Tasmania

DEPARTMENT *of*
PRIMARY INDUSTRIES,
WATER *and* ENVIRONMENT

Natural Heritage Trust
*Helping Communities Helping Australia*
A Commonwealth Government Initiative

# Water Quality In The Montagu River Catchment

# Part 1

**Authors:**
Christopher Bobbi
David Blühdorn
David Andrews &
Mark Bantich

Environmental & Resource Analysis,
Hydro Tasmania
December 2003

Hydro Tasmania
*the renewable energy business*

***Preferred Citation:***

DPIWE (2003) *State of the River Report for the Montagu River Catchment.* Water Assessment and Planning Branch, Department of Primary Industries, Water and Environment, Hobart. Technical Report No. WAP 03/09

**ISSN:** 1449-5996

**The Department of Primary Industries, Water and Environment**

The Department of Primary Industries, Water and Environment provides leadership in the sustainable management and development of Tasmania's resources. The Mission of the Department is to advance Tasmania's prosperity through the sustainable development of our natural resources and the conservation of our natural and cultural heritage for the future.

The Water Resources Division provides a focus for water management and water development in Tasmania through a diverse range of functions including the design of policy and regulatory frameworks to ensure sustainable use of the surface water and groundwater resources; monitoring, assessment and reporting on the condition of the State's freshwater resources; facilitation of infrastructure development projects to ensure the efficient and sustainable supply of water; and implementation of the *Water Management Act 1999*, related legislation and the State Water Development Plan.

## Executive Summary


The information contained in this report should be viewed together with the reports on river hydrology, aquatic ecology and river condition. These four reports combined form the "State of River' report for the Montagu River drainage system.

The Montagu River has a long history of drainage management aimed at improving access to fertile land that was originally Blackwood swamps for the purpose of dairy farming. A large portion of the lower catchment has been managed as a 'river improvement district' (Togari and Britten Swamp), with the end result being that large sections of the main river and many of the tributary streams have been highly modified or straightened to decrease the time that floodwaters cover agricultural lands. These changes, along with the habitat modifications that have occurred, have some significant impacts on water quality and the health of the aquatic community that inhabit this river system.

The major findings arising from the study into water quality in the catchment are;

- That the removal of riparian vegetation and river channelisation has significant impacts on the pattern and scale of daily changes in water quality (dissolved oxygen and water temperature) in the main river and tributaries. The shallow characteristics of many waterways, the increased level of light penetration and the loads of nutrients being delivered all encourage the prolific growth of aquatic plants and algae which drive these changes.
- While turbidity levels in the main river are within the range normally expected in lowland rivers (<10NTU), turbidity is more elevated in the tributaries, and most significantly in Fixters Creek where land and water use activities produce generally poor water quality.
- The occurrence of dolomite outcrops in the reaches of the Montagu River below the Bass Highway at Togari cause a significant change in many water quality variables, with water downstream containing higher levels of dissolved salts and increased buffering capacity. Very high levels of sulphate (>50 mg/L) periodically occur in the middle and lower reaches of the Montagu River and while deposition from ocean aerosols may contribute to these high levels, fertiliser application is likely to be the main cause.
- The data from nutrient sampling clearly shows that drainage from the Brittons Swamp and Togari districts contains very high concentrations of both phosphorus and nitrogen, and this is likely to be the major factor causing poor water quality in the lower reaches of the Montagu River. Concentrations of nitrate-N, TN and TP at sites sampled monthly in the middle-lower catchment all exceeded National trigger values.
- Nutrient load estimates for the Montagu River were the highest of any Tasmanian river system so far investigated as part of the 'State of River' program, with 3-year average annual export of 81, 000 kg P and 268, 100 kg N.
- A short study of nutrient loss from hump and hollow pasture in the Togari area indicates that this is likely to contribute as much as 70% to the total load of P leaving the Montagu catchment in any year.
- The challenge for future management of rivers in the catchment is to identify viable options for improving water quality while maintaining the effectiveness of the flood control system, as the management of flood waters is likely to be the over-riding process that governs the movement of contaminants in the system.
- The potential impact of existing agricultural practices on groundwater was also identified as an issue requiring additional attention, as preliminary evidence suggests that groundwater may be more seriously degraded than surface waters.

# TABLE OF CONTENTS

## A GLOSSARY OF TERMS

**Baseflow**
Flow in a stream is essentially a function of overland flow, subsurface flow and groundwater input. During periods when there is no contribution of water from precipitation, flow in a stream is composed of water from deep subsurface and groundwater sources and is termed 'baseflow'.

**Box and Whisker Plots**
One common method of examining data collected at varous sites is to plot the data from each site as a 'box and whisker' plot. These plots display the median (or the middle of the data) as a line across the inside of the box. The bottom and top edges of the box mark the first and third quartiles respectively, indicating the middle 50% of the data. The ends of the whiskers show the extremes of the data and together enclose 95% of the data.

**Catchment**
The land area which drains into a particular watercourse (river, stream or creek) and is a natural topographic division of the landscape. Underlying geological formations may alter the perceived catchment area suggested solely by topography (limestone caves are an example of this).

**Discharge**
The volume of water passing a specific point during a particular period of time. It usually refers to water flowing in a stream or drainage channel, but can also refer to waste water from industrial activities.

**Diurnal Variation**
'Diurnal variation' is a term that is used to describe the cyclical pattern of change that occurs within a daily timescale. Water temperature variation is a typical example of a parameter that varies 'diurnally', with lowest temperatures occurring in the hours before dawn and the highest temperatures occurring around the middle of the day. Many water quality parameters that are influenced by biological processes also tend to vary on a diurnal basis.

**Dissolved Oxygen**
Oxygen is essential for all forms of aquatic life and many organisms obtain this oxygen directly from the water in the dissolved form. The level of dissolved oxygen in natural waters varies with temperature, turbulence, photosynthetic activity and atmospheric pressure. Dissolved oxygen varies over 24 hour periods as well as seasonally and can range from as high as 15 mg/L to levels approaching 0 mg/L. Levels below 5 mg/L will begin to place stress on aquatic biota and below 2 mg/L will cause death of fish.

**Ecosystem**
An environment, the physical and chemical parameters that define it and the organisms which inhabit it.

**Electrical Conductivity (EC)**
Conductivity is a measure of the capacity of an aqueous solution to carry an electrical current, and depends on the presence of ions; on their total concentration, mobility and valence. Conductivity is commonly used to determine salinity and is mostly reported in microSiemens per centimetre (µS/cm) or milliSiemens per metre (mS/m) at a standard reference temperature of $25^{o}$ Celsius.

**Eutrophication**

The enrichment of surface waters with nutrients such as nitrates and phosphates, which cause nuisance blooms of aquatic plants and algae.

**Export Loads / Export Coefficients**
The calculation of export loads of nutrients, or any other parameter, involves using nutrient concentration data collected over a wide variety of flow conditions and from various seasons. This information, when plotted against flow at the time of collection, can reveal relationships between flow and concentration which can then be used to estimate the load of a particular nutrient leaving the catchment (estimates of export loads should be regarded as having no greater accuracy than +/- 15%).

The export coefficient (also known as the Runoff Coefficient) corrects for catchment size so that export loads from variously sized catchments can be compared. The most commonly used formula to perform this correction is;

**Discharge** (ML) / **Catchment Area** ($km^2$) = **X** ($mm\ km^{-2}$)
**Total Load** (kg) / **X** = **Y** ($kg\ mm^{-1}$)
**Y** / **Catchment Area** ($km^2$) = **Export Coefficient** ($kg\ mm^{-1}km^{-2}$)

Where Z is the Export Coefficient and is equivalent to Total Load (kg) / Discharge (ML).

**Faecal Coliforms (also known as 'thermotolerant coliforms' - eg. *E.coli*)**
Faecal coliform bacteria are a sub-group of the total coliform population that are easy to measure and are present in virtually all warm blooded animals. Although measurement of this group is favoured by the NHMRC (1996) as suitable indicators of faecal pollution, it is recognised that members of this group may not be exclusively of faecal origin. However their presence in samples implies increased risk of disease. Pathogenic bacteria are those which are considered capable of causing disease in animals.

**General Ions**
General ions are those mineral salts most commonly present in natural waters. They are primarily sodium, potassium, chloride, calcium, magnesium, sulphate, carbonates and bicarbonates. Their presence affects conductivity of water and concentrations variable in surface and groundwaters due to local geological, climatic and geographical conditions.

**Hydrograph**
A plot of flow (typically in a stream) versus time. The time base is variable so that a hydrograph can refer to a single flood event, to a combination of flood events, or alternatively to the plot of all flows over a month, year, season or any given period.

**Macroinvertebrate**
Invertebrate (without a backbone) animals which can be seen with the naked eye. In rivers common macroinvertebrates are insects, crustaecans, worms and snails.

**Median**
The middle reading, or $50^{th}$ percentile, of all readings taken.
i.e. Of the readings 10, 13, 9, 16 and 11
{Re-ordering these to read 9, 10, 11, 13 and 16}
**The median is 11.**
The **Mean** (or Average), is the sum of all values divided by the total number of readings (which in this case equals 11.8).

**Nutrients**

Nutrients is a broad term which encompasses elements and compounds which are required by plants and animals for growth and survival. In the area of water quality the term is generally used with only phosphorus and nitrogen species in mind, though there are many other 'nutrients' that living organisms require for survival.

**pH and Alkalinity**
The pH is a measure of the acidity of a solution and ranges in scale from 0 to 14 (from very acid to very alkaline). A pH value of 7 is considered 'neutral'. In natural waters, pH is generally between 6.0 and 8.5. In waters with little or no buffering capacity, pH is related to alkalinity which is controlled by concentrations of carbonates, bicarbonates and hydroxides in the water. Waters of low alkalinity (< 24 ml/L as CaCO3) have a low buffering capacity and are susceptible to changes in pH from outside sources.

**Riparian Vegetation**
Riparian vegetation are plants (trees, shrubs, ground covers and grasses) which grow on the banks and floodplains of rivers. A 'healthy' riparian zone is characterised by a homogeneous mix of plant species (usually native to the area) of various ages. This zone is important in protecting water quality and sustaining the aquatic life of rivers.

**Suspended Solids**
Suspended solids are typically comprised of clay, silt, fine particulate organic and inorganic matter and microscopic organisms. Suspended solids are that fraction which will not pass through a 0.45μm filter and as such corresponds to non-filterable residues. It is this fraction which tends to contribute most to the turbidity of water.

**Total Kjeldahl Nitrogen (TKN)**
The Kjeldahl method determines nitrogen in water and is dominated by the organic and ammoniacal forms. It is commonly used to determine the organic fraction of nitrogen in samples and when the ammonia nitrogen is not removed, the term 'kjeldahl nitrogen' is applied. If the ammonia nitrogen is determined separately, 'organic nitrogen' can be calculated by difference.

**Total Nitrogen (TN)**
Nitrogen in natural waters occurs as Nitrate, Nitrite, Ammonia and complex organic compounds. Total nitrogen concentration in water can be analysed for directly or through the determination of all of these components. In this report, Total Nitrogen has been calculated as the sum of Nitrate-N + Nitrite-N + TKN.

**Total Phosphorus (TP)**
Like nitrogen, phosphorus is an essential nutrient for living organisms and exists in water as both dissolved and particulate forms. Total phosphorus can be analysed directly, and includes both forms. Dissolved phosphorus mostly occurs as orthophosphates, polyphosphates and organic phosphates.

**Turbidity**
Turbidity in water is caused by suspended material such as clay, silt, finely divided organic and inorganic matter, soluble coloured compounds and plankton and microscopic organisms. Turbidity is an expression of the optical properties that cause light to be scattered and absorbed rather than transmitted in a straight line through the water. Standard units for turbidity are 'nephelometric turbidity units' (NTU's) standardised against Formazin solution.

## *Units and Conversions*

mg/L = milligrams per litre (1000 milligrams per gram)
μg/L = micrograms per litre (1000 micrograms per milligram)
e.g. 1000 μg/L = 1 mg/L
μS/cm = Microsiemens per centimeter
$m^3$/s = cubic metre per second (commonly referred to as a 'cumec')
ML = 1 million litres (referred to as a 'megalitre')

## *Acronyms*

ANZECC - Australian and New Zealand Environment and Conservation Council
ARMCANZ - Agricultural and Resource Management Council of Australia and New Zealand
DPIWE - Department of Primary Industries, Water and Environment
DPIF - Department of Primary Industry and Fisheries (replaced by DPIWE)
DCHS - Department of Community and Health Services
NHMRC - National Health and Medical Research Council
NHT – Natural Heritage Trust (formerly the National Landcare Program)
RWSC - Rivers and Water Supply Commission
NWRWA – North West Regional Water Authority

## B SUMMARY OF NATIONAL GUIDELINES FOR WATER QUALITY

**Australian Water Quality Guidelines as per ANZECC (2000)**

As part of a National strategy to 'pursue the sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development' the Australian and New Zealand Environment and Conservation Council (ANZECC) has been developing guidelines for water quality for a range of Australian waters. Since 1992, a document titled 'Australian Water Quality Guidelines For Fresh and Marine Waters (1992) ' has been available for use as a reference tool for catchment management plans and policies. Since 1995, these guidelines have been under review and have now been superseded by new and more rigorous guidelines (ANZECC, 2000). Where possible, these new guidelines have had a more regional focus. This new approach has changed the emphasis of guideline setting, suggesting a 'risk assessment' approach which utilises the concept of increased risk with increasing departure from 'safe' levels.

The revised guidelines also restate the principle that guidelines are only to be used in the absence of local data, and that where local data can be obtained, they should be used to develop local water quality standards. For some water quality parameters, this approach has been taken, with data from Tasmanian systems (where available) being used to develop guidelines for use within Tasmania. In the National document, Tasmanian rivers have been broadly classified as upland or alpine rivers, as available data at the time was from upland river systems only. However it is important to note that some of the North West river systems originate below the 150m classification level for upland systems and can therefore be classified as lowland rivers.

**Table 1. Trigger Levels for Nutrients, pH and Dissolved Oxygen (ANZECC 2000).**

| Ecosystem Type | TP (µg/L) | FRP (µg/L) | TN (µg/L) | NOx (µg/L) | pH | DO (%sat) |
|---|---|---|---|---|---|---|
| Lowland River | 50 | 20 | 500 | 40 | 6.5 - 8.0 | <85 & >110 |
| Upland River | 13 | 5 | 480 | 190 | 6.5 to 7.5 | <90 & >110 |
| Lakes and Reservoirs | 10 | 5 | 350 | 10 | 6.5 to 8.0 | <90 & >110 |

**Table 2. Trigger Levels for Conductivity and Turbidity (ANZECC 2000).**

| Ecosystem type | Salinity ($\mu Scm^{-1}$) | Explanatory notes |
|---|---|---|
| Lowland Rivers | 125-2200 | Lowland rivers may have higher conductivity during low flow periods and if the system receives saline groundwater inputs. Low values are found in eastern highlands of Victoria (125$\mu Scm^{-1}$) and higher values in western lowlands and northern plains of Vic ( 2200$\mu Scm^{-1}$), NSW coastal rivers are typically in the range 200-300 $\mu Scm^{-1}$. |
| Upland Rivers | 30–350 | Conductivity in upland streams will vary depending upon catchment geology. Low values found in Victorian alpine regions (30 $\mu Scm^{-1}$) and eastern highlands (55 $\mu Scm^{-1}$), high value (350 $\mu Scm^{-1}$) in NSW rivers. Tasmanian rivers mid-range (90 $\mu Scm^{-1}$). |
| Lakes/ Reservoirs | 20–30 | Conductivity in lakes and reservoirs are generally low, but will vary depending upon catchment geology. Values provided are typical of Tasmanian lakes and reservoirs. |

| Ecosystem type | Turbidity (NTU) | Explanatory notes |
|---|---|---|
| Lowland Rivers | 6-50 | Turbidity in lowland rivers can be extremely variable. Values at the low end of the range would be found in rivers flowing through well-vegetated catchments and at low flows. Values at the high end of the range would be found in rivers draining slightly disturbed catchments and in many rivers at high flows. |
| Upland Rivers | 2–25 | Most good condition upland streams have low turbidity. High values may be observed during high flow events. |
| Lakes & Reservoirs | 1–20 | Most deep lakes and reservoirs have low turbidity. However shallow lakes and reservoirs may have higher natural turbidity due to wind-induced resuspension of sediments. Lakes and reservoirs in catchment with highly dispersable soils will have high turbidity. |

## 4. Proposed Microbiological Guidelines

### Primary contact

The median bacterial content in samples of fresh or marine waters taken over the bathing season should not exceed:

- *150 faecal coliform organisms/100 mL (minimum of five samples taken at regular intervals not exceeding one month, with four out of five samples containing less than 600 organisms/100 mL);*
- *35 enterococci organisms/100 mL (maximum number in any one sample: 60–100 organisms/100 mL).*

Pathogenic free-living protozoans should be absent from bodies of fresh water. (It is not necessary to analyse water for these pathogens unless the temperature is greater than 24°C.)

### Secondary contact

The median bacterial content in fresh and marine waters should not exceed:

- *1000 faecal coliform organisms/100 mL (minimum of five samples taken at regular intervals not exceeding one month, with four out of five samples containing less than 4000 organisms/100 mL);*
- *230 enterococci organisms/100 mL (maximum number in any one sample 450–700 organisms/100 mL).*

### National Health and Medical Research Council - Drinking Water

For drinking water, guidelines published by the National Health and Medical Research Council (NHMRC, 1996) suggest that no thermotolerant coliforms (eg *E. coli*) should be present in water used for drinking.

# Water Quality of Rivers in the Montagu Catchment

## *1 Historical Data*

No significant water quality investigations have previously been undertaken in this catchment. The main water quality data that is available from the State water quality database are spot measurements of water temperature and pH made during routine visits to sites that have been maintained for streamflow monitoring purposes. The only other significant body of data from this source relates to coliform sampling that was undertaken in the early 1990's, following concerns about the impact of dairy-shed effluent on water quality in the catchment. These data were collected by the Rivers and Waters Supply Commission (RWSC) and helped to instigate a dairy-shed effluent improvement program (Water Management Officer, DPIWE.).

Tables 1.1 – 1.3 summarise the data that is contained on the State database, and shows that the bulk of the data comes from the streamflow monitoring sites 14200 (Montagu River at Montagu Rd) and 14216 (Montagu River at Togari), located in the middle and lower reaches of the Montagu River. A single comprehensive sample, taken at site 14216 in November of 1995, provides some indication of the chemistry of water in the river at that time. While most of the data suggests that nutrient concentrations in the river are moderately low, the ammonia-N value is quite high. Although the conductivity range indicates moderate levels of dissolved salts in the river at this site, the ionic parameters (calcium, magnesium, chloride, sodium, etc) suggest that water in the river at the time of sampling was more dilute that usual (conductivity of 130 μS/cm). Examination of the flow data from this site shows that the sample was taken following a small 'fresh' in the river, when water is likely to be more dilute than normal.

Comparison of the data for conductivity at sites 14216 (Montagu River at Togari) and 14200 (Montagu River at Montagu Rd) shows that conductivity increases substantially between site 14216 and site 14200, which is more than 20km downstream. The geological map for this area shows that between these two sites the river flows through extensive formations of dolomite, and this is likely to cause substantial increases in dissolved salts, resulting in the higher conductivity levels at site 14200 (Montagu River at Montagu Rd Bridge). Dolomite outcrops in the river between these two sites are likely to add appreciable amounts of dissolved calcium and magnesium, two of the main constituents of calcareous rocks.

Comparison of the summary data on thermotolerant coliforms shows that there is little difference between the microbiological quality of water at the two sites. This is to be expected as there is intensive dairy farming throughout this section of the catchment.

**Table 1.1:** Statistics of historical record - Montagu River at Togari (Hydrol 14216)

| MONTAGU RIVER AT TOGARI | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **n** | **Mean** | **Max** | **Min** | **Unit** |
| Alkalinity (Total) | 1 | 26 | 26 | 26 | mg/L |
| Ammonia as N | 1 | 0.12 | 0.12 | 0.12 | mg/L |
| Calcium (Total) as Ca | 1 | 4.5 | 4.5 | 4.5 | mg/L |
| Chloride as Cl | 1 | 15 | 15 | 15 | mg/L |
| Field Cond @ TRef 20 | 9 | 226.22 | 425 | 130 | uS/cm |
| Field Cond @ TRef 25 | 1 | 110 | 110 | 110 | uS/cm |
| Fluoride as F | 1 | 0.1 | 0.1 | 0.1 | mg/L |
| Iron (Total) as Fe | 1 | 0.65 | 0.65 | 0.65 | mg/L |
| Magnesium (Total) as Mg | 1 | 4.1 | 4.1 | 4.1 | mg/L |
| Manganese (Total) as Mn | 1 | 0.02 | 0.02 | 0.02 | mg/L |
| Molybdate Reactive S | 1 | 10 | 10 | 10 | mg/L |
| Nitrate as N | 1 | 0.13 | 0.13 | 0.13 | mg/L |
| pH field - litmus | 1 | 6.7 | 6.7 | 6.7 | mg/L |
| Potassium (Total) as K | 1 | 0.95 | 0.95 | 0.95 | mg/L |
| Reactive Phosphorous | 1 | 0.005 | 0.005 | 0.005 | mg/L |
| Redox Europe Stnd Ox | 2 | 118 | 141 | 95 | mv |
| Sodium (Total) as Na | 1 | 10 | 10 | 10 | mg/L |
| Sulphate (Total) as SO4 | 1 | 3.6 | 3.6 | 3.6 | mg/L |
| Suspended Solids | 1 | 2 | 2 | 2 | mg/L |
| Thermotolerant coliforms | 23 | 518.13 | 4000 | 4 | cfu/100 ml |
| Total Dissolved Solids | 1 | 65 | 65 | 65 | mg/L |
| Total Hardness ($CaCO_3$) | 1 | 28 | 28 | 28 | mg/L |
| Total Kjeldahl Nitrogen | 1 | 0.26 | 0.26 | 0.26 | mg/L |
| Total Phosphorus | 1 | 0.008 | 0.008 | 0.008 | mg/L |

**Table 1.2:** Statistics of historical record - Montagu River at Montagu Road Bridge (Hydrol 14200)

| MONTAGU RIVER AT MONTAGU ROAD BRIDGE | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **n** | **Mean** | **Max** | **Min** | **Unit** |
| Field Cond @ TRef 20 | 24 | 209 | 1695 | 207 | uS/cm (20 TRef) |
| Filt Resid (103-105) | 2 | 327.5 | 385 | 270 | mg/L |
| Redox Europe Stnd Ox | 3 | 77.33 | 85 | 61 | mv |
| Thermotolerant colif | 21 | 410.38 | 4000 | 10 | cfu/100 ml |

The time series plot of water temperature for site 14200 (Montagu River at Montagu Rd) (Figure 1.1) shows that the variation in temperature is quite large, with winter-time minima of around 6 $^{o}$C and summer-time maxima of up to 19 $^{o}$C.

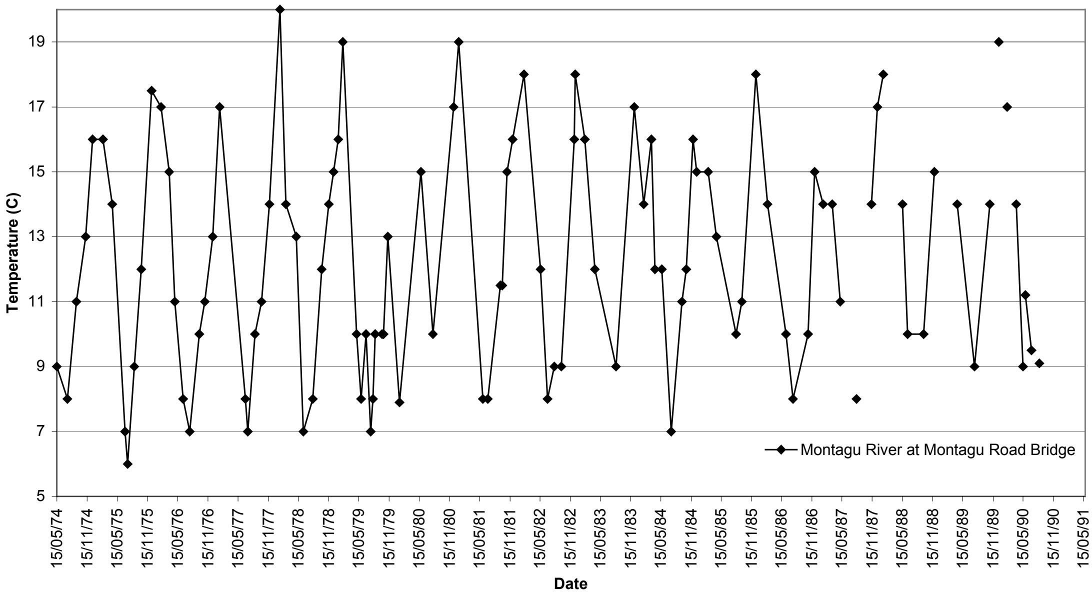


**Figure 1.1:** Plot showing variation in water temperature at site 14200 as represented by spot measurements made at the site from 1974 – 1995.

The time series for pH at site 14200 (Montagu Rd) is of unknown quality, as it is known that early measurements of pH were taken using litmus paper, which is not reliable for use on environmental waters. As the data in Figure 1.2 shows, there appears to be considerable variation in pH at this site, with values as low as 5.7 and as high as 9.1 being recorded. Given the occurrence of dolomite outcropping in reach of river immediately upstream, this kind of variation is unlikely, as the river water is likely to be buffered against such large pH changes. The record prior to 1986 suggests that the water at this site is generally alkaline, while the data following 1986 suggests a more neutral pH.

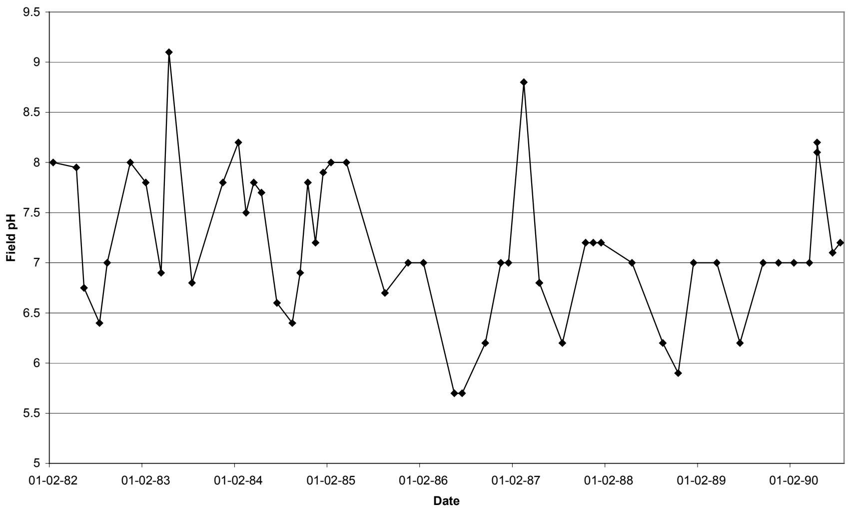


**Figure 1.2:** Plot showing variation in pH at site 14200 as represented by spot measurements made at the site from 1982 – 1991.

Data on thermotolerant coliform levels was collected at an additional three sites in the catchment (Table 1.3), two of these sites being on the Montagu River. Site 14243 (Montagu River at Roger River Rd) is at the upper end of the catchment and the data from this site clearly shows that faecal pollution is much less than at those sites within the main dairy farming region downstream. The data from site 14246 (Fentons Creek) also suggests that the quality of smaller tributary streams may also be poorer than that found in the main river, with average coliform levels almost double those found in the main river.

**Table 1.3** Statistics of bacterial sampling at sites in the Montagu catchment (Hydrol 14243, 14246 & 14252)

| MONTAGU RIVER UPSTREAM ROGER RIVER RD (14243) | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **n** | **Mean** | **Max** | **Min** | **Unit** |
| Thermotolerant coliforms | 22 | 26.32 | 160 | 0 | cfu/100 ml |

| FENTONS CREEKS AT MONTAGU RD (14246) | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **n** | **Mean** | **Max** | **Min** | **Unit** |
| Thermotolerant coliforms | 14 | 893 | 4000 | 176 | cfu/100 ml |

| MONTAGU RIVER AT RENISON RD (14252) | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **n** | **Mean** | **Max** | **Min** | **Unit** |
| Thermotolerant coliforms | 21 | 469.57 | 4000 | 14 | cfu/100 ml |

While the data presented above is scarce and of unconfirmed quality, some broad inferences can be made. The data support the conclusion that there is widespread faecal pollution in the lower reaches of the Montagu River and that tributary streams are likely to carry higher coliform loads that the main river. Other data also suggests that the presence of calcareous sedimentary rock in the middle and lower catchment influences the ionic characteristics of water in the main river. There is insufficient data available from the State database to support any additional comments on the nature of water quality in the Montagu catchment.

***Togari Effluent Reuse Project – DPIF***

During the 1994-96 a pilot project to investigate options for irrigating water from dairy-shed effluent ponds resulted in the collection of some data on the quality of groundwater at two 'test' farms in the Togari area. The project collected monthly data on faecal coliform concentration from shallow and deep bores on the two properties, as well as spot measurements of nutrient concentrations. While no final report on the findings of this project was written, the data showed that groundwater in the area was highly contaminated by faecal pollution and contained high to very high concentrations of nutrients.