Water Quality Report 2018/19

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Introduction

About Western Water

In 2018/19, Western Water provided water, recycled water and sewerage services to 74,081 properties across a region of 3,000 square kilometres to the north-west of Melbourne.

Serviced properties grew by 5.5% this year – particularly within the new residential estates in and around Melton, Sunbury and Bacchus Marsh. Average property growth rates over the next ten years are expected to exceed 4.6% per annum.

With an average of 2.6 people per household, the service region's population is calculated at almost 170,000 – up from around 160,000 reported last financial year.

Highlights

- Safely delivered 16,478 million litres of drinking water to 68,193 properties
- Passed the Department of Health and Human Services (DHHS) biennial drinking water quality audit
- Sourced 22% of all drinking water supplied from local reservoirs compared to 35% the year before due to low rainfall and resulting low levels of inflows to the local catchments
- Fully complied with the requirements of the *Safe Drinking Water Act 2003* and the drinking water quality standards specified in the *Safe Drinking Water Regulations 2015* (SDWR) across the distribution network, with the exception of one low level *Escherichia coli (E.coli)* exceedance in the Darley locality
- Introduced the Waternamics data management application to support operational activities
- Collaborated with other water corporations, local councils, Traditional Owners and the Department Environment, Land, Water and Planning through regional Integrated Water Management Forums
- Engaged more than 4,000 of customers in the development of Western Water's Price Submission 2020–23
- Continued collaboration with the Intelligent Water Network, trialling new technologies to improve water systems management.

Table 1: Drinking water supply system

	2017/18	2018/19
Connected water customers	64,981	68,193
• Residential	61,811	64,901
• Non-residential	3,170	3,292
Water consumption (ML)	15,284	16,477
• Residential (ML)	11,382	12,255
• Non-residential (ML)	2,158	2,463
Water losses (ML)	1,744	1,760
Water filtration plants	7	7
Water mains[1] (km)	2,123	2,261

[1] *Total includes recycled water mains.*

Manner of establishment and responsible Minister

Established under the *Water Act 1989*, Western Region Water Corporation (trading as Western Water) is one of Victoria's 13 regional urban water corporations.

The responsible Minister for the reporting period, 1 July 2018 to 30 June 2019, was the Hon. Lisa Neville MP, Minister for Water. Western Water is responsible to the Minister for Water via the Department of Environment, Land, Water and Planning (DELWP). The Department of Treasury and Finance (DTF) also has a shareholder governance role.

The Department of Health and Human Services (DHHS) sets and supervises water quality standards, while the Environment Protection Authority (EPA) governs environmental standards, particularly for wastewater discharge, recycled water and biosolids management.

The Essential Services Commission (ESC), the Victorian Government's economic regulator for essential utility services, regulates Western Water's prices, service standards and market conduct. The Energy and Water Ombudsman Victoria (EWOV) receives, investigates and resolves escalated enquiries and complaints against electricity and water suppliers across Victoria.

Drinking water regulations

Western Water is governed by Victoria's *Safe Drinking Water Act 2003* and SDWR, which provide a comprehensive regulatory framework for the provision of drinking water to customers.

The framework encompasses a risk-based approach to the management of drinking water from water catchment to the customer's tap, with linkages to the Australian Drinking Water Guidelines 2011 where applicable.

The DHHS Water Unit in the Health Protection Branch is responsible for administering the regulatory framework.

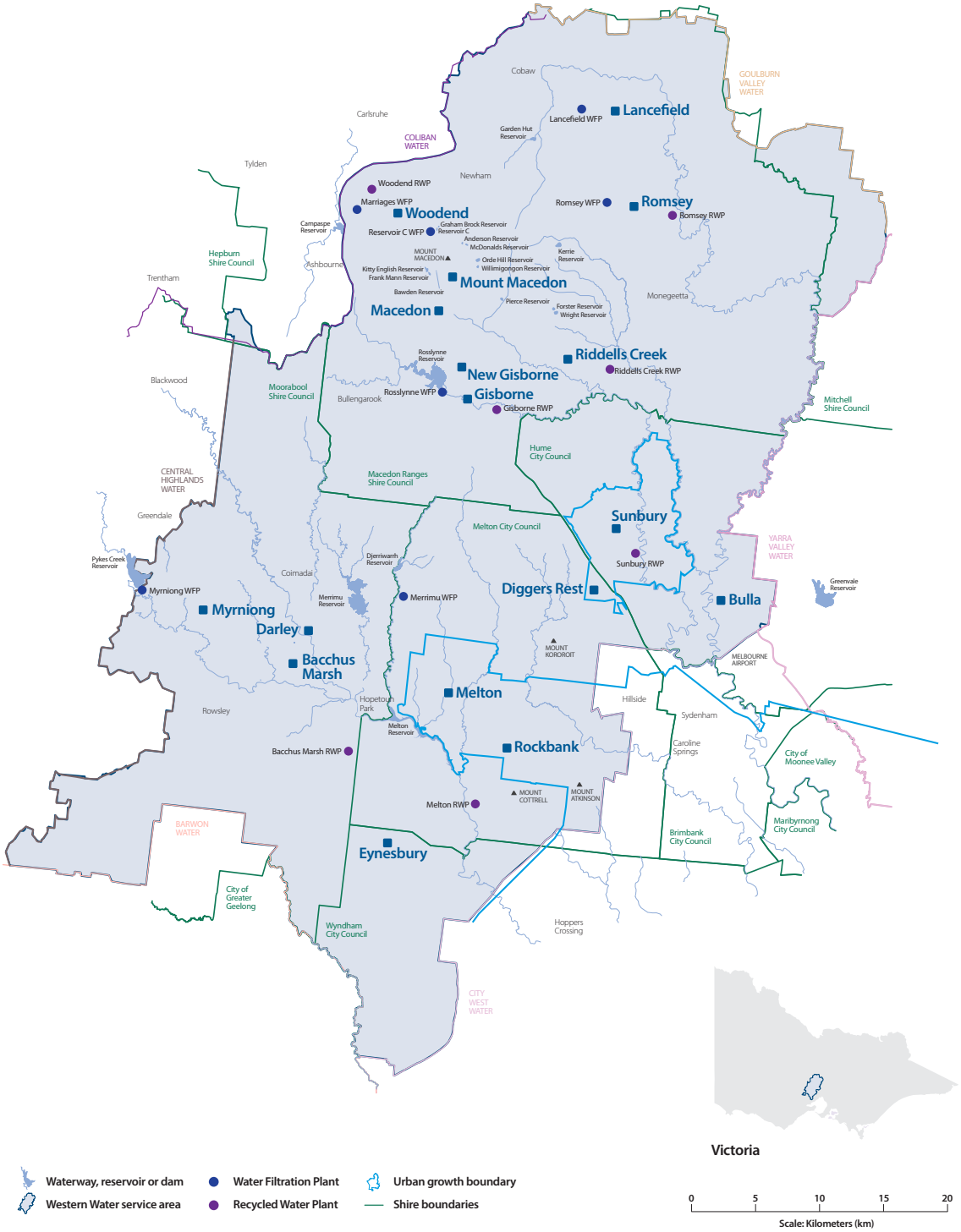
16,478

Million litres of drinking water safely delivered to 68,193 properties

22%

Supplied water sourced from local reservoirs compared to 35% the year before due to low rainfall

Service area map



Foreword from the Managing Director

The Western Water service region is growing at an unprecedented rate. Much of this growth is being observed at new residential developments in the Melton and Sunbury regions and our serviced population is forecast to quadruple by 2050. Alongside this rapid growth, we are experiencing increased effects of climate change with rising temperatures and decreased rainfall being recorded across the region.

Despite these ongoing challenges, Western Water ensured the delivery of safe, quality drinking water to our customers and in 2018/19 we supplied 16,478 million litres of drinking water to a population of almost 170,000. This is an increase of 7.8% when compared with last financial year (15,284 million litres of water delivered during 2017/18) and is indicative of the rising demand associated with the growing population and decreased rainfall.

One of our significant achievements over the past year has been our work in developing partnerships through our Integrated Water Management forums. We are aware that a collaborative management and planning approach has the potential to deliver excellent outcomes for the environment and community.

Community engagement has also been a noteworthy accomplishment for Western Water and during 2018/19 we connected with more than 4,000 customers in the development of Western Water's Price Submission 2020–23.

Securing water for the future

At the end of 2018/19 the combined capacity of our largest reservoirs fell to 32% while our customer base grew by 5.5%. Our local reservoirs supplied 22% of all the drinking water in the region, which is down from 35% in the previous financial year. The decrease in the volume of local supply compared to the previous year is due to low rainfall and resulting low levels of inflows in the local catchments.

To supplement our local sources, Western Water operates an interconnected water supply system which allows us to ensure safe drinking water supplies to all the towns we service. This system is in place to ensure ongoing water security to our growing service population.

Committed to drinking water quality

In 2018/19 Western Water completed the Department of Health and Human Service's biennial drinking water quality audit and there were no issues of concern raised from the audit.

We also introduced the Waternamics data management application to support our operational activities and continued to trial projects through the water industry's Intelligent Water Networks program. These trials enable us to test new technologies which help us identify and resolve issues promptly, ultimately improving the way we manage our water networks.

This report reflects our commitment to meeting our drinking water quality responsibilities by addressing the twelve elements of the Framework for Management of Drinking Water Quality.

In 2018/19 Western Water was an efficient, responsive and capable water utility and we've continued to be innovative in our approach to delivering quality water to our customers. Undoubtedly, our dedicated employees are responsible for many of our accomplishments, and I would like to take this opportunity to thank all staff for their commitment and professionalism in managing the production and supply of our drinking water over the past year.

It is with pleasure that I submit Western Water's 2018/19 Water Quality Report to customers, stakeholders and regulators.

Jeff Rigby
Managing Director
October 2019

1 Commitment to drinking water management

Western Water closely monitors the quality of drinking water supplies to ensure compliance with standards set out in the Safe Drinking Water Regulations 2015. We also adopt other industry guidelines associated with health and aesthetics of drinking water including the Australian Drinking Water Guidelines 2011 (ADWG). Together, these are used to set the physical, chemical, radiological and microbiological performance targets ensuring our water quality targets are more than adequate.

Drinking water policy

Western Water's Drinking Water Policy, contained in Appendix 1, reflects current practice in the delivery of safe drinking water, with procedures and initiatives to support policy implementation. This includes the continual application of the Drinking Water Quality Management System (DWQMS), and associated HACCP Plans to manage and protect water quality.

The policy also outlines our aim to continuously improve processes and meet the requirements of the *Safe Drinking Water Act 2003* and subordinate legislation. It is displayed on noticeboards in the Sunbury office and at all water filtration plants and is included in inductions for new staff.

Implementation

Western Water implements this policy through:

- application of the DWQMS
- delivery of strategic planning actions and initiatives
- communicating policy content and intent to our employees, customers and stakeholders
- educating customers and stakeholders on use of water as a precious resource
- maintaining a high standard of asset management practices, and
- undertaking regulatory audits, certification audits and internal audits.

Regulatory and formal requirements

Western Water maintains a register of regulatory and other formal requirements for the delivery of drinking water through its DWQMS (refer to the full list in Appendix 2). This includes Federal and Victorian legislation, codes of practice, standards, service level agreements, contracts and operating agreements that are relevant to the delivery of safe drinking water.

Western Water ensures responsibilities in relation to drinking water are understood by referencing these regulatory and formal requirements in applicable policies, procedures, work instructions, position descriptions and individual performance reviews. A review of requirements is conducted periodically by Western Water's Hazard Analysis and Critical Control Points (HACCP) team to ensure changes are reflected throughout all systems. This HACCP system was audited during the reporting period, validating our multi-barrier approach to protecting drinking water quality.

Engaging stakeholders

Ensuring Western Water has sustainable, resilient water services systems requires a consultative, collaborative approach with all stakeholders. In addition, it is critical that we engage customers, the community and others in our integrated water management approach and encourage all to make optimum use of the full range of water resources.

Community and stakeholder engagement

Western Water is committed to building positive, cooperative relationships with all stakeholders who have the potential to either affect or be affected by our operations. These are included in the corporation's emergency contact list, which is updated regularly.

Recognising that we must embrace customer-friendly channels, Western Water's online customer panel now includes almost 40,000 members. They are kept well informed of water quality issues and changes and, when required, participate in consultation and engagement. Water Matters, our online Have Your Say consultation site, extends engagement opportunities to customers, the wider community and stakeholders.

Major external stakeholders include regulatory bodies such as the DHHS, EPA, DELWP and the ESC as well as suppliers, Melbourne Water and Southern Rural Water. These organisations are actively engaged through regular meetings and/or reporting. Other significant external stakeholders are those contractors who provide analytical services or water treatment chemical supplies.

Internal stakeholders including management, office, plant and field workers are engaged regularly through the HACCP team and the monthly reporting program.

2 Assessment of the drinking water supply system

Water supply system analysis

Western Water addresses multiple challenges to provide our customers with quality drinking water. One of the most significant challenges we have faced in the past two decades has been ensuring water supply security. The impact of the Millennium Drought combined with long term sustained population growth resulted in significant demand for water from dwindling local supplies. As a result, Western Water became reliant on water sourced from Melbourne's water system.

Our Integrated Water Management Strategy will ensure long term sustainability of water supplies in the region, while the connection to the Melbourne supply system will remain critical for supply security.

Currently the major towns of Sunbury and Melton are being supplied with Melbourne Water (MW) while Bacchus Marsh and towns in the Macedon Ranges are receiving local supplies. In the past year, 78% of drinking water supplied in Western Water's service area was sourced from the Melbourne system. Low rainfall has reduced local reservoirs to a combined total of 32% of capacity.

Water supply system

Western Water utilises a cross-disciplinary team to develop the risk assessment of water supply systems including office and plant staff. Where significant changes to risks are identified, the assessment process is assisted by external consultants.

Flow diagrams have been constructed of all water supply systems and are checked periodically to ensure they reflect actual system arrangements. The DWQMS includes key documentation developed from assessment and analysis of water supply systems with a periodic review of water supply systems.

Water sampling localities

There are six water supply systems in Western Water's region:

- Rosslynne/Sunbury
- Merrimu
- Romsey
- Lancefield
- Woodend, and
- Myrniong.

For water quality monitoring, these supply systems are divided into 19 water sampling localities, formally published by DHHS in the Government Gazette. Each locality is determined by the origin of the water, the location of treatment and storage facilities, and the associated delivery system. These localities form the basis of our water sampling program.

Table 2: Residential population by water sampling locality and town

Water sampling locality	Towns[1]	Residential population[2] 2017/18	2018/19
Bulla	Bulla, Oaklands Junction	680	690
Darley	Darley, Pentland Hills	8,310	8,520
Diggers Rest	Diggers Rest	3,940	4,770
Eynesbury	Eynesbury	2,400	2,420
Gisborne	Gisborne, New Gisborne, Bullengarook	10,440	10,690
Lancefield	Lancefield	2,120	2,170
Lerderderg	Bacchus Marsh, Merrimu, Coimadai, Rowsley	8,380	8,350
Macedon	Macedon	1,630	1,620
Maddingley	Maddingley, Parwan	3,980	4,360
Melton South	Brookfield, Cobblebank, Grangefields, Melton, Melton South, Strathtulloh, Weir Views	32,450	33,660
Merrimu	Harkness, Melton West, Kurunjang, Long Forest	27,980	29,224
Mount Macedon	Mount Macedon	1,420	1,430
Myrniong	Myrniong	260	260
Riddells Creek	Riddells Creek	3,530	3,600
Rockbank	Aintree, Bonnie Brook, Caroline Springs, Deanside, Fieldstone, Fraser Rise, Mount Cottrell, Plumpton, Rockbank, Thornhill Park, Truganina	4,210	6,370
Romsey	Romsey, Kerrie, Monegeetta	4,720	4,930
Sunbury	Sunbury, Clarkefield, Wildwood	37,750	38,470
Toolern Vale	Toolern Vale	450	1,410
Woodend	Woodend, Woodend North, Ashbourne	5,390	5,510
Total		**160,340**	**168,450**

[1] *There have been changes to the towns within localities in line with new suburb naming in Melton and Woodend during the year.*

[2] *Population estimates are based on the number of water connections to residential properties multiplied by the average number of persons (as a standardaised factor of 2.6) per residential property for each locality and rounded to the nearest 10.*

Drinking water sources

Most towns in Western Water's service region are connected to at least two drinking water sources – Melbourne water and local reservoirs. The major local reservoirs are Rosslynne Reservoir, near Gisborne, and Merrimu Reservoir, near Bacchus Marsh.

In addition, a number of smaller local reservoirs supply water to some towns in the Macedon Ranges and Pykes Creek Reservoir supplies the community of Myrniong.

Local water sources are used for drinking water supply whenever possible but are insufficient to meet the demands of the region's growing population. As a result, 78% of drinking water supplied to the region this financial year has been sourced from the Melbourne supply system.

At 30 June 2019, local storages held a combined capacity of 32%. The ongoing impacts of climate change and sustained population growth mean that the region's future water supply security is dependent on Western Water maintaining access to Melbourne water supplies.

Melbourne water supplies

Western Water has a bulk entitlement with MW to access water from the Melbourne Headworks system. As demonstrated this year, this entitlement is critical for the region's drinking water supplies to counter the impact of extended periods of high demand and/or low rainfall.

Water in the Melbourne system is sourced from protected natural catchments (Upper Yarra Thomson and the Yarra Valley tributaries) and transferred from the Silvan Reservoir directly or via the Greenvale Reservoir filled by Silvan. These sources feed the Sunbury/Rosslynne supply system from Loemans Road Pump Station, and the Merrimu supply system via the Hillside Pump Station.

Western Water applies the same level of water restrictions as Melbourne to all customers in our region. This is a condition of the bulk entitlement agreement with MW. Details of supply systems for all towns are outlined in Table 4.

Smaller town supply systems

Woodend, Romsey, Lancefield and Myrniong each have their own local supply systems with additional water supplemented from bulk entitlements in nearby systems. In times of drought, the bulk entitlement from Melbourne supplements these local supplies via the interconnected water transfer network.

Woodend

Woodend receives treated water from two local sources: Campaspe Reservoir via the Marriages Water Filtration Plant, near Woodend, and the Graham Brock Reservoir via Reservoir C Water Filtration Plant, on Mt Macedon.

During 2018/19, Woodend was supplied with 285ML from Campaspe Reservoir and a further 203ML from the Graham Brock Reservoir which received 180ML from the Macedon bulk entitlement. Woodend can also receive a potable supply from the Rosslynne system during times of low local storages or water quality events. 76 ML was supplied from the Rosslynne system during the year.

Romsey

Romsey receives treated water from the Romsey Water Filtration Plant, which is supplied with water from Kerrie Reservoir. Supplementary water can be sourced from Wright Reservoir in Riddells Creek.

In the past year, Romsey received 378ML from Kerrie Reservoir. Extra inflows were sent to Romsey from the Riddells Creek and Maribyrnong bulk entitlements this year and bore water was also used to supplement surface water storages for Romsey.

Myrniong

Myrniong receives its water supply from Pykes Creek Reservoir after treatment from the Myrniong Water Filtration Plant.

A total of 55ML was taken from the storage during the reporting period in compliance with its bulk entitlement. Significant inflows had resulted in a storage increase during the year.

Lancefield

The Lancefield Water Filtration Plant can receive and treat surface water, bore water or a mixture of both.

In 2018/19, 65ML of water was taken from Garden Hut Reservoir at Lancefield. The transfer network from Romsey to Lancefield also allowed for water to be transferred from the Romsey, Riddells Creek and Maribyrnong bulk entitlements during the year.

Assessment of water quality data

Western Water collects extensive history of water quality at water source, treatment plants and customer taps. Samples are scheduled and collected by an independent NATA accredited laboratory with results sent directly to our Aquantify database to allow for investigation into trends and emerging water quality issues.

The Aquantify database includes an automatic notification process for any results that are outside defined limits. The contracted laboratory is required to immediately notify Western Water of any health-related exceedances detected in drinking water samples. In the case of drinking water samples, the limits are based upon the ADWG 2011.

Western Water uses water quality data obtained from the Aquantify database to review trends and data from SCADA to monitor trends of water systems on an as needed basis.



Table 3: Major reservoir levels (% capacity)

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Rosslynne Reservoir	5%	66%	72%	85%	76%	44%	15%	38%	24%	24%
Merrimu Reservoir	9%	85%	78%	76%	63%	29%	10%	51%	37%	38%

Table 4: Drinking water sources

Towns supplied	Reservoir	Catchment
Melton, Melton South, Eynesbury, Hopetoun Park, Rockbank, Toolern Vale, Bacchus Marsh and Long Forest, Darley, Pentland Hills, Merrimu, Coimadai, Maddingley, Parwan, Balliang and Balliang East	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Merrimu Reservoir	Lerderderg River, Goodman Creek and Pyrites Creek Catchments
	Djerriwarrh Reservoir	Djerriwarrh Catchment
Gisborne, New Gisborne, Gisborne South, Bullengarook, Mount Macedon, Macedon and Riddells Creek	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Rosslynne Reservoir	Jacksons Creek Catchment
Sunbury, Goonawarra, Jacksons Hill, Clarkefield, Bulla, Oaklands Junction and Diggers Rest	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Rosslynne Reservoir	Upper Maribyrnong Catchment
Woodend	Graham Brock Reservoir and Reservoir C	Falls/Smokers Creek and Graham Brock Reservoir and Reservoir C Catchments
	Campaspe Reservoir	Campaspe River Catchment
	Rosslynne Reservoir	Upper Maribyrnong Catchment
	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
Myrniong	Pykes Creek Reservoir	Werribee River and Pykes Creek Catchment
	Greenvale Reservoir (when carting)	Yan Yean, Thomson and Upper Yarra Catchment
	Merrimu Reservoir (when carting)	Lerderderg River, Goodman Creek and Pyrites Creek Catchments
Romsey, Kerrie and Monegeeta	Kerrie Reservoir	Upper Bolinda Creek
	Romsey Bore	Local aquifer
	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Rosslynne Reservoir	Upper Maribyrnong Catchment
Lancefield	Garden Hut Reservoir	Deep Creek Catchment
	Monument Creek Weir	Monument Creek Catchment
	Bore Number 3	Local aquifer
	Kerrie Reservoir	Upper Bolinda Creek
	Romsey Bore	Local aquifer
	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Rosslynne Reservoir	Upper Maribyrnong Catchment

Hazard identification and risk management

Western Water uses a risk framework based on ISO 31000:2018 Risk Management – Principles and Guidelines for the management of water quality hazards and risk assessments.

In accordance with the regulatory framework, Western Water manages the quality of drinking water through implementation of a Drinking Water Quality Management System based on the HACCP principles.

3 Preventative measures for drinking water supply

Western Water operates its drinking water supply systems under the Victorian *Safe Drinking Water Act 2003*, administered by DHHS. Western Water is required to manage health risks associated with drinking water, effectively monitor the water and undergo annual audits of our management systems.

A number of processes have been adopted to ensure delivery of safe, high quality drinking water supplies to customers. This is achieved through the multiple barrier from catchment to tap approach, including various water treatment methods, which are covered within the HACCP system.

The most recent independent external audit of Western Water's Drinking Water Quality Management System (DWQMS) took place in May 2018 and confirmed Western Water is fully compliant with the *Safe Drinking Water Act 2003* risk management plan requirements. The next audit is expected to take place in mid-2020.

Preventative measures and multiple barriers approach

The adoption of preventative strategies for the protection of drinking water supplies is one of the key elements of the Framework for Management of Drinking Water Quality, developed under the ADWG. A key aspect of this risk-based approach to the production of safe drinking water is the use of multiple water treatment processes, also known as the multiple barrier approach.

At Western Water, drinking water provided to customers is subject to a multiple barrier approach to ensure safe and aesthetically acceptable supplies. This demands a highly skilled workforce and requires constant vigilance and attention to detail. Each water quality barrier in place at Western Water is discussed in detail below, including:

- implementation of the Guidelines for Planning Permits in Open Potable Water Supply Catchments and liaison with storage managers to support protection of catchments and reservoirs in accordance with DSC Guidelines, November 2012
- operation of water treatment and disinfection systems to meet water quality standards and improve aesthetics
- protection of water quality through a fully enclosed water distribution network to prevent possible contamination after treatment, including regular maintenance
- implementation of management systems (QMS, EMS, OH&S and HACCP) procedures that are audited and reviewed regularly, and followed by experienced operators, and
- delivery of training and competency assessment of operators through registered training organisations.

Catchment protection

Western Water works alongside storage managers, Southern Rural Water (SRW) and Melbourne Water (MW), to support effective water quality management from catchment to customer.

Protected reservoirs and storage tanks

The amount of time water is held in surface water supply reservoirs is a key element to maintaining good water quality as longer detention time allows sediment to settle. This improves water clarity and enables longer exposure to solar radiation, which aids in the disinfection process.

In addition to the region's three major storage reservoirs – Rosslynne, Merrimu and Pykes Creek (managed by SRW), Western Water owns 17 smaller storages, most of which are located in or near the Macedon Ranges. Western Water's storages are protected through restricting access. Water quality at reservoirs is also monitored to ensure safety.

A total of 30 water storage tanks and 37 pump stations are used to supply water to customers throughout the water reticulation system. The tanks are typically constructed of concrete or metal and are fully enclosed. These sites are regularly tested to ensure water safety and security.

Alternative sources of supply

Western Water's extensive interconnection to the Melbourne supply system has ensured there is capacity in all the region's towns to access alternate water supply sources through the bulk entitlement. In the case of Myrniong, this access would involve carting water.

Water treatment practices

Drinking water sourced from unprotected catchments – such as the local source water storages available to Western Water – requires both filtration and disinfection due to the surrounding agricultural and urban activity. To ensure the provision of safe and healthy drinking water at customer taps, all water is disinfected at the point where it enters the supply system and again at specified points along the delivery system.

However, drinking water sourced from the Melbourne Headworks system comes from highly protected catchments which have long detention time in reservoirs. As a result, disinfection alone is sufficient to ensure water quality. MW carries out primary disinfection. Western Water booster stations chlorinate the water as it enters the local network.

Filtration

Western Water operates seven water filtration Plants (WFPs) and an additional 14 water treatment facilities which booster chlorinate the water. Five WFPs employ dissolved air flotation filtration (DAFF),Merrimu WFP uses the traditional sedimentation-filtration process and Romsey WFP uses microfiltration.

Each process efficiently removes potential pathogens and, coupled with disinfection, maintains a healthy drinking water supply with minimal impact on taste and odour. In addition, all filtration processes deliver high aesthetic water quality with minimal chemistry added. Typically, they provide turbidity values of <0.3 NTU and true colour of <5 PCU.

Chemical treatment and disinfection

Western Water uses both chlorination and chloramination to disinfect water supplies. The method used depends on the supply system. This process kills any bacteria or viruses and provides disinfection residual to maintain water quality as it travels from the WFP through the distribution system. In addition, MW adds fluoride to the supply from the Melbourne system. Lime, carbon dioxide or sodium carbonate may also be added to the water to adjust the pH level. Powder Activated Carbon is also used to combat taste and odours produced by high concentrations of naturally occurring organic carbon.

Fluoridation

Fluoride is a naturally occurring element that is found in rocks, soils, water and Plants. One milligram of fluoride for every litre of water has been shown to provide maximum dental benefits to the community and this is the 'optimal' level for temperate climates such as Victoria.

Western Water now supplies fluoridated local water from both Merrimu and Rosslynne Water Filtration Plants.

Construction was completed on the Fluoridation Plant at Rosslynne WFP in 2014, made possible with financial assistance from the Department of Health and Human Services. None of Western Water's smaller water filtration plants currently add fluoride to their water supply.

Fluoride (dosed as sodium hexafluorosilicate or hydro-fluorosilic acid) is added by MW before delivery to Western Water's supply region in line with the requirements of the *Health (Fluoridation) Act 1973*.

The table below lists the towns which receive a fluoridated supply. Supplies to Lancefield, Myrniong, Romsey and Woodend are only fluoridated when local supplies are supplemented with water from Melbourne or Rosslynne Reservoir. During the reporting period, some water from Rosslynne supply system was used to top up local supplies for Romsey and Lancefield resulting in low levels of fluoride present in their water supply.

Table 5: Fluoridated and non-fluoridated water supply by town

Fluoridated water supply	Non-fluoridated water supply
Bulla	Lancefield[1]
Darley	Myrniong[2]
Diggers Rest	Romsey[1]
Eynesbury	Woodend[3]
Gisborne	
Lerderderg	
Macedon	
Maddingley	
Melton South	
Merrimu	
Mount Macedon	
Riddells Creek	
Rockbank	
Sunbury	
Toolern Vale	

[1] *Lancefield and Romsey received a small proportion of fluoridated water during 2018/19 when Rosslynne Reservoir water was mixed with local water supplies to ensure supply security*

[2] *Myrniong received some fluoridated water supply during the investigation into the Pykes Creek Reservoir septic leak incident (further details can be found in Section 6)*

[3] *Woodend received fluoridated water from Rosslynne Reservoir for a few weeks in March while Marriages Water Filtrations Plant was undergoing maintenance*

Preventative measures for drinking water supply (continued)

pH correction

Acidity in water is corrected to provide a neutral pH at different stages of the treatment process to ensure added chemicals are effective and that there are minimal impacts on pipes and associated fittings within the distribution network.

Water's pH level may be corrected by adding lime and carbon dioxide or sodium carbonate at the start of the treatment process to assist with coagulation. The pH may be adjusted again at the end of the process to ensure effective disinfection and limit final water corrosiveness. The average pH of water should be maintained within the ADWG specified range of 6.5–8.5 pH units for aesthetic purposes.

Table 6: Water treatment chemicals and processes by sampling locality

Locality	Population[1] supplied	System	Treatment process	Added substances	Comments
Melton South, Lerderderg, Maddingley, Darley, Merrimu, Rockbank, Toolern Vale, Eynesbury	94,310	Merrimu system (Merrimu Reservoir via Merrimu Water Filtration Plant)	Coagulation, clarification/ filtration, fluoridation, chlorination Additional chlorination by booster chlorinators along reticulation system as required	Aluminium chlorohydrate, polyelectrolyte, chlorine gas, sodium silicofluoride, sodium hypochlorite[3]	Melton and Melton South have been supplied with MW since June 2016. Other towns in the Bacchus Marsh area of the Merrimu system have been supplied from Merrimu Reservoir. Booster chlorinators exist in Melton South, Rockbank, Merrimu, Darley, Maddingley and Lerderderg localities.
		Merrimu system (Greenvale Reservoir via Hillside Pump Station)	Fluoridation and primary chlorination by MW Secondary chlorination at Hillside Pump Station Additional chlorination by booster chlorinators along reticulation system as required	Sodium hexafluorosilicate, chlorine gas, sodium hypochlorite[3]	
Gisborne, Macedon, Mount Macedon, Riddells Creek	17,340	Rosslynne system (Rosslynne Reservoir via Rosslynne Water Filtration Plant)	Oxidation, absorption coagulation, pH correction Dissolved air flotation filtration fluoridation, chlorination Additional chlorination	Aluminium sulphate, potassium permanganate (as required), powder activated carbon, polyelectrolyte, lime, carbon dioxide, fluorosilicic acid, chlorine gas, sodium hypochlorite[4]	During 2018/19 Rosslynne treated water was supplied to Gisborne, Riddells Creek, Macedon and Mt Macedon. Sunbury, Bulla and Diggers Rest remain on Melbourne water supply. Both supplies are further chlorinated at Gisborne, Bulla, Sunbury, Macedon, Mount Macedon and Riddells Creek.
			Fluoridation and primary chlorination by MW Secondary disinfection (chlorination) at Loemans Rd Pump Station/Riddell Rd Tank Additional chlorination by booster chlorinators along reticulation system as required	Sodium hexafluorosilicate[2], sodium hypochlorite[3,4]	
Sunbury, Bulla, Diggers Rest	43,930	Sunbury system (Greenvale Reservoir via Loemans Road Pump Station)	Fluoridation and primary chlorination by Melbourne Water or at Rosslynne Water Filtration Plant Secondary disinfection (chloramination or chlorination) at Loemans Rd Pump Station/ Riddell Rd Tank	Sodium hexafluorosilicate[2], sodium hypochlorite[3,4]	

Table 6: Water treatment chemicals and processes by sampling locality

Locality	Population[1] supplied	System	Treatment process	Added substances	Comments
Woodend	5,510	Woodend system (Campaspe Reservoir via Marriages Water Filtration Plant and Graham Brock Reservoir, Reservoir C & Greenvale Reservoir via Reservoir C Water Filtration Plant)	Coagulation pH correction Dissolved air flotation filtration chlorination Fluoridation by MW[5]	Powdered activated carbon (as required at Marriages Water Filtration Plant), aluminium sulphate, polyelectrolyte, sodium carbonate ('soda ash'), sodium hypochlorite, sodium hexafluorosilicate[5], fluorosilicic acid[5]	Drinking water is supplied from two ends of the system – the Marriages Basin and Reservoir C Contact tank. Supply is fully treated at the Marriages Water Filtration Plant and Reservoir C Water Filtration Plant. If required, Woodend's water supply can be sourced from Rosslynne or Melbourne during dry periods.
Romsey	4,930	Romsey system (Kerrie Reservoir, Romsey Bore & Greenvale Reservoir via Romsey Water Filtration Plant)	Microfiltration Chloramination Fluoridation by MW[6] Additional chlorination by booster chlorinators along reticulation system as required	Poly aluminium chlorohydrate (as required), sodium hypochlorite, sodium hydroxide, aqueous ammonia, sodium hexafluorosilicate[6], fluorosilicic acid[6]	Drinking water is supplied from Kerrie Reservoir and Wright Reservoir and local groundwater. If required, Romsey's untreated water supply can be sourced from Rosslynne or Melbourne during dry periods.
Lancefield	2,170	Lancefield system (Garden Hut Reservoir, Lancefield Basin and groundwater)	Coagulation pH, correction filtration Dissolved air flotation chlorination Fluoridation by MW[7]	Aluminium chlorohydrate (as required), polyelectrolyte, sodium hydroxide (caustic soda), potassium permanganate, powdered activated carbon (pac), sodium hypochlorite, sodium hexafluorosilicate[7], fluorosilicic acid[7]	Drinking water is supplied from Garden Hut Reservoir and local groundwater. The Lancefield system is also connected to Romsey via a source water pipeline which allows transfer of water from Kerrie Reservoir into the Lancefield Basin.
Myrniong	260	Pykes Creek Reservoir	Coagulation, oxidation, ph correction, dissolved air flotation filtration, chlorination Fluoridation by MW[8]	Powdered activated carbon (as required), potassium permanganate, aluminium sulphate, polyelectrolyte, sodium carbonate ('soda ash'), chlorine gas, sodium hypochlorite, sodium hexafluorosilicate[8]	Drinking water is supplied from Pykes Creek Reservoir. When necessary, additional water can be carted to Myrniong from Bacchus Marsh (Lerderderg locality).

[1] *Population estimates are based on the number of water connections to residential properties multiplied by the average number of persons per residential property for each locality and rounded to the nearest 10*

[2] *Chemicals may be added by MW for treatment, chlorination and fluoridation*

[3] *Chemicals added by Western Water for additional disinfection at entry point from MW mains*

[4] *Chemicals added by Western Water throughout the distribution system to increase chlorine residual levels*

[5] *When receiving water from the Mount Macedon system, and that water has been supplemented with MW or Rosslynne Reservoir*

[6] *When receiving water from MW or Rosslynne system through transfer to Wright Reservoir*

[7] *When receiving water from the Romsey/Lancefield pipeline, and that water has been supplemented with MW supply or Rosslynne system water supply via Wright Reservoir*

[8] *When receiving water from MW through water carting from Bacchus Marsh (Merrimu System, supplied by Merrimu Treatment Plant or supplemented with MW supply)*

Preventative measures for drinking water supply (continued)

Water distribution network maintenance

The maintenance of the water distribution network, particularly pipes and tanks, is essential to ensure water quality from source to customer taps.

Distribution pipe cleaning and maintenance

In 2018/19, Western Water supplied 68,193 connected properties with drinking water through 2,261km of water mains.

The extensive reticulation system is maintained through renewals, repairs and operational actions such as valve exercising, mains flushing, mains cleaning, and flow and condition monitoring and assessment. These actions help reduce water losses through leakage and bursts and assist in maintaining water quality. The number of water main bursts during 2018/19 remains at low levels, refer to Table 7.

Table 7: Water main bursts per 100km

	2014/15	2015/16	2016/17	2017/18	2018/19
Bursts per 100km	12.1	13.3	12.3	12.2	12.7

68,193

Properties connected with drinking water

2,261

Kms of water mains

Critical control points

Western Water uses Hazard Analysis and Critical Control Point (HACCP), an internationally recognised food industry standard based on risk prevention and management in food processing applications. The HACCP system is used to manage significant risks at key points in harvesting, treatment and distribution of drinking water, employing the developed Victorian legislative RMPs and QMP as supporting tools.

Western Water's HACCP system provides comprehensive documentation and a framework for field monitoring and maintenance, with a number of HACCP plans relating to each system providing critical and alert limits for system controls, monitoring audits and maintenance guides for disinfection equipment, maintenance and inspection of plants, pump stations and tanks, equipment calibration and staff accountability. The most recent HACCP certificate is included in Appendix 3.

Storage tank integrity and cleaning

Western Water has a routine cleaning program for storage tanks in the distribution system involving the use of specialised underwater cleaning equipment by scuba divers to remove any sediment accumulated at the bottom of the tank. All storage tanks are covered and checked regularly to minimise contamination from birds or animals as well as dirt, leaves and other matter.

Backflow prevention

A dedicated backflow prevention officer helps target and reduce the likelihood of backflow occurrences in the system. This backflow role is part of Western Water's HACCP team and potential detections are assessed by a risk based process within the HACCP system. Backflow auditing is performed by Western Water staff.

4 Operational procedures and process control

Operational procedures

Western Water understands that formal operational procedures are critical to ensure the consistent delivery of quality drinking water across the region. Standard operating procedures (SOPs) and work instructions (WIs) can be used and referenced for maintenance tasks, specific or more complex tasks, or may exist as a standalone single reference for the agreed best practice for undertaking routine operational tasks. Whenever necessary, SOPs are reviewed and updated in line with risk management requirements.

Current procedures and work instructions available at Western Water include:

- Powder Activated Carbon Loading
- Fluoride Handling
- Fluoride Dosing System Maintenance
- Fluoride Chemical Delivery Procedure
- Clean In Place Procedure
- Flow Tests for Chemical Dosing Pumps
- Chlorine Strength Test Work Instructions
- Calibration Procedures and Schedules
- Tank inspection procedures,
- Internal Auditing Procedure and Scheduling, and
- Non-Conformance Procedures.

Western Water's Integrated Management System (IMS) addresses and links various business practices including Health, Safety & Wellbeing (HS&W), QMS, HACCP, Environmental Management System (EMS) and Risk Management. As issues, events, audits, incidents or improvement actions are required, they are captured by a common system for coordinated monitoring and follow up.

Operational monitoring and process control

Operational monitoring is conducted at all water filtration plants across the region. Section 5 details the results of microbiological water quality monitoring in 2018/19.

Western Water employs online monitoring equipment which includes chlorine, fluoride, conductivity, turbidity and pH sensors. All WFPs use fully automated, continuously operating Supervisory Control and Data Acquisition (SCADA) technology to remotely monitor and control the processes.

Alert and critical limits obtained from HACCP plans are integrated into treatment Plant control systems. This results in Plants automatically shutting down and triggering alarms to Plant operators if water quality fails critical limits.

5 Verification of drinking water quality

The Water Unit at DHHS regulates the safety of drinking water supplied by all Victorian water corporations. No undertakings, exemptions or variations apply to Western Water potable supply during 2018/19.

Drinking water quality monitoring

Western Water closely monitors the quality of drinking water to ensure compliance with the Safe Drinking Water Regulations 2015 (SDWR). In addition to meeting standards for the key water quality parameters highlighted in the Safe Drinking Water legislation, Western Water also aims
to ensure that the water provided to customers meets the ADWG.

These guidelines provide a benchmark for a large range of biological, radiological, physical and chemical parameters, and also detail the use and development of Western Water's Drinking Water RMP.

The health and aesthetic quality of drinking water supplied to customers is ensured through a rigorous process of water quality monitoring and reporting. Monitoring includes continuous measurement of key parameters via online instruments (linked to alarm systems and graphic displays), daily operational checks by filtration plant staff, and external independent monitoring.

To assess the quality of our water supplies, daily routine monitoring is undertaken to confirm compliance with the Safe Drinking Water Legislation. Water samples are collected in each of our 19 water sampling localities, at the reservoirs, WFPs and various points throughout the supply system including water storage tanks and customer taps.

Samples are tested for a range of microbiological, physical, chemical, algal and radiological parameters. All regulatory testing is undertaken through an independent laboratory accredited by the National Authority of Testing Association (NATA) as required by the SDWR.

Non-routine testing is also used to investigate water quality trends, source variation issues, customer complaints or any suspected contamination issues. Non-routine testing may either be done by external NATA accredited laboratories or by operational testing, depending on the nature of the issue and the water quality information required.

The water treatment chemicals used to treat our drinking water are all delivered by approved chemical suppliers. Chemical quality is verified through the quality systems built into the chemical supply contract, which ensures the approved chemicals are used throughout the treatment process according to specifications.

Drinking water quality compliance

During 2018/19, all water localities complied with the microbiological requirements that 100% of drinking water samples collected during the reporting period must have zero *E.coli* organisms per 100 milliliters, with the exception of:

- any false positive samples as determined by the SDWR, and
- the Darley locality had 99.99% compliance with the microbiological requirements of drinking water samples collected during the reporting period due to a single confirmed low level exceedance in the Darley locality.

Further details are presented in Section 6 Incident Management and Emergency Response.

Table 8 and Chart 1 provide a snapshot of Western Water's compliance on key health and aesthetic parameters for drinking water quality, as required by the SDWR and ADWG. *E.coli* and Trihalomethanes are core indicators of drinking water health, and turbidity, pH level and true colour are core indicators of drinking water aesthetics.

Full details of Western Water's drinking water quality standard compliance are contained in Appendix 4, with all parameters measured compliant during the year including:

- *E.coli*
- chlorine-based disinfection by-product chemicals
  - trihalomethanes
- other parameters
  - turbidity
  - fluoride, as per Code of practice for fluoridation of drinking water supplies 2018 mention fluoride code, and
- examples of other chemicals not specified in the standards but may pose a risk to human health are listed in Table 8.

Table 8: Drinking water quality compliance

Parameter	2016/17	2017/18	2018/19
Arsenic, Filtered[2]	100%	100%	100%
Barium, as Ba	100%	100%	100%
Barium, Filtered	100%	100%	100%
Benzo(a)pyrene[2]	100%	100%	100%
Berylium, Filtered	100%	100%	100%
Beryllium, as Be	100%	100%	100%
BHC (alpha)	100%	100%	100%
BHC (beta)	100%	100%	100%
BHC (delta)	100%	100%	100%
Bicarbonate Alkalinity as CaCO3	100%	100%	100%
Boron	100%	100%	100%
Boron, Filtered	100%	100%	100%
Bromate	100%	100%	100%
Bromobenzene	100%	100%	100%
Bromodichlormethane	100%	100%	100%
Bromoform	100%	100%	100%
Cadmium	100%	100%	100%
Cadmium, Filtered	100%	100%	100%
Calcium[2]	100%	100%	100%
Carbon tetrachloride[2]	100%	100%	100%
Carbonate Alkalinity as CaCO3	100%	100%	100%
Chlordane, Total[2]	100%	100%	100%
Chlorine	100%	100%	100%
Chlorine, Free	100%	100%	100%
Chloroacetic acid	100%	100%	100%
Chlorobenzene	100%	100%	100%
Chloroform	100%	100%	100%
Chromium	100%	100%	100%
Chromium, Filtered	100%	100%	100%
cis-1.2-Dichloroethene	100%	100%	100%
cis-1.3-Dichloropropylene	100%	100%	100%
cis-Chlordane	100%	100%	100%
Cobalt, as Co	100%	100%	100%
Cobalt, Filtered	100%	100%	100%
Coliforms, Total[2]	100%	100%	100%
Colour, true[2]	100%	100%	100%
Copper[2]	100%	100%	100%
Copper, Filtered[2]	100%	100%	100%
Cyanide	100%	100%	100%
Dibromochloromethane	100%	100%	100%
Dibromomethane	100%	100%	100%
Dichloroacetic acid	100%	100%	100%
1,1-Dichloroethene[2]	100%	100%	100%
1,2-Dichloroethane[2]	100%	100%	100%
1.1-Dichloropropylene	100%	100%	100%
1.1.1.2- Tetrachloroethane	100%	100%	100%

Table 8: Drinking water quality compliance

Parameter	2016/17	2017/18	2018/19
1.1.1-Trichloroethane	100%	100%	100%
1.1.2.2-Tetrachloroethane	100%	100%	100%
1.1.2-Trichloroethane	100%	100%	100%
1.1-Dichloropropylene	100%	100%	100%
1.2.3-Trichlorobenzene	100%	100%	100%
1.2.3-Trichloropropane	100%	100%	100%
1.2.4-Trichlorobenzene	100%	100%	100%
1.2.4-Trimethylbenzene	100%	100%	100%
1.2-Dibromo-3-chloropropane	100%	100%	100%
1.2-Dibromoethane (EDB)	100%	100%	100%
1.2-Dichlorobenzene	100%	100%	100%
1.2-Dichloropropane	100%	100%	100%
1.3.5 - Trimethylbenzene	100%	100%	100%
1.3-Dichlorobenzene	100%	100%	100%
1.3-Dichloropropane	100%	100%	100%
1.4-Dichlorobenzene	100%	100%	100%
2,4,6-Trichlorophenol	100%	100%	100%
2,4-D[2]	100%	100%	100%
2.3.4.6-Tetrachlorophenol	100%	100%	100%
2.4.5-T	100%	100%	100%
2.4.5-Trichlorophenol	100%	100%	100%
2.4-Dichlorophenol	100%	100%	100%
2.6-Dichlorophenol	100%	100%	100%
2-Chlorophenol	100%	100%	100%
2-Chlorotoluene	100%	100%	100%
4,4'-DDT	100%	100%	100%
4.4'-DDD	100%	100%	100%
4.4'-DDE	100%	100%	100%
4-Chloro-3-Methylphenol	100%	100%	100%
4-Chlorotoluene	100%	100%	100%
Aldrin[2]	100%	100%	100%
Alkalinity, Total as CaCO3[2]	100%	100%	100%
Aluminium, filtered2	100%	100%	100%
Aluminium, Total as Al[2]	100%	100%	100%
Ammonia[2]	100%	100%	100%
Antimony	100%	100%	100%
Antimony, Filtered	100%	100%	100%
Arsenic	100%	100%	100%
Dissolved Organic Carbon[2]	100%	100%	100%
Dissolved Oxygen (Field)[2]	100%	100%	100%
Electrical Conductivity @ 25C[2]	100%	100%	100%
Endosulfan I	100%	100%	100%
Endosulfan II	100%	100%	100%
Endosulfan sulfate	100%	100%	100%
Endrin	100%	100%	100%
Endrin aldehyde	100%	100%	100%
Endrin ketone	100%	100%	100%

Verification of drinking water quality (continued)

Table 8: Drinking water quality compliance

Parameter	2016/17	2017/18	2018/19
Enterococci	100%	100%	100%
E.coli[2]	99.8%	100%	99.99%[1]
Ethylbenzene	100%	100%	100%
Faecal Streptococci[2]	99.9%	100%	100%
Fluoride[2]	100%	100%	100%
Formaldehyde	100%	100%	100%
Hardness, as CaCO3[2]	100%	100%	100%
Heptachlor[2]	100%	100%	100%
Heptachlor Epoxide[2]	100%	100%	100%
Heterotrophic Plate Count, 22C	100%	100%	100%
Heterotrophic Plate Count, 37C	100%	100%	100%
Hexachlorobenzene[2]	100%	100%	100%
Hydroxide Alkalinity as CaCO3	100%	100%	100%
Iron, Filtered (Soluble)[2]	100%	100%	100%
Iron, total as Fe[2]	100%	100%	100%
Lead	100%	100%	100%
Lead, Filtered	100%	100%	100%
Lindane	100%	100%	100%
Magnesium, as Mg[2]	100%	100%	100%
Manganese, Filtered (Soluble)[2]	100%	100%	100%
Manganese, total as Mn[2]	100%	100%	100%
MCPA	100%	100%	100%
Mercury, as Hg[2]	100%	100%	100%
meta- & para-Xylene	100%	100%	100%
Methoxychlor[2]	100%	100%	100%
Methylene chloride	100%	100%	100%
Molybdenum, as Mo	100%	100%	100%
Monochloramine	100%	100%	100%
n-Butylbenzene	100%	100%	100%
Nickel	100%	100%	100%
Nickel, Filtered	100%	100%	100%
Nitrate[2]	100%	100%	100%
Nitrite[2]	100%	100%	100%
n-Propylbenzene	100%	100%	100%
ortho-Xylene	100%	100%	100%
Pentachlorophenol[2]	100%	100%	100%
pH[2]	100%	100%	100%
Phosphorus, Reactive as P[2]	100%	100%	100%
p-Isopropyltoluene	100%	100%	100%
Potassium, as K[2]	100%	100%	100%
sec-Butylbenzene	100%	100%	100%
Selenium[2]	100%	100%	100%
Selenium, Filtered[2]	100%	100%	100%
Silica, Non Reactive[2]	100%	100%	100%
Silica, Reactive[2]	100%	100%	100%
Silver, Filtered as Ag	100%	100%	100%
Silver, Total as Ag	100%	100%	100%
Simazine	100%	100%	100%

Table 8: Drinking water quality compliance

Parameter	2016/17	2017/18	2018/19
Sodium	100%	100%	100%
Strontium, Filtered	100%	100%	100%
Strontium, Total	100%	100%	100%
Styrene	100%	100%	100%
Sulphate[2]	100%	100%	100%
tert-Butylbenzene	100%	100%	100%
Tetrachloroethene[2]	100%	100%	100%
Thallium, Total	100%	100%	100%
Tin, Filtered	100%	100%	100%
Tin, Total as Sn	100%	100%	100%
Titanium, Filtered	100%	100%	100%
Titanium, Total	100%	100%	100%
Toluene	100%	100%	100%
trans-1.2-Dichloroethene	100%	100%	100%
trans-1.3-Dichloropropylene	100%	100%	100%
trans-Chlordane	100%	100%	100%
Trichloroacetic acid	100%	100%	100%
Trichloroethene	100%	100%	100%
Trihalomethanes	99.8%	100%	100%
Turbidity[2]	100%	100%	100%
UV Transmission@254nm[2]	100%	100%	100%
Vanadium, as V	100%	100%	100%
Vanadium, Filtered	100%	100%	100%
Zinc	100%	100%	100%
Zinc, Filtered	100%	100%	100%

[1] *Refer to 2019 Gisborne Road Tank exceedance, details presented in Section 6*
[2] *Parameter is tested on untreated water source, refer to Appendix 5.*

Drinking water aesthetics

Source water monitoring

One of the key components of Western Water's Drinking Water Quality Management System (DWQMS) is the extensive source water monitoring program aimed at increasing the understanding of the source water quality in reservoirs, bores and basins.

It involves monitoring and identifying hazards, sources and events which could compromise drinking water quality in a catchment, with a multiple barrier approach.

Through an independent NATA accredited laboratory, a comprehensive source water monitoring program was undertaken during 2018/19. An overview of the parameters tested, frequency of testing at each sampling location for pesticides, chemicals (organics and in-organics), metals, physical and radiological parameters and their results are enclosed in Appendix 4.

Microbiological monitoring

In addition to the source water monitoring conducted by an independent NATA accredited laboratory, source water samples at various sampling locations were taken routinely for physical microbiological analysis by specialist biological scientists. This involves the determination of any flagellates, diatoms, algae and cyanobacteria (blue green algae) that were present in the source water sources.

General observations provided by these assessments in relation to any water discolouration, the levels of detritus and the presence of any odour in the source water provided valuable information in assessing the quality of the source water at various times during 2018/19. This information allows Western Water to monitor the changes in conditions of source water sources and their potential impacts towards drinking water quality.

Blue green algae

For Merrimu, Rosslynne and Pykes Creek Reservoirs, blue green algae (BGA) monitoring was conducted by Western Water and data was shared with water storage manager Southern Rural Water (SRW). Regular results on BGA numbers in the three reservoirs allowed for the timely assessment of adverse impacts on our ability to treat and provide safe drinking water to customers.

Melbourne Water (MW) monitors water prior to the off-take entry point to Western Water's region. Monthly water quality reports are provided by MW for Greenvale Reservoir. These include information on algal populations. MW is required to notify Western Water of any major changes in treated water quality for supplies from the Melbourne system. These changes include any that have potential to impact on our ability to supply safe drinking water to customers and meet the ADWG.

During the reporting period, Western Water did not report any BGA blooms as a Section 22 notification to the Department of Health and Human Services.

Customer satisfaction

In May 2019, Western Water conducted its annual customer satisfaction survey with customers. For the first time, this survey was conducted online, resulting in close to 1900 responses from across the service region. Weighted average results were then calculated to reflect the number of serviced properties by town.

The online survey method captured responses from a more representative demographic – particularly from younger adults. Declines in satisfaction across virtually all measures were noted. This may be due to the nature of the survey (less personal than phone-based) as well as the change in sample. The impact of shifting to online surveying will be further tested in 2020.

Customer satisfaction with water quality was measured at 7.9 out of 10. Water quality aspects like taste (7.5) and smell (7.7) generated lower results while colour (8.1) and cleanliness (8.0) received stronger satisfaction ratings. Lancefield customers were the least satisfied with their water quality – particularly its taste and smell. Historic attitudes about water quality and the addition of chlorine to the water supply are likely to be contributing to this result.

Water quality complaints

Western Water's holistic approach to complaints management ensures any complaint is fully addressed from receipt to resolution, ensuring fast and effective resolution and minimal adverse customer impact. A range of actions are undertaken for water quality related complaints including verbal advice, further investigation, on-site inspection and testing, and works to improve water supply.

In accordance with the ADWG, Western Water adopted a benchmark for water quality complaints of 0.400 complaints per 100 customer properties. This benchmark was met again in 2018/19 with Western Water receiving 0.201 complaints per 100 customer properties as per DHHS reporting requirements.

During 2018/19, customer complaints about water quality reduced by 18% compared to last year. The decrease in complaints is believed to be primarily due to maintaining a consistent supply source to Sunbury and Melton localities, and increased maintenance of the network including flushing.

Water quality complaints by locality

During the reporting period, 2 localities recorded 10 or more complaints. There were Melton South and Sunbury. The main reason for complaint was coloured/dirty water due to sediment stirred-up in the mains. The locations of the coloured/dirty water were flushed via the hydrant locations in the mains.

The highest level of complaints per 100 customer properties (refer to Table 11) was recorded in Merrimu due to accumulated sediments in the mains being stirred up. An ongoing routine flushing program for the Western Water service region is in development with Field Service teams. This will assist in determining the frequency some areas should be flushed and cleaned to prevent customer complaints.

The Mount Macedon and Riddells Creek localities rated second and third highest for water quality complaints. These were largely due to accumulated sediments in the mains getting stirred up with network demand or unplanned pipe bursts.

Verification of drinking water quality (continued)

Table 9: Customer complaints

Complaint category	2017/18	2018/19
Water quality	170[1]	130
Other complaints	46	47
Total	**216**	**177**

[1] *While 170 water quality complaints were recorded for ESC, only 167 of these complaints were drinking water quality related. The other 3 quality complaints were related to recycled water*

Table 10: Water quality complaints by type and locality

Complaint type	Complaints	Complaints per 100 properties	Localities by highest no. complaints 1st	2nd	3rd
Taste/odour	17	0.026	Macedon	Riddells Creek	Lancefield
Dirty/discoloured	106	0.164	Merrimu	Rockbank	Woodend
Illness	2	0.003	Melton South	Melton South	N/A
Other	5	0.008	Lancefield	Melton South	Sunbury
Total	167	0.201			

Table 11: Water quality complaints by locality

Locality	Complaints	Complaints per 100 customer properties[1]
Bulla	0	0.000
Darley	3	0.092
Eynesbury	0	0.000
Diggers Rest	0	0.000
Gisborne	4	0.097
Lancefield	2	0.240
Lerderderg	3	0.093
Macedon	2	0.321
Maddingley	2	0.119
Melton South	56	0.433
Merrimu	3	0.027
Mount Macedon	2	0.363
Myrniong	0	0.000
Riddells Creek	4	0.289
Rockbank	6	0.245
Romsey	0	0.000
Sunbury	38	0.257
Toolern Vale	0	0.000
Woodend	5	0.236

[1] *Based on the number of complaints per 100 customer properties supplied.*

Table 12: Water quality complaints per 100 customers[1]

	2014/15	2015/16	2016/17	2017/18	2018/19
Complaints per 100 customers	0.316	0.397	0.235	0.262	0.201

[1] *For this reporting format, a customer is one customer property. Complaints are tracked through internal business performance reporting.*

6 Incident management and emergency response

Communication protocols

Western Water's incident response procedures describe the protocols for communication to the public and other stakeholders in the event of a significant water quality event, such as the need to issue a boil water notice.

This is further supported by a Boil Water Notice Procedure which identifies the key stakeholders to be contacted and provides information on the appropriate communication methods for each stakeholder.

Incident and emergency management

As an essential service provider, incident and emergency management is vital to Western Water. We have systems and resources ready to respond to emergencies 24 hours a day, seven days a week with crews strategically located across our region including a Duty Officer roster system for Treatment Plants, Field Services and Business Services.

Each year several situations are escalated to an incident, in which case established response processes are followed to resolution. Once the incident has been de-escalated, it is analysed in detail via an incident debrief session to minimise the risk of recurrence by identifying the likely cause and additional controls that would apply. This process is vital for large scale incidents that present major risks and/or offer useful learnings.

All *E.coli* detections, Turbidity and Total Trihalomethanes levels above the Standards reported to DHHS and are investigated using the guidelines published by the Secretary's office in theSafe Drinking Water Regulations 2015 (SDWR) under Schedule 2 Appendix 1.

All other water quality tested parameters are reported to DHHS based on exception to the ADWG or other appropriate guidelines, as per the SDWR.

All incidents that may affect public health, and as defined by Section 22 of the *Safe Drinking Water Act 2003*, are immediately reported to DHHS, and applicable paperwork provided within 24 hours of occurrence.

All incidents that confirm the non-conformance at the time of sampling the supplied drinking water are reported under Section 18 requirements of the *Safe Drinking Water Act 2003*, within 10 days of the initial report to DHHS by Western Water.

During the reporting period of 2018/19 there was one Section 18 report issued to DHHS. There were two Section 22 notifications of potential issues, however the investigation findings did show the water sampled was not representative of the water supplied to customers.

Incidents reported under Section 18 *Safe Drinking Water Act 2003*

a. Gisborne Road Tank, Gisborne (March 2019)

Issue – A routine sample from the Gisborne Road Tank on 26 March 2019 reported a result of 2org/100ml *E.coli* (SDWR limit is 0orgs/100ml *E.coli*).

Actions – The investigation showed the tank at the time of sampling had a low chlorine residual present, and there was one downstream network report of 1org/100ml *E.coli* on the day of resampling on 27 March 2019 at the tank. Due to the verified report of water contamination, the issue was addressed in accordance with Section 18 *Safe Drinking Water Act 2003*.

Outcome – the tank has as upstream booster chlorination system to maintain a good chlorine residual in the tank. Investigation determined the importance of ongoing maintenance of this system and regular inspections of the tank and booster chlorination system were recommended.

Incidents reported under Section 22 *Safe Drinking Water Act 2003*

a. Gisborne Road Tank, Gisborne (March 2019)

Issue – A routine sample from the Gisborne Road Tank on 26 March 2019 reported a result of 2org/100ml *E.coli* (SDWR limit is 0orgs/100ml *E.coli*). Refer to 'Incidents reported under Section 22 *Safe Drinking Water Act 2003*' also.

Actions – The investigation showed the tank at the time of sampling had a low chlorine residual present, and there was one downstream network report of 1org/100ml *E.coli* on the day of resampling on 27 March 2019 at the tank. Resampling at the tank, upstream and downstream network was performed on the day of reporting the initial exceedance, and the tank roof, hatch and sample tap were examined. The investigation identified the source of contamination was likely due to rainfall entering from pinholes on the tank roof. Proactive flushing of the tank and network was undertaken on the same day as the initial report, post resampling for accurate verification.

The roof was repaired on the day after resampling, and additional repairs were priority planned as part of an ongoing tank roof capital project. The follow up sampling on the day after resampling verified the corrective actions did successfully remove the contaminated water from the tank and network.

Outcome – the tank has as upstream booster chlorination system to maintain a good chlorine residual in the tank. Investigation determined ongoing maintenance of this system and regular inspections and optimisation of the tank and booster chlorination system were recommended.

b. Melton routine customer tap sampling, Melton (December 2018)

Issue – During routine sampling in December 2018 in the Melton South locality, a laboratory result of 2orgs/100ml *E.coli* was reported (SDWR limit is 0orgs/100ml *E.coli*.

Actions – The laboratory was instructed to resample on the day of the reported exceedance. Further investigation showed the sample was taken during poor weather conditions, resulting in a contaminated sample due to rainfall and dust entering the sample bottle. Based on the resample at the same location, and a very good chlorine residual present at the sample location, the initial sample was not representative of water supplied to customers at the time of sampling.

Outcome – weather conditions during routine sampling were identified as a key issue during the investigation of the exceedance. Opportunities for improvement included condition and location of sample taps and continued discussion with the external laboratory to prevent sources of contamination which may cause a non-representative result.

Incidents not reported under Section 22 *Safe Drinking Water Act 2003*

a. Pykes Creek Reservoir – Detection of elevated *E.coli* levels (December 2018 and February 2019)

High *E.coli* levels in Pykes Creek Reservoir were detected between 31 December 2018 and 11 February 2019 during routine monitoring. After significant on-site investigation by Southern Rural Water (SRW) and genome sequence testing undertaken by the Australian Water Quality Centre (AWQC), the cause of the high *E.coli* levels was determined to be a bloom of an environmental strain of *E.coli*. Though unconfirmed, it is very likely that a similar event caused the high *E.coli* levels at Pykes Creek during the 2017–18 Financial Year.

During the incident:

- as per SRW's Memorandum of Understanding with Western Water, SRW continued to receive and share water quality data with Western Water over the course of the incidents
- additional water quality sampling and testing was undertaken by SRW and Western Water to monitor the situation
- the storage was closed for public recreation during high *E.coli* levels, and re-opened when testing confirmed a return to levels considered safe for recreational use
- AWQC was engaged to undertake genome testing to identify the strain of *E.coli*
- the issue was reported to all relevant agencies such as the DHHS, EPA & DELWP, and regular updates were provided to internal and external stakeholders, and

- Western Water's water treatment plant located at Pykes Creek continued to successfully treat and supply drinking water to the township of Myrniong for the duration of the event.

Following the incident, SRW convened a workshop with industry, regulators and experts to discuss the issue of environmental *E.coli*, and ways to manage future incidents. SRW also participated in research undertaken by Water Research Australia that has resulted in a guidance document on managing environmental *E.coli* incidents from a drinking water and treatment perspective.

Current research indicates that environmental *E.coli* strains are non-pathogenic, and they occur without fecal contamination. Regardless, environmental *E.coli* has been added to SRW's risk management plans, and SRW are developing a procedure for the identification and management of environmental *E.coli* incidents from both a drinking and recreational water perspective.

b. Rosslynne Water Treatment Plant filtered water turbidity issue, December 2018.

A HACCP issue at the Rosslynne WFP occurred during 29 December 2018, due to a brief elevation of turbidity measured in the filtered water on one of the three filters. The duration of the event was less than 30 minutes caused by a fault in a dosing pump, resulting in filtered water turbidity measured up to 0.52NTU, target is below 0.2NTU. The monitoring on water produced by all three filters did not exceed 0.22NTU, and the other two filters were operating without issue during the event.

The dosing pump was repaired, and the event further investigated as part of a plant control system diagnostic project. Based on the findings of the investigation, the drinking water quality was not impacted and there was no impact to customers.

c. Merrimu Water Treatment Plant chlorinator issue, January 2019.

During routine maintenance of the Merrimu WFP air compressor, the air operated valves faulted closed. When the treatment plant was restarted, the chlorination process remained in fault and did not operate.

The water from the Merrimu Reservoir and the pre-chlorination treatment was of excellent quality, and very low risk for bacteria at the time of the issue. The duration of the chlorination fault resulted in a 10% unchlorinated volume blend into the fully chlorinated treated water storage tank. The tank chlorine residual and contact time ensured the water leaving the plant did meet ADWG requirements for suitable disinfection.

The plant control system was reviewed as part of corrective actions, and changes were implemented to prevent the plant from operating while the chlorination process is offline.

d. Dodemaide Tank, missed sampling during the 2017/18 and 2018/19 reporting period

Dodemaide Tank was offline for planned capital works from October to December 2017 and during this time the routine sampling program was paused. Routine sampling of the tank was missed between December 2017 to July 2018 (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the SDWR were met however the additional sample is part of the routine sample program. In accordance with the Act and Regulations, the Department of Health Water Unit was notified of the missed sampling.

Incident management and emergency response (continued)

Review of the demand on the Dodemaide Tank determined the demand in the downstream network is too low for sustaining the operation of a storage tank. The tank was taken offline for much of 2018/19, until additional demand requires the tank to be reinstated. A standard operating procedure has been developed for the decommission and recommission of tanks either due to low demand or planned works.

A review of the routine sampling program, to improve performance efficiency, was undertaken during 2019. The implementation of the changes to the program are ongoing during 2019/20.

e. Greenvale Reservoir, Melbourne Water (MW) reported widespread complaint due to discoloured water

In February 19 discoloured water from MW's Greenvale Reservoir led to customer complaints within certain zones of Western Water, City West Water and Yarra Valley Water. The flows were contained and at no time was there any risk to public health.

Upon investigation it was determined that a small volume of discoloured water from below the reservoir thermocline containing iron and manganese inadvertently bypassed a lower gate valve. The gate was in the shut position however was found not to be fully closed. Subsequently works were completed to close the gate fully. Position sensors have also been installed on the gate valves at Greenvale to verify that gates are fully shut when showing in the shut position. A review is underway to ensure that this risk is managed at all MW reservoirs with variable offtakes. A Section 22 Notification was submitted to DHHS relating to this incident due to the potential for widespread public complaint and is discussed in Emergency Incident and Event Management below.

A Section 22 Notification was submitted for the Greenvale coloured water event on 7 March 2019. While the impact on the water was of an aesthetic nature rather than health-related, this incident was one which could cause widespread complaint. This incident impacted on City West Water, Yarra Valley Water and Western Water causing a s number of complaints. MW maintained ongoing consultation with the affected Retail Water Corporations throughout and after the incident which lasted approximately 20 days. A number of actions have been undertaken to reduce the risk of recurrence at Greenvale and all of our other reservoirs with variable offtakes.

Blue green algae (BGA)

During 2018/19, there were no blue green algae notifications that impacted drinking water quality at Rosslynne Reservoir, Pykes Creek Reservoir, Merrimu Reservoir, local reservoirs or the Melbourne supply from Greenvale Reservoir.

Several reports of blooms were reported to the Department of Sustainability and Environment (DSE) web portal, including a bloom at the Wrights reservoir used for supply as part of the raw water by agreement contracts. While this reservoir was not used for drinking water supply, the customers with these contracts were notified at the start and cessation of the bloom.

Notifications of water blooms were received from the independent external laboratory as part of the biological monitoring at the treatment plants. However, numbers detected in the samples were very low, if present, and confirmed by online monitoring at the treatment plants.

Additional changes to communication practices by Western Water include using the water quality database to document asset status checks and to provide more active notification to the external laboratory provider. There are ongoing investigations by Western Water to determine long term solutions to ensure active communication between Western Water and external laboratory providers to prevent missed samples due to notification oversights.

There will be times where an asset cannot be sampled in accordance with the water sampling program. This can be due to unplanned or emergency circumstances that make attending the asset high risk to the sampler (e.g. bushfires), or due to planned activities such as tank refurbishment. The routine water sampling performed around the network each week ensures that although an asset may not be accessible, the requirements of SDWR 2015 are achieved and the water is safe to drink.

7 Employee awareness and training

Western Water's water quality team are a significant asset to the business with their experience, skills and training, ensuring the ongoing safe delivery of drinking water across the region. We are committed to ensuring all employees are fully aware of their responsibilities and trained appropriately for our water supply systems.

During 2018/19, the water quality team consisted of twelve staff with four based in the Sunbury office, six based at Rosslynne Water Filtration Plant and another three based at Merrimu Water Filtration Plant.

There was one role made permanent during the reporting period; a full time Water Treatment Coordinator. There were two operators placed within the Rosslynne and Merrimu Teams respectively, to refill existing positions. There was also a trainee operator placed within the Merrimu WFP team for 12 months.

Employee awareness and involvement

Staff attend regular site/team meetings to remain up to date with the latest developments. Changes to existing policies and the introduction of new ones are also included in meeting agendas and can be accessed on our intranet.

Western Water reinforces key safety messages via safety alerts, the intranet and site/toolbox meetings. All water systems staff as well as the Board and Executive are considered accountable for implementation of Western Water's Drinking Water Policy.

Employee training

All water quality team members undertook training during the year with some attending the Water Industry Training Centre, Geelong and Chisholm Institute of TAFE. In addition to formal training, ongoing training and reskilling is required as procedures are revised due to new equipment or techniques. This ensures the safety of both employees and the community.

Water treatment operators were mapped across to the National Certification Framework for Water Operator, as part of DHHS recommendations to industry. Over the course of two years, the operators will be assessed to ensure the qualifications are documented in Western Water's training database, including the Recognised Prior Learning assessment process.

Employee awareness and training (continued)

Western Water's water quality team members took part in more than 100 different training opportunities during 2018/19. Courses and activities covered a range of specialised water treatment and general workplace training and learning opportunities. The water treatment specialised training included:

- AIIMS Emergency Incident Workshop
- Bushfire Awareness
- Chlorine Changeover
- Defensive Driving
- Ferric Sulfate
- First Aid
- Lone Worker Procedure
- Taking water tank inspections into the future (Lunch and Learn)
- Manual Handling
- Monitor and control Dam Operations
- Conduct and Report Dam Safety Instrumentation Monitoring
- Monitor and Implement Dam Maintenance
- Inspect and Report on Concrete Dam Safety
- Inspect and Report on Embankment Dam Safety
- Operating Breathing Apparatus
- Providing CPR
- Radio Training, and
- Sodium Hydroxide Solution

100+

Participation in different training opportunities by Western Water's water quality team members

Staff also had the opportunity to participate in several learning and development opportunities over the year including:

- Developing the Melbourne 50-year Sewerage Strategy (Lunch and Learn)
- IWN Collaboration Conference 2019
- IWN Program Update (Lunch and Learn)
- Victorian Public Sector Young Leaders Conference, and
- Water Industry Operators Australia Conference

Water industry operations

Western Water strongly encourages operational staff to obtain their certificate qualifications in water industry operations through the provision and funding of training opportunities, as well as linking the achievement of Certificate III to banding progression opportunities. Five employees from the water quality and outdoor teams took part in the Water Industry Operations Conference. Western Water continues its commitment to employee learning and development through a range of training advisory bodies, including:

- VicWater Industry Training Consultative Committee
- National Water Industry Training Forum
- Victorian Employers' Chamber of Commerce and Industry (VECCI), and
- Water Services Association Australia's (WSAA) Water Quality Network
- Water Industry Training Centre
- Water Industry Operators Association of Australia, and
- Victorian Water Industry Advisory Committee.

Western Water has committed to transitioning all Operators across to the new National Water Training Package. A skills gap audits was implemented to inform a training program. It is anticipate to have all Operators certified under the new competency based system by 2020.

8 Community involvement and awareness

Western Water aims to engage and educate the community about the safe delivery of its quality water supply.

Community involvement

Western Water strives to be recognised as a responsible corporate citizen within the community and considers its community sponsorship program to be an important element of this strategy.

Western Water is committed to improving the biodiversity value of its properties and enhancing the environment across the region. Long standing partnerships with Pinkerton Landcare and Environment Group, Deep Creek Landcare and Friends of Toolern Creek are testimony to this commitment.

Consultation

Western Water's customer advisory network has expanded to include our online customer panel which provides a significant additional resource for community consultation including contacts for almost 40,000 customers.

Our communications and engagement capability has been expanded through the Water Matters consultation site where customers can join in discussions on critical topics and provide input for decision making. The site has been a cornerstone for Western Water's Price Submission engagement program and will continue to add value for ongoing consultation.

An important component of our ongoing consultation with customers about water quality is encouraging reporting of concerns through a variety of channels to enable us to better understand any issues presenting across the network.

Education programs

Western Water recognises that educating young people on crucial issues such as climate variability and water conservation creates a ripple effect reaching far beyond the classroom. Presentations, programs and teacher resources for children are offered at the preschool, prep, primary and secondary school levels.

Over 13,500 from across the region took part in Western Water preschool and primary school education presentations during the year. We also introduced a community education presentation program aimed at migrants and adults with low literacy about the benefits of drinking tap water.

Tours and presentations

Western Water offers free tours and presentations to schools and community groups. Free guided tours are offered at our largest treatment plants at Gisborne and Merrimu. In 2018/19, educational tours and community presentations were conducted for a range of groups including primary, secondary, tertiary and community groups.

Community involvement and awareness (continued)

Sponsorship and grants

Western Water builds and strengthens local community relations through sponsorships and offering grants across the service region. We attended numerous community events to promote the health benefits and quality of our drinking water. In addition, our mobile water tanks are made available free of charge to various community activities across the region.

We strongly support the Choose Tap program providing bottles and key messages via local cafés, businesses, sporting groups and via drinking water fountains in public places. During 2018/19, we offered Choose Tap grants, providing drinking water fountains in local schools. We also worked with several schools to develop the Water Only School initiative.

Publications

Apart from the annual Drinking Water Quality Report, Western Water's other current water treatment publications include the following factsheets:

- Bore water for drinking
- Drinking water for health
- Rosslynne WFP treatment
- T155 (Water use around the home, saving water, plant selection)
- Water by agreement
- Water supply changes, and
- Your water supply.

Choose Tap

Grants introduced, providing drinking water fountains in local schools

Community awareness and communications

To ensure the community fully comprehends our issues and actions, Western Water produces a range of planned and reactive communication materials including the customer newsletter, email campaigns, factsheets, brochures, media stories, social media and customer letters.

Western Water's new social media communication channels, online consultation panel and growing SMS capability are increasing our means of communicating with customers about critical water quality issues. They go well beyond traditional channels by offering timely, direct, two-way communication.

Facebook and email have become significant communication channels for Western Water – particularly when customers have issues with their water quality or supply.

9 Research and development

Western Water is committed to improving understanding and delivery of quality drinking water. To this end, we have invested in new technologies specifically aimed at better water quality monitoring and delivery. In addition, we have created a link with WSAA and the American Water Research Foundation to access best practice water industry research on both a national and international scale.

Western Water participates in the state-wide Drinking Water Quality Network and the metropolitan retailers' network. These foster good working relationships across the industry.

Western Water has a small library of 170 core reference texts and research papers on water quality and other matters.

Research

Western Water continues to optimise water filtration plant operations, and this starts with the untreated water in the reservoir. Online profile sampling for Merrimu Reservoir and Rosslynne Reservoir is undergoing optimisation, both in quality of the data and the location of the monitoring sensor. Completion of the Rosslynne Reservoir sampler installation during 2019 was achieved, and Merrimu Reservoir sampler is anticipated for completion during 2019/2020.

The sampler will provide a better understanding of the source water characterisation and allow predictive actions to prevent potential water quality issues. The long-term capture of this data will influence how we can better manage the reservoirs. Following the success of this project, further samplers are planned for other storages.

Online Manganese monitoring at Rosslynne WFP

In June 2019, Western Water began successfully trialling the use of online monitoring in the Rosslynne Reservoir, to prevent health and aesthetic issues relating to blue green algae, manganese (black water events), iron (coloured water events) and taste issues. Previously, this monitoring has been performed in the laboratory by operators or by specialist external laboratory providers. The use of online monitoring improves response times at the plant to optimise the treatment process.

Trihalomethane investigation at Rosslynne WFP

Rosslynne Reservoir refilled quickly during June to September 2016 which resulted in the water quality in the reservoir changing – particularly in organic type. The type of organics in the reservoir were difficult to remove through the existing treatment process. Because of chlorination used for disinfection at the plant, there were elevated levels of disinfection by-products namely Trihalomethanes.

Extensive investigation of the organics and quantities of Trihalomethane produced at the plant determined the issue is likely to persist for many years and the removal of organic type is a costly activity. The investigation included review of other water agencies in America and Europe to identify alternative technology.

The technology most suitable for the treatment of Trihalomethanes is a PAX™ system, using tank mixing and aeration to release the volatile compounds from the treated water to tank air space, and venting the air to external atmosphere. The project has undergone assessments of financial and environmental impacts, prior to design and installation during 2018.

Research and development (continued)

Review of external laboratory program

Western Water reviewed the program for sampling and testing of drinking water during 2018/19. The review included historical water quality analysis to determine appropriate testing for current and future growth of the network, and verification of changing risk profiles in the catchment, reservoir and treatment plant. The program aims to verify and inform on changes to water quality of chemical, bacterial, physical and radiological nature. The data collected from testing of the drinking water will be part of operation optimisation processes, for overall improvement to safety and aesthetics.

Intelligent Water Networks – ongoing trials

Western Water continues to take a lead role in the Intelligent Water Networks program, a partnership between VicWater, the 19 water corporations and the Department of Environment, Land, Water and Planning. IWN is investigating new technologies and innovations to meet common challenges such as population growth, ageing infrastructure and climate variability.

Several IWN projects are now underway at Western Water, designed to drive efficiency and system-wide cost reductions. These include augmented reality for plant inspections and training, maintenance of water mains and remote tank inspections using drones.

Waternamics data integration initiative

Like many water corporations, Western Water uses a number of different systems to manage information about customers, and our network of pipes, valves, pumps and tanks. Having information in different places means we are more likely to respond to an incident after it's been reported by a customer, rather than identifying them before they become an issue.

Western Water is trialling Waternamics, an IWN initiative, which is a new data integration system that is changing the way we view our network and improving the service we provide to customers. Waternamics was developed with the assistance of Veolia and IBM.

Waternamics pulls data from five existing systems into a single platform to obtain a comprehensive view of our network and customers in one place. This is helping us:

- identify issues and fix them before they impact on customers
- reduce the time it takes to respond to priority faults, and
- improve the speed of our response to customer enquiries and complaints.

The first phase of the project commenced in late 2017. Waternamics has helped with managing bursts, leaks and faults. It also assists with tracking water quality complaints and lab reporting.

Industry knowledge

Western Water maintains active membership of industry groups such as Australian Water Association (AWA), Water Industry Operators Association (WIOA), Water Services Association of Australia (WSAA), VicWater and the Institute of Water Administration (IWA) to ensure awareness, communication and involvement with our broader stakeholder groups.

As part of Western Water's membership of the Water Services Association of Australia (WSAA), we support the WSAA research program, including international collaborative research. Working cooperatively with other WSAA members provides significant leverage in research dollars in a range of important water research areas including customer service, water quality, recycling and environmental impacts.

Staff participate in industry associations including the AWA Victoria Branch Committee and the Institute of Water

Administration. Staff also attend seminars and conferences to access up to date industry knowledge. Western Water also takes part in the state-wide Drinking Water Quality Network and the metropolitan retailers' network.

10 Documentation and reporting

Management of documentation

Reporting water quality data and performance is an integral component of Western Water's Water QMS. All documentation is regularly reviewed and updated in line with HACCP for water supply systems and the internal water QMS. This is part of our IMS.

HACCP documents reviewed and/or rewritten in 2018/19 include:

- Rosslynne WFP HACCP plan
- Lancefield WFP HACCP plan
- Customer Tap HACCP plan
- Booster site HACCP plan
- Reservoir C WFP HACCP plan
- Marriages WFP HACCP plan, and
- Product specification.

An annual review of the following sites was carried out:

- Swans Rd Booster Chlorinator
- Darley High Chlorinator
- Gisborne Rd Chlorinator
- Underbank Chlorinator
- Settlement Rd Booster Chlorinator
- Sandy Creek Booster Chlorinator
- Loemans Rd Entry Point
- Norton Rd Booster Chlorinator
- Salisbury Rd Booster Chlorinator
- Hillside Entry Point
- Shepherds Rd Tank and pump station
- McDonalds Rd Booster Chlorinator
- Greens Hill Tank
- Aitken St Chlorinator
- Romsey Water Filtration Plant
- Merrimu Water Filtration Plant
- Lancefield Water Filtration Plant
- Marriages Water Filtration Plant
- Reservoir C Water Filtration Plant
- Rosslynne Water Filtration Plant
- Myrniong Water Filtration Plant, and
- Customer tap.

Water quality excursions/non-conformances and incidents are reviewed by the HACCP team on a monthly basis and are tracked and closed out using the IMS database. Western Water's centralised water quality database is provided by Aquantify. This system ensures automated data storage and generates automated emails advising of any water quality exceedances.

Reporting

Western Water uses the Balanced Scorecard (BSC) to manage and report on strategic business performance and ensure the business is progressing toward its strategic intent 'engaging with our community on the provision of water services to enable regional economic growth and resilience in a climate-changing environment'.

Through BSC reporting, key objectives, actions and system performance are monitored by the Board, Executive and management on a monthly basis. Providing quality water services is a key objective of the BSC with actions including maintaining water quality practices and managing water main assets.

11 Evaluation and audit

Evaluating and auditing water quality management systems ensures the successful management of water quality data and processes. This report is an integral part of the review and evaluation process.

Long term evaluation

Water quality data has been collected from various sites across Western Water's service area for over ten years including catchments, reservoirs, plants and customer taps. This data is used to develop trends of long term changes to water quality, which is essential to recognise and understand risks to water quality. It also assists in identifying possible solutions.

Audit of drinking water quality management

Audits ensure that operational procedures and processes are in place so that accurate water quality data is collected, and appropriate management systems are maintained. One external surveillance audit was conducted by a certified auditor in February 2019, confirming the ongoing HACCP certification.

In 2018/19, 26 internal gap audits on the Drinking Water HACCP System were undertaken by members of Western Water's HACCP team. The internal gap audits included review of Western Water's internal procedures and practices to ensure compliance with the requirements for ADWG and HACCP certification.

The reports were noted in monthly HACCP team meeting minutes and reported in the BSC and to the IMS Committee on a monthly basis.

Reports were also registered in the IMS database to ensure efficient close out of any opportunities for improvement in the HACCP system. An audit schedule is maintained and reviewed by the HACCP team to ensure ongoing compliance.

DHHS regulatory audit

Western Water passed the June 2018 Regulatory Audit, and during 2018/19 commenced work on implementing the opportunities for improvement identified by the auditor, including:

- a comprehensive review of the HACCP system, including updates to alarm process and layout to correctly identify the QCPs and CCPs at the treatment plants
- rationale of the HACCP alarm settings has been fully documented into the HACCP plans with consultation including the HACCP Team
- ongoing review of storage facilities for field staff, including relocation of the Gisborne facility to a Sunbury location, and
- scheduled implementation of labelling sample taps during 2019/20.

26

Internal gap audits on the Drinking Water HACCP System were undertaken by members of Western Water's HACCP team

12 Review and continual improvement

Management reviews

Water quality is viewed as a vital performance issue for Western Water at the most senior level. The performance of the Drinking Water QMS is reviewed monthly by the management team which includes the Managing Director and five General Managers. All audit outcomes are assessed, and resources allocated as necessary to resolve critical issues.

All water quality complaints logged in CARE are assigned to the relevant staff member who then follows the complaint from receipt to resolution in accordance with Western Water's Correspondence and Complaints Management Procedure. Should the customer be dissatisfied with the initial outcome, an internal dispute resolution process is introduced whereby the complaint is reviewed by management with appropriate actions taken as necessary. If a customer remains dissatisfied, they may be directed to an external dispute resolution forum such as the Energy and Water Ombudsman of Victoria (EWOV).

Drinking water quality management improvement plan

Western Water already has an extensive Drinking Water QMS in place. It is framed around the twelve elements of the Australian Drinking Water Guidelines. This assessment will ensure continual improvement measures are identified, and strengths and weaknesses in water quality risk management are well understood, by the Board, Executive, senior management and staff.

Water supply – capital works improvement

During 2018/19, Western Water invested close to $6.1 million in the region's water supply system.

Nearly $4.7 million was invested on new infrastructure:

- $752k for electrical upgrades to water pump stations at Loemans Road and Shephards Lane, Sunbury
- $678k for a new water main in Deanside
- $589k for the Bridge Road Water Main
- $540k for the Barkly Street water main replacement in Sunbury
- $356k on site improvements (shed and outlet main) at Rosslynne Water Filtration Plant
- $350k for the Francis Boulevard water main replacement in Sunbury
- $318k on the Harpers Road water main replacement in Woodend
- $126k for the White Avenue water main replacement in Bacchus Marsh
- $125k to install a new pump station and valve to increase water pressure for properties along Longforest Road near Clematis Court, and
- $82k for an electrical upgrade to Hillside Water Pump Station.

We also decommissioned the old Bacchus Marsh Water Filtration Plant on Main Street ($1.049 million), removed the old water tank on Longforest Road, Longforest ($120k) and invested $280k on security upgrades to the Rosslynne Water Filtration Plant and pump station.

$6.1

Million (approx.) invested by Western Water in the region's water supply system

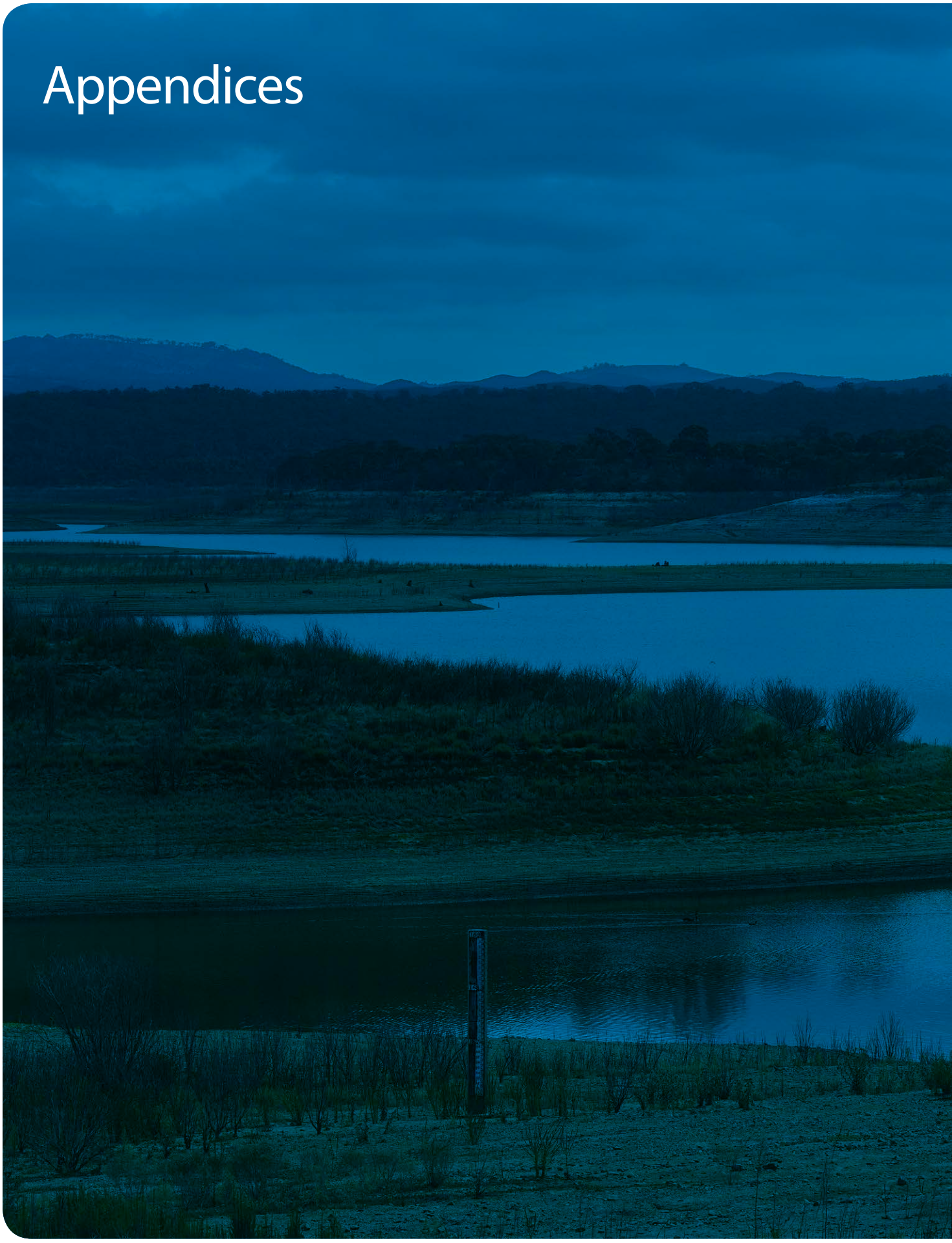
Non-potable supply

Non-potable water is water that has not been treated to the standards considered acceptable for drinking water under the *Safe Drinking Water Act 2003*. It can include source (untreated) water direct from reservoirs as well as partially treated water. There are no regulated water declarations regarding the non-potable water supply customers of Western Water.

Western Water manages the supply of non-potable water through water by agreement contracts with individual customers. During 2018/19, Western Water had 15 non-potable water by agreement residential customers located across our system. Typically, they are customers who have made special arrangements for connection to Western Water's system between untreated source water and the treatment plant.

Western Water advises that this water is not suitable for either drinking or food preparation through the individual contracts as well as ongoing notification on all applicable customer bills in accordance with Section 25 of the Act.

Appendices



Appendix 1 – Drinking water policy

Western Water will continue to meet the requirements of the *Safe Drinking Water Act 2003* and subordinate legislation, as well as the Western Water Customer Service Charter.

Customers will be provided with safe (biologically, chemically, radiologically and physically), cost effective and reliable drinking water and associated services throughout our area of operations. Drinking water is defined as water intended for human consumption or purposes connected with human consumption.

Western Water will provide adequate resources for ongoing implementation and improvement of the Drinking Water Quality Management System (DWQMS). The DWQMS is based on sound risk management principles of AS4360.

Certification of its Hazard Analysis and Critical Control Point (HACCP) system will be maintained to provide a catchment-to-tap multi-barrier approach in line with international best practice.

Supply by Agreement customers will regularly be provided with advisory notices to ensure customers understand the fit-for-purpose implications.

Western Water will enhance the sustainability of drinking water supply through initiatives outlined in the Victorian Government's 'Our Water Our Future' strategy.

Western Water supports Government policy regarding the introduction of fluoridation to all water supplies. Fluoridation of water will be maintained to all areas supplied from the Melbourne Water entitlement and intermittent fluoridated areas will be appropriately managed.

Western Water will communicate with customers to support the maintaining of public confidence in the safety of drinking water supply. This includes information on the impact of drought on water sources, water quality and water system maintenance.

Appendix 2 – Regulatory and formal requirements for drinking water

Related legislation, policies, systems and procedures include:

- *Safe Drinking Water Act 2003*, and Safe Drinking Water Regulations 2015
- *Health (Fluoridation) Act 1973*
- Code of Practice for Fluoridation of Drinking Water Supplies 2018
- *Food Act 1984*
- *Essential Services Commission Act 2001*
- *Environmental Protection Act 1970*
- *Water Efficiency Labelling and Standards Act 2005*
- Dangerous Goods (Storage and Handling) Regulations 2000
- NHMRC/ARMCANZ Australian Drinking Water Guidelines 2011
- Risk Management (AS/NZS ISO 31000)
- Relevant State Environment Protection Policies (SEPPs)
- Environmental Management Systems – ISO 14001
- Quality Management Systems – ISO 9001
- Occupational Health & Safety Management Systems – AS 4801
- Drinking Water Quality Management System
- HACCP Principles & Systems Procedures
- Integrated Management System procedures
- All relevant Western Water policies

Appendix 3 – Audit and HACCP Certificates

Risk management plan audit certificate

Safe Drinking Water Regulations 2015 - Regulation 10

Certificate Number: 152

Audit period: 10 June 2016 to 30 May 2018

To: Rebecca Chapman, Water Quality Advisor

Western Water, 36 Macedon Road, Sunbury, Vic 3429

Australian Business Number (ABN): 67 433 835 375

I, Dr Daniel Deere , after conducting a risk management plan audit of

the water supplied by Western Water am of the opinion that -

Western Water has complied with the obligations

imposed by section 7(1) of the ***Safe Drinking Water Act 2003*** during the audit period.

Signature of approved auditor: DADeere Date: 31 May 2018

Lloyd's Register

Certificate of Approval

This is to certify that:

Western Region Water Corporation

36 Macedon Street Sunbury, Melbourne, 3429, VIC, Australia

has been approved to the following standards:

HACCP Codex Alimentarius Annex to CAC/RCP 1-1969 (2009)

Basem Obaid - Global Head of Training and Improvement Services

Issued by: Lloyd's Register Quality Assurance Limited

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The scope of this approval is applicable to:
Storage, treatment and distribution of drinking water.

Appendix 4 – Water quality compliance results

4.1 Compliance with drinking water quality standards

This section reports on 2018/19 compliance with the Safe Drinking Water Regulations 2015. The limits for all parameters tested by Western Water – as specified by various guides such as the Australian Drinking Water Guidelines – are outlined below in table A2. In some cases, a parameter does not have a limit specified but has been identified through risk assessments as a parameter of interest in case a limit is determined in the future.

Table A1: Drinking water quality standards

Parameter	Sampling frequency	Water quality standard
E.coli	Weekly	100% of all samples collected in any 12-month period to contain no *E.coli* per 100mL
Trihalomethanes	Monthly	Must not exceed 0.25 mg/L
Turbidity	Weekly	Samples in any 12-month period must be less than or equal to the 95th percentile of 5.0 Nephelometric Turbidity Units (NTU)

Table A2: Drinking water quality compliance in accordance with the Australian Drinking Water Guidelines

Parameter	Sampling frequency	Water quality standard
1,1-Dichloroethene	Various	should not exceed 0.03mg/L
1,2-Dichloroethane	Various	should not exceed 0.06mg/L
1.1-Dichloropropylene	Various	currently no recommended health guideline value set
1.1.1.2- Tetrachloroethane	Various	should not exceed 1mg/L
1.1.1-Trichloroethane	Various	currently no recommended health guideline value set
1.1.2.2-Tetrachloroethane	Various	should not exceed 1mg/L
1.1.2-Trichloroethane	Various	currently no recommended health guideline value set
1.1-Dichloropropylene	Various	currently no recommended health guideline value set
1.2.3-Trichlorobenzene	Various	should not exceed 0.005mg/L
1.2.3-Trichloropropane	Various	should not exceed 0.007mg/L
1.2.4-Trichlorobenzene	Various	should not exceed 0.005mg/L
1.2.4-Trimethylbenzene	Various	currently no recommended health guideline value set
1.2-Dibromo-3- chloropropane	Various	currently no recommended health guideline value set
1.2-Dibromoethane (EDB)	Various	should not exceed 40mg/L
1.2-Dichlorobenzene	Various	should not exceed 0.001mg/L
1.2-Dichloropropane	Various	should not exceed 75mg/L
1.3.5 - Trimethylbenzene	Various	should not exceed 25mg/L
1.3-Dichlorobenzene	Various	currently no recommended health guideline value set
1.3-Dichloropropane	Various	currently no recommended health guideline value set
1.4-Dichlorobenzene	Various	should not exceed 0.0003mg/L
2,4,6-Trichlorophenol	Various	currently no recommended health guideline value set
2,4-D	Various	should not exceed 0.03mg/L
2.3.4.6-Tetrachlorophenol	Various	currently no recommended health guideline value set
2.4.5-T	Various	should not exceed 0.1mg/L
2.4.5-Trichlorophenol	Various	should not exceed 0.02mg/L
2.4-Dichlorophenol	Various	should not exceed 0.02mg/L
2.6-Dichlorophenol	Various	should not exceed 0.02mg/L
2-Chlorophenol	Various	should not exceed 0.2mg/L
2-Chlorotoluene	Various	should not exceed 1mg/L

Table A2: Drinking water quality compliance in accordance with the Australian Drinking Water Guidelines

Parameter	Sampling frequency	Water quality standard
4,4'-DDT	Various	should not exceed 0.009mg/L
4.4'-DDD	Various	currently no recommended health guideline value set
4.4'-DDE	Various	currently no recommended health guideline value set
4-Chloro-3-Methylphenol	Various	currently no recommended health guideline value set
4-Chlorotoluene	Various	should not exceed 1mg/L
Aldrin	Various	should not exceed 0.0003mg/L
Alkalinity, Total as CaCO3	Various	aesthetic limit is 200mg/L
Aluminium, filtered	Various	currently no recommended health guideline value set
Aluminium, Total as Al	Various	currently no recommended health guideline value set
Ammonia	Various	aesthetic limit is 0.5 mg/L
Antimony	Various	should not exceed 0.003mg/L
Antimony, Filtered	Various	should not exceed 0.003mg/L
Arsenic	Various	should not exceed 0.01mg/L
Arsenic, Filtered	Various	should not exceed 0.01mg/L
Barium, as Ba	Various	should not exceed 2mg/L
Barium, Filtered	Various	limit based on Barium
Benzo(a)pyrene	Various	should not exceed 0.00001mg/L
Berylium, Filtered	Various	should not exceed 0.06mg/L
Beryllium, as Be	Various	should not exceed 0.06mg/L
BHC (alpha)	Various	should not exceed 1.2mg/L
BHC (beta)	Various	should not exceed 1.2mg/L
BHC (delta)	Various	should not exceed 1.2mg/L
Bicarbonate Alkalinity as CaCO3	Various	aesthetic limit is 200mg/L
Boron	Various	should not exceed 4mg/L
Boron, Filtered	Various	limit based on Boron
Bromate	Various	should not exceed 0.02mg/L
Bromobenzene	Various	should not exceed 50mg/L
Bromodichlormethane	Various	should not exceed 0.25mg/L
Bromoform	Various	should not exceed 0.25mg/L
Cadmium	Various	should not exceed 0.002mg/L
Cadmium, Filtered	Various	limit based on Cadmium
Calcium	Various	currently no recommended health guideline value set
Carbon tetrachloride	Various	should not exceed 0.003mg/L
Carbonate Alkalinity as Ca-CO3	Various	aesthetic limit is 200mg/L
Chlordane, Total	Various	should not exceed 0.002mg/L
Chlorine, Total	Various	should not exceed 5 mg/L
Chlorine, Free	Various	Limit based on Chlorine, Total
Chloroacetic acid	Various	should not exceed 0.15 mg/L
Chlorobenzene	Various	should not exceed 0.01mg/L
Chloroform	Various	should not exceed 0.25mg/L
Chromium	Various	should not exceed 0.05mg/L
Chromium, Filtered	Various	should not exceed 0.05mg/L
cis-1.2-Dichloroethene	Various	should not exceed 0.06mg/L
cis-1.3-Dichloropropylene	Various	should not exceed 0.03mg/L
cis-Chlordane	Various	should not exceed 0.002mg/L
Cobalt, as Co	Various	should not exceed 0.02mg/L
Cobalt, Filtered	Various	limit based on Cobalt

Appendix 4 – Water quality compliance results (continued)

Table A2: Drinking water quality compliance in accordance with the Australian Drinking Water Guidelines

Parameter	Sampling frequency	Water quality standard
Coliforms, Total	Various	currently no recommended health guideline value set
Colour, true	Various	should not exceed 15HU
Copper	Various	should not exceed 1mg/L
Copper, Filtered	Various	limit based on Copper
Cyanide	Various	should not exceed 0.08 mg/L
Dibromochloromethane	Various	should not exceed 0.25mg/L
Dibromomethane	Various	should not exceed 0.04mg/L
Dichloroacetic acid	Various	should not exceed 0.1mg/L
Dissolved Organic Carbon	Various	currently no recommended health guideline value set
Dissolved Oxygen (Field)	Various	currently no recommended health guideline value set
Electrical Conductivity @ 25C	Various	aesthetic limit of 940µS/cm
Endosulfan I	Various	should not exceed 0.02mg/L
Endosulfan II	Various	should not exceed 0.02mg/L
Endosulfan sulfate	Various	currently no recommended health guideline value set
Endrin	Various	should not exceed 0.00002mg/L
Endrin aldehyde	Various	should not exceed 0.01mg/L
Endrin ketone	Various	should not exceed 0.005mg/L
Enterococci	Various	Should not exceed 0 orgs/100ml
E.coli	Weekly	100% of all samples collected in any 12 month period to contain no *E.coli* per 100mL (reference Safe Drinking Water Regulations 2015)
Ethylbenzene	Various	should not exceed 0.003mg/L
Faecal Streptococci	Various	should not exceed 0 orgs/100ml
Fluoride	Various	should exceed the limit of 1.5 mg/L
Formaldehyde	Various	should not exceed 0.5mg/L
Hardness, as CaCO3	Various	aesthetic limit is 200 mg/L
Heptachlor	Various	should not exceed 0.0003mg/L
Heptachlor Epoxide	Various	should not exceed 0.0003mg/L
Heterotrophic Plate Count, 22C	Various	currently no recommended health guideline value set
Heterotrophic Plate Count, 37C	Various	currently no recommended health guideline value set
Hexachlorobenzene	Various	currently no recommended health guideline value set
Hydroxide Alkalinity as Ca-CO3	Various	aesthetic limit is 200mg/L
Iron, Filtered (Soluble)	Various	limit based on Iron, total
Iron, total as Fe	Various	aesthetic limit 0.3 mg/L
Lead	Various	should not exceed 0.01 mg/L
Lead, Filtered	Various	limit based on Lead, total
Lindane	Various	should not exceed 0.01mg/L.
Magnesium, as Mg	Various	currently no recommended health guideline value set
Manganese, Filtered (Solu- ble)	Various	limit based on Manganese, total
Manganese, total as Mn	Various	aesthetic limit should not exceed 0.1mg/L, should not exceed 0.5mg/L
MCPA	Various	should not exceed 0.04 mg/L
Mercury, as Hg	Various	should not exceed 0.001 mg/L
meta- & para-Xylene	Various	should not exceed 0.02mg/L.
Methoxychlor	Various	should not exceed 0.3mg/L
Methylene chloride	Various	should not exceed 0.004mg/L
Molybdenum, as Mo	Various	should not exceed 0.05mg/L
Monochloramine	Various	should not exceed 3 mg/L

Table A2: Drinking water quality compliance in accordance with the Australian Drinking Water Guidelines

Parameter	Sampling frequency	Water quality standard
Nickel	Various	should not exceed 0.02 mg/L
Nickel, Filtered	Various	Limit based on Nickel
Nitrate	Various	should not exceed 50 mg/L
Nitrite	Various	should not exceed 3 mg/L
n-Propylbenzene	Various	currently no recommended health guideline value set
ortho-Xylene	Various	should not exceed 0.02mg/L
Pentachlorophenol	Various	should not exceed 0.01mg/L
pH	Various	aesthetic limits are no less than 6.5, and no greater than 8.5
Phosphorus, Reactive as P	Various	should not exceed 1mg/L
p-Isopropyltoluene	Various	currently no recommended health guideline value set
Potassium, as K	Various	currently no recommended health guideline value set
sec-Butylbenzene	Various	currently no recommended health guideline value set
Selenium	Various	should not exceed 0.01mg/L
Selenium, Filtered	Various	limit based on Selenium
Silica, Non Reactive	Various	currently no recommended health guideline value set
Silica, Reactive	Various	currently no recommended health guideline value set
Silver, Filtered as Ag	Various	limit based on Silver
Silver, Total as Ag	Various	should not exceed 0.1mg/L
Simazine	Various	should not exceed 0.02mg/L
Sodium	Various	aesthetic limit should not exceed 180 mg/L
Strontium, Filtered	Various	limit based on Strontium
Strontium, Total	Various	should not exceed 1.5mg/L
Styrene	Various	should not exceed 0.004mg/L
Sulfate	Various	aesthetic limit should not exceed 250 mg/L
tert-Butylbenzene	Various	currently no recommended health guideline value set
Tetrachloroethene	Various	should not exceed 0.05mg/L
Thallium, Total	Various	should not exceed 2mg/L
Tin, Filtered	Various	currently no recommended health guideline value set
Tin, Total as Sn	Various	currently no recommended health guideline value set
Titanium, Filtered	Various	currently no recommended health guideline value set
Titanium, Total	Various	currently no recommended health guideline value set
Toluene	Various	should not exceed 0.025mg/L
trans-1.2-Dichloroethene	Various	should not exceed 0.06mg/L
trans-1.3- Dichloropropylene	Various	should not exceed 0.03mg/L
trans-Chlordane	Various	should not exceed 0.002mg/L
Trichloroacetic acid	Various	should not exceed 0.1mg/L
Trichloroethene	Various	currently no recommended health guideline value set
Trihalomethanes	Monthly	must not exceed 0.25 mg/L (reference Safe Drinking Water Regulations 2015)
Turbidity	Weekly	95th percentile limit of drinking water samples collected in the preceding 12 months must be less than or equal to 5.0 Nephelometric Turbidity Units (NTU) (reference Safe Drinking Water Regulations 2015)
UV Transmission@254nm	Various	currently no recommended health guideline value set
Vanadium, as V	Various	should not exceed 0.021mg/L
Vanadium, Filtered	Various	should not exceed 0.021mg/L
Zinc	Various	should not exceed 3mg/L
Zinc, Filtered	Various	limit based on Zinc

NB: where detailed result information of the listed parameters is not shown in the following tables, this information is available on request.

Appendix 4 – Water quality compliance results (continued)

4.1.2 *E.coli*

E.coli is abundant in human and animal faeces and is tested as a specific indicator of faecal contamination in the drinking water supply. Detection of *E.coli* can indicate a failure in water treatment, contamination of a water storage facility or possible infiltration of the enclosed system.

Treatment through disinfection removes *E.coli.* Western Water applies chemical disinfection by chlorination or chloramination in all its supply systems. A level of disinfection residual is maintained within the distribution system to prevent potential regrowth of microorganisms before reaching customer taps.

Table A3: *E.coli* results

Water sampling locality	Sampling frequency	No. of samples[1]	No. of samples detecting *E.coli*	No. of *E.coli* investigations completed	No. of false detections of *E.coli*	Max. result (true result) (orgs/mL)	Complying (Yes/No)	Compliance %, as per ESC reporting
Bulla	Weekly	104	0	0	0	0	Yes	100%
Darley	Weekly	312	0	0	0	0	Yes	100%
Diggers Rest	Weekly	103	0	0	0	0	Yes	100%
Eynesbury	Weekly	155	0	0	0	0	Yes	100%
Gisborne	64/year	300[4]	0	0	0	0	Yes	100%
Lancefield	Weekly	104	0	0	0	0	Yes	100%
Lerderderg[2]	64/year	224[5]	1	1	0	2	No	99.99%
Macedon	Weekly	156	0	0	0	0	Yes	100%
Maddingley	Weekly	155	0	0	0	0	Yes	100%
Melton South[3]	112/year	322	1	1	1	0	Yes	100%
Merrimu	64/year	167	0	0	0	0	Yes	100%
Mount Macedon	Weekly	208	0	0	0	0	Yes	100%
Myrniong	Weekly	259	0	0	0	0	Yes	100%
Riddells Creek	Weekly	156	0	0	0	0	Yes	100%
Rockbank	Weekly	208	0	0	0	0	Yes	100%
Romsey	Weekly	310	0	0	0	0	Yes	100%
Sunbury	112/year	423	0	0	0	0	Yes	100%
Toolern Vale	Weekly	104	0	0	0	0	Yes	100%
Woodend	64/year	231[6]	0	0	0	0	Yes	100%

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Lerderderg positive E.coli sample was at the Gisborne Rd Tank March 2019, for further details refer to Section 6 Incident Management and Emergency Response.*

[3] *Melton South false positive E.coli sample was at a network sample tap December 2018, for further details refer to Section 6 Incident Management and Emergency Response.*

[4] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[5] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

[6] *Supply via the Rosslynne network to Woodend, as part of supply transfers, refer to Section 6 Incident management and Emergency Response.*

4.2 Chlorine-based disinfection by-product chemicals

Western Water disinfects its drinking water supplies by either chlorination or chloramination. Chlorine-based disinfection by-products measured under the Safe Drinking Water Regulations 2015 include total trihalomethanes. The following section reports the results for the 2018/19 monitoring program.

Total trihalomethanes

Trihalomethanes are present in drinking water principally as a by-product of disinfection from chlorination or chloramination, where chlorine reacts with organic material.

Trihalomethanes

Table A4: Trihalomethanes results

Water sampling locality	Sampling frequency	No. of samples[1]	No. of non-complying samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying (Yes/No)[2]
Bulla	Monthly	25	0	0.05	0.01	0.03	Yes
Darley	Monthly	72	0	0.20	0.08	0.13	Yes
Diggers Rest	Monthly	13	0	0.03	0.02	0.03	Yes
Eynesbury	Monthly	24	0	0.06	0.03	0.04	Yes
Gisborne	Monthly	132[3]	0	0.12	0.02	0.07	Yes
Lancefield	Monthly	24	0	0.20	0.06	0.10	Yes
Lerderderg	Monthly	38[4]	0	0.17	0.08	0.12	Yes
Macedon	Monthly	66	0	0.19	0.03	0.10	Yes
Maddingley	Monthly	24	0	0.17	0.08	0.13	Yes
Melton South	Monthly	61	0	0.05	0.02	0.03	Yes
Merrimu	Monthly	24	0	0.13	0.03	0.08	Yes
Mount Macedon	Monthly	93	0	0.19	0.04	0.12	Yes
Myrniong	Monthly	47	0	0.13	0.02	0.08	Yes
Riddells Creek	Monthly	67	0	0.17	0.02	0.09	Yes
Rockbank	Monthly	48	0	0.06	0.01	0.03	Yes
Romsey	Monthly	48	0	0.09	0.00	0.02	Yes
Sunbury	Monthly	72	0	0.15	0.01	0.04	Yes
Toolern Vale	Monthly	45	0	0.13	0.04	0.10	Yes
Woodend	Monthly	36	0	0.12	0.02	0.05	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the guideline values set out in the SDWR2015 and ADWG for total trihalomethanes in drinking water based on health considerations should not exceed 0.25mg/L.*

[3] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

4.3 Ozone-based disinfection by-product chemicals

The ozone-based disinfection by-products bromate and formaldehyde are not deemed to be a significant risk in drinking water supplied by Western Water as the largest potential risk for the presence of these by-products in drinking water exceeding compliance levels is through ozonation.

Western Water does not use ozone-based chemicals for disinfection of drinking water. Accordingly, sampling and analyses for bromate and formaldehyde were not undertaken in the 2018/19 reporting period.

4.4 Turbidity

Turbidity is the measurement of the light scattering properties of water and is caused by the presence of fine suspended matter in the supply. Based on aesthetic considerations, the turbidity standard is set at 5 nephelometric turbidity units (NTU), which is the point where water may appear slightly discoloured in a glass.

The following table reflects the reporting period 1 July 2018 to 30 June 2019, under the SWDR.

A summary of the turbidity results for samples taken at customer taps in 2018/19 is listed below. It includes the statistical measure of the 95th percentile for samples taken for turbidity over a 12-month period.

Turbidity

Table A5: Turbidity results

Water sampling locality	Frequency of sampling	No. of samples[1, 2]	Max. NTU	Min. NTU	95th percentile	Complying (Yes/No)
Bulla	Weekly	104	1.5	0.4	1.2	Yes
Darley	Weekly	312	2.5	0.1	0.4	Yes
Diggers Rest	Weekly	103	1.4	0.4	1.1	Yes
Eynesbury	Weekly	155	6.2	0.4	1.1	Yes
Gisborne	Weekly	288[2]	1.7	0.1	1.1	Yes
Lancefield	Weekly	104	1.9	0.1	0.1	Yes
Lerderderg	Weekly	212[3]	0.9	0.1	0.3	Yes
Macedon	Weekly	156	1.8	0.1	1.1	Yes
Maddingley	Weekly	155	0.7	0.1	0.4	Yes
Melton South	Weekly	261	1.5	0.1	1.0	Yes
Merrimu	Weekly	155	1.0	0.1	0.8	Yes
Mount Macedon	Weekly	208	2.5	0.1	1.1	Yes
Myrniong	Weekly	259	5.2	0.1	0.3	Yes
Riddells Creek	Weekly	156	1.6	0.1	1.2	Yes
Rockbank	Weekly	208	3.8	0.4	1.4	Yes
Romsey	Weekly	311	0.5	0.1	0.1	Yes
Sunbury	Weekly	363	2.2	0.1	1.2	Yes
Toolern Vale	Weekly	102	0.9	0.1	0.3	Yes
Woodend	Weekly	219	1.1	0.1	0.3	Yes

NTU: nephelometric turbidity unit

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[3] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

4.5 Fluoride

Both the *Health (Fluoridation) Act 1973* and DHHS require that the average fluoride in fluoridated drinking water supplied by Western Water must not exceed a level of 1.2 mg/L for operational control, and a yearly average of no greater than 1.0mg/L. Fluoride levels in any individual sample from drinking water supplied must also not exceed 1.5 mg/L, according to the ADWG. Western Water treatment plant dosing targets between 0.7mg/L and 0.9mg/L of fluoride in treated drinking water for the 12-month period. The Melbourne Water treated supply targets 0.8mg/L of fluoride for the 12-month period.

The following table reflects the reporting period 1 July 2018 to 30 June 2019 under the SDWR.

Fluoride is added to the drinking water to improve dental health. In supplies where fluoride is not added, naturally occurring sources, such as soils and rock, may impart fluoride to the water. For further information on water fluoridation, please visit the Victorian Department of Health and Human Services' website for water fluoridation https://www2.health.vic.gov.au/public-health/water/water-fluoridation.

Fluoride

Table A6: Fluoride results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)[3]	Complying (Yes/ No)
Bulla	Fortnightly	[52]	0.9	0.5	0.8	Yes
Darley	Fortnightly	46	0.8	0.5	0.7	Yes
Diggers Rest	Fortnightly	38	0.9	0.4	0.8	Yes
Eynesbury	Fortnightly	91	1.0	0.6	0.8	Yes
Gisborne	Fortnightly	191[4]	1.0	0.3	0.8	Yes
Lancefield[2]	Quarterly	16	0.2	0.1	0.1	Yes
Lerderderg	Fortnightly	47[5]	0.9	0.4	0.7	Yes
Macedon	Fortnightly	66	1.0	0.5	0.8	Yes
Maddingley	Fortnightly	42	0.8	0.6	0.7	Yes
Melton South	Fortnightly	38	0.8	0.7	0.8	Yes
Merrimu	Fortnightly	51	0.8	0.6	0.7	Yes
Mount Macedon	Fortnightly	72	0.9	0.7	0.8	Yes
Myrniong[2]	Quarterly	16	0.1	0.1	0.1	Yes
Riddells Creek	Fortnightly	62	0.9	0.1	0.8	Yes
Rockbank	Fortnightly	82	0.8	0.6	0.8	Yes
Romsey[2]	Quarterly	52	0.4	0.2	0.2	Yes
Sunbury	Fortnightly	172	0.9	0.1	0.8	Yes
Toolern Vale	Fortnightly	28	0.9	0.5	0.7	Yes
Woodend[2]	Quarterly	45	0.9	0.1	0.2	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Non-fluoridated supplies (unless supplied with external water sources).*

[3] *Health (Fluoridation) Act 1973, fluoride added to an extent that must not results in an average optimum concentration in excess of one part fluoride per million parts of water. Hence, 1.0 mg/L.*

[4] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project. Fluoride monitoring briefly changed to weekly for Rosslynne system (less than 5 localities supplied by Rosslynne fluoride plant, as per the Code). Changed long term to monthly (5 plus localities supplied by Rosslynne fluoride plant, as per the Code).*

[5] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network. .*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health

Besides those parameters tested under the Safe Drinking Water Regulations 2015, Western Water also tests for other substances that may pose a risk to human health. These results are measured in accordance with the ADWG. All results presented in this report are available to customers on request. Any further explanation on any parameters of concern is provided as required.

The following reports 2018/19 compliance against the health-related guideline values set out in ADWG or other cited guidelines for other parameters measured at customers' taps that may pose a risk to human health. All samples complied with the health-related guideline values for ADWG or other cited guidelines.

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health cont.

Chloroacetic acid

Chloroacetic acid is a by-product of the reaction between chlorine and naturally-occurring humic and fulvic acids in the drinking water supply.

Table A7: Chloroacetic acid results

Water sampling locality	Frequency of sampling	No. of samples[1]	Mean (mg/L)	Max. (mg/L)	Min. (mg/L)	Complying (Yes/No)[2]
Bulla	Yearly	1	0.005	0.005	0.005	Yes
Darley	Yearly	1	0.005	0.005	0.005	Yes
Diggers Rest	Yearly	1	0.005	0.005	0.005	Yes
Eynesbury	Yearly	1	0.005	0.005	0.005	Yes
Gisborne	Yearly	1	0.005	0.005	0.005	Yes
Lancefield	Yearly	1	0.005	0.005	0.005	Yes
Lerderderg	Yearly	1	0.005	0.005	0.005	Yes
Macedon	Yearly	1	0.005	0.005	0.005	Yes
Maddingley	Yearly	1	0.005	0.005	0.005	Yes
Melton South	Yearly	1	0.005	0.005	0.005	Yes
Merrimu	Yearly	1	0.005	0.005	0.005	Yes
Mount Macedon	Yearly	1	0.005	0.005	0.005	Yes
Myrniong	Yearly	1	0.005	0.005	0.005	Yes
Riddells Creek	Yearly	1	0.005	0.005	0.005	Yes
Rockbank	Yearly	[1]	0.005	0.005	0.005	Yes
Romsey	Yearly	1	0.005	0.005	0.005	Yes
Sunbury	Yearly	1	0.005	0.005	0.005	Yes
Toolern Vale	Yearly	1	0.005	0.005	0.005	Yes
Woodend	Yearly	1	0.005	0.005	0.005	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the guideline values set out in ADWG for total chloroacetic acid in drinking water based on health considerations should not exceed 0.15mg/L.*

Dichloroacetic acid

Dichloroacetic acid is a by-product of the reaction between chlorine and naturally occurring humic and fulvic acids in the drinking water supply.

Table A8: Dichloroacetic acid results

Water sampling locality	Frequency of sampling	No. of samples[1]	Mean (mg/L)	Max. (mg/L)	Min. (mg/L)[2]	Complying[3] (Yes/No)
Bulla	Yearly	1	0.005	0.005	0.005	Yes
Darley	Yearly	1	0.005	0.005	0.005	Yes
Diggers Rest	Yearly	1	0.007	0.007	0.007	Yes
Eynesbury	Yearly	1	0.007	0.007	0.007	Yes
Gisborne	Yearly	1	0.010	0.010	0.010	Yes
Lancefield	Yearly	1	0.012	0.012	0.012	Yes
Lerderderg	Yearly	1	0.009	0.009	0.009	Yes
Macedon	Yearly	1	0.008	0.008	0.008	Yes
Maddingley	Yearly	1	0.005	0.005	0.005	Yes
Melton South	Yearly	1	0.008	0.008	0.008	Yes
Merrimu	Yearly	1	0.005	0.005	0.005	Yes
Mount Macedon	Yearly	1	0.011	0.011	0.011	Yes
Myrniong	Yearly	1	0.005	0.005	0.005	Yes
Riddells Creek	Yearly	1	0.009	0.009	0.009	Yes
Rockbank	Yearly	1	0.010	0.010	0.010	Yes
Romsey	Yearly	1	0.005	0.005	0.005	Yes
Sunbury	Yearly	1	0.005	0.005	0.005	Yes
Toolern Vale	Yearly	1	0.012	0.012	0.012	Yes
Woodend	Yearly	1	0.008	0.008	0.008	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *A result of <0.005 mg/L is a result less than the detection limit for total dichloroacetic acid.*

[3] *Compliance as measured against the guideline values set out in ADWG for total dichloroacetic acid in drinking water based on health considerations should not exceed 0.1mg/L.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Trichloroacetic acid

Trichloroacetic acid is a by-product of the reaction between chlorine and naturally occurring humic and fulvic acids in the drinking water supply.

Table A9: Trichloroacetic acid results

Water sampling locality	Frequency of sampling	No. of samples[1]	Mean (mg/L)	Max. (mg/L)	Min. (mg/L)[2]	Complying[3] (Yes/No)
Bulla	Yearly	1	0.012	0.012	0.012	Yes
Darley	Yearly	1	0.010	0.010	0.010	Yes
Diggers Rest	Yearly	1	0.009	0.009	0.009	Yes
Eynesbury	Yearly	1	0.016	0.016	0.016	Yes
Gisborne	Yearly	1	0.005	0.005	0.005	Yes
Lancefield	Yearly	1	0.007	0.007	0.007	Yes
Lerderderg	Yearly	1	0.008	0.008	0.008	Yes
Macedon	Yearly	1	0.006	0.006	0.006	Yes
Maddingley	Yearly	1	0.009	0.009	0.009	Yes
Melton South	Yearly	1	0.008	0.008	0.008	Yes
Merrimu	Yearly	1	0.005	0.005	0.005	Yes
Mount Macedon	Yearly	1	0.008	0.008	0.008	Yes
Myrniong	Yearly	1	0.005	0.005	0.005	Yes
Riddells Creek	Yearly	1	0.007	0.007	0.007	Yes
Rockbank	Yearly	1	0.010	0.010	0.010	Yes
Romsey	Yearly	1	0.005	0.005	0.005	Yes
Sunbury	Yearly	1	0.010	0.010	0.010	Yes
Toolern Vale	Yearly	1	0.007	0.007	0.007	Yes
Woodend	Yearly	1	0.010	0.010	0.010	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *A result of <0.005 mg/L is a result less than the detection limit for total trichloroacetic acid.*

[3] *Compliance as measured against the guideline values set out in ADWG for total trichloroacetic acid in drinking water based on health considerations should not exceed 0.1mg/L.*

Manganese

Table A10: Manganese (total as Mn) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	17[5]	0.018	0.001	0.005	Yes
Darley	Quarterly	20	0.002	0.001	0.001	Yes
Diggers Rest	Quarterly	18[5]	0.017	0.002	0.006	Yes
Eynesbury	Quarterly	32[5]	0.045	0.002	0.008	Yes
Gisborne	Quarterly	79[3]	0.016	0.001	0.006	Yes
Lancefield	Quarterly	12	0.046	0.001	0.005	Yes
Lerderderg	Quarterly	20[4]	0.004	0.001	0.001	Yes
Macedon	Quarterly	8	0.006	0.001	0.004	Yes
Maddingley	Quarterly	16	0.003	0.001	0.001	Yes
Melton South	Quarterly	28[5]	0.022	0.001	0.007	Yes
Merrimu	Quarterly	24	0.002	0.001	0.001	Yes
Mount Macedon	Quarterly	8	0.007	0.001	0.004	Yes
Myrniong	Quarterly	76	0.085	0.001	0.004	Yes
Riddells Creek	Quarterly	8	0.005	0.001	0.003	Yes
Rockbank	Quarterly	68[5]	0.022	0.001	0.005	Yes
Romsey	Quarterly	48	0.025	0.001	0.005	Yes
Sunbury	Quarterly	108[5]	0.025	0.001	0.005	Yes
Toolern Vale	Quarterly	4	0.001	0.001	0.001	Yes
Woodend	Quarterly	81	0.049	0.001	0.006	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the health related guideline values set out in ADWG for manganese in drinking water should not exceed 0.1 mg/L for aesthetics and 0.5mg/L for health limit.*

[3] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project .*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

[5] *Increased operational monitoring due to Melbourne Water discoloured water event, refer to Section 6 for details.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Lead

Table A11: Lead (total as Pb) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	4	0.001	0.001	Yes
Darley	Quarterly	4	0.001	0.001	Yes
Diggers Rest	Quarterly	4	0.001	0.001	Yes
Eynesbury	Quarterly	4	0.001	0.001	Yes
Gisborne	Quarterly	6	0.001	0.001	Yes
Lancefield	Quarterly	5	0.001	0.001	Yes
Lerderderg	Quarterly	4	0.001	0.001	Yes
Macedon	Quarterly	4	0.001	0.001	Yes
Maddingley	Quarterly	4	0.002	0.001	Yes
Melton South	Quarterly	4	0.001	0.001	Yes
Merrimu	Quarterly	4	0.001	0.001	Yes
Mount Macedon	Quarterly	4	0.001	0.001	Yes
Myrniong	Quarterly	5	0.001	0.001	Yes
Riddells Creek	Quarterly	4	0.001	0.001	Yes
Rockbank	Quarterly	4	0.001	0.001	Yes
Romsey	Quarterly	4	0.001	0.001	Yes
Sunbury	Quarterly	4	0.001	0.001	Yes
Toolern Vale	Quarterly	4	0.001	0.001	Yes
Woodend	Quarterly	6	0.001	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the health related guideline values set out in ADWG for lead in drinking water should not exceed 0.01 mg/L.*

Copper

Table A12: Copper (total as Cu) results

Water sampling locality	Frequency of sampling	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	4	0.009	0.001	Yes
Darley	Quarterly	4	0.003	0.003	Yes
Diggers Rest	Quarterly	4	0.005	0.001	Yes
Eynesbury	Quarterly	4	0.013	0.002	Yes
Gisborne	Quarterly	4	0.002	0.001	Yes
Lancefield	Quarterly	4	0.015	0.002	Yes
Lerderderg	Quarterly	4	0.005	0.001	Yes
Macedon	Quarterly	4	0.012	0.001	Yes
Maddingley	Quarterly	4	0.008	0.001	Yes
Melton South	Quarterly	4	0.006	0.001	Yes
Merrimu	Quarterly	4	0.003	0.001	Yes
Mount Macedon	Quarterly	4	0.003	0.001	Yes
Myrniong	Quarterly	4	0.026	0.016	Yes
Riddells Creek	Quarterly	4	0.004	0.001	Yes
Rockbank	Quarterly	4	0.004	0.001	Yes
Romsey	Quarterly	4	0.012	0.002	Yes
Sunbury	Quarterly	4	0.012	0.001	Yes
Toolern Vale	Quarterly	4	0.036	0.001	Yes
Woodend	Quarterly	4	0.006	0.002	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the guideline values set out in ADWG for copper in drinking water should not exceed 2 mg/L based on health considerations, and 1mg/L base on aesthetic considerations.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Arsenic

Table A13: Arsenic results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.001	0.001	Yes
Darley	Annually	1	0.001	0.001	Yes
Diggers Rest	Annually	1	0.001	0.001	Yes
Eynesbury	Annually	1	0.001	0.001	Yes
Gisborne	Annually	1	0.001	0.001	Yes
Lancefield	Annually	1	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	1	0.001	0.001	Yes
Maddingley	Annually	1	0.001	0.001	Yes
Melton South	Annually	1	0.001	0.001	Yes
Merrimu	Annually	1	0.001	0.001	Yes
Mount Macedon	Annually	1	0.001	0.001	Yes
Myrniong	Annually	1	0.001	0.001	Yes
Riddells Creek	Annually	1	0.001	0.001	Yes
Rockbank	Annually	2	0.001	0.001	Yes
Romsey	Annually	1	0.001	0.001	Yes
Sunbury	Annually	2	0.001	0.001	Yes
Toolern Vale	Annually	1	0.001	0.001	Yes
Woodend	Annually	1	0.001	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the health related guideline value set out in ADWG for arsenic in drinking water should not exceed 0.01 mg/L. The detection limit for arsenic is 0.001 mg/L.*

Chlorite

Chlorite is a by-product of chlorine dioxide disinfection. Western Water does not use chlorine dioxide as a disinfectant for drinking water. For this reason, is unlikely to be present in the drinking water supplied by Western Water as it does not occur naturally. As a result, sampling for chlorite was not undertaken in the 2018/19 reporting period.

Monochloramine

Sampling for monochloramine was conducted in all localities receiving water supply disinfected by chloramination. Routine sampling for monochloramine in some localities that are chlorinated occurred as the disinfection mode had changed, but the sampling regime had not.

During 2018/19, no monochloramine sampling was performed in Bulla, Diggers Rest or Sunbury. These localities were disinfected by chlorination.

Table A14: Monochloramine results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean. (mg/L)	Complying[2] (Yes/No)
Romsey	Weekly	310	0.98	0.05	0.40	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for monochloramine in drinking water should not exceed 3 mg/L.*

Nickel

Table A15: Nickel (total as Ni) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.001	0.001	Yes
Darley	Annually	1	0.001	0.001	Yes
Diggers Rest	Annually	1	0.001	0.001	Yes
Eynesbury	Annually	1	0.001	0.001	Yes
Gisborne	Annually	3	0.001	0.001	Yes
Lancefield	Annually	2	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	1	0.001	0.001	Yes
Maddingley	Annually	1	0.001	0.001	Yes
Melton South	Annually	1	0.001	0.001	Yes
Merrimu	Annually	1	0.001	0.001	Yes
Mount Macedon	Annually	1	0.001	0.001	Yes
Myrniong	Annually	2	0.002	0.001	Yes
Riddells Creek	Annually	1	0.001	0.001	Yes
Rockbank	Annually	1	0.001	0.001	Yes
Romsey	Annually	1	0.001	0.001	Yes
Sunbury	Annually	1	0.001	0.001	Yes
Toolern Vale	Annually	1	0.001	0.001	Yes
Woodend	Annually	3	0.001	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for nickel in drinking water should not exceed 0.02 mg/L.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Chlorine

Table A16: Total Chlorine results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying[2] (Yes/No)
Bulla	Weekly	104	1.40	0.05	0.73	Yes
Darley	Weekly	312	4.40	0.09	0.67	Yes
Diggers Rest	Weekly	103	1.20	0.05	0.45	Yes
Eynesbury	Weekly	155	0.96	0.06	0.53	Yes
Gisborne	64/year	300[3]	1.60	0.05	0.91	Yes
Lancefield	Weekly	104	1.40	0.37	1.04	Yes
Lerderderg	64/year	224[4]	2.20	0.12	0.60	Yes
Macedon	Weekly	157	1.70	0.08	0.88	Yes
Maddingley	Weekly	155	1.40	0.10	0.70	Yes
Melton South	112/year	322	1.30	0.05	0.54	Yes
Merrimu	64/year	167	2.00	0.09	0.67	Yes
Mount Macedon	Weekly	208	1.40	0.22	0.82	Yes
Myrniong	Weekly	259	4.50	0.05	0.63	Yes
Riddells Creek	Weekly	156	1.50	0.05	0.92	Yes
Rockbank	Weekly	208	1.60	0.11	0.92	Yes
Romsey	Weekly	310	1.50	0.11	0.71	Yes
Sunbury	112/year	423	4.60	0.05	0.80	Yes
Toolern Vale	Weekly	104	2.00	0.07	0.70	Yes
Woodend	64/year	231	1.60	0.08	0.89	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the health related guideline value set out in ADWG for chlorine in drinking water should not exceed 5 mg/L. Western Water has an internal benchmark of maximum 1.10 mg/L for total chlorine at its customer taps.*

[3] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

Chromium

Table A17: Chromium (total as Cr) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.001	0.001	Yes
Darley	Annually	1	0.001	0.001	Yes
Diggers Rest	Annually	1	0.001	0.001	Yes
Eynesbury	Annually	1	0.001	0.001	Yes
Gisborne	Annually	1	0.001	0.001	Yes
Lancefield	Annually	1	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	1	0.001	0.001	Yes
Maddingley	Annually	1	0.001	0.001	Yes
Melton South	Annually	1	0.001	0.001	Yes
Merrimu	Annually	1	0.001	0.001	Yes
Mount Macedon	Annually	5	0.001	0.001	Yes
Myrniong	Annually	1	0.001	0.001	Yes
Riddells Creek	Annually	1	0.001	0.001	Yes
Rockbank	Annually	2	0.001	0.001	Yes
Romsey	Annually	1	0.001	0.001	Yes
Sunbury	Annually	2	0.001	0.001	Yes
Toolern Vale	Annually	1	0.001	0.001	Yes
Woodend	Annually	5	0.001	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality g/L.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for chromium in drinking water should not exceed 0.05 mg/L.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Cyanide

Table A18: Cyanide results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.005	0.005	Yes
Darley	Annually	1	0.005	0.005	Yes
Diggers Rest	Annually	1	0.005	0.005	Yes
Eynesbury	Annually	1	0.005	0.005	Yes
Gisborne	Annually	1	0.005	0.005	Yes
Lancefield	Annually	1	0.005	0.005	Yes
Lerderderg	Annually	1	0.005	0.005	Yes
Macedon	Annually	1	0.005	0.005	Yes
Maddingley	Annually	1	0.005	0.005	Yes
Melton South	Annually	1	0.005	0.005	Yes
Merrimu	Annually	1	0.005	0.005	Yes
Mount Macedon	Annually	1	0.005	0.005	Yes
Myrniong	Annually	1	0.005	0.005	Yes
Riddells Creek	Annually	1	0.005	0.005	Yes
Rockbank	Annually	2	0.005	0.005	Yes
Romsey	Annually	1	0.005	0.005	Yes
Sunbury	Annually	2	0.005	0.005	Yes
Toolern Vale	Annually	1	0.005	0.005	Yes
Woodend	Annually	1	0.005	0.005	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for cyanide in drinking water should not exceed 0.08 mg/L.*

Mercury

Table A19: Mercury results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.0001	0.0001	Yes
Darley	Annually	1	0.0001	0.0001	Yes
Diggers Rest	Annually	1	0.0001	0.0001	Yes
Eynesbury	Annually	1	0.0001	0.0001	Yes
Gisborne	Annually	1	0.0001	0.0001	Yes
Lancefield	Annually	1	0.0001	0.0001	Yes
Lerderderg	Annually	1	0.0001	0.0001	Yes
Macedon	Annually	1	0.0001	0.0001	Yes
Maddingley	Annually	1	0.0001	0.0001	Yes
Melton South	Annually	1	0.0001	0.0001	Yes
Merrimu	Annually	1	0.0001	0.0001	Yes
Mount Macedon	Annually	1	0.0001	0.0001	Yes
Myrniong	Annually	1	0.0001	0.0001	Yes
Riddells Creek	Annually	1	0.0001	0.0001	Yes
Rockbank	Annually	2	0.0001	0.0001	Yes
Romsey	Annually	1	0.0001	0.0001	Yes
Sunbury	Annually	2	0.0001	0.0001	Yes
Toolern Vale	Annually	1	0.0001	0.0001	Yes
Woodend	Annually	1	0.0001	0.0001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality*
2. Compliance as measured against the health related guideline value set out in ADWG for mercury in drinking water should not exceed 0.001 mg/L

Nitrate

Table A20: Nitrate results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Monthly	24	0.180	0.004	Yes
Darley	Monthly	32	0.110	0.040	Yes
Diggers Rest	Monthly	12	0.140	0.022	Yes
Eynesbury	Monthly	24	0.140	0.030	Yes
Gisborne	Annually	20[3]	0.250	0.035	Yes
Lancefield	Monthly	24	0.120	0.009	Yes
Lerderderg	Monthly	20[4]	0.110	0.038	Yes
Macedon	Annually	1	0.200	0.200	Yes
Maddingley	Monthly	16	0.100	0.043	Yes
Melton South	Monthly	13	0.140	0.036	Yes
Merrimu	Monthly	12	0.140	0.036	Yes
Mount Macedon	Annually	5	0.210	0.040	Yes
Myrniong	Monthly	76	0.510	0.020	Yes
Riddells Creek	Annually	1	0.180	0.180	Yes
Rockbank	Monthly	16	0.140	0.021	Yes
Romsey	Monthly	37	0.250	0.088	Yes
Sunbury	Monthly	40	0.200	0.019	Yes
Toolern Vale	Monthly	15	0.160	0.039	Yes
Woodend	Monthly	36	0.230	0.003	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*

[2] *Compliance as measured against the health related guideline value set out in ADWG for nitrate in drinking water should not exceed 50 mg/L.*

[3] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Nitrite

Table A21: Nitrite results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Monthly	24	0.002	0.002	Yes
Darley	Monthly	32	0.002	0.002	Yes
Diggers Rest	Monthly	12	0.002	0.002	Yes
Eynesbury	Monthly	24	0.002	0.002	Yes
Gisborne	Annually	20[3]	0.002	0.002	Yes
Lancefield	Monthly	24	0.002	0.002	Yes
Lerderderg	Monthly	20[4]	0.002	0.002	Yes
Macedon	Annually	1	0.002	0.002	Yes
Maddingley	Monthly	16	0.002	0.002	Yes
Melton South	Monthly	13	0.002	0.002	Yes
Merrimu	Monthly	12	0.002	0.002	Yes
Mount Macedon	Annually	5	0.002	0.002	Yes
Myrniong	Monthly	76	0.002	0.002	Yes
Riddells Creek	Annually	1	0.002	0.002	Yes
Rockbank	Monthly	16	0.002	0.002	Yes
Romsey	Monthly	37	0.220	0.002	Yes
Sunbury	Monthly	40	0.002	0.002	Yes
Toolern Vale	Monthly	15	0.002	0.002	Yes
Woodend	Monthly	36	0.002	0.002	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*

[2] *Compliance as measured against the health related guideline value set out in ADWG for nitrite in drinking water should not exceed 3 mg/L.*

[3] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

Selenium

Table A22: Selenium results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.001	0.001	Yes
Darley	Annually	1	0.001	0.001	Yes
Diggers Rest	Annually	1	0.001	0.001	Yes
Eynesbury	Annually	1	0.001	0.001	Yes
Gisborne	Annually	1	0.001	0.001	Yes
Lancefield	Annually	1	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	1	0.001	0.001	Yes
Maddingley	Annually	1	0.001	0.001	Yes
Melton South	Annually	1	0.001	0.001	Yes
Merrimu	Annually	1	0.001	0.001	Yes
Mount Macedon	Annually	1	0.001	0.001	Yes
Myrniong	Annually	1	0.001	0.001	Yes
Riddells Creek	Annually	1	0.001	0.001	Yes
Rockbank	Annually	2	0.001	0.001	Yes
Romsey	Annually	1	0.001	0.001	Yes
Sunbury	Annually	2	0.001	0.001	Yes
Toolern Vale	Annually	1	0.001	0.001	Yes
Woodend	Annually	1	0.001	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for selenium in drinking water should not exceed 0.01 mg/L.*

Cadmium

Table A23: Cadmium results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.0002	0.0002	Yes
Darley	Annually	1	0.0002	0.0002	Yes
Diggers Rest	Annually	1	0.0002	0.0002	Yes
Eynesbury	Annually	1	0.0002	0.0002	Yes
Gisborne	Annually	3	0.0002	0.0002	Yes
Lancefield	Annually	2	0.0002	0.0002	Yes
Lerderderg	Annually	1	0.0002	0.0002	Yes
Macedon	Annually	1	0.0002	0.0002	Yes
Maddingley	Annually	1	0.0002	0.0002	Yes
Melton South	Annually	1	0.0002	0.0002	Yes
Merrimu	Annually	1	0.0002	0.0002	Yes
Mount Macedon	Annually	1	0.0002	0.0002	Yes
Myrniong	Annually	2	0.0002	0.0002	Yes
Riddells Creek	Annually	1	0.0002	0.0002	Yes
Rockbank	Annually	1	0.0002	0.0002	Yes
Romsey	Annually	1	0.0002	0.0002	Yes
Sunbury	Annually	1	0.0002	0.0002	Yes
Toolern Vale	Annually	1	0.0002	0.0002	Yes
Woodend	Annually	3	0.0002	0.0002	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for cadmium in drinking water should not exceed 0.002 mg/L.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results

Western Water tests for parameters in the drinking water supply that may affect appearance or taste and odour, as well as those that may interact with pipes and fittings within the distribution system and within hot water services.

These results are measured in accordance with the aesthetic measures in the ADWG or other cited guidelines. Compliance calculations hereafter are based on mean results for samples taken throughout the year, as outlined in ADWG or other cited guidelines.

The following tables reflect the reporting period 1 July 2018 to 30 June 2019 under the SDWR.

Aluminium

Aluminium can be present in water through the natural leaching of soils and the use of aluminium salts as coagulants during the water treatment process. Acid-soluble aluminium concentrations in excess of 0.2 mg/L, caused by post-flocculation may lead to aesthetic problems such as 'milky coloured' water in the distribution system which may result in the precipitation of aluminium hydroxide depending on the pH level.

Total aluminium is measured quarterly at customer taps at all 19 localities whether or not aluminium is added as a coagulant as part of the water treatment process. Where aluminium is not used in the treatment process, any detection of aluminium will likely be due to naturally-occurring microscopic clay particles.

Table A24: Total aluminium results

Water sampling locality	Frequency of sampling	No. of samples[1]	Average (mg/L)	Max. (mg/L)	Min. (mg/L)[2]	Complying[3] (Yes/No)
Bulla	Quarterly	4	0.14	0.04	0.08	Yes
Darley	Quarterly	24	0.05	0.01	0.02	Yes
Diggers Rest	Quarterly	16	0.14	0.03	0.07	Yes
Eynesbury	Quarterly	20	0.14	0.03	0.07	Yes
Gisborne	Quarterly	83	0.16	0.04	0.07	Yes
Lancefield[3]	Quarterly	56	0.07	0.01	0.01	Yes
Lerderderg	Quarterly	24	0.04	0.01	0.02	Yes
Macedon[3]	Quarterly	4	0.18	0.04	0.13	Yes
Maddingley	Quarterly	20	0.04	0.01	0.02	Yes
Melton South	Quarterly	8	0.14	0.04	0.07	Yes
Merrimu	Quarterly	20	0.09	0.01	0.02	Yes
Mount Macedon[3]	Quarterly	4	0.19	0.04	0.13	Yes
Myrniong[3]	Quarterly	72	0.06	0.01	0.02	Yes
Riddells Creek[3]	Quarterly	4	0.14	0.03	0.09	Yes
Rockbank	Quarterly	64	0.15	0.02	0.07	Yes
Romsey	Quarterly	132	0.02	0.01	0.01	Yes
Sunbury	Quarterly	68	0.16	0.02	0.08	Yes
Toolern Vale	Quarterly	8	0.07	0.01	0.03	Yes
Woodend[3]	Quarterly	125	0.09	0.01	0.03	Yes

[1] *Compliance as measured against the guideline values set out in ADWG for acid soluble aluminium in drinking water based on aesthetic considerations should not exceed 0.2mg/L. There is no ADWG limit for total aluminium.*

[2] *A result of <0.01 mg/L is a result less than the detection limit for total aluminium.*

[3] *Alum is added to these supplies.*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

[5] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

pH

Table A25: pH results

Water sampling locality	Sampling frequency	No. of samples[1]	Max	Min.	Mean	Complying[2] (Yes/No)
Bulla	Weekly	104	9.6	6.8	7.6	Yes
Darley	Weekly	312	9.1	7.3	7.9	Yes
Diggers Rest	Weekly	103	7.8	6.6	7.2	Yes
Eynesbury	Weekly	155	7.7	6.6	7.3	Yes
Gisborne	Weekly	288[3]	8.9	6.8	7.4	Yes
Lancefield	Weekly	104	7.9	7.3	7.6	Yes
Lerderderg	Weekly	212[4]	8.1	7.1	7.7	Yes
Macedon	Weekly	157	9.6	6.8	8.0	Yes
Maddingley	Weekly	155	8.0	7.1	7.7	Yes
Melton South	Weekly	259	8.2	6.6	7.2	Yes
Merrimu	Weekly	156	8.5	7.0	7.6	Yes
Mount Macedon	Weekly	209	9.3	6.9	8.2	Yes
Myrniong	Weekly	259	8.9	7.0	7.6	Yes
Riddells Creek	Weekly	156	9.0	6.8	7.7	Yes
Rockbank	Weekly	208	8.6	6.5	7.3	Yes
Romsey	Weekly	310	7.8	6.9	7.4	Yes
Sunbury	Weekly	343	9.0	6.6	7.4	Yes
Toolern Vale	Weekly	102	8.0	7.2	7.5	Yes
Woodend	Weekly	219	9.1	6.6	7.5	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality*

[2] *Compliance as measured against the aesthetic guideline range set out in ADWG for pH in drinking water of 6.5-8.5, based on the mean result in each locality for the reporting period*

[3] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results (continued)

Iron

Table A26: Iron (total) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	21	0.11	0.04	0.07	Yes
Darley	Quarterly	24	0.04	0.01	0.02	Yes
Diggers Rest	Quarterly	22	0.12	0.01	0.07	Yes
Eynesbury	Quarterly	36	0.60	0.04	0.12	Yes
Gisborne	Quarterly	135[3]	0.12	0.01	0.04	Yes
Lancefield	Quarterly	16	0.10	0.01	0.02	Yes
Lerderderg	Quarterly	24[4]	0.06	0.01	0.02	Yes
Macedon	Quarterly	12	0.10	0.01	0.06	Yes
Maddingley	Quarterly	20	0.05	0.01	0.02	Yes
Melton South	Quarterly	32	0.15	0.04	0.07	Yes
Merrimu	Quarterly	28	0.06	0.01	0.01	Yes
Mount Macedon	Quarterly	12	0.16	0.02	0.07	Yes
Myrniong	Quarterly	80	0.42	0.01	0.03	Yes
Riddells Creek	Quarterly	12	0.10	0.01	0.06	Yes
Rockbank	Quarterly	72	0.14	0.04	0.07	Yes
Romsey	Quarterly	53	0.02	0.01	0.01	Yes
Sunbury	Quarterly	112	0.17	0.01	0.07	Yes
Toolern Vale	Quarterly	8	0.07	0.01	0.02	Yes
Woodend	Quarterly	85	0.11	0.01	0.01	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic related guideline value set out in ADWG for the mean concentration of iron in drinking water not exceeding 0.3 mg/L.*

[3] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

Total hardness

Table A27: Total hardness (as calcium carbonate) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Ave. (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	12	28	13	17	Yes
Darley	Quarterly	24	120	58	90	Yes
Diggers Rest	Quarterly	12	17	11	14	Yes
Eynesbury	Quarterly	16	19	11	15	Yes
Gisborne	Quarterly	23[3]	110	11	58	Yes
Lancefield	Quarterly	16	120	48	72	Yes
Lerderderg	Quarterly	12[4]	110	39	83	Yes
Macedon	Quarterly	7	89	15	30	Yes
Maddingley	Quarterly	8	110	39	81	Yes
Melton South	Quarterly	4	17	8	12	Yes
Merrimu	Quarterly	4	95	18	72	Yes
Mount Macedon	Quarterly	8	91	18	30	Yes
Myrniong	Quarterly	18	140	110	124	Yes
Riddells Creek	Quarterly	8	87	11	38	Yes
Rockbank	Quarterly	8	17	10	13	Yes
Romsey	Quarterly	28	89	58	69	Yes
Sunbury	Quarterly	12	24	9	15	Yes
Toolern Vale	Quarterly	8	92	11	75	Yes
Woodend	Quarterly	28	50	17	33	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic guideline value set out in ADWG for hardness as calcium carbonate in drinking water of 200 mg/L based on the mean result for the reporting period 2016/17. Note, the unit milligrams per litre (mg/L) is equivalent to parts per million (ppm). For conversion from mg/L to °dH (German Hardness), multiply mg/L by 0.056. Conversely, multiply °dH by 17.9 for conversion to mg/L or ppm.*

[3] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results (continued)

Calcium

Table A28: Total calcium (as Ca) results

Water sampling locality	Sampling frequency[1]	No. of samples[2]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)[3]
Bulla	Quarterly	12	11	4	6
Darley	Quarterly	24	15	7	10
Diggers Rest	Quarterly	12	5	3	4
Eynesbury	Quarterly	16	5	3	4
Gisborne	Quarterly	23[4]	25	3	12
Lancefield	Quarterly	16	14	7	10
Lerderderg	Quarterly	12[5]	11	6	9
Macedon	Quarterly	4	18	4	9
Maddingley	Quarterly	8	11	5	9
Melton South	Quarterly	4	5	2	3
Merrimu	Quarterly	4	16	4	11
Mount Macedon	Quarterly	4	18	5	9
Myrniong	Quarterly	18	26	13	19
Riddells Creek	Quarterly	8	18	3	9
Rockbank	Quarterly	8	5	2	3
Romsey	Quarterly	28	16	10	12
Sunbury	Quarterly	12	6	2	4
Toolern Vale	Quarterly	8	11	2	8
Woodend	Quarterly	28	10	3	4

[1] *Scheduled for monthly sampling during review of monitoring program in January 2013, subsequent review conducted in February 2014 reduced sampling frequency to quarterly*

[2] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[3] *There is currently no recommended guideline value set out for the concentration of calcium in drinking water.*

[4] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[5] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

Magnesium

Table A29: Total magnesium (as Mg) results

Water sampling locality	Sampling frequency[1]	No. of samples[2]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)[3]
Bulla	Quarterly	12	1.4	0.3	0.9
Darley	Quarterly	24	21.0	9.8	15.6
Diggers Rest	Quarterly	12	1.4	1.0	1.2
Eynesbury	Quarterly	16	1.5	1.0	1.2
Gisborne	Quarterly	23[4]	12.0	1.0	6.8
Lancefield	Quarterly	16	19.0	7.3	10.9
Lerderderg	Quarterly	12[5]	20.0	5.9	14.7
Macedon	Quarterly	7	11.0	1.0	2.8
Maddingley	Quarterly	8	20.0	6.3	14.3
Melton South	Quarterly	4	1.3	0.8	1.0
Merrimu	Quarterly	4	15.0	1.9	10.7
Mount Macedon	Quarterly	8	11.0	1.1	2.6
Myrniong	Quarterly	18	22.0	15.0	18.3
Riddells Creek	Quarterly	8	10.0	1.0	3.8
Rockbank	Quarterly	8	1.3	0.8	1.1
Romsey	Quarterly	28	12.0	8.3	9.5
Sunbury	Quarterly	12	2.3	0.9	1.3
Toolern Vale	Quarterly	8	17.0	1.3	13.3
Woodend	Quarterly	28	9.2	2.2	5.3

[1] *Scheduled for monthly sampling during review of monitoring program in January 2013. Subsequent review conducted in February 2014 reduced sampling frequency to quarterly.*

[2] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[3] *There is currently no recommended guideline value set out for the concentration of magnesium in drinking water.*

[4] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[5] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results (continued)

Ammonia

Table A30: Ammonia results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying[2] (Yes/No)
Bulla	Monthly	24	0.007	0.002	0.003	Yes
Darley	Monthly	32	0.250	0.002	0.013	Yes
Diggers Rest	Monthly	12	0.004	0.002	0.002	Yes
Eynesbury	Monthly	24	0.004	0.002	0.002	Yes
Gisborne	Annually	20[3]	0.005	0.002	0.002	Yes
Lancefield	Monthly	24	0.012	0.002	0.003	Yes
Lerderderg	Monthly	20[4]	0.120	0.002	0.011	Yes
Macedon	Annually	1	0.002	0.002	0.002	Yes
Maddingley	Monthly	16	0.012	0.002	0.004	Yes
Melton South	Monthly	13	0.006	0.002	0.002	Yes
Merrimu	Monthly	12	0.009	0.002	0.003	Yes
Mount Macedon	Annually	5	0.035	0.002	0.009	Yes
Myrniong	Monthly	76	0.012	0.002	0.003	Yes
Riddells Creek	Annually	1	0.002	0.002	0.002	Yes
Rockbank	Monthly	16	0.002	0.002	0.002	Yes
Romsey	Monthly	36	0.380	0.024	0.199	Yes
Sunbury	Monthly	40	0.005	0.002	0.002	Yes
Toolern Vale	Monthly	15	0.007	0.002	0.003	Yes
Woodend	Monthly	36	0.054	0.002	0.004	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic guideline value set out in ADWG for the mean concentration of ammonia in drinking water should not exceed 0.5 mg/L. There is no health-based guideline for ammonia. The aesthetic consideration is to limit the corrosion of pipe and fittings and to reduce any nuisance growth of micro-organisms.*

[3] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

True Colour

Table A31: True colour results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (TCU)	Min. (TCU)	Mean (TCU)	Complying[2] (Yes/No)
Bulla	Weekly	57	8	2	4	Yes
Darley	Weekly	312	6	2	2	Yes
Diggers Rest	Weekly	103	8	2	4	Yes
Eynesbury	Weekly	155	8	2	3	Yes
Gisborne	Weekly	132[3]	6	2	3	Yes
Lancefield	Weekly	104	4	2	2	Yes
Lerderderg	Weekly	209[4]	4	2	2	Yes
Macedon	Weekly	60	6	2	3	Yes
Maddingley	Weekly	155	4	2	2	Yes
Melton South	Weekly	76	8	2	4	Yes
Merrimu	Weekly	115	6	2	3	Yes
Mount Macedon	Weekly	60	4	2	3	Yes
Myrniong	Weekly	155	6	2	2	Yes
Riddells Creek	Weekly	60	6	2	3	Yes
Rockbank	Weekly	64	8	2	4	Yes
Romsey	Weekly	258	8	2	3	Yes
Sunbury	Weekly	122	12	2	4	Yes
Toolern Vale	Weekly	102	6	2	3	Yes
Woodend	Weekly	219	6	2	2	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic guideline value set out in ADWG for true colour in drinking water should not exceed 15 HU (True Colour Units - TCU).*

[3] *Rosslynne 3ML tank offline for much of 2018/19 as part of refurbishment project.*

[4] *Dodemaide Tank offline from October to December 2017, samples were missed between December to July (sampling reinstated 1st August 2018) due to a delay in resuming the scheduled sampling regime after the tank was returned to service. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program. Dodemaide Tank taken offline for much of 2018/19, due to low demand in downstream network.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results (continued)

Sodium

Table A32: Sodium (as Na) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	6	6	6	Yes
Darley	Annually	1	37	37	37	Yes
Diggers Rest	Annually	1	5	5	5	Yes
Eynesbury	Annually	1	6	6	6	Yes
Gisborne	Annually	5	38	5	25	Yes
Lancefield	Annually	3	52	44	48	Yes
Lerderderg	Annually	1	38	38	38	Yes
Macedon	Annually	1	37	37	37	Yes
Maddingley	Annually	1	41	41	41	Yes
Melton South	Annually	1	5	5	5	Yes
Merrimu	Annually	1	37	37	37	Yes
Mount Macedon	Annually	1	37	37	37	Yes
Myrniong	Annually	3	48	45	47	Yes
Riddells Creek	Annually	1	33	33	33	Yes
Rockbank	Annually	1	5	5	5	Yes
Romsey	Annually	1	31	31	31	Yes
Sunbury	Annually	1	10	10	10	Yes
Toolern Vale	Annually	1	37	37	37	Yes
Woodend	Annually	5	48	24	37	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic (taste) guideline value set out in ADWG for the mean concentration of sodium in drinking water should not exceed 180 mg/L. No health-related guideline has been set for sodium. (Note: No health-based guideline value is proposed for sodium. Medical practitioners treating people with severe hypertension or congestive heart failure should be aware if the sodium concentratio n in the patient's drinking water exceeds 20mg/L).*

Zinc

Table A33: Zinc (total as Zn) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Ave. (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	4	0.001	0.001	0.001	Yes
Darley	Quarterly	4	0.003	0.001	0.002	Yes
Diggers Rest	Quarterly	4	0.002	0.001	0.002	Yes
Eynesbury	Quarterly	4	0.022	0.001	0.007	Yes
Gisborne	Quarterly	6	0.004	0.002	0.003	Yes
Lancefield	Quarterly	5	0.009	0.003	0.006	Yes
Lerderderg	Quarterly	4	0.005	0.001	0.002	Yes
Macedon	Quarterly	4	0.013	0.002	0.006	Yes
Maddingley	Quarterly	4	0.003	0.001	0.002	Yes
Melton South	Quarterly	4	0.003	0.001	0.002	Yes
Merrimu	Quarterly	4	0.002	0.001	0.002	Yes
Mount Macedon	Quarterly	4	0.004	0.001	0.002	Yes
Myrniong	Quarterly	5	0.004	0.001	0.002	Yes
Riddells Creek	Quarterly	4	0.001	0.001	0.001	Yes
Rockbank	Quarterly	4	0.003	0.001	0.002	Yes
Romsey	Quarterly	4	0.004	0.002	0.003	Yes
Sunbury	Quarterly	4	0.003	0.001	0.002	Yes
Toolern Vale	Quarterly	4	0.047	0.001	0.017	Yes
Woodend	Quarterly	6	0.005	0.002	0.004	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*

[2] *Compliance as measured against the aesthetic (taste) guideline value set out in ADWG for the mean concentration of zinc in drinking water should not exceed 3 mg/L. No health-related guideline limits were set for zinc.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results (continued)

Sulfate

Table A34: Sulfate (as SO4) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Ave. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	1	1	1	Yes
Darley	Annually	1	25	25	25	Yes
Diggers Rest	Annually	1	1	1	1	Yes
Eynesbury	Annually	1	1	1	1	Yes
Gisborne	Annually	5	47	1	32	Yes
Lancefield	Annually	3	9	3	5	Yes
Lerderderg	Annually	1	25	25	25	Yes
Macedon	Annually	1	48	48	48	Yes
Maddingley	Annually	1	25	25	25	Yes
Melton South	Annually	1	2	2	2	Yes
Merrimu	Annually	1	25	25	25	Yes
Mount Macedon	Annually	1	49	49	49	Yes
Myrniong	Annually	3	45	36	41	Yes
Riddells Creek	Annually	1	47	47	47	Yes
Rockbank	Annually	1	2	2	2	Yes
Romsey	Annually	1	12	12	12	Yes
Sunbury	Annually	1	1	1	1	Yes
Toolern Vale	Annually	1	23	23	23	Yes
Woodend	Annually	5	48	15	32	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*

[2] *Compliance as measured against the aesthetic (taste) guideline value set out in ADWG for the mean concentration of sulfate in drinking water should not exceed 250 mg/L.*

Appendix 5 – Source water monitoring

Western Water uses the principles of the 12 elements of the ADWG framework for the management of its drinking water quality. This framework is incorporated within Western Water's Drinking Water Quality Management System (DWQMS), and is part of the business' strategic approach to providing quality drinking water to customers and protecting public health.

One of the key components of Western Water's DWQMS is the extensive source water monitoring program aimed at increasing the understanding of source water quality in the reservoirs, bores and basins. It involves the monitoring and identification of hazards, sources and events which could compromise drinking water quality in a catchment-to-consumer multiple barrier approach.

The source water monitoring program for 2018/19 allows for the assessment of source water quality at water storages for key chemicals with health-related guidelines, physical features such as turbidity and colour, impacts of rainfall events, organic matter and common waterborne disease pathogens.

This continual monitoring of sources water quality enables Western Water to conduct historical trending analysis, review individual system risk assessment plans, identify new hazards and review risk at each source of water. This information better positions Western Water to appropriately select the type of disinfectant to use for each water system and provide the most effective water treatment.

Through an independent NATA-accredited laboratory, a comprehensive source water monitoring program at reservoirs, bores and final source water entry points to water filtration plants was undertaken during 2018/19

An overview of the parameters tested and the frequency of testing at each sampling location for pesticides, chemicals (organics and in-organics), metals, physical and radiological parameters and their results is contained in this appendix. Table A35 on the following page is a list of all parameters monitored during 2018/19.

In addition to chemical testing for water quality monitoring, the independent NATA accredited laboratory also examines samples for water for algae. The laboratory identifies the type and quantity of algae, including cyanobacteria (blue-green algae), diatoms and flagellates.

General observations provided by microbiologists in relation to any water discolouration, the levels of detritus and the presence of any odour in the source water provided valuable information in assessing the quality of the source water. This information allows Western Water to monitor changes in conditions of source water sources and their potential impacts on drinking water quality.

For Merrimu, Rosslynne and Pykes Creek Reservoirs, BGA monitoring was conducted by water storage manager, Southern Rural Water. Western Water received regular results on BGA numbers in the three reservoirs during the reporting period, which allowed for Western Water to assess the adverse impacts on its ability to treat and provide safe drinking water to customers.

Water sourced from Melbourne Water (MW) prior to the off-take entry point to Western Water's region was monitored by MW during 2018/19. Western Water receives monthly water quality reports from MW for Greenvale and Silvan reservoirs, which include information on algal populations. MW is required to notify Western Water of any major changes in treated water quality that could potentially impact the ability to supply safe drinking water to customers and to meeting the ADWG.

Appendix 5 – Source water monitoring (continued)

Table A35: List of all source water parameters monitored during 2018/19

Parameter	Type
1,1-Dichloroethane	Chemical organics
1,2-Dichloroethane	Chemical organics
2,4 D	Pesticides
4,4' – DDT	Pesticides
Aldrin	Pesticides
Alkalinity, total as CaCO3	Physical
Aluminium, filtered	Metals
Aluminium, total	Metals
Ammonia	Chemical inorganics
Amoebae (Naegleria SPP)	
Arsenic	Chemical inorganics
Atrazine	Pesticides
Benzene	Chemical organics
Benzo(a)pyrene	Chemical organics
Calcium	Chemical inorganics
Carbon Tetrachloride	Chemical organics
Chlordane, total	Pesticides
Chloride	Chemical inorganics
Chromium	Metals
Coliforms, total	Microbiological
Colour, true	Physical
Copper	Metals
Cryptosporidium spp.	Microbiological
Cyanide	Chemical inorganics
Dieldrin	Pesticides
Dissolved organic carbon	Chemical organics
Dissolved oxygen	Physical
Electrical conductivity @ 25ºC	Physical
Parameter	Type
E.coli	Microbiological
Faecal streptococci	Microbiological
Fluoride[1]	Chemical inorganics
FRNA Coliphage	Microbiological
Giardia spp.	Microbiological
Gross alpha activity	Radiological

Parameter	Type
Gross beta activity	Radiological
Hardness, as CaCO3	Physical
Hardness, as MgCO3	Physical
HCHC (gamma) (Lindane)	Pesticides
Helminth (Ascaris ova)	Microbiological
Helminth (Taenia ova)	Microbiological
Heptachlor	Chemical organics
Heptachlor epoxide	Chemical organics
Hexachlorobenzene	Chemical organics
Iron, filtered	Metals
Iron, total as Fe	Metals
Magnesium, as Mg	Metals
Manganese, filtered	Metals
Manganese, total as Mn	Metals
Mercury, as Hg	Metals
Methoxychor	Chemical organics
Nitrate	Chemical inorganics
Nitrite	Chemical inorganics
Pentachlorophenol	Chemical organics
pH	Physical
Phosphorus, reactive as P	Chemical inorganics
Potassium	Metals
Parameter	Type
Selenium	Chemical inorganics
Silica, total as SiO2	Chemical inorganics
Silicon	Chemical inorganics
Sodium	Chemical organics
Sulphate	Chemical organics
Tetrachloride	Chemical organics
Tetrachloroethene	Chemical organics
Total dissolved solids	Physical
Trichloroethene	Chemical organics
Turbidity	Physical
UVT 254	Physical

[1] *Fluoride is measured where potable transfers into an untreated reservoir are performed or if the natural level of fluoride present in the untreated water source that is significant enough to require monitoring.*

Glossary

Algae	Simple types of plant with no root, stems of leaves. They occur mostly in freshwater and marine environments.
Algal bloom	A rapid growth of algae in aquatic environments often triggered by an input of high levels of nutrients and an increase in temperature. Blue-green algae (or cyanobacteria) are of most concern.
Alum	An aluminium sulphate based chemical used as a coagulant in the water treatment process.
Aluminium (Al)	A naturally occurring element in soils which can enter water from catchments.
Ammonia (NH3)	A highly soluble compound resulting from the decomposition of organic matter containing nitrogen. Usually only found in small concentrations in surface waters.
Aquifer	A layer or section of earth or rock that contains freshwater (known as groundwater), any water that is stored naturally underground or that flows through rock or soil, supplying springs and wells.
ADWG	National Health and Medical Research Council's Australian Drinking Water Guidelines 2004
AWA	Australian Water Association
Blue-green algae (cyanobacteria) (BGA)	Single celled, filamentous or colony-forming organisms which are widely distributed in the freshwater and marine environments. Under favourable conditions of light, temperature and nutrient supply, extensive growth of blue green algae may occur, leading to blooms. These can result in environmental problems and can create challenges for water treatment.
Bulk entitlement (BE)	An agreement that outlines the conditions for supply of bulk drinking water from reservoirs managed by Southern Rural Water and drinking water supplied by the Melbourne Water Corporation to Western Water.
Calcium (Ca)	A naturally occurring element which can enter water from catchments. It may also be added to water in the treatment process to reduce the acidity levels or increase the capacity of water to buffer pH changes.
Catchment	An area of land surrounding a water storage. The runoff water from rain falling over the catchment drains into the storage and may collect nutrients, minerals and other contaminants including microorganisms from the surface of the land.
Chlorination	The disinfection of water, wastewater and industrial waste through the application of chlorine (Cl) as part of the water treatment process. Chlorination kills microorganisms and oxidises undesirable compounds.
Chloramination	The application of the chlorine followed by ammonia to create monochloramine (NH2Cl), a stable disinfectant that is added to drinking water to kill bacteria or to oxidise undesirable compounds. Chloramines persist for a longer time than chlorine and as a result are used in longer water distribution systems.
Coliforms	Coliform bacteria are used as one of the indicators of the quality of drinking water and the possible presence of disease-causing microorganisms. These bacteria are killed by chlorine.
Cryptosporidium	A parasitic protozoan (microorganism) which causes gastroenteritis in humans. These organisms occur in the gut of infected warm-blooded animals and can be introduced into source water through faecal contamination.
DHHS	Department of Health and Human Services
Disinfection	Inactivation (killing) of pathogens or organisms capable of causing infectious disease by chemical or physical processes, including chlorination.
Drinking Water Quality Management System (DWQMS)	Western Water's DWQMS is used to ensure our drinking water supplies are managed effectively to provide high quality drinking water and to ensure the protection of public health.
EPA	Environment Protection Authority
ESC	Essential Services Commission
Escherichia coli (*E.coli*)	The most common heat tolerant coliform present in faeces, which is regarded as the most specific indicator of recent faecal contamination. *E.coli* can be killed by standard disinfection practices.
Filtration	A process for removing particles from water by passing through a porous barrier, such as a screen, membrane, sand or gravel. Often used in conjunction with a coagulant to settle contaminants.
Fluoride (F)	Fluoride is regarded as a useful constituent of drinking water, particularly for the prevention of tooth decay. Fluoride is added to the water supply at Merrimu WFP, Rosslynne WFP and all water supplied from the Melbourne system.
Groundwater	Water beneath the earth's surface (often between saturated soil and rock) that supplies bores, wells and springs.
HACCP	Hazard Analysis and Critical Control Point. A system that identifies, evaluates and controls hazards that are significant for food safety (Codex 1997).
Incident	Any event or circumstance that causes or is likely to cause: a) threat to community health or safety; or b) creation of the need for urgent action under statute or legislation.
Inflows	Water flowing from the catchment to the reservoirs through streams, rivers and creeks.
Iron (Fe)	An element which when found in water leads to brownish discolouration. Limits on the amount of iron in water are usually due to taste and appearance factors rather than any detrimental health effects.
IWA	Institute of Water Administration

Glossary (continued)

kL	kilolitres (thousand litres)
Manganese (Mn)	Manganese in a water supply may affect taste, cause staining of clothes, produce deposits in pipes and contribute to turbidity.
MW	Melbourne Water
mg/L	milligrams per litre
ML	megalitres (million litres)
µg/L	micrograms per litre
National Association of Testing Authorities (NATA)	NATA is Australia's national laboratory accreditation authority. NATA accreditation recognises and promotes facilities competent in specific types of testing, measurement, inspection and calibration.
National Health and Medical Research Council (NHMRC)	NHMRC is Australia's peak body for supporting health and medical research for developing health advice for the Australian community, health professionals and governments.
Nitrogen (N)	Nitrogen is an essential nutrient for plant growth. It is used in fertilisers and is present in sewage effluent. High levels of nutrients can lead to excessive algal growth.
Nitrate (N03-)	The most stable form of combined nitrogen in water. Present in surface waters in small amounts, the major sources are from human and animal wastes.
Nephelometric turbidity unit (NTU)	A measure of the turbidity in water.
Nutrients	Compounds required for growth by plants and other organisms. Major nutrients for plant growth are phosphorous and nitrogen.
Pathogens	Disease causing organisms such as bacteria and viruses.
pH	The pH value indicates if a substance is acidic, neutral or alkaline. It is calculated from the number of hydrogen ions present and is measured on a scale of 0 to 14. A pH greater than 7 is alkaline, less than 7 is acidic and 7 is neutral.
Phosphorous (P)	Phosphorous is an essential nutrient for plant growth. High levels of phosphorous can lead to excessive algal growth and can be due to inputs from human activity such as fertiliser run-off and land clearing.
Potable water (drinking water)	Water that is intended for human consumption or for purposes connected with human consumption (e.g. food preparation, making of ice, preservation of unpackaged food).
QMS	Quality Management System
Reservoir	A natural or artificial body of water used as storage for water supply.
Risk assessment	A scientifically based process consisting of the following steps: i) hazard identification; ii) hazard characterisation; iii) exposure assessment; and, iv) risk characterisation.
Risk management	The process of weighing policy alternatives in the light of the results of risk assessment and, if required, selecting and implementing an appropriate control option, including regulatory measures.
Risk management plan	As set out in Section 9 of the *Safe Drinking Water Act 2003*.
SCADA	Supervisory Control and Data Acquisition system
Source water	Water that has not been treated in any way.
SRW	Southern Rural Water, bulk water supplier responsible for Merrimu, Rosslynne and Pyke Creek Reservoirs
Total dissolved solids	A measure of organic salts and small amounts of organic matter that are dissolved in water.
Total hardness	Total hardness is the sum of the concentrations of calcium and magnesium ions expressed as calcium carbonate equivalent. Waters with a total hardness in excess of 200mg/L are considered hard.
Treatment (water)	The filtration and disinfection processes employed to produce drinking water.
Trihalomethanes	Compounds that may occur in a chlorinated water supply as a by-product of organic materials present in the water reacting with chlorine.
True colour	True colour refers to the colour of water after particles of organic matter have been removed through filtration and is the measurement of the extent to which light is absorbed by the water. Measured in Hazen Units (HU).
Turbidity	Refers to the presence of suspended solids in water causing a muddy or discoloured appearance. Turbidity is measured in Nephelometric Turbidity Units (NTUs).
Water Filtration Plant	Drinking water treatment plant.
Water quality standard	A quality standard specified for drinking water by regulations made for the purposes of Section 17 of the *Safe Drinking Water Act 2003*.
Water supply system	The complete system that provides a water supply to customers. It includes all infrastructure from the water source to the customer including the catchment, water storage, treatment and delivery systems and networks.
WIOA	Water Industry Operators Association
WSAA	Water Services Association of Australia

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