monitoring Network and State Biological Monitoring Program Manual of Procedures.

AWT Victoria, 1999c. Water Quality Monitoring Program Review – Part 1. Data Summary and Recommendations. Report prepared for the Murray Darling Basin Commission by AWT Victoria Pty Ltd. Report No. 98/169.

AWT Victoria, 2000. MDBC Water Quality Review – Stage 2. Report prepared for the Murray Darling Basin Commission by AWT Victoria.

AWT Victoria, 2000. Victorian Water Quality Monitoring Annual Report: 1999. Report prepared for the Department of Natural Resources and Environment by AWT Victoria. Report No. 554/00.

CMAC, DNRE and EPA, 1996. Testing the Waters - The 1996 review of Victorian Water Quality Monitoring. Draft Technical Discussion Paper, December 1996.

Cottingham, P., Bennison, G., Dunn, R., Lidston, J. and Robinson, D., 1995. Algal Bloom and Nutrient Status of Victorian Inland Waters. Government of Victoria.

Dallas, H.F. and Day, J.A., 1993. The Effect of Water Quality Variables on Riverine Ecosystems: A Review. Report prepared for the Water Research Commission by Freshwater Research Unit, University of Capetown, Rondebosch, Republic of South Africa.

EPA, 2000. Guide to Sampling and Analysis of Waters and Wastewaters. Environmental Protection Authority, Victoria. Publication 441.

Greenberg, A.E., Clesceri, L.S. and Eaton, A.D., 1992. Standard Methods for the Examination of Water and Wastewater (18th edn). American Public Health Association, Washington, USA.

Harris, G.P., 1994. Nutrient Loadings and Algal Blooms in Australian Waters - A Discussion Paper. LWRRDC Occasional Paper No. 12/94.

Hart, B.T., Maher, W. Lawrence, I., 1998. New-risk-based water quality guidelines. Water 25 (3) 24-25

Hunter, K.M., 1996. State Water Quality Monitoring Annual Report: Victoria 1996. A Report prepared for the Department of Natural Resources and Environment by AWT Victoria Pty Ltd. Report No. 70/96.

Hunter, K.M., 1993. Victorian Water Quality Monitoring Network: August 1990 - December 1992. State Water Laboratory of Victoria. Report No. 110.

Hunter, K.M. and Hedger, M.M., 1995. Victorian Water Quality Monitoring Network Annual Report 1994. A Report prepared for the Department of Conservation and Natural Resources Industry Standards Group by AWT Victoria.

Hunter, K.M. and Zampatti, B.P., 1994a. Victorian Water Quality Monitoring Network Annual Report 1994. State Water Laboratory of Victoria. Report No.112.

Hunter, K.M. and Zampatti, B.P., 1994b. Victorian Water Quality Monitoring Summary of Historical Data 1975 - 1992. State Water Laboratory of Victoria. Report No.115.

NHMRC & ARMCANZ, 1996. National Water Quality Management Strategy: Australian Drinking Water Guidelines. National Health and Medical Research Council and Agriculture and Resource Management Council of Australia and New Zealand.

OCE, 1988. State of the Environment Report: Victoria's Inland Waters. Office of the Commissioner for the Environment, Government of Victoria.

RWC, 1991. Monitoring and Assessment of the Quality of Victorian Waters. Report No.106. Rural Water Commission of Victoria.

Tiller, D. and Newell, P., 1995. Preliminary Nutrient Guidelines for Victorian Inland Streams. Environmental Protection Authority.

Victorian Government Printing Office, 1970. Environment Protection Act 1970.

Victorian Government, 1982. State Environment Protection Policy (The Waters of Lake Colac and Catchment). Policy No. W-34A.

Victorian Government, 1982. State Environment Protection Policy (The Waters of the Western District Lakes). Policy No. W-34B.

Victorian Government, 1983. State Environment Protection Policy (The Waters of Lake Burrumbeet and Catchment). Policy No.W-36A.

Victorian Government, 1985. State Environment Protection Policy (The Waters of the Wimmera River and Catchment). Policy No. W-15A.

Victorian Government, 1985. State Environment Protection Policy (The Waters of Far East Gippsland). Policy No. W-21.

Victorian Government, 1988. State Environment Protection Policy (Waters of Victoria). Policy No. S122.

Victorian Government, 1988. State Environment Protection Policy (The Waters of the Dandenong Valley). Policy No. W-28A.

Victorian Government, 1990. Industrial Waste Management Policy (Waste Minimisation).

Victorian Government, 1996. State Environment Protection Policy (Waters of Victoria) – Schedule F5. The LaTrobe and Thomson River Basins and Merriman Creek Catchment.

Victorian Government, 1997. State Environment Protection Policy (Waters of Victoria) – Schedule F6. Waters of Port Phillip Bay.

Victorian Government, 1999. State Environment Protection Policy (Waters of Victoria) – Schedule F7. Waters of the Yarra Catchment.

Victorian Government, 2001. State Environment Protection Policy (Waters of Victoria) – Schedule F8. Waters of Western Port and Catchment.

WATER ECOscience, 1997a. State Water Quality Monitoring Annual Report: Victoria 1996 – Volume 1. Report prepared for the Department of Natural Resources and Environment by WATER ECOscience Pty Ltd. Report No. 171/97.

WATER ECOscience, 1997b. State Water Quality Monitoring Annual Report: Victoria 1996 – Volume 2. Report prepared for the Department of Natural Resources and Environment by WATER ECOscience Pty Ltd. Report No. 171/97.

WATER ECOscience, 1998. State Water Quality Monitoring Annual Report: Victoria 1997. Report prepared for the Department of Natural Resources and Environment by WATER ECOscience Pty Ltd. Report No.260/98.

WATER ECOscience, 2003. Victorian Water Quality Monitoring Annual Report: Victoria 2001. Report prepared for the Department of Sustainability and Environment by WATER ECOscience Pty Ltd. Report No.720/03.

www.vicwaterdata.net

7 Glossary

°C	degrees Celsius
μg/L	micrograms per litre (1 mg = 1,000 μg)
μS/cm	micro Siemens per centimetre
Alkalinity	The concentration of hydroxyl [OH^-], bicarbonate [HCO_3^-] and carbonate [CO_3^{2-}] ions in the water. Alkalinity is a capacity factor that represents the acid-neutralising capacity of an aqueous system
cfu	colony forming units
DO%sat	Percent saturation of oxygen in water: the proportion of oxygen actually dissolved in the water relative to the theoretical maximum, taking into account temperature, salinity and air pressure.
EC	Electrical Conductivity as μS/cm (≈ 0.67 x TDS), a measure of salinity, the ability of the water to conduct and electrical current
FRP	Filterable Reactive Phosphorus (bioavailable phosphorus)
FTU	Formazin Turbidity Unit
g/m^3	grams per cubic metre (equivalent to mg/L)
mg/L	milligrams per litre
NO_x	Nitrate (NO_3) and Nitrite (NO_2) (bioavailable nitrogen)
NTU	Nephelometric Turbidity Unit
PAR	Photosynthetic active radiation the light attenuation extinction co-efficient calculated from the decrease in photosythetically active radiation penetrating the water column
pH	The negative logarithm of concentration of hydrogen ions [H^+] in solution pH ranges from 1 (acidic) through 7 (neutral) to 14 (alkaline) on a log scale, therefore a change of 1 pH unit represents a 10-fold change in [H^+]
SPM	Suspended particulate matter (≡ SS)
SS	Suspended Solids insoluble material which resides in the water column
TDS	Total Dissolved Solids as mg/L (≈ 1.5 x EC) ,a measure of salinity, a measure of the inorganic salts and organic compounds dissolved in water
TKN	Total Kjeldahl Nitrogen (organic nitrogen)
TN	Total Nitrogen (≡ NO_x + TKN)
TP	Total Phosphorus
TSS	Total Suspended Solids (≡ SS)

Appendix I:
Water Quality Guidelines

Table AI.1. SEPP Waters of Victoria (1988)

Objectives for Environmental Water Quality Indicators (General and Ecosystem Protection)

Indicators	Objectives				
	Aquatic Reserves	**Parks and Forests**	**Estuarine**	**Coastal**	**General Surface Waters**
Dissolved Oxygen	N	>6 g/m^3 >60% saturation	>5 g/m^3 >60% saturation	>6.5 g/m^3 >85% saturation	>5 g/m^3 >50% saturation
Bacteria (*E.coli*)	N	1000 orgs/100 mL (geometric mean)			
pH – variation – range	 N N	 <0.5 6.5 – 8.5	 <0.5 6.5 – 8.5	 <0.5 7.5 – 8.5	 <1.0 6.0 – 9.0
Temperature – variation	 N	 <1.0°C	 <1.0°C	 <0.5°C	 <2.0°C
Light penetration	N	Qualitative	Qualitative	Qualitative	Qualitative
Toxicants (μg/L) – As – Cd – Cr – Cu – Fe – Pb – Hg – Ni – Zn	N	≤N + 0.5 (T–N) T = 50 T = 0.4 or 1.2[(a)] T = 10 T = 10 T = 1000 T = 4, 25, 50 or 100[(a)] T = 0.05 T = 25 T = 50, 100, 300, 600[(a)]	≤N + 0.5 (T–N) T = 10 T = 3.0 T = 10 T = 5 T = 200 T = 10 T = 0.10 T = 20 T = 20	≤N + 0.5 (T–N) T = 10 T = 3.0 T = 10 T = 5 T = 200 T = 10 T = 0.10 T = 20 T = 20	≤T T = 50 T = 0.4 or 1.2[(a)] T = 10 T = 10 T = 1000 T = 4, 25, 50 or 100[(a)] T = 0.05 T = 25 T = 50, 100, 300, 600[(a)]
Nutrients & Biostimulants	N	Qualitative	Qualitative	Qualitative	Qualitative
Total Dissolved Solids	N	The level shall not vary from background levels by >5%			Qualitative
Suspended Solids (g/m^3)	 N	50th percentile <10 90th percentile <25	50th percentile <25 90th percentile <90	50th percentile <10 90th percentile <25	50th percentile <25 90th percentile <80

(a) = depending on hardness (mg/L $CaCO_3$)
N = natural background level
T = threshold concentration of chronic sublethal effects ("Recommended Water Quality Criteria" EPA 1983)
Qualitative = no quantitative objective

Table AI.2. SEPP Waters of Victoria (1988) – Schedules F1, F2, F3

Objectives for Environmental Water Quality Indicators.
Schedule F4 has same objectives as Waters of Victoria (1988)

Indicators	Objectives			
	Schedule F1 Waters of the Werribee and Little River Catchments	**Schedule F2 Waters of the Maribyrnong River and Tributaries**	**Schedule F3 Gippsland Lakes and Catchment**	
			Upper Riverine	**Lower Riverine**
Dissolved Oxygen	>5 g/m^3 >50% saturation	>5 g/m^3 >50% saturation	>8 g/m^3 >85% sat^n	>7.5 g/m^3 >75% sat^n
Bacteria (*E.coli*)	No objective	1000 orgs/100 mL (geometric mean)		
pH – variation – range	 <1.0 6.0 – 9.0	 <1.0 6.0 – 9.0	 <0.5 6.5 – 8.5	 <0.5 6.0 – 9.0
Temperature – variation	 <2.0°C	 <1.0°C	 <0.5°C	 <1.0°C
Turbidity (FTU)	Qualitative	Qualitative	50th percentile <5 90th percentile <15	50th percentile <10, 5$^{(b)}$ 90th percentile <20, 15$^{(b)}$
Toxicants (μg/L) – As – Cd – Cr – Cu – Fe – Pb – Hg – Ni – Zn	≤10 T = 500 = 4 or 12$^{(a)}$ = 100 = 100 = 10,000 = 40, 250, 500 or 1,000$^{(a)}$ = 0.5 = 250 = 500, 1,000, 3,000, 6,000$^{(a)}$	≤N + 0.5 (T – N) T = 10 T = 3.0 T = 10 T = 5 T = 200 T = 10 T = 0.10 T = 20 T = 20	≤N + 0.2 (T-N) T = 50 T = 0.4$^{(a)}$ T = 10 T = 10 T = 1000 T = 4$^{(a)}$ T = 0.05 T = 25 T = 50$^{(a)}$	≤N + 0.5 (T-N) T = 50 T = 0.4$^{(a)}$ T = 10 T = 10 T = 1000 T = 4$^{(a)}$ T = 0.05 T = 25 T = 50$^{(a)}$
Nutrients & Biostimulants	Qualitative	Qualitative	Qualitative	
Total Dissolved Solids	Qualitative			
Suspended Solids (g/m^3)	50th percentile <25 80th percentile <80	50th percentile <25 80th percentile <90	50th percentile <5 90th percentile <10	50th percentile <10 90th percentile <20

(a) = depending on hardness (mg/L $CaCO_3$)
(b) = Merriman Creek only
N = natural background level
T = threshold concentration of chronic sublethal effects ("Recommended Water Quality Criteria" EPA 1983)
Qualitative = no quantitative objective

Table AI.3. SEPP No W-34B The Waters of the Western District Lakes (1982)

Objectives for Environmental Water Quality Indicators. (Only the lakes sampled in the networks in this report are listed.)

Indicators	Objectives		
	A **Lake Purrumbete**	**B** **Lake Bullen Merri**	**G** **Lake Colongulac**
Dissolved Oxygen – g/m^3 – % saturation	 >7.5 >85%	 >7.2 >85%	 >5.7 >75%
Bacteria (*E.coli*) – orgs/100 mL	Mean <200 80^{th} percentile <400	Mean <200 80^{th} percentile <400	Mean <1000 80^{th} percentile <2000
pH – variation from background – range	 ± 0.5 6.5 – 8.5	 ± 0.5 6.5 – 8.5	 ± 0.5 6.0 – 9.0
Temperature – variation from background	 ± 0.5 °C	 ± 0.5 °C	 ± 1.0 °C
Salinity guidance range – g/m^3	 0 - 500	 2,500 – 10,600	 6,100 – 13,700
Light penetration – secchi depth (m)	 ± 0.48	 ± 0.26	Qualitative -
Toxicants (mg/m^3) guidance levels – As – Cd – Cr – Cu – Fe – Pb – Hg – Ni – Zn	N + 0.2(T-N) T = (x) T = 0.4 T = 50.0 T = 10.0 T = 1000 T = 30.0 T = 0.05 T = 100 T = 30.0	N + 0.2(T-N) T = (x) T = 0.4 T = 50.0 T = 10.0 T = 1000 T = 30.0 T = 0.05 T = 100 T = 30.0	N + 0.5(T-N) T = (x) T = 0.4 T = 50.0 T = 10.0 T = 1000 T = 30.0 T = 0.05 T = 100 T = 30.0
Nutrients & Biostimulants – Total N (g/m^3) – Total P (g/m^3)	Qualitative <0.7 <0.05	Qualitative <0.7 <0.05	Qualitative NL NL
Total Dissolved Solids – g/m^3	 90^{th} percentile <250	 90^{th} percentile <1000	 90^{th} percentile <3000
Suspended Solids (g/m^3)	<25	<25	<80
Settleable Matter	Qualitative	Qualitative	Qualitative
Aesthetic Characteristics	Qualitative	Qualitative	Qualitative

N = natural background level
T = threshold concentration of chronic sublethal effects (listed in SEPP)
(x) = insufficient data to determine threshold concentration
NL = No Level set
Qualitative = no quantitative objective

Table AI.4. SEPP No W-34A The Waters of Lake Colac and Catchment (1982)

Objectives for Environmental Water Quality Indicators

Indicators	Objectives	
	A Lake Colac Segment	B General Land Segment
Dissolved Oxygen – g/m^3 – % saturation	 >6.0 >60%	 >76.0 >60%
Bacteria (*E.coli*) – orgs/100 mL	 Mean <200	 Mean <1000
pH – variation from background – range	 ± 1.5 6.0 – 9.0	 ± 1.5 6.0 – 9.0
Temperature – variation from background	 <± 2.0 °C	 <± 2.0 °C
Light penetration – Turbidity (FTU)	 Median <35	 Median <35
Toxicants (μg/L) – As – Cd – Cr – Cu – Fe – Pb – Hg – Ni – Zn	<T (x) <0.4 <50.0 <10.0 <1000 <30.0 <0.05 <100 <30.0	<T (x) <0.4 <50.0 <10.0 <1000 <30.0 <0.05 <100 <30.0
Nutrients & Biostimulants	Qualitative	Qualitative
Total Dissolved Solids – variation	 <10%	 <10%
Suspended Solids (mg/L)	Median <80	Median <30
Aesthetic Characteristics	Qualitative	Qualitative

N = natural background level
T = threshold concentration of chronic sublethal effects (listed in SEPP)
(x) = insufficient information
Qualitative = no quantitative objective

Table AI.5. SEPP No W-36A The Waters of Lake Burrumbeet and Catchment (1983)

Objectives for Environmental Water Quality Indicators

Indicators	Objectives			
	Lakes Burrumbeet and Learmonth	**Upper Burrumbeet Creek**	**Lower Burrumbeet Creek**	**General**
Dissolved Oxygen – mg/L – % saturation	 >6.0 >60%	 >2.0	 >4.5 >45%	 >6.0 >60%
Bacteria (*E.coli*) – orgs/100 mL	 Mean <200	 Mean <1,000	 Mean <1,000	 Mean <1,000
pH – variation from background – range	 ± 1.5 6.0 – 9.0	 ± 1.5 5.5 – 9.5	 ± 1.5 6.0 – 9.0	 ± 1.5 6.0 – 9.0
Temperature – variation from background	 <± 2.0°C	 <± 2.0°C	 <± 2.0°C	 <± 2.0°C
Light penetration – Turbidity (FTU)	 Median <35	 Median <45	 Median <35	 Median <35
Toxicants (μg/L) – As – Cd – Cr – Cu – Fe – Pb – Hg – Ni – Zn	<T <200 <0.4 <50 <10 <1000 <30 <0.05 <100 <30	<T (agricultural) <200 <10 <1000 <500 (x) <100 <2 (x) <20000	<T <200 <0.4 <50 <10 <1000 <30 <0.05 <100 <30	<T <200 <0.4 <50 <10 <1000 <30 <0.05 <100 <30
Nutrients and Biostimulants	Qualitative	Qualitative	Qualitative	Qualitative
Aesthetic Characteristics	Qualitative	Qualitative	Qualitative	Qualitative
Suspended Solids (mg/L)	Median <80	Median <45	Median <40	Median <50

(x) = indicates insufficient information
N = natural background level (no variation from)
T = threshold concentration of chronic sublethal effects (listed in SEPP)
Qualitative = no quantitative objective

Table AI.6. SEPP No.W-21 The Waters of Far East Gippsland (1985)

Objectives for Environmental Water Quality Indicators

Indicator	Objectives					
	Scientific Reference Segment	**General Potable Water Supply Segment**	**Bekta Potable Water Supply Segment**	**Mallacoota Inlet Segment**	**Estuarine Segment**	**General Surface Waters Segment**
Dissolved Oxygen – mg/L – % saturation	 N N	 >8.0 >85	 >8.0 >85	 >7.5 >75	 >8.0 >85	 >8.0 >85
Bacteria (orgs/100 mL) – total coliforms – faecal coliforms – *E.coli*	 N N N	 NL NL 90th percentile <100	 NL NL 90th percentile <100	 50thpercentile <70 50thpercentile <14 NL	 50thpercentile <70 50thpercentile <14 NL	 NL NL Mean <200
pH – variation – range	 Nil N	 <0.5 6.5 – 8.5	 <0.5 6.5 – 8.5	 <0.2 6.5 – 8.5	 <0.2 6.5 – 8.5	 <0.5 6.5 – 8.5
Temperature variation	Nil	<0.5°C	<0.5°C	<1.0°C	<0.5°C	<0.5°C
Salinity or Total Dissolved Solids – % variation	N Nil	 <2	 <2	 <5	 <2	 <2
Light Penetration - % variation	 N	 <10	 <10	 <10	 <10	 <10
Toxicants (μg/L) – As – Cd – Cr – Cu – Fe – Pb – Hg – Ni – Zn	N	<N+0.2(T-N) T = 50 T = 0.4 T = 10 T = 10 T = 1000 T = 25 T = 0.05 T = 30 T = 50	<N+0.2(T-N) T = 50 T = 0.4 T = 10 T = 10 T = 1000 T = 25 T = 0.05 T = 30 T = 50	<N+0.5(T-N) T = 10 T = 3.0 T = 10 T = 5.0 T = 200 T = 10 T = 0.10 T = 20 T = 20	<N+0.2(T-N) T = 10 T = 3.0 T = 10 T = 5.0 T = 200 T = 10 T = 0.10 T = 20 T = 20	<N+0.2(T-N) T = 50 T = 0.4 T = 10 T = 10 T = 1000 T = 25 T = 0.05 T = 30 T = 50
Nutrients	N	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Aesthetic Quality	N	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Suspended Solids – mg/L	N	50th percentile <25 90th percentile <80	50th percentile <25 90th percentile <80	50th percentile <25 90th percentile <80	50th percentile <25 90th percentile <80	50th percentile <25 90th percentile <80
Settleable Matter	N	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative

N = natural background level
T = threshold concentration of chronic sublethal effects (listed in SEPP)
NL = No Level set
Qualitative = no quantitative objective

Table AI.7. SEPP No.W-15A The Waters of the Wimmera and Catchment (1985)

Objectives for Water Quality Environmental Indicators

	Objectives					
Indicators	**A - Potable Water Supply**	**B - Water Storages**	**C – Wimmera Tributaries**	**D – Upper Wimmera R.**	**E – Lower Wimmera R.**	**F – Terminal Lakes**
Dissolved Oxygen – g/m^3 – % saturation	 >7.5 >75%	 >7.5 >75%	 >4.5 >45%	 >6.0 >60%	 >6.0 >60%	 >6.0 >60%
Bacteria (*E.coli*) – orgs/100 mL	90th percentile <100	Mean <200	Mean <1000	Mean <200	Mean <200	Mean <200
pH – variation – range	 ± 0.5 6.0 – 9.0	 ± 0.5 6.0 – 9.0	 ± 1.5 5.5 – 9.5	 ± 1.0 6.0 – 9.0	 ± 1.0 6.0 – 9.0	 ± 1.0 6.0 – 9.0
Temperature – variation	<± 1.0°C	<± 1.0°C	<± 2.0°C	<± 2.0 °C	<± 2.0°C	<± 2.0°C
Light penetration – Turbidity (FTU)	90th percentile <25	90th percentile <50	90th percentile <50	90th percentile <50	90th percentile <50	90th percentile <50
Toxicants (μg/L) – As – Cd – Cr – Cu – Fe – Pb – Hg – Ni – Zn	N + 0.5(T-N) = 50 = 0.4 or 1.2[a] = 10 = 10 = 1000 = 4, 25, 50, 100[a] = 0.05 = 25 = 50, 100, 300 or 600[a]	N + 0.5(T-N) = 50 = 0.4 or 1.2[a] = 10 = 10 = 1000 = 4, 25, 50, 100[a] = 0.05 = 25 = 50, 100, 300 or 600 [a]	2T = 100 = 0.8 or 2.4[a] = 20 = 20 = 2000 = 8, 50, 100, 200[a] = 0.10 = 50 = 100, 200, 600 or 1200 [a]	T = 50 = 0.4 or 1.2[a] = 10 = 10 = 1000 = 4, 25, 50, 100[a] = 0.05 = 25 = 50, 100, 300 or 600 [a]	T = 50 = 0.4 or 1.2[a] = 10 = 10 = 1000 = 4, 25, 50, 100[a] = 0.05 = 25 = 50, 100, 300 or 600 [a]	T = 50 = 0.4 or 1.2[a] = 10 = 10 = 1000 = 4, 25, 50, 100[a] = 0.05 = 25 = 50, 100, 300 or 600 [a]
Nutrients & Biostimulants – Total P (g/m^3)	Qualitative	Qualitative	Qualitative	Qualitative 90th percentile <0.2	Qualitative 90th percentile <0.2 90th percentile <0.1[f]	Qualitative
Total Dissolved Solids – g/m^3 – variation	90th % <250	90th % <1000	90th % <3000	90th % <3000° 90th % <2000°	90th % <1500[d] 90th % <2500°	 <10%
Suspended Solids (g/m^3)	50th percentile <10 90th percentile <30	50th percentile <25 90th percentile <80	50th percentile <25 90th percentile <80	50th percentile <25 90th percentile <80	50th percentile <25 90th percentile <80	50th percentile <25 90th percentile <80
Settleable Matter	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Aesthetic Characteristics	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative

(a) = depending on hardness (mg/L $CaCO_3$)
(b) = upstream of Glenorchy Weir
(c) = between Glenorchy Weir and Horsham Weir
(d) = between Horsham Weir and Dimboola Weir
(e) = between Dimboola Weir and entry to Lake Hindmarsh
(f) = in Wimmera River at point of entry to Lake Hindmarsh
N = natural background level
T = threshold concentration of chronic sublethal effects ("Recommended Water Quality Criteria" EPA 1983)
Qualitative = no quantitative objective

Note: Electrical conductivity values used throughout this report for the Wimmera CMA were calculated using the following formula:
Total Dissolved Solids = Electrical Conductivity x 0.6

Table AI.8. SEPP No.W-28A The Waters of the Dandenong Valley (1988)

Objectives for Environmental Water Quality Indicators

Indicators	Objectives							
	Mordialloc & Kananook Creeks	**Mordialloc & Kananook Tributaries**	**Patterson River**	**Dandenong Ck Major Tributaries**	**Headwaters**	**Minor Tributaries**	**Wetlands**	**Lysterfield**
Dissolved Oxygen – mg/L – % saturation	 >4.0 >45%	 >4.5 >45%	 >4.0 >45%	 >4.5 >45%	 >8.0 >85%	 >4.5 >45%	 >4.5 >45%	 >8.0 >85%
Bacteria (*E.coli*) – orgs/100 mL	Mean (G) <1000 80thpercentile <2000	Mean (G) <1000 80thpercentile <2000	Mean <200 80thpercentile <400	Mean (G) <1000 80thpercentile <2000	Mean <1000 80thpercentile <2000	 90thpercentile <5000	Mean <1000 80thpercentile <2000	Mean <200 80thpercentile <400
pH – variation – range	 <± 0.5 6.5 – 8.5	 <± 1.0 6.0 – 8.5	 <± 0.5 6.5 – 8.5	 <± 1.0 6.0 – 8.5	 <± 0.5 6.5 – 8.5	 <± 1.0 6.0 – 9.0	 <± 1.0 5.0 – 9.0	 <± 0.5 6.5 – 8.5
Temperature – variation	 <± 2.0 ^{o}C	 <± 2.0 ^{o}C	 <± 2.0 ^{o}C	 <± 2.0 ^{o}C	 <± 0.5 ^{o}C	 <± 2.0 ^{o}C	 <± 2.0 ^{o}C	 <± 0.5 ^{o}C
Total Dissolved Solids (mg/L)	NL	90thpercentile <1000	NL	90thpercentile <1000	N <± 2%	90thpercentile <1000	N <± 10%	N <± 2%
Salinity – variation	<10%	NL	<10%	NL	NL	NL	NL	NL
Light penetration – Turbidity (FTU)	Median <20 90thpercentile <35	Qualitative	Median <20 90thpercentile <35	Median <25 90thpercentile <50	Median <25 90thpercentile <30	Median <50 90thpercentile <200	Median <25 90thpercentile <50	Median <30 90thpercentile <35
Toxicants (μg/L)	<T	<5T	<T	<5T	N + 0.2(T-N)	<5T	<5T	N + 0.2(T-N)
– As	<20	<100	<10	<100	T = 50	<100	<100	T = 50
– Cd	<6.0	<0.8	<3.0	<0.8	T = 0.4	<0.8	<0.8	T = 0.4
– Cr	<20	<20	<10	<20	T = 10	<20	<20	T = 10
– Cu	<10	<20	<5	<20	T = 10	<20	<20	T = 10
– Fe	<400	<2000	<200	<2000	T = 1000	<2000	<2000	T = 1000
– Pb	<20	<50	<10	<50	T = 25	<50	<50	T = 25
– Hg	<0.20	<0.10	<0.10	<0.10	T = 0.05	<0.10	<0.10	T = 0.05
– Ni	<40	<60	<20	<60	T = 30	<60	<60	T = 30
– Zn	<40	<250	<20	<250	T = 50	<250	<250	T = 50
Nutrients and Biostimulants	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Aesthetic Characteristics	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Suspended Solids (mg/L)	Median <25 90thpercentile <80	Median <25 90thpercentile <80	Median <25 90thpercentile <80	Median <25 90thpercentile <80	Median <20 90thpercentile <30	Median <50 90thpercentile <200	Median <25 90thpercentile <80	Median <10 90thpercentile <20
Settleable Matter	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative

G = Geometric mean

N = natural background level (no variation from)
T = threshold concentration of chronic sublethal effects (listed in SEPP)
NL = No Level set
Qualitative = no quantitative objective

Table AI.9. SEPP (Waters of Victoria) – Schedule F5. Waters of the Latrobe and Thomson River Basins and Merriman Creek Catchment (1996)

Objectives for Environmental Water Quality Indicators

Indicators	Objectives						
	A Reserves & Conservation Areas	**B Forests & Forestry Activities**	**C Mixed Forestry & Agricultural**	**D Agricultural**	**E Industrial Area of Latrobe Valley**	**F Natural Watercourses Training Irrigation**	**G Wetlands**
Dissolved Oxygen – mg/L – % saturation	 N N	 >8.0 >85%	 >7.0 >75%	 >6.0 >65%	 >5.0 >55%	 >5.0 >55%	 >6.0 >65%
Bacteria (*E.coli*) – orgs/100 mL	 N	 N	 Mean <200	 Mean <200	 Mean <200	 Mean <1000	 N
pH – variation – range	 N	 <± 0.5 5.5 – 8.0	 <± 0.7 5.5 – 8.0	 <± 1.0 6.0 – 8.5	 <± 1.0 6.0 – 8.5	 <± 1.0 6.0 – 8.5	 <± 0.5 6.0 – 8.5
Temperature – variation	 N	 90thpercentile ± 0.3 max <± 0.5	 90thpercentile ± 0.7 max <± 1.0	 90thpercentile ± 1.5 max <± 2.0	 90thpercentile ± 1.5 max <± 2.0	 90thpercentile ± 1.5 max <± 2.0	 90thpercentile ± 0.3 max <± 0.5
Salinity (mg/L) – variation (increase)	N	90thpercentile <200 max <300 <5%	90thpercentile <300 max <400 <10%	90thpercentile <400 max <500 <10%	90thpercentile <500[a] max <700[b] <10%	90thpercentile <700 max <1000[c]	N N
Turbidity (NTU)	N	Median <5 90thpercentile <10	Median <10 90thpercentile <20	Median <15 90thpercentile <30	Median <25 90thpercentile <50	Median <30 90thpercentile <60	N
Toxicants (μg/L) – As – Cd – Cr – Cu – Fe – Pb – Hg – Ni – Zn	N	<0.2T <10 <0.04–0.4[d] <2.0 <0.4–1.0[d] <200 <0.2-1.0[d] <0.02 <3–30[d] <1–10	<0.5T <25 <0.1-1.0[d] <5.0 <1.0-2.5[d] <500 <0.5-2.5[d] <0.05 <7.5–75[d] <2.5-25	<T <50 <0.2–2.0[d] <10 <2.0–5.0[d] <1000 <1.0–5.0[d] <0.1 <15–150[d] <5.0-50	<T <50 <0.2–2.0[d] <10 <2.0–5.0[d] <1000 <1.0–5.0[d] <0.1 <15–150[d] <5.0-50	<T <50 <0.2–2.0[d] <10 <2.0–5.0[d] <1000 <1.0 – 5.0[d] <0.1 <15–150[d] <5.0-50	<0.2T <10 <0.04– 0.4[d] <2.0 <0.4–1.0[d] <200 <0.2-1.0[d] <0.02 <3–30[d] <1–10
Nutrients and Biostimulants – Total P (mg/L) – Total N (mg/L)	 N N	 Median <0.015 90thpercentile <0.030 Median <0.60 90thpercentile <1.00	 Median <0.025 90thpercentile<0.045 Median <0.70 90thpercentile <1.20	 Median <0.040 90thpercentile <0.065 Median <0.80 90thpercentile <1.40	 Median <0.060 90thpercentile <0.100 Median <0.90 90thpercentile <1.60	 Median <0.070 90thpercentile <0.120 Median <1.00 90thpercentile <1.80	 N N
Aesthetic Characteristics – colour (Pt Co units)	 N	 N	 Median <60 90thpercentile <100	 Median <60 90th% <100	 Median <60 90th% <100	 Median <100 90th% <150	 N
Suspended Solids (mg/L)	N	Median <5 90thpercentile <10	Median <10 90thpercentile <20	Median <20 90thpercentile <40	Median <50 90thpercentile <90	Median <60 90thpercentile <100	N

N = natural background level (no variation from)
T = threshold concentration of chronic sublethal effects (ANZECC 1992)
(a) = Latrobe River upstream of Glengarry Rd where 90thpercentile <350
(b) = Latrobe River upstream of Glengarry Rd where max <400
(c) = Newry Ck and Nuntin Ck where max <1200
(d) = depending on the hardness of the water

Table AI.10. SEPP (Waters of Victoria) – Schedule F6. Waters of Port Phillip Bay (1997)

Objectives for Environmental Water Quality Indicators

Indicators	Objectives					
	Aquatic Reserves	**Corio**	**Hobsons**	**Werribee**	**Inshore**	**General**
Dissolved Oxygen – % sat'n (1 m below surface) – % sat'n (1 m above bottom)	 N N	 >90% >90%	 >90% >90%	 >90% >90%	 >90% >90%	 >90% 90th percentile >90%
Bacteria (*E.coli*) – orgs/100 mL	N	Mean <200 80th percentile <400	Mean <200 80th percentile <400	Mean <1000	Mean <14(a) Mean <200 80th percentile <400	Mean <14
pH – variation from background – range	 N N	 N ± 0.5 7.5 – 8.5	 N ± 0.5 7.5 – 8.5	 N ± 0.5 7.5 – 8.5	 N ± 0.5 7.5 – 8.5	 N ± 0.5 7.5 – 8.5
Temperature – variation from background	N	N ± 1.0°C	N ± 1.0°C	N ± 1.0°C	N ± 1.0°C	N ± 1.0°C
Light penetration – Secchi Depth (m) – attenuation of PAR (m^{-1})	 N N	 >3 90th percentile <0.45	 >2 90th percentile <0.50	 >3 90th percentile <0.45	 >3 90th percentile <0.45	 >4 90th percentile <0.35
Toxicants (μg/L) – As – Cd – Cr – Cu – Fe – Pb – Hg – Ni – Zn	N	<0.5T <3 <25.0 <5 <5.0 NL <5.0 <0.1 <15.0 <5	<0.5T <3 <25.0 <5 <5.0 NL <5.0 <0.1 <15.0 <10	<0.5T <3 <25.0 <5 <5.0 NL <5.0 <0.1 <15.0 <0.5	<0.5T <3 <0.15(a) <5 <5.0 NL <5.0 <0.1 <15.0 <5	<0.5T <3 <0.15 <5 <5.0 NL <5.0 <0.1 <15.0 <5
Salinity – variation	N	N ± 5%	N ± 5%	N ± 5%	N ± 5%	N ± 5%
Chlorophyll-*a* (μg/L)	N	Median <1.5 90th percentile <2.5	Median <2.5 90th percentile <4.0	Median <2.5 90th percentile <4.0	Median <1.5 90th percentile <2.5	Median <1.0 90th percentile <2.0

G = Geometric mean
(a) = in aquaculture zones
N = natural background level (no variation from)
T = threshold concentration of chronic sublethal effects (ANZECC 1992)
NL = No Level set

Table AI.11. SEPP (Waters of Victoria) – Schedule F7. Waters of the Yarra Catchment (1999)

Objectives for Environmental Water Quality Indicators

Indicators	Objectives						
	Aquatic Reserves	**Parks and Forests**	**Rural Eastern Waterways**	**Rural Western Waterways**	**Urban Waterways**	**Upper Estuary**	**Yarra Port**
Temperature – °C increase	N	<1	<2	<2	<2	<2	<2
pH – range – variation	N Nil	6.5 – 8.5 <0.5	6.0 – 8.5 <0.5	6.0 – 8.5 <0.5	6.0 – 8.5 <0.5	6.5 – 8.5 <0.5	6.5 – 8.5 <0.5
Salinity – mg/L – % variation	N Nil	<200 <10	<200[a]/ <500[b] <10	<1500 <25	<500[a]/<1000[b] <10[a]/<20[b]	NL NL	NL NL
Dissolved Oxygen – mg/L – % saturation	N N	>8.0 >85	>6.0 >80	>6.0 >60	>6.0 >60	>6.0 >60	>6.0 >60
Turbidity (NTU) – 50th% – 90th%	N N	<5 <10	<15 <30	<25 <80	<20[c]/<30[d]/<25[b] <50[c]/<80[d]/<80[b]	<30 <80	<20 <50
Suspended Solids – 50th% (mg/L) – 90th% (mg/L)	N N	<5 <10	<20 <40	<25 <90	<25[c]/<50[d]/<25[b]< 60[c]/<90[d]/<90[b]	<50 <90	<25 <60
Nutrients (mg/L) – total phosphorus – total nitrogen	N N	<0.03 <0.2	<0.05 <0.6	<0.05 <0.6	<0.08[a]/ <0.1[b] <0.9[a]/ <1.0[b]	NL NL	NL NL
Toxicants (μg/L)	N	<0.2T	<T	<T	<T	<T	<T
– As		<10.0	<50.0	<50.0	<50.0	<50.0	<50.0
– Cd		<0.04 – 0.4*	<0.2 – 2.0*	<0.2 – 2.0*	<0.2 – 2.0*	<2.0	<2.0
– Cr		<2.0	<10.0	<10.0	<10.0	<50.0	<50.0
– Cu		<0.4 – 1.0*	<2.0 – 5.0*	<2.0 – 5.0*	<2.0 – 5.0*	<5.0	<5.0
– Fe		<200[#]	<1000[#]	<1000[#]	<1000[#]	NL	NL
– Pb		<0.2 – 1.0*	<1.0 – 5.0*	<1.0 – 5.0*	<1.0 – 5.0*	<5.0	<5.0
– Ni		<3.0 – 30*	<15.0 – 150*	<15.0 – 150*	<15.0 – 150*	<15.0	<15.0
– Zn		<1.0 – 10[#]	<5.0 – 50[#]	<5.0 – 50[#]	<5.0 – 50[#]	<50.0	<50.0
– Mercury (Hg)		<0.01	<0.05	<0.05	<0.05	<0.05	<0.05
– Methylmercury		<0.0008	<0.004	<0.004	<0.004	<0.004	<0.004
– biomagnification		<TH	<TH	<TH	<TH	<TH	<TH
Taints	N	TC	TC	TC	TC	TC	TC
E.coli (orgs/100 mL)	N	<200	<200	<200	<200[a]/<1000[be]	<1000[e]	<1000

N = natural background level (no variation from)
T = national guideline concentration for protection of aquatic ecosystems (ANZECC 1992)
TC = threshold concentration of chemicals in water capable of tainting fish flesh and other aquatic organisms (ANZECC 1992)
TH = minimum risk concentrations required to protect consumers from toxicants accumulated in tissues of fish, crustacea and shellfish (ANZECC 1992)
a = objective for Yarra River main stream
b = objective for tributaries of the Yarra River
c = objective for urban waterways segment of Yarra River upstream of confluence with Diamond Creek
d = objective for urban waterways segment of Yarra River downstream of confluence with Diamond Creek
e = objective until 31 December 2002, when reverts to <200 organisms/ 100 mL
* = depending on the hardness of the water
[#] = provided iron not present as Fe(II)
NL = No Level set

Table AI.12. SEPP (Waters of Victoria) – Schedule F8. Waters of Western Port and Catchment (2001)
Objectives for Environmental Water Quality Indicators.

Indicators	Objectives						
	Marine		Freshwater				
	Entrances and North Arm	East Arm	Northern Hills	Peninsula	French Island	South Eastern Rural	Lowland and Phillip Island
Secchi Disk (metre)	Median >2.4 75th percentile >1.4	Median >0.7 75th percentile >0.4	NL	NL	NL	NL	NL
Turbidity (NTU)	NL	75th percentile <10	Median <5 75th percentile <10	Median <15 75th percentile <25	Median <15 75th percentile <25	Median <15 75th percentile <25	Median <15 75th percentile <25
Suspended Solids (mg/L)	Median <9 75th percentile <19	Median <30 75th percentile <90	Median <5 75th percentile <10	Median <20 75th percentile <30	Median <20 75th percentile <30	Median <20 75th percentile <30	Median <20 75th percentile <30
Total Phosphorus (mg/L)	NL	NL	<0.03	<0.05	<0.05	<0.05	<0.05
Total Nitrogen (mg/L)	NL	NL	<0.2	<0.6	<0.6	<0.6	<0.6
Dissolved Inorganic Nitrogen (μg/L)	Median <7 75th percentile <15	Median <20 75th percentile <43	NL	NL	NL	NL	NL
Dissolved Inorganic Phosphorus (μg/L)	Median <6 75th percentile <8	Median <7 75th percentile <10	NL	NL	NL	NL	NL
Chlorophyll-*a*	Median <1.6 75th percentile <2.1	Median <2.5 75th percentile <5.0	NL	NL	NL	NL	NL
E.coli (orgs/100 mL)	Mean <14(a) Mean <200(b)	Mean <200	Mean <200	Mean <400	Mean <400	Mean <400	Mean <200
Toxicants (μg/L) – As – Cd – Cu – Pb – Hg – Ni – Zn	 <3.0 <0.05 <1.0 <1.0 <0.005 <1.0 <2.0	 <5.0 <0.05 <2.0 <2.0 <0.01 <3.0 <5.0	N <10.0 <0.4 <1.0 <1.0 <0.02 <30.0 <10.0	T <50.0 <2.0 <5.0 <5.0 <0.1 <150.0 <50.0	T <50.0 <2.0 <5.0 <5.0 <0.1 <150.0 <50.0	T <50.0 <2.0 <5.0 <5.0 <0.1 <150.0 <50.0	T <50.0 <2.0 <5.0 <5.0 <0.1 <150.0 <50.0
Total Dissolved Solids – maximum (mg/L) – % variation	NL	NL	 <200 <N ± 10	 <500 <N ± 10	 <500 <N ± 10	 <500 <N ± 10	 <500 <N ± 10
Salinity (PSU) – variation	<N ± 1	<N ± 1	NL	NL	NL	NL	NL
Dissolved Oxygen – % saturation	 >90%	 >90%	 >85%	 >80%	 >80%	 >80%	 >80%
pH – variation – range	 <N ± 0.5 7.5 – 8.5	 <N ± 0.5 7.5 – 8.5	 <N ± 0.5 6.5 – 9.0	 <N ± 0.5 6.5 – 9.0	 <N ± 0.5 6.5 – 9.0	 <N ± 0.5 6.5 – 9.0	 <N ± 0.5 6.5 – 9.0
Temperature (°C) - variation	<N ± 1.0	<N ± 1.0	<N ± 2.0	<N ± 2.0	<N ± 2.0	<N ± 2.0	<N ± 2.0
Aesthetic Characteristics	No visible floating oil, grease, scum, litter or other objectionable matter, or odours or colours in waters						

N = natural background level
T = guideline concentration specified in ANZECC 1992
NL = No Level set
(a) objective for waters within designated aquaculture areas
(b) objective for waters outside designated aquaculture areas

Table AI.13. Default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems (ANZECC & ARMCANZ, 2000)

Guidelines use 20th percentiles for lower limits and 80th percentiles for upper limits

Indicator	Alpine River	Upland River	Lowland River	Lowland East Flowing Coastal River	Freshwater Lake	Wetland	Estuary	Marine
Chlorophyll-*a* (μg/L)	--	--	5	3	5	--	4	1
Total Phosphorus (μg P/L)	10	20	50	25	10	--	30	25
FRP (μg P/L)	5	15	20	20	5	--	5	10
Total Nitrogen (μg N/L)	100	250	500	350	350	--	300	120
NO_x (μg N/L)	15	15	40	40	10	--	15	5
NH_4 (μg N/L)	113	13	20	20	10	--	15	15
Dissolved Oxygen (% saturation)	90 - 110	90 - 110	85 - 110	85 - 110	90 - 100	--	80 - 110	90 - 110
pH (range)	6.5 - 7.5	6.5 - 7.5	6.5 - 8.0	6.5 - 8.0	6.5 - 8.0	--	7.0 - 8.5	8.0 – 8.4
	Ranges of default trigger values for EC, Turbidity and SPM. Values reflect high site-specific and regional variability							
EC (μS/cm)	30 - 350 (Vic. Alpine 30, eastern highlands 55, NSW rivers 350)		125 – 2200 (eastern highlands 125, western lowlands 2200, northern plains 2200)		20 - 30	--	--	
Turbidity (NTU)	2 – 25		6 - 50		1 - 20	--	0.5 - 10	
SPM (SS) (mg/L)	As for turbidity						As for turbidity	
	Trigger values for toxicants apply to typical slightly to moderately disturbed systems. Level of protection (95% of species)							
Toxicants (μg/L)								
– As	As(III) 24, As(V) 13						--	
– Cd	0.2 (see table AI.14)						0.7	
– Cr	Cr(III) 3.3 (see table AI.14), Cr(VI) 1.0						Cr(III) 27.4, Cr(VI) 4.4	
– Cu	1.4 (see table AI.14)						1.3	
– Pb	3.4 (see table AI.14)						4.4	
– Hg	0.06						0.1	
– Ni	11 (see table AI.14)						7.0	
– Zn	8.0 (see table AI.14)						15	

-- = no guideline

Table AI.14. Recommended guideline trigger values for metals in freshwaters of varying hardness (ANZECC & ARMCANZ, 2000)

(μg/L)	Soft 0–59 (mg/L as $CaCO_3$)	Moderate 60-119 (mg/L as $CaCO_3$)	Hard 120-179 (mg/L as $CaCO_3$)	Very Hard 180-240 (mg/L as $CaCO_3$)	Extremely Hard 400 (mg/L as $CaCO_3$)
Cd	0.2	0.54	0.84	1.14	2.0
Cr(III)[#]	3.3	8.25	12.2	16.2	27.7
Cu	1.4	3.5	5.5	7.3	12.6
Pb	3.4	13.6	25.8	40.1	90.8
Ni	11.0	27.5	42.9	57.2	99.0
Zn	8.0	20.0	31.2	41.6	72.0

[#] = Low reliability freshwater trigger value for Cr (III) and should only be used as an indicative interim working level

Table AI.15. Guideline values for recreational water quality and Aesthetics (ANZECC, 1992)

Indicator	Guideline
Physico-chemical	
Clarity	Not to be reduced by >20%.
pH	5.0 - 9.0
Bacteria (primary contact)	
faecal coliforms	150/100 mL
enterococci	35/100 mL
protozoans	0/100 mL
Bacteria (secondary contact)	
faecal coliforms	1,000/100 mL
enterococci	230/100 mL
Algae	
Algae	Contact discouraged if levels >15,000 - 20,000 cells/mL depending on algal species

Table AI.16. Australian Drinking Water Guidelines (NHMRC & ARMCANZ, 1996)

Indicator	Guideline
Physical	
Dissolved Oxygen	>85%
Hardness	60 – 200 mg/L $CaCO_3$
pH	6.5 – 8.5
Taste/Odour	Acceptable to most people
Temperature	No value set
Total Dissolved Solids	<500 mg/L
True Colour	<15 HU
Turbidity	<5 NTU
Inorganic	
Nitrate (as NO_3)	<50 mg/L
Nitrite (as NO_2)	<3 mg/L
Metals (mg/L)	
– As	<0.007 mg/L
– Cd	<0.002 mg/L
– Cr (VI)	<0.05 mg/L
– Cu	<2 (health), <1 (aesthetic) mg/L
– Pb	<0.01 mg/L
– Hg	<0.001 mg/L
– Ni	<0.02 mg/L
– Zn	<3 mg/L
Bacteria	
E.coli	0 organisms/100 mL
Total Coliforms	0 organisms/100 mL
Algae	
Blue-green	<1,000 cells/mL

Table AI.17. Agricultural water quality guidelines (ANZECC & ARMCANZ, 2000)

Indicator	Guideline
General	
pH	6–9 to limit corrosion and fouling of pumping, irrigation and stock water systems
For Irrigation Use	
Biological	
Algae	Excessive algal growth may indicate nutrient pollution of the water supply
Blue-green algae	Use current recommendations of government authorities for management of blooms
Faecal coliforms (cfu = colony forming units)	Median <10 cfu/100 mL raw human food crops in direct contact with water & consumed raw or unprocessed Median <1,000 cfu/100 mL raw human food crops not in direct contact with water or sold cooked or processed Median <100 cfu/100 mL pasture and fodder for dairy animals (no withholding period) Median <1000 cfu/100 mL pasture and fodder for dairy animals (5 day withholding period) and other grazing animals except pigs
Inorganic	
Salinity	Depends on crop tolerance
	Short-term trigger value — Long-term trigger value
Total Nitrogen	<25-125 (site specific) — <5 mg/L
Total Phosphorus	<0.8-12 (site specific) — <0.05 mg/L
Metals (mg/L)	Short-term trigger value — Long-term trigger value
–- As	<2.0 — <0.1
–- Cd	<0.05 — <0.01
– Cr	<1 — <0.1
– Cu	<5 — <0.2
– Pb	<5 — <2
– Hg	<0.002 — <0.002
– Ni	<2 — <0.2
– Zn	<5 — <2
For Livestock Use	
Biological	
Blue-green algae	Increased risk to livestock when cell counts exceed *Microcyctis* 11,500 cells/mL and/or microcystins exceed 2.3 μg/L
Faecal coliforms	Median <100 cfu/100 Ml
Inorganic	
Nitrate (as NO_3)	<1,500 mg/L (≡ <340 mg/L nitrate-N)
Nitrite (as NO_2)	<30 mg/L (≡ <9 mg/L nitrite-N)
TDS (mg/L)	<3,000 (poultry), <4,000 (dairy cattle), <5,000 (beef cattle), <6,000 (horses, pigs), <10,000 (sheep)
Metals	
–- As	<0.5 mg/L
–- Cd	<0.01 mg/L
–- Cr	<1 mg/L
–- Cu	<0.4 (sheep), <1 (cattle), <5 (pigs and poultry) mg/L
–- Pb	<0.1 mg/L
–- Hg	<0.002 mg/L
–- Ni	<1 mg/L
–- Zn	<20 mg/L

Table AI.18. Preliminary nutrient guidelines for Victorian inland streams during baseflow (EPA, 1995)

River Region	TP (mg/L)	TN (mg/L)
Highlands	0.020	0.150
Murray Foothills	0.030	0.200
Murray Plains	0.050	0.600
Southern and Isolated Foothills	0.030	0.200
Northwest Plains	0.050	0.900
Southwest	0.035	1.000
Southern Lowland-rural rivers and streams	0.050	0.600
Southern Lowland-urban rivers (interim)	0.080	0.900
Southern Lowland-urban rivers (long term)	0.050	0.600
Southern Lowland-urban tributaries (interim)	0.100	1.000
Southern Lowland-urban tributaries (long term)	0.030	0.200

Appendix II:
Victorian CMA and CaLP Regions and Drainage Basins

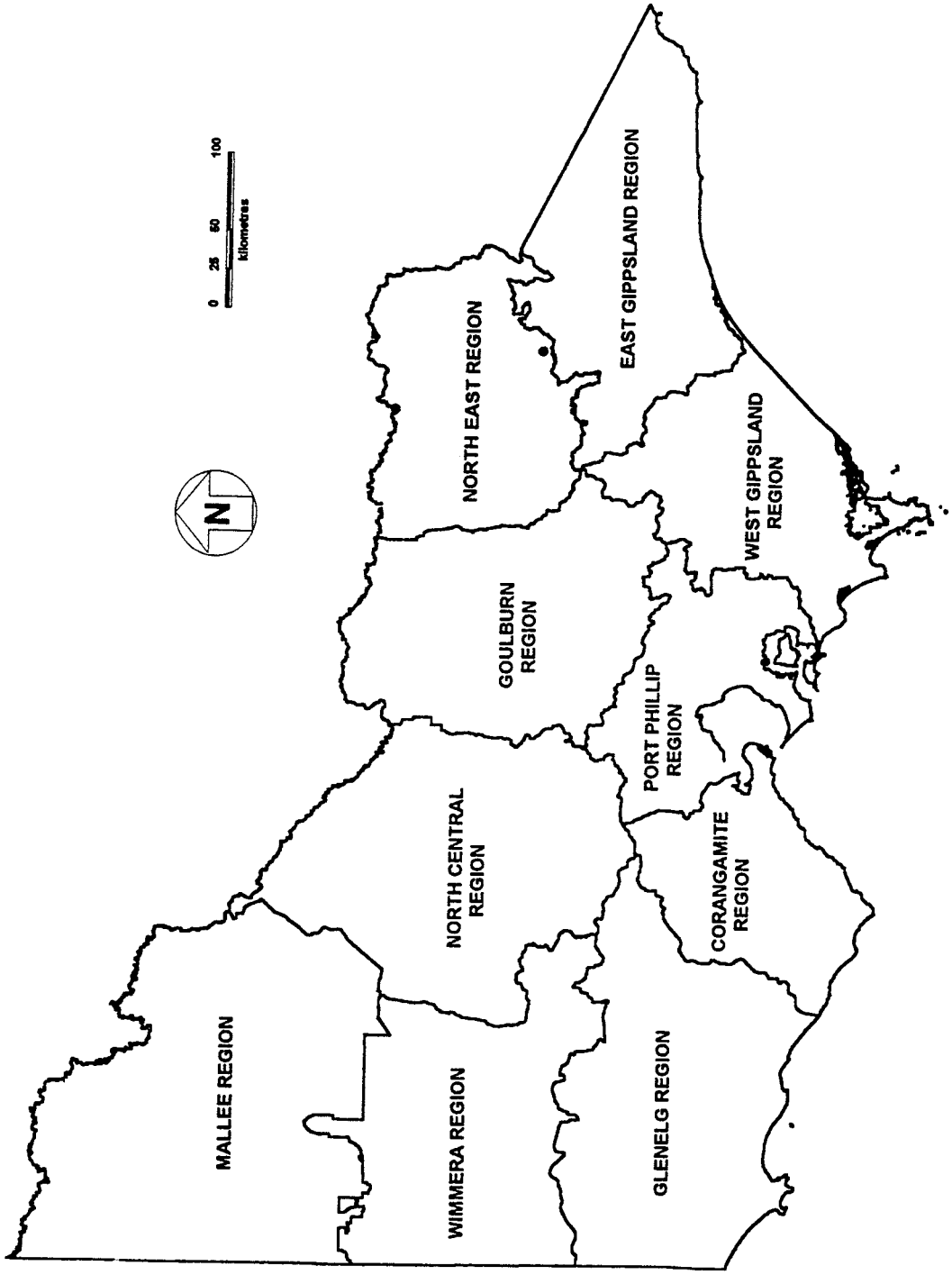


Figure AII.1. Catchment Management Authority (CMA) and Catchment and Land Protection (CaLP) regions of Victoria

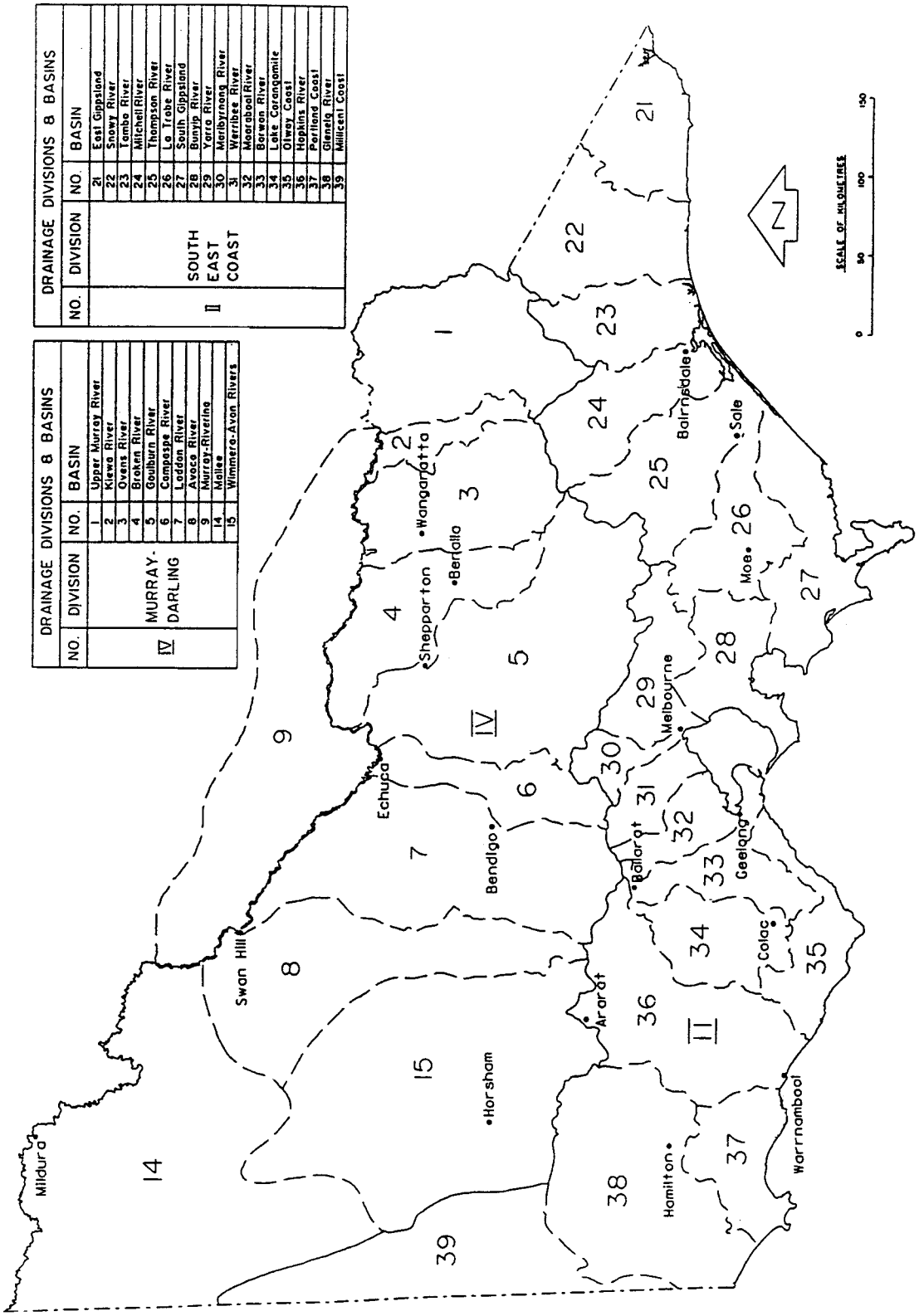


Figure AII.2. Victorian Drainage Basins

Appendix III:
Station Descriptions and Locations

Table AIII.1. CMA and CaLP Region abbreviations

Abbreviation	Region
Cor	Corangamite
EG	East Gippsland
Glg	Glenelg-Hopkins
GB	Goulburn-Broken
M	Mallee
NC	North Central
NE	North East
PP	Port Phillip
WG	West Gippsland
Wim	Wimmera

Table AIII.2. VWQMN Rivers and Streams station description and locations for stations monitored during 2002[2].

CMA Region	Station Number	Site Indicator	River	Description	Analysis	Latitude (deg. min)	Longitude (deg. min)
EG	221001	A	Genoa River	Rockton	F, L	37°08'	149°09'
EG	221201	B	Cann River	Weeragua	F, L	37°23'	149°12'
EG	221207	B	Errinundra River	Errinundra	F, L	37°27'	148°55'
EG	221208	A	Wingan River	Wingan Inlet National Park	F	37°41'	149°31'
EG	221210	A	Genoa River	The Gorge	F, L	37°25'	149°31'
EG	221211	A	Combienbar River	Combienbar	F, L	37°27'	148°59'
EG	221212	A	Bemm River	Princes Highway	F, L	37°37'	148°54'
EG	222200	C	Snowy River	Jarrahmond	F, L	37°41'	148°22'
EG	222202	E	Brodribb River	Sardine Creek	F, L	37°31'	148°33'
EG	222209	A	Snowy River	McKillop Bridge	F, L	37°5'	148°25'
EG	222217	A	Rodger River	Jacksons Crossing	F, L	37°25'	148°22'
EG	223202	C	Tambo River	Swifts Creek	F, L	37°16'	147°43'
EG	223204	A	Nicholson River	Deptford	F, L	37°36'	147°42'
EG	223213	A	Tambo River	d/s of Duggan Creek	F, L	37°00'	147°53'
EG	223214	A	Tambo River	u/s of Smith Creek	F, L	36°57'	147°56'
EG	224203	B	Mitchell River	Glenaladale	F, L	37°46'	147°22'
EG	224206	B	Wonnangatta River	Crooked River	F, L	37°25'	147°05'
EG	224213	A	Dargo River	Lower Dargo Road	F, L	37°30'	147°16'

[2] With respect to analysis, F denotes field parameters, L denotes laboratory parameters, I denotes major ions and M denotes metals. u/s = upstream, d/s = downstream. Site denoted with * were previously duplicated by EPA FSN program and were merged in 1997. For definition of site indicator see Section 1.2.1.

CMA Region	Station Number	Site Indicator	River	Description	Analysis	Latitude (deg. min)	Longitude (deg. min)
WG	225114	A	Thomson River	Whitelaws	F, L	37°43'	146°17'
WG	225201	A	Avon River	Stratford	F, L	37°58'	147°04'
WG	225204	D	Macalister River	1.8 km d/s of Lake Glenmaggie	F, L	37°54'	146°48'
WG	225209	A	Macalister River	Licola	F, L, I	37°38'	146°37'
WG	225210	B	Thomson River	The Narrows	F, L	37°54'	146°24'
WG	226005	A	La Trobe River	Thoms Bridge	F, L, I	38°10'	146°25'
WG	226222	A	La Trobe River	near Noojee (u/s Ada River Junction)	F, L, I	37°53'	145°53'
WG	226226	A	Tanjil River	Tanjil Junction	F	38°01'	146°12'
WG	226228	A	La Trobe River	Rosedale (main stream)	F, L	38°09'	146°47'
WG	226402	A	Moe Drain	Trafalgar East	F, L	38°10'	146°12'
WG	226408	B	Morwell River	Yallourn	F, L	38°12'	146°22'
WG	227200	B	Tarra River	Yarram	F, L	38°33'	146°41'
WG	227202	A	Tarwin River	Meeniyan	F, L	38°35'	146°00'
WG	227211	B	Agnes River	Toora	F, L	38°39'	146°22'
WG	227225	A	Tarra River	Fischers	F, L	38°28'	146°32'
PP	227231	A	Bass River	Glen Forbes South	F, L	38°28'	146°31'
WG	227237	B	Franklin River	Toora	F, L	38°38'	146°19'
WG	227240	A	Merriman Creek	Prospect Rd (Giffard-Seaspray Rd)	F	38°22'	147°10'
PP	230202*	B	Jackson Creek	Sunbury	F, L,	37°35'	144°45'
PP	230205*	A	Deep Creek	Bulla (d/s of Emu Creek Junction)	F, L,	37°38'	144°48'
PP	230209	A	Barringo Creek	Barringo (u/s of diversion)	F, L	37°24'	144°38'
PP	230232	A	Deep Creek	Bolinda	F, L	37°25'	144°49
PP	231204*	A	Werribee River	Werribee (Diversion Weir)	F, L, M	37°53'	144°39'
PP	231213	A	Lerderderg River	Sardine Creek (O'Briens Crossing)	F, L	37°30'	144°22'
PP	231231	A	Toolern Creek	Melton South	F, L	37°44'	144°35'
PP	231234	A	Parwan Creek	Parwan	F, L	37°43'	144°25'
PP	232200	C	Little River	Little River	F, L	37°58'	144°30'
Cor	232202	A	Moorabool River	Batesford	F, L	38°06'	144°17'
Cor	232204	B	Moorabool River	Morrisons	F, L	37°47'	144°07'
Cor	232210	A	Moorabool River	Lal Lal	F, L	37°39'	144°03'
Cor	233200	B	Barwon River	Pollocksford	F, L	38°09'	144°11'
Cor	233211	A	Birregurra Creek	Ricketts Marsh	F, L	38°18'	146°51'
Cor	233214	A	Barwon River (east branch)	Forrest (u/s of tunnel)	F, L	38°32'	143°46'
Cor	233215	A	Leigh River	Mount Mercer	F, L	37°49'	143°55'
Cor	233218	B	Barwon River	Inverleigh	F, L	38°09'	143°60'
Cor	233224*	A	Barwon River	Ricketts Marsh	F, L, M	38°20'	143°50'
Cor	233228	A	Boundary Creek	Yeodene	F, L	38°26'	143°43'
Cor	234201	B	Woady Yaloak River	Cressy (Yarima)	F, L	38°01'	143°39'
Cor	234203	A	Pirron Yallock Creek	Pirron Yallock u/s of Hwy	F, L	38°21'	143°25'
Cor	235202	C	Gellibrand River	upper Gellibrand	F, L	38°34'	143°39'
Cor	235203	B	Curdies River	Curdie	F, L	38°27'	142°58'
Cor	235204	A	Little Aire Creek	Beech Forest	F	38°39'	143°32'
Cor	235205	B	Arkins Creek (west)	Wyelangta	F, L	38°39'	143°27'
Cor	235209	B	Aire River	Beech Forest	F, L	38°40'	143°35'
Cor	235211	A	Kennedy's Creek	Kennedy's Creek	F, L	38°35'	143°15'
Cor	235216	B	Cumberland River	Lorne	F, L	38°34'	143°57'
Cor	235224	A	Gellibrand River	Burrupa	F, L	38°42'	143°15'

CMA Region	Station Number	Site Indicator	River	Description	Analysis	Latitude (deg. min)	Longitude (deg. min)
Cor	235227	A	Gellibrand River	Bunkers Hill	F, L	38°32'	143°29'
Cor	235234	A	Love Creek	Gellibrand	F, L	38°29'	143°34'
Cor	235237	A	Scotts Creek	Curdie (Digneys Bridge)	F, L	38°27'	142°59'
Glg	236215	A	Burrumbeet Creek	Lake Burrumbeet	F, L	37°32'	143°40'
Glg	236216*	A	Mount Emu Creek	Taroon (Ayrford Road bridge)	F, L, M	38°18'	142°53'
Glg	237200	B	Moyne River	Toolong	F, L	38°19'	142°14'
Glg	237207	A	Surry River	Heathmere	F, L	38°15'	141°40'
Glg	238202*	B	Glenelg River	Sandford	F, L, M	37°37'	141°26'
Glg	238204	C	Wannon River	Dunkeld	F, L	37°38'	141°20'
Glg	238205	C	Glenelg River	Rocklands Reservoir	F	37°14'	141°57'
Glg	238206	B	Glenelg River	Dartmoor	F, L	37°56'	141°17'
Glg	238208	A	Jimmy Creek	Jimmy Creek	F, L	37°23'	142°31'
Glg	238223	A	Wando River	Wando Vale	F, L	37°30'	141°25'
Glg	238224	A	Glenelg River	Fulhams Bridge	F, L	37°09'	141°51'
Glg	238228*	A	Wannon River	Henty	F, L, M	37°39'	141°30'
Glg	238231	A	Glenelg River	Big Cord	F, L	37°19'	142°22'
EG	401203	A	Mitta Mitta River	Hinnomunjie	F, L	36°57'	147°36
NE	401211	A	Mitta Mitta River	Colemans	F, L	36°32'	147°37'
NE	401212	A	Nariel Creek	Upper Nariel	F, L	36°27'	147°50'
EG	401215	C	Morass Creek	Uplands	F	36°52'	147°42'
NE	401216	A	Big River	Joker Creek	F, L	36°57'	147°28'
EG	401226	A	Victoria River	u/s of Falls	F, L	37°05'	147°27'
NE	402203	A	Kiewa River	Mongans Bridge	F, L	36°36'	147°06'
NE	402204	A	Yackandandah Creek	Osbornes Flat	F, L	36°18'	146°54'
NE	402222	A	Kiewa River	Kiewa (main stream)	F, L	36°15'	147°01'
NE	402223	A	Kiewa River (west branch)	u/s of offtake	F, L	36°47'	147°09'
NE	403205*	C	Ovens River	Bright	F, L, M	36°44'	146°57'
NE	403210	B	Ovens River	Myrtleford	F, L	36°34'	146°42'
NE	403213	A	Fifteen Mile Creek	Greta South	F, L	36°37'	146°15'
NE	403217	B	Rose River	Matong North	F, L	36°60'	146°35'
NE	403223	A	King River	Docker Road Bridge	F, L	36°31'	146°23'
NE	403228	B	King River	Lake William Hovell	F	36°55'	146°24'
NE	403230	A	Ovens River	Rocky Point	F, L, I	36°32'	146°40'
NE	403244	A	Ovens River	Harrietville	F, L, I	36°52'	147°04'
GB	404206	B	Broken River	Moorngag	F, L	36°48'	146°01'
GB	404207	A	Holland Creek	Kelfeera	F, L	36°37'	146°03'
GB	404214	A	Broken Creek	Katamatite	F, L	36°06'	145°41'
GB	404216	A	Broken River	Goorambat (Casey Weir)	F, L	36°29'	145°56'
GB	404224	B	Broken River	Gowangardie (Weir)	F, L	36°26'	145°40'
GB	405200	A	Goulburn River	Murchison	F, L	36°37'	145°13'
GB	405203	C	Goulburn River	Eildon	F, L, I	37°15'	145°54'
GB	405204	C	Goulburn River	Shepparton	F, L	36°23'	145°24'
GB	405205	A	Murrindindi River	Murrindindi above "Colwells"	F, L, I	37°25'	145°34'
GB	405209	B	Acheron River	Taggerty	F, L, I	37°19'	145°43'
GB	405212	D	Sunday Creek	Tallarook	F, L	37°06'	145°03
GB	405214	A	Delatite River	Tonga Bridge	F, L	37°09'	146°08'
GB	405219	A	Goulburn River	Dohertys	F, L, I	37°20'	146°08'
GB	405231	A	King Parrot Creek	Flowerdale	F, L	37°21'	145°17'
GB	405234	B	Seven Creeks	d/s of Polly McQuinn Weir	F, L	36°53'	145°40'

CMA Region	Station Number	Site Indicator	River	Description	Analysis	Latitude (deg. min)	Longitude (deg. min)
GB	405237	A	Seven Creeks	d/s of Euroa	F, L	36°46'	145°35'
GB	405240	A	Sugarloaf Creek	Ash Bridge	F, L	37°04'	145°03'
GB	405246	A	Castle Creek	Arcadia	F, L	36°36'	145°21'
GB	405251	A	Brankeet Creek	Ancona	F, L	36°59'	145°47'
GB	405264	A	Big River	d/s Frenchman Creek Junction	F, L	37°31'	146°05'
NC	406207	C	Campaspe River	Eppalock	F, L	36°51'	144°32
NC	406208	B	Campaspe River	Ashbourne	F, L	37°23'	144°27'
NC	406213*	C	Campaspe River	Redesdale	F, L, M	37°01'	144°33'
NC	406214	A	Axe Creek	Longlea	F, L	36°47'	144°26'
NC	406215	A	Coliban River	Lyal	F, L	36°58'	144°30'
NC	406224	A	Mt.Pleasant Creek	Runnymede	F, L	36°33'	144°38'
NC	406235	A	Wild Duck Creek	u/s Heathcote-Mia Mia Rd	F, L	36°57'	144°40'
NC	407203	B	Loddon River	Laanecoorie	F, L	36°50'	143°50'
NC	407214	A	Creswick Creek	Clunes	F	37°18'	143°47'
NC	407215*	C	Loddon River	Newstead	F, L, M	37°08'	144°05'
NC	407220	A	Bet Bet Creek	Norwood	F	36°60'	143°38'
NC	407221	B	Jim Crow Creek	Yandoit	F, L, I	37°12'	144°6'
NC	407229	A	Loddon River	Serpentine Weir	F, L, I	36°26'	143°57'
NC	407236	B	Mt. Hope Creek	Mitiamo	F, L	36°10'	144°17'
NC	407255	B	Bendigo Creek	Huntly	F, L	36°28'	144°22'
NC	408200*	A	Avoca River	Coonooer	F, L, M	36°29'	143°19'
NC	408202*	A	Avoca River	Amphitheatre	F, L, M	37°11'	143°25'
NC	408203	B	Avoca River	Quambatook	F, L	35°55'	143°31
Wim	415200*	D	Wimmera River	Horsham	F, L, M	36°44'	142°09'
Wim	415201	B	Wimmera River	Glenorchy	F, L	36°55'	142°39'
Wim	415203	D	Mount William Creek	Lake Lonsdale (tail gauge)	F	37°02'	142°35'
Wim	415207	C	Wimmera River	Eversley	F, L	37°11'	143°11'
NC	415220	B	Avon River	Wimmera Highway	F, L	36°39'	142°59'
Wim	415237	A	Concongella Creek	Stawell	F	37°02'	142°49'
Wim	415246*	A	Wimmera River	Lochiel Railway Bridge Crossing	F, L, M	36°45'	142°08'
Wim	415251	A	MacKenzie Creek	MacKenzie Creek	F, L	36°25'	142°11'
NC	415257	A	Richardson River	u/s of Donald	F, L	36°25'	142°59'
NC	415259	A	Richardson River	Banyena	F, L	36°00'	140°00'

Table AIII.3. EPA Fixed Site Network site descriptions and locations for sites monitored during 2002

Region	Authority	Program	Site No.	Description	Latitude	Longitude
Cor	EPA	Lakes	0220#	Lake Colac	38° 17'	143° 36'
Glg	EPA	Lakes	1234#	Lake Burrumbeet	37° 30'	143° 38'
Cor	EPA	Lakes	1606	Lake Colongulac	38° 11'	143° 10'
Cor	EPA	Lakes	1707#	Lake Bullen Merri	38° 15'	143° 07'
Cor	EPA	Lakes	1810#	Lake Purrumbete	38° 17'	143° 14'
GB	EPA	Rivers	0529	Goulburn River @ Trawool	37° 06'	145° 12'
NC	EPA	Rivers	0705	Loddon River @ Appin	35° 55'	143° 52'
PP	EPA	Rivers	3120	Werribee River @ Cobbledick Ford	37° 47'	144° 35'
PP	EPA	Rivers	3133	Werribee River below Werribee Gorge	37° 41'	144° 25'
PP	EPA	Rivers	3135	Werribee River @ Diversion Weir u/s Bacchus Marsh	37° 41'	144° 23'
Cor	EPA	Rivers	3361	Barwon River @ Queens Park, Geelong	38° 09'	144° 19'
Glg	EPA	Rivers	3676*	Hopkins River @ Hopkins Falls	38° 20'	142° 38'
Glg	EPA	Rivers	3685	Hopkins River @ Framlingham	38 ° 15'	142◦ 42'
PP	MW	Rivers	2904	Yarra River @ Maroondah Highway, Healesville	37° 41'	145° 29'
PP	MW	Rivers	2916	Yarra River @ Don Road, Launching Place	37° 47'	145° 35'
PP	MW	Rivers	3030	Maribyrnong River @ Brimbank Park Ford, Keilor	37° 44'	144° 50'
PP	MW	Rivers	4940*	Yarra River @ Chandler Highway, Kew	37° 47'	145° 01'
PP	MW	Rivers	4991*	Yarra River @ Warrandyte Bridge, Warrandyte	37° 44'	145° 13'
PP	MW	Rivers	4992	Yarra River @ Spadonis Reserve, Coldstream	37° 41'	145° 21'
PP	MW	Rivers	5254	Mordialloc Creek @ Wells Road, Mordialloc	38° 01'	145° 06'
PP	MW	Rivers	5502	Kororoit Creek @ Racecourse Road, Altona	37° 51'	144° 51'
PP	MW	Rivers	5509	Kororoit Creek @ Millicent Drive, Deer Park	37° 46'	144° 46'
PP	MW	Rivers	5635	Mile Creek @ Cheltenham Road, Keysborough	37° 59'	145° 11'
PP	MW	Rivers	5652	Dandenong Creek @ Pillars Crossing, Dandenong South	38 ° 02'	145° 11'
PP	MW	Rivers	5654	Dandenong Creek @ Stud Road, Dandenong North	37° 57'	145° 14'
PP	MW	Rivers	5681	Patterson River @ National Watersports Centre Outlet, Bangholme	38° 04'	145° 09'
PP	MW	Rivers	6070	Maribyrnong River @ Canning Street Ford, Avondale Heights	37° 46'	144° 51'

Site denoted with * were previously duplicated by VWQMN program and were merged in 1997. Lake sites denoted by # were previously duplicated by VWQMN lakes program and were merged in 1997. EPA = Environment Protection Authority. MW = Melbourne Water.

Table AIII.4. Melbourne Water station descriptions and locations for stations monitored in 2002

Region	Authority	Program	Site No.	Description	Latitude	Longitude
PP	MW	Rivers	AM007	Eumemmerring Creek @ Worsley Road, Dandenong	38° 03'	145° 11'
PP	MW	Rivers	AM010	Kananook Creek @ Wells Street, Frankston	38° 09'	145° 07'
PP	MW	Rivers	AM014	Dandenong Creek @ Boronia Road, Wantirna	37° 51'	145° 13'
PP	MW	Rivers	AM032	Hallam Valley Contour Drain @ South Gippsland Hwy, Hampton Park	38° 01'	145° 14'
PP	MW	Rivers	AM055	Corhanwarrabul Creek @ Wellington Road, Rowville	37° 55'	145° 12'
PP	MW	Rivers	AM085	Dandenong Creek upstream Sheffield Road, Doongalla Forest	37° 51'	145° 20'
PP	MW	Rivers	AM094	Toomuc Creek @ Princes Highway, Pakenham	38° 04'	145° 28'
PP	MW	Rivers	AM119	Cardinia Creek @ Ballarto Road, Cardinia	38° 09'	145° 26'
PP	MW	Rivers	AM120	Deep Creek @ Ballarto Road, Rythdale	38° 09'	145° 27'
PP	MW	Rivers	AM121	Merricks Creek @ end Bridge Street (Beach Road), Merricks	38° 24'	145° 07'
PP	MW	Rivers	AM122	Warrangine Creek d/s of Frankston-Flinders Rd, Hastings	38° 19'	145° 11'
PP	MW	Rivers	AM124	Watsons Creek @ Dandenong-Hastings Rd, Somerville	38° 14'	145° 13'
PP	MW	Rivers	AM127	Lang Lang River u/s Drouin-Poowong Rd, Athlone	38° 14'	145° 47'
PP	MW	Rivers	AM129	Bunyip Main Drain @ Iona Gauging Station	38° 08'	145° 41'
PP	MW	Rivers	AM131	Tarago River @ Morrisons Road, Labertouche	38° 05'	145° 46'
PP	MW	Rivers	AM148	Lang Lang River @ South Gippsland Highway, Lang Lang	38° 15'	145° 33'
PP	MW	Rivers	AM150	Yallock Outfall @ South Gippsland Highway, Monomeith	38° 13'	145° 30'
PP	MW	Rivers	AM151	Balcombe Creek @ Uralla Drive, Mt Martha	38° 16'	145° 02'
PP	MW	Rivers	AM161	Chinamans Creek @ Eastborne Road, Rosebud West	38° 22'	144° 53'
PP	MW	Rivers	AM162	Main Creek @ Boneo Road, Flinders	38° 29'	144° 56'
PP	MW	Rivers	AM166	Elster Creek @ Cochrane Street, Elwood	37° 54'	144° 60'
PP	MW	Rivers	AM177	Dunns Creek @ Marine Drive, Safety Beach	38° 19'	144° 59'
PP	MW	Rivers	WPBR01	Bunyip River @ North Labertouche Road, Labertouche	37° 59'	145° 45'
PP	MW	Rivers	WPBR02	Bunyip River d/s Cannibal Creek @ farm bridge, Longwarry North	38° 05'	145° 45'
PP	MW	Rivers	WPBR04	Bunyip River @ Healesville Koo-Wee-Rup Rd, Koo-Wee-Rup	38° 12'	145° 29'
PP	MW	Rivers	WPCC01	Cardinia Creek u/s Chadwick Road ford, Upper Beaconsfield	37° 59'	145° 23'
PP	MW	Rivers	WPTC02	Toomuc Creek @ Ballarto Road, Rythdale	38° 09'	145° 27'
PP	MW	Rivers	LY06	Merri Creek @ Roseneath Street, Yarra Bend	37° 48'	145° 00'
PP	MW	Rivers	LY07	Moonee Ponds Creek @ Mt Alexander Road, Flemington	37° 47'	144° 56'
PP	MW	Rivers	LY08	Yarra River @ Princes Bridge, South Melbourne	37° 49'	144° 58'
PP	MW	Rivers	UY01	Watts River @ Healesville-Kinglake Road, Healesville	37° 39'	145° 30'
PP	MW	Rivers	UY04	Wandin Yallock Creek @ Killara Road via Sunnyside Road, Gruyere	37° 45'	145° 29'
PP	MW	Rivers	UY09	Woori Yallock Creek @ Warburton Hwy, Woori Yallock	37° 47'	145° 30'
PP	MW	Rivers	UY11	Woori Yallock Creek @ Macclesfield-Woori Yallock Road, Yellingbo	37° 49'	145° 30'
PP	MW	Rivers	UY12	Cockatoo Creek @Tschampions Road, Macclesfield	37° 53'	145° 32'
PP	MW	Rivers	UY35	Little Yarra River @ Corduroy Road, Upstream of	37° 47'	145° 36'

Region	Authority	Program	Site No.	Description	Latitude	Longitude
				Bridge, Yarra Junction		
PP	MW	Rivers	UY38	Yarra River @ Dee Road Bridge, Millgrove	37° 45'	145° 39'
PP	MW	Rivers	MA1081	Steele Creek @ Rose Avenue, Niddrie	37° 45'	144° 53'
PP	MW	Rivers	MD05	Gardiners Creek d/s of junction with SE Freeway & Glenferrie Rd, Hawthorn	37° 50'	145° 02'
PP	MW	Rivers	MY02	Darebin Creek @ Clark Road Footbridge, Alphington	37° 47'	145° 02'
PP	MW	Rivers	MY05	Koonung Creek @ Bulleen Road, Bulleen	37° 47'	145° 05'
PP	MW	Rivers	MY07	Plenty River @ Henty Road Bridge, Lower Plenty	37° 44'	145° 06'
PP	MW	Rivers	MY10	Diamond Creek @ Main Road, Eltham	37° 44'	145° 09'
PP	MW	Rivers	MY12	Mullum Mullum Creek @ Deep Creek Reserve, Warrandyte	37° 45'	145° 11'
PP	MW	Rivers	MY15	Andersons Creek @ Everard Drive Bridge, Warrandyte	37° 45'	145° 12'
PP	MW	Rivers	MY18	Brushy Creek @ Lower Homestead Road Bridge, Wonga Park	37° 44'	145° 17'
PP	MW	Rivers	MY19	Jumping Creek @ Jumping Creek Road Bridge, Wonga Park	37° 44'	145° 14'
PP	MW	Rivers	MY21	Watsons Creek @ Henley Road, Kangaroo Ground	37° 42'	145° 16'
PP	MW	Rivers	MY25	Ruffey Creek @ Parker Street, Templestowe	37° 46'	145° 07'
PP	MW	Rivers	MY26	Merri Creek @ Summerhill Road, Craigieburn	37° 34'	144° 58'
PP	MW	Rivers	MY27	Plenty River @ Kurrak Rd, South Morang	37° 39'	145° 06'
PP	MW	Rivers	MY28	Arthurs Creek @ Burkes bridge, Hurstbridge	37° 37'	145° 12'
PP	MW	Rivers	MY29	Diamond Creek @ Strathhaven Road, Cottles Bridge	37° 37'	145° 13'
PP	MW	Rivers	MY30	Olinda Creek @ Macintyre Lane, Coldstream	37° 42'	145° 22'
PP	MW	Rivers	MY31	Stringybark Creek @ Melba Hwy, Yerring	37° 41'	145° 23'
PP	MW	Rivers	MY32	Steels Creek @ Yarra Glen - Healesville Rd, Yarra Glen	37° 40'	145° 23'
PP	MW	Rivers	ST01	Stony Creek @ Bena Street, Yarraville	37° 50'	144° 53'
PP	MW	Rivers	SK5828	Skeleton Creek @ Ayr Street, Laverton	37° 52'	144° 46'

Table AIII.5. Major Storage Operational Monitoring Program station descriptions and locations for stations monitored in 2002

CMA Region	Station No.	Description	Storage Manager
Glg	238236	Rocklands Reservoir	Wimmera Mallee Water
Glg	238237	Moora Moora	Wimmera Mallee Water
NE	401224	Lake Dartmouth	Goulburn Murray Water
NE	403234	Lake William Hovell	Goulburn Murray Water
NE	403235	Lake Buffalo	Goulburn Murray Water
GB	404218	Lake Nillahcootie	Goulburn Murray Water
GB	404219	Lake Mokoan	Goulburn Murray Water
GB	405254	Lake Eildon at Bonnie Doon	Goulburn Murray Water
GB	405258	Lake Eildon Outlet Tower	Goulburn Murray Water
GB	405259	Lake Nagambie	Goulburn Murray Water
GB	405260	Waranga Basin	Goulburn Murray Water
GB	405601	Greens Lake	Goulburn Murray Water
NC	406219	Lake Eppalock	Goulburn Murray Water
NC	407240	Laanecoorie Reservoir	Goulburn Murray Water
NC	407241	Cairn Curran Reservoir	Goulburn Murray Water
NC	407244	Tullaroop Reservoir	Goulburn Murray Water
NC	407603	Hepburns Lagoon	Goulburn Murray Water
NC	407604	Newlyns Reservoir	Goulburn Murray Water
GB	409216	Yarrawonga Weir	Murray-Darling Basin Commission
Wim	415202	Lake Wartook	Wimmera Mallee Water
Wim	415227	Lake Lonsdale	Wimmera Mallee Water
Wim	415229	Lake Bellfield	Wimmera Mallee Water
Wim	415606	Dock Lake	Wimmera Mallee Water
Wim	415607	Pine Lake	Wimmera Mallee Water
Wim	415608	Taylors Lake	Wimmera Mallee Water
NC	415609	Lake Batyo Catyo	Wimmera Mallee Water
Wim	415610	Lake Fyans	Wimmera Mallee Water
Wim	415612	Green Lake	Wimmera Mallee Water
Wim	415620	Toolondo Reservoir	Wimmera Mallee Water

Table AIII.6. MDBC Physico-Chem Baseline Monitoring station descriptions and locations, classes and authorities for stations monitored in 2002

Stations marked with * were previously duplicated by EPA FSN sites and were merged in 1997.
Class indicates which parameters are routinely monitored (as listed in Appendix IV).

Victorian CMA Region	Authority	Station	Description	Class	Victorian Latitude	Victorian Longitude
NE	WES	401201	River Murray at Jingellic	2	35°56’	147°43’
NE	WES	401204	Mitta Mitta River at Tallandoon	2	36°25’	147°14’
NE	WES	402205	Kiewa River at Bandiana	2	36°08’	146°57’
NE	WES	403241*	Ovens River at Peechelba East	2	36°10’	146°14’
GB	WES	404210	Broken Creek at Rices Weir	2	35°58’	144°58’
GB	WES	405232*	Goulburn River at McCoys Bridge	2	36°10’	145°07’
NC	WES	406202*	Campaspe River at Rochester	2	36°22’	144°42’
NC	WES	407202	Loddon River at Kerang	2	35°42’	143°55’
NC	WES	407209	Gunbower Creek at Koondrook	2	35°40’	144°07’
NC	WES	407252	Barr Creek at Capels Crossing	2	35°36’	142°56’
NC	WES	409005	River Murray at Barham	2	35°38’	144°07’
NE	WES	409011	Lake Hume at Dam Wall	2	34°00’	147°00’
NE	WES	409016	River Murray at Heywoods	2	36°05’	146°57’
M	WES	409034	Wakool River at Kyalite	2	34°53’	143°29’
NC	WES	409204	River Murray d/s Swan Hill	2	35°19’	143°34’
NC	WES	409207	River Murray d/s Torrumbarry Weir	2	35°59’	144°28’
M	WES	414200	River Murray d/s Wakool Junction	4	34°51’	143°20’
M	WES	414204	River Murray at Red Cliffs	4	34°18’	142°14’
State	**Authority**	**Station**	**Description**	**Class**		
NSW	DLWC	409025	River Murray d/s Yarrawonga Weir	2	-	-
NSW	DLWC	410130	Murrumbidgee River at Balranald	2	-	-
NSW	DLWC	410134	Billabong Creek at Darlot	3	-	-
NSW	DLWC	414203	River Murray at Euston Weir	2	-	-
NSW	DLWC	414206	River Murray at Merbein	2	-	-
NSW	DLWC	425007	Darling River at Burtundy	2	-	-
NSW	DLWC	425012	Darling River at Weir 32	3	-	-
SA	SAW	426200	River Murray d/s Rufus River	4	-	-
SA	SAW	426501	River Murray at Lock 9	2	-	-
SA	SAW	426512	River Murray at Lock 5	2	-	-
SA	SAW	426516	River Murray at Lock 3	2	-	-
SA	SAW	426522	River Murray at Murray Bridge	2	-	-
SA	SAW	426524	Lake Alexandrina at Milang	2	-	-
SA	SAW	426539	River Murray at Waikerie	4	-	-
SA	SAW	426551	River Murray at Tailem Bend	2	-	-
SA	SAW	426553	Lake Victoria	2	-	-
SA	SAW	426554	River Murray at Morgan	1	-	-

WES = WATER ECOscience
DLWC = Department of Land and Water Conservation
SAW = South Australia Water

Appendix IV:
Parameters Monitored

Table AIV.1. Parameters currently monitored as part of the VWQMN program

Field Parameters		Laboratory Parameters	
Electrical Conductivity (EC) (μS/cm)		Colour (Filt.) (Pt/Co Units)	
Turbidity (NTU)		Filterable Reactive Phosphorus (FRP) (mg/L P)	
pH (pH Units)		Total Phosphorus (TP) (mg/L P)	
Water Temperature (^{0}C)		Nitrates and Nitrites (NO_x) (mg/L N)	
Dissolved Oxygen (mg/L)		Total Kjeldahl Nitrogen (TKN) (mg/L N)	
Gauge Height (m)		Suspended Solids (SS) (mg/L)	
Discharge (ML/day)			
Metals		**Major Ions**	
Arsenic (As) (mg/L)	Lead (Pb) (mg/L)	Sodium (Na)	Potassium (K)
Cadmium (Cd) (mg/L)	Nickel (Ni) (mg/L)	Magnesium (Mg)	Chloride (Cl)
Chromium (Cr) (mg/L)	Zinc (Zn) (mg/L)	Alkalinity ($CaCO_3$)	pH
Copper (Cu) (mg/L)		Sulphate (SO_4)	Electrical Conductivity (EC)
		Calcium (Ca)	

Table AIV.2. Parameters monitored as part of the Major Storages Operational Monitoring Program

Field parameters	Laboratory parameters
Electrical Conductivity (EC μS/cm)	Total Phosphorus (TP) (mg/L P)
pH (pH units)	Filterable Reactive Phosphorus (FRP) (mg/L P)
Turbidity (NTU)	Total Kjeldahl Nitrogen (TKN) (mg/L N)
	Nitrates and Nitrites (NO_x) (mg/L N)
	Chlorophyll-*a* (CHLA) (μg/L)
	Total Nitrogen (TN) (mg/L N) - calculated using NO_x and TKN
	Phaeophytin (PHAO) (μg/L)

Table AIV.3. Parameters monitored as part of the EPA Fixed Sites Network

Field Parameters	Program
Water Temperature (^{o}C)	EPA and MWC
pH (pH units)	EPA and MWC
Electrical Conductivity (EC) (μS/cm)	EPA and MWC
Dissolved Oxygen (DO) (mg/L) (Depth Profile)	EPA Lakes
Dissolved Oxygen (DO) (mg/L, % saturation) (Surface)	MWC
Secchi depth (m)	EPA Lakes
Discharge (ML/day)	MWC
Laboratory Parameters - Nutrients	**Program**
Total Phosphorus (TP) (mg/L P)	EPA and MWC
Filterable Reactive Phosphorus (FRP) (mg/L P)	EPA and MWC
Total Kjeldahl Nitrogen (TKN) (mg/L N)	EPA and MWC
Nitrates (NO_3) (mg/L N)	EPA and MWC
Nitrites (NO_2) (mg/L N)	EPA and MWC
Ammonia (NH_3) (mg/L N)	EPA and MWC
Total Nitrogen (TN) (mg/L N)	EPA and MWC
Laboratory Parameters - Other	**Program**
Turbidity (NTU)	EPA and MWC
Non-filterable residue/Suspended solids (mg/L)	EPA and MWC
Chlorophyll-*a* (mg/L)	EPA Lakes
Phaeophytin (mg/L)	EPA Lakes
True Colour (Pt/Co units)	EPA Lakes
E. coli	MWC
Zooplankton	EPA Lakes
Metals	**Program**
Arsenic (As) (mg/L)	EPA and MWC
Cadmium (Cd) (mg/L)	EPA and MWC
Chromium (Cr) (mg/L)	EPA and MWC
Copper (Cu) (mg/L)	EPA and MWC
Lead (Pb) (mg/L)	EPA and MWC
Mercury (Hg) (mg/L)	EPA
Nickel (Ni) (mg/L)	EPA and MWC
Zinc (Zn) (mg/L)	EPA and MWC

Table AIV.4. Parameters monitored as part of the MDBC Physico-Chem Baseline Monitoring Program.

Field Parameters	Frequency	Stations (Class)
pH (pH units)	Weekly	Classes 1, 2, 3, 4
Turbidity (NTU)	Weekly	Classes 1, 2, 3, 4
Electrical Conductivity (EC) (μS/cm)	Weekly	Classes 1, 2, 3, 4
Water Temperature (^{o}C)	Weekly	Classes 1, 2, 3, 4
Gauge Height (m)	Weekly	Classes 1, 2, 3, 4
Discharge (ML/day)	Weekly	Classes 1, 2, 3, 4
Laboratory Parameters (set 1)	**Frequency**	**Stations (Class)**
Bicarbonate (HCO_3^-) (mg/L)	Monthly	Classes 1, 2, 3
Chloride (Cl) (mg/L)	Monthly	Classes 1, 2, 3
Sulphate (SO_4) (mg/L)	Monthly	Classes 1, 2, 3
Potassium (K) (mg/L)	Monthly	Classes 1, 2, 3
Sodium (Na) (mg/L)	Monthly	Classes 1, 2, 3
Calcium (Ca) (mg/L)	Monthly	Classes 1, 2, 3
Magnesium (Mg) (mg/L)	Monthly	Classes 1, 2, 3
Soluble Organic Carbon (SOC) (mg/L)	Monthly	Classes 1, 2, 3
Colour (Pt/Co Units)	Monthly	Classes 1, 2, 3
Laboratory Parameters (set 2)	**Frequency**	**Stations (Class)**
Nitrates and Nitrites (NO_x) (mg/L N)	Weekly	Classes 1, 2
Total Kjeldahl Nitrogen (TKN) (mg/L N)	Weekly	Classes 1, 2
Total Phosphorus (TP) (mg/L P)	Weekly	Classes 1, 2
Soluble Phosphorus (mg/L)	Weekly	Classes 1, 2
Silica (SiO_2) (mg/L SiO_2)	Weekly	Classes 1, 2
Additional Parameters (set 3)	**Frequency**	**Stations (Class)**
Boron (B) (mg/L)	Monthly	River Murray at Morgan (Class 1)
Cadmium (Cd) (mg/L)	Monthly	River Murray at Morgan (Class 1)
Copper (Cu) (mg/L)	Monthly	River Murray at Morgan (Class 1)
Chromium (Cr) (mg/L)	Monthly	River Murray at Morgan (Class 1)
Iron (Fe) (mg/L)	Monthly	River Murray at Morgan (Class 1)
Lead (Pb) (mg/L)	Monthly	River Murray at Morgan (Class 1)
Manganese (Mn) (mg/L)	Monthly	River Murray at Morgan (Class 1)
Mercury (Hg) (mg/L)	Monthly	River Murray at Morgan (Class 1)
Nickel (Ni) (mg/L)	Monthly	River Murray at Morgan (Class 1)
Zinc (Zn) (mg/L)	Monthly	River Murray at Morgan (Class 1)
Herbicides	Monthly	River Murray at Morgan (Class 1)
Pesticides	Monthly	River Murray at Morgan (Class 1)
Trihalomethanes (THM)	Monthly	River Murray at Morgan (Class 1)
Algal Counts are conducted as part of a separate program at 14 stations only Phaeophytin and Chlorophyll-*a* are performed on selected stations only		

Table AIV.5. Parameters monitored as part of the Melbourne Water Waterway Water Quality Monitoring Network

Field Parameters	Program
Water Temperature (^oC)	MWC
pH (pH units)	MWC
Electrical Conductivity (EC) ($\mu S/cm$)	MWC
Dissolved Oxygen (DO) (mg/L, % saturation) (Surface)	MWC
Discharge (ML/day)	MWC
Laboratory Parameters - Nutrients	**Program**
Total Phosphorus (TP) (mg/L P)	MWC
Filterable Reactive Phosphorus (FRP) (mg/L P)	MWC
Total Kjeldahl Nitrogen (TKN) (mg/L N)	MWC
Nitrates (NO_3) (mg/L N)	MWC
Nitrites (NO_2) (mg/L N)	MWC
Ammonia (NH_3) (mg/L N)	MWC
Total Nitrogen (TN) (mg/L N)	MWC
Laboratory Parameters - Other	**Program**
Turbidity (NTU)	MWC
Non-filterable residue/Suspended solids (mg/L)	MWC
E. coli	MWC
Phytoplankton	MWC (blue-green algae program only)
Metals	**Program**
Arsenic (As) (mg/L)	MWC
Cadmium (Cd) (mg/L)	MWC
Chromium (Cr) (mg/L)	MWC
Copper (Cu) (mg/L)	MWC
Lead (Pb) (mg/L)	MWC
Nickel (Ni) (mg/L)	MWC
Zinc (Zn) (mg/L)	MWC

Appendix V:
Quality Assurance/Quality Control

Table AV.1. Quality control on filters utilised for field filtration of FRP during 2002

Date	Filtrate	No. Replicates	Mean	Maximum	St.Deviation
10/9/02	Filtered Blank – Filtech G/M filter	9	<0.003	<0.003	NV
	Filtered Blank – Millipore H2CN	10	<0.003	<0.003	NV

NV = no value recorded as measurements below the limits of detection

Table AV.2. Schedule of field inspection and calibration performed by WATER ECOscience during 2002

Group	Office	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
West	Gisborne		Y			Y			Y			Y	
	Hamilton		Y			Y			Y			Y	
	Horsham		Y			Y			Y			Y	
North	Kerang			Y			Y			Y			Y
	Tatura			Y			Y			Y			Y
	Wangaratta			Y			Y			Y			Y
East	Maffra	Y			Y			Y			Y		
	Woori Yallock	Y			Y			Y			Y		

Y = inspection performed at the end of that month

Table AV.3. Inter-laboratory test results during 2002

Differences from the known values that fall outside the acceptable range are indicated in bold.

Date	Office	pH	% Difference	EC @ 250°C (µS/cm)	% Difference	Turbidity (NTU)	% Difference
Feb'02	**KNOWN VALUE**	**6.4**		**1100**		**5.1**	
	ACCEPTABLE RANGE*	**6.2 – 6.6**	**± 0.2**	**1045-1155**	**± 5%**	**4.6 – 5.6**	**± 10%**
	Overall Mean	**6.4**		**1092**		**4.7**	
	Overall Min	**6.2**		**1033**		**4.2**	
	Overall Max	**6.4**		**1144**		**5.6**	
	Gisborne	6.4	**0.8**	1085	1.4	4.6	9.8
		6.3	**1.3**	1082	1.7	4.5	**11.8**
		6.4	**0.6**	1108	-0.7	4.7	7.8
		6.3	**0.9**	1105	-0.4	4.6	9.8
		6.3	**1.1**	1105	-0.4	4.6	9.8
		6.3	**1.1**	1099	0.1	4.6	9.8
	Hamilton	6.3	**1.6**	1144	-4.0	4.6	9.8
		6.4	0	1091	0.8	5.0	2.0
		6.3	**1.6**	1091	0.8	4.7	7.8
	Horsham	6.4	**0.6**	1082	1.7	4.5	**11.8**
	Kerang	6.3	**1.6**	1090	0.9	4.4	**13.7**
		6.4	0.0	1077	2.1	4.4	**13.7**
	Maffra	6.4	0.0	1092	0.7	**5.5**	-7.8
		6.2	**3.1**	1102	-0.2	5.0	2.0
		6.34	**0.9**	1033	**6.1**	5.0	2.0
		6.4	0.0	1092	0.7	5.6	-9.8
		6.28	**1.9**	1103	-0.2	5.0	2.0
		6.4	**-0.6**	1053	4.2	5.0	2.0
	Tatura	6.3	**1.1**	1082	1.7	4.2	**17.6**
		6.3	**1.6**	1081	1.7	4.2	**17.6**
		6.3	**1.6**	1091	0.8	4.2	**17.6**
		6.4	0.0	1133	-3.0	4.4	**13.7**
		6.4	-0.2	1100	0.0	4.3	**15.7**
		6.4	**0.5**	1075	2.3	4.3	**15.7**
	Wangaratta	6.4	0.0	1105	-0.5	4.6	9.8
		6.3	**1.6**	1100	0.0	4.6	9.8
		6.3	**1.6**	1100	0.0	4.6	9.8
		6.3	**1.6**				
		6.4	0.0				
		6.3	**1.6**				
	Woori Yallock	6.4	**-0.5**	1097	0.3	4.5	**11.8**
		6.4	**-0.5**	1061	3.6	4.7	7.8
		6.5	**-2.0**	1076	2.2	5.1	0.0
		6.4	**-0.5**	1127	-2.5	4.9	3.9
		6.5	**-0.8**	1071	2.6	4.6	9.8

Table AV.4. Inter-laboratory test results during 2002

Differences from the known values that fall outside the acceptable range are indicated in bold.

Date	Office	pH	% Difference	EC @ 250°C (µS/cm)	% Difference	Turbidity (NTU)	% Difference
Aug'02	**KNOWN VALUE**	**7.0**		**1800**		**7.9**	
	ACCEPTABLE RANGE*	**6.8 – 7.2**	**± 0.2**	**1710 – 1890**	**± 5%**	**7.1 – 8.7**	**± 10%**
	Overall Mean	**6.93**		**1769**		**7.5**	
	Overall Min	**6.80**		**1650**		**6.6**	
	Overall Max	**7.00**		**1915**		**8.5**	
	Gisborne	7.00	0.0	1749	2.9	7.9	0.0
		6.98	**0.3**	1733	3.7	7.8	1.3
		7.00	0.0	1781	1.1	7.7	2.5
		6.98	**0.3**	1753	2.6	7.9	0.0
		6.99	0.2	1702	**5.4**	7.8	1.3
	Hamilton	6.90	**1.6**	1730	3.9	8.4	-6.3
		6.80	**3.1**	1708	**5.1**	8.5	-7.6
		7.00	0.0	1732	3.8	8.4	-6.3
	Horsham	6.97	**0.5**	1760	2.2	6.7	**15.2**
		7.00	0.0	1787	0.7	6.7	**15.2**
	Kerang	6.95	**0.8**	1784	0.9	7.5	5.1
		6.95	**0.8**	1814	-0.8	7.5	5.1
	Maffra	6.80	**3.1**	1857	-3.2	7.9	0.0
		6.90	**1.6**	1749	2.8	7.8	1.3
		6.80	**3.1**	1806	-0.3	7.7	2.5
		6.80	**3.1**	1915	**-6.4**	7.7	2.5
		6.90	**1.6**	1734	3.7	7.9	0.0
	Tatura	6.9	**1.6**	1858	-3.2	7.8	1.3
		6.9	**1.6**	1861	-3.4	7.7	2.5
		6.9	**1.6**	1792	0.5	7.6	3.8
		6.9	**1.6**	1858	-3.2	7.5	5.1
	Wangaratta	6.95	**0.8**	1677	**6.8**	6.6	**16.5**
		6.90	**1.6**	1694	**5.9**	6.6	**16.5**
		6.90	**1.6**	1664	**7.6**	6.6	**16.5**
	Woori Yallock	6.94	**0.9**	1766	1.9	7.4	6.3
		6.96	**0.6**	1785	0.8	7.1	**10.1**
		7.02	**-0.3**	1650	**8.3**	7.0	**11.4**
		6.99	0.2	1836	-2.0	6.9	**12.7**

* = Acceptable variation taken from *Standard Methods* 20th Edition (Clesceri *et al.* 1998)

Follow-up action regarding specific instruments, laboratories, maintenance of equipment or methodology was recommended following each inter-laboratory test. Specifically:

- Re-testing turbidity an electrical conductivity as afollow up to the above interlab.
- Correct maintenance and calibration of meters.
- Re-training on use of standard methodology as contained in the Manual of Procedures for VWQMN Network.
- Checking meters on following QA loop to identify instrument malfunction.

Table AV.4. Inspection results during 2002
GISBORNE

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
28/02/02	7895	9.5	9.4	WGT001	20.3°	20.3°	16789	0.37	0.37	31412058	146.5	In field	62990644	7.00	Broken
		9.2	9.1	WGT002	20.3°	20.3°		8.1	8.1		1415			4.00	Probe
		18°	20°	WGT003	20.3°	20.3°		77	77	78080	123	128	62990640	7.00	7.00
	10921	9.5	9.4					760	760		1185	1160		4.00	4.01
		9.2	9.0							030715	146.5	In field			
		18°	20°								1415				
29/05/02	7895	10.1	10.0	WGT001	11.8	11.75	16789	0.34	0.34	31412058	146.9	14703	62990644	7.00	7.00
		15.0°	15.0°	WGT002	11.8	11.75		7.8	7.9		1415	1407		4.00	4.00
				WGT003	11.8	11.75		77	78	78080	116	116	62990640	7.00	7.00
								780	740		1120	1120		4.00	3.99
	10921	10.1	10.1							030715	150	160			
		15.0°	15.0°								1420	1420			
29/08/02	7895	10.6	10.4	WGT001	14.0°	13.5°	16789	0.47	0.41	31412058	146.5	147	62990644	7.00	7.00
		14°	14°	WGT002	13.5°	13.5°		7.2	8.4		1415	1404		4.00	4.00
				WGT003	13.5°	13.5°		83	80	78080	14.0°	14.0°	62990640	7.00	7.00
								710	720		116	110		4.00	4.01
	10921	10.2	10.2								1120	1100			
		15.5°	15.5°							030715	146.5	150			
											1415	1360			

Table AV.5. Inspection results during 2002
GISBORNE continued

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
27/11/02	7895		Under repair	WGT001	17.0°	17.0°	16789	0.37	0.37	030715	146.5	160	62990644	7.00	7.00
				WGT002	In use			8.3	8.4		1415	1360		4.00	4.00
				WGT003	16.7°	17.0°		78	80	78080	14°	14°	62990640	7.00	7.00
								710	710		116	120		4.00	3.99
	10921	9.7	9.7								1120	1100			
		17°	17°							31412058	146.5	148.2			
											1415	1389			
										01390040	146.9	148.4			
											1415	1424			

= Comparison of temperature measurement function essential for DO measurements
= Exp. Is the expected value; Act. Is the value actually obtained

Table AV.5. Inspection results during 2002
HAMILTON

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
27/02/02	38330	9.2	9.2	WHT001	23.3°	23.3°	6068	0.37	0.37	236116	132	138	3249	7.00	7.02
		20°	20°	WHT002	23.3°	23.5°		8.1	8.1		1280	1260		4.00	4.01
		9.5	9.4	WHT003	23.3°	23.5°		77	77				63995510	7.00	Serviced
		18°	18°					760	760	42195103	146.5	149.3		4.00	
	7483	9.2	9.1								1415	1414			
		20°	20°							905082	146.5	151			
		9.5	9.3								1415	1424			
		18°	18°												
29/05/02	38330	9.7	9.7	WHT001	In use		6068	0.34	0.34	236116	126.5	126.5	3249	7.00	7.00
		17°	17°	WHT002	In use			7.8	7.8		1225	1225		4.00	4.01
				WHT003	13.8°	14.0°		77	77	42195103	146.5	146.3	63995510	7.00	7.00
								780	780		1415	1408		4.00	4.00
	7483	9.7	9.7							905082	146.5	149.3			
		17°	17°								1415	1385			
29/08/02	38330	10.3	10.3	WHT001	13.5°	13.0°	6068	0.47	0.47	236116	130	145	3249	7.00	7.00
		14.4°	14.4°	WHT002	13.4°	13.4°		7.2	7.3		1250	1280		4.00	4.00
				WHT003	13.0°	13.0°		83	83				63995510	7.00	7.01
								710	690	42195103	128	131		4.00	4.00
	7483	10.5	10.2								1235	1251			
		15.0°	15.0°							905082	146.5	155			
											1415	1433			

Table AV.5. Inspection results during 2002
HAMILTON continued

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
27/11/02	38330	9.3	9.3	WHT001	22.5°	22.5°	6068	0.37	0.41	236116	131	137	3249	7.00	6.99
		19.0°	19.0°	WHT002	In use			8.3	7.6		1265	1250		4.00	4.01
				WHT003	22.5°	22.5°		78	78	42195103	146.5	146.0	63995510	Repair	
								710	700		1415	1414			
	7483	9.2	9.2							905082	In use		02110032	7.00	7.00
		20°	20°											4.00	4.00

Table AV.5. Inspection results during 2002
HORSHAM

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
26/02/02	94J23138	7.9	7.8	WRT001	27.0°	27.0°	6042	0.37	0.37	6324 1084	In use		6299 0549	6.86	6.99
		28°	28°	WRT002	27.0°	27.0°		8.1	8.1					3.97	4.00
		8.5	8.3	WRT003	27.0°	27.0°		77	77	8272 4032	In use				
		24°	24°					760	760						
										114978	151	151			
											26.5°	2635°			
											1460	1468			
											26.5°	26.5°			
30/05/02	94J23138	10.6	10.5	WRT001	13.8°	13.8°	6042	0.34	0.34	6324 1084	Not available		6299 0549	7.00	7.02
		13°	13°	WRT002				7.8	7.8					4.00	4.01
				WRT003	13.8°	13.9°		77	77	8272 4032	146.9	147.0			
								780	780		1415	1405			
										114978	115	115			
											1105	1105			
30/08/02	94J23138	10.6	11.0	WRT001	13.0°	13.0°	6042	0.47	0.40	8272 4032	146.9	147.1	6299 0549	7.00	7.04
		13°	13°	WRT002	13.0°	13.0°		7.2	7.3		1435	1434		4.00	3.98
				WRT003	13.0°	13.0°		83	80	114978	115	117			
								710	710		1105	1100			
											13.5°	13.5°			
28/11/02	94J23138	9.0	8.9	WRT001	21.5°	21.5°	6042	0.37	0.36	6324 1084	146.5	146.9	6299 0549	7.00	7.00
		21.0°	21.0°	WRT002	21.5°	21.5°		8.3	8.3		1415	1412		4.00	4.00
				WRT003	21.5°	21.5°		78	83	8272 4032					
								710	710						
										114978	125	128			
											1210	1210			

Table AV.5. Inspection results during 2002
KERANG

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
27/03/02	7160	9.09	9.1	WKT001	19.6°	19.6°	16786	0.36	0.36	126363	135	135	62994431	7.00	7.00
		20°	20°	WKT003	19.6°	19.6°		8.1	8.0		1305	1305		4.00	4.00
				WKT004	19.6°	19.6°		77	78		21.0°	21.0°			
				WKT005	20.0°	20.0°		775	770						
	93CO3441	9.09	9.1							62191041	146.5	146.4			
		20°	20°								1415	1421			
										72143164	146.5	146.7			
											1415	1407			
20/06/02	7160	8.92	8.9	WKT001	16.6°	16.6°	16786	0.36	0.35	126363	123	123	62994431	7.00	7.00
		21.0°	21.0°	WKT003				7.9	7.9		1185	1185		4.00	4.00
				WKT004	16.6°	16.6°		78	78		16.5°	16.5°			
				WKT005	16.6°	16.6°		745	745	62191041	146.9	147.5			
	93C03441	8.92	8.9								1412	1411			
		21.0°	21.0°							72143164	146.9	146.9			
											1412	1408			
										00210007	146.9	148.5			
											1412	1393			
25/09/02	7160	9.0	9.0	WKT001	21.0°	21.0°	16786	0.34	0.36	126363	135	140	62994431	7.00	7.02
		21°	21°	WKT003				7.8	7.7		1305	1300		4.00	4.00
				WKT004	21.0°	21.0°		78	76		21.0°	21.0°			
				WKT005	21.0°	21.0°		710	710						
	93CO3441	9.1	9.1							72143164	146.9	145.7			
		20.0°	20.0°								1415	1413			

Table AV.5. Inspection results during 2002
MAFFRA

Date	DO (mg/L O_2)			Temperature (^{0}C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
25/01/02	7159	8.8	8.8	WMT001	21.2^o	21.2^o	6886	0.37	0.37	228282	133.5	137.5	53031087	7.00	7.01
		9.0	8.9	WMT002	21.2^o	21.2^o		8.5	8.5		1290	1275		4.00	3.98
		21^o	21^o	WMT004	21.2^o	21.2^o		82	82		20.5^o	20.5^o	99220058	7.00	7.00
	94K2 4648	8.8	8.8	WMT006	21.2^o	21.2^o		800	800					4.00	3.99
		9.0	9.0	WMT007	21.2^o	21.2^o				62191023	146.5	147.5	53031081	7.00	7.00
		21^o	21^o	WMT010	21.2^o	21.2^o					1415	1394		4.00	3.99
3/05/02	7159			WMT001			6886	0.35	0.35	228282	133	145	53031087	7.00	7.00
				WMT002				7.9	7.9		1295	1310		4.00	3.99
				WMT004	16.3^o	16.3^o		77	77		20.3^o	20.3^o	99220058	7.00	7.00
	94K2 4648	9.28	9.2	WMT006				755	755	62191023				4.00	3.99
		19^o	19^o	WMT007	16.3^o	16.3^o							53031081	In use	
				WMT010	16.3^o	16.3^o									
	W01080000	9.09	9.02												
		20^o	20^o												
26/07/02	7159	9.6	9.6	WMT001	18.0^o	18.1^o	6886	0.35	0.35	228282	132	152	53031087	7.00	6.99
		16^o	16^o	WMT002				8.0	8.0		1160	1250		4.00	4.01
				WMT004	18.4^o	18.3^o		80	80		17.0^o	17.0^o	99220058	7.00	6.99
	94K2 4648	9.0	9.0	WMT006				770	770					4.00	4.00
		19^o	19^o	WMT007	18.6^o	18.3^o				62191023	146.5	146.8	53031081	7.00	6.98
				WMT010	18.3^o	18.3^o					1415	1400		4.00	4.00
	99K0725	9.7	9.7	WMT011	18.3^o	18.3^o					17.5^o	17.5^o			
		17^o	17^o												

Table AV.5. Inspection results during 2002
MAFFRA continued

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
31/10/02	7159	Membrane	change	WMT001	18.3°	18.3°	6886	0.36	0.36	228282	Probe	broken	53031087	7.00	6.97
				WMT002	Broken			8.2	8.2					4.00	4.04
				WMT004	In use			79	79				99220058	7.00	7.00
	94K2 4648	Membrane	change	WMT006				730	730					4.00	4.02
				WMT007	18.3°	18.3°				62191023	146.5	151.5	71217090	7.00	6.95
				WMT010	18.3°	18.7°					1415	1418		4.00	4.02
				WMT011	18.3°	18.2°									
	99K0725	Membrane	change												

Table AV.5. Inspection results during 2002
TATURA

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
28/03/02	7161	8.8	8.8	WTT001	21.6°	21.6°	12835	0.36	0.36	228270	135	135	62990308	7.00	7.00
		21.5°	21.5°	WTT003	21.6°	21.6°		8.1	8.1		1305	1305		4.00	4.00
				WTT005	21.6°	21.6°		77	77		21.6°	21.6°	72347148	7.00	7.00
				WTT006	21.6°	21.6°		775	775	31412125	146.5	147.0		4.00	4.00
	94L26004	8.8	8.8	WY007	21.6°	21.3°					1415	1413	62994427	7.00	7.00
		21.5°	21.5°							905025	Repair			4.00	4.00
										01120035	146.5	146.9			
	7158		Repair								1415	1402			
										42087057	Repair				
										1911209	146.5	146.8			
											1415	1403			
21/06/02	7161	10.2	10.2	WTT001	12.9°	12.9°	12835	0.36	0.36	228270	114	114	62990308	In use	
		15.5°	15.5°	WTT003	In use			7.9	7.9		1100	1100			
				WTT005	12.6°	12.6°		78	78		4°	4°	72347148	7.00	7.00
				WTT006	12.6°	112.6°		745	745					4.00	4.00
	94L26004	9.8	10.0	WYT007	12.9°	12.8°				31412125	146.5	147	62994427	7.00	6.99
		15.5°	15.5°								1415	1412		4.00	4.00
										42195116	146.5	146.9			
											1415	1413			
	7158	9.9	10.0							42087057	146.5	147			
		15.5°	15.5°								1415	1413			
										1911209	146.5	146.8			
											1415	1413			

Table AV.5. Inspection results during 2002
TATURA continued

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
26/09/02	7161	10.6	10.4	WTT001	18.3°	18.5°	12835	0.34	0.35	228270	118.5	123	62990308	7.00	6.99
		14.0°	14.0°	WTT003	18.3°	18.5°		7.8	7.8		1145	1140		4.00	4.01
				WTT005	18.3°	18.3°		78	78		15.0°	15.0°	72347148	7.00	6.99
				WTT006	18.3°	18.2°		710	720	31412125	146.5	148.0		4.00	4.00
	94L26004	10.0	9.4								1415	1420	62994427	7.00	7.00
		19.0°	19.0°							0905025	146.9	145.5		4.00	3.99
											1415	1412			
										42195116	146.9	153.0			
	7158	9.2	9.4								1415	1412			
		19.0°	19.0°							42087057	146.5	145.9			
											1415	1412			
										1911209	146.5	146.2			
											1415	1418			

Table AV.5. Inspection results during 2002
WANGARATTA

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
28/03/02	801482	8.8	8.5	WWT001	21.1°	21.0°	16318	0.36	0.36	30708	In use		1299	7.00	7.07
		21.5°	21.5°	WWT002	21.1°	21.5°		8.1	8.1					4.00	4.02
				WWT003	23.9°	24.2°		77	77	31655	150	150	1336	7.00	7.03
				WWT004	21.1°	21.0°		775	775		1420	1200		4.00	3.99
	9996	8.8	8.7	WWT005	23.9°	24.0°				78189	144	144			
		21.5°	21.5°								1390	1390			
	5850	8.8	8.9								24°	24°			
		21.5°	21.5°												
21/06/02	801482	10.8	10.7	WWT001	13.1°	13.1°	16318	0.36	0.36	30708	146.5	160	1299	7.00	7.07
		12°	12°	WWT002	13.1°	13.1°		7.9	7.9		1415	1410		4.00	4.00
				WWT003	13.1°	13.1°		78	78	31655	146.5	160	1336	7.00	7.01
				WWT004	13.1°	13.1°		745	745		1415	1290		4.00	3.99
	9996	10.8	10.7	WWT005						78189	120	120			
		12°	12°								1160	1160			
											15.5°	15.5°			
	5850	10.8	10.7												
		12°	12°												

Table AV.5. Inspection results during 2002
WANGARATTA continued

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
26/09/02	801482	9.0	9.7	WWT001	21.5°	21.5°	16318	Not working		30708	146.5	150	1095	7.00	7.00
		17°	17°	WWT002	21.5°	21.5°		In for Repair			1415	1370		4.00	4.07
				WWT003	21.5°	21.5°				31655	146.5	150	1336	In forRepair	
				WWT004	21.5°	21.5°					1415	1310			
	9996	9.3	9.9	WWT005	21.5°	21.5°				78189	132	134			
		16°	16°								1280	1250			
											20.0°	20.0°			
	5850	9.7	10.2												
		15°	15°												

Table AV.5. Inspection results during 2002
WOORI YALLOCK

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
25/01/02	94A1 444B	In use		WYT001			2264	0.37	0.37	64082156	141	151.4	64203157	7.00	7.01
				WYT002	21.9°	21.9°		8.5	8.5		1415	1389		4.00	3.99
				WYT003	21.9°	21.7°		82	82				62994098		
				WYT004				800	800						
	W99J0476	8.8	8.7							228278	151	155	53031096		
		22°	22°								1460	1450			
											26.5°	26.5°			
3/05/02	W00110000	8.92	8.96	WYT001			2264	0.35	0.32	64082156	146.9	166.5	64203157	7.00	7.00
		21.0°	21.0°	WYT002	18.7°	18.7°		7.9	8.0		1415	1411		4.00	4.00
				WYT003	18.7°	18.7°		77	79	228278	123	123	53031096	7.00	7.00
				WYT006	18.7°	18.3°		755	760		1185	1185		4.00	4.00
	W99J0476	8.9	8.8								16.5°	16.5°			
		21.3°	21.3°							470003					
26/07/02	W00K0739	9.7	9.2	WYT001			9210000 23333	0.35	0.35	64082156	146.5	149.6	64203157	7.00	6.99
		18°	18°	WYT002	In use			8.0	8.0		1415	1413		4.00	4.00
				WYT003	18°	16.5°		80	80	228278	112	123	53031096	7.00	7.00
	W99J0476	9.8	9.2	WYT004	In use			770	770		1120	1120		4.00	3.99
		18°	18°								16.5°	16.5°	62994048	7.00	6.99
														4.00	4.00
										150020	146.5	148.9			
											1415	1412			

Table AV.5. Inspection results during 2002
WOORI YALLOCK continued

Date	DO (mg/L O_2)			Temperature (°C)			Turbidity (NTU)			EC (µS/cm)			pH (units)		
	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#	Serial No.	Exp.#	Act#
31/10/02	W99J0476	9.06	9.06	WYT002	18.6°	18.6°	2264	0.36	0.37	64082156	146.5	148.3	64203157	7.00	7.02
		20.3°	20.3°	WYT003	18.6°	17.5°		8.2	8.3		1415	1408		4.00	4.04
				WYT004	18.6°	18.5°		79	79	228278	124	124	53031096	7.00	7.03
								730	730		1200	1150		7.00	4.00
											17.0°	17.0°			