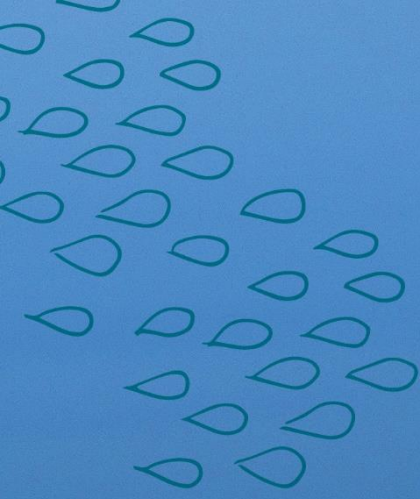


A young woman with brown hair, wearing a black top and a beige checkered blazer, stands in a kitchen. She is smiling and holding a clear glass of water in her right hand. Her left hand rests on the white countertop of a stainless steel sink. In the background, there are potted orchids, a striped towel hanging on a rack, and a window with natural light. The image is framed by teal circular graphic elements in the top right and bottom corners.

Annual Drinking Water Quality Report

2022/23



Further information



For more information on the 2022/23 Annual Drinking Water Quality Report, or any other concerns regarding water quality, including opportunities to work with us on improving water quality services, please contact our Product Quality Team on 1300 656 007 or email us at info@barwonwater.vic.gov.au.

barwonwater.vic.gov.au



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Message from the Managing Director



On behalf of Barwon Water, I am delighted to introduce our Annual Drinking Water Quality Report for the 2022/23 financial year. This report underscores our dedication to ensuring the provision of high-quality, secure, and safe drinking water to our customers and community.

We acknowledge the Wadawurrung and Eastern Maar people as the Traditional Owners of the areas we service, and extend our respect to elders past, present, and emerging. We also acknowledge the enduring custodianship of Aboriginal and Torres Strait Islander peoples, who have managed water and the environment with care for millennia. It is an honour to learn from and share in the wisdom of the world's oldest living culture and as we focus on enhancing water quality in our catchments and waterways we have so much more to learn.

Looking forward, our Strategy 2030 and 2023 Price Submission lay out our proactive response to the challenges posed by climate change and show how we are ensuring the delivery of secure, sustainable, and safe drinking water to our region.

As part of our 2023 Price Submission, we have committed to investing nearly \$95 million over the next five years in drinking water quality, including through upgrades to the Forrest and Gellibrand water treatment plants, our renewals program, catchment management and preventive asset management initiatives.

Central to our approach is the recognition that a flourishing environment is integral to safeguarding drinking water quality. To this end, our investment in catchment protection and enhancement will help improve the quality of the water in our catchments as well as the vitality of our rivers. By prioritising these initiatives, we prioritise the well-being of our customers and the broader community.

Our dedication to providing safe drinking water is rooted in a preventative risk-management methodology upheld by our HACCP (hazard analysis and critical control points) quality management system. This system places strong emphasis on continuous enhancement, and this report serves as a measure of our performance for the community.

Despite challenging weather conditions in 2022/23 we maintained consistently high drinking water quality performance with no regulatory notifications required for potential public health risks.

We also maintained drinking water complaint performance at near record lows.

Meanwhile, the external Safe Drinking Water Act audit of our Drinking Water Quality Risk Management Plan was undertaken in March 2023 by an independent certified auditor, on behalf of the Department of Health. Four minor non compliances were identified, that do not pose a public health risk. A detailed action plan has been completed to systematically address these minor non compliances and deliver opportunities for improvement.

Our commitment to the supply of safe, secure, sustainable water is outlined in our Drinking Water Quality Policy, where we have committed to working with our customers and other relevant agencies to:

- sustainably oversee water quality across the entire delivery chain, spanning from the source water to the end consumer
- enhance catchment and waterway health through partnerships with stakeholders, including councils, catchment agencies, and private landholders, in order to safeguard water quality
- implement a risk-based strategy that identifies and balances potential threats linked to water quality
- integrate the perspectives and needs of consumers, stakeholders, regulators, and employees into planning processes
- foster trust in water supply management through regular monitoring of drinking water quality and reporting, ensuring pertinent and prompt information for customers and regulators
- continue to develop and refine contingency plans and bolster incident response capabilities to effectively preserve public health
- work well with the Department of Health and contribute to discussions about shaping industry regulations and guidelines
- continuously enhance practices by evaluating performance against corporate commitments and stakeholder expectations.

It is with pleasure that I present to you Barwon Water's 2022/23 Annual Drinking Water Quality Report.



Shaun Cumming
Managing Director
Barwon Water



Key information

12 major reservoirs	8 surface water treatment plants	1 pre-treatment plant for ground water operations
23 secondary disinfection plants	26 water distribution basins	39 water distribution tanks
7,498 kilometers of water mains	8,100 square kilometers serviced	30 water quality localities
370,487 permanent population serviced	638,740 peak population serviced	178,505 properties serviced

1 Introduction

In accordance with the *Safe Drinking Water Act 2003*, this report provides an overview of Barwon Water's water supply system, the risk management processes in place to ensure the provision of safe drinking water and water quality performance for the 2022/23 financial year.

Barwon Water supplied approximately 33,254 million litres of drinking water during 2022/23 through a network of 12 reservoirs, 1 groundwater borefield, 8 water treatment plants, 20 disinfection sites and 6,866 kilometres of pipes.

To ensure customers are provided with safe drinking water, Barwon Water maintains a HACCP-certified drinking water quality management system, which covers the entire water supply system from the catchment to customers' connection. This system entails:

- detailed water quality risk identification processes
- audited control measures to manage the risks
- verification systems, including an independent water quality monitoring program
- water quality performance reporting to the public
- continuous improvement projects to further increase the systems capabilities.

Throughout 2022/23, we delivered drinking water to all 30 water sampling localities in accordance with the required water quality standards in the *Safe Drinking Water Regulations 2015*.

2 Requirements for drinking water

2.1 Meeting customer expectations

Barwon Water is committed to managing its water supply effectively to provide safe, high quality drinking water to its customers and ensure public health. This commitment forms part of Barwon Water's Drinking Water Quality Policy and our Customer Charter.

To ensure Barwon Water is open to customer feedback, the following measures are in place:

- complaints management system – this is used to record all complaints received regarding water quality.
- customer perception surveys – a broad survey carried out to ascertain the general customer attitude towards the quality of service provided.
- Customer Consultative Committee – a committee formed from members of the community who represent Barwon Water customers.
- customer feedback received during community panel workshops and pricing submission deliberative forums held during the reporting period.

2.2 Legislative requirements

The *Safe Drinking Water Act 2003* (the Act) is the principal legislation applicable to the quality of drinking water supplied by Barwon Water. The Act:

- requires Barwon Water to prepare, implement, review and revise plans to manage risks in relation to drinking water and some types of non-potable water
- provides criteria for the auditing of those plans by approved auditors
- requires Barwon Water to ensure drinking water meets quality standards specified in associated regulations (*Safe Drinking Water Regulations 2015*)
- requires Barwon Water to disclose to the public information concerning the quality of drinking water.

The Health (Fluoridation) Act 1973 regulates the safe and effective addition of fluoride into drinking water supplies in Victoria. *The Health (Fluoridation) Act* requires Barwon Water to include the Code of Practice for the Fluoridation of Water Supplies in their quality management system.

2.3 Undertakings, Variations and Exemptions

Barwon Water had no undertakings pursuant to regulation 16(c) of the Safe Drinking Water Regulations 2015, during this reporting period.

No variation in aesthetic standards pursuant to regulation 16(i)(i) or exemptions from a water quality standard pursuant to regulation 16(i)(ii) of the *Safe Drinking Water Regulations, 2015* were sought during this reporting period.

3 Defining drinking water

Drinking water supplied by Barwon Water must meet the obligations under the *Safe Drinking Water Act 2003* and Safe Drinking Water Regulations 2015.

The Australian Drinking Water Guidelines 2011 (ADWG) are used as a benchmark for safe drinking water. These guidelines are intended to provide a framework for effective management of drinking water supplies that, if implemented, will assure safety at point of use.

The ADWG include two types of guideline values:

- A health-related guideline value, which is the concentration or measure of a water quality characteristic that, based on present knowledge, does not result in any significant risk to health of the consumer over a lifetime of consumption.
- An aesthetic guideline value, which is the concentration or measure of a water quality characteristic that is associated with acceptability of water to the consumer, such as appearance, taste and odour.

The intended use of drinking water supplied by Barwon Water is:

- immediate consumption by the general public, with no further treatment or boiling by the consumer necessary for it to be reasonably considered safe and aesthetically acceptable.
- other domestic and commercial uses where the requirements for these other applications do not exceed government obligations.

The ADWG states that “The Guidelines are derived so as to take account of the needs of an individual through a normal lifetime, including changes in sensitivity that may occur between life stages” and that “Sensitive sub-populations (including those who are severely immuno-compromised) should seek further medical advice”.

The water quality data presented in this report is representative of the drinking water supplied in accordance with this definition and the above-mentioned requirements.

3.1 Regulated Water

Regulated water is “... *water that is not intended for drinking water but which could reasonably be mistaken as being drinking water.*” (as defined in the Department of Health, Regulated Water – Drinking Water Regulation Guidance Note).

Barwon Water does not have any regulated water supplies.

4 System Description

4.1 Overview

Barwon Water provided drinking water to a permanent population of approximately 370,487 people across an area of more than 8,100 square kilometres.

A map of the water supply system, including an overview of Barwon Water's service area and major infrastructure, is provided in Figure 1.

Source water is harvested from water supply catchments and is stored in reservoirs.

Additional water has been accessed from an interconnection between Geelong and Melbourne, the Melbourne to Geelong Pipeline.

Groundwater from the Anglesea borefield was also utilised during the reporting period. This was part of a pumping test to ensure a robust review and confirm how much water can continue to be taken sustainably. The test will also help ensure the protection of groundwater-dependent ecosystems into the future.

A network of pipes, channels and pumps then conveys the water to treatment plants, where it is treated to produce drinking water. The water is then delivered to customers by a network of pipes, basins, tanks and pump stations.

Figure 1 Barwon Water service area and major infrastructure



4.2 Water quality localities

Barwon Water's reticulation system is divided into water quality localities for the purpose of monitoring and reporting. Allocation of water quality localities allows for greater consistency in defining quality zones. This provides more meaningful data analysis, a greater understanding of water quality issues directly related to treatment,

consistency in water quality monitoring / reporting and a more intelligent response to water quality issues and noncompliances should they arise. Table 1 summarises the 2022/23 water quality localities.

A summary of the location of water quality localities in Barwon Water's service district is provided in Figure 2.

Table 1 Summary of water sampling localities

Water quality locality	Source water	Storage	Treatment plant	Number of Connections ¹	Permanent Population ²
Aireys Inlet	Barwon catchments	Wurdee Boluc reservoir	Wurdee Boluc	1,696	1,400
Anakie	Moorabool catchments	Stony Creek reservoir	Moorabool	302	650
	Barwon catchments	Wurdee Boluc reservoir	Wurdee Boluc		
Melbourne-Geelong Pipeline*					
Anglesea	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	3,232	3,110
Apollo Bay	Barham River	Marengo basin	Apollo Bay	2,488	2,500
Bannockburn	Moorabool catchments**	Stony Creek reservoir	Moorabool	2,529	7,070
Batesford	Moorabool catchments**	Stony Creek reservoir	Moorabool	406	1,370
Bellarine	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	110	190
Birregurra	West Barwon reservoir	Birregurra basins	Birregurra	422	850
Clifton Springs	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	6,357	13,340
Colac	West Gellibrand and Olangolah reservoirs	Colac basin no. 4	Colac	8,102	14,700
		Colac basin no. 5			
Cressy	West Gellibrand and Olangolah reservoirs	Colac basin no. 4	Colac	206	300
		Colac basin no. 5			
Forrest	West Barwon reservoir	Forrest basin	Forrest	150	200
Gellibrand	Lardners Creek	Gellibrand tanks	Gellibrand	70	300

Table 1 continued

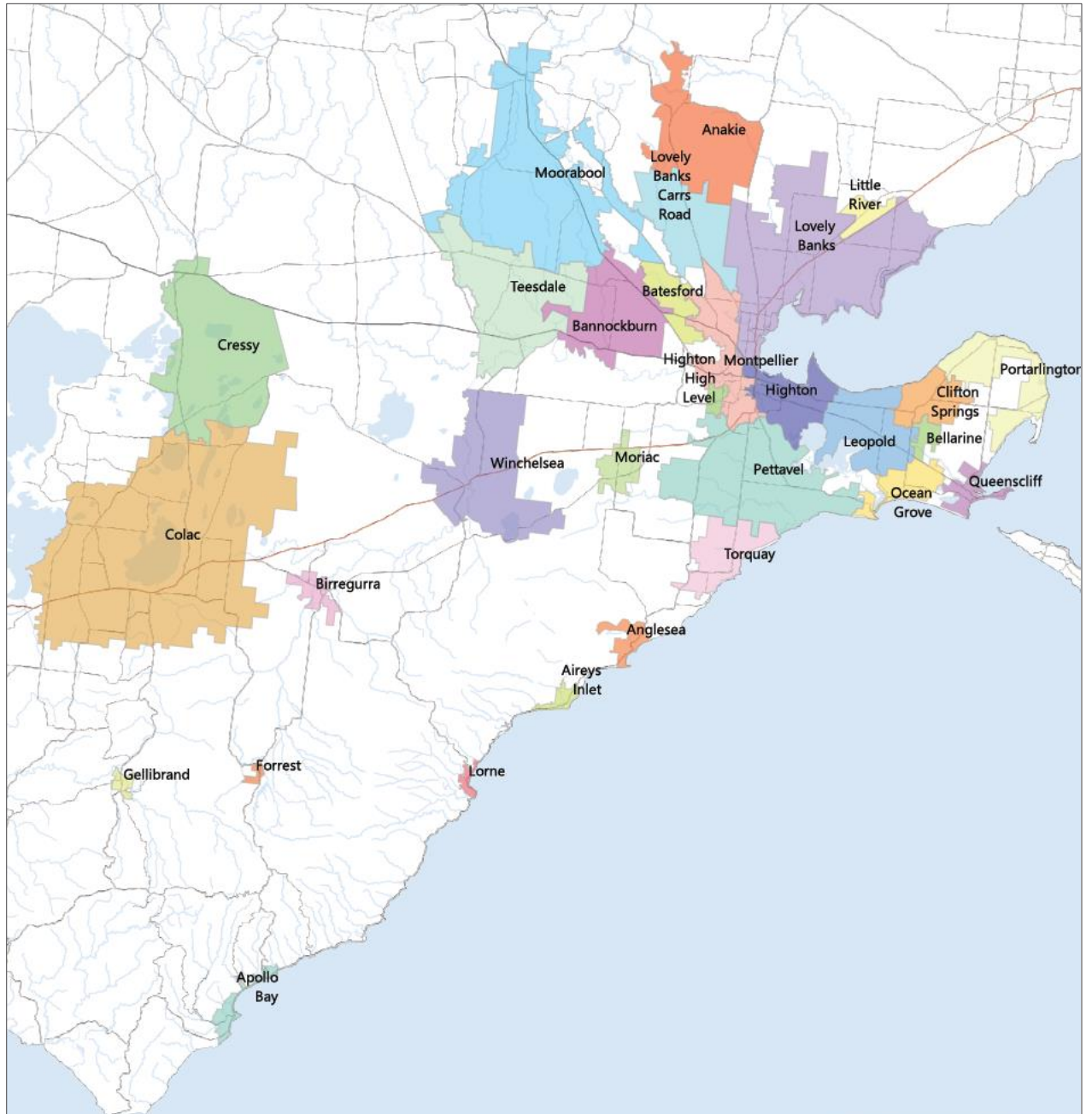
Water quality locality	Source water	Storage	Treatment plant	Number of Connections ¹	Permanent Population ²
Highton	Moorabool catchments Barwon catchments Ground water (drought)*	Stony Creek reservoir Wurdee Boluc reservoir	Moorabool Wurdee Boluc	22,054	39,000
Highton High Level	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	1,145	3,220
Leopold	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	7,963	19,240
Little River West	Moorabool catchments Barwon catchments	Stony Creek reservoir Wurdee Boluc reservoir	Moorabool Wurdee Boluc	152	390
	Melbourne-Geelong Pipeline*				
Lorne	Lorne catchment	Allen reservoir	Lorne	2,456	2,000
Lovely Banks	Moorabool catchments Barwon catchments	Stony Creek reservoir Wurdee Boluc reservoir	Moorabool Wurdee Boluc	27,765	63,410
	Melbourne-Geelong Pipeline*				
Lovely Banks - Carrs Road	Moorabool catchments Barwon catchments	Stony Creek reservoir Wurdee Boluc reservoir	Moorabool Wurdee Boluc	47	110
	Melbourne-Geelong Pipeline*				
Montpellier	Moorabool catchments Barwon catchments	Stony Creek reservoir Wurdee Boluc reservoir	Moorabool Wurdee Boluc	29,111	67,280
Moorabool	Moorabool catchments	Stony Creek reservoir	Moorabool	682	1,860
Moriac	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	346	960
Ocean Grove	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	12,162	24,360
Pettavel	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	21,377	54,990
Portarlinton	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	8,353	10,520
Queenscliff	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	4,562	5,730
Teesdale	Moorabool catchments**	Stony Creek reservoir	Moorabool	1,468	4,620
Torquay	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	11,559	24,110
Winchelsea	Barwon catchments Ground water (drought)*	Wurdee Boluc reservoir	Wurdee Boluc	1,233	2,640

1. This is the total number of properties connected to Barwon Water's waters supply system. This number includes residential and non-residential properties.
2. This is an estimated number of population serviced rounded to the closest 10. Each estimate is made by multiplying the number of residential connections by the occupancy rate (number of persons per dwelling) in ABS census data and adding any non-private dwellings (hospitals, nursing homes etc.).

* The Melbourne-Geelong Pipeline (MGP) and groundwater borefields are alternative water resources for improved water security. Water from the MGP was harvested for drinking water during the 2022/23 reporting period.

** These localities can be fed from Moorabool or Wurdee WTP and have received water from the Moorabool WTP only during the 2022/23 reporting period.

Figure 2 Water sampling localities 2022/23



4.3 Source of water

Drinking water is generally harvested from natural run-off into streams and reservoirs. Barwon Water's service area and supply system is relatively complex because it covers many small towns and water is harvested from a variety of different sources. All surface water catchments are declared Special Water Supply Catchments under the *Catchment and Land Protection Act 1994*.

Lorne, Apollo Bay, Gellibrand, Colac, Forrest and Birregurra are supplied from separate catchments all located in the Otway Ranges.

Barwon Water has a connection to Melbourne's water supply via the Melbourne to Geelong Pipeline. Barwon Water also holds a licence to extract water from the Anglesea borefield.

Torquay, Anglesea, Aireys Inlet, Winchelsea, Moriac, and the Bellarine Peninsula are all supplied from the Barwon catchment and can be supplemented by groundwater from the Anglesea borefield during times of drought. Geelong, Anakie, Lara and Little River West are supplied by water from both the Moorabool and Barwon catchments.

Bannockburn, Teesdale, Moorabool and Batesford are supplied from the Moorabool catchment.

The Melbourne to Geelong Pipeline was utilised to supplement drinking water in the Lovely Banks and Little River West localities. Montpellier and Highton can also receive water from Melbourne via the Lovely Banks to Montpellier pipeline, which did not occur in 2022/23.

Catchment management and protection is the first defence in the multi-barrier approach applied by Barwon Water to ensure safe drinking water. The condition of the catchment is arguably the most important factor influencing the quality of drinking water. It determines how much treatment is needed before the water is safe to drink and the costs associated with treatment. The effectiveness of catchment management is reliant on Barwon Water building and maintaining good relationships with stakeholders.

While most of our catchment areas are within protected national parks, some are open to the public and subject to a variety of land uses,

including townships, rural living, forestry, agriculture, and recreation. Barwon Water has conducted comprehensive catchment risk assessments to assess the water quality risks associated with activities undertaken in the catchments. In addition, the impact of catchment activities on water quality is assessed through wide-ranging monitoring in catchments, streams, and reservoirs.

Barwon Water aims to prevent deterioration of water quality in our catchments in accordance with the priorities established in the Corangamite Regional Catchment Strategy, the Corangamite Waterway Strategy and the Victorian Waterway Management Strategy. We achieve this through several different strategies and initiatives prioritised within our Declared Special Water Supply Catchments, including:

- Planning and development controls
- Waterway protection and rehabilitation
- Fire management
- Prevention of soil erosion
- Community education
- Appropriate land management practices
- Restricting recreations activity
- Promoting awareness of the impact of human activity on our water quality.

4.4 Water treatment

After water is harvested from natural run-off into streams and reservoirs, or extracted from groundwater sources, it is filtered and disinfected. These processes provide key risk barriers to ensure safe drinking water. Filtration is the process of physically removing contaminants from drinking water. There are five types of filtration methods used at Barwon Water:

1. Dissolved air flotation filtration
2. Direct filtration
3. Conventional clarification/filtration
4. Micro filtration
5. Ultra filtration.

Disinfection is the process of inactivating pathogens so they cannot cause disease. Water disinfection is an important means of ensuring positive public health outcomes are achieved. The complex system

of pipes used to distribute water means disinfection must be maintained from filtration through to our customers' taps, in order to prevent the regrowth of bacteria within the system. This is achieved using three main types of disinfection:

1. Chlorination
2. Chloramination
3. Ultraviolet light (UV).

The type of filtration and disinfection used depends on a number of factors including water quality, size of network and potential rate of consumption. An overview of the treatment processes for each water sampling locality is provided in Table 2.

Over the 2022/23 reporting period there were no issues arising from the treatment plants. Improvements to the treatment plants are explained in Section 9.

Table 2 Water filtration and treatment/disinfection processes

Water sampling locality	Main source	Water treatment plant	Treatment process	Treatment aids (Some aids only used seasonally)
Moorabool, Montpellier, Highton, Lovely Banks, Lovely Banks - Carrs Road, Bannockburn, Teesdale, Anakie, Little River West, Batesford.	East and West Moorabool River Barwon catchment (dependent on operational preference and time of year)	Moorabool	Dissolved Air Flotation Filtration (DAFF)	Aluminum Chlorohydrate Polymer
			Chlorination	Chlorine Gas
			Fluoridation	Fluorosilicic Acid
			Ultra Violet disinfection (supernatant return only)	
Lorne	Allen reservoir (St George River)	Lorne	Dissolved Air Flotation Filtration (DAFF)	Aluminum Chlorohydrate Sodium Hydroxide Polymer Potassium Permanganate Sodium Hexametaphosphate
			Chlorination	Sodium Hypochlorite
Colac, Cressy	West Gellibrand reservoir and Olangolah reservoir	Colac	Dissolved Air Flotation Filtration (DAFF)	Aluminum Chlorohydrate Potassium Permanganate Soda Ash Lime Polymer Sodium Hexametaphosphate
			Chlorination	Sodium Hypochlorite Chlorine Gas
			Fluoridation	Fluorosilicic Acid
Birregurra	West Barwon reservoir	Birregurra	Clarification	Aluminum Chlorohydrate
			pH Correction	Sulphuric Acid
			Microfiltration	*Sodium Hydroxide *Citric Acid (*used for cleaning membranes only)
			Chlorination	Sodium Hypochlorite

Table 2 continued

Water sampling locality	Main source	Water treatment plant	Treatment process	Treatment aids (Some aids only used seasonally)
Forrest	West Barwon reservoir	Forrest	Clarification	Aluminum Sulphate Polymer Potassium Permanganate Soda Ash Sodium Hexametaphosphate
			Filtration	
			Chlorination	Sodium Hypochlorite
			UV disinfection	
Apollo Bay	Barham River (Marengo basin)	Apollo Bay	Dissolved Air Floatation (DAF) Clarification	Aluminum Chlorohydrate Sulfuric Acid
			Ultrafiltration	*Sodium Hydroxide *Citric Acid (*used for cleaning membranes only)
			Chlorination	Sodium Hypochlorite
			GAC (Granular Activated Carbon) filtration	
Aireys Inlet, Winchelsea, Moriac, Little River West, Highton High Level, Montpellier, Pettavel, Highton, Lovely Banks, Lovely Banks - Carrs Road, Anakie, Torquay, Ocean Grove, Ocean Acres, Clifton Springs, Anglesea, Leopold, Portarlington, Queenscliff, Bellarine	West Barwon reservoir, East Barwon River, Callahan Creek diversion weir, Matthews Creek diversion weir, Pennyroyal Creek diversion weir and *Anglesea borefield	Wurdee Boluc *Pre-treatment for Anglesea borefield	Direct enhanced filtration	Aluminum Chlorohydrate Poly DADMAC Polymer
			Chlorination	Chlorine Gas
			Fluoridation	Fluorosilicic Acid
			*Aeration, Oxidation and pH adjustment	*Sodium hypochlorite *Lime *Potassium Permanganate *Polymer
Gellibrand	Lardners Creek	Gellibrand	Clarification	Aluminum Sulphate Polymer Soda Ash
			Filtration	
			Chlorination	Sodium Hypochlorite
			UV disinfection	

4.5 Distribution

After water is filtered and disinfected, it is conveyed to customers by a network of tanks, basins, pumps and pipes. Positive pressure and backflow prevention are the final barriers used by Barwon Water to ensure safe drinking water. Positive pressure means the water will direct any unwanted material away from the water supply system if leaks occur. Barwon Water requires the installation of testable backflow prevention devices when medium and high-hazard properties connect to the water supply system.

4.6 Secondary disinfection

Disinfectant residuals decrease as water passes throughout the distribution system and within storage tanks. Water disinfection plants are used to maintain adequate disinfection levels within the

distribution system. Barwon Water endeavours to maintain a balance between adequate disinfection residuals and aesthetic quality. Barwon Water manages 20 water disinfection plants. The two methods of secondary disinfection employed across the sites are chlorination and chloramination.

Chlorination is a widely used disinfection process, particularly effective against bacteriological organisms, and is most suited in shorter distribution systems.

Chloramination is an alternative disinfection process produced by combining chlorine with ammonia. The ammonia component stabilises the chlorine so disinfection can be sustained for longer in the drinking water distribution system.

Table 3 List of disinfection sites and disinfection mode

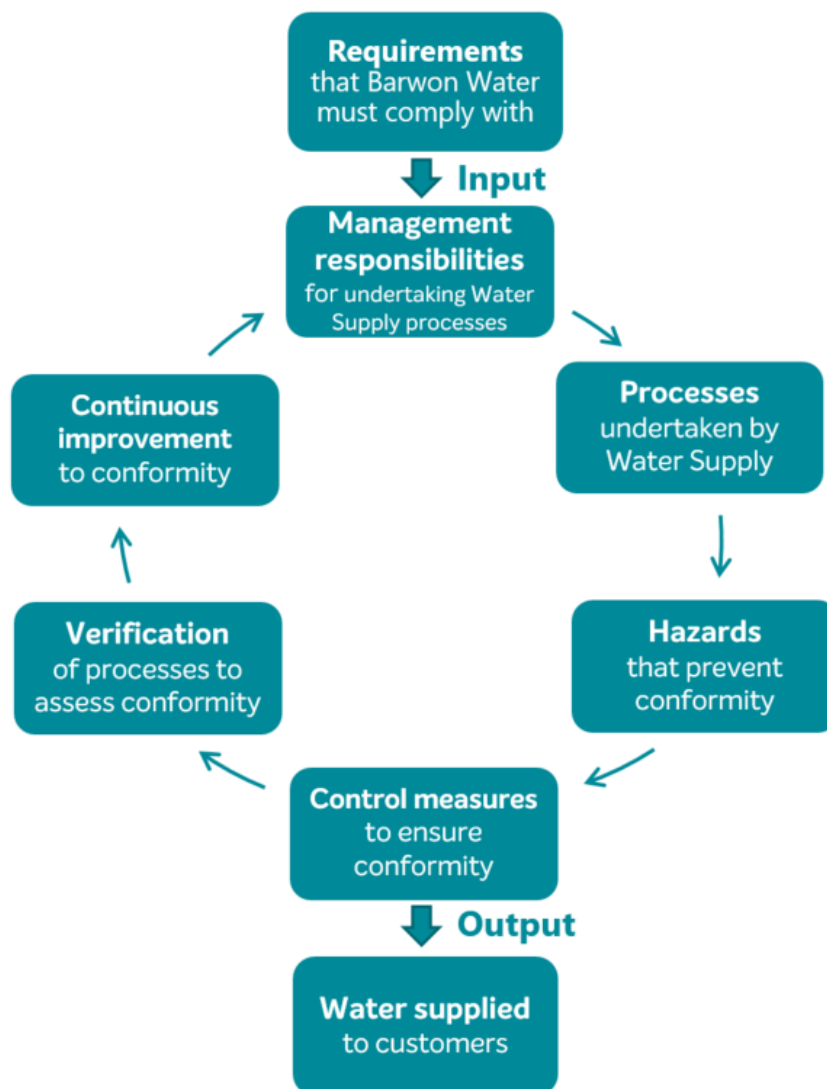
Water disinfection plant	Disinfection mode
Aireys Inlet	Chloramination
Alvie	Chlorination
Anakie	Chloramination
Anglesea	Chloramination
Bannockburn	Chloramination
Bellarine	Chlorination
Clifton Springs	Chloramination
Highton	Chlorination (seasonal operation)
Little River	Chlorination
Lovely Banks 1,2&3	Chloramination
Lovely Banks – Carrs Rd	Chloramination
Meredith	Chlorination
Montpellier 2&4	Chlorination (seasonal operation)
Ocean Grove	Chloramination
Pettavel	Chlorination (seasonal operation)
Portarlinton	Chloramination
Queenscliff	Chlorination
Teesdale	Chloramination
Torquay	Chlorination
Torquay High Level	Chlorination

5 Quality management system

5.1 Overview

Barwon Water utilises both AS/NZS ISO 9001:2015 and HACCP principles in its Quality Management System for the supply of safe and aesthetically pleasing drinking water. This system is summarised in Figure 3 below.

Figure 3 Quality Management System for the supply of drinking water



The requirements Barwon Water must meet, and the processes undertaken to meet these requirements, are described in previous sections of this report.

The following pages outline other steps that form the Quality Management System, namely hazard identification, control measures, verification and continual improvement.

5.2 Hazard identification

To determine key risks to the supply of safe and aesthetically pleasing drinking water, an extensive hazard assessment process has been undertaken from catchment to customer connection involving independent experts, management, engineers and system operators.

The key risks resulting from this assessment are reviewed regularly to identify when new risks emerge or when existing risks change. In addition to system-wide assessments, each water treatment plant undergoes a thorough risk assessment based on asset/component and process failure.

5.3 Control measures

5.3.1 Critical control points

Control measures are established to reduce the key risks to the supply of drinking water to an acceptable level. Where control is vital, critical control points (CCPs) are established using HACCP principles. CCPs in the Barwon Water system include process steps such as chemical receipt, filtration and disinfection.

5.3.2 Maintenance programs

Maintenance programs are undertaken on Barwon Water assets to maintain and improve water quality. These include programmed mains flushing and air scouring, tank and basin cleaning, and risk-based treatment plant asset maintenance and replacement programs.

5.3.3 Trained operators

All operators involved in the water supply process undertake training to ensure a high knowledge of treatment processes and associated risks. Operators are required to achieve a minimum level of qualification and experience as per the National Water Industry Operator Certification Framework. Ongoing competency is managed and demonstrated through an individual competency plan.

5.4 Verification and monitoring

Verification is used to authenticate the performance of the water supply system with respect to meeting process requirements. Verification at Barwon Water includes:

- individual supervisory control and data acquisition systems (SCADA)
- system-wide telemetry providing monitoring and alarms 24 hours a day, 7 days a week
- on-call operators with remote access to the telemetry system
- a drinking water quality monitoring program conducted by an independent National Association of Testing Authorities (NATA) accredited laboratory with extensive monitoring at source, treatment and distribution
- a water treatment chemical assurance program that includes quality assured chemical suppliers, the provision of a certificate of analysis, and independent testing to verify the purity of the chemical
- customer feedback captured in the complaints management system and customer perception surveys. These provide important information about the performance of the water supply system.

5.5 Continual improvement

Continuous improvement of water supply processes enables Barwon Water to continually comply with regulatory obligations and meet customer expectations. This is achieved through improvement actions identified from verification monitoring and through management review.

The production of an annual report directs Barwon Water to the key areas of improvement, particularly in relation to improvement projects. Section 9 of this report outlines some of the continuous improvement projects implemented in 2022/23 and maintains a strategic focus on continuously improving Barwon Water systems ongoing.

5.6 System auditing/peer review

An annual internal and external auditing program is established to assess the compliance of the quality management system.

5.7 Review of risk management plan

A review of the risk management plan was undertaken throughout the reporting period as part of Barwon Water's internal and external audit program.

The annual external audit of Barwon Water's quality management system was conducted by Bureau Veritas Australia Pty Ltd. This was a surveillance audit for our HACCP system. The audit was successfully passed and provides confidence that we continually identify, assess, and manage drinking water quality risks.

A regulatory audit of Barwon Water's Drinking Water Quality Risk Management Plan against the requirements of the *Safe Drinking Water Act 2003* was also undertaken during 2022/23. Please see the audit certificate in [Appendix A](#).

The lead auditor highlighted that Barwon Water has a strong commitment to the risk management of drinking water quality and a mature system for production and delivery of fit for purpose drinking water. After conducting a risk management plan audit of the water supplied by Barwon Water, the auditor was of the opinion that Barwon Water has not complied with the obligations imposed by section 7(1) of the *Safe Drinking Water Act 2003* during the audit period 1 January 2021 to 31 December 2022. There were four minor noncompliances (NCs) identified. All were graded as minor as they do not pose a public health risk. The causes of the four issues have been addressed as detailed in Table 4.

Ten opportunities for improvement (OFIs) were also identified. The OFI's relate to procedural, administrative and record-keeping improvements. 11 actions were implemented during the 2022/23 reporting period. See Table 4 for details and progress.

Table 4 Safe Drinking Water Act Audit 2023 Actions Taken

Reference number	Grade	2023 SDWA Audit Action	Target Date	Status	Action taken
1D-1	Minor noncompliance 1	For completeness, add Apollo Bay Water Treatment Plan (WTP) Granular Activated Carbon (GAC) Filtration Critical Control Point (CCP) to the CCP locations list.	31/5/2023	Complete	GAC CCP has been added to the Apollo Bay WTP CCP locations list.
1D-3	Minor noncompliance 1	Undertake a review, and revision as necessary, of all CCPs, and implement the revisions.	31/5/2023	Complete	All CCPs have been reviewed, updated and and revisions implemented.
1E-1	Minor noncompliance 2	Develop and implement processes to improve understanding of and adherence to the chemical delivery requirements by operational staff, including the importance of record keeping.	30/6/2023	Complete	An additional note was added to the checklists for receipt of bulk chemicals to provide reminder that records are to be kept on site for seven years from the date of receipt.
1E-2	Minor noncompliance 3	Undertake a systems-wide review of the annual calibration and implement findings.	30/9/2023	Complete	System wide review has been completed via stakeholder engagement.
2M-3	Minor noncompliance 4	The Colac WTP fluoridation CCP limit in the SCADA should be corrected to 1.5 mg/L (this was advised as completed on 2023-03-22).	30/6/2023	Complete	All CCPs are hardwired into PLCs.
1A-1	Opportunity for improvement	Update reference in Water Quality Risk Management Plan (WQRMP) to current Drinking Water Quality Policy (at the site visit, updating of the new policy was confirmed within the WQRMP).	n.a.	Complete	Link to the policy document available on Barwon Water's website was updated.
1B-2	Opportunity for improvement	Review and revise as necessary, the 2021 Water Treatment Process Risk Assessment – Guidance Document ECM ID: A16859653 to ensure currency of document history and content.	31/5/2023	Complete	The internal guidance document was updated to reflect the continuous review process of the Water Treatment Plant Risk Assessments.
1C-1	Opportunity for improvement	Ensure that the flow diagram used to conduct the risk assessment is documented in the slide pack that is used to inform the risk assessment process.	30/9/2023	Complete	Flow diagrams are documented in the risk assessments.
1D-2	Opportunity for improvement	Consider amending CCP Locations list to differentiate between CCPs and other control points.	31/8/2023	Complete	Other control points will be removed from the CCP Locations list after further engagement with stakeholders.

Table 5 continued

Reference number	Grade	2023 SDWA Audit Action	Due Date	Status	Action taken
1F-1	Opportunity for improvement	For future risk assessments, ensure that positions (not just names) are captured in the Risk Assessment Workshop presentation materials.	30/9/2023	Complete	Attendance summaries now include position title of participants.
2F-1	Opportunity for improvement	Add high risk entry points to the monitoring scan.	31/5/2023	Complete	Considered and assessed as unlikely to contribute to risk reduction. Backflow agreement register and pressure monitoring in distribution system allows assessment of a backflow risk.
2I-1	Opportunity for improvement	For completeness, consider adding beryllium and thallium to the sampling program, as possible impurities in alum as per Australian Drinking Water Guideline (ADWG) recommendations.	31/5/2023	Complete	Beryllium was added to the sampling program, as ADWG Table 9.5 Generic frequencies for monitoring non-microbial drinking water quality as supplied to the customers supports annual testing for Beryllium as an inorganic chemical. There are no health or aesthetic limits for Thallium.
2M-1	Opportunity for improvement	The GAC CCP should be updated across all documentation	30/6/2023	Complete	A review of all areas of the WQRMP has verified that Apollo Bay WTP GAC CCP is specifically identified where required.
2M-2	Opportunity for improvement	Documentation should be updated to clarify that distribution chlorine is Total Chlorine residual rather than Free and that only the upper limit is a CCP.	30/6/2023	Complete	The Process Control Manuals were updated to reference Free Chlorine (WTPs) and Total Chlorine (WDPs)
3B-1	Opportunity for improvement	Update the risk methodology to include a requirement to ensure that each regulated parameter, as relevant for the hazardous event, is specifically itemised.	30/6/2023	Complete	Hazards that pose a health risk are now specifically itemised in the Distribution Risk Assessments in line with the SDWA s9(2): (i) pathogenic micro-organisms, (ii) inorganic chemicals, (iii) organic chemicals including pesticides and organic DBPs, (iv) radiological parameters, (v) algal toxins.

6 Water quality for 2022/23

Barwon Water has developed a Drinking Water Quality Monitoring Program (DWQMP), undertaken by an independent laboratory, accredited by the National Association of Testing Authorities (NATA), under a laboratory services contract.

Source waters such as streams, channels and reservoirs, are analysed to provide for the early notice of changing upstream water quality and to verify catchment management plans are effective in minimising risks to source water quality.

Treated water is analysed to provide critical control point monitoring and to verify water quality risks associated with treatment plant operation are minimised.

Water throughout the distribution system and at designated customer water meters are analysed to verify Barwon Water is consistently delivering safe, high-quality water that meets identified guidelines.

The DWQMP is based on sound risk management principles in accordance with Barwon Water's HACCP plan

and the recommendations of the Australian Drinking Water Guidelines.

The monitoring results and performance assessments of drinking water are presented in this report. Results provided in this report include all regulatory sampling conducted during the 2022/23 financial year.

Additional water quality data, including that which may prove helpful for enthusiasts such as home brewers can be found on the Barwon Water public website <https://www.barwonwater.vic.gov.au/water-and-waste/water-quality/results-and-data>. This data is updated quarterly to provide up-to-date, representative information to our customers.

If there is further data of interest, in compliance with Section 23 of the Act, all results from Barwon Water's drinking water quality monitoring program are available on request to the public within 7 days of being compiled.

6.1 Escherichia coli (*E. coli*)

- Limit of detection = 0 MPN/100 mL
- Regulatory standard: All samples of drinking water collected to contain no *E. coli* per 100 mL of drinking water, with the exception of any false positive sample.

Table 6 *E. coli* compliance

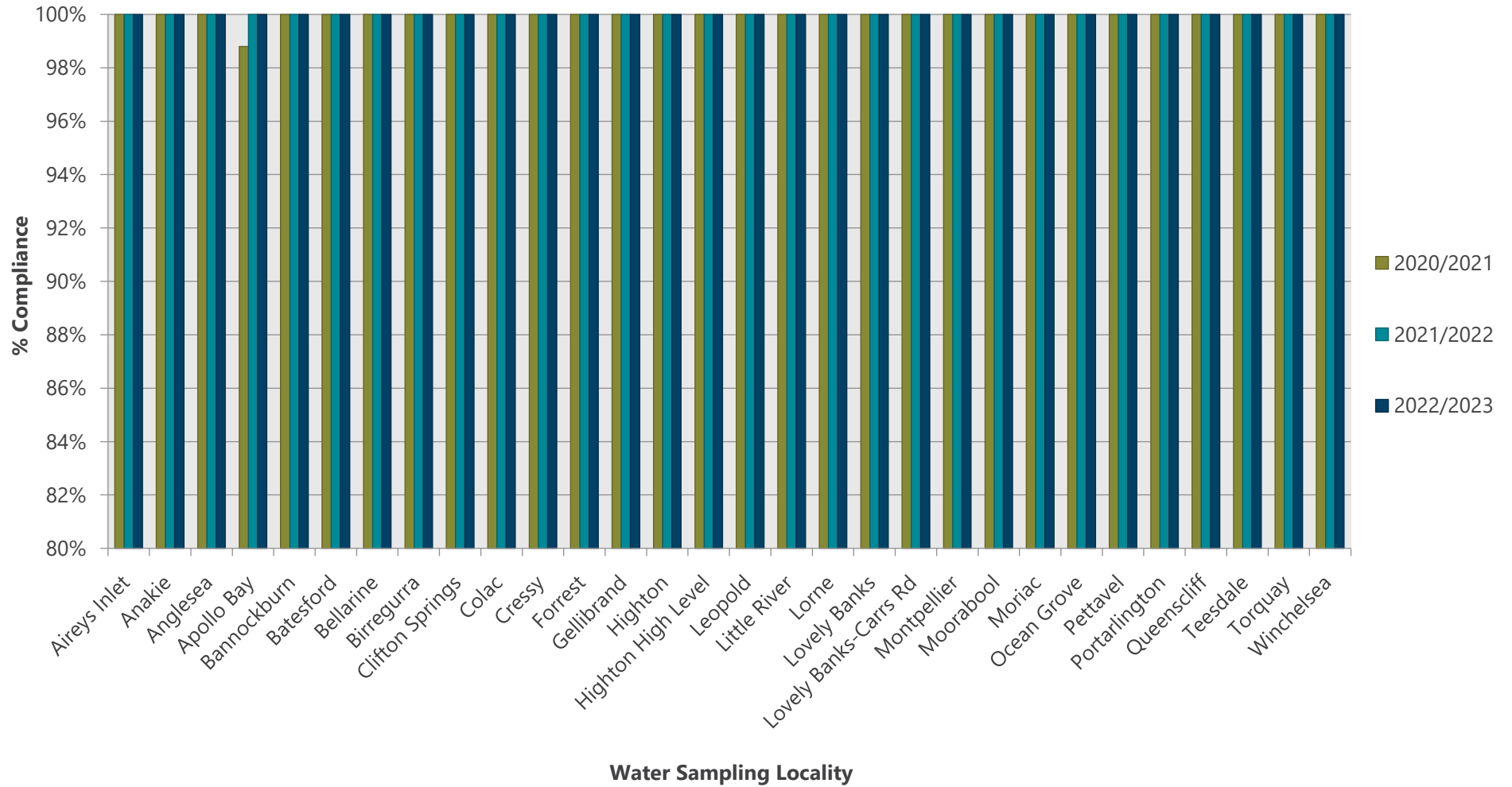
6.1.1 Results

Water Quality Locality	Frequency of sampling*	Number of samples	Maximum Result (organisms/100mL)	Number of detections and investigations conducted (s22)	Number of samples where standard was not met (s18)
Aireys Inlet	> weekly	76	0	0	0
Anakie	> weekly	75	0	0	0
Anglesea	> weekly	81	0	0	0
Apollo Bay	> weekly	86	0	0	0
Bannockburn	> weekly	76	0	0	0
Batesford	> weekly	76	0	0	0
Bellarine	> weekly	77	0	0	0
Birregurra	> weekly	76	0	0	0
Clifton Springs	> weekly	92	0	0	0
Colac	> weekly	203	0	0	0
Cressy	> weekly	76	0	0	0
Forrest	> weekly	76	0	0	0
Gellibrand	> weekly	76	0	0	0
Highton	> weekly	158	0	0	0
Highton High Level	> weekly	76	0	0	0
Leopold	> weekly	109	0	0	0
Little River	> weekly	74	0	0	0
Lorne	> weekly	91	0	0	0
Lovely Banks	> weekly	255	0	0	0
Lovely Banks-Carrs Rd	> weekly	74	0	0	0
Montpellier	> weekly	259	0	0	0
Moorabool	> weekly	100	0	0	0
Moriac	> weekly	76	0	0	0
Ocean Grove	> weekly	143	0	0	0
Pettavel	> weekly	205	0	0	0
Portarlington	> weekly	106	0	0	0
Queenscliff	> weekly	86	0	0	0
Teesdale	> weekly	76	0	0	0
Torquay	> weekly	149	0	0	0
Winchelsea	> weekly	76	0	0	0

* Sampling frequency is dependent on population and varies in each locality as described in the Australian Drinking Water Guidelines 2011. This is in addition to distribution entry point samples taken to compare the representativeness of reticulation samples.

Figure 4 E. coli

% E.coli compliance (0 MPN/100mL)



6.1.2 Analysis of results

6.1.2.1 Trend over localities

In 2022/23 all of Barwon Water's water quality sampling localities complied with the *E. coli* water quality standard over the duration of the reporting period.

6.1.2.2 Trend over time

In 2022/23 compliance with the *E. coli* water quality standard was maintained with 100%.

6.2 Trihalomethanes (THMs)

- Limit of detection = 0.004 mg/L
- Regulatory standard ≤ 0.250 mg/L

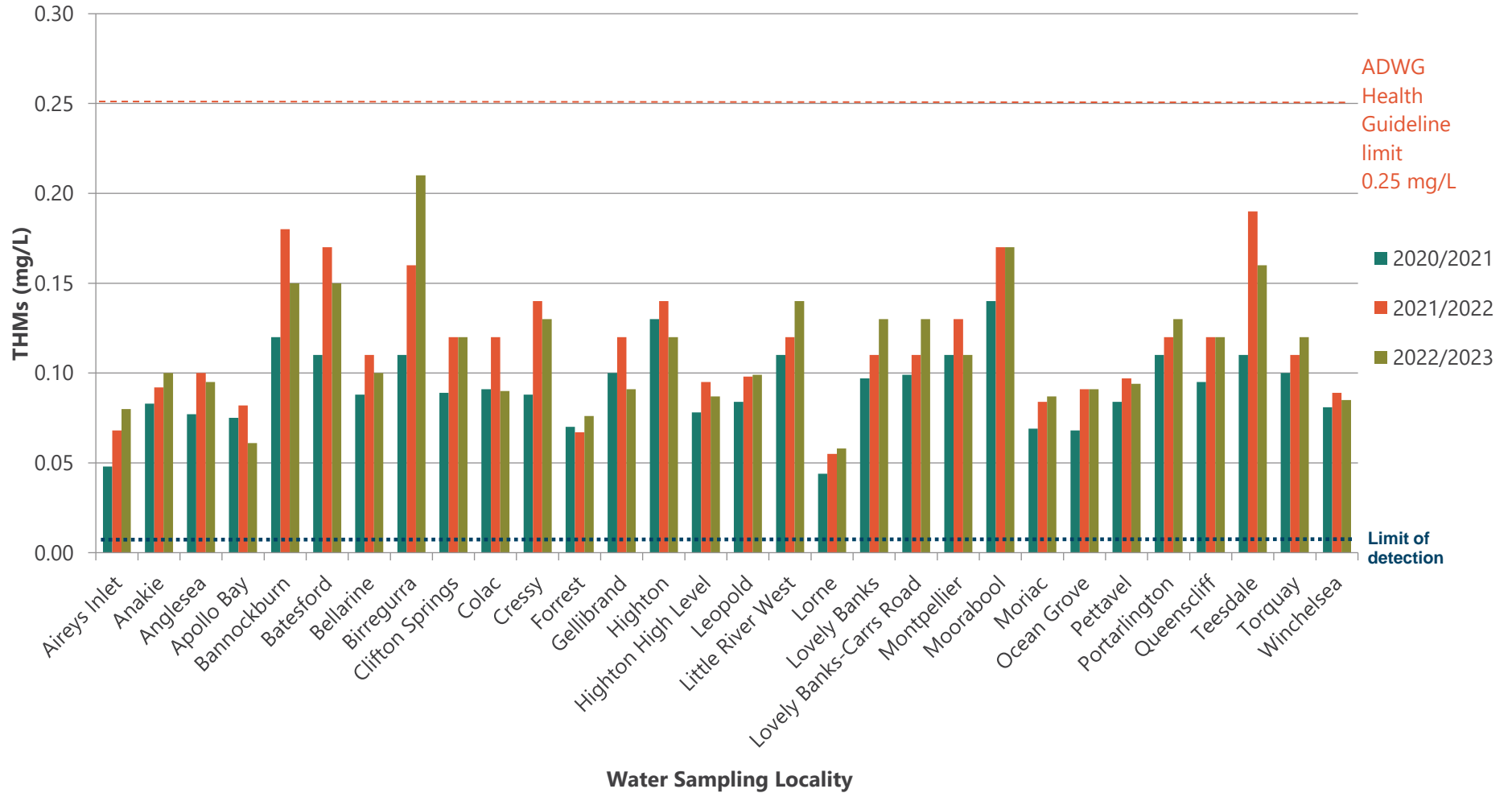
6.2.1 Results

Table 7 Trihalomethane results

Water Quality Locality	Frequency of sampling	Number of samples	Drinking Water Quality Standard (mg/L)	Maximum (mg/L)	Average (mg/L)	Number of samples where standard was not met (s18)
Aireys Inlet	> monthly	23	0.25	0.080	0.049	0
Anakie	> monthly	22	0.25	0.100	0.076	0
Anglesea	> monthly	24	0.25	0.095	0.072	0
Apollo Bay	> monthly	24	0.25	0.061	0.031	0
Bannockburn	> monthly	24	0.25	0.150	0.135	0
Batesford	> monthly	24	0.25	0.150	0.115	0
Bellarine	> monthly	23	0.25	0.100	0.072	0
Birregurra	> monthly	33	0.25	0.210	0.112	0
Clifton Springs	> monthly	24	0.25	0.120	0.086	0
Colac	> monthly	47	0.25	0.090	0.070	0
Cressy	> monthly	24	0.25	0.130	0.096	0
Forrest	> monthly	22	0.25	0.076	0.055	0
Gellibrand	> monthly	23	0.25	0.091	0.067	0
Highton	> monthly	24	0.25	0.120	0.081	0
Highton High Level	> monthly	24	0.25	0.087	0.067	0
Leopold	> monthly	24	0.25	0.099	0.073	0
Little River	> monthly	23	0.25	0.140	0.107	0
Lorne	> monthly	24	0.25	0.058	0.033	0
Lovely Banks	> monthly	44	0.25	0.130	0.092	0
Lovely Banks-Carrs Rd	> monthly	23	0.25	0.130	0.096	0
Montpellier	> monthly	36	0.25	0.110	0.080	0
Moorabool	> monthly	35	0.25	0.170	0.116	0
Moriac	> monthly	23	0.25	0.087	0.056	0
Ocean Grove	> monthly	23	0.25	0.091	0.069	0
Pettavel	> monthly	36	0.25	0.094	0.068	0
Portarlington	> monthly	24	0.25	0.130	0.098	0
Queenscliff	> monthly	23	0.25	0.120	0.084	0
Teesdale	> monthly	24	0.25	0.160	0.125	0
Torquay	> monthly	34	0.25	0.120	0.085	0
Winchelsea	> monthly	24	0.25	0.21	0.082	0

Figure 5 Trihalomethanes

Trihalomethanes (MAX, mg/L)



6.2.2 Analysis of results

6.2.2.1 Trend over localities

Full compliance was achieved for all water quality localities for Trihalomethanes (THMs). The highest result for the year was from the Birregurra water quality locality at 0.21 mg/L. This is due to the seasonal higher level of organics in the source water and required chlorine disinfection dose.

6.2.2.2 Trend over time

In general, maximum THMs levels in 2022/23 were slightly higher than in previous years. The maximums were associated with increased levels of organics brought about by source water changes. Average THM levels followed a similar pattern to previous years.

6.3 Turbidity

- Limit of detection = 0.1 NTU
- Regulatory standard = The 95th percentile of results for samples in any 12-month period must be less than or equal to 5 NTU.

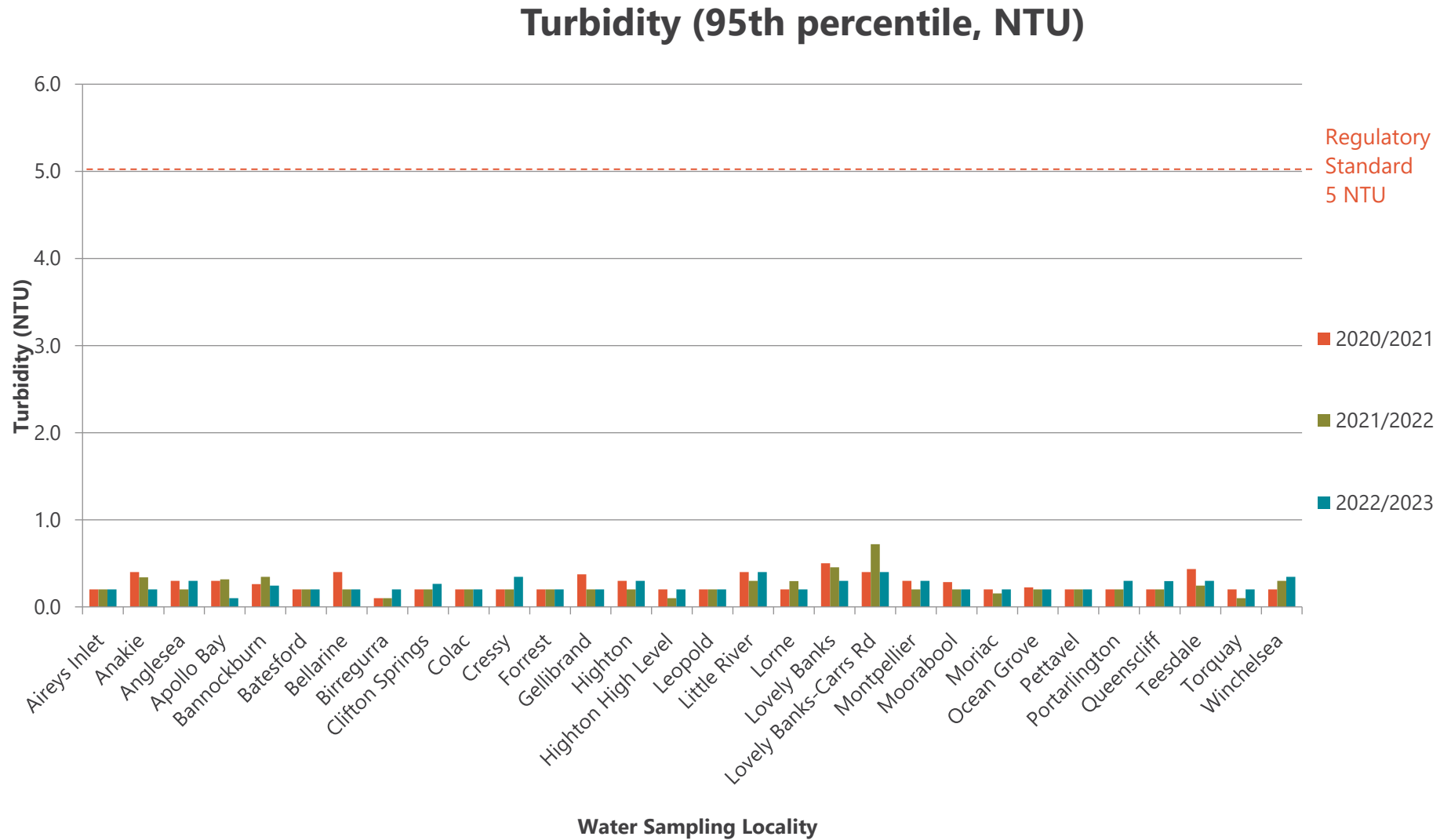
6.3.1 Results

Table 8 Turbidity

Water Quality Locality	Frequency of sampling*	Number of samples	Maximum (NTU)	Maximum 95th Percentile of turbidity results in any 12 months (NTU)	Number of 95th Percentile of results in any 12 months above the standard (s18)
Aireys Inlet	weekly	52	0.6	0.2	0
Anakie	weekly	52	0.3	0.2	0
Anglesea	> weekly	57	0.6	0.3	0
Apollo Bay	> weekly	62	0.3	0.1	0
Bannockburn	weekly	52	1.3	0.2	0
Batesford	weekly	52	1.6	0.2	0
Bellarine	> weekly	53	0.6	0.2	0
Birregurra	weekly	52	0.3	0.2	0
Clifton Springs	> weekly	68	0.6	0.3	0
Colac	> weekly	74	0.8	0.2	0
Cressy	weekly	52	2.3	0.3	0
Forrest	weekly	52	0.3	0.2	0
Gellibrand	weekly	52	0.6	0.2	0
Highton	> weekly	134	8.2	0.3	0
Highton High Level	weekly	52	0.2	0.2	0
Leopold	> weekly	85	2.1	0.2	0
Little River	weekly	52	0.5	0.4	0
Lorne	> weekly	67	0.3	0.2	0
Lovely Banks	> weekly	187	1.1	0.3	0
Lovely Banks-Carrs Rd	weekly	52	1.1	0.4	0
Montpellier	> weekly	211	0.9	0.3	0
Moorabool	weekly	52	0.2	0.2	0
Moriac	weekly	52	0.7	0.2	0
Ocean Grove	> weekly	119	1.5	0.2	0
Pettavel	> weekly	157	0.2	0.2	0
Portarlington	> weekly	82	0.5	0.3	0
Queenscliff	> weekly	62	7.2	0.3	0
Teesdale	weekly	52	0.4	0.3	0
Torquay	> weekly	115	0.4	0.2	0
Winchelsea	weekly	52	0.7	0.3	0

* Sampling frequency is dependent on population and varies in each locality as described in the Australian Drinking Water Guidelines 2011. This is in addition to distribution entry point samples taken to compare the representativeness of reticulation samples.

Figure 6 Turbidity



6.3.2 Analysis of results

6.3.2.1 Trend over localities

The turbidity (95th Percentile) standard was met in each locality during the reporting period.

6.3.2.2 Trend over time

Turbidity results during 2022/23 followed a similar pattern to previous years. All localities displayed results well below the quality standard.

6.4 Fluoride

The *Health (Fluoridation) Act 1973* states that the annual average fluoride concentration in drinking water shall not exceed 1 mg/L. The Department of Health (DH) directs that fluoride plants should achieve: a minimum average level greater than or equal to 0.6 mg/L (the lower action limit)

and an average level as close as possible to the operating target of 0.9 mg/L. The natural background fluoride levels from the catchment were monitored and are reported in section 6.7.3 of this report.

6.4.1 Results

- Limit of detection = 0.05 mg/L
- ADWG health guideline value < 1.5 mg/L

Table 9 Fluoride

Water Quality Locality	Water Treatment Plant	Frequency of sampling	Number of samples	Drinking water quality standard (mg/L)	Target optimum fluoride concentration (mg/L)	Maximum (mg/L)	Average (mg/L)	Number of samples where standard was not met (s. 18)
Anakie	Moorabool WTP	monthly	12	1.5	0.9	0.91	0.83	0
Bannockburn		monthly	12	1.5	0.9	0.96	0.77	0
Batesford		monthly	12	1.5	0.9	0.98	0.79	0
Little River West		monthly	12	1.5	0.9	0.92	0.81	0
Lovely Banks		> monthly	42	1.5	0.9	0.91	0.69	0
Lovely Banks-Carrs Road		monthly	12	1.5	0.9	0.92	0.83	0
Montpellier		> quarterly	10	1.5	0.9	0.92	0.87	0
Moorabool		> monthly	62	1.5	0.9	0.98	0.81	0
Teesdale		monthly	12	1.5	0.9	0.89	0.76	0
Aireys Inlet		Wurdee Boluc WTP	monthly	12	1.5	0.9	0.93	0.84
Anglesea	monthly		12	1.5	0.9	0.93	0.83	0
Bellarine	monthly		12	1.5	0.9	0.95	0.82	0
Clifton Springs	monthly		12	1.5	0.9	0.93	0.83	0
Highton	>monthly		13	1.5	0.9	0.92	0.82	0
Highton HL	monthly		12	1.5	0.9	0.92	0.81	0
Leopold	monthly		12	1.5	0.9	0.94	0.81	0
Moriac	> weekly		65	1.5	0.9	0.94	0.85	0
Ocean Grove	monthly		12	1.5	0.9	0.93	0.83	0
Pettavel	monthly		12	1.5	0.9	0.93	0.80	0
Portarlington	monthly		12	1.5	0.9	0.94	0.83	0
Queenscliff	monthly		12	1.5	0.9	0.91	0.82	0
Torquay	>quarterly		11	1.5	0.9	0.94	0.83	0
Winchelsea	monthly		12	1.5	0.9	0.90	0.81	0
Colac	Colac WTP	> weekly	101	1.5	0.9	0.95	0.71	0
Cressy		> weekly	52	1.5	0.9	0.91	0.74	0

Figure 7 Fluoride

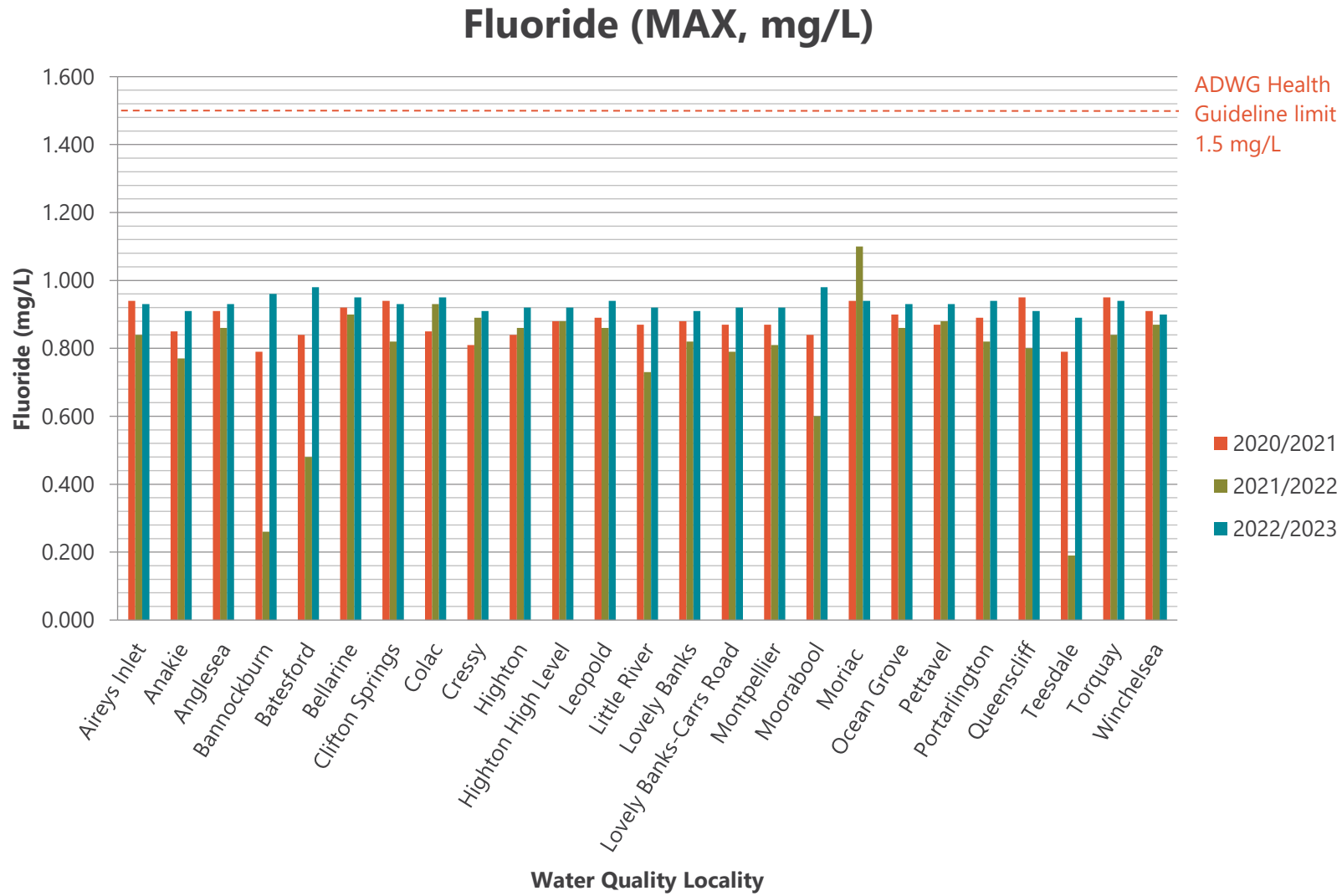
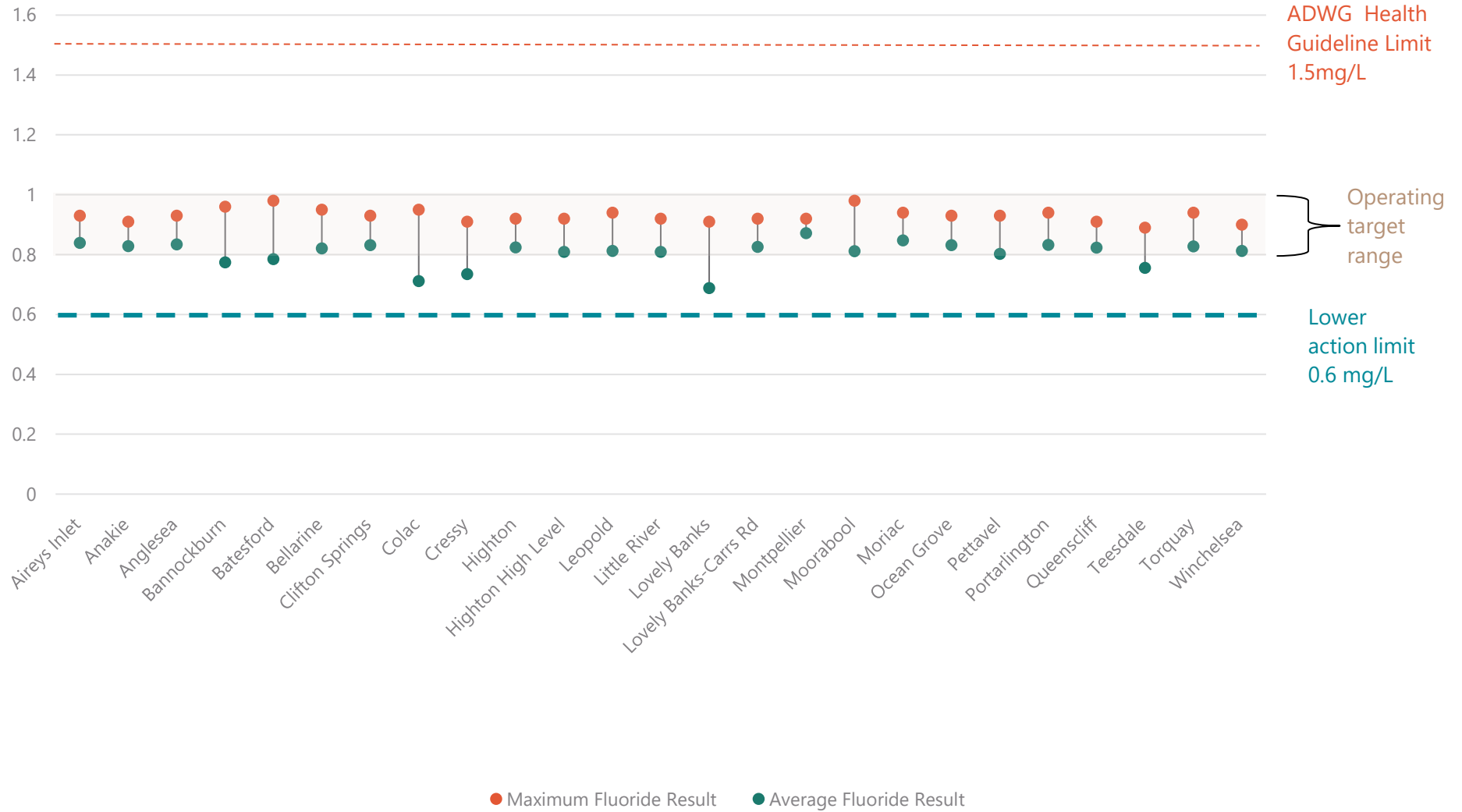


Figure 8 Fluoride (target)



6.4.2 Analysis of results

6.4.2.1 Trend over localities

The maximum fluoride level within all localities supplied by these treatment plants was below the drinking water quality standard value of 1.5 mg/L.

Barwon Water is working towards meeting the rolling annual average target of 0.9 mg/L, as per the updated Fluoridation Code of Practice. A project plan for this was approved by the Department of Health.

The fluoridation systems at Wurdee Boluc and Moorabool WTP were upgraded during 2021/22.

Since completion of the upgrades, all WTPs have been targeting the optimum dose of 0.9 mg/L. Barwon Water expects to meet the rolling annual average target for all fluoridated supplies during 2023/24.

Fluoride dosing at Colac WTP was offline for two weeks during the 2022/23 reporting period as notified to the Department of Health.

6.4.2.2 Trend over time

Average fluoride levels in all water quality localities improved in 2022/23 due to completion of fluoride upgrades at all WTPs.

6.5 Total chlorine

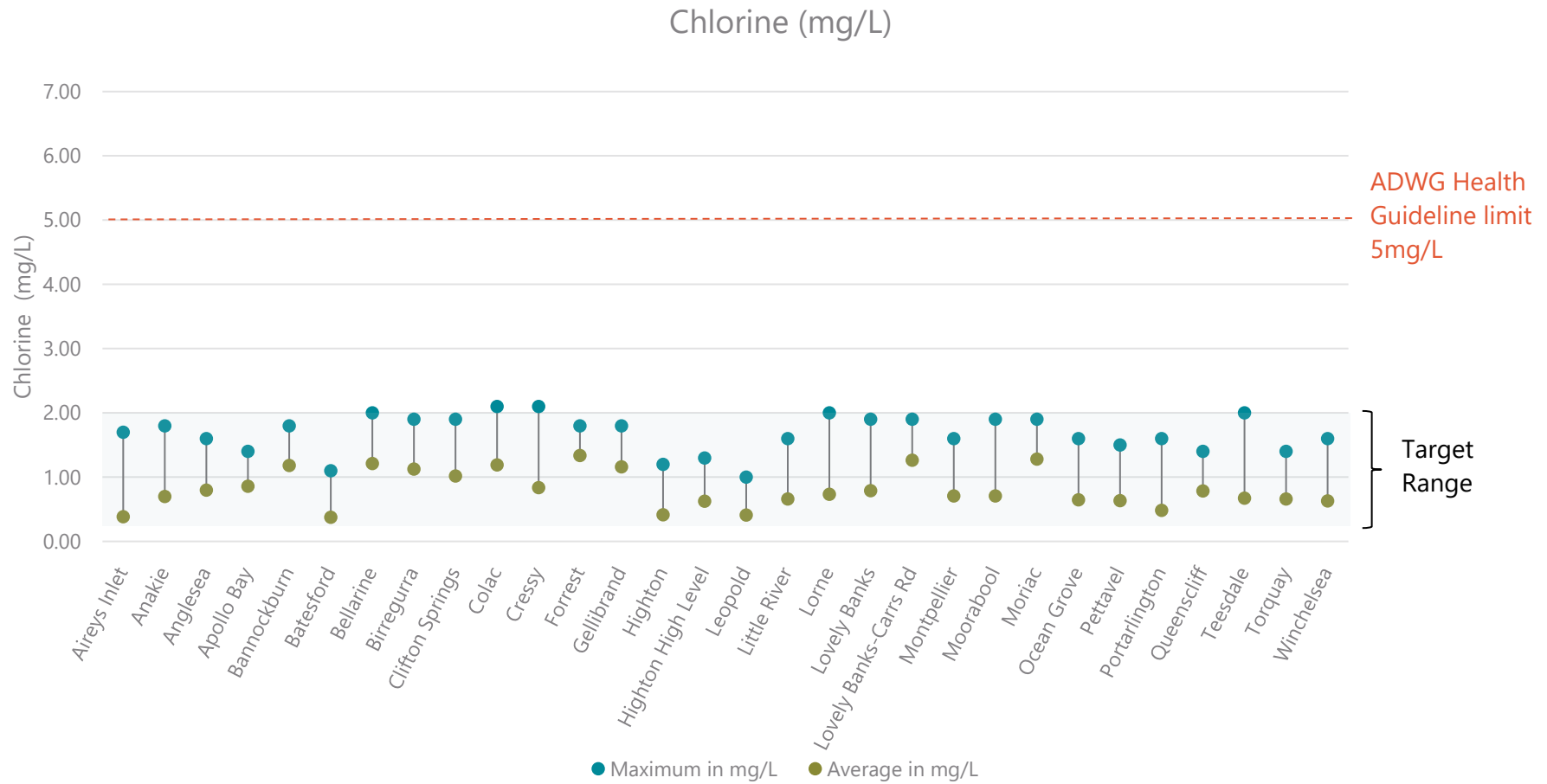
- Limit of detection = 0.1 mg/L
- ADWG health guideline value \leq 5.0 mg/L

6.5.1 Results

Table 10 Total Chlorine

Water Quality Locality	Frequency of sampling	Number of samples	Maximum (mg/L)	Average (mg/L)	Complying (Yes/No)
Aireys Inlet	> weekly	76	1.70	0.38	Yes
Anakie	> weekly	76	1.80	0.70	Yes
Anglesea	> weekly	81	1.60	0.80	Yes
Apollo Bay	> weekly	86	1.40	0.86	Yes
Bannockburn	> weekly	76	1.80	1.18	Yes
Batesford	> weekly	76	1.10	0.38	Yes
Bellarine	> weekly	77	2.00	1.21	Yes
Birregurra	> weekly	80	1.90	1.13	Yes
Clifton Springs	> weekly	92	1.90	1.02	Yes
Colac	> weekly	201	2.10	1.19	Yes
Cressy	> weekly	76	2.10	0.84	Yes
Forrest	> weekly	76	1.80	1.34	Yes
Gellibrand	> weekly	76	1.80	1.16	Yes
Highton	> weekly	158	1.20	0.42	Yes
Highton High Level	> weekly	76	1.30	0.63	Yes
Leopold	> weekly	109	1.00	0.41	Yes
Little River	> weekly	77	1.60	0.66	Yes
Lorne	> weekly	91	2.00	0.73	Yes
Lovely Banks	> weekly	261	1.90	0.79	Yes
Lovely Banks-Carrs Rd	> weekly	76	1.90	1.26	Yes
Montpellier	> weekly	259	1.60	0.71	Yes
Moorabool	> weekly	100	1.90	0.71	Yes
Moriac	> weekly	75	1.90	1.28	Yes
Ocean Grove	> weekly	143	1.60	0.65	Yes
Pettavel	> weekly	205	1.50	0.64	Yes
Portarlinton	> weekly	107	1.60	0.48	Yes
Queenscliff	> weekly	86	1.40	0.79	Yes
Teesdale	> weekly	76	2.00	0.67	Yes
Torquay	> weekly	163	1.40	0.66	Yes
Winchelsea	> weekly	76	1.60	0.63	Yes

Figure 9 Total Chlorine (target)



6.5.2 Analysis of results

6.5.2.1 Trend over localities

During 2022/23, the maximum and average total chlorine results for the majority of localities were within Barwon Water's target range, with results from individual localities influenced by method of storage, system length, and water demand. In all localities, the maximum total chlorine result was well below the ADWG health guideline value of 5.0 mg/L (4.1 mg/L in chloraminated systems).

All water quality localities met their target of maintaining minimum average total chlorine residual of >0.2 mg/L. Additional water quality end

of system monitoring is undertaken to inform future water quality improvement plans and proactive system changes to guide residuals management practices in all water quality localities.

6.5.2.2 Trend over time

Total chlorine results for the 2022/23 year are similar to those seen in the 2021/22 and 2020/21 years. An increased focus on targeting appropriate chlorine levels to achieve adequate chlorine residual at network ends in recent years has led to improvements in the average residual experienced in most localities.

6.6 Analysis of results – summary for regulatory standards

Table 11 Compliance with regulatory standards outlined in Schedule 2 of the Safe Drinking Water Regulations (2015) over time – by analyte

Parameter	Percentage of water quality localities receiving compliant water										
	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023
<i>E. coli</i>	100	100	100	100	97	100	100	100	97	100	100

In 2022/23, results were compliant with the drinking water quality standards (Schedule 2 of the Safe Drinking

Trihalomethanes	100	100	100	100	100	100	100	100	100	100	100
Turbidity	100	100	100	100	100	100	100	100	100	100	100

Water Regulations 2015) in all 30 water sampling localities.

Table 12 Compliance with regulatory standards outlined in Schedule 2 of the Safe Drinking Water Regulations (2015) over time – by percentage of population

Year	Percentage of population with complying water
2011/12	100
2012/13	100
2013/14	100
2014/15	100
2015/16	100
2016/17	99.63
2017/18	100
2018/19	100
2019/20	100
2020/21	99.99
2021/22	100
2022/23	100

In 2022/23, 100 percent of the serviced population received water compliant with the drinking water quality standards.

6.7 Other health related parameters

Other drinking water quality standards under regulation 12(b) of the Safe Drinking Water Regulations 2015.

6.7.1 Arsenic

Barwon Water tests for the presence of arsenic in post-filtration water samples on a quarterly basis.

- Limit of detection = 0.001 mg/L
- ADWG health guideline value <0.01 mg/L

Table 13 Arsenic

Water Quality Locality	Source of Supply	Frequency of sampling	Number of samples	Maximum Result (mg/L)	Minimum Result (mg/L)	Complying (Yes/No)
Anakie	Wurdee Boluc WTP, Moorabool WTP	Quarterly	4	<0.001	<0.001	Yes
Little River West						
Lovely Banks			4	<0.001	<0.001	Yes
Lovely Banks-Carrs Road						
Montpellier						
Highton						
Highton High Level	Wurdee Boluc WTP	Quarterly	4	<0.001	<0.001	Yes
Aireys Inlet						
Bellarine						
Clifton Springs						
Anglesea						
Ocean Grove						
Leopold						
Pettavel						
Portarlington						
Queenscliff						
Torquay						
Moriac						
Winchelsea						
Batesford	Moorabool WTP	Quarterly	4	<0.001	<0.001	Yes
Bannockburn						
Moorabool						
Teesdale						
Colac	Colac WTP	Quarterly	4	<0.001	<0.001	Yes
Cressy						
Apollo Bay	Apollo Bay WTP	Quarterly	4	<0.001	<0.001	Yes
Birregurra	Birregurra WTP	Quarterly	4	<0.001	<0.001	Yes
Forrest	Forrest WTP	Quarterly	4	<0.001	<0.001	Yes
Gellibrand	Gellibrand WTP	Quarterly	4	<0.001	<0.001	Yes
Lorne	Lorne WTP	Quarterly	4	<0.001	<0.001	Yes

6.7.2 Copper

- Limit of detection = 0.001 mg/L
- ADWG health guideline value <2 mg/L

Table 14 Copper

Water Quality Locality	Frequency of sampling	Number of samples	Maximum Result (mg/L)	Average Result (mg/L)	Complying (Yes/No)
Aireys Inlet	monthly	12	0.033	0.009	Yes
Anakie	monthly	12	0.020	0.011	Yes
Anglesea	monthly	12	0.034	0.015	Yes
Apollo Bay	> monthly	16	0.014	0.007	Yes
Bannockburn	monthly	12	0.026	0.012	Yes
Batesford	monthly	12	0.023	0.011	Yes
Bellarine	monthly	12	0.023	0.013	Yes
Birregurra	> monthly	16	0.013	0.006	Yes
Clifton Springs	monthly	12	0.140	0.038	Yes
Colac	> monthly	16	0.016	0.006	Yes
Cressy	monthly	12	<0.001	<0.001	Yes
Forrest	> monthly	16	0.009	0.004	Yes
Gellibrand	> monthly	16	0.038	0.018	Yes
Highton	monthly	12	0.074	0.026	Yes
Highton High Level	monthly	12	0.055	0.015	Yes
Leopold	monthly	12	0.050	0.015	Yes
Little River	monthly	12	0.009	0.005	Yes
Lorne	> monthly	16	0.073	0.018	Yes
Lovely Banks	monthly	12	0.029	0.015	Yes
Lovely Banks-Carrs Rd	monthly	12	0.055	0.019	Yes
Montpellier	monthly	12	0.050	0.017	Yes
Moorabool	> monthly	15	0.150	0.037	Yes
Moriac	> monthly	16	0.028	0.010	Yes
Ocean Grove	monthly	12	0.059	0.015	Yes
Pettavel	monthly	12	0.028	0.013	Yes
Portarlington	monthly	12	0.062	0.021	Yes
Queenscliff	monthly	12	0.150	0.042	Yes
Teesdale	monthly	12	0.063	0.013	Yes
Torquay	monthly	12	0.059	0.018	Yes
Winchelsea	monthly	12	0.035	0.022	Yes

6.7.3 Natural background fluoride

The following results are for the natural background fluoride levels from the catchment. The fluoride results for localities supplied with fluoridated water are reported in Table 8.

- Limit of detection = 0.05 mg/L
- ADWG health guideline value < 1.5 mg/L

Table 15 Natural background fluoride

Water Quality Locality	Source of supply	Minimum Frequency of sampling	Number of samples	Maximum (mg/L)	Minimum (mg/L)	Average (mg/L)
Anakie	Wurdee Boluc Reservoir,	Monthly	12	0.10	0.07	0.08
Little River West						
Lovely Banks	East and West Moorabool River		12	0.14	0.09	0.11
Lovely Banks-Carrs Road						
Highton						
Montpellier						
Bellarine	Wurdee Boluc Reservoir	Monthly	12	0.1	0.07	0.08
Clifton Springs						
Anglesea						
Ocean Grove						
Leopold						
Aireys Inlet						
Pettavel						
Portarlington						
Queenscliff						
Torquay						
Moriac						
Winchelsea						
Highton High Level						
Batesford						
Bannockburn						
Moorabool						
Teesdale						
Colac	Colac Basin No. 4 & 5	Monthly	12	0.07	0.06	0.07
Cressy						
Apollo Bay	Marengo Basin	Monthly	12	0.10	0.07	0.08
Birregurra	Birregurra Basin	Monthly	12	0.19	0.09	0.15
Forrest	Forrest Basin	Monthly	12	0.08	0.06	0.06
Gellibrand	Lardners Creek	Monthly	12	0.05	0.05	0.05
Lorne	Allen Reservoir	Monthly	12	0.07	0.05	0.06

6.7.4 Lead

- Limit of detection = 0.001 mg/L
- ADWG health guideline value < 0.01 mg/L

Table 16 Lead

Water Quality Locality	Frequency of sampling	Number of samples	Maximum Result (mg/L)	Average Result (mg/L)	Complying (Yes/No)
Aireys Inlet	monthly	12	<0.001	<0.001	Yes
Anakie	monthly	12	<0.001	<0.001	Yes
Anglesea	monthly	12	<0.001	<0.001	Yes
Apollo Bay	> monthly	16	0.003	<0.001	Yes
Bannockburn	monthly	12	0.002	<0.001	Yes
Batesford	monthly	12	0.001	<0.001	Yes
Bellarine	monthly	12	0.003	<0.001	Yes
Birregurra	> monthly	16	<0.001	<0.001	Yes
Clifton Springs	monthly	12	0.004	0.004	Yes
Colac	> monthly	16	0.002	<0.001	Yes
Cressy	monthly	12	<0.001	<0.001	Yes
Forrest	> monthly	16	<0.001	<0.001	Yes
Gellibrand	> monthly	16	<0.001	<0.001	Yes
Highton	monthly	12	0.001	<0.001	Yes
Highton High Level	monthly	12	<0.001	<0.001	Yes
Leopold	monthly	12	<0.001	<0.001	Yes
Little River	monthly	12	<0.001	<0.001	Yes
Lorne	> monthly	16	0.001	<0.001	Yes
Lovely Banks	monthly	12	0.001	0.001	Yes
Lovely Banks-Carrs Rd	monthly	12	0.007	0.006	Yes
Montpellier	monthly	12	<0.001	<0.001	Yes
Moorabool	> monthly	15	0.002	0.002	Yes
Moriac	> monthly	16	0.001	<0.001	Yes
Ocean Grove	monthly	12	<0.001	<0.001	Yes
Pettavel	monthly	12	<0.001	<0.001	Yes
Portarlington	monthly	12	<0.001	<0.001	Yes
Queenscliff	monthly	12	0.001	<0.001	Yes
Teesdale	monthly	12	<0.001	<0.001	Yes
Torquay	monthly	12	0.001	<0.001	Yes
Winchelsea	monthly	12	0.001	<0.001	Yes

6.7.5 Manganese

- Limit of detection = 0.002 or 0.01 mg/L (method dependent)
- ADWG health guideline value < 0.5 mg/L

Table 17 Manganese

Water Quality Locality	Frequency of sampling	Number of samples	Maximum Result (mg/L)	Average Result (mg/L)	Complying (Yes/No)
Aireys Inlet	> monthly	28	0.020	<0.01	Yes
Anakie	> monthly	27	<0.01	<0.01	Yes
Anglesea	> monthly	28	<0.01	<0.01	Yes
Apollo Bay	> monthly	49	<0.01	<0.01	Yes
Bannockburn	> monthly	28	<0.01	<0.01	Yes
Batesford	> monthly	26	0.060	0.01	Yes
Bellarine	> monthly	27	<0.01	<0.01	Yes
Birregurra	> monthly	48	<0.01	<0.01	Yes
Clifton Springs	> monthly	26	<0.01	<0.01	Yes
Colac	> monthly	51	0.010	<0.01	Yes
Cressy	> monthly	25	0.001	<0.01	Yes
Forrest	> monthly	48	0.120	0.02	Yes
Gellibrand	> monthly	48	0.002	<0.01	Yes
Highton	> monthly	25	<0.01	<0.01	Yes
Highton High Level	> monthly	25	<0.01	<0.01	Yes
Leopold	> monthly	25	<0.01	<0.01	Yes
Little River	> monthly	28	<0.01	<0.01	Yes
Lorne	> monthly	49	<0.01	<0.01	Yes
Lovely Banks	> monthly	32	0.001	<0.01	Yes
Lovely Banks-Carrs Rd	> monthly	28	0.005	<0.01	Yes
Montpellier	> monthly	25	<0.01	<0.01	Yes
Moorabool	> monthly	49	0.020	<0.01	Yes
Moriac	> monthly	48	<0.01	<0.01	Yes
Ocean Grove	> monthly	27	<0.01	<0.01	Yes
Pettavel	> monthly	25	<0.01	<0.01	Yes
Portarlington	> monthly	26	<0.01	<0.01	Yes
Queenscliff	> monthly	26	<0.01	<0.01	Yes
Teesdale	> monthly	28	<0.01	<0.01	Yes
Torquay	> monthly	27	<0.01	<0.01	Yes
Winchelsea	>monthly	24	<0.01	<0.01	Yes

6.7.6 Other

The complete list of other health-related parameters analysed in 2022/23 are listed in Table 18, Table 19 and Table 20.

Table 18 Other health-related parameters for 2022/23

Analytes	Frequency of sampling	Health guideline compliance (Yes/No)
Antimony	Quarterly	Yes
Barium	Quarterly	Yes
Boron ¹	Quarterly	Yes
Cadmium	Quarterly	Yes
Chloral Hydrate (Trichloroacetaldehyde)	Annually	Yes
Chlorophenols ^{1 2}	Annually	Yes
Chlorine	Weekly	Yes
Chromium	Monthly	Yes
Cyanide ¹	Quarterly	Yes
Iodide ¹	Annually	Yes
Mercury	Annually	Yes
Molybdenum ¹	Annually	Yes
Monochloramine	Weekly	Yes
Nickel	Quarterly	Yes
Nitrate	Monthly	Yes
Nitrite	Monthly	Yes
Pesticides/herbicides ¹	Quarterly/monthly	Yes
Radioactive constituents	Annually	Yes
Selenium	Annually	Yes
Silver ¹	Annually	Yes
Sulphate	Quarterly/Monthly	Yes
Uranium ¹	Annually	Yes
Volatile organic carbons ¹	Annually	Yes

(1) Analytes only measured in source water pre-treatment. Measurement in source water is relevant to drinking water quality since it confirms that levels are below ADWG health guideline values prior to treatment.

(2) See Table 19 for a full list of pesticides/herbicides analysed

(3) See Table 20 for a full list of volatile organic carbons analysed.

All pesticides/herbicides are only monitored in the source water pre-treatment.

Table 19 Pesticides/herbicides analysed for in 2022/23 in source water

44-DDD	CHLOROPYRIFOS	2,4-DB
44-DDE	COUMAPHOS	2,4-DP
44-DDT	DEMETON-S	2,6-D, 2,4-D
ALDRIN	DIAZINON	4-Chlorophenoxyaceticacid
ATRAZINE	DICHLORVOS	Clopyralid
BHC (ALPHA ISOMER)	CHLORFENVINPHOS	Dicamba
BHC (BETA ISOMER)	CHLOROTHALONIL	MCPA
BHC (DELTA ISOMER)	EPN	MCPB
CIS-CHLORDANE	FENSULFOTHION	PHENOLS
DIQUAT	FENTHION	TRICHLOPYR
DIELDRIN	MALATHION	HEXAZINONE
ENDOSULPHAN I	METHYL PARATHION	MOLINATE
ENDOSULPHAN II	MONOCROTOPHOS	PICLORAM
ENDOSULPHAN	PARATHION	TEMEPHOS
ENDOSULPHAN SULPHATE	PHORATE	PROPICONAZOLE
ENDRIN ALDEHYDE	PROPHOS	PARAQUAT
HEPTACHLOR EPOXIDE	RONNEL	SIMAZINE
HEPTACHLOR	TETRACHLORVINPHOS	QUINTOZENE
HEXACHLOROBENZENE	TETRAETHYLDITHIOPYRPHOS	PIRIMICARB
LINDANE	TRICHLORINATE	DIURON
METHOXYCHLOR	TUKUTHION	PROPACHLOR
MECOPROP	2,4,5-T	
TRANS-CHLORDANE	2,4,6-T	
GLYPHOSATE		

All volatile organic compounds are monitored in both the source water pre-treatment, post-filtration water entry and reticulation.

Table 20 Volatile organic compounds analysed for in 2022/23

VINYL CHLORIDE	13-DICHLOROPROPANE	HEXACHLORO-13-BUTADIENE
1112-TETRACHLOROETHANE	14-DICHLOROBENZENE	ISOPROPYLBENZENE
111-TRICHLOROETHANE	22-DICHLOROPROPANE	METHYLENECHLORIDE
1122-TETRACHLOROETHANE	2-CHLOROTOLUENE	MP-XYLENE
112-TRICHLOROETHANE	4-CHLOROTOLUENE	NAPHTHALENE
11-DICHLOROETHANE	BENZENE	N-BUTYLBENZENE
11-DICHLOROETHENE	BROMOBENZENE	N-PROPYLBENZENE
11-DICHLOROPROPENE	BROMOCHLOROMETHANE	O-XYLENE
123-TRICHLOROBENZENE	BROMODICHLOROMETHANE	P-ISOPROPYLTOLUENE
123-TRICHLOROPROPANE	BROMOFORM	SEC-BUTYLBENZENE
124-TRICHLOROBENZENE	CARBON DISULPHIDE	STYRENE
124-TRIMETHYLBENZENE	CARBONTETRACHLORIDE	TERT-BUTYLBENZENE
12-DIBROMO-3-CHLOROPROPANE	CHLOROBENZENE	TETRACHLOROETHENE
12-DIBROMOETHANE	CHLOROFORM	TOLUENE
12-DICHLOROBENZENE	CIS-12-DICHLOROETHENE	TRANS-12-DICHLOROETHENE
12-DICHLOROETHANE	CIS-12-DICHLOROPROPENE	TRANS-13-DICHLOROPROPENE
12-DICHLOROPROPANE	DIBROMOCHLOROMETHANE	TRICHLOROETHENE
135-TRIMETHYLBENZENE	DIBROMOMETHANE	NAPHTHALENE
13-DICHLOROBENZENE	ETHYLBENZENE	

6.7.7 Analysis of results

6.7.7.1 Trend over localities

There were no non-compliances relating to other health-related water quality parameters, herbicides/pesticides or volatile organic compounds during 2022/23 in any locality. All results for these parameters were well below their respective health guideline value.

6.7.7.2 Trend over time

The results for these parameters in the 2022/23 period are consistent with those experienced in the 2020/21 and 2021/22 periods.

6.8 Other aesthetic (not health-related)

6.8.1 True Colour

Based on aesthetic considerations, true colour in drinking water should not exceed 15 HU.

- Limit of detection = 1 Hu
- ADWG quality value < 15 Hu

Table 21 True Colour

Water Quality Locality	Frequency of sampling*	Number of samples	Maximum (HU)	Minimum (HU)	Average (HU)
Aireys Inlet	> weekly	76	2	<1	1.17
Anakie	> weekly	75	1	<1	1.00
Anglesea	> weekly	81	4	<1	1.50
Apollo Bay	> weekly	86	1	<1	1.00
Bannockburn	> weekly	76	3	<1	1.40
Batesford	> weekly	76	2	<1	1.63
Bellarine	> weekly	77	1	<1	1.00
Birregurra	> weekly	75	2	<1	1.75
Clifton Springs	> weekly	92	1	<1	1.00
Colac	> weekly	203	<1	<1	<1
Cressy	> weekly	76	<1	<1	<1
Forrest	> weekly	75	1	<1	1.00
Gellibrand	> weekly	76	2	<1	1.50
Highton	> weekly	158	3	<1	1.45
Highton High Level	> weekly	76	2	<1	1.33
Leopold	> weekly	109	2	<1	1.22
Little River	> weekly	75	1	<1	1.00
Lorne	> weekly	91	1	<1	1.00
Lovely Banks	> weekly	258	7	<1	2.20
Lovely Banks-Carrs Rd	> weekly	75	1	<1	1.00
Montpellier	> weekly	259	3	<1	1.40
Moorabool	> weekly	100	3	<1	1.56
Moriac	> weekly	75	<1	<1	<1
Ocean Grove	> weekly	143	1	<1	1.00
Pettavel	> weekly	205	2	<1	1.63
Portarlington	> weekly	106	2	<1	1.25
Queenscliff	> weekly	86	3	<1	2.00
Teesdale	> weekly	76	3	<1	1.67
Torquay	> weekly	163	2	<1	1.50
Winchelsea	> weekly	76	1	<1	1.00

* Sampling frequency is dependent on population and varies in each locality, as described in the Australian Drinking Water Guidelines 2011.

6.8.2 Hardness (Total)

Total hardness is the sum of the concentrations of calcium and magnesium ions expressed as a calcium carbonate equivalent.

Hard water requires more soap than soft water to obtain lather. It can also cause scale to form on hot water pipes and fittings.

- Limit of detection = 1 mg/L
- ADWG quality value < 200 mg/L

Table 22 Hardness (total)

Water Quality Locality	Source of supply	Frequency of sampling (min)	Number of samples	Maximum (mg/L)	Minimum (mg/L)	Average (mg/L)
Anakie	Wurdee Boluc Reservoir,	>monthly	13	37	30	35
Little River West						
Lovely Banks						
Lovely Banks-Carrs Road	East and West Moorabool River	>monthly	13	90	52	79
Montpellier						
Highton						
Highton High Level	Wurdee Boluc Reservoir	>monthly	13	37	30	35
Aireys Inlet						
Bellarine						
Clifton Springs						
Anglesea						
Ocean Grove						
Leopold						
Pettavel						
Portarlington						
Queenscliff						
Torquay						
Moriac						
Winchelsea						
Batesford						
Bannockburn						
Lethbridge						
Teesdale						
Cressy	Colac Basin No. 4 & No. 5	>monthly	14	23	14	18
Colac						
Apollo Bay	Marengo Basin	monthly	12	45	31	39
Birregurra	Birregurra Basin	>monthly	13	63	26	38
Forrest	Forrest Basin	>monthly	13	29	22	25
Gellibrand	Lardners Creek	>monthly	13	33	17	23
Lorne	Allen Reservoir	monthly	12	37	22	28

6.8.3 pH

The pH value is a measure of hydrogen ion concentration in water. A pH value of 7.0 is neutral, values lower than 7.0 are acidic, and values higher than 7.0 are basic. The ADWG guideline range for pH is based on management of assets and is not related to health. According to current literature, a direct relationship between pH and human health is difficult to determine, as pH is closely associated with other aspects of water quality.

Consumption of food and beverages with quite low or high pH is common and does not result in adverse health effects (ADWG, 2011). A guideline value for pH between 6.5 and 8.5* is desirable to reduce corrosion and encrustation of pipes and fittings.

- Range of detection = 0 to 14
- ADWG value = 6.5 to 8.5

Table 23 pH

Water Quality Locality	Frequency of sampling	Number of samples	Maximum	Minimum	Average	Aesthetic operating range
Aireys Inlet	> weekly	76	8.3	7.2	7.5	6.5 - 8.5
Anakie	> weekly	76	8.6*	7.2	7.4	6.5 - 8.5
Anglesea	> weekly	81	7.7	7.1	7.5	6.5 - 8.5
Apollo Bay	> weekly	86	7.9	7.0	7.4	6.5 - 8.5
Bannockburn	> weekly	76	7.8	7.1	7.3	6.5 - 8.5
Batesford	> weekly	76	7.4	7.1	7.2	6.5 - 8.5
Bellarine	> weekly	77	8.0	7.0	7.3	6.5 - 8.5
Birregurra	> weekly	76	8.0	7.1	7.7	6.5 - 8.5
Clifton Springs	> weekly	92	7.9	7.0	7.2	6.5 - 8.5
Colac	> weekly	203	7.7	6.6	7.1	6.5 - 8.5
Cressy	> weekly	76	9.2**	6.9	7.9	6.5 - 8.5
Forrest	> weekly	76	8.3	7.2	7.7	6.5 - 8.5
Gellibrand	> weekly	76	7.7	7.2	7.6	6.5 - 8.5
Highton	> weekly	158	7.4	6.9	7.1	6.5 - 8.5
Highton High Level	> weekly	76	7.4	7.0	7.1	6.5 - 8.5
Leopold	> weekly	109	7.6	7.0	7.2	6.5 - 8.5
Little River	> weekly	76	8.9*	7.2	7.5	6.5 - 8.5
Lorne	> weekly	91	7.9	6.9	7.3	6.5 - 8.5
Lovely Banks	> weekly	259	8.7*	7.0	7.2	6.5 - 8.5
Lovely Banks-Carrs Rd	> weekly	76	7.3	6.9	7.2	6.5 - 8.5
Montpellier	> weekly	259	7.6	6.9	7.1	6.5 - 8.5
Moorabool	> weekly	100	8.2	7.0	7.3	6.5 - 8.5
Moriac	> weekly	76	7.2	6.7	7.0	6.5 - 8.5
Ocean Grove	> weekly	143	8.3	6.7	7.3	6.5 - 8.5
Pettavel	> weekly	205	7.3	6.9	7.1	6.5 - 8.5
Portarlington	> weekly	106	7.6	7.1	7.3	6.5 - 8.5
Queenscliff	> weekly	86	7.4	7.0	7.2	6.5 - 8.5
Teesdale	> weekly	76	8.4	7.1	7.6	6.5 - 8.5
Torquay	> weekly	163	7.5	6.7	7.2	6.5 - 8.5
Winchelsea	> weekly	76	7.7	6.8	7.1	6.5 - 8.5

* Based on the need to reduce corrosion and encrustation in pipes and fittings, the pH of drinking water should be between 6.5 and 8.5. New concrete tanks and cement or mortar-lined pipes can significantly increase pH and a value above 8.5 may be tolerated, provided monitoring indicates no deterioration in microbiological quality. Barwon Water maintains a scheduled preventative maintenance program to proactively flush more vulnerable systems.

** Low turnover and cement and mortar-lined pipes contribute to some elevated pH results in Cressy. A scheduled maintenance program is in place to flush the network in Cressy. This mitigates the development of an elevated pH in the network. Additional weekly chlorine dosing is used to maintain residual in the network.

6.8.4 Conductivity

The electrical conductivity of water, measured in EC units, increases with the concentration of dissolved solids. A general rule of thumb is that electrical conductivity (EC) may be converted to total dissolved solids (TDS) by halving the value (an EC of 1000uS/cm is equivalent to a TDS of 500mg/L). Based on taste, total dissolved solids in drinking water should not exceed 500 mg/L. No health

effects have been associated specifically with high TDS concentrations (ADWG, 2011).

- Limit of detection = 1 uS/cm
- ADWG quality value < 1000 uS/cm

Table 24 Conductivity

Water Quality Locality	Source of supply	Frequency of sampling (min)	Number of samples	Maximum (µS/cm)	Minimum (µS/cm)	Average (µS/cm)
Anakie	Wurdee Boluc Reservoir,	twice monthly	24	270	250	256
Little River West						
Lovely Banks						
Lovely Banks-Carrs Road	East and West Moorabool River	twice monthly	24	490	440	468
Montpellier						
Highton						
Aireys Inlet	Wurdee Boluc Reservoir	twice monthly	24	270	250	256
Bellarine						
Clifton Springs						
Anglesea						
Ocean Grove						
Leopold						
Pettavel						
Portarlinton						
Queenscliff						
Torquay						
Moriac						
Winchelsea						
Highton High Level						
Batesford	East and West Moorabool River	twice monthly	24	490	440	468
Bannockburn						
Lethbridge						
Teesdale						
Colac	Colac Basin No. 4 & No. 5	>twice monthly	25	160	130	146
Cressy						
Apollo Bay	Marengo Basin	twice monthly	24	290	240	260
Birregurra	Birregurra Basin	twice monthly	24	300	240	275
Forrest	Forrest Basin	twice monthly	24	390	300	352
Gellibrand	Lardners Creek	twice monthly	24	440	250	399
Lorne	Allen Reservoir	twice monthly	24	230	180	200

6.8.5 Analysis of results

6.8.5.1 Trend over localities

The average colour reported across all localities was at an acceptable level, with all localities recording a 1-2 HU colour average value well below the <15HU ADWG quality value.

The average pH reported in each locality was within the targeted 6.5-8.5 pH range. However, a number of samples from several localities reported maximum levels that exceed the recommended pH range.

When these were identified, actions were implemented to correct pH levels within the network through increasing water turnover. The pH of the drinking water supply can become elevated due to natural leaching of calcium and hydroxide ions from cement linings in pipes and concrete in supply tanks.

All zones complied with the recommended hardness and conductivity levels.

6.8.5.2 Trend over time

The average colour, pH, hardness and conductivity, over each locality has followed a comparable pattern to previous years.

7 Emergency/ incident management

7.1 Emergencies/events – Section 22 reports

No Section 22 reports were made during the 2022/23 reporting period.

7.2 Emergencies/events – Section 18 notifications

No Section 18 notifications were made during the 2022/23 reporting period.

8 Water Quality Complaints

8.1 Complaints 2022/2023

In accordance with our commitment to providing high quality drinking water, complaints regarding water quality are taken very seriously. Barwon Water records all complaints relating to drinking water quality. The complaints are compared to the number of connected properties to enable comparison with other water suppliers. The number of complaints in 2022/2023 was 1.17 per 1,000 properties. This is comparable to last year's

complaints trend (1.15 complaints per 1,000 properties).

Although there was an increase in discoloured water and other complaints, these were not attributed to specific events, and many were associated with corrosion of customer plumbing beyond the point of supply (the water meter).

Table 25 Comparison of complaints for financial years 2022/23 and 2021/22

Type of complaints	Number of complaints			Comparison to 2021/22 reporting period	Comments
	2022/23	2021/22	2020/21		
Alleged Diagnosed Illness	0	0	0	0	Comparable figure to previous.
Discoloured Water	80	66	75	14	21% increase in number of complaints compared with previous year
Taste or Odour	62	70	75	-8	11% decrease in number of complaints compared with previous year
White Water	19	26	36	-7	27% decrease in number of complaints compared with previous year
Other	48	39	56	9	23% increase in number of complaints compared with previous year
TOTAL	209	201	242	8	4% increase in number of complaints compared with previous year. Comparable to previous year on the basis of per 1000 properties.

Table 26 Customer complaints summary for each sampling locality 2022/23

Water Quality Locality	Type of complaint					Total
	Alleged Diagnosed Illness	Discoloured Water	Taste or odour	White water	Other	Total
Aireys Inlet	0	0	1	0	0	1
Anakie	0	0	0	0	0	0
Anglesea	0	0	0	0	0	0
Apollo Bay	0	1	1	0	1	3
Bannockburn	0	1	1	1	1	4
Batesford	0	0	0	0	0	0
Bellarine	0	0	0	0	0	0
Birregurra	0	0	0	0	0	0
Clifton Springs	0	2	3	0	1	6
Colac	0	6	2	0	1	9
Cressy	0	0	0	1	0	1
Forrest	0	1	0	0	0	1
Gellibrand	0	0	0	0	0	0
Highton	0	12	6	4	8	30
Highton HL	0	0	2	1	2	5
Leopold	0	3	3	0	2	8
Little River West	0	0	0	0	0	0
Lorne	0	0	0	0	0	0
Lovely Banks	0	17	6	1	13	37
Lovely Banks-Carrs Road	0	0	0	0	0	0
Montpellier	0	17	13	4	5	39
Moorabool	0	1	0	0	0	1
Moriac	0	0	0	0	0	0
Ocean Grove	0	2	2	1	5	10
Pettavel	0	9	10	1	0	20
Portarlinton	0	2	3	4	2	11
Queenscliff	0	2	1	0	0	3
Teesdale	0	2	0	1	3	6
Torquay	0	2	7	0	3	12
Unknown locality - no address provided	0	0	1	0	0	1
Winchelsea	0	0	0	0	1	1
Total	0	80	62	19	48	209

Table 27 Table of customer complaints by type for 2022/23

Type of Complaint	Number of Complaints 2022/23	Percentage of Total Complaints	Number of complaints per 1000 properties 2022/23
Alleged Diagnosed Illness	0	0.00%	0.00
Discoloured Water	80	38.28%	0.46
Taste or Odour	62	29.67%	0.36
White Water	19	9.09%	0.11
Other	48	22.97%	0.28
TOTAL	209	100.00%	1.17

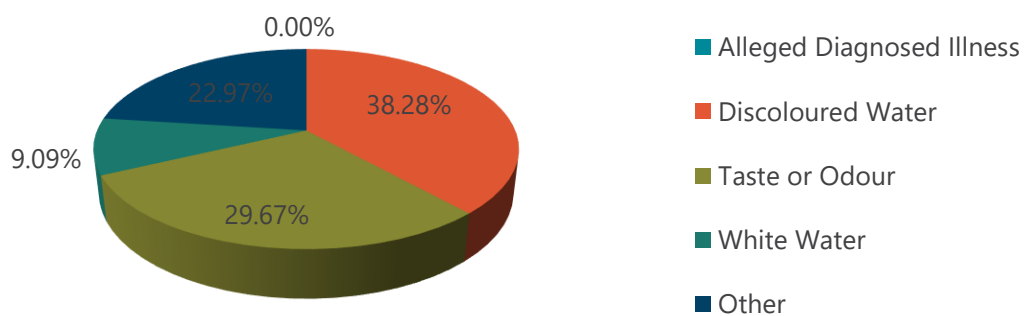
Figure 10 Complaints per 1000 properties 2022/23



Most complaints for 2022/23 related to taste or odour and discoloured water (Figure 11). Table 26 shows a breakdown of complaints by complaint

type. This is a similar breakdown to that recorded in previous years.

Figure 11 Customer complaint summary by type 2022/23



8.2 Complaint response

Customer complaints are mostly received by Barwon Water’s Customer Contact Centre and registered on our customer and complaints management system. Barwon Water also

occasionally receives complaints via social media, or the enquiry function of the public website. This feedback is registered in the complaints and customer management system and managed in the same way as telephone complaints.

During business hours, the Product Quality team endeavour to respond as quickly as possible (within the same day) to liaise with the customer to resolve the problem. Outside business hours, the Duty Officer will respond to complaints and initiate corrective action immediately where required. These complaints are then assessed to determine if follow up contact is required by a member of the Product Quality team during the next business day.

8.2.1 Discoloured water

Discoloured water can be caused by a number of different factors, including burst main events, manganese and iron oxidation and problems which may relate to the plumbing of a customer's property. The response given to these complaints varies depending on the nature of the cause, but may include reactive mains cleaning, reviewing treatment processes or advising the customer to have their internal plumbing inspected by a licensed plumber.

Generally blue discolouration of water is caused by copper corrosion. As Barwon Water does not use copper fittings or pipes, when investigated, the issue is often traced back to the internal plumbing on the customer's property. Advice is usually provided to customers to engage a licensed plumber to make an assessment.

8.2.2 Taste/odour

Taste and odour issues are usually related to chlorine in the water or a change in the raw water quality, such as an increase in organics or algae in the raw water. In responding to these complaints, treatment processes and recent monitoring results are reviewed and, where possible, alterations are made. In cases where a customer may be particularly sensitive to taste and odour, advice is given on methods to address the issue.

8.2.3 White water

When air becomes trapped in water supply, it has a white or "milky" appearance. This is generally caused by a burst main. Where possible, attempts are made to remove the affected water from the reticulation system by flushing the main at the location where air is gathering. However, as this is not always possible, customers are asked to wait for

the air to be removed naturally, which can take two to three days. Customers are advised that the appearance of the water is caused by trapped air becoming entrained in the water supply when it is under pressure in the main.

When a white water complaint is received a number of factors are evaluated to determine if flushing is necessary including; investigating to verify the source to ensure the water supply remains safe, topography of the area (to determine where the air is likely to be collecting in the main), number of connections in the area (likelihood that the air will be flushed out via normal use), how long the problem has been occurring for, and other factors that may affect the customer.

If necessary, a flush will be arranged at the time of complaint, alternatively the customer is advised that the problem should clear naturally and to call back if it is persisting after 1-2 days. If a second call is received, a flush is arranged.

8.2.4 Alleged diagnosed illness

Illness complaints are generally received from customers who wish to confirm whether the water they have been drinking may have made them ill. To address this type of complaint a review of monitoring results is undertaken. If there is no evidence indicating the delivered water has been unsafe, the customer is advised to consult a doctor if they have further concerns.

A standard operating procedure developed by Barwon Water and aligned with Department of Health (DH) guidance is in place. The procedure has been adopted to ensure all illness complaints prompt a thorough investigation of the water supply system to confirm there have been no system failures which could provide an opportunity for unsafe water to be supplied. If at any point in time Barwon Water believes there has been potential for unsafe water to be supplied, DH will be notified (via Section 22). If multiple illness complaints are received from the same water quality locality within a 7-day period, and investigations show there has been no potential for the water

supply to be the cause, Barwon Water will notify DH as a courtesy to enable them to investigate further.

9 Water quality improvement projects

9.1 Forrest and Gellibrand WTP upgrade project

In 2022/23 we started constructing the upgraded Forrest WTP, while the upgrade to the Gellibrand WTP is in the design phase. Both plants are approaching the end of their service lives. The upgraded plants will be within the existing site footprint and will be designed to increase resilience against variable raw water quality. The upgraded plants are expected to be in operation early in 2023/24.

9.2 Design of Lorne Tank No. 3 WDP

In 2022/23 we concluded the design of a new secondary disinfection plant supplying Lorne Tank No.3. The project will improve water quality for the Lorne area, by providing consistent chlorine residual through the network. The construction and commissioning of the new plant is expected to be completed late 2023/24.

9.3 Installation of mixers to Colac Clearwater storage tank no.2

In 2022/23 we completed the installation of mixers to the Colac clear water storage tank no.2. The mixers will improve water quality for the Colac area, by reducing the risk of short circuiting or stratification of water within the tank.

9.4 Catchment management and river health

Barwon Water harvests water from declared drinking water supply catchments on the Barham, Upper Barwon, Gellibrand, Moorabool and St George Rivers and their tributaries. While these are largely contained within publicly managed national parks and reserves, significant areas of private land are also present within some catchments.

We have a keen interest in ensuring the protection and rehabilitation of land and waterways within these catchments in partnership with key stakeholders and in accordance with the priorities established in the Corangamite Regional Catchment Strategy, the Corangamite Waterway Strategy and the Victorian Waterway Management Strategy.

In 2022/23, we continued to work in partnership with the Corangamite Catchment Management Authority (CMA) through our river health agreement, and with Landcare to protect and enhance waterways within drinking water supply catchments, contributing \$142,000 in partnership funds to the:

- Moorabool Catchment Landcare Group
- Southern Otway Landcare Network
- Upper Barwon Landcare Network.

We also contribute \$70,000 annually to on-ground work for river health projects in water supply catchments under the Barwon Water-Corangamite CMA River Health Partnership Agreement. This funding supported the Corangamite CMA's 2021-2024 Waterway Frontage Protection Program, which saw 65 individual sites funded, 32 of these located within Barwon Water's service region and Special Water Supply Catchment areas. Funded works included stock exclusion fencing, stock crossings and off stream water points for stock, willow removal, weed control, revegetation, and pest animal management to protect and improve over 35 km's of river frontage.

We have also increased our contribution to over \$40,000 towards ongoing operation of the

Corangamite Citizen Science program. The program supports community groups to conduct water quality testing at monitoring sites and delivers education programs for students in the Corangamite region. Staff also promote river health and catchment issues through presentations and attendance at these public events. Another significant inclusion in the program is the opportunity to support the delivery of water quality testing at Waterwatch sites selected by and monitored by Wadawurrung Traditional Owner Aboriginal Corporation (WTOAC) and publication developed in partnership with the Wudawurrung Traditional Owners.

We continued to support Corangamite CMA on both the Living Moorabool and Upper Barwon Flagship projects which aim to deliver a large-scale restoration approach to catchment and waterway health. Investment from Barwon Water enabled the Corangamite CMA to remove invasive willows and revegetate with over 13,000 native plants on the 51ha site around Bolwarrah Weir to improve the health of the Moorabool catchment.

In addition, we also completed on-ground works for Stage one of a \$4.3M project to remove willows, stabilise the stream banks and revegetate streamside buffers for a 4km reach of the East Barwon River. This is a significant project and is critical for improving flows in the river and reduce water logging of adjacent land. Stock exclusion fencing and revegetation will also be undertaken to improve and protect water quality. Planning for Stage two is well underway and will be delivered during summer 2023/24.

In collaboration with the Corangamite CMA and Upper Barwon Landcare Network we also continue to undertake ongoing maintenance of a large river restoration project on Dewing Creek, a tributary of the Barwon River, This project also included fencing for stock exclusion and revegetation along a 2.8km reach of the creek to improve water quality.

Supported by Conservation Ecology Centre and the Wild Otways Initiative, we also monitored and managed feral pig and deer populations around West Barwon reservoir.

The partnerships established between Barwon Water, the Corangamite CMA, and community

groups are delivering key activities that include river bank protection and riparian enhancement, removal

of fish barriers, delivery of environmental flows and shared benefits for the community.



 BarwonWater

Appendices

Appendix A – Audit Certificates



BUREAU VERITAS
Certification

Certification

Awarded to

BARWON REGION WATER CORPORATION
61-67 RYRIE STREET, GEELONG, VIC, 3220
AUSTRALIA

Bureau Veritas certify that the Management System of the above organisation has been audited and found to be in accordance with the requirements of the management system standards indicated below

STANDARD

HACCP as defined by

CAC/RCP 1-1969, REV4, 2003

SCOPE OF SUPPLY

THE REGISTRATION COVERS THE FOOD SAFETY MANAGEMENT SYSTEM FOR THE HARVESTING, TREATMENT AND DISTRIBUTION OF DRINKING WATER TO A BROAD RANGE OF CUSTOMERS

Original Approval Date: **16 July 2004**
Subject to the continued satisfactory operation of the organisation's Management System,
this certificate is valid until: **13 November 2024**

To check the validity of this certificate please call tel. **1800 855 190**
Further clarification regarding the scope of this certificate and the applicability of the Management System requirements may be obtained by consulting the organisation.

Certificate Number: **AU004804-1**  Date: **13 November 2021**

Andrew Mortimore
Vice President – I&F Pacific Region

Managing office: Bureau Veritas Pty Ltd, 3/435 Williamstown Road,
Port Melbourne, Victoria, 3207

Issuing office: Bureau Veritas Pty Ltd, 3/435 Williamstown Road,
Port Melbourne, Victoria, 3207



Risk Management Plan Audit Certificate

Safe Drinking Water Regulations 2015

Certificate Number:	BW-346
Auditor Notice of Approval Conditions #:	181
Audit period:	1 January 2021 to 31 December 2022
To:	Ms Komal Dalal Product Quality Lead Asset, Systems & Environment Barwon Water 55-67 Ryrie Street (PO Box 659) Geelong VIC 3220
Australian Business Number (ABN):	86 348 316 514

I, Dr Annette Davison, after conducting a risk management plan audit of the water supplied by Barwon Water, am of the opinion that Barwon Water has not complied with the obligations imposed by section 8(1) of the *Safe Drinking Water Act 2003* during the audit period.

The details of the reasons for noncompliance (all minor) are detailed in the table below.

Signed:



Date: 2023-04-22

Auditable Area	Noncompliances	OFIs
1 Activities Conducted to Manage Risk	<p>The Act requires development and implementation of preventative strategies (including appropriate control and monitoring measures). (s. 9(1)(d)). While minor, a GAC Filtration CCP was identified as part of the Apollo Bay WTP Process Control, but not listed on the CCP Locations list, creating potential for a gap in process understanding. OFIs (OFI 1D-1 and OFI 1D-3) have been captured to address this gap.</p> <p>The Act requires implementation and compliance with the requirements of the risk management plan (s. 7(1)(b), s. 8(1)(b)). Some minor noncompliances in implementation were observed including gaps in completion of chemical deliveries record requirements, omission of one test on PAC23 (Colac WTP), raw and treated water turbidity meters at Colac WTP not been externally calibrated when due and instrument numbers on calibration stickers at Colac WTP did not always align with the instrument number in SCADA (instrument numbers that do not match in the field and on SCADA can result in incorrect assumptions regarding the location of the instrument). OFIs (OFI 1E-1 and OFI 1E-2) have been captured to address these noncompliances.</p>	<p>OFI 1D-1: For completeness, add Apollo Bay WTP GAC Filtration CCP to the CCP Locations list.</p> <p>OFI 1D-3: Undertake a review, and revision as necessary, of all CCPs, and implement the revisions.</p> <p>OFI 1E-1: Develop and implement processes to improve understanding of and adherence to the chemical delivery requirements by operational staff, including the importance of record keeping.</p> <p>OFI 1E-2: Undertake a systems-wide review of the annual calibration and implement the findings.</p>
2 Risk Management Plan Contents	<p>Regulation 8(1)(i) requires the development and maintenance of appropriate critical control points, and procedures for their implementation to ensure protection of public health outcomes.</p> <p>Colac WTP fluoridation critical limit was inconsistent between CCP documentation (1.5 mg/L) and SCADA (1.6 mg/L). This is considered a minor noncompliance as there are more conservative shutdown processes prior to the CCP limit. While an OFI (OFI 2M-3) has been captured for this noncompliance, it is noted that the limit has already been changed in SCADA.</p>	<p>OFI 2M-3: The Colac fluoridation CCP limit in the SCADA should be corrected to 1.5 mg/L (this was advised as completed on 2023-03-22).</p>
3 Identification and Management of Risks to Water Supply	<p>None</p>	<p>None</p>
4 Risk Management Plan Documents	<p>Based on a review of all supporting documentation including at the site visits, we were largely able to confirm compliance for all requirements of s. 10(2) of the Act, with the exception of an isolated incident for chemical receivals. Chemical delivery records were not available for the entire audit period at Colac WTP (older records had been thrown out as part of a tidy-up). This fact meant that the auditors were unable to confirm the audit guidance component: "During the audit all documentation must be available for inspection." [our emphasis]. This outcome is considered minor, because it was not found to be a systemic issue. An OFI captured under Area 1 (OFI 1E-1) covers the identified noncompliance.</p>	<p>See OFI 1E-1.</p>

Ms Suzie Sarkis
Manager Water
Victorian Public Health Division
Department of Health
14 / 50 Lonsdale Street
Melbourne Victoria 3000

2023-06-06

Dear Ms Sarkis

Audit Correction

I confirm that the submitted risk management plan audit certificate for Barwon Water dated 22 April 2023 contained an incorrect section reference to the *Safe Drinking Water Act 2003* (Vic).

The incorrect section reference was: **section 8(1)**

The corrected section reference should be: **section 7(1)**

Please treat the certificate as having been amended accordingly.

Yours sincerely



Dr Annette Davison
HND, BSc(Hons), MEnvLGovLaw, PhD, PMAWA



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