Water Quality Report
2016/17

Contents

Cover image: Garden Hut Reservoir, Lancefield

Introduction

About Western Water

In 2016/17, Western Water provided water, recycled water and sewerage services to 63,200 properties across a region of 3,000 square kilometres to the north-west of Melbourne.

Serviced properties grew by 4% 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% per annum.

The service area population was recently recalibrated following the release of the Australian Bureau of Statistics Census 2016 data. With an average of 2.6 people per household, the population is now calculated at 153,358 – down from the estimate of 163,400 reported last financial year.

2016/17 Highlights

- Safely delivered 13,775 million litres of drinking water to 62,234 properties
- Completed an Urban Water Strategy outlining Western Water's drinking water supply management approach for the next 50 years
- Compliance with the requirements of the *Safe Drinking Water Act 2003* and the water quality parameters specified in the Safe Drinking Water Regulations 2015 (SDWR) across the drinking water distribution network with only minor exceptions
- Successfully passed an external hazards and critical control points (HACCP) audit for drinking water quality in February 2017
- Water quality complaints reduced by 42% compared to prior year
- Local reservoirs recovered to a combined capacity of 47% (from 12% last financial year)

Table 1: Drinking water statistics - 2015/16 vs 2016/17

	2015/16	2016/17
Connected water customers	60,158	62,234
- Residential	57,062	59,118
- Non-residential	3,096	3,116
Water consumption (ML)	14,357	13,775
- Residential	11,022	10,584
- Non-residential	2,032	1,971
- Water losses	1,303	1,220
Water mains[1] (km)	1,960	2,020
Water filtration plants	7	7
Chlorination plants	14	16

1. Total water mains (km) figure also includes 185km Class A recycled water mains in 2015/16 and 195km in 2016/17.

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 2016 to 30 June 2017, 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.

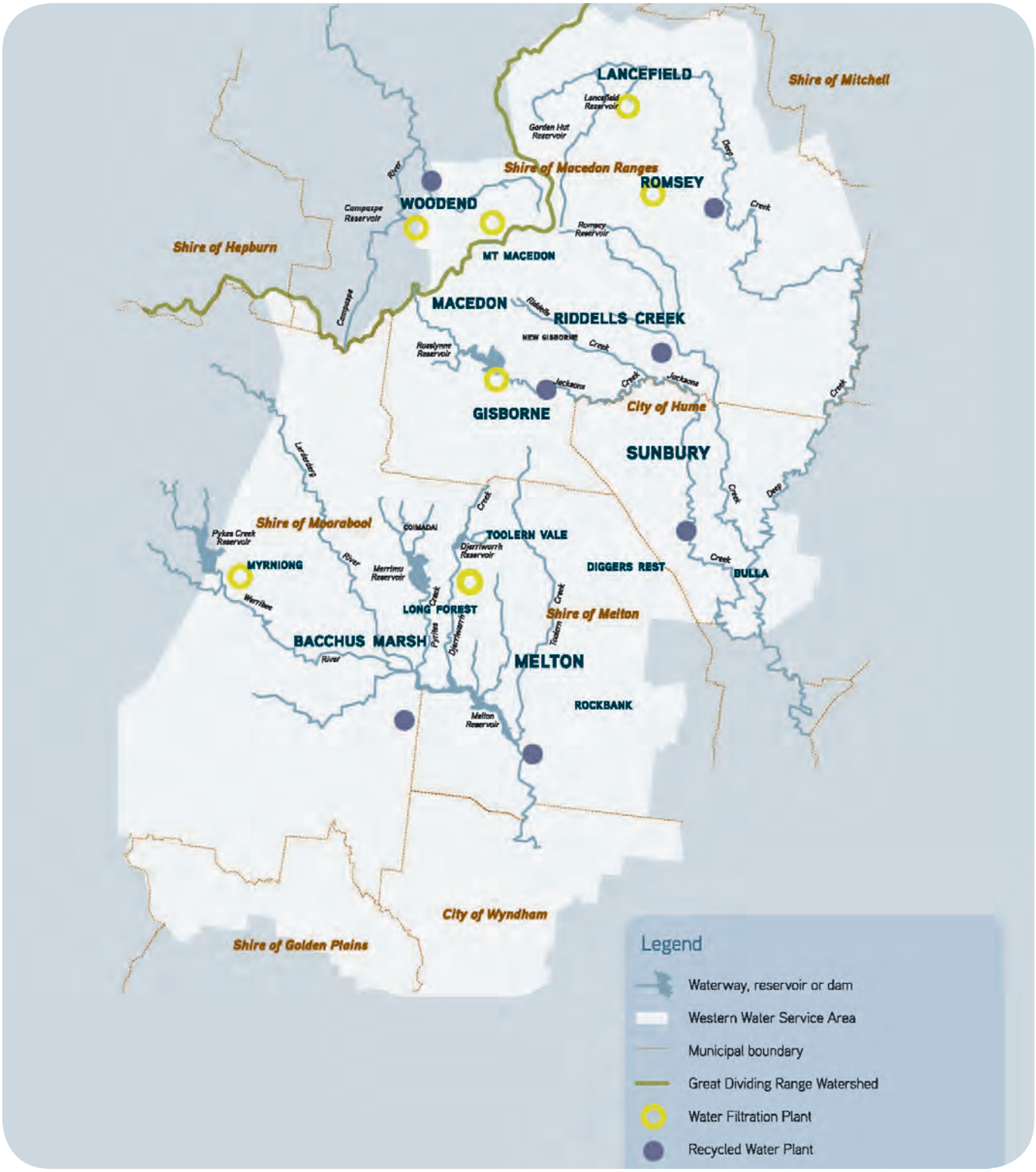
The Essential Services Commission (ESC), the Victorian Government's economic regulator for essential utility services, regulates Western Water's prices, service standards and market conduct. The Energy and Water Ombudsman Victoria (EWOV) receives, investigates and resolves escalated enquiries and complaints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

Drinking water regulations

Western Water is governed by Victoria's *Safe Drinking Water Act 2003* and Safe Drinking Water Regulations 2015, 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 Program in the Health Protection Branch is responsible for administering the regulatory framework.

Service area map



Foreword from the Managing Director

The major challenges facing Western Water as the region's drinking water supplier are the impact of climate change and catering for demand from continuing, strong population growth.

Since Western Water commenced operations more than two decades ago, we have developed a strong track record for meeting these challenges head on - delivering safe, quality and affordable water, sewerage and recycled water services and maintaining high levels of customer satisfaction.

During 2016/17, Western Water safely delivered 13,775 million litres of drinking water to a population of 153,358. On average, our customers consumed 189 litres per person per day.

Securing water for the future

Most of the region's drinking water has been sourced from the Melbourne supply system this year with less than a quarter sourced locally.

This is due to the very low capacity remaining in local reservoirs at the end of last financial year. While high rainfall in the past year has seen local storages recover to a combined total of 47%, inflows in future years are expected to be below average.

At the same time, property numbers are expected to grow by more than 4% per year over the coming decade – particularly in and around Melton, Sunbury and Bacchus Marsh.

To ensure we can meet demand, Western Water will continue to utilise the full range of water sources available, including Melbourne water, and encourage customers to reduce consumption.

During the year, we completed an Urban Water Strategy outlining Western Water's drinking water supply management approach for the next 50 years to ensure long term water supply security for our customers.

Our Integrated Water Management Strategy will further extend how well we address the combined impact of climate change and population growth, within a framework of maintaining affordable services.

Committed to drinking water quality

Western Water is aware of the responsibility it bears to provide safe, affordable drinking water to the people living and working in our service region. This report reflects our commitment to meeting this responsibility by addressing the twelve elements of the Framework for Management of Drinking Water Quality.

I am pleased to report a very high level of compliance with the requirements of the *Safe Drinking Water Act 2003* and the water quality parameters specified in the Safe Drinking Water Regulations 2015 (SDWR) across all Western Water's distribution networks.

We successfully passed an external hazards and critical control points (HACCP) audit for drinking water quality and water quality complaints reduced significantly this year.

Western Water is committed to improving water quality for customers and innovative solutions can provide a step change in how we provide our services.

Through the Victorian water industry's Intelligent Water Networks program, we have taken a lead role in exploring technologies to enable customer, quality, operations and water data systems talk to each other.

A single platform, known as Waternamics, is being developed. If successful it will enable water businesses to identify and fix issues much sooner, reduce response times for priority faults and improve customer communications.

I would like to take this opportunity to thank all Western Water staff involved in the production and supply of our drinking water for their professional and committed approach over the past year.

It is with pleasure that I submit Western Water's 2016/17 Water Quality Report to customers, stakeholders and regulators.

Neil Brennan, Managing Director

October 2017

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 Water Plan 2013-2018 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 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 that 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 customer advisory network now includes 20,000 online consultation panel members. They are kept well informed of water quality issues and changes and, when required, participate in consultation and engagement. During the year, we developed an online consultation site, Water Matters, to extend engagement opportunities with 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 (SRW). 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.

In the past year, 76% of drinking water supplied in Western Water's service area was sourced from the Melbourne system. This was due to the low capacity in local storages at the end of last financial year. Since then, good rainfall has seen local reservoirs recover to a combined total capacity of 47%.

Currently the major towns of Sunbury and Melton are being supplied with Melbourne water while Bacchus Marsh and towns in the Macedon Ranges are receiving local supplies.

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.

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 these 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 - 2015/16 vs 2016/17*

Water sampling locality	Towns	Residential population[1]	
		2015/16	2016/17[2]
Bulla	Bulla, Oaklands Junction	750	680
Darley	Darley, Pentland Hills	8,770	8,110
Diggers Rest	Diggers Rest	3,190	3,220
Eynesbury	Eynesbury	2,560	2,360
Gisborne	Gisborne, New Gisborne, Bullengarook	11,120	10,260
Lancefield	Lancefield	2,240	2,060
Lerderderg	Bacchus Marsh, Merrimu, Coimadai	8,820	8,180
Macedon	Macedon	1,790	1,590
Maddingley	Maddingley, Parwan	3,890	3,740
Melton South	Melton, Melton South, Brookfield, Hopetoun Park, Toolern, Mount Cottrell, Plumpton	33,590	32,040
Merrimu	Melton West, Kurunjang, Long Forest	28,850	26,830
Mount Macedon	Mount Macedon	1,560	1,410
Myrniong	Myrniong	290	250
Riddells Creek	Riddells Creek	3,720	3,400
Rockbank	Rockbank	1,640	2,280
Romsey	Romsey, Kerrie, Monegeetta	4,780	4,500
Sunbury	Sunbury, Clarkefield, Wildwood	40,090	36,790
Toolern Vale	Toolern Vale	480	440
Woodend	Woodend	5,640	5,220
Total		163,770	153,360

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. Population numbers for FY17 have fallen due to Western Water's adoption of the ABS Census 2016 people per household estimate for the region of 2.6. This figure is lower than the multiplier previously used

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, near Gisborne, and Merrimu, 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 small community of Myrniong.

Local water sources are used for drinking water supply whenever possible. However, by the end of 2015/16, an extended dry period had resulted in the combined total capacity in the region's local storages reducing to just 12%.

As a result, 76% of drinking water supplied to the region this financial year has been sourced from the Melbourne supply system.

While local storages have recovered to 47% combined capacity by June 2017, the ongoing impacts of climate change and strong 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 Melbourne Water 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 to the Greenvale Reservoir. 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 Melbourne Water. Details of supply systems for all towns are outlined in table 4.

Smaller town supply systems

The towns of Woodend, Romsey, Lancefield and Myrniong 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 2016/17, Woodend was supplied with 234ML from Campaspe Reservoir and a further 283ML from the Graham Brock Reservoir which received 199ML from the Macedon bulk entitlement.

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 457ML 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 45.2ML 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. There were times during drought when all water supplied in Lancefield was from bores.

In 2016/17, 131ML 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.

Table 3: Major reservoir levels (% capacity) - 10 years

	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Rosslynne Reservoir	3%	3%	5%	66%	72%	85%	76%	44%	15%	38%
Merrimu Reservoir	13%	10%	9%	85%	78%	76%	63%	29%	10%	51%

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, Balliang East.	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Merrimu Reservoir	Lerderderg River, Goodman Creek, 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, Pyrites Creek Catchments
Romsey, Kerrie & 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 Numbers 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

Assessment of water quality data

Western Water collects extensive history of water quality at water sources, 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.

Hazard identification and risk management

Western Water uses a risk framework based on ISO 31000:2009 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 the Department of Health and Human Services. 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 last independent external audit of Western Water's risk management plan took place in June 2016 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-2018.

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.

Graham Brock Reservoir, Mount Macedon

Catchment protection

Western Water works alongside storage managers, Southern Rural Water (SRW) and Melbourne Water, 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 54 water storage tanks are used to supply water to customers throughout the water reticulation system. These tanks are typically constructed of concrete or metal and are fully enclosed. They 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. Melbourne Water carries out primary disinfection. Western Water booster chlorinates the water as it enters the local network.

Filtration

Western Water operates seven water filtration plants (WFPs) and an additional 16 water treatment facilities which booster chlorinate the water. Five WFPs employ dissolved air flotation filtration (DAFF) while Merrimu WFP uses the traditional sedimentation-filtration process and Romsey 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, Melbourne Water 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 utilised 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-fluorosilicacid) is added by Melbourne Water 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 Darley Diggers Rest Eynesbury Gisborne Lerderderg Macedon Maddingley Melton South Merrimu Mount Macedon Riddells Creek Rockbank Sunbury Toolern Vale	Lancefield[1] Myrniong[2] Romsey[1] Woodend

1. Lancefield and Romsey received a small proportion of fluoridated water during 2016/17 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)

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 pH of water should be maintained within the ADWG specified range of 6.5-8.5 pH units for aesthetic purposes.

Preventative measures for drinking water supply cont.

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	83,980	Merrimu system (Merrimu Reservoir via Merrimu Water Filtration Plant)	Coagulation Clarification/ filtration pH correction Fluoridation Chlorination Additional chlorination by booster chlorinators along reticulation system as required	Aluminium Sulphate, Polyelectrolyte, Lime, Chlorine gas, Sodium Silicofluoride, Sodium Hypochlorite[3]	Melton and Melton South have been supplied with Melbourne water since June 2016. Other towns in the Bacchus Marsh area of the Merrimu system have been supplied from Merrimu Reservoir. In April 2017, there was a switch to Melbourne supply and then back to Merrimu supply in June 2017 to address low levels in the 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 Melbourne Water Secondary chlorination at Hillside Pump Station Additional chlorination by booster chlorinators along reticulation system as required	Fluorosilicic Acid[2], Chlorine gas[3], Sodium Hypochlorite[4 5]	
Gisborne Macedon Mount Macedon Riddells Creek	16,660	Rosslynne system (Rosslynne Reservoir via Rosslynne Water Filtration Plant)	Oxidation Adsorption Coagulation pH correction Dissolved Air Flotation Filtration Fluoridation Chlorination Additional chlorination	Aluminium Sulphate, Potassium Permanganate (as required), Powder Activated Carbon, Polyelectrolyte, Lime[3], Carbon Dioxide[3], Fluorosilicic Acid[2], Chlorine Gas, Sodium Hypochlorite[4]	During 2016/17, all towns in this system received supply from Melbourne until January 2017 when Gisborne, Macedon, Mount Macedon and Riddells Creek were returned to local supply from Rosslynne Reservoir. Sunbury, Bulla and Diggers Rest remain on Melbourne water supply. Both supplies are further chlorinated at Bulla, Macedon, Mount Macedon and Riddells Creek.
			Fluoridation and primary chlorination by Melbourne Water Secondary disinfection (Chloramination) at Loemans Rd Pump Station Additional chlorination by booster chlorinators along reticulation system as required	Fluorosilicic Acid[2], Chlorine Gas[2], Sodium Hypochlorite[3 4], Aqueous Ammonia[3]	
Sunbury Bulla Diggers Rest	40,690	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) at Loemans Rd Pump Station/ Riddell Rd tank	Fluorosilicic Acid[2], Sodium Hypochlorite[3], Aqueous Ammonia	
Woodend	5,220	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 Melbourne Water[5]	Powdered Activated Carbon (as required at Marriages Water Filtration Plant), Aluminium Sulphate, Polyelectrolyte, Sodium Carbonate ('Soda Ash'), Sodium Hypochlorite Fluorosilicic Acid[2] (when supplied by Melbourne Water)	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	4,500	Romsey system (Kerrie Reservoir, Romsey Bore & Greenvale Reservoir via Romsey Water Filtration Plant)	Microfiltration Chloramination Fluoridation by Melbourne Water[6]	Poly Aluminium Chlorohydrate (as required), Sodium Hypochlorite, Sodium Hydroxide, Aqueous Ammonia Fluorosilicic Acid[2] (when supplied by Melbourne Water)	Drinking water is supplied from Kerrie Reservoir and Wright Reservoir and local groundwater. If required, Romsey's water supply can be sourced from Rosslynne or Melbourne during dry periods.
Lancefield	2,060	Lancefield system (Garden Hut Reservoir, Lancefield Basin and groundwater)	Coagulation pH Correction Filtration Dissolved Air Flotation Chlorination Fluoridation by Melbourne Water[7]	Aluminium Chlorohydrate (as required), Sodium Hydroxide (Caustic Soda), Potassium Permanganate, Powdered Activated Carbon (PAC), Sodium Hypochlorite Fluorosilicic Acid[2] (when supplied by Melbourne Water)	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	250	Pykes Creek Reservoir	Coagulation Oxidation pH correction Dissolved Air Floatation Filtration Chlorination Fluoridation by Melbourne Water[8]	Powdered Activated Carbon (as required), Potassium Permanganate, Aluminium Sulphate, Polyelectrolyte, Sodium Carbonate ('Soda Ash'), Chlorine gas, Sodium Hypochlorite, Fluorosilicic Acid[2] (when supplied by Melbourne Water)	Drinking water is supplied from Pykes Creek Reservoir. When necessary, additional water can be carted to Myrniong from Bacchus Marsh.

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. Population numbers for FY17 have fallen due to Western Water's adoption of the ABS Census 2016 people per household estimate for the region of 2.6. This figure is lower than the multiplier previously used
2. Chemicals may be added by Melbourne Water for treatment and chlorination
3. Chemicals added by Western Water for additional disinfection at entry point from Melbourne Water 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 Melbourne Water or Rosslynne Reservoir
6. When receiving water from Melbourne Water or Rosslynne system through transfer to Wright Reservoir
7. When receiving water for the Romsey/Lancefield pipeline, and that water has been supplemented with Melbourne Water supply or Rosslynne system water supply via Wright Reservoir
8. When receiving water from Melbourne Water through water carting from Bacchus Marsh (Merrimu System)

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 2016/17, Western Water supplied 62,234 connected properties with drinking water through 2,020km of water mains.

The extensive reticulation system is maintained through renewals, repairs and operational actions such as valve exercising, mains flushing, and flow and condition monitoring and assessment. These actions help reduce water losses through leakage and bursts and assist in maintaining water quality and the number of water main bursts during 2016/17 remains at low levels.

Table 7: Water main bursts per 100km - 5 years

	2012/13	2013/14	2014/15	2015/16	2016/17
Bursts per 100km of water main	18.8	14.0	12.1	13.3	12.3

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.

Critical control points

Western Water utilises 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, using 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 certificate from February 2017 is included in Appendix 3.

Drinking water storage tank near Bacchus Marsh (Merrimu supply system)

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
- Laboratory Test Work Instructions
- Internal Auditing Procedure and Scheduling, and
- Non-Conformance Procedures.

Western Water's Integrated Management System (IMS) addresses and links various business practices including Occupational Health & Safety (OH&S), QMS, HACCP, Environmental Management System (EMS) and Risk Management. As issues, events, audits, incidents or improvement actions are required, they are captured to 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 2016/17.

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.

Water quality system monitoring, Merrimu Water Filtration Plant

5. Verification of drinking water quality

The Drinking Water Regulatory 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.

Drinking water quality monitoring

Western Water closely monitors the quality of drinking water to ensure compliance with the Safe Drinking Water Regulations 2015. 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, 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, validating 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 Safe Drinking Water Regulations 2015.

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 within specifications.

Drinking water quality compliance

During 2016/17, all water localities complied with the microbiological requirements that 100% of drinking water samples collected during the reporting period must have zero *Escherichia coli (E.coli)* organisms per 100 millilitres, with the exception of any false positive samples as determined by the Safe Drinking Water Regulations 2015, with the exception of Sunbury, Romsey and Bacchus Marsh. 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 Safe Drinking Water Regulations 2015 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.

In June 2016, Western Water successfully passed its fifth Regulatory Audit for its Drinking Water RMP under the *Safe Drinking Water Act 2003.* The next audit is scheduled for mid-2018.

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

- *Escherichia coli (E.coli)*
- chlorine-based disinfection by-product chemicals
  - trihalomethanes
- other parameters
  - turbidity
  - fluoride

Examples of other chemicals not specified in the standards but may pose a risk to human health: manganese, lead, copper, arsenic, chlorine dioxide, nickel, chlorine, chromium, cyanide, mercury, nitrate, nitrite, selenium, carbon tetrachloride, and cadmium.

Verification of drinking water quality cont.

Table 8: Drinking water quality compliance

Parameter	2014/15	2015/16	2016/17
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%
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, filtered[2]	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%

Table 8 cont.

Parameter	2014/15	2015/16	2016/17
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[2]	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	100%	100%	100%
Cyanide	100%	100%	100%
Dibromochloromethane	100%	100%	100%
Dibromomethane	100%	100%	100%
Dichloroacetic acid	100%	100%	100%

Table 8 cont.

Parameter	2014/15	2015/16	2016/17
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%
Enterococci	100%	100%	100%
Escherichia coli[2]	100%	100%	98%[1]
Ethylbenzene	100%	100%	100%
Faecal Streptococci[2]	100%	100%	99%[1]
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%

Table 8 cont.

Parameter	2014/15	2015/16	2016/17
n-Propylbenzene	100%	100%	100%
ortho-Xylene	100%	100%	100%
Pentachlorophenol[2]	100%	100%	100%
pH[2]	89.5%	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%
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[2]	100%	100%	100%
Trihalomethanes	100%	100%	99%[1]
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. Discussion of non-compliances to the Safe Drinking Water Regulations 2015 is presented in detail in Section 6
2. Parameter is tested on untreated water source, refer to Appendix 5

Drinking water monitoring

Through an independent NATA accredited laboratory, a comprehensive water monitoring program was undertaken during 2016/17. An overview of parameters and standards limits are shown in Appendix 4. Some parameters including chemicals and metals are further detailed along with the frequency of testing at each locality in Appendix 4.

Source water monitoring

One of the key components of Western Water's Drinking Water RMP 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 to consumer, multiple barrier approach.

Through an independent NATA accredited laboratory, a comprehensive source water monitoring program was undertaken during 2016/17. An overview of the parameters tested is shown in Appendix 5.

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 2016/17. 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 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 monitors water prior to the off-take entry point to Western Water's region. Monthly water quality reports are provided by Melbourne Water for Greenvale Reservoir. These include information on algal populations. Melbourne Water 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

Western Water undertakes a major customer satisfaction survey each May with 600 residential and 200 non-residential customers randomly selected from across our service area in 2017. The most recent survey found that water quality remains the major driver of customer satisfaction.

Scoring a weighted average of 8.2 out of 10, customers' overall satisfaction with water quality remains high and has been stable over many years. Satisfaction with water taste has improved in the past year but remains lower than overall satisfaction, scoring 7.8 out of 10. Smell was also below the overall level at 8.0 out of 10 while satisfaction with colour and cleanliness was much higher with both scoring 8.4 out of 10 each.

The lower results are mainly driven by customers in Melton whose average satisfaction score of 8.0 out of 10 is slightly below the region's overall satisfaction level.

Lancefield customers continue to record the lowest levels of customer satisfaction with water quality (7.2 out of 10). This result is due to long-term perception of poor water quality, related to past unfiltered supplies and groundwater use. Improvements to water treatment and a limit on the proportion of groundwater used in the town's supply has seen Lancefield's satisfaction with water quality improve over time with this year's result significantly higher than last year's.

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, onsite 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 2016/17 with Western Water receiving 0.235 complaints per 100 customer properties as per DHHS reporting requirements.

During 2016/17, customer complaints about water quality decreased by 41% compared to last year. The reduction in complaints is believed to be primarily due to maintaining a consistent supply source to Sunbury and Melton localities. However, planned maintenance - included air scouring of mains - resulted in some complaints in Gisborne.

Water quality complaints by locality

During the reporting period, 4 localities recorded 10 or more complaints. The highest level of complaints per 100 customers was recorded in Rockbank due to taste, odour and dirty water which was resolved through routine flushing. Rockbank is also being impacted by high levels of housing development.

The Diggers Rest and Bulla localities rated second and third highest for water quality complaints. These were largely due to taste and odour issues with the Rosslynne supply and sediments in the mains, and was resolved through improved treatment and flushing.

Table 11: Water quality complaints by locality

Locality	Complaints	Complaints per 100 customer properties[1]
Bulla	2	0.007
Darley	8	0.003
Eynesbury	1	0.001
Diggers Rest	7	0.008
Gisborne	11	0.003
Lancefield	3	0.004
Lerderderg	5	0.001
Macedon	1	0.002
Maddingley	6	0.004
Melton South	31	0.002
Merrimu	26	0.002
Mount Macedon	1	0.002
Riddells Creek	3	0.002
Rockbank	8	0.016
Romsey	2	0.001
Sunbury	26	0.002
Toolern Vale	1	0.005
Woodend	3	0.001

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

Table 9: Customer complaints 2015/16 vs 2016/17

Complaint category	2015/16	2016/17
Water quality	251	145
Other complaints	81	61
Total	332	206

Table 12: Water quality complaints per 100 customers[1] - 5 years

	2012/13	2013/14	2014/15	2015/16	2016/17
Complaints per 100 customers	0.325	0.368	0.316	0.397	0.235

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

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	26	0.042	Rockbank	Gisborne	Sunbury
Dirty/ discoloured	82	0.133	Melton South	Merrimu	Sunbury
Illness	3	0.005	Maddingley	Merrimu	Melton South
Other	34	0.055	Diggers Rest	Merrimu	Sunbury
Total	145	0.235			

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 any repeat. This process is particularly 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 are reported to the Department of Health and Human Services (DHHS) and are investigated using the guidelines published by the Secretary's office in the Safe Drinking Water Regulations 2015 under Schedule 2 Appendix 1.

All incidents that may affect public health, and as defined by Section 22 of the *Safe Drinking Water Act 2003*, are reported to DHHS 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*, to DHHS once verification of non-conformance is determined by Western Water.

DHHS was notified of five non-conformance water events during the reporting period, 30 June 2016 to 1 July 2017. The details of these events are presented in Section 6.2.2.

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

a. Hopetoun Park wide spread public complaint, 10 August 2016 (Hopetoun Park, Melton South)

Issue – A section of pipeline in Hopetoun Park was isolated for routine planned cleaning. Due to technical difficulties, the section of pipeline cleaned was larger than initially planned. As a result, the interruption to supply was unplanned for some customers. These customers reported coloured water due to the distribution system cleaning process and the lack of isolation/consultation.

Actions – Affected customer properties were attended by Western Water staff for individual assessment and advised to flush the coloured water out of their properties.

Outcome – A review of the Hopetoun Park critical valve design and settings was performed and recorded for future planned works on the distribution network.

b. Water supply tank security concern, 19 October 2016

Issue – As part of routine tank inspection there was evidence of unauthorised access to the site.

Actions - The tank was inspected and tested for potential contamination. The results showed the water quality had no contamination present in the tank or in the downstream network. The security issue was rectified and Victoria Police provided assistance.

Outcome – External consultants and Western Water's security team assessed the security of tanks across the network and resulting projects included raising public awareness of tank security through local media via newspaper articles.

c. Western Tank pipe burst and widespread public complaints, 18 November 2016 (Sunbury)

Issue – Early on 18 November 2016, a pipe burst occurred on a large transfer pipeline in Riddell Road, Sunbury. This resulted in a widespread outage affecting approximately 2,000 customers that lasted most of the day. The Western Tank and approximately 50km of pipeline in Sunbury was emptied by the break.

Actions – The pipeline was repaired on the day of the burst and the distribution network and tank were refilled by early evening.

Customer calls were effectively handled by Western Water's call centre and regular communication about the outage utilised website, social media and roadside signage to keep customers informed about the issue and expected time of reinstatement.

During the refilling of the distribution network, staff flushed the affected area to prevent air trapping and subsequent water colour issues.

Outcome – The investigation of the pipe burst found it was due to the asset's age and the pipe will now be a focus for ongoing assessment. In addition, the automated settings for level monitoring on the Western Tank were assessed and improved to ensure that early warning of a rapid increase/decrease in levels would be quickly communicated. Improvements were also made to the pressure and flow control system on the tanks in this part of the network.

d. Water quality complaints due to Rees Road Transfer Main works, 24 January 2017 (Melton South)

Issue – The work to create a new connection to a large transfer main pipeline at the end of the Rees Road resulted in multiple customer complaints of coloured water when a valve was opened too quickly.

Actions – Customer calls were managed by Western Water's call centre and a flushing program was undertaken in the affected area to remove coloured water. The coloured water was cleared away within hours with no ongoing issues after the incident ended.

Outcome – Changes to improve Western Water's procedure for installing new connections to existing transfer pipelines was implemented within the week of the incident occurrence.

e. Class A Recycled Water cross-connection, 2 February 2017 (Melton South)

Issue – Western Water detected a Class A recycled water cross-connection on a single property through the internal standard preparation checks followed for dual pipe schemes. The preparation is performed prior to the final inspection before customers move into a new property. The cross-connection was made illegally by the customer's builder; the customer estimated this was done up to 2 weeks prior to occupying the property.

Actions – On the day of detection, the Class A recycled water connection was isolated and the cross-connection was corrected by Western Water. Flushing of the property was performed to remove all remaining Class A recycled water from drinking water plumbing. Follow up water quality testing of the water in the property was performed after flushing.

Outcome – Following corrective actions, the water quality was confirmed as being suitable for drinking. External consultants were engaged to perform a risk assessment of the consumption of Class A recycled water. The Victoria Building Authority, as domestic plumbing regulator, was engaged to address the illegal connection.

Community facilities at Pykes Creek Reservoir, Myrniong

f. Pykes Creek Reservoir septic leak, 22 February 2017 (Myrniong)

Issue – A leak was detected by Southern Rural Water (SRW) at one of the onsite septic systems at Pykes Creek Reservoir (pictured above). SRW manage the park land and septic systems at the reservoir and Western Water has a treatment plant at the reservoir to treat water for Myrniong.

Actions – After discussion with SRW on the day of detection, Western Water temporarily shut down Myrniong Water Filtration Plant until it could be verified that the reservoir's water quality was unaffected by the septic system leak. Testing on both the day of detection and the following day by an independent NATA accredited laboratory confirmed the water quality was unaffected.

While the filtration plant was shut down, Myrniong was supplied by tanker truck from Bacchus Marsh. Customer engagement included contact with the local school, SMS and email notification to customers, and advice on Western Water's website. SRW erected signage at the reservoir to warn against swimming until the water quality was verified. Customer queries were handled by Western Water's call centre.

Outcome – SRW repaired the septic system and Western Water resumed treating water from Pykes Creek Reservoir within one week of receiving the confirmed water quality results.

Incidents reported under Section 22 and Section 18 *Safe Drinking Water Act 2003*

a. *E.coli* detection in Williams Rise Tank and network, 23 November 2016 (Sunbury)

Issue – During storm activity from 22-24 November 2016, the Williams Rise Tank in Sunbury experienced a small volume of rainwater intrusion. This resulted in a low-level *E.coli* detection (1 org/100ml), in the routine sample taken on 23 November. Resampling to verify the result was undertaken on the same day and confirmed the presence of both low-level *E.coli* (1 org/100ml) and Faecal Streptococci (3 orgs/100ml) – both in the tank and at one location downstream in the Williams Rise network.

The Williams Rise Tank supplies to an isolated part of the network near Sunbury, 44 properties in total. DHHS was notified on the day of the reported detection in accordance with the requirements of Section 18.

Actions – After resampling on the day of the detection, the tank and network were spot dosed with chlorine to disinfect the water supply. Sampling on the following two days verified that the tank and network had no further contamination present and minor repairs were made to the tank roof and hatch as a result of storm damage.

Outcome – The tank was reviewed as part of the Drinking Water Tank Integrity Program with appropriate work scheduled for 2017/18, based on priority.

A permanent chlorinator system was installed early 2017 to maintain adequate chlorine levels. The tank is audited yearly as part of the HACCP system.

b. *E.coli* detection in Gisborne Road Tank and network, 30 December 2016 (Bacchus Marsh)

Issue – During storm activity on 29 December 2016, the Gisborne Road Tank in Bacchus Marsh had a small volume of rainwater intrusion. This resulted in a low-level *E.coli* detection (1 org/100ml) in the routine sample taken on 30 December.

Resampling was undertaken that day to verify the result. While the tank reported no *E.coli* presence in this sample, testing confirmed the presence of low-level *E.coli* (1 org/100ml) in the downstream network.

The Gisborne Road Tank supplies to an isolated part of the network near Bacchus Marsh, 55 properties in total. DHHS was notified on the day of detection in accordance with the requirements of Section 18.

Actions – After resampling on the day of detection, the tank and network were spot dosed with chlorine to disinfect the water supply.

Sampling on the following three days confirmed that the tank and network had no contamination present and some minor repairs were made to the tank roof and hatch as a result of storm damage.

Outcome – The tank was reviewed as part of the Drinking Water Tank Integrity Program with appropriate work scheduled for 2017/18, based on priority. In early 2017, improvements to chlorine online monitoring were made at the tank to ensure adequate chlorine levels. The tank is audited yearly as part of the HACCP system.

c. Total Trihalomethane detection at McDonalds Tank, 31 January 2017 (Mount Macedon)

Issue – A prolonged dry period in 2015/16 reduced the water level in Rosslynne Reservoir to 15% capacity. Over several months from June-September, large rainfall events refilled the reservoir to 45% capacity. Changed activity within the catchment meant that the quality of water entering the reservoir changed in amount and type of organics. Under these conditions, Trihalomethanes were easily formed within the Rosslynne distribution system.

On 31 January 2016, the routine sample for McDonalds Tank detected Total Trihalomethanes of 0.26mg/L – above the ADWG limit (0.25mg/L). DHHS was notified on the day of the reported detection in accordance with the requirements of Section 18.

Actions – To prevent formation of Trihalomethanes, the treatment process at Rosslynne Water Filtration Plant was modified to reduce organics, and both the disinfection system at the plant and the Rosslynne network's booster chlorination stations were also modified.

Outcome – External consultants conducted a review of the catchment, reservoir, plant and distribution network to assess the source of the organics and options to prevent future issues. Treatment options to prevent Trihalomethane formation during future refilling events included other types of chemical dosing and improvements to the disinfection system and storage tank management.

d. Trihalomethane detection in the Riddells Creek network, 1 February 2017 (Riddells Creek)

Issue – Refer to prior incident content for background discussion regarding Trihalomethane detection at McDonalds Tank.

The routine sample for the Riddells Creek network on 1 February 2017 detected Total Trihalomethanes of 0.28mg/L, above the ADWG limit (0.25mg/L). DHHS was notified on the day of the reported detection in accordance with the requirements of Section 18.

Actions – To prevent formation of Trihalomethanes, the treatment process at Rosslynne Water Filtration Plant was modified to reduce organics, and both the disinfection system at the plant and the Rosslynne network's booster chlorination stations were also modified.

Outcome – External consultants conducted a review of the catchment, reservoir, plant and distribution network to assess the source of the organics and options to prevent future issues. Treatment options to prevent Trihalomethane formation during future refilling events included other types of chemical dosing and improvements to the disinfection system and storage tank management.

e. *E.coli* detection at Romsey Water Filtration Plant Tank B, 10 April 2017 (Romsey)

Issue – During storm activity on 8 April 2017, Tank B at the Romsey Water Filtration Plant (picture below) experienced a small volume of rainwater intrusion. This resulted in a low-level *E.coli* detection (1 org/100ml), in the routine sample taken on 10 April 2017. There were no *E.coli* detections in the downstream network on the day of reporting, indicating the chloramine residual was efficiently protecting the network and the contamination was isolated to the tank.

Resampling was undertaken on the day of detection to verify the result and there was no *E.coli* detected in the tank or the downstream network. DHHS was notified on the day of the detection in accordance with the requirements of Section 18.

Actions - After resampling on the day of detection, some minor repairs were made to the tank roof and hatch as a result of storm damage and where rain water intrusion had occurred.

Outcome – The tank was reviewed as part of the Drinking Water Tank Integrity Program with appropriate work scheduled for 2017/18 based on priority. The tank is audited yearly as part of the HACCP system.

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

All incidents relating to drinking water were reported under Section 22 and/or Section 18, during the reporting period.

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

a. Elevated Manganese levels at Rosslynne Water Filtration Plant, June-December 2016 (various)

Issue – From June-September 2016, the Rosslynne Reservoir refilled from 15% level to 45% capacity. Water from the catchment was elevated in manganese and high levels of manganese have the potential to cause water quality issues – such as coloured water - for customers.

Action – The treatment process at Rosslynne Water Filtration Plant was optimised to remove the manganese, through changes to chemical dosing in the plant as well as increased aeration in the Rosslynne Reservoir.

b. Lower pH levels at Loemans Rd and Hillside pump stations, December 2015 - February 2016

Issue – Due to water quality issues at Greenvale Reservoir (Melbourne supply) the offtake level was lowered. As a result, the Loemans Rd and Hillside pump stations delivered lower pH water to Western Water. The pH in the distribution network remained within the limits specified by the ADWG.

Action – Online monitoring at both sites was maintained and Melbourne supply was minimised. A pH correction unit will be installed at both sites, to maintain optimal pH.

Blue green algae (BGA)

During 2016/17, there were no blue green algae notifications that impacted drinking water quality at Rosslynne, Pykes, Merrimu Reservoirs, local reservoirs or the Melbourne supply from Greenvale Reservoir.

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.

Romsey Water Filtration Plant

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 2016/17, the water quality team consisted of ten staff with two based in the Sunbury office, five based at Rosslynne Water Filtration Plant and another three based at Merrimu Water Filtration Plant.

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 Management Team 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. 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.

Western Water's water quality team members took part in 32 different training opportunities during 2016/17. Courses covered a range of specialised water treatment and general workplace training including:

- Confined space entry
- Construction site inductions
- First aid
- Forklift safety
- HACCP – water systems and solutions
- Hazardous substances safety essentials
- Manual handling
- Safe working at heights, and
- Security awareness.

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.

Water quality monitoring, Lancefield Water Filtration Plant

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 more than 18,000 customers.

In early 2017, we extended our engagement capability through the introduction of 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.

A discussion on water quality was launched in January 2017 and included a link to an online survey. This generated 76 responses and found similar levels of satisfaction with water quality as are found through our annual survey. 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.

Western Water improving water quality is a priority for around one in five customers and this feedback has helped shape our strategies for the next five years.

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.

Close to 8,000 students from across the region attended 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 2016/17, educational tours and community presentations were conducted for a range of groups including primary, secondary, tertiary and community groups.

Sponsorship and grants

Western Water builds and strengthens local community relations through sponsorships and offering grants across the service region. We staged eight community information sessions across our region in 2016/17 as well as attending numerous community events. Western Water promotes the health benefits and quality of our drinking water at all events. 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.

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
- Your water supply.

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 a 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.

Research

Western Water continues to optimise water filtration plant operations, and this starts with the untreated water in the reservoir. In July 2016, an online profile sampler was installed and commissioned at Merrimu Reservoir. The online profile sampler will test for a number of chemicals at different heights to provide data on quality changes. This will assist with predictive operation activities to prevent future and potential water quality issues.

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.

Rapid microbial testing

Western Water successfully trialled the use of rapid microbial testing in the field, using LuminUltra for operational drinking water monitoring. The focus of the technology is the ease of use in the field and the timely response delivered to provide an indication of residual bacteria level in the water sample. The testing can assist in identifying locations where biofilm presence is above the desired level and corrective action such as flushing or additional chlorination can be implemented.

The LuminUltra technology has been used for onsite customer property testing, as part of incident response, and after planned pipe maintenance such as air scouring. Western Water will continue to use this type of testing as part of the operator toolbox where the additional test can provide greater insight to the health of the drinking water network.

Intelligent Water Networks

Western Water has taken 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.

The IWN program is investigating new technologies and innovations to meet common challenges such as population growth, ageing infrastructure and climate variability.

Several projects are now under way as part of the IWN program, designed to drive efficiency and system-wide cost reductions including maintenance of water mains and leak detection programs.

Waternamics

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.

An initiative of the Intelligent Water Networks, Western Water is gearing up to trial Waternamics, a new system that can change the way we view our network and improve the service we provide to customers. Waternamics has been developed with the assistance of Veolia and IBM.

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

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

The first phase of the project is scheduled for late 2017 where Waternamics will assist with managing bursts, leaks and faults. It will also track water quality complaints and lab reporting.

Western Water also 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.

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 2016/17 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
- 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
- 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 Management Team and Senior Management Team 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.

Water quality monitoring, Merrimu Reservoir

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 identify and understand risks to water quality. It also assists in identifying possible solutions.

Audit of drinking water quality management

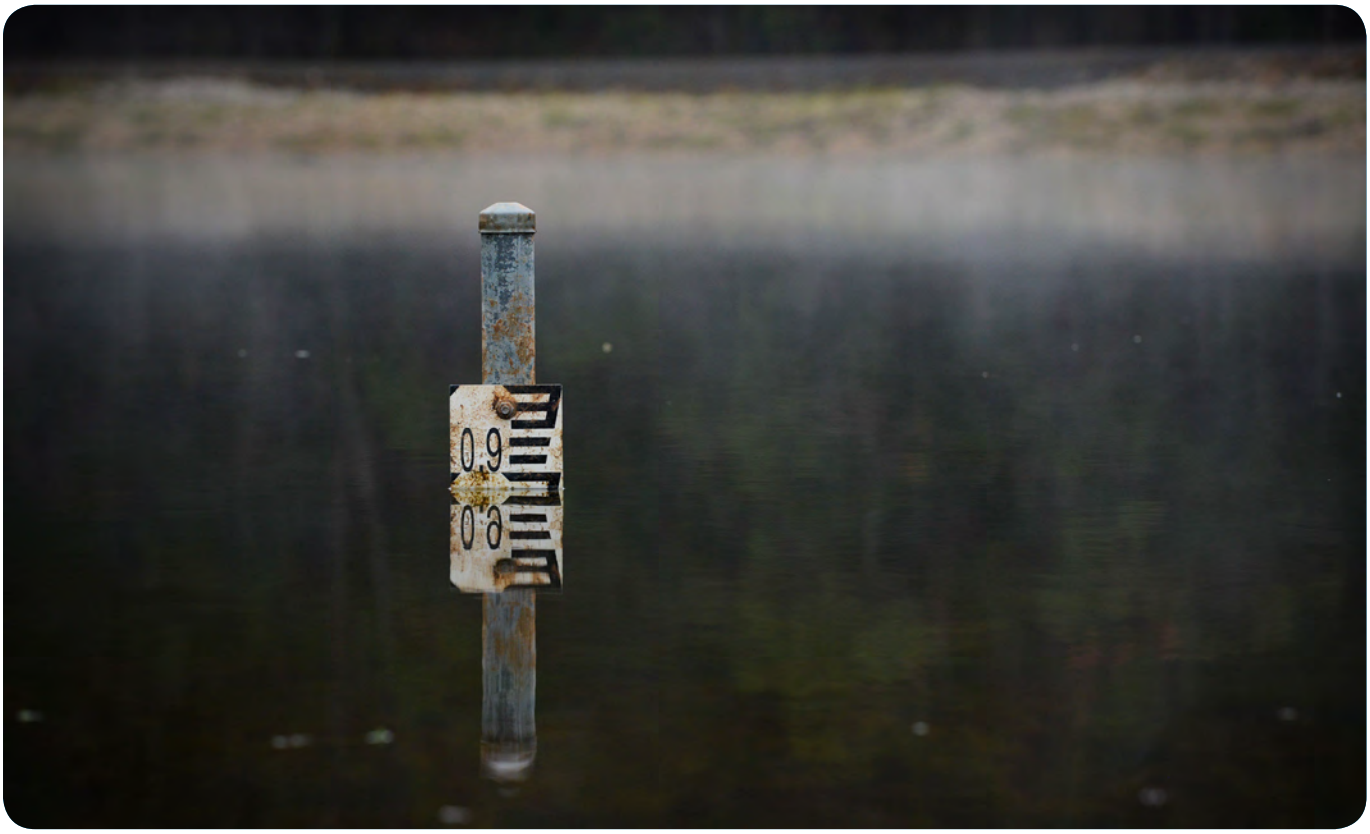
Audits ensure that operational procedures and processes are in place so that accurate water quality data is collected and appropriate management systems are maintained. One external surveillance audit was conducted by a certified auditor in February 2016 achieving confirmation of the ongoing HACCP certification.

In 2016/17, 22 internal audits on the Drinking Water HACCP System were undertaken by members of Western Water's HACCP team. The internal 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 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.

Department of Health and Human Services (DHHS) regulatory audit

Western Water successfully passed its fifth Regulatory Audit for Drinking Water Risk in June 2016. This result confirms Western Water's commitment to delivering quality and safe drinking water to customers. The audit was based directly on the ADWG and the *Safe Drinking Water Act 2003*. The next audit is expected to be mid-2018.



Forster Reservoir, Riddells Creek

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 Executive 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 in place an extensive Drinking Water QMS. 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 Management Team, Senior Management Team and staff.

Water supply – capital works improvement

The major water supply work undertaken by Western Water in 2016/17 was $3.1 million for the Leakes Road water main for new housing estates in Rockbank.

In May 2017, we invested $110k on development and installation of a new aerator system at Rosslynne Reservoir to improve water quality. The aerator is an innovative system designed in-house. It has dual pipes - one used for buoyancy while the other is for air delivery. Both pipes are wrapped with steel chains to sink to the bottom. Applying air to the buoyancy pipe re-floats the aerators and delivery hoses for inspection from a boat at the reservoir's surface. Previously this work would have been undertaken by divers.

Western Water also replaced the membranes at Romsey Water Filtration Plant for $140k in October 2016. The membranes had lasted seven years which is about two years over the normal scheduled replacement frequency. This extended membrane longevity was due to the combined impact of good operations and several years of water restrictions avoiding high summer flows. The new membranes will provide ongoing water quality for the community.

New and replacement water main projects continued this year with total water mains increasing from 1,960km to 2,020km.

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 2016/17, Western Water had 15 non-potable water by agreement 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.

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 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 in order 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 in order 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 to 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*
- *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 (AS4360)
- Relevant State Environment Protection Policies (SEPPs)
- Environmental Management System - ISO 14001
- Quality Management System – ISO 9001
- Occupational Health & Safety Management System - AS 4801
- Drinking Water Quality Management System
- HACCP Principles & Systems Procedures
- Integrated Management System procedures
- All relevant policies contained in the Policy Manual

Appendix 3 - HACCP certification

CERTIFICATE OF APPROVAL

This is to certify that the HACCP System of:

Western Region Water Corporation
Trading as Western Water
36 Macedon Street
Sunbury, Victoria
Australia

has been approved by Lloyd's Register Quality Assurance Limited to the following Management System Standard:

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

This certificate is applicable to:

Storage, treatment and distribution of drinking water.

Approval
Certificate No: MEL6029027

Inspection Date: 08 December 2015

Issue Date: 28 March 2016

Certificate Expiry: 21 March 2019

M. T. Lovato

Issued by: Lloyd's Register Quality Assurance Limited

Appendix 4 - Water quality compliance results

4.1 Compliance with drinking water quality standards

This section reports on 2016/17 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
Escherichia coli	Weekly	At least 98% of all samples collected in any 12-month period to contain no E*scherichia 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

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

Table A2: Drinking water quality compliance cont.

Parameter	Sampling frequency	Water quality standard
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.
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

Appendix 4 - Water quality compliance results cont.

4.1 Compliance with drinking water quality standards cont.

Table A2 cont.

Parameter	Sampling frequency	Water quality standard
Arsenic, Filtered	Various	should not exceed 0.01mg/L
Barium, as Ba	Various	should not exceed 2mg/L.
Barium, Filtered	Various	should not exceed 2mg/L.
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	should not exceed 4mg/L.
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	should not exceed 0.002mg/L
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	Various	should not exceed 5 mg/L
Chlorine, Free	Various	should not exceed 4 mg/L
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

Parameter	Sampling frequency	Water quality standard
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	should not exceed 0.02mg/L
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	should not exceed 1mg/L
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	100% of all samples collected in any 12 month period to contain no Entero-cocci per 100mL
Escherichia coli	Weekly	100% of all samples collected in any 12 month period to contain no *Escherichia coli* per 100mL (reference Safe Drinking Water Regualtions 2015)

Table A2 cont.

Parameter	Sampling frequency	Water quality standard
Ethylbenzene	Various	should not exceed 0.003mg/L.
Faecal Streptococci	Various	100% of all samples collected in any 12 month period to contain no Faecal Streptococci per 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	should not exceed 0.3 mg/L
Iron, total as Fe	Various	should not exceed 0.3 mg/L
Lead	Various	should not exceed 0.01 mg/L
Lead, Filtered	Various	should not exceed 0.01 mg/L
Lindane	Various	should not exceed 0.01mg/L.
Magnesium, as Mg	Various	currently no recommended health guideline value set
Manganese, Filtered (Soluble)	Various	should not exceed 0.1mg/L
Manganese, total as Mn	Various	should not exceed 0.1mg/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
n-Butylbenzene	Various	currently no recommended health guideline value set

Parameter	Sampling frequency	Water quality standard
Nickel	Various	should not exceed 0.02 mg/L
Nickel, Filtered	Various	should not exceed 0.02 mg/L
Nitrate	Various	aesthetic limits should not exceed 50 mg/L
Nitrite	Various	aesthetic limits should not exceed 3mg/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	should not exceed 0.01mg/L
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	should not exceed 0.1mg/L.
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	should not exceed 1.5mg/L
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

Appendix 4 - Water quality compliance results cont.

4.1 Compliance with drinking water quality standards cont.

Table A2 cont.

Parameter	Sampling frequency	Water quality standard
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	should not exceed 3mg/L

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

4.1.2 *E.Coli*

Escherichia 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: Escherichia 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)	% Samples with no *E.coli* (true result)	Complying (Yes/No)
Bulla	Weekly	105	0	0	0	0	100%	Yes
Darley	Weekly	312	0	0	0	0	100%	Yes
Diggers Rest	Weekly	145	0	0	0	0	100%	Yes
Eynesbury	Weekly	160	0	0	0	0	100%	Yes
Gisborne	64/year	330	0	0	0	0	100%	Yes
Lancefield	Weekly	104	0	0	0	0	100%	Yes
Lerderderg	64/year	273	1	1	0	1	98%[3]	No
Macedon	Weekly	156	0	0	0	0	100%	Yes
Maddingley	Weekly	156	0	0	0	0	100%	Yes
Melton South	112/year	253	0	0	0	0	100%	Yes
Merrimu	64/year	202	0	0	0	0	100%	Yes
Mount Macedon	Weekly	208	0	0	0	0	100%	Yes
Myrniong	Weekly	226[2]	0	0	0	0	100%	Yes
Riddells Creek	Weekly	157	0	0	0	0	100%	Yes
Rockbank	Weekly	213	0	0	0	0	100%	Yes
Romsey	Weekly	314	1	1	0	1	98%[4]	No
Sunbury	112/year	478	1	1	0	1	98%[5]	No
Toolern Vale	Weekly	104	0	0	0	0	100%	Yes
Woodend	64/year	221	0	0	0	0	100%	Yes

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

2. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

3. Lerderderg positive E.coli *sample was at the Gisborne Rd Tank 30/12/16, for further details refer to Section 6 Incident Management and Emergency Response*

4. Romsey positive E.coli *sample was at the Romsey WTP Tank B 10/4/17, for further details refer to Section 6 Incident Management and Emergency Response*

5. Sunbury positive E.coli *sample was at the William Rise Tank 23/11/16, for further details refer to Section 6 Incident Management and Emergency Response*

Appendix 4 - Water quality compliance results cont.

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 2016/17 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	17	0	0.04	0.01	0.02	Yes
Darley	Monthly	32	0	0.19	0.03	0.10	Yes
Diggers Rest	Monthly	16	0	0.04	0.01	0.02	Yes
Eynesbury	Monthly	24	0	0.06	0.04	0.05	Yes
Gisborne	Monthly	89	0	0.22	0.02	0.08	Yes
Lancefield	Monthly	14	0	0.13	0.05	0.10	Yes
Lerderderg	Monthly	24	0	0.16	0.03	0.09	Yes
Macedon	Monthly	12	0	0.25	0.05	0.12	Yes
Maddingley	Monthly	16	0	0.16	0.03	0.10	Yes
Melton South	Monthly	13	0	0.05	0.02	0.03	Yes
Merrimu	Monthly	12	0	0.13	0.03	0.07	Yes
Mount Macedon	Monthly	45	1	0.26	0.07	0.14	No[4]
Myrniong	Monthly	23[3]	0	0.14	0.01	0.07	Yes
Riddells Creek	Monthly	12	1	0.28	0.01	0.08	No[5]
Rockbank	Monthly	17	0	0.06	0.02	0.04	Yes
Romsey	Monthly	12	0	0.01	0.00	0.00	Yes
Sunbury	Monthly	38	0	0.07	0.01	0.03	Yes
Toolern Vale	Monthly	16	0	0.15	0.04	0.10	Yes
Woodend	Monthly	21	0	0.11	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 ADWG for total trihalomethanes in drinking water based on health considerations should not exceed 0.25mg/L

3. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

4. Mount Macedon non-conformance Trihalomethane occurred at MacDonald's Tank 31/1/17, for further details refer to Section 6 Incident Management and Emergency Response

5. Riddell's Creek non-conformance Trihalomethane occurred at the routine reticulation network sample site 1/2/17, for further details refer to Section 6 Incident Management and Emergency Response

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 2016/17 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 2016 to 30 June 2017, under the Safe Drinking Water Regulations 2015.

A summary of the turbidity results for samples taken at customer taps in 2016/17 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]	Max. NTU	Min. NTU	95th percentile	Complying (Yes/No)
Bulla	Weekly	104	1.7	0.2	0.9	Yes
Darley	Weekly	312	2.8	0.1	0.7	Yes
Diggers Rest	Weekly	104	0.9	0.3	0.8	Yes
Eynesbury	Weekly	158	2.5	0.2	1.0	Yes
Gisborne	Weekly	156	0.9	0.1	0.7	Yes
Lancefield	Weekly	104	0.7	0.1	0.1	Yes
Lerderderg	Weekly	260	1.1	0.1	0.6	Yes
Macedon	Weekly	60	1.4	0.1	0.9	Yes
Maddingley	Weekly	156	1.0	0.1	0.6	Yes
Melton South	Weekly	192	2.5	0.1	0.7	Yes
Merrimu	Weekly	123	1.1	0.1	0.6	Yes
Mount Macedon	Weekly	60	2.2	0.1	0.8	Yes
Myrniong	Weekly	131[2]	0.6	0.1	0.2	Yes
Riddells Creek	Weekly	60	0.9	0.1	0.6	Yes
Rockbank	Weekly	163	2.3	0.2	1.2	Yes
Romsey	Weekly	264	0.4	0.1	0.1	Yes
Sunbury	Weekly	248	1.9	0.1	0.8	Yes
Toolern Vale	Weekly	104	0.8	0.1	0.7	Yes
Woodend	Weekly	211	1.7	0.1	0.2	Yes

NTU: nephelometric turbidity unit *UCL: upper confidence limit*

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

2. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

Appendix 4 - Water quality compliance results cont.

4.5 Fluoride

Both the *Health (Fluoridation) Act 1973* and the Department of Health and Human Services require that the annual average fluoride in fluoridated drinking water supplied by Western Water must not exceed a level of 1.2 mg/L. Fluoride levels in any individual sample from drinking water supplied must also not exceed 1.5 mg/L.

The following table reflects the reporting period 1 July 2015 to 30 June 2016, under the Safe Drinking Water Regulations 2015.

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)	Complying (Yes/ No)
Bulla	Fortnightly	78	0.97	0.79	0.85	Yes
Darley	Fortnightly	48	0.98	0.74	0.85	Yes
Diggers Rest	Fortnightly	48	0.97	0.80	0.85	Yes
Eynesbury	Fortnightly	91	0.96	0.79	0.86	Yes
Gisborne	Fortnightly	178	0.95	0.68	0.84	Yes
Lancefield[2]	Quarterly	16	0.34	0.11	0.17	Yes
Lerderderg	Fortnightly	53	0.97	0.71	0.85	Yes
Macedon	Fortnightly	35	0.98	0.77	0.86	Yes
Maddingley	Fortnightly	46	0.97	0.71	0.85	Yes
Melton South	Fortnightly	29	0.97	0.80	0.86	Yes
Merrimu	Fortnightly	57	1.10	0.22	0.84	Yes
Mount Macedon	Fortnightly	29	1.00	0.76	0.86	Yes
Myrniong[2]	Quarterly	16	0.07	0.05	0.05	Yes
Riddells Creek	Fortnightly	34	0.97	0.77	0.86	Yes
Rockbank	Fortnightly	83	0.98	0.80	0.85	Yes
Romsey[2]	Quarterly	52	0.52	0.21	0.30	Yes
Sunbury	Fortnightly	174	0.97	0.69	0.85	Yes
Toolern Vale	Fortnightly	30	1.10	0.62	0.84	Yes
Woodend[2]	Quarterly	40	0.44	0.05	0.12	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)

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 2016/17 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.

Appendix 4 - Water quality compliance results cont.

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[1]	No. of samples[2]	Mean (mg/L)	Max. (mg/L)	Min. (mg/L)	Complying (Yes/No)[3]
Bulla	Yearly	1	0.002	0.002	0.002	Yes
Darley	Yearly	1	0.002	0.002	0.002	Yes
Diggers Rest	Yearly	1	0.002	0.002	0.002	Yes
Eynesbury	Yearly	1	0.002	0.002	0.002	Yes
Gisborne	Yearly	1	0.002	0.002	0.002	Yes
Lancefield	Yearly	1	0.002	0.002	0.002	Yes
Lerderderg	Yearly	1	0.002	0.002	0.002	Yes
Macedon	Yearly	1	0.002	0.002	0.002	Yes
Maddingley	Yearly	1	0.002	0.002	0.002	Yes
Melton South	Yearly	1	0.002	0.002	0.002	Yes
Merrimu	Yearly	1	0.002	0.002	0.002	Yes
Mount Macedon	Yearly	1	0.002	0.002	0.002	Yes
Myrniong	Yearly	1	0.002	0.002	0.002	Yes
Riddells Creek	Yearly	1	0.002	0.002	0.002	Yes
Rockbank	Yearly	13	0.002	0.002	0.002	Yes
Romsey	Yearly	1	0.002	0.002	0.002	Yes
Sunbury	Yearly	1	0.002	0.002	0.002	Yes
Toolern Vale	Yearly	1	0.002	0.002	0.002	Yes
Woodend	Yearly	1	0.002	0.002	0.002	Yes

1. Scheduled for monthly sampling under Safe Drinking Water Regulations 2005. During review of monitoring program in August 2015 this was reduced to yearly in accordance with Safe Drinking Water Regulations 2015

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

3. 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[1]	No. of samples[2]	Mean (mg/L)	Max. (mg/L)	Min. (mg/L)[3]	Complying[4] (Yes/No)
Bulla	Yearly	1	0.002	0.002	0.002	Yes
Darley	Yearly	1	0.008	0.008	0.008	Yes
Diggers Rest	Yearly	1	0.004	0.004	0.004	Yes
Eynesbury	Yearly	1	0.005	0.005	0.005	Yes
Gisborne	Yearly	1	0.006	0.006	0.006	Yes
Lancefield	Yearly	1	0.005	0.005	0.005	Yes
Lerderderg	Yearly	1	0.012	0.012	0.012	Yes
Macedon	Yearly	1	0.009	0.009	0.009	Yes
Maddingley	Yearly	1	0.018	0.018	0.018	Yes
Melton South	Yearly	1	0.013	0.013	0.013	Yes
Merrimu	Yearly	1	0.005	0.005	0.005	Yes
Mount Macedon	Yearly	1	0.009	0.009	0.009	Yes
Myrniong	Yearly	1	0.002	0.002	0.002	Yes
Riddells Creek	Yearly	1	0.012	0.012	0.012	Yes
Rockbank	Yearly	13	0.008	0.014	0.005	Yes
Romsey	Yearly	1	0.002	0.002	0.002	Yes
Sunbury	Yearly	1	0.006	0.006	0.006	Yes
Toolern Vale	Yearly	1	0.004	0.004	0.004	Yes
Woodend	Yearly	1	0.008	0.008	0.008	Yes

1. Scheduled for monthly sampling under Safe Drinking Water Regulations 2005. During review of monitoring program in August 2015 this was reduced to yearly in accordance with Stage Drinking Water Regulations 2015

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

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

4. 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 cont.

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

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[1]	No. of samples[2]	Mean (mg/L)	Max. (mg/L)	Min. (mg/L)[3]	Complying[4] (Yes/No)
Bulla	Yearly	1	0.002	0.002	0.002	Yes
Darley	Yearly	1	0.027	0.027	0.027	Yes
Diggers Rest	Yearly	1	0.008	0.008	0.008	Yes
Eynesbury	Yearly	1	0.016	0.016	0.016	Yes
Gisborne	Yearly	1	0.036	0.036	0.036	Yes
Lancefield	Yearly	1	0.010	0.010	0.010	Yes
Lerderderg	Yearly	1	0.032	0.032	0.032	Yes
Macedon	Yearly	1	0.042	0.042	0.042	Yes
Maddingley	Yearly	1	0.035	0.035	0.035	Yes
Melton South	Yearly	1	0.017	0.017	0.017	Yes
Merrimu	Yearly	1	0.020	0.020	0.020	Yes
Mount Macedon	Yearly	1	0.045	0.045	0.045	Yes
Myrniong	Yearly	1	0.002	0.002	0.002	Yes
Riddells Creek	Yearly	1	0.034	0.034	0.034	Yes
Rockbank	Yearly	13	0.010	0.017	0.004	Yes
Romsey	Yearly	1	0.002	0.002	0.002	Yes
Sunbury	Yearly	1	0.008	0.008	0.008	Yes
Toolern Vale	Yearly	1	0.009	0.009	0.009	Yes
Woodend	Yearly	1	0.006	0.006	0.006	Yes

1. Scheduled for monthly sampling under Safe Drinking Water Regulations 2005. During review of monitoring program in August 2015 this was reduced to yearly in accordance with Stage Drinking Water Regulations 2015

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

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

4. 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	53	0.003	0.010	0.001	Yes
Darley	Quarterly	20	0.003	0.005	0.001	Yes
Diggers Rest	Quarterly	22	0.003	0.012	0.002	Yes
Eynesbury	Quarterly	24	0.003	0.006	0.001	Yes
Gisborne	Quarterly	68	0.008	0.046	0.002	Yes
Lancefield	Quarterly	12	0.001	0.001	0.001	Yes
Lerderderg	Quarterly	25	0.002	0.009	0.001	Yes
Macedon	Quarterly	9	0.005	0.010	0.002	Yes
Maddingley	Quarterly	18	0.002	0.005	0.001	Yes
Merrimu	Quarterly	31	0.003	0.036	0.001	Yes
Mount Macedon	Quarterly	8	0.005	0.013	0.002	Yes
Myrniong	Quarterly	42[3]	0.004	0.012	0.001	Yes
Riddells Creek	Quarterly	8	0.004	0.007	0.002	Yes
Rockbank	Quarterly	57	0.005	0.060	0.001	Yes
Romsey	Quarterly	48	0.009	0.044	0.001	Yes
Sunbury	Quarterly	93	0.003	0.010	0.001	Yes
Toolern Vale	Quarterly	4	0.003	0.007	0.001	Yes
Woodend	Quarterly	77	0.003	0.014	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 manganese in drinking water should not exceed 0.1 mg/L

3. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

Appendix 4 - Water quality compliance results cont.

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

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	5	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	7	0.001	0.001	Yes
Lancefield	Quarterly	5	0.001	0.001	Yes
Lerderderg	Quarterly	4	0.001	0.001	Yes
Macedon	Quarterly	5	0.001	0.001	Yes
Maddingley	Quarterly	4	0.001	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	4	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	5	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	5	0.008	0.001	Yes
Darley	Quarterly	4	0.005	0.002	Yes
Diggers Rest	Quarterly	4	0.260	0.003	Yes
Eynesbury	Quarterly	4	0.012	0.006	Yes
Gisborne	Quarterly	6	0.014	0.001	Yes
Lancefield	Quarterly	4	0.008	0.001	Yes
Lerderderg	Quarterly	4	0.011	0.003	Yes
Macedon	Quarterly	5	0.009	0.001	Yes
Maddingley	Quarterly	4	0.004	0.002	Yes
Melton South	Quarterly	4	0.054	0.004	Yes
Merrimu	Quarterly	4	0.014	0.001	Yes
Mount Mace-don	Quarterly	4	0.002	0.001	Yes
Myrniong	Quarterly	4	0.049	0.014	Yes
Riddells Creek	Quarterly	4	0.007	0.001	Yes
Rockbank	Quarterly	4	0.013	0.002	Yes
Romsey	Quarterly	4	0.018	0.006	Yes
Sunbury	Quarterly	5	0.022	0.004	Yes
Toolern Vale	Quarterly	4	0.006	0.002	Yes
Woodend	Quarterly	4	0.002	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 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 cont.

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

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	2	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	2	0.001	0.001	Yes
Lancefield	Annually	1	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	2	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 2016/17 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.

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)
Bulla	Weekly	53	0.21	0.05	0.06	Yes
Diggers Rest	Weekly	156	0.81	0.05	0.20	Yes
Romsey	Weekly	314	1.00	0.05	0.41	Yes
Riddells Creek	Weekly	58	0.87	0.05	0.21	Yes
Sunbury	110 per year	360	1.10	0.05	0.31	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	2	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	4	0.001	0.001	Yes
Lancefield	Annually	2	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	2	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	1	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	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 cont.

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

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	1.10	0.05	0.45	Yes
Darley	Weekly	312	2.30	0.05	0.60	Yes
Diggers Rest	Weekly	156	1.10	0.05	0.36	Yes
Eynesbury	Weekly	160	3.90	0.05	0.70	Yes
Gisborne	64/year	331	1.80	0.05	0.60	Yes
Lancefield	Weekly	104	1.30	0.20	0.75	Yes
Lerderderg	64/year	273	1.70	0.05	0.52	Yes
Macedon	Weekly	156	1.50	0.07	0.65	Yes
Maddingley	Weekly	156	1.40	0.05	0.61	Yes
Melton South	112/year	254	2.00	0.05	0.53	Yes
Merrimu	64/year	203	1.60	0.05	0.65	Yes
Mount Macedon	Weekly	208	2.10	0.05	0.60	Yes
Myrniong	Weekly	224[3]	3.20	0.05	0.38	Yes
Riddells Creek	Weekly	159	1.90	0.05	0.78	Yes
Rockbank	Weekly	214	1.50	0.11	0.88	Yes
Romsey	Weekly	314	1.10	0.05	0.60	Yes
Sunbury	112/year	490	1.40	0.05	0.53	Yes
Toolern Vale	Weekly	104	1.30	0.08	0.50	Yes
Woodend	64/year	221	1.50	0.07	0.74	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. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

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	2	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	2	0.001	0.001	Yes
Lancefield	Annually	1	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	2	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 cont.

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

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	2	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	2	0.005	0.005	Yes
Lancefield	Annually	1	0.005	0.005	Yes
Lerderderg	Annually	1	0.005	0.005	Yes
Macedon	Annually	2	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	1	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

Appendix 4 - Water quality compliance results cont.

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

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	12	0.38	0.18	Yes
Darley	Monthly	32	0.32	0.04	Yes
Diggers Rest	Monthly	12	0.36	0.10	Yes
Eynesbury	Monthly	25	0.11	0.03	Yes
Gisborne[3]	Annually	13	0.52	0.20	Yes
Lancefield	Monthly	24	0.27	0.01	Yes
Lerderderg	Monthly	24	0.32	0.04	Yes
Macedon[3]	Annually	1	0.32	0.32	Yes
Maddingley	Monthly	16	0.32	0.03	Yes
Melton South	Monthly	12	0.10	0.01	Yes
Merrimu	Monthly	12	0.34	0.04	Yes
Mount Macedon[3]	Annually	5	0.33	0.13	Yes
Myrniong	Monthly	42[4]	0.55	0.09	Yes
Riddells Creek[3]	Annually	2	0.33	0.29	Yes
Rockbank	Monthly	16	0.10	0.01	Yes
Romsey	Monthly	36	0.13	0.04	Yes
Sunbury	Monthly	40	0.35	0.02	Yes
Toolern Vale	Monthly	16	0.30	0.03	Yes
Woodend	Monthly	37	0.13	0.00	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. Disinfection mode changes from chloramination to chlorination meant that sampling for nitrite in these localities was reduced

4. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

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	12	0.120	0.002	Yes
Darley	Monthly	32	0.002	0.002	Yes
Diggers Rest	Monthly	12	0.130	0.002	Yes
Eynesbury	Monthly	25	0.009	0.002	Yes
Gisborne[3]	Annually	13	0.091	0.002	Yes
Lancefield	Monthly	24	0.002	0.002	Yes
Lerderderg	Monthly	24	0.002	0.002	Yes
Macedon[3]	Annually	1	0.002	0.002	Yes
Maddingley	Monthly	16	0.002	0.002	Yes
Melton South	Monthly	12	0.002	0.002	Yes
Merrimu	Monthly	12	0.010	0.002	Yes
Mount Macedon[3]	Annually	5	0.002	0.002	Yes
Myrniong	Monthly	42[4]	0.002	0.002	Yes
Riddells Creek[3]	Annually	2	0.015	0.002	Yes
Rockbank	Monthly	16	0.002	0.002	Yes
Romsey	Monthly	36	0.190	0.002	Yes
Sunbury	Monthly	40	0.140	0.002	Yes
Toolern Vale	Monthly	16	0.002	0.002	Yes
Woodend	Monthly	37	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. Disinfection mode changes from chloramination to chlorination meant that sampling for nitrite in these localities was reduced

4. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

Appendix 4 - Water quality compliance results cont.

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

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	2	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	2	0.001	0.001	Yes
Lancefield	Annually	1	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	2	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	2	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	1	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 cont.

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 2015 to 30 June 2016, under the Safe Drinking Water Regulations 2015.

pH

Table A24: pH results

Water sampling locality	Sampling frequency	No. of samples[1]	Max	Min.	Mean	Complying[2] (Yes/No)
Bulla	Weekly	105	9.6	7.0	7.5	Yes
Darley	Weekly	312	9.3	7.1	7.8	Yes
Diggers Rest	Weekly	114	7.7	6.9	7.3	Yes
Eynesbury	Weekly	157	7.7	6.9	7.4	Yes
Gisborne	Weekly	274	9.2	6.8	7.4	Yes
Lancefield	Weekly	104	8.1	7.5	7.9	Yes
Lerderderg	Weekly	260	8.0	6.8	7.5	Yes
Macedon[3]	Weekly	67	9.2	7.0	8.2	Yes
Maddingley	Weekly	156	8.0	7.1	7.6	Yes
Melton South	Weekly	192	8.2	7.0	7.3	Yes
Merrimu	Weekly	123	8.8	7.1	7.7	Yes
Mount Macedon	Weekly	70	9.4	7.5	8.4	Yes
Myrniong	Weekly	186[3]	8.8	7.0	7.5	Yes
Riddells Creek	Weekly	109	9.1	7.1	8.0	Yes
Rockbank	Weekly	159	8.6	6.9	7.3	Yes
Romsey	Weekly	312	7.9	7.2	7.6	Yes
Sunbury	Weekly	228	9.3	7.0	7.5	Yes
Toolern Vale	Weekly	104	8.8	7.1	7.5	Yes
Woodend	Weekly	211	9.4	6.9	7.7	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. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

Iron

Table A25: 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	57	0.09	0.02	0.04	Yes
Darley	Quarterly	24	0.08	0.01	0.04	Yes
Diggers Rest	Quarterly	26	0.07	0.03	0.04	Yes
Eynesbury	Quarterly	28	0.18	0.03	0.07	Yes
Gisborne	Quarterly	127	0.26	0.01	0.04	Yes
Lancefield	Quarterly	16	0.01	0.01	0.01	Yes
Lerderderg	Quarterly	29	0.08	0.01	0.03	Yes
Macedon	Quarterly	13	0.07	0.01	0.04	Yes

Maddingley	Quarterly	22	0.06	0.01	0.03	Yes
Melton South	Quarterly	4	0.06	0.03	0.04	Yes
Merrimu	Quarterly	35	0.07	0.01	0.03	Yes
Mount Macedon	Quarterly	12	0.08	0.01	0.04	Yes
Myrniong	Quarterly	44[3]	0.04	0.01	0.02	Yes
Riddells Creek	Quarterly	12	0.08	0.01	0.04	Yes
Rockbank	Quarterly	61	0.24	0.02	0.05	Yes
Romsey	Quarterly	52	0.03	0.01	0.01	Yes
Sunbury	Quarterly	97	0.09	0.01	0.04	Yes
Toolern Vale	Quarterly	8	0.05	0.01	0.03	Yes
Woodend	Quarterly	81	0.06	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. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

Aluminium

Table A26: 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	57	0.04	0.08	0.01	Yes
Darley[4]	Quarterly	24	0.05	0.10	0.02	Yes
Diggers Rest	Quarterly	26	0.05	0.07	0.02	Yes
Eynesbury[4]	Quarterly	28	0.05	0.09	0.02	Yes
Gisborne	Quarterly	68	0.06	0.15	0.02	Yes
Lancefield[4]	Quarterly	56	0.01	0.02	0.01	Yes
Lerderderg[4]	Quarterly	29	0.04	0.08	0.02	Yes
Macedon	Quarterly	5	0.08	0.12	0.04	Yes
Maddingley[4]	Quarterly	22	0.04	0.09	0.02	Yes
Melton South[4]	Quarterly	4	0.05	0.06	0.03	Yes
Merrimu[4]	Quarterly	35	0.04	0.11	0.01	Yes
Mount Macedon	Quarterly	4	0.09	0.13	0.04	Yes
Myrniong[4]	Quarterly	44[5]	0.02	0.04	0.01	Yes
Riddells Creek	Quarterly	4	0.07	0.13	0.02	Yes
Rockbank	Quarterly	73	0.04	0.10	0.01	Yes
Romsey	Quarterly	132	0.02	0.06	0.01	Yes
Sunbury	Quarterly	69	0.04	0.09	0.01	Yes
Toolern Vale[4]	Quarterly	8	0.05	0.07	0.01	Yes
Woodend[4]	Quarterly	121	0.03	0.11	0.01	Yes

1. Compliance as measured against the guideline values set out in ADWG for acid soluble aluminium in drinking water based on health considerations should not exceed 0.2mg/l.

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

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

Appendix 4 - Water quality compliance results cont.

A4.7 Drinking water aesthetics results cont.

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	13	26	13	20	Yes
Darley	Quarterly	24	160	16	54	Yes
Diggers Rest	Quarterly	12	24	15	17	Yes
Eynesbury	Quarterly	16	38	14	19	Yes
Gisborne	Quarterly	31	130	18	84	Yes
Lancefield	Quarterly	16	110	53	76	Yes
Lerderderg	Quarterly	16	91	15	50	Yes
Macedon	Quarterly	8	110	26	76	Yes
Maddingley	Quarterly	8	82	17	47	Yes
Melton South	Quarterly	4	19	15	17	Yes
Merrimu	Quarterly	4	78	17	33	Yes
Mount Macedon	Quarterly	8	110	27	80	Yes
Myrniong	Quarterly	15	190	90	116	Yes
Riddells Creek	Quarterly	12	130	21	75	Yes
Rockbank	Quarterly	8	19	15	17	Yes
Romsey	Quarterly	28	100	56	82	Yes
Sunbury	Quarterly	13	23	13	18	Yes
Toolern Vale	Quarterly	8	92	17	53	Yes
Woodend	Quarterly	28	74	18	36	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

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	13	10	3	6
Darley	Quarterly	24	22	4	8
Diggers Rest	Quarterly	12	6	4	5
Eynesbury	Quarterly	16	6	4	5
Gisborne	Quarterly	31	29	5	18
Lancefield	Quarterly	16	17	8	11
Lerderderg	Quarterly	16	12	4	7
Macedon	Quarterly	8	28	7	19
Maddingley	Quarterly	8	10	4	7
Melton South	Quarterly	4	5	4	4
Merrimu	Quarterly	4	10	4	6
Mount Macedon	Quarterly	8	29	8	20
Myrniong	Quarterly	15	34	14	22
Riddells Creek	Quarterly	12	29	6	18
Rockbank	Quarterly	8	5	4	4
Romsey	Quarterly	28	19	10	15
Sunbury	Quarterly	13	7	3	5
Toolern Vale	Quarterly	8	16	4	9
Woodend	Quarterly	28	16	3	6

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.

Appendix 4 - Water quality compliance results cont.

A4.7 Drinking water aesthetics results cont.

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	13	1.4	0.4	1.1
Darley	Quarterly	24	26.0	1.2	8.1
Diggers Rest	Quarterly	12	1.9	1.3	1.4
Eynesbury	Quarterly	16	6.4	1.1	1.9
Gisborne	Quarterly	31	14.0	1.5	9.4
Lancefield	Quarterly	16	18.0	7.5	11.9
Lerderderg	Quarterly	16	15.0	1.3	8.0
Macedon	Quarterly	8	9.6	1.6	6.7
Maddingley	Quarterly	8	14.0	1.3	7.2
Melton South	Quarterly	4	1.5	1.3	1.4
Merrimu	Quarterly	4	13.0	1.1	4.3
Mount Macedon	Quarterly	8	9.3	1.6	7.1
Myrniong	Quarterly	15	27.0	11.0	15.1
Riddells Creek	Quarterly	12	13.0	1.1	7.1
Rockbank	Quarterly	8	1.7	1.2	1.4
Romsey	Quarterly	28	14.0	7.6	11.1
Sunbury	Quarterly	13	1.8	1.2	1.4
Toolern Vale	Quarterly	8	15.0	1.2	7.7
Woodend	Quarterly	28	8.5	2.2	5.1

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

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	12	0.063	0.002	0.012	Yes
Darley	Monthly	32	0.010	0.002	0.002	Yes
Diggers Rest	Monthly	12	0.210	0.002	0.071	Yes
Eynesbury	Monthly	25	0.003	0.002	0.002	Yes
Gisborne	Annually[3]	13	0.006	0.002	0.002	Yes
Lancefield	Monthly	24	0.002	0.002	0.002	Yes
Lerderderg	Monthly	24	0.004	0.002	0.002	Yes
Macedon	Annually[3]	1	0.005	0.005	0.005	Yes
Maddingley	Monthly	16	0.006	0.002	0.003	Yes
Melton South	Monthly	12	0.007	0.002	0.003	Yes
Merrimu	Monthly	12	0.005	0.002	0.002	Yes
Mount Macedon	Annually[3]	5	0.003	0.002	0.002	Yes
Myrniong	Monthly	42[4]	0.005	0.002	0.003	Yes
Riddells Creek	Annually[3]	2	0.013	0.004	0.009	Yes
Rockbank	Monthly	16	0.010	0.002	0.003	Yes
Romsey	Monthly	36	0.260	0.011	0.201	Yes
Sunbury	Monthly	40	0.300	0.002	0.136	Yes
Toolern Vale	Monthly	16	0.012	0.002	0.003	Yes
Woodend	Monthly	37	0.006	0.002	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 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. Sampling for ammonia in these localities was reduced due to the change in disinfection method from chloramination to chlorination

4. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

Appendix 4 - Water quality compliance results cont.

A4.7 Drinking water aesthetics results cont.

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	53	4	2	2	Yes
Darley	Weekly	312	6	2	2	Yes
Diggers Rest	Weekly	104	6	2	3	Yes
Eynesbury	Weekly	157	8	2	3	Yes
Gisborne	Weekly	120	6	2	2	Yes
Lancefield	Weekly	104	6	2	2	Yes
Lerderderg	Weekly	260	4	2	2	Yes
Macedon	Weekly	60	4	2	2	Yes
Maddingley	Weekly	156	4	2	2	Yes
Melton South	Weekly	53	4	2	2	Yes
Merrimu	Weekly	123	6	2	2	Yes
Mount Macedon	Weekly	60	4	2	2	Yes
Myrniong	Weekly	121[3]	6	2	2	Yes
Riddells Creek	Weekly	60	4	2	2	Yes
Rockbank	Weekly	53	4	2	2	Yes
Romsey	Weekly	260	6	2	3	Yes
Sunbury	Weekly	111	8	2	3	Yes
Toolern Vale	Weekly	104	4	2	2	Yes
Woodend	Weekly	211	4	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. One missed sample due to laboratory scheduling error. The requirements of the Safe Drinking Water Regulations 2015 were met however the additional sample is part of the routine sample program

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	2	6	4	5	Yes
Darley	Annually	1	34	34	34	Yes
Diggers Rest	Annually	1	6	6	6	Yes
Eynesbury	Annually	1	7	7	7	Yes
Gisborne	Annually	4	35	5	25	Yes
Lancefield	Annually	3	41	36	39	Yes
Lerderderg	Annually	1	34	34	34	Yes
Macedon	Annually	1	32	32	32	Yes
Maddingley	Annually	1	36	36	36	Yes
Melton South	Annually	1	6	6	6	Yes
Merrimu	Annually	1	34	34	34	Yes
Mount Macedon	Annually	1	34	34	34	Yes
Myrniong	Annually	1	44	44	44	Yes
Riddells Creek	Annually	1	33	33	33	Yes
Rockbank	Annually	1	6	6	6	Yes
Romsey	Annually	1	30	30	30	Yes
Sunbury	Annually	2	5	4	5	Yes
Toolern Vale	Annually	1	37	37	37	Yes
Woodend	Annually	5	46	26	31	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: people who suffer from severe hypertension or congestive heart failure need to be aware the sodium concentration in their drinking water should not exceed 20 mg/L)

Appendix 4 - Water quality compliance results cont.

A4.7 Drinking water aesthetics results cont.

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	0.004	0.001	0.002	Yes
Darley	Quarterly	4	0.005	0.002	0.004	Yes
Diggers Rest	Quarterly	4	0.003	0.002	0.002	Yes
Eynesbury	Quarterly	4	0.009	0.003	0.007	Yes
Gisborne	Quarterly	6	0.005	0.002	0.003	Yes
Lancefield	Quarterly	5	0.010	0.003	0.005	Yes
Lerderderg	Quarterly	4	0.005	0.002	0.004	Yes
Macedon	Quarterly	5	0.004	0.001	0.002	Yes
Maddingley	Quarterly	4	0.005	0.003	0.004	Yes
Melton South	Quarterly	4	0.013	0.003	0.009	Yes
Merrimu	Quarterly	4	0.003	0.001	0.002	Yes
Mount Macedon	Quarterly	4	0.017	0.001	0.006	Yes
Myrniong	Quarterly	4	0.009	0.002	0.004	Yes
Riddells Creek	Quarterly	4	0.002	0.001	0.002	Yes
Rockbank	Quarterly	4	0.014	0.002	0.006	Yes
Romsey	Quarterly	4	0.007	0.001	0.004	Yes
Sunbury	Quarterly	4	0.009	0.001	0.004	Yes
Toolern Vale	Quarterly	4	0.004	0.001	0.003	Yes
Woodend	Quarterly	6	0.006	0.001	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 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

Sulfate

Table A34: Sulfate (as SO_4) 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	1	1	1	Yes
Darley	Annually	1	18	18	18	Yes
Diggers Rest	Annually	1	1	1	1	Yes
Eynesbury	Annually	1	5	5	5	Yes
Gisborne	Annually	3	63	43	56	Yes
Lancefield	Annually	3	20	5	10	Yes
Lerderderg	Annually	1	18	18	18	Yes
Macedon	Annually	1	64	64	64	Yes
Maddingley	Annually	1	19	19	19	Yes
Melton South	Annually	1	4	4	4	Yes
Merrimu	Annually	1	19	19	19	Yes
Mount Macedon	Annually	1	64	64	64	Yes
Myrniong	Annually	1	44	44	44	Yes
Riddells Creek	Annually	1	56	56	56	Yes
Rockbank	Annually	1	4	4	4	Yes
Romsey	Annually	1	10	10	10	Yes
Sunbury	Annually	1	1	1	1	Yes
Toolern Vale	Annually	1	19	19	19	Yes
Woodend	Annually	5	49	19	31	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 Risk Management Plan (DWRMP), 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 DWRMP 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 2016/17 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 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 2016/17.

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 2016/17.

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

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 prior to the off-take entry point to Western Water's region was monitored by Melbourne Water during 2016/17. Western Water receives monthly water quality reports from Melbourne Water for Greenvale and Silvan reservoirs, which include information on algal populations. Melbourne Water 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.

Table A35: List of all source water parameters monitored during 2016/17

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 @ 25°C	Physical

Parameter	Type
Escherichia coli	Microbiological
Faecal streptococci	Microbiological
Fluoride*	Chemical inorganics
FRNA Coliphage	Microbiological
Giardia spp.	Microbiological
Gross alpha activity	Radiological
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

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 (NH_3)	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 (NH_2Cl), 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
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.

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 ($N0_3$)	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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