Volunteer Nicole Howie

Being a citizen scientist is a great opportunity to volunteer and connect with the community and the environment

The story of **North Central Waterwatch**

The future of our waterways is in good hands

North Central Waterwatch connects communities with the health of their local waterways. Most waterways across the North Central Catchment Management Authority (CMA) region have been monitored for water quality over the past two decades. Thousands of volunteers have been supported to act as citizen scientists to collect important ecological information and have helped us to create a snapshot of waterway health.

Understanding these issues and reporting on the condition of creeks, rivers and lakes is important for guiding waterway management decisions and understanding the impact of a changing climate.

The results in this report highlight that our regions waterways are generally in good to moderate health, with some areas affected by high salinity levels commonly associated with land use activities such as land clearing and irrigation. Some waterways are also impacted by increased nutrients, mostly associated with nearby Water Reclamation Plants (WRP).

Foreword

by **Brad Drust**
Chief Executive Officer, North Central CMA

Brad Drust

CAM545 Upstream 14 January 2009

Since 1993, Waterwatch Victoria has been a successful community engagement program connecting local communities with river health and sustainable water management. North Central Waterwatch has been working with our community to increase their knowledge and skills in waterway related issues, supporting them to become custodians of our local waterways.

Water quality measurements taken in our waterways by themselves tell us very little, just as measuring your body temperature or heart rate alone tells you very little. However, these measurements are called data. What we need to know is what does this data mean? In the case of body temperature, we know what it should be in a healthy human, as also with our heart rate, and that if either are too high or too low something might be wrong.

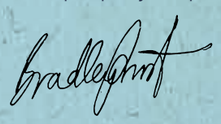
What is a healthy turbidity or salinity measurement in our regions waterways? Water quality measurements can vary naturally from waterway to waterway. For example, turbidity is a measure of water clarity. Highly turbid water appears cloudy or murky because of a large number of suspended particles. Many natural events can lead to an increase of suspended particles in a waterway. If all our waterways had good levels of turbidity, we would expect to see a pretty healthy ecosystem supporting a diverse range of aquatic plants and native animals.

The interpretation of data gives us information, or fundamental knowledge about the ecological health of a waterway. More than one indicator is required to comprehensively evaluate ecological health.

The North Central CMA's Regional Waterway Strategy underpins the actions of Waterwatch monitoring program and aims to use the data collected by our region's citizen scientists to help strengthen trust, credibility and participation in forming a collective awareness of the current condition of our precious waterways.

The evaluation of data in this report has used the Waterwatch Victoria report "Interpreting River Health Data" (www.vic.waterwatch.org.au) to assist in the interpretation of the data.

On behalf of the North Central CMA, I would like to take this opportunity to thank those involved in the North Central Waterwatch program and, in particular, those who volunteer their time to do this important work. The information provided by the program directly supports the sustainable management of our waterways, a task that is critical for the future prosperity and productivity of our region.



Brad Drust
Chief Executive Officer, North Central CMA

Acknowledgment to Country

The North Central Catchment Management Authority (CMA) acknowledges Aboriginal Traditional Owners within the region, their rich culture and spiritual connection to Country. We also recognise and acknowledge the contribution and interest of Aboriginal people and organisations in land and natural resource management.

"Water is in our blood it connects us to country and without water we have nothing"

Sharnie Hamilton

Sharnie Hamilton

Interpreting results

The results in this report provide a summary of water quality data collected by citizen scientists from 1996 to 2016 and are a snapshot of the current condition (good, moderate, poor) of 25 waterways in 76 locations across the north central region. While there were many more sites visited during this time, the results in this report are based on data availability: frequency, duration and continuity. The data has been calculated using standard methods from the Interpreting River Health Data, Waterwatch Victoria manual.

The four major catchments in this report are; Campaspe, Loddon, Avoca and the Avon -Richardson.

The Victorian Government has a set of guidelines that provides limits to acceptable water quality levels for healthy ecosystems. These levels are based on biological characteristics assigned to parts of the catchment which is determined by its position in the region.

In our region, most of the upper catchments lie within the Cleared Hills Bioregion, while the lower elevation and floodplain areas lie within the Murray Plains Bioregion.

Four water quality parameters were measured at each site during this time; pH, electrical conductivity, reactive phosphorus and turbidity. Each site was assessed against the reference values for the bioregion it is in. Reference condition values are calculated based on information known for an area, as if it was in the best available condition for that region.

Colour Coding

Sites have been colour coded and interpreted as follows:

- **Good:** Water quality is acceptable and has minimal impacts on aquatic ecosystem health.
- **Moderate:** Water quality and aquatic ecosystem health are moderately impacted.
- **Poor:** Water quality and aquatic ecosystem health are largely impacted.

Symbols

pH is a measure of acidity or alkalinity in freshwater and is commonly measured using a pH meter. The pH scale ranges from 0 to 14, with 7 being neutral. A large increase or decrease in pH, outside of the neutral range, can have a dramatic effect on the abundance or diversity of species found within a waterway.

Electrical conductivity is a measure of dissolved salts in freshwater and is commonly measured using an electrical conductivity meter. Dissolved salts are needed for metabolic processes by aquatic organisms, however, excessive amounts may be toxic.

Reactive phosphorus is a measure of nutrients in freshwater and is commonly measured using a Visocolor Colorcard. Although naturally occurring, increased concentrations of phosphorus provide opportunity for excessive growth of algae and other plants.

Turbidity is a measure of freshwater clarity and is commonly measured using a turbidity tube. High turbidity levels can impact plant growth, increase water temperature and can reduce the amount of available oxygen in the water, affecting plant growth and the behaviour of animals.

Water quality indicator levels

Water quality indicator levels for the Murray Plains and the Cleared Hills bioregions:

SEPP (WoV) segment	River health category	Reactive Phosphorus (mg/L)	pH (lower)	pH (upper)	Electrical conductivity (µS/cm)	Turbidity (NTU)
Cleared Hills	Good	≤0.03	≥6.3	≤8.5	≤700	≤15
	Moderate	>0.03 ≤0.1	<6.3 ≥5.5	>8.5≤9.0	>700 ≤1500	>15 ≤25
	Poor	>0.1	<5	>9.0	>1500	>25
Murray Plains	Good	≤0.06	≥6.3	≤8.5	≤2000	≤40
	Moderate	>0.06 ≤0.1	<6.3 ≥5.5	>8.5≤9.0	>2000 ≤3000	>40 ≤50
	Poor	>0.1	<5	>9.0	>3000	>50

Campaspe Catchment

Volunteer Felicity

Volunteers John, George and Veronica

CAM580 Upstream 20th January 2009

Lower Campaspe Program Area

The lower Campaspe River is in good condition. High concentrations of salinity during 2007 and 2009, the height of the Millennium Drought, maybe associated with land clearing and the application of irrigation water entering the into the groundwater, at the same time increasing the level of groundwater and therefore having a greater contribution to the baseflow of the river. The data suggests since the floods in 2010/11, the salinity levels have significantly dropped, and more recently are moderate to good.

What can be done? Planting deep-rooted native trees in high recharge areas (areas where water is entering the groundwater) to lower the water table and discharge areas (where water is returning to the surface), improved land management practices e.g. whole farm planning; and monitoring of groundwater and surface water to determine changes in salinity levels.

The lower Campaspe is a priority waterway and receives water for the environment, as well as a focussed program to reduce livestock and improve riparian vegetation. Waterwatch monitoring will track the progress of the Caring for the Campaspe program and help assess the benefits of water for the environment.

Active volunteers: David George, John and Veronica Groat, Felicity Johnson

Average results	pH	Electrical conductivity	Reactive phosphorus	Turbidity
Cleared Hills	7.5	1740.3	0.03	22.5
Murray Plains	7.7	2507.7	0.04	37.1

Coliban Program Area

The Coliban catchment generally meets the indicator levels for healthy ecosystems. There is a generally high threat of diffuse nutrient inputs along the Coliban River associated with land-use and soil erosion, particularly along the mid-reaches of the Program Area. These were also considered to be a high threat to water quality along the mid reaches, as is demonstrated in the results

What can be done? Managing or reducing the amount of phosphorus or sediments entering a waterway can be achieved by determining and reducing the primary source of effect. Managing urban stormwater and improving native vegetation along the banks of waterways will protect water quality as plants often act as a physical filter, trapping sediments as water drains through and stabilising banks, protecting against erosion.

The Coliban River below Malmsbury receives a minimum passing flows. Waterwatch monitoring will help assess the benefits of the environmental flows.

Active volunteers: Naomi Hewitt-Ware

Average results	pH	Electrical conductivity	Reactive phosphorus	Turbidity
	7.7	871.1	0.05	15

Upper Campaspe Program Area

Although this part of the catchment meets the indicator levels for healthy ecosystems, peaks in phosphorus and turbidity at some sites have been identified. These results are not alarmingly high. Increased turbidity levels are often a result of increased sediment entering the waterway from localised erosion or areas of high soil disturbance. Increased phosphorus may indicate that eroded soils are depositing as sediment (including particles with phosphate fertiliser attached), discharge from WRPs, stormwater runoff, discharges from intensive agriculture / dairying, stock access to streams and poor land management. Although both phosphorus and sediment are a naturally occurring, both can change dramatically after a rainfall event following a prolonged dry period.

What can be done? Managing or reducing the amount of phosphorus or sediments entering a waterway can be achieved by determining and reducing the primary source of effect. Managing stormwater and sewage input, particularly from Kyneton and Woodend WRP, and improving native vegetation along the banks of waterways will protect water quality as plants often act as physical filters, trapping sediments as water drains through them and stabilising banks, protecting against erosion.

Upper Campaspe River is priority waterway, and has a program that aims to improve water quality by undertaking environmental works with a focus on riparian vegetation. Waterwatch monitoring will track the progress of the Caring for the Campaspe project and will contribute to tracking the management of WRPs near Kyneton and Woodend

Active volunteers: Geoff McLeod, Tess Williamson, Barbara James

Average results	pH	Electrical conductivity	Reactive phosphorus	Turbidity
	7.2	749.4	0.05	17.6

Loddon Catchment

Volunteers Frank Steele and Ken Laing

Lower Loddon Program Area

The Lower Loddon was generally in moderate condition although salinity was moderately high downstream of Cairn Curran.

What can be done? Planting deep-rooted native trees in high recharge areas (areas where water is entering the groundwater) to lower the water table and discharge areas (where water is returning to the surface), improved land management practices e.g. whole-farm planning; monitoring of groundwater and surface water to determine changes in salinity levels.

Water for the environment is released from Cairn Curran and the Waterwatch monitoring will track the progress of the Native Fish Recovery Plan (NFRP) for the lower Loddon River and help assess the benefits of the environmental flows

Active volunteers: Cathy McCallum, Bridgewater Primary School, Jim Lawson, Ruth and John Penny

Average results	pH	Electrical conductivity	Reactive phosphorus	Turbidity
Murray Plains	7.9	2702	0.0	15.9
Cleared Hills	7.6	1048	0.0	20.0

Loddon Western Tributaries Program Area

Only two sites were monitored in this catchment which makes an assessment of the entire program area difficult. Birch's Creek is in good condition and while the ephemeral Pretty Jane Creek is in moderate condition, turbidity is poor.

What can be done? Managing or reducing the amount of sediments entering the waterways will protect aquatic ecosystem. Improving native vegetation along the banks of waterways will protect water quality as plants often act as a physical filter, trapping sediments as water drains through and stabilising banks, protecting against erosion.

Birch's Creek is a priority waterway, receives water for the environment and has a program to improve river blackfish habitat. Waterwatch monitoring will track the progress of the Birch's Creek priority recovery program and help assess the benefits of the environmental flows.

Active volunteers: Ron Cosgrave, Marion Da Costa

Average results	pH	Electrical conductivity	Reactive phosphorus	Turbidity
	7.4	400.8	0.0	42.5

Gunbower Program Area

Only one site was monitored in the Gunbower Program Area which makes an assessment of the entire program area difficult. The one site monitored on Gunbower Creek was in good condition. It should be noted that Gunbower Creek is used as an irrigation water carrier, while once ephemeral, now flows constantly with the highest flows in summer. A recent assessment of macroinvertebrates (waterbugs) shows the creek system is in poor ecological condition, most likely due to altered flow regime and nutrient enrichment.

What can be done? Managing or reducing the amount of sediments entering the waterways will protect the aquatic ecosystem. Improving native vegetation along the banks of the waterway will protect water quality, as plants often act as a physical filter, trapping sediments as water drains through and stabilising banks, protecting against erosion. Gunbower Creek is a priority waterway, receives water for the environment and benefits from the NFRP program to improve riparian vegetation and fish habitat. Waterwatch monitoring will track the progress of the NFRP and help assess the benefits of water for the environment.

Active volunteers: Glenn Rogers

Average results	pH	Electrical conductivity	Reactive phosphorus	Turbidity
	7.5	81.7	0.02	30

Loddon Eastern Tributaries Program Area

Monitoring is largely restricted to Bendigo Creek and the results indicate that it is in moderate to poor ecological condition. Urban stormwater and Bendigo WRP discharge have a substantial effect on water quality in the creek. The other waterway monitored is the ephemeral Spring Creek that is in moderate condition.

What can be done? Managing urban stormwater runoff and sewage input from Coliban Water's Bendigo WRP will improve water quality. Waterwatch monitoring will track the progress of stormwater runoff and industrial and WRP effluent management.

Active volunteers: Nicole Howie, Terri Williams, Frank Steele

Average results	pH	Electrical conductivity	Reactive phosphorus	Turbidity
	7.7	5441.8	0.1	39.3

Upper Loddon Program Area

The upper Loddon is in moderately good condition, but had high salinity in Forest and Campbells creeks. Phosphorus was also high in Campbells Creek. The Campbells Creek site is downstream of the Castlemaine WRP discharge. High concentrations of salinity may be associated with land clearing, particularly for mining and, at the same time, an increasing level of groundwater due to the drought. The data suggests since the floods in 2010/11 the salinity levels have markedly dropped, and more recently are moderate to good.

What can be done? Planting deep-rooted native trees in high recharge areas (areas where water is entering the groundwater) to lower the water table and discharge areas (where water is returning to the surface), improved land management practices e.g. whole-farm planning; monitoring of groundwater and surface water to determine changes in salinity levels; and managing urban stormwater and sewage input, particularly from Castlemaine WRP. Local Landcare groups are working with the local council to improve and protect water quality and ecological function. Waterwatch monitoring will track the progress of these programs and will track the management of the Castlemaine WRP.

Active volunteers: Lyn Grocke, Castlemaine Landcare: Anne Perkins, Matt, George Ryan and Marilyn Vincent

Average results	pH	Electrical conductivity	Reactive phosphorus	Turbidity
	7.7	1721.8	0.1	10.4

Avoca Catchment

Volunteer Mel Watts

Upper Avoca River Program Area

The Upper Avoca is generally in moderate condition. While pH, phosphorus and turbidity were good at all sites, salinity was poor. At two sites, the salinity levels were likely to be toxic to aquatic life. Salinity is known to be naturally high in parts of this Program Area, and not necessarily reflective of human impacts.

What can be done? Planting deep-rooted native trees in high recharge areas (areas where water is entering the groundwater) to lower the water table and discharge areas (where water is returning to the surface), improved land management practices e.g. whole-farm planning; monitoring of groundwater and surface water to determine changes in salinity levels. Waterwatch monitoring will track changes in water quality, particularly salinity.

Active volunteers: John and Jan Dods, Melanie and Aron Watts

Average results	pH	Electrical conductivity	Reactive phosphorus	Turbidity
Cleared Hills	7.8	2620	0.1	35
Murray Plains	7.9	9530,5	0.01	27

Lower Avoca River Program Area

There is insufficient data to summarise for the Lower Avoca Program Area.

Volunteers John and Jan

AVO450 Upstream 20 January 2009

Avon-Richardson Catchment

Avon-Richardson Program Area

The Avon-Richardson Program Area was in moderate to poor ecological condition. Salinity was very high, particularly in the Richardson River and Hollands Lake, where it was regularly at levels greater than seawater, and toxic to aquatic life. Turbidity was poor, particularly in the lakes and Avon River.

What can be done? Planting deep-rooted native trees in high recharge areas (areas where water is entering the groundwater) to lower the water table and discharge areas (where water is returning to the surface), improved land management practices e.g. whole-farm planning; monitoring of groundwater and surface water to determine changes in salinity levels.

Active volunteers: Rob Loats, Keith McPherson

Average results	pH	Electrical conductivity	Turbidity
	8.8	20592	51

AVO350 Upstream 20th January 2009

Volunteer Rob Loats

A message from the North Central Waterwatch Coordinator

Citizen science has played a major role in the North Central Waterwatch program since 1993. I would like to take this opportunity to say thank you to all our volunteers, past and present, who contributed thousands of volunteer hours collecting and reporting have contributed important information about our regions waterways.

Two years ago, I asked David Tiller to help me design a report that would showcase volunteer data and help tell the story about water quality in our catchment. Since then, David and I, along with the help of others, have trawled through thousands of data sets, analysed and interpreted data and assessed it against water quality indicators.

Overall, the condition of the water as it makes its way across the catchments and into our precious waterways, is in moderate condition. Understanding this has helped us create a better program to identify areas where we can focus our monitoring efforts. While citizen science has been identified as important in monitoring outcomes of river restoration activities, a review of this data has helped us also identify information that is collected from even the smallest and driest of streams to better understand the bigger issues such as climate change.

Over the centuries, amateur scientists and volunteers made key contributions to the understanding of climate, evolution, geological processes, electricity, astronomy, and other phenomena (McKinley et al 2015). Before the internet and mobile devices, many naturalists, including Charles Darwin, contributed observations to museums and universities for researchers to study (Auerbach 2015).

The North Central CMA knows the value of supporting a citizen science programs such as North Central Waterwatch. Working closely with our volunteers means communities are well-placed to understand the issues surrounding water quality in their local rivers and creeks. This knowledge contributes to decisions about the future of our waterways by land managers, researchers, scientists and natural resource managers.

Thank you!

Cass Davis,
Regional Waterwatch Coordinator,
North Central CMA

Citizen scientists monitor:

- Water quality
- Waterbugs
- Photopoints
- Gauge boards
- Waterbirds
- Frogs
- Fish
- Mammals

North Central Waterwatch region

Waterwatchers are needed across the region to help collect vital information about the health of our waterways

Acknowledgments

North Central Waterwatch would like to acknowledge the contribution and support from the following individuals during the development of this publication: North Central CMA staff members Cass Davis – Regional Waterwatch Coordinator; Sophie Pritchard – River Detectives Project Officer and Peter Rose, Native Fish Recovery Plan Project Officer; Melissa Ludeman, Waterwatch volunteer, and Kelly Button, Bendigo Tafe student and a very special thank you to David Tiller whose contribution, commitment and support made this report possible.

The Victorian Government in supporting community partnerships over the next four years through Waterwatch and other citizen science initiatives to address local waterway priorities.

These priorities are being addressed as part of the government's $222 million investment over the next four years to improve catchment and waterway health across regional Victoria. This investment is a key component of Water for Victoria – the government's plan for management of our water resources now and into the future.

Cass Davis

Volunteer Cathy McCallum

How to get involved

Contact your local **Waterwatch Coordinator** at the **North Central Catchment Management Authority**

Via post: **PO Box 18, Huntly VIC 3551**

Main Office: **628–634 Midland Hwy Huntly Victoria 3551**

Phone: **03 5448 7124**

Email: **info@nccma.vic.gov.au**

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Coliban WATER

CITY OF GREATER BENDIGO