WESTERN WATER

Water Quality Report 2013/14

Contents

Introduction

About Western Water

Western Water provides water, recycled water and sewerage services to 59,660 properties - with a population of 159,800 - across a region of 3,000 square kilometres to the north-west of Melbourne.

Historically, this region has been one of the fastest growing in the state, with average population growth rates of 3-4% per annum over the past decade.

In the past year, however, the region experienced lower population growth of 1.0% while serviced properties grew by 2.4% in the same period. This lower rate of population growth, particularly compared to higher growth in properties, is ascribed to the combined effect of smaller household sizes and a lag in new home occupancy.

In coming years, housing development in Melton and Sunbury will continue to attract new residents, and a return to higher population growth rates is forecast for Western Water's service region.

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. During the reporting period, 1 July 2013 to 30 June 2014, the relevant minister was the Hon Peter Walsh MLA, Minister for Water.

Western Water is responsible to the Minister for Water via the Department of Environment and Primary Industries (DEPI) and the Office of Living Victoria (OLV). The Department of Treasury and Finance (DTF) also has a shareholder governance role.

The Department of Health (DH) 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 2005, 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 DH Drinking Water Regulatory Unit is responsible for administering the regulatory framework, the key objectives of which are to ensure that:

- any water supplied as drinking water is safe to drink
- water quality information is available to consumers and open to public accountability
- any water that is not intended as drinking water cannot be mistaken for drinking water
- overseeing the management of incidents affecting drinking water quality, and
- ensuring compliance with the Australian Drinking Water Guidelines to ensure customer safety.

10ML Drinking water storage tank, Rosslynne WFP

2013/14 Highlights

- Safely delivered 12,648 million litres of drinking water to 57,000 properties
- Successfully passed regulatory audit by Department of Health
- 100% compliance with the *Safe Drinking Water Act 2003* and all parameters specified in the Safe Drinking Water Regulations 2005
- Continued independent certification of Western Water's Hazard Analysis and Critical Control Point system, passing an external audit in February 2013
- Resolution of 210 water quality complaints, working with customers to understand the root cause and addressing issues identified
- Completed $3.9 million upgrade at Rosslynne Water Filtration Plant to improve water quality and return region to 100% local water supply
- Completed construction of the $2.0 million Lancefield-Romsey pipeline, and
- Connected Romsey borefield to the water supply system in November 2013, to augment surface water supplies.

Table 1: Drinking water statistics FY 13 vs FY14

	2012/13	2013/14
Connected water customers	55,481	56,930
- Residential	52,534	53,939
- Non-residential	2,947	2,991
Water consumption (ML)	12,830	12,648
- Residential	9,525	9,794
- Non-residential	1,680	1,716
- Water losses	1,626	1,138
Water mains (km)	1,823	1,955
Water filtration plants	7	7
Chlorination plants	14	14

Foreword from the Managing Director

Since Western Water was established in 1995, we have developed a strong track record for delivering safe, quality and affordable water, sewerage and recycled water services and maintaining high levels of customer satisfaction.

During 2013/14, Western Water safely delivered 12,648 million litres of drinking water to a population of 159,800 from a combination of local water supplies and the Melbourne supply system. Almost three quarters (74%) of all drinking water supplied was sourced from local catchments, compared to 20% in the prior year.

Completion of $3.9 million upgrade at Rosslynne Water Filtration Plant returned the region to 100% local water supply for the first time in many years. The works addressed operational efficiency and drinking water aesthetics. However, the changeover resulted in a spike in customer complaints in April due to changes in taste and odour for customers in the Rosslynne supply system.

To guarantee future supply, it is essential that we make the most of our local water resources while maintaining the flexibility of being connected to the Melbourne system. This is reflected in our new Whole-of-water-cycle Strategy.

Western Water connected the Romsey borefield to the water supply system in November 2013, to augment surface water supplies for the town. Bore water made up 10% of Romsey's total drinking water in the reporting period.

After many years of reliance on limited surface water supplemented by borewater supplies in Lancefield, Western Water constructed a $2 million pipeline to link Lancefield to the Romsey supply system and via Romsey, to the broader regional supply network including Melbourne water. The pipeline will increase water availability for Lancefield.

Committed to drinking water quality

We are pleased to report that all 19 water sampling localities in Western Water's region complied with the *Safe Drinking Water Act 2003* and all parameters specified in the Safe Drinking Water Regulations 2005.

Our multi-barrier approach to protecting drinking water quality was validated in April 2014 when Western Water was found fully compliant with the *Safe Drinking Water Act 2003* by a Department of Health regulatory audit.

In December 2013, Western Water also passed an external hazards and critical control points (HACCP) audit for drinking water quality.

Proactively managing risk

Western Water is aware of the responsibility it bears to provide safe 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 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 2013/14 Water Quality Report to customers, stakeholders and regulators.

Neil Brennan, Managing Director

October 2014

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 2005. 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 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 continued 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
- education to 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 received independent certification again in the reporting period, validating our multi-barrier approach to protecting drinking water quality.

Engaging stakeholders

Ensuring Western Water has sustainable, resilient water services systems requires a consultative, collaborative approach with all stakeholders; engaging customers, the community and others in our whole-of-water-cycle philosophy, and encouraging all to make the most of local resources through choosing the right water for the purpose and conserving resources as much as possible.

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 emergency contact list which is updated regularly.

Western Water's customer advisory network is recognised as a significant stakeholder group. They are kept well informed of water quality issues and changes and, when required, facilitate consultation. Western Water's 1,000 strong online consultation panel has extended the customer base for this network.

Major external stakeholders include regulatory bodies such as the EPA, DH, DEPI 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.

Assessment of the drinking water supply system

Water supply system analysis

Western Water addresses multiple challenges to provide quality drinking water. One of the most significant has been ensuring water supply security. The impact of the millennium drought, combined with long term 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.

This year, upgrades to our water filtrations plants along with high capacity levels in local storages enabled Western Water to return to 100% local water supply for the first time in many years.

To make the most of these local sources, we have adopted whole-of-water-cycle management to ensure long term sustainability of water supply in the region. Nonetheless, the region's connection to the Melbourne supply system will remain critical for supply security.

Water supply system

Western Water utilises a cross-disciplinary team including office and plant staff to develop the risk assessment of water supply systems. 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

The Western Water region has six water supply systems:

- 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 DH in the Government Gazette. Each locality is determined by the origin of the water, the location of treatment and storage facilities and associated delivery system. These localities form the basis of our water sampling program.

Whole-of-water-cycle Strategy

Western Water's Whole-of-water cycle Strategy was developed during the reporting period. It outlines a new approach to water planning and management, safeguarding water resources for the future.

The strategy provides a platform to collaborate with regional partners and implement whole-of-water-cycle opportunities that contribute value to the community.

The whole-of-water-cycle approach aims to deliver a range of outcomes, including:

- optimising local water supplies
- maximising the beneficial reuse of recycled water
- protecting waterway heath
- enhancing liveability, and
- maintaining economic prosperity.

The strategy aims to achieve:

- maximum (greater than 95%) drinking water sourced from local supplies
- reduction of 50% in drinking water consumption in new growth areas through alternative supply, and
- 100% beneficial reuse of recycled water.

Stormwater basin, Toolern

Assessment of the drinking water supply system cont.

Table 2: Residential population by water sampling locality and town - FY 13 vs FY14

Water sampling locality	Towns	2012/13	2013/14*
Bulla	Bulla, Oaklands Junction	790	760
Darley	Darley, Pentland Hills	8,600	9,000
Diggers Rest	Diggers Rest	2,670	2,720
Eynesbury	Eynesbury	1,840	2,640
Gisborne	Gisborne, New Gisborne, Bullengarook	10,410	10,850
Lancefield	Lancefield	2,220	2,270
Lerderderg	Bacchus Marsh, Merrimu, Coimadai	8,810	8,720
Macedon	Macedon	1,870	1,840
Maddingley	Maddingley, Parwan	3,350	3,590
Melton South	Melton, Melton South, Brookfield, Hopetoun Park, Toolern, Mount Cottrell, Plumpton	31,680	32,490
Merrimu	Melton West, Kurunjang, Long Forest	27,900	27,970
Mount Macedon	Mount Macedon	1,620	1,560
Myrniong	Myrniong	300	300
Riddells Creek	Riddells Creek	3,750	3,700
Rockbank	Rockbank	1,390	1,440
Romsey	Romsey, Kerrie, Monegeetta	4,760	4,690
Sunbury	Sunbury, Clarkefield, Wildwood	40,240	39,240
Toolern Vale	Toolern Vale	490	490
Woodend	Woodend	5,610	5,530
Total		158,300	159,800

** Population estimates are based on the number of water connections to residential properties multiplied by average no. of persons per residential property for each locality, rounded to the nearest 10. Changes to the multiplier have resulted in declines in some towns where property growth has been lower.*

Drinking water sources

Most of Western Water's service region is supplied by two major local reservoirs – Rosslynne and Merrimu. Having recovered capacity significantly in recent years, these local water sources are used for drinking water supply whenever possible. In 2013/14, 74% of all drinking water supplied was sourced from local catchments, compared to 20% the year before.

The combined local reservoir storage levels dropped over the year from 84% to 68% capacity as inflows were lower than demand. To assure future water supply security, it is critical that the Western Water region remains connected to Melbourne supplies.

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

	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Rosslynne Reservoir	14%	7%	4%	3%	3%	5%	66%	72%	85%	76%
Merrimu Reservoir	22%	17%	13%	13%	10%	9%	85%	78%	76%	63%

Melbourne water supplies

Western Water has a bulk entitlement agreement with Melbourne Water to access water from the Melbourne Headworks system. This entitlement is critical during extended periods of 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.

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 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 and Upper Yarra Catchment
	Rosslynne Reservoir	Jacksons Creek Catchment
Sunbury, Goonawarra, Jacksons Hill, Clarkefield, Bulla, Oaklands Junction and Diggers Rest	Greenvale Reservoir	Yan Yean and Upper Yarra Catchment
Woodend	Graham Brock Reservoir and Reservoir C	Falls/Smokers Creek and Graham Brock Reservoir and Reservoir C Catchments
	Campaspe Reservoir	Campaspe River Catchment
	Greenvale Reservoir	Yan Yean and Upper Yarra Catchment
Myrniong	Pykes Creek Reservoir	Werribee River and Pykes Creek Catchment
	Greenvale Reservoir	Yan Yean and Upper Yarra Catchment
Romsey, Kerrie, Monegeetta	Kerrie Reservoir	Upper Bolinda Creek
	Romsey Bore	Local aquifer
	Greenvale Reservoir	Yan Yean and Upper Yarra Catchment
Lancefield	Garden Hut Reservoir	Deep Creek Catchment
	Monument Creek Weir	Monument Creek Catchment
	Bore Number 3	Local aquifer

Assessment of the drinking water supply system cont.

Smaller town supply systems

The towns of Woodend, Romsey, Lancefield and Myrniong have their own 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.

Woodend

Woodend receives treated water from two local sources: Campaspe Reservoir via the Marriages Water Filtration Plant, and the Macedon Ranges via Reservoir C Water Filtration Plant. During 2013/14, 230ML was taken from the Woodend storages. The Woodend supply was supplemented by an additional 240ML from the Macedon bulk entitlement.

Romsey

Romsey receives treated water from the Romsey Water Filtration Plant, which is supplied with raw water from Kerrie Reservoir, which in turn receives supplementary water from Wright Reservoir.

During the reporting period, 472ML was taken from the local storage with another 187ML added to the storage's drought reserve from Riddells Creek and Maribyrnong bulk entitlements. 37ML from the new Romsey Bore was used to supplement supply.

Myrniong

Myrniong receives its water supply from Pykes Creek Reservoir after treatment from the Myrniong Water Filtration Plant. A total of 38.5ML was taken from the storage during 2013/14 in compliance with its bulk entitlement.

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 the bore.

During the year, 102ML of water was taken from local surface water storages at Lancefield with another 65ML taken from Lancefield's bore water supplies.

New water source for Lancefield

Western Water completed construction of the $2.0 million Romsey-Lancefield water supply pipeline in 2013/14 to increase supply security for both towns.

Both Romsey and Lancefield now have access to local surface water and bore water supplies, as well as connection to each other's supplies and, via Romsey, to the broader Melbourne water supply network.

In addition, a filter-to-reservoir pipeline was constructed at Lancefield Water Filtration Plant to directly return any out of specification water to the reservoir ensuring ongoing public health and safety.

When local, small surface water supplies are experiencing shortages in Lancefield and Romsey in the future, these can be addressed through a combination of supply solutions including groundwater and surface water transfers from other connected systems.

Lancefield Water Filtration Plant

Assessment of water quality data

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

The WIMS 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 WIMS database to monitor trends and data from SCADA to review trends of water systems on an as needed basis.

Hazard identification and risk management

Western Water uses an established risk criteria based upon AS/NZ 4360:1999 Risk Management Standards for water quality hazards and risk assessment. In accordance with the regulatory framework, Western Water has implemented a Drinking Water QMS, including HACCP plans, for drinking water supply.

Mark Closter, Team Leader Merrimu WFP

Aquantify: Efficient assessment of water quality data

The collection and storage of water quality data is an integral component of monitoring and managing the Drinking Water Quality Management System. Historically Western Water has utilised WIMS. However, there has been a growing need for a better system with more functionality.

After extensive consultation with the water industry, a new product, Aquantify, was chosen to fulfill Western Water's increasing needs in the data collection space.

Aquantify not only has the ability to collect and store data, it can also:

- alert relevant staff when critical limits are breached
- generate automated reports and send those reports to the relevant staff member, and
- give field and office staff the ability to view water quality data instantly.

This in turn will better inform the water quality team of emerging water quality issues.

Preventative measures for drinking water supply

Western Water operates its drinking water supply systems under the Victorian S*afe Drinking Water Act 2003*, administered by the Department of Health. 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, covered within the HACCP system.

The last independent external audit by the Department of Health took place in April 2014 and confirmed Western Water is fully compliant with the requirements of the S*afe Drinking Water Act 2003*. The next audit will take place early in 2016.

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
- operation of water treatment and disinfection systems in order 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 competence assessment of operators through registered training organisations.

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 Water 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 and Lancefield, this access would involve carting water.

Water treatment practices

Drinking water sourced from unprotected catchments - such as the local raw 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 carried out primary disinfection and Western Water booster chlorinates the water as it enters our network.

Table 5: Water treatment chemicals and processes by sampling locality

Locality	System	Treatment process	Added substances	Comments
Melton South, Lerderderg, Maddingley, Darley, Merrimu, Rockbank, Toolern Vale, Eynesbury *Population supplied: 86,340*	Merrimu system (Merrimu Reservoir via Merrimu WFP)	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]	The locality returned to mainly Merrimu supply in December 2010. However, water source may vary between Melbourne water and a blend with Merrimu Reservoir. Booster chlorinators exist in 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	Sodium hexafluorosilicate[1] , Lime[2], Carbon dioxide[2], Chlorine gas[1], Sodium hypochlorite[2 3]	
Gisborne, Macedon, Mount Macedon, Riddells Creek *Population supplied: 17,950*	Rosslynne system (Rosslynne Reservoir via Rosslynne WFP)	Oxidation Absorption Coagulation pH correction Dissolved air flotation filtration Fluoridation Chlorination Additional chlorination Fluoridation and primary chlorination by Melbourne Water Secondary disinfection (chloramination) at Loemans Road pump station Additional chlorination by booster chlorinators along reticulation system as required	Aluminium sulphate, Potassium permanganate (as required), Powdered activated carbon, Polyelectrolyte, Lime[2], Carbon dioxide[2], Fluorosilicic acid, Chlorine gas, Sodium hypochlorite[3], Sodium hexafluorosilicate[1], Chlorine gas, Lime[2], Carbon dioxide[2], Sodium hypochlorite[2 3], Aqueous ammonia	Water for the most part is sourced from Melbourne. At times this can vary between Melbourne Water and a Rosslynne Reservoir/ Melbourne Water blend to ensure that Rosslynne WFP and associated infrastructure are maintained. This supply is further chlorinated at Macedon, Mount Macedon and Riddells Creek. March 2014 saw the maximisation of the Rosslynne Reservoir source when the Rosslynne WFP commenced full production of drinking water into the Sunbury system.
Sunbury, Bulla, Diggers Rest *Population supplied: 42,720*	Sunbury system (Greenvale Reservoir via Loemans Road pump station until March 2014, then return to Rosslynne Reservoir and Rosslynne WFP)			
Woodend *Population supplied: 5,530*	Woodend system (Campaspe Reservoir via Marriages WFP and Graham Brock Reservoir, Reservoir C & Greenvale Reservoir via Reservoir C WFP)	Coagulation pH correction Dissolved air flotation filtration Chlorination	Powdered activated carbon (as required at Marriages WFP), Aluminium sulphate, Polyelectrolyte, Sodium carbonate (soda ash), Sodium hypochlorite	Supply is fully treated at the Marriages WFP and Reservoir C WFP. Drinking water is supplied from two ends of the system - the Marriages Basin and Reservoir C contact tank. Prior to extensive mains cleaning in 2011, the disinfection regime was switched from chloramination to chlorination.
Romsey *Population supplied: 4,690*	Romsey system (Kerrie Reservoir, Romsey Bore & Greenvale Reservoir via Romsey Water Filtration Plant)	Microfiltration Chloramination Fluoridation by Melbourne Water[4]	Poly aluminium chlorohydrate (as required), Sodium hypochlorite, Sodium hydroxide, Aqueous ammonia	Changes to the disinfection mode in this locality are planned for late 2014.
Lancefield *Population supplied: 2,270*	Lancefield system (Garden Hut Reservoir and groundwater)	Coagulation pH correction Filtration Dissolved air flotation filtration Chlorination	Aluminium chlorohydrate (as required), Sodium hydroxide (caustic soda), Potassium permanganate, Powdered activated carbon, Sodium hypochlorite	The Lancefield system is now connected to Romsey via a raw water pipeline which will see the transfer of water from Kerrie Reservoir into Lancefield Basin.
Myrniong *Population supplied: 300*	Pykes Creek Reservoir	Coagulation Oxidation pH correction Dissolved air flotation filtration Chlorination Fluoridation by Melbourne Water[5]	Powdered activated carbon (as required), Potassium permanganate, Aluminium sulphate, Polyelectrolyte, Sodium carbonate (soda ash), Chlorine gas, Sodium hexafluorosilicate[5]	

1 Chemicals may be added by Melbourne Water for treatment and chlorination.
2 Chemicals added by Western Water for additional disinfection at entry point from Melbourne Water mains.
3 Chemicals added by Western Water throughout the distribution system to increase chlorine residual levels.
4 When receiving water from Melbourne Water through transfer to Wright Reservoir from Sunbury (Sunbury System).
5 When receiving water from Melbourne Water through water carting from Bacchus Marsh (Merrimu System).

Preventative measures for drinking water supply cont.

Water treatment practices cont.

Filtration

Western Water operates seven water filtration plants (WFPs) and an additional 15 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. Powdered activated carbon is also utilised to combat taste and odours produced by high concentrations of naturally occurring organic carbon.

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.

The pH level in the water 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 level of water sourced from Melbourne must be maintained within the ADWG specified range of 6.5-8.5 pH units.

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 during the reporting period, made possible with financial assistance from the Department of Health. 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.

Table 6: Fluoridated and non-fluoridated water supply by town

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

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 2013/14, Western Water supplied 56,930 connected properties with drinking water through 1,955 km 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. The number of water main bursts during 2013/14 was less than previous years.

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

	2009/10	2010/11	2011/12	2012/13	2013/14
Bursts per 100km of water main	17.0	14.0	18.0	18.8	14.0

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 continuing in partnership with Casey Inspections.

Rosslynne WFP quality upgrades

Upgrades at Rosslynne WFP were completed during the reporting period, and include a new powdered activated carbon (PAC) treatment plant to address taste and odour issues with the reservoir water.

The PAC treatment absorbs dissolved organics that are otherwise less able to be removed by the treatment process.

A fluoridation system has also been added to Rosslynne WFP's water treatment practices, to bring the plant in line with State Government fluoridation policy.

PAC tank construction, Rosslynne WFP

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. Appendix 3 includes this certificate.

Drinking water in O'Shannassy Street, Sunbury

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:

- Powdered 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 and 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 2013/14.

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 testing

Verification of drinking water quality

The Drinking Water Regulatory Unit at the Department of Health regulates the safety of drinking water supplied by all Victorian water corporations.

Drinking water quality monitoring

Western Water closely monitors the quality of drinking water to ensure compliance with the Safe Drinking Water Regulations 2005.

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 also 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 reservoir, 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 testing is undertaken through an independent laboratory accredited by the National Authority of Testing Association (NATA).

In addition to testing methods being NATA accredited, the parameters listed in the table in Schedule 2 of the Safe Drinking Water Regulations 2005 are to be analysed by DH approved drinking water analysts.

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 2013/14, all 19 water sampling localities complied with the microbiological requirement that at least 98% of the drinking water samples collected in a 12 month period must have zero *Escherichia coli (E.coli)* organisms per 100 millilitres, as determined by the Safe Drinking Water Regulations 2005 and the ADWG.

Table 8 provides a snapshot of Western Water's compliance on key health and aesthetic parameters for drinking water quality. *E.coli* and turbidity are core indicators of drinking water health and turbidity, pH level and true colour are core indicators of drinking water aesthetics.

Table 8: Drinking water quality compliance

	2009/10	2010/11	2011/12	2012/13	2013/14
E.coli	100.0%	99.9%	100.0%	99.1%	100.0%
Turbidity	100.0%	94.8%	100.0%	100.0%	100.0%
pH level	92.1%	91.0%	89.5%	100.0%	89.5%
Colour, true	100.0%	99.0%	100.0%	100.0%	100.0%

In 2014, Western Water successfully passed its third Regulatory Audit by DH for its Drinking Water RMP under the *Safe Drinking Water Act 2003*. The next audit is scheduled for 2016.

Full details of Western Water's drinking water quality compliance are contained in Appendix 5, with all parameters measured compliant during the year including:

- *Escherichia coli (E. coli)*
- Chlorine-based disinfection by-product chemicals
  - Trihalomethanes
  - Chloroacetic acid
  - Dichloroacetic acid
  - Trichloroacetic acid
- Other parameters
  - Aluminium
  - Turbidity
  - Fluoride
- Other chemicals not specified in the standards but may pose a risk to human health: manganese, lead, copper, arsenic, chlorine dioxide, nickel, total chlorine, chromium, cyanide, mercury, nitrate, nitrite, selenium, carbon tetrachloride, and cadmium.

Drinking water aesthetics

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 hot water services. Routine measurement parameters for drinking water aesthetics include the pH level, iron, hardness, calcium, magnesium, ammonia, true colour, sodium, total dissolved solids, and sulphate.

These results are measured in accordance with the aesthetic and health measures in the ADWG. Compliance calculations hereafter are based on mean results for samples taken throughout the year, as outlined in the ADWG. Further descriptions of the aesthetic parameters can be found in Appendix 5. The majority of drinking water aesthetics parameters were compliant during 2013/14.

Raw water monitoring

One of the key components of Western Water's Drinking Water RMP is the extensive raw water monitoring program aimed at increasing the understanding of the raw 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 raw water monitoring program was undertaken during 2013/14. An overview of the parameters tested, frequency of testing at each sampling location for pesticides, chemicals (organics and in-organics), metals, physical and radiological parameters and their results are enclosed in Appendix 6.

Microbiological monitoring

In addition to the raw water monitoring conducted by an independent NATA accredited laboratory, raw 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 raw 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 raw water provided valuable information in assessing the quality of the raw water at various times during 2013/14.

This information allows Western Water to monitor the changes in conditions of raw 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 their water storage manager SRW with regular results on BGA numbers provided to Western Water. This approach allows for 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.

Table 9: Blue green algae notification from SRW

Location of incident	Nature of incident	Drinking water supply potentially affected	Date and duration of incident
Merrimu Reservoir	Level 2 Bloom Alert	Melton South, Bacchus Marsh, Eynesbury, Rockbank and Toolern Vale	3/9 – 10/9/2013 1 week
Rosslynne Reservoir	Level 2 Bloom Alert	Sunbury, Gisborne, Macedon, Mount Macedon, Riddells Creek, Diggers Rest and Bulla	31/3–7/04/2014 1 week

Western Water did not report either of these alerts as a section 22 notification to the Department of Health. Follow up sampling from the off-take level to the relevant treatment plants was conducted and results showed no BGA issue at the depth the water was being extracted. Thus, there was no concern for water production or safety.

Customer satisfaction

Previously an annual program, Western Water now conducts major customer satisfaction research each two years in May. The next survey is scheduled for 2015.

Water quality complaints

Western Water's holistic approach ensures any complaint is managed from receipt to resolution, ensuring fast and effective resolution and minimal adverse customer impact. Action is taken on all water quality related complaints. This action can include verbal advice, further investigation, on-site inspection and testing, and works to improve water supply.

In accordance with the ADWG, Western Water adopted a benchmark for water quality complaints of 4 complaints per 1,000 customers. This benchmark was met again in 2013/14 with Western Water receiving 3.68 complaints per 1,000 customers (or 0.368 complaints per 100 properties as per DH reporting requirements).

During 2013/14, overall customer complaints increased by 15%. This was mainly due to water quality issues resulting from changing water sources from Melbourne Water to local sources in the Rosslynne supply system.

This system supplies Sunbury and Gisborne as well as several smaller towns. While still meeting health and aesthetic guidelines for drinking water quality, local supplies had different taste and odour characteristics from Melbourne Water's.

Table 10: Water quality complaints per 1,000 customers - 5 years

	2009/10	2010/11	2011/12	2012/13	2013/14
Complaints per 1,000 customers	2.14	3.48	3.07	3.25	3.68

Table 11: Customer complaints FY13 vs FY14

Complaint category	2012/13	2013/14
Water quality	180	210
Other complaints	40	44
Total	220	254

Drinking water in Riddells Creek

Water quality complaints by locality

In 2013/14, four localities recorded 10 or more complaints. The highest level of complaints per 100 customers was recorded in Sunbury. This was largely due to the reinstatement of Rosslynne-produced water into the Sunbury system which generated additional taste and odour complaints from this locality.

All taste and odour complaints for the Sunbury locality were recorded after the introduction of Rosslynne water in late March 2014.

The Melton South locality rated second highest for water quality complaints with 50% of complaints in relation to dirty water. This system is scheduled to be air scoured during 2014/15.

Table 12: Water quality complaints by locality

Locality	Complaints	Complaints per 100 customers[1]
Bulla	2	0.004
Darley	6	0.010
Diggers Rest	3	0.005
Eynesbury	4	0.007
Gisborne	8	0.014
Lancefield	7	0.012
Lerderderg	4	0.007
Macedon	2	0.004
Maddingley	11	0.019
Melton South	48	0.084
Merrimu	16	0.030
Mount Macedon	4	0.007
Myrniong	0	0.000
Riddells Creek	7	0.012
Rockbank	0	0.000
Romsey	4	0.007
Sunbury	79	0.140
Toolern Vale	1	0.002
Woodend	4	0.007

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

Table 13: Water quality complaints by type and locality

Complaint type	Complaints	Complaints per 100 customers	Localities by highest number of complaints		
			1st	2nd	3rd
Taste/odour	82	0.15	Sunbury	Melton South	Maddingley
Dirty/discoloured	89	0.15	Melton South	Sunbury	Merrimu
White water	27	0.047	Melton South	Sunbury	Maddingley
Illness	3	0.005	Melton South	Mount Macedon	N/A
Other	9	0.015	Sunbury	Lancefield	Melton South
Total	210	0.368			

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.

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.

Incidents reported under section 22 Safe Drinking Water Act 2003

a. Gisborne Road Tank, 2 Dec 2013 (Lerderderg locality)

Issue

Routine sampling at the tank resulted in detection of 1 org/100ml of faecal streptococci in the presence of 0.01mg/L free chlorine and 0.06mg/L of total chlorine.

Actions

The tank was isolated from supply and spot dosed. While the tank was isolated, freshly chlorinated water was pumped into the reticulation system via a local chlorine booster station.

Flushing was also conducted at the extremities of the system in order to ensure increases in chlorine residuals were met.

Operational site visits to the tank were increased along with spot dosing and works to increase water turnover in the tank.

Resampling was conducted for three consecutive days with all results clear for the tank. However, one reticulation site downstream of the tank returned positive results for faecal streptoccoci despite increases in chlorine across the system.

The reticulation site in question was inspected. The sample tap was an old garden-style tap fitting which brought into question the integrity of the sample collected. A new click-in fitting was installed and the reticulation site resampled for three further days with all results remaining clear.

b. Dickson's Overpass Incident, 28 Dec 2013 (Darley locality)

Issue

Routine sampling at the Dicksons Road Overpass resulted in an *E.coli* detection of 3 orgs/100ml in the presence of 0.01mg/L free chlorine and 0.07ml/L total chlorine.

Actions

The two tanks supplying this system were immediately spot dosed then flushing works were carried out at the extremities to pull chlorine residuals through the network. Resampling was conducted for three consecutive days with clear results.

Investigations were carried out in this system with backflow suspected to be the root cause. Western Water's backflow prevention officer conducted backflow audits of the Dicksons tanks and also one other privately owned tank that was considered a potential source. Both audits showed that these tanks were not a backflow risk.

Works are underway to install a small booster chlorination station at the beginning of the Dicksons tank system to ensure chlorine residuals are maintained and thus improve the water quality in that system.

c. Stamford Hill Tank, 9 Jan 2014 (Lerderderg locality)

Issue

Routine sampling at the Stamford Hill tank resulted in a faecal streptococci detection of 1 org/100ml in the presence of 0.01mg/L free chlorine and 0.06mg/L total chlorine.

Actions

As per procedure, this tank was spot dosed and resampling conducted at the tank and two reticulation sites downstream of the tank. All results were clear of any microbiological detection.

This tank receives freshly chlorinated water from a nearby booster chlorination station. It was thought that there may be some short circuiting occurring in the tank. This was investigated through an extensive system analysis of historical chlorine residuals in the reticulation system supplied by this tank.

The analysis revealed that despite having a chlorine dosing system located just before the tank, the water leaving the tank showed low chlorine residuals.

Future works for this site include the installation of a mixer to alleviate short circuiting and increase chlorine residuals in the reticulation system. The root cause for this detection was suspected to be sample tap contamination.

d. Minns Road Tank B, 25 Jan 2014 (Melton South locality)

Issue

Routine sampling at the Minns Road tanks resulted in a single *E.coli* detection at tank B. Tanks A and C were also sampled and were clear of any detections.

Actions

Tank B was isolated from supply, an integrity inspection was conducted and the tank was spot dosed with chlorine to increase residuals.

The tank was resampled for three consecutive days and remained isolated until all results were clear. Suspected cause was sample contamination as all other sites, including Minns Rd tanks A and C, were clear.

e. Stamford Hill and Gisborne Road Tanks, 7 Feb 2014 (Lerderderg locality)

Issue

Routine sampling resulted in two detections of faecal streptococci at two separate tanks, on Stamford Hill and Gisborne Road. The results were 2 orgs/100ml and 4 orgs/100ml respectively.

Actions

Both tanks were spot dosed and resampling was then conducted over three consecutive days with all follow up results remaining clear.

At the time of the detections it was noted that the chlorine residuals were dropping away rapidly from the treatment plant. Investigation into the water quality showed an increase in dissolved organics as well as soluble manganese. The water being treated at the time was a blend of Merrimu water and Djerriwarrh Reservoir water.

The Djerriwarrh Reservoir water was found to be the source of the organics and manganese. Blending was discontinued and 100% Merrimu water was supplied with chlorine residuals stabilising shortly afterwards.

f. Mundy Road sentinel site, 13 Feb 2014 (Sunbury locality)

Issue

Sentinel sites are routinely sampled weekly to ascertain any early indications of water quality changes. A routine sample at the Mundy Road sentinel site resulted in a positive detection for *E.coli* (1org/100ml).

Actions

The system was immediately flushed extensively to pull fresh water through to the extremity. Resampling was then conducted for three consecutive days with each sampling effort requiring the collection of a set of three samples, five minutes apart. The first resample returned a further positive result for faecal streptococci (2orgs/100ml) indicating that system ingress had occurred. All follow up results were clear.

These detections were immediately preceded by a major bushfire in the Sunbury/Riddells Creek water quality localities. The CFA were drawing on the drinking water system in the immediate vicinity of the sample point with two trucks reporting that they were experiencing low water pressure at the time. This indicates a high likelihood that backflow may have occurred from either one or both trucks.

The key learnings from this issue were that the reticulation system is vulnerable when under significant pressure due to bushfire.

g. Riddell Road Tank Incident, 20 Feb 2014 (Sunbury locality)

Issue

Routine sampling at the Riddell Road tank resulted in an *E.coli* detection of 2 orgs/100ml.

Actions

An incident was declared at a minor level 1 level due to the possible impact. The tank was spot dosed and an integrity inspection carried out with no obvious issues found.

A network trace was conducted to identify the impacted supply area and Western Water's communications team were engaged to organise the logistics around a potential boil water alert should the follow up sampling return positive results.

Resampling was conducted at the tank and two reticulation sites downstream in an effort to increase the data set, with three sets of samples collected at each site for three consecutive day. All resampling was clear.

A key learning from this incident is comprehending the logistics involved in delivering a boil water notice when the impacted number of properties is large (in this instance 1,825).

Incident management and emergency response cont.

h. Ochiltree Tank, 25 Feb 2014 (Romsey locality)

Issue

Routine sampling at the Ochiltree tank resulted in a detection of *E.coli* at 2 orgs/100ml.

Emerging water quality issues with manganese in the source water were being identified at the same time that this detection occurred. Water quality in the source water had deteriorated (increasing manganese) as a result of aeration failure.

Actions

The tank was spot dosed at the time of the detection and an ongoing spot dosing regime was developed. The tank was resampled for three consecutive days without further detections.

Corrective actions at the source water were to install emergency submersible pumps in the reservoir in order to generate oxidation of the soluble manganese.

Installation of mixers in the two clear water storages at the treatment plant has now been completed in readiness for switching the disinfection mode from chloramination to chlorination.

i. Shepherds Lane Tank, 8 May 2014 (Bulla locality)

Issue

Routine sampling resulted in a positive *E.coli* detection of 1 org/100ml at the Shepherds Lane tank.

Actions

As per procedure, the tank was spot dosed and resampling was conducted for three consecutive days at the tank and at one reticulation site downstream. The cause of the detection was considered to be potential ingress into the tank, along with low chlorine residuals.

The operating regime of the system had changed dramatically since the introduction of local water sources. Water age has been an ongoing issue at this site and actions have been identified for implementation in this system in the future.

These corrective actions include the installation of a small pump to create extra demand on the Shepherds Lane tank, thus exercising the chloramination dosing system at Loemans Road and increasing chlorine residuals in the tank.

On the second day of the resampling, an *E.coli* was detected at the reticulation site downstream of the tank and an incident was declared (see following entry for further details).

Incidents not reported under section 22 Safe Drinking Water Act 2003

a. Bulla *E.coli* detection, 8 May 2014

Following on from the *E.coli* detection at the Shepherds Lane tank (refer previous entry), this detection occurred whilst resampling the Shepherds Lane tank system. A separate section 22 was not raised as the results were included in the report already raised for the forementioned detection at the Shepherds Lane tank.

Actions

The tank was again spot dosed, with target chlorine level achieved of 1.2mg/L. Once the dosing had occurred an extensive flushing regime was undertaken to pull freshly chlorinated water through the system. Six sites were chosen as flushing points and were systematically flushed for 30 minutes each.

Repeat sampling was organised with clear results at the reticulation site in question. However, the chlorine residuals collected showed that despite flushing approximately 250KL of water through the system, residuals remained low. Faecal streptococci was added to the test suite to improve the micro data set.

A presumptive faecal streptococci was reported during follow up sampling at a different reticulation site. Further actions were carried out to improve chlorine residuals in the Bulla system. These included injecting pre-dosed chlorinated water directly into the reticulation system and further flushing.

A water quality sweep was conducted on the Bulla locality honing in on fluoride and electrical conductivity as some fluoride results were anomalous.

After further investigation and systems analysis, it was ascertained that due to ice pigging works going on the Bulla system, the water supply was oscillating between Melbourne Water and non-fluoridated Rosslynne water. Therefore backflow into the system was ruled out.

Once the chlorinated water was injected into the system, all follow up samples remained clear of any micro detections. Further works are currently underway to improve the water age and chlorine residuals in the Shepherds Lane tank.

b. Romsey supply security incident

Following on from a manganese excursion, remedial actions to resolve the introduction of manganese into the Romsey WFP were successful. However, the feed pipe to the treatment plant had been drained. Romsey WFP has a small basin, holding about 45ML of water. It was the supply line to this basin that had been drained. Being mid-summer, the pressing issue was supply security for the town.

The incident ran for seven days. Actions included trucking drinking water from Riddells Creek into the Glenfern Basin to keep supply up for Romsey. In addition, local residents were informed of the issue and asked to limit drinking water use.

The difficulty with this issue was reinstating the syphon required to get the water over the hills around Kerrie Reservoir and into Glenfern Basin. Operational staff had to install a number of air valves along the line and use those valves as flushing points to drag water through.

Excursions not reported under Section 22 Safe Drinking Water Act 2003

Western Water has an internal reporting process that is designed to document operational processes as part of the HACCP system. These reports identify issues that deviate from the normal operation of the drinking water treatment plants, identify water quality issues in the reticulation system and capture issues such as break-ins at reservoirs.

During 2013/14, Western Water documented 42 excursions. Excursion reports are raised by members of the water systems team. The reports document details of the issue and list actions required to resolve the issue. When all actions have been completed the excursion is closed out.

Some examples of excursions are described below:

a. South Gisborne tank coliform exceedence

Routine sampling at the South Gisborne tank resulted in a high coliform count, unusual for this tank. As a precaution, the tank was inspected and a small gap in the hatch was identified as a potential source of ingress. The gap was covered and an external contractor carried out repairs.

Water quality at the tank was then monitored closely and the coliform numbers decreased rapidly. No further issues have occurred at this site.

b. Romsey manganese

Raw water manganese levels are monitored as per HACCP plan requirements due to the potential for dirty laundry events (no related health impacts) occurring if high manganese levels reach treated water. Operational monitoring showed an increase in the soluble manganese occurring at the main supply reservoir.

The root cause for the increase was found to be mechanical breakdown of the aeration system in the reservoir. Remedial actions were undertaken to increase aeration whilst the duty aerators were repaired.

Three aspirated air mixers were installed in Kerrie Reservoir near the off-take point and manganese was monitored closely over the following days. This action was not successful and a new plan was required.

Utilising the GIS system to locate valves around the reservoir, it was found that the reservoir could be bypassed completely and water from another reservoir could be transferred into the Romsey WFP. The bypass was utilised and water was successfully drawn from a reservoir with no manganese issues.

c. Merrimu low fluoride

The fluoride levels in the treated water at the Merrimu WFP had dropped below the critical limit, with the plant automatically shutting down. An excursion was raised to document the root cause.

It was discovered that the feed control unit on the switchboard had failed, so an electrical contractor immediately undertook repairs. Drinking water supply was supplemented with Melbourne water until the switchboard was fixed.

Blue green algae (BGA)

During 2013/14, Western Water received two raw water quality and blue green algae bloom notifications from SRW on the Merrimu and Rosslynne Reservoirs. Further details on these notifications were provided in the previous section.

Emergency main repairs

Employee awareness and training

Western Water is committed to ensuring all employees are fully aware of their responsibilities and trained appropriately for our water supply systems.

The 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.

During 2013/14, 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 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 re-skilling 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 attended over 40 different training opportunities during 2013/14. Courses covered a range of specialised water treatment and general workplace training including:

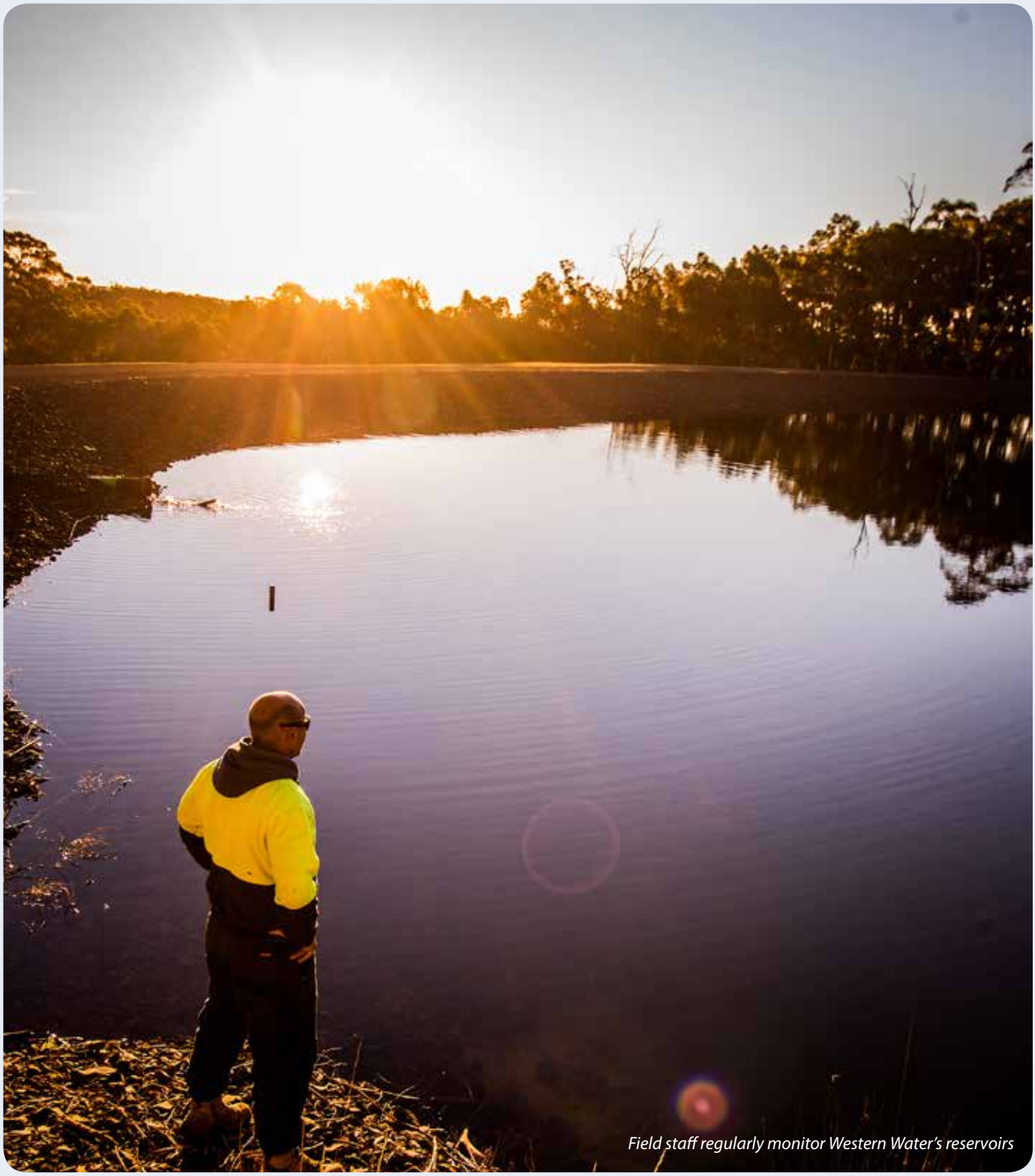
- Appropriate workplace behaviour
- Australian inter-service incident management system (AIMS)
- Chlorine gas and hypochlorite
- Coagulation flocculation
- Dissolved air flotation
- Filtration
- Fluoridation
- Giving and receiving feedback
- Laboratory skills and procedures
- Manual handling
- Privacy
- Running effective meetings
- Sedimentation/clarification
- Equal opportunity in employment
- Sexual harassment in the workplace
- Workplace bullying, and
- Water treatment.

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. Four employees from the water quality and outdoor teams were enrolled in Certificate III Water Operations in the reporting period.

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
- WSAA Water Quality Network
- Water Industry Training Centre
- Water Industry Operators Association of Australia, and
- Victorian Water Industry Advisory Committee.



Field staff regularly monitor Western Water's reservoirs

Community involvement and awareness

Community involvement

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

Western Water is also 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 has an established customer advisory network that provides ongoing advice to the Board on issues important to the achievement of Western Water's vision. This is supported by an online customer panel which provides a significant additional resource for community consultation and totals more than 1,000 members.

An important facet of delivering Western Water's capital investment program is consultation with our community. Consultation processes are carefully designed to engage, establish the issues and ensure the optimum community outcome with consideration to a triple bottom line approach.

Education programs

Western Water recognises that educating young people on crucial issues such as climate variability and water efficiency creates a ripple effect reaching far beyond the classroom.

Presentations, programs and teacher resources are offered at the preschool, prep, primary and secondary school levels.

During the year, close to 8,700 students from across the region attended Western Water primary school education presentations.

School Garden Grant winners, Pentland Primary, Bacchus Marsh

Water filtration plant tour with Alan Shea

Tours and presentations

During the reporting period, Western Water offered free tours and presentations to schools and community groups. Free guided tours are offered at our largest treatment plants at Gisborne, Sunbury and Melton.

Educational tours and community presentations were also 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 grants across the service region. We attend numerous events, promoting the health benefits and quality of our drinking water. In addition, our mobile water tanks are available for use at community activities across the region.

Publications

Apart from the annual Water Quality Report, Western Water's key water treatment publications include:

- Disinfection of your water supply
- Melton Recycled Water Plant
- Merrimu Water Filtration Plant
- Rosslynne Water Filtration Plant
- Sunbury Recycled Water Plant
- Water filters
- Water treatment, and
- 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 H2infO newsletter, fact sheets, brochures, media stories and customer letters.

Typically these are delivered through mail or the media but, when required, communications are supported through direct contact either by phone or in person. In addition, copies of all publications are located on our website.

Western Water's new social media communication channels and online consultation panel have increased our means of communicating with customers about critical water quality issues and have enabled us to go beyond traditional channels, offering very timely, direct, two way communication.

Timely communication is particularly essential when incidents and planned interruptions are occurring. Social media has also provided a quick channel for customers to get in touch with us when they have concerns about water supply or quality.

Our Facebook page has close to 2,500 friends and the reach is far greater when updates are shared. Facebook was a significant communication channel utilised by Western Water during major water outages in early 2014.

Research and development

Western Water is committed to improving understanding and delivery of quality drinking water. To this end, we have invested in a number of 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

Intelligent Water Networks

Western Water has taken a lead role in the Intelligent Water Networks (IWN) program, a partnership between VicWater, the 19 water corporations and the Department of Environment and Primary Industries, in consultation with the Office of Living Victoria.

IWN is part of a new era of innovation in the Victorian water industry focusing on increased collaboration and information-sharing.

The 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.

Pipe Rover trial

As part of the IWN program, Western Water is trialling technology that can be placed in water, sewer or recycled water infrastructure. This technology can determine the life of the asset and, more importantly, predict the type of repair required.

The Pipe Rover can be inserted into a water, sewer or recycled water main, where it gathers detailed information about the condition of the pipe, including video footage.

The Pipe Rover can detect, communicate and manage information for analysis to understand size and type of leaks and other parameters. Information gathered is then translated into repair solutions, including type of repair required and time before replacement is required.

The Pipe Rover is being trialled throughout Victoria and presents great potential to deliver efficiencies in the long term, from faster, simpler repairs to reduced water losses.

Western Water used the technology to identify areas of high sediment build up, allowing us to undertake targeted mains cleaning work. The Pipe Rover was also used in the transfer main to Sunbury in the Rosslynne water supply system prior to transferring from Melbourne water to local supplies. The Pipe Rover identified that mains flushing was not required, saving Western Water significant time and resources.

Pipe Rover trial

Ice pigging trial

Ice pigging the water mains

Western Water is utilising a new water main cleaning technique known as ice pigging. The innovative technique, which originated in the UK, uses ice to clean water pipes and is particularly useful in supply systems with lower water pressure.

For this reason, Western Water's ice pigging trial was conducted in Bulla in May 2014 with very positive results compared against Western Water's traditional cleaning processes of either air scouring or water flushing.

The ice pigging technique involves turning off the water main before pumping a thick slurry of ice into the pipe. As the ice slurry flows through the pipe, it cleans the surface and collects any natural sediment that may have built up over time.

Industry knowledge

In addition to the IWN program, 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 group.

As part of Western Water's membership of the Water Services Association of Australia (WSAA), we actively support the WSAA research program, including international collaborative research with the American Water Research Foundation.

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 actively participate in key industry associations with committee representation in the AWA Victoria Branch Committee and the Institute of Water Administration. Western Water staff also attend seminars and conferences to access up to date industry knowledge. This includes those run by AWA, WQRA, IWA, VicWater and WIOA.

Western Water also participates in the state-wide Drinking Water Quality Network and the metropolitan retailers network.

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

Water industry operators tour

In October 2013, Western Water hosted a Water Industry Operators Association technical tour of the Melton Recycled Water Plant.

Rod Curtis, Senior Coordinator Treatment Teams, presented to industry representatives and conducted a tour of the innovative wastewater treatment plant.

Water industry operators tour, Melton RWP

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 2013/14 include:

- Hillside Booster HACCP plan
- Loemans/Shepherds HACCP plan
- Rosslynne WFP HACCP plan
- Riddell Road Tank Booster HACCP plan
- Lancefield WFP HACCP plan, and
- Product Specification.

An annual review of the following sites was carried out:

- Swans Road Booster Chlorinator
- Darley High Chlorinator
- Gisborne Road Chlorinator
- Underbank Chlorinator
- Settlement Road Booster Chlorinator
- Sandy Creek Booster Chlorinator
- Merrimu Water Filtration Plant
- Lancefield Water Filtration Plant
- Romsey Water Filtration Plant
- Loemans Road Entry Point
- Norton Road Booster Chlorinator
- Salisbury Road Booster Chlorinator
- Hillside Entry Point
- Marriages Water Filtration Plant, and
- Reservoir C Water Filtration Plant.

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 the Water Information Management System (WIMS). 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 vision:

to provide safe secure, healthy and reliable water and sewerage services to meet the current and future needs of our community, and to do so in an efficient and sustainable manner.

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

The following actions are undertaken by Western Water:

- monthly reporting to Department of Health of results for seven key parameters identified in the Safe Drinking Water Regulations 2005
- monthly reporting of results for seven key parameters on our website
- annual Water Quality Report provides a key component in meeting our reporting requirements for DH, and by extension, our customers, and
- immediate reporting of certain water quality issues to Department of Health, as required by the *Safe Drinking Water Act 2003*.

Paul Wilkie, Team Leader Rosslynne WFP

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 well in excess of ten years. These sites include catchments, reservoirs, plants and customer taps. This data is used to develop trends of long term changes to water quality, essential to identify and understand risks as well as 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 December 2013 achieving confirmation of the ongoing HACCP certification.

In 2013/14, 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 Regulatory Audit

Western Water successfully passed its fourth Department of Health Regulatory Audit for Drinking Water Risk in April 2014. 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 scheduled for early 2016.

Opportunities for improvement, identified during through the audit, are detailed in table 14.

Continuous improvement

Western Water recognises that improvements to public health knowledge and water treatment technology are ongoing, both in Australia and around the world. A philosophy of continuous improvement is embedded in our water quality management systems to assess opportunities from both new discoveries and innovations, as well as operational enhancements with existing systems.

Table 14: Department of Health audit - opportunities for improvement

Element	Opportunity for improvement	Comments or actions to be undertaken by Western Water
Assessment of water quality data	Capture operational data as well as external data into the same database. Utilise an electronic database to match SCADA, operational and field data.	Aquantify implemented and enhancements in progress.
Preventative measures for drinking water quality management	Improvements in real time monitoring within the reticulation system are required to better understand and manage disinfection, water flow and impacts of air scouring.	Research and development project underway in Bulla with real time monitoring.
Critical control points	Assign responsibility for regular checks of critical control points against SCADA with management sign off on a weekly basis.	In progress.
Operational procedures and process control	Continue to develop standard operating procedures, review and improve those currently in place. Stricter controls to be placed on backwash return water to the head of the plant.	Project underway to complete task.
Operational monitoring	Operational data to be transformed into useful information in a systematic and timely manner.	Aquantify implemented.
Equipment capability and maintenance	Upgrade fluoride plant at Merrimu Water Filtration Plant.	Upgrade planned for 2016.
Materials and chemicals	Undertake a random sampling program of water treatment chemicals to verify standard of the product.	Needs review.
Research and development	Improve system understanding to minimise water quality impacts to consumers.	Research and development project underway.

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 Quality Management System (DWQMS) is reviewed monthly by Executive Management, which includes the Managing Director and General Managers. All audit outcomes are assessed and resources allocated as needed 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's extensive DWQMS is framed around the twelve elements of the Australian Drinking Water Guidelines.

This assessment will ensure continual improvement measures are identified - and that strengths and weaknesses in water quality risk management - are well understood by the Board, management and staff.

Water supply – capital works improvement

The following is an overview of the significant water supply works undertaken in 2013/14:

Rosslynne WFP upgrade

During the reporting period, Western Water completed a $3.9 million upgrade of the Rosslynne Water Filtration Plant to address operational efficiency and drinking water aesthetics.

Significant water quality capital works were completed at Rosslynne, including a new powdered activated carbon facility to combat organics in the source water.

A fluoride dosing plant was also constructed to maintain fluoridated supply following the changeover from Melbourne.

Romsey-Lancefield water supply interconnection

A $2.0 million Romsey-Lancefield raw water pipeline was constructed in 2013/14 to increase water supply availability for both towns. Previously Lancefield was reliant upon limited surface water supply and its bore.

This pipeline secures the town's supply by the connection through Romsey to the rest of Western Water's supply system.

Filter to reservoir pipelines

Filter-to-reservoir pipelines were constructed at both Lancefield and Merrimu water filtration plants in 2013/14. These pipelines directly return any out of specification water to the reservoir to ensure ongoing public health and safety.

Ongoing mains replacements and renewals

Western Water continued to identify and replace ageing water reticulation systems across the region. The program is helping to reduce water losses through leakage as well as helping maintain water quality.

In addition, a total of 132 km of water mains were added to the supply system over the year.

Tank construction work at Rosslynne WFP

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 raw (untreated) water direct from reservoirs as well as partially treated water.

Western Water manages the supply of non-potable water through water by agreement contracts with individual customers.

During 2013/14, Western Water had 18 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.

Appendices

Appendix 1 - Drinking water policy

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

Customers will be provided with safe (biologically, chemically 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 in line with Victorian Government 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*
- *Health (Fluoridation) Act 1973*
- *Food Act 1984*
- *Essential Services Commission Act 2001*
- *Environmental Protection Act 1970*
- *Water Efficiency Labelling and Standards Act 2005*
- Safe Drinking Water Regulations 2005
- Dangerous Goods (Storage and Handling) Regulations 2000
- NHMRC/ARMCANZ Australian Drinking Water Guidelines 2004
- Risk Management (AS4360)
- Relevant State Environment Protection Policies (SEPPs)
- Environmental Management System - ISO 14001
- Quality Management System – ISO 9001
- Occupational Health and Safety Management System - AS 4801
- Drinking Water Quality Management System
- HACCP Principles and Systems Procedures
- Integrated Management System procedures, and
- All relevant policies contained in the Policy Manual.

Appendix 3 - HACCP certification

CERTIFICATE

DQS CERTIFICATION AUSNZ PTY LTD

hereby certifies that the company

Western Water

36 Macedon Street,
Sunbury VIC 3429

has implemented and maintains a **HACCP System**

Scope:

Storage, treatment and distribution of drinking water.

Through an audit, documented in report, it was verified that the management system fulfills the requirements of:

GENERAL PRINCIPLES OF FOOD HYGIENE AND GUIDELINES FOR THE APPLICATION OF THE HACCP SYSTEM CAC/RCP 1 - 1969, REV. 4 - 2003
Relevant Food Safety Act requirements.

Certificate registration no.	2123
Date of issue	16-MAY-2012
Valid until	15-MAY-2015

Director Certification Programs

DQS CERTIFICATION AUSNZ PTY LTD
Building 2, Level 2, 630 Mitcham Road, Mitcham, VIC 3132, Australia

Appendix 4 - Department of Health Audit

Schedule 1

Regulation 8

Safe Drinking Water Regulations 2005

RISK MANAGEMENT PLAN AUDIT CERTIFICATE

Certificate Number: 101

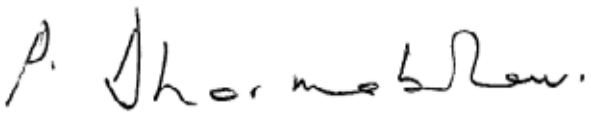
Audit period: 27 January 2012 to 23rd April 2014

To: Mr. Neil Brennan
Managing Director
Western Region Water Corporation
P.O.Box 2371
Sunbury DC Vic 3429

Australian Business Number (ABN): 67 433 835 375

I, Dr.Pararajasegram (Dharma) Dharmabalan, after conducting a risk management plan audit of the water supplied by Western Region Water Corporation, am of the opinion that—

Western Region Water Corporation has complied with the obligations imposed by section 7(1) of the ***Safe Drinking Water Act*** **2003** during the audit period.



Signature of approved auditor: _____

Dr.P. (Dharma) Dharmabalan

Date: 23th April 2014

Exemplar Global Certified Auditor
Drinking Water QMS Scheme
Certificate Number 14555

Appendix 5 - Water quality compliance results

The following section reports on 2013/14 compliance with the water quality standards outlined below, in table A1.

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 *Escherichia coli* per 100mL
Chloroacetic acid	Monthly	Must not exceed 0.15 mg/L
Dichloroacetic acid	Monthly	Must not exceed 0.1 mg/L
Trichloroacetic acid	Monthly	Must not exceed 0.1 mg/L
Trihalomethanes	Monthly	Must not exceed 0.25 mg/L
Bromate	Monthly	Must not exceed 0.02 mg/L
Formaldehyde	Monthly	Must not exceed 0.5 mg/L
Aluminium	Monthly	Must not exceed 0.2 mg/L
Turbidity	Weekly	95% upper confidence limit of the mean of drinking water samples collected in the preceding 12 months must be less than or equal to 5.0 Nephelometric Turbidity Units (NTU)

A5.1 *Escherichia 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 A2: Escherichia coli results

Water sampling locality	Sampling frequency*	No. of samples	No. of samples containing *E.coli*	Max. result (orgs/mL)	% Samples with no *E.coli*	Complying (Yes/No)
Bulla	Weekly	82	0	0	100%	Yes
Darley	Weekly	54	0	0	100%	Yes
Diggers Rest	Weekly	52	0	0	100%	Yes
Eynesbury	Weekly	52	0	0	100%	Yes
Gisborne	64/year	64	0	0	100%	Yes
Lancefield	Weekly	52	0	0	100%	Yes
Lerderderg	64/year	64	0	0	100%	Yes
Macedon	Weekly	52	0	0	100%	Yes
Maddingley	Weekly	120	0	0	100%	Yes
Melton South	112/year	116	0	0	100%	Yes
Merrimu	64/year	64	0	0	100%	Yes
Mount Macedon	Weekly	52	0	0	100%	Yes
Myrniong	Weekly	112	0	0	100%	Yes
Riddells Creek	Weekly	52	0	0	100%	Yes
Rockbank	Weekly	52	0	0	100%	Yes
Romsey	Weekly	52	0	0	100%	Yes
Sunbury	112/year	112	0	0	100%	Yes
Toolern Vale	Weekly	56	0	0	100%	Yes
Woodend	64/year	64	0	0	100%	Yes

** The frequency of sampling for escherichia coli was based on estimated population in each locality. For the large populated localities (e.g. Melton South and Sunbury), the necessary increase in the frequency of sampling was based on table 10.2, ADWG "guidelines for microbial quality ".*

A5.2 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 2005 include total trihalomethanes, chloroacetic acid, dichloroacetic acid and trichloroacetic acid. The following section reports the results for the 2013/14 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.

Table A3: Trihalomethanes results

Water sampling locality	Sampling frequency	No. of samples	No. of non-complying samples	Max. (mg/L)	Min. (mg/L)#	Complying (Yes/No)*
Bulla	Monthly	12	0	0.100	0.012	Yes
Darley	Monthly	12	0	0.140	0.037	Yes
Diggers Rest	Monthly	12	0	0.100	0.011	Yes
Eynesbury	Monthly	12	0	0.140	0.032	Yes
Gisborne	Monthly	12	0	0.130	0.025	Yes
Lancefield	Monthly	12	0	0.140	0.071	Yes
Lerderderg	Monthly	12	0	0.120	0.036	Yes
Macedon	Monthly	12	0	0.150	0.035	Yes
Maddingley	Monthly	12	0	0.150	0.035	Yes
Melton South	Monthly	12	0	0.120	0.050	Yes
Merrimu	Monthly	12	0	0.130	0.044	Yes
Mount Macedon	Monthly	12	0	0.190	0.043	Yes
Myrniong	Monthly	12	0	0.110	0.035	Yes
Riddells Creek	Monthly	12	0	0.140	0.018	Yes
Rockbank	Monthly	12	0	0.140	0.029	Yes
Romsey	Monthly	12	0	0.028	0.001	Yes
Sunbury	Monthly	12	0	0.092	0.011	Yes
Toolern Vale	Monthly	12	0	0.130	0.039	Yes
Woodend	Monthly	12	0	0.074	0.023	Yes

** 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.*

 # A result of <0.001 mg/L is a result less than the detection limit for trihalomethanes.

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 A4: Chloroacetic acid results

Water sampling locality	Frequency of sampling	No. of samples	No. of non-complying samples	Max. (mg/L)	Min. (mg/L)	Complying (Yes/No)*
Bulla	Monthly	12	0	0.002	0.002	Yes
Darley	Monthly	12	0	0.002	0.002	Yes
Diggers Rest	Monthly	12	0	0.002	0.002	Yes
Eynesbury	Monthly	12	0	0.002	0.002	Yes
Gisborne	Monthly	12	0	0.002	0.002	Yes
Lancefield	Monthly	12	0	0.002	0.002	Yes
Lerderderg	Monthly	12	0	0.002	0.002	Yes
Macedon	Monthly	12	0	0.002	0.002	Yes
Maddingley	Monthly	12	0	0.002	0.002	Yes
Melton South	Monthly	12	0	0.002	0.002	Yes
Merrimu	Monthly	12	0	0.002	0.002	Yes
Mount Macedon	Monthly	12	0	0.002	0.002	Yes
Myrniong	Monthly	12	0	0.002	0.002	Yes
Riddells Creek	Monthly	12	0	0.002	0.002	Yes
Rockbank	Monthly	12	0	0.002	0.002	Yes
Romsey	Monthly	12	0	0.002	0.002	Yes
Sunbury	Monthly	12	0	0.002	0.002	Yes
Toolern Vale	Monthly	12	0	0.002	0.002	Yes
Woodend	Monthly	12	0	0.002	0.002	Yes

** 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 A5: Dichloroacetic acid results

Water sampling locality	Frequency of sampling	No. of samples	No. of non-complying samples	Max. (mg/L)	Min. (mg/L)#	Complying* (Yes/No)
Bulla	Monthly	12	0	0.005	0.002	Yes
Darley	Monthly	12	0	0.013	0.002	Yes
Diggers Rest	Monthly	12	0	0.006	0.002	Yes
Eynesbury	Monthly	12	0	0.003	0.002	Yes
Gisborne	Monthly	12	0	0.015	0.003	Yes
Lancefield	Monthly	12	0	0.019	0.002	Yes
Lerderderg	Monthly	12	0	0.013	0.002	Yes
Macedon	Monthly	12	0	0.014	0.003	Yes
Maddingley	Monthly	12	0	0.011	0.002	Yes
Melton South	Monthly	12	0	0.012	0.002	Yes
Merrimu	Monthly	12	0	0.013	0.002	Yes
Mount Macedon	Monthly	12	0	0.028	0.004	Yes
Myrniong	Monthly	12	0	0.003	0.002	Yes
Riddells Creek	Monthly	12	0	0.016	0.002	Yes
Rockbank	Monthly	12	0	0.009	0.002	Yes
Romsey	Monthly	12	0	0.009	0.002	Yes
Sunbury	Monthly	12	0	0.008	0.002	Yes
Toolern Vale	Monthly	12	0	0.012	0.002	Yes
Woodend	Monthly	12	0	0.018	0.003	Yes

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

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 A6: Trichloroacetic acid results

Water sampling locality	Frequency of sampling	No. of samples	No. of non-complying samples	Max. (mg/L)	Min. (mg/L)#	Complying* (Yes/No)
Bulla	Monthly	12	0	0.010	0.002	Yes
Darley	Monthly	12	0	0.015	0.005	Yes
Diggers Rest	Monthly	12	0	0.010	0.003	Yes
Eynesbury	Monthly	12	0	0.011	0.002	Yes
Gisborne	Monthly	12	0	0.014	0.004	Yes
Lancefield	Monthly	12	0	0.017	0.003	Yes
Lerderderg	Monthly	11	0	0.015	0.002	Yes
Macedon	Monthly	12	0	0.017	0.004	Yes
Maddingley	Monthly	12	0	0.013	0.002	Yes
Melton South	Monthly	12	0	0.013	0.002	Yes
Merrimu	Monthly	12	0	0.012	0.002	Yes
Mount Macedon	Monthly	12	0	0.018	0.003	Yes
Myrniong	Monthly	12	0	0.003	0.002	Yes
Riddells Creek	Monthly	12	0	0.014	0.003	Yes
Rockbank	Monthly	12	0	0.013	0.002	Yes
Romsey	Monthly	12	0	0.005	0.002	Yes
Sunbury	Monthly	12	0	0.012	0.002	Yes
Toolern Vale	Monthly	12	0	0.012	0.002	Yes
Woodend	Monthly	12	0	0.019	0.003	Yes

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

A5.3 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 2013/14 reporting period.

A5.4 Aluminium

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

Total aluminium is measured monthly at customer taps at all 19 localities whether or not aluminium is added as a coagulant as part of the water treatment process. If the result for total aluminium exceeds 0.2 mg/L, an automatic retest of sampling is conducted by our contracted NATA-accredited laboratory. Where aluminium is not used in the treatment process, any detection of aluminium will likely be due to naturally-occurring microscopic clay particles.

Table A7: Total aluminium results

Water sampling locality	Frequency of sampling	No. of samples	No. of non-complying samples	Max. (mg/L)	Min. (mg/L)#	Complying* (Yes/No)
Bulla	Monthly	12	0	0.18	0.01	Yes
Darley^	Monthly	12	0	0.17	0.01	Yes
Diggers Rest	Monthly	12	0	0.17	0.01	Yes
Eynesbury^	Monthly	12	0	0.08	0.01	Yes
Gisborne	Monthly	12	0	0.17	0.01	Yes
Lancefield^	Monthly	12	0	0.01	0.01	Yes
Lerderderg^	Monthly	12	0	0.16	0.02	Yes
Macedon	Monthly	12	0	0.17	0.02	Yes
Maddingley^	Monthly	12	0	0.18	0.02	Yes
Melton South^	Monthly	12	0	0.07	0.01	Yes
Merrimu^	Monthly	12	0	0.16	0.01	Yes
Mount Macedon	Monthly	12	0	0.20	0.02	Yes
Myrniong^	Monthly	12	0	0.02	0.01	Yes
Riddells Creek	Monthly	12	0	0.18	0.02	Yes
Rockbank	Monthly	12	0	0.16	0.01	Yes
Romsey	Monthly	12	0	0.01	0.01	Yes
Sunbury	Monthly	12	0	0.17	0.01	Yes
Toolern Vale^	Monthly	12	0	0.15	0.01	Yes
Woodend^	Monthly	12	0	0.06	0.01	Yes

** 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. The values in this table are for total aluminium. Department of Health rounding policy means that results of 0.24mg/L or below are compliant.*

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

^ Alum is added to these supplies.

A5.5 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.

A summary of the turbidity results for samples taken at customer taps in 2013/14 is listed below. It includes the statistical measure of the 95% upper confidence limit (UCL) of the mean for samples taken for turbidity over a 12 month period.

Table A8: Turbidity results

Water sampling locality	Frequency of sampling	No. of samples	Max. NTU	Min. NTU	95% UCL of mean	Complying (Yes/No)
Bulla*	Min. Weekly	82	1.8	0.2	0.9	Yes
Darley	Min. Weekly	54	1.1	0.1	0.3	Yes
Diggers Rest	Min. Weekly	52	1.3	0.1	0.9	Yes
Eynesbury	Min. Weekly	53	1	0.1	0.3	Yes
Gisborne	Min. Weekly	52	1.2	0.1	0.6	Yes
Lancefield	Min. Weekly	54	0.7	0.1	0.2	Yes
Lerderderg*	Min. Weekly	62	1.1	0.1	0.3	Yes
Macedon	Min. Weekly	52	1.2	0.1	0.6	Yes
Maddingley	Min. Weekly	54	1.1	0.1	0.3	Yes
Melton South	Min. Weekly	55	1	0.1	0.3	Yes
Merrimu	Min. Weekly	54	0.9	0.1	0.2	Yes
Mount Macedon	Min. Weekly	52	1.1	0.1	0.6	Yes
Myrniong	Min. Weekly	53	1	0.1	0.2	Yes
Riddells Creek	Min. Weekly	52	1.2	0.1	0.7	Yes
Rockbank	Min. Weekly	52	1	0.1	0.3	Yes
Romsey	Min. Weekly	55	0.6	0.1	0.2	Yes
Sunbury*	Min. Weekly	67	1.4	0.1	0.8	Yes
Toolern Vale	Min. Weekly	54	1.8	0.1	0.3	Yes
Woodend	Min. Weekly	52	0.3	0.1	0.1	Yes

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

** Three localities received extra sampling for turbidity in response to localised water quality issues in the reporting period. Hence these have more than 52 samples.*

A5.6 Fluoride

Both the *Health (Fluoridation) Act 1973* and the Department of Health require that the annual average fluoride in fluoridated drinking water supplied by Western Water must not exceed a level of 1.0 mg/L. Fluoride levels in any individual sample from drinking water supplied must also not exceed 1.5 mg/L.

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's website for water fluoridation http://www.health.vic.gov.au/environment/fluoridation.

Table A9: Fluoride results

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Average (mg/L)	Complying* (Yes/No)
Bulla	Fortnightly	26	1.00	0.55	0.88	Yes
Darley	Fortnightly	26	0.85	0.41	0.76	Yes
Diggers Rest	Fortnightly	26	0.96	0.77	0.89	Yes
Eynesbury	Fortnightly	26	0.89	0.65	0.78	Yes
Gisborne	Fortnightly	26	0.97	0.05	0.59	Yes
Lancefield *	Quarterly	4	0.10	0.08	0.10	Yes
Lerderderg	Fortnightly	26	0.86	0.63	0.78	Yes
Macedon	Fortnightly	26	0.96	0.06	0.64	Yes
Maddingley	Fortnightly	26	0.84	0.63	0.77	Yes
Melton South	Fortnightly	26	0.87	0.69	0.78	Yes
Merrimu	Fortnightly	26	0.86	0.39	0.75	Yes
Mount Macedon	Fortnightly	26	0.94	0.09	0.63	Yes
Myrniong *	Quarterly	4	0.07	0.05	0.06	Yes
Riddells Creek	Fortnightly	26	0.92	0.13	0.79	Yes
Rockbank	Fortnightly	26	1.00	0.69	0.80	Yes
Romsey *	Quarterly	4	0.44	0.08	0.20	Yes
Sunbury	Fortnightly	26	0.96	0.74	0.91	Yes
Toolern Vale	Fortnightly	26	0.86	0.62	0.76	Yes
Woodend *	Quarterly	4	0.05	0.05	0.05	Yes
Woodend *	Quarterly	4	0.05	0.05	0.05	Yes

** Non-fluoridated supplies.*

A5.7 Other chemicals not specified in the Standards but which may pose a risk to human health

Besides those parameters tested under the Safe Drinking Water Regulations 2005, Western Water also tests for other substances that may pose a risk to human health. These results are measured in accordance with the ADWG to ensure compliance with recommended industry standards. 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 2013/14 compliance against the health-related guideline values set out in ADWG 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.

Manganese

Table A10: Manganese (total as Mn) results

Water sampling locality	Sampling frequency*	No. of samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying (Yes/No)
Eynesbury	Quarterly	39	0.013	0.001	0.004	Yes
Lancefield	Quarterly	37	0.007	0.001	0.003	Yes
Lerderderg	Quarterly	39	0.019	0.001	0.005	Yes
Maddingley	Quarterly	39	0.018	0.001	0.004	Yes
Merrimu	Quarterly	39	0.010	0.001	0.002	Yes
Myrniong	Quarterly	39	0.022	0.002	0.004	Yes
Romsey	Quarterly	20	0.048	0.005	0.029	Yes
Sunbury	Quarterly	39	0.005	0.001	0.002	Yes

Lead

Table A11: Lead (total as Pb) results

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Complying* (Yes/No)
Bulla	Quarterly	4	0.001	0.001	Yes
Darley	Quarterly	4	0.001	0.001	Yes
Diggers Rest	Quarterly	4	0.001	0.001	Yes
Eynesbury	Quarterly	4	0.001	0.001	Yes
Gisborne	Quarterly	4	0.001	0.001	Yes
Lancefield	Quarterly	4	0.001	0.001	Yes
Lerderderg	Quarterly	4	0.001	0.001	Yes
Macedon	Quarterly	4	0.001	0.001	Yes
Maddingley	Quarterly	4	0.001	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	4	0.001	0.001	Yes
Toolern Vale	Quarterly	4	0.001	0.001	Yes
Woodend	Quarterly	4	0.001	0.001	Yes

** 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	Max. (mg/L)	Min. (mg/L)	Complying* (Yes/No)
Bulla	Quarterly	4	0.001	0.001	Yes
Darley	Quarterly	4	0.001	0.001	Yes
Diggers Rest	Quarterly	4	0.680	0.001	Yes
Eynesbury	Quarterly	4	0.130	0.001	Yes
Gisborne	Quarterly	4	0.001	0.001	Yes
Lancefield	Quarterly	4	0.001	0.001	Yes
Lerderderg	Quarterly	4	0.020	0.001	Yes
Macedon	Quarterly	4	0.001	0.001	Yes
Maddingley	Quarterly	4	0.010	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	0.030	0.001	Yes
Riddells Creek	Quarterly	4	0.001	0.001	Yes
Rockbank	Quarterly	4	0.001	0.001	Yes
Romsey	Quarterly	4	0.010	0.001	Yes
Sunbury	Quarterly	4	0.001	0.001	Yes
Toolern Vale	Quarterly	4	0.001	0.001	Yes
Woodend	Quarterly	4	0.001	0.001	Yes

** 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.*

Arsenic

Table A13: Arsenic results

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

** 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 2013/14.

Monochloramine

Table A14: Monochloramine result

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Complying* (Yes/No)
Bulla	Weekly	52	0.68	0.01	Yes
Diggers Rest	Weekly	52	0.67	0.01	Yes
Romsey	Weekly	52	0.88	0.02	Yes
Sunbury	110 per year	110	0.65	0.01	Yes

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

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.

Nickel

Table A15: Nickel (total as Ni) result

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

** 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.*

Chlorine

Table A16: Total chlorine result

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Complying* (Yes/No)
Bulla	Weekly	52	0.99	0.01	Yes
Darley	Weekly	52	1.60	0.09	Yes
Diggers Rest	Weekly	52	1.30	0.03	Yes
Eynesbury	Weekly	52	0.39	0.02	Yes
Gisborne	64/year	64	1.00	0.06	Yes
Lancefield	Weekly	52	1.10	0.18	Yes
Lerderderg	64/year	64	0.99	0.05	Yes
Macedon	Weekly	52	0.89	0.05	Yes
Maddingley	Weekly	52	1.20	0.08	Yes
Melton South	112/year	112	0.98	0.09	Yes
Merrimu	64/year	64	0.78	0.06	Yes
Mount Macedon	Weekly	52	1.00	0.04	Yes
Myrniong	Weekly	53	0.50	0.02	Yes
Riddells Creek	Weekly	52	1.00	0.05	Yes
Rockbank	Weekly	52	0.99	0.07	Yes
Romsey	Weekly	52	1.00	0.14	Yes
Sunbury	112/year	112	1.10	0.05	Yes
Toolern Vale	Weekly	54	0.83	0.03	Yes
Woodend	64/year	64	1.20	0.09	Yes

** 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 1.10 mg/L for total chlorine at its customer taps.*

Chromium

Table A17: Chromium (total as Cr) result

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

** 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.*

Cyanide

Table A18: Cyanide result

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

** 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 result

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Complying* (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	1	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

** Compliance as measured against the health related guideline value set out in ADWG for mercury in drinking water should not exceed 0.001 mg/L.*

Nitrate

Table A20: Nitrate result

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Complying* (Yes/No)
Bulla	Monthly	12	0.51	0.12	Yes
Darley	Monthly	12	0.18	0.02	Yes
Diggers Rest	Monthly	12	0.48	0.12	Yes
Eynesbury	Monthly	12	0.19	0.03	Yes
Gisborne#	Annually	1	0.23	0.23	Yes
Lancefield	Monthly	12	0.26	0.02	Yes
Lerderderg	Monthly	12	0.19	0.02	Yes
Macedon#	Annually	1	0.22	0.22	Yes
Maddingley	Monthly	12	0.19	0.02	Yes
Melton South	Monthly	12	0.15	0.02	Yes
Merrimu	Monthly	12	0.19	0.02	Yes
Mount Macedon#	Annually	1	0.23	0.23	Yes
Myrniong	Monthly	12	0.32	0.16	Yes
Riddells Creek#	Annually	1	0.15	0.15	Yes
Rockbank	Monthly	12	0.18	0.02	Yes
Romsey	Monthly	12	0.39	0.09	Yes
Sunbury	Monthly	12	0.38	0.12	Yes
Toolern Vale	Monthly	11	0.19	0.02	Yes
Woodend	Monthly	12	0.19	0.01	Yes

** Compliance as measured against the health related guideline value set out in ADWG for nitrate in drinking water should not exceed 50 mg/L.*
 # Disinfection mode changes from chloramination to chlorination meant that sampling for nitrate in these localities was dropped.

Nitrite

Table A21: Nitrite result

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Complying* (Yes/No)
Bulla	Monthly	12	0.080	0.002	Yes
Darley	Monthly	12	0.002	0.002	Yes
Diggers Rest	Monthly	12	0.090	0.002	Yes
Eynesbury	Monthly	12	0.002	0.002	Yes
Gisborne#	Annually	1	0.002	0.002	Yes
Lancefield	Monthly	12	0.002	0.002	Yes
Lerderderg	Monthly	12	0.002	0.002	Yes
Macedon#	Annually	1	0.002	0.002	Yes
Maddingley	Monthly	12	0.002	0.002	Yes
Melton South	Monthly	12	0.002	0.002	Yes
Merrimu	Monthly	12	0.002	0.002	Yes
Mount Macedon#	Annually	1	0.002	0.002	Yes
Myrniong	Monthly	12	0.002	0.002	Yes
Riddells Creek#	Annually	1	0.002	0.002	Yes
Rockbank	Monthly	12	0.002	0.002	Yes
Romsey	Monthly	12	0.300	0.002	Yes
Sunbury	Monthly	12	0.120	0.002	Yes
Toolern Vale	Monthly	11	0.002	0.002	Yes
Woodend	Monthly	12	0.002	0.002	Yes

** Compliance as measured against the health related guideline value set out in ADWG for nitrite in drinking water should not exceed 3 mg/L.*
 # Disinfection mode changes from chloramination to chlorination meant that sampling for nitrite in these localities was dropped.

Selenium

Table A22: Selenium result

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

** 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 result

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

** 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.*

A5.8 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. Compliance calculations hereafter are based on mean results for samples taken throughout the year, as outlined in ADWG.

pH

Table A24: pH results

Water sampling locality	Sampling frequency	No. of Samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying* (Yes/No)
Bulla	Weekly	52	9.4	7.2	8.0	Yes
Darley	Weekly	52	7.8	7.3	7.5	Yes
Diggers Rest	Weekly	52	7.8	7.1	7.4	Yes
Eynesbury	Weekly	52	7.6	6.5	7.3	Yes
Gisborne	Weekly	52	9.5	7.2	7.7	Yes
Lancefield	Weekly	52	8.3	7.6	7.9	Yes
Lerderderg	Weekly	52	8.1	6.8	7.4	Yes
Macedon#	Weekly	52	9.6	7.6	8.7	No
Maddingley	Weekly	52	8.0	7.3	7.6	Yes
Melton South	Weekly	52	7.6	6.8	7.2	Yes
Merrimu	Weekly	52	9.3	6.8	7.9	Yes
Mount Macedon#	Weekly	52	9.4	7.7	8.8	No
Myrniong	Weekly	52	7.9	6.5	7.5	Yes
Riddells Creek	Weekly	52	9.0	7.2	7.9	Yes
Rockbank	Weekly	52	7.7	6.8	7.3	Yes
Romsey	Weekly	52	8.5	7.0	7.7	Yes
Sunbury	Weekly	52	9.2	6.8	7.8	Yes
Toolern Vale	Weekly	52	8.6	6.8	7.4	Yes
Woodend	Weekly	52	7.9	7.0	7.4	Yes

** 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.*
 # In 2013/14, the Macedon and Mount Macedon water sampling localities laid outside the pH range of 6.5-8.5, based on the mean result. Elevated pH levels were expected to be reduced due to the switch over to Rosslynne water supply. The final switch did not occur until late in the reporting period. Therefore the predicted reduction is not evident in these results. The microbial quality of the water was not compromised due to the increase in pH.

Iron

Table A25: Iron results

Water sampling locality	Sampling frequency	No. of Samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying* (Yes/No)
Bulla	Quarterly	4	0.16	0.07	0.12	Yes
Darley	Quarterly	4	0.03	0.01	0.02	Yes
Diggers Rest	Quarterly	4	0.11	0.02	0.07	Yes
Eynesbury	Quarterly	4	0.03	0.01	0.02	Yes
Gisborne	Quarterly	4	0.10	0.01	0.04	Yes
Lancefield	Quarterly	4	0.03	0.01	0.02	Yes
Lerderderg	Quarterly	4	0.03	0.01	0.02	Yes
Macedon	Quarterly	4	0.12	0.02	0.06	Yes
Maddingley	Quarterly	4	0.01	0.01	0.01	Yes
Melton South	Quarterly	7	0.03	0.01	0.01	Yes
Merrimu	Quarterly	4	0.01	0.01	0.01	Yes
Mount Macedon	Quarterly	4	0.11	0.02	0.07	Yes
Myrniong	Quarterly	4	0.03	0.01	0.02	Yes
Riddells Creek	Quarterly	4	0.12	0.01	0.07	Yes
Rockbank	Quarterly	4	0.08	0.01	0.03	Yes
Romsey	Quarterly	4	0.01	0.01	0.01	Yes
Sunbury	Quarterly	3	0.11	0.07	0.09	Yes
Toolern Vale	Quarterly	5	0.01	0.01	0.01	Yes
Woodend	Quarterly	4	0.02	0.01	0.01	Yes

** 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.*

Total hardness

Table A26: Total hardness (as calcium carbonate) results

Water sampling locality	Sampling frequency#	No. of samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying* (Yes/No)
Bulla	Monthly	9	120	15	46	Yes
Darley	Monthly	9	130	22	102	Yes
Diggers Rest	Monthly	9	110	13	39	Yes
Eynesbury	Monthly	9	130	19	98	Yes
Gisborne	Monthly	9	110	21	63	Yes
Lancefield	Monthly	9	120	57	88	Yes
Lerderderg	Monthly	9	130	20	101	Yes
Macedon	Monthly	9	110	21	57	Yes
Maddingley	Monthly	9	120	21	101	Yes
Melton South	Monthly	9	120	69	103	Yes
Merrimu	Monthly	9	120	24	100	Yes
Mount Macedon	Monthly	9	100	21	64	Yes
Myrniong^	Monthly	9	130	100	120	Yes
Riddells Creek	Monthly	9	100	16	46	Yes
Rockbank	Monthly	9	120	14	89	Yes
Romsey	Monthly	9	110	17	38	Yes
Sunbury	Monthly	9	110	11	45	Yes
Toolern Vale	Monthly	9	130	23	100	Yes
Woodend	Monthly	9	29	10	18	Yes

** 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 2013/14. 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.*
 # Scheduled for monthly sampling during review of monitoring program in January 2013. Subsequent review conducted in February 2014 reduced sampling frequency to quarterly.

Calcium

Table A27: Total calcium (as Ca) results

Water sampling locality	Sampling frequency#	No. of samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)*
Bulla	Monthly	9	44.0	4.7	14.9
Darley	Monthly	9	21.0	6.2	16.9
Diggers Rest	Monthly	9	29.0	3.5	9.9
Eynesbury	Monthly	9	21.0	5.4	16.5
Gisborne	Monthly	9	27.0	5.9	15.5
Lancefield	Monthly	9	17.0	8.9	12.8
Lerderderg	Monthly	9	21.0	5.6	17.6
Macedon	Monthly	9	27.0	6.8	15.7
Maddingley	Monthly	9	20.0	6.2	17.2
Melton South	Monthly	9	21.0	15.0	18.0
Merrimu	Monthly	9	23.0	7.6	17.8
Mount Macedon	Monthly	9	28.0	6.9	18.6
Myrniong	Monthly	9	21.0	11.0	17.7
Riddells Creek	Monthly	9	27.0	4.6	12.7
Rockbank	Monthly	9	20.0	2.9	16.1
Romsey	Monthly	9	22.0	3.7	7.5
Sunbury	Monthly	9	30.0	2.8	12.0
Toolern Vale	Monthly	9	22.0	7.0	17.8
Woodend	Monthly	9	4.0	1.9	3.1

** There is currently no recommended guideline value set out for the concentration of calcium in drinking water.*
 # Scheduled for monthly sampling during review of monitoring program in January 2013, subsequent review conducted in February 2014 reduced sampling frequency to quarterly.

Magnesium

Table A28: Total magnesium (as Mg) results

Water sampling locality	Sampling frequency#	No. of samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)*
Bulla	Monthly	7	1.4	0.6	0.9
Darley	Monthly	7	14.0	1.2	3.7
Diggers Rest	Monthly	7	1.6	1.0	1.3
Eynesbury	Monthly	7	15.0	1.0	3.3
Gisborne	Monthly	7	1.5	1.1	1.3
Lancefield	Monthly	7	20.0	8.6	17.8
Lerderderg	Monthly	7	14.0	1.2	4.2
Macedon	Monthly	7	1.4	0.8	1.1
Maddingley	Monthly	7	14.0	1.2	4.2
Melton South	Monthly	7	13.0	1.1	3.0
Merrimu	Monthly	7	15.0	1.2	3.5
Mount Macedon	Monthly	7	1.4	0.8	1.0
Myrniong	Monthly	12	18.0	12.0	15.4
Riddells Creek	Monthly	7	1.5	1.2	1.3
Rockbank	Monthly	7	12.0	1.0	3.0
Romsey	Monthly	7	2.9	1.8	2.4
Sunbury	Monthly	7	1.5	1.0	1.3
Toolern Vale	Monthly	7	12.0	1.0	3.3
Woodend	Monthly	7	7.5	1.7	3.8

** There is currently no recommended guideline value set out for the concentration of magnesium in drinking water.*
 # Scheduled for monthly sampling during review of monitoring program in January 2013. Subsequent review conducted in February 2014 reduced sampling frequency to quarterly.

Ammonia

Table A29: Ammonia results

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying* (Yes/No)
Bulla	Monthly	12	0.140	0.003	0.045	Yes
Darley	Monthly	12	0.006	0.002	0.003	Yes
Diggers Rest	Monthly	12	0.140	0.009	0.088	Yes
Eynesbury	Monthly	12	0.010	0.002	0.006	Yes
Gisborne	Annually#	1	0.004	0.004	0.004	Yes
Lancefield	Monthly	10	0.007	0.002	0.003	Yes
Lerderderg	Monthly	11	0.012	0.002	0.005	Yes
Macedon	Annually#	1	0.006	0.006	0.006	Yes
Maddingley	Monthly	12	0.004	0.002	0.003	Yes
Melton South	Monthly	12	0.007	0.002	0.004	Yes
Merrimu	Monthly	12	0.008	0.002	0.005	Yes
Mount Macedon	Annually#	1	0.002	0.002	0.002	Yes
Myrniong	Monthly	12	0.007	0.002	0.005	Yes
Riddells Creek	Annually#	1	0.007	0.007	0.007	Yes
Rockbank	Monthly	12	0.052	0.002	0.009	Yes
Romsey	Monthly	12	0.230	0.014	0.127	Yes
Sunbury	Monthly	11	0.150	0.002	0.088	Yes
Toolern Vale	Monthly	11	0.008	0.002	0.004	Yes
Woodend	Monthly	12	0.006	0.002	0.003	Yes

** 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.*
 # Sampling for ammonia in these localities was reduced due to the change in disinfection method from chloramination to chlorination over twelve months ago.

True colour

Table A30: True colour results

Water sampling locality	Sampling frequency	No. of samples	Max. (TCU)	Min. (TCU)	Mean (TCU)	Complying* (Yes/No)
Bulla	Weekly	52	6	2	3	Yes
Darley	Weekly	54	2	2	2	Yes
Diggers Rest	Weekly	52	6	2	3	Yes
Eynesbury	Weekly	52	6	2	2	Yes
Gisborne	Weekly	52	6	2	2	Yes
Lancefield	Weekly	52	4	2	2	Yes
Lerderderg	Weekly	52	4	2	2	Yes
Macedon	Weekly	52	4	2	2	Yes
Maddingley	Weekly	52	4	2	2	Yes
Melton South	Weekly	52	4	2	2	Yes
Merrimu	Weekly	52	6	2	2	Yes
Mount Macedon	Weekly	52	6	2	2	Yes
Myrniong	Weekly	52	4	2	2	Yes
Riddells Creek	Weekly	52	6	2	2	Yes
Rockbank	Weekly	52	4	2	2	Yes
Romsey	Weekly	52	8	2	3	Yes
Sunbury	Weekly	52	6	2	3	Yes
Toolern Vale	Weekly	54	4	2	2	Yes
Woodend	Weekly	52	4	2	2	Yes

** 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).*

Sodium

Table A31: Sodium (as Na) results

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying* (Yes/No)
Bulla	Annually	1	27.0	27.0	27.0	Yes
Darley	Annually	1	39.0	39.0	39.0	Yes
Diggers Rest	Annually	1	5.1	5.1	5.1	Yes
Eynesbury	Annually	1	28.0	28.0	28.0	Yes
Gisborne	Annually	1	28.0	28.0	28.0	Yes
Lancefield	Annually	1	43.0	43.0	43.0	Yes
Lerderderg	Annually	1	37.0	37.0	37.0	Yes
Macedon	Annually	1	26.0	26.0	26.0	Yes
Maddingley	Annually	1	41.0	41.0	41.0	Yes
Melton South	Annually	1	35.0	35.0	35.0	Yes
Merrimu	Annually	1	37.0	37.0	37.0	Yes
Mount Macedon	Annually	1	28.0	28.0	28.0	Yes
Myrniong	Annually	1	48.0	48.0	48.0	Yes
Riddells Creek	Annually	1	27.0	27.0	27.0	Yes
Rockbank	Annually	1	6.2	6.2	6.2	Yes
Romsey	Annually	1	25.0	25.0	25.0	Yes
Sunbury	Annually	1	5.0	5.0	5.0	Yes
Toolern Vale	Annually	1	41.0	41.0	41.0	Yes
Woodend	Annually	1	19.0	19.0	19.0	Yes

** 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).*

Zinc

Table A32: Zinc (total as Zn) results

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying* (Yes/No)
Bulla	Quarterly	4	0.002	0.001	0.002	Yes
Darley	Quarterly	4	0.004	0.002	0.003	Yes
Diggers Rest	Quarterly	4	0.002	0.001	0.002	Yes
Eynesbury	Quarterly	4	0.014	0.001	0.005	Yes
Gisborne	Quarterly	4	0.002	0.001	0.001	Yes
Lancefield	Quarterly	4	0.009	0.005	0.006	Yes
Lerderderg	Quarterly	4	0.006	0.002	0.004	Yes
Macedon	Quarterly	4	0.079	0.001	0.021	Yes
Maddingley	Quarterly	4	0.007	0.003	0.004	Yes
Melton South	Quarterly	4	0.007	0.002	0.004	Yes
Merrimu	Quarterly	4	0.005	0.001	0.003	Yes
Mount Macedon	Quarterly	4	0.004	0.001	0.002	Yes
Myrniong	Quarterly	4	0.003	0.001	0.002	Yes
Riddells Creek	Quarterly	4	0.002	0.001	0.002	Yes
Rockbank	Quarterly	4	0.007	0.001	0.003	Yes
Romsey	Quarterly	4	0.003	0.001	0.002	Yes
Sunbury	Quarterly	3	0.003	0.001	0.002	Yes
Toolern Vale	Quarterly	4	0.005	0.001	0.002	Yes
Woodend	Quarterly	4	0.005	0.002	0.003	Yes

** 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 was set for zinc.*

Sulfate

Table A33: Sulfate (as SO_4) results

Water sampling locality	Sampling frequency	No. of samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying* (Yes/No)
Bulla	Annually	1	1	1	1	Yes
Darley	Annually	1	50	50	50	Yes
Diggers Rest	Annually	1	1	1	1	Yes
Eynesbury	Annually	1	37	37	37	Yes
Gisborne	Annually	1	64	64	64	Yes
Lancefield	Annually	1	5	5	5	Yes
Lerderderg	Annually	1	48	48	48	Yes
Macedon	Annually	1	52	52	52	Yes
Maddingley	Annually	1	56	56	56	Yes
Melton South	Annually	1	41	41	41	Yes
Merrimu	Annually	1	59	59	59	Yes
Mount Macedon	Annually	1	52	52	52	Yes
Myrniong	Annually	1	41	41	41	Yes
Riddells Creek	Annually	1	64	64	64	Yes
Rockbank	Annually	1	2	2	2	Yes
Romsey	Annually	1	3	3	3	Yes
Sunbury	Annually	1	2	2	2	Yes
Toolern Vale	Annually	1	59	59	59	Yes
Woodend	Annually	1	10	10	10	Yes

** 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 6 - Raw 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 raw water monitoring program aimed at increasing the understanding of raw 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 raw water monitoring program for 2013/14 allows for the assessment of raw 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 raw water quality enables Western Water to conduct historical trending analysis, review individual system risk assessment plans, identify new hazards and review risk at each raw water source. 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 raw water monitoring program at reservoirs, bores and final raw water entry points to water filtration plants was undertaken during 2013/14.

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 A34 (at right) is a list of all parameters monitored during 2013/14.

In addition to the raw water monitoring conducted by a contracted, independent NATA-accredited laboratory, raw 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 raw 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 raw water provided valuable information in assessing the quality of the raw water. This information allows Western Water to monitor changes in conditions of raw 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 2013/14. 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 A34: List of all raw water parameters monitored during 2013/14

Parameter		Parameter	
Type		Type	
Chemical organics	1,1-Dichloroethane	Physical	Alkalinity, total as CaCO3
	1,2-Dichloroethane		Colour, true
	Benzene		Dissolved oxygen
	Dissolved organic carbon		Electrical conductivity @ 25ºC
	Heptachlor		Hardness, as CaCO3
	Heptachlor epoxide		pH
	Hexachlorobenzene		Total dissolved solids
	Methoxychor		Turbidity
	Pentachlorophenol		
	Tetrachloroethene	Metals	
	Trichloroethene		Aluminium, filtered
Chemical inorganics	Ammonia		Aluminium, filtered
	Arsenic		Iron, filtered
	Calcium*		Iron, total as Fe
	Chloride*		Magnesium, as Mg
	Cyanide		Manganese, filtered
	Fluoride*		Manganese, total as Mn
	Nitrate		Mercury, as Hg
	Nitrite		
	Phosphorus, reactive as P	Microbiological	Amoebae, total
	Selenium		Coliforms, total
	Silica, total as SiO2*		Cryptosporidium spp.
	Silicon*		Escherichia coli
	Silica, total as SiO2*		Giardia spp.
	Silicon*		Heterotrophic plate count, 37ºC
Pesticides	2,4 D		Naegleria Fowleri
	4,4' – DDT		Faecal streptococci*
	Aldrin		Helminth (Ascaris ova)*
	Atrazine		Helminth (Taenia ova)*
	BHC (gamma)		
	Chlordane, total	Radiological	Gross alpha activity
	Dieldrin		Gross beta activity

** These parameters were only measured at some of the sampling locations where appropriate.*

Glossary

Algae	Simple types of plant with no root, stems of leaves. They occur mostly in freshwater and marine environments.
Algal bloom	A rapid growth of algae in aquatic environments often triggered by an input of high levels of nutrients and an increase in temperature. Blue-green algae (or cyanobacteria) are of most concern.
Alum	An aluminium sulphate based chemical used as a coagulant in the water treatment process.
Aluminium (Al)	A naturally occurring element in soils which can enter water from catchments.
Ammonia (NH3)	A highly soluble compound resulting from the decomposition of organic matter containing nitrogen. Usually only found in small concentrations in surface waters.
Aquifer	A layer or section of earth or rock that contains freshwater (known as groundwater), any water that is stored naturally underground or that flows through rock or soil, supplying springs and wells.
ADWG	National Health and Medical Research Council's Australian Drinking Water Guidelines 2004* The ADWG is freely available at www.nhmrc.gov.au/publications/synopses/eh19syn.htm
Blue-green algae (cyanobacteria) (BGA)	Single celled, filamentous or colony-forming organisms which are widely distributed in the freshwater and marine environments. Under favourable conditions of light, temperature and nutrient supply, extensive growth of blue green algae may occur, leading to blooms. These can result in environmental problems and can create challenges for water treatment.
Bulk entitlement (BE)	An agreement that outlines the conditions for supply of bulk drinking water from reservoirs managed by Southern Rural Water and drinking water supplied by the Melbourne Water Corporation to Western Water.
Calcium (Ca)	A naturally occurring element which can enter water from catchments. It may also be added to water in the treatment process to reduce the acidity levels or increase the capacity of water to buffer pH changes.
Catchment	An area of land surrounding a water storage. The runoff water from rain falling over the catchment drains into the storage and may collect nutrients, minerals and other contaminants including microorganisms from the surface of the land.
Chlorination	The disinfection of water, wastewater and industrial waste through the application of chlorine (Cl) as part of the water treatment process. Chlorination kills microorganisms and oxidises undesirable compounds.
Chloramination	The application of the chlorine followed by ammonia to create monochloramine (NH2Cl), a stable disinfectant that is added to drinking water to kill bacteria or to oxidise undesirable compounds. Chloramines persist for a longer time than chlorine and as a result are used in longer water distribution systems.
Coliforms	Coliform bacteria are used as one of the indicators of the quality of drinking water and the possible presence of disease-causing microorganisms. These bacteria are killed by chlorine.
Cryptosporidium	A parasitic protozoan (microorganism) which causes gastroenteritis in humans. These organisms occur in the gut of infected warm-blooded animals and can be introduced into source water through faecal contamination.
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.
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 Melbourne water supply.
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.
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 (N03-)	The most stable form of combined nitrogen in water. Present in surface waters in small amounts, the major sources are from human and animal wastes.
Nephelometric Turbidity Unit (NTU)	A measure of the turbidity in water.
Nutrients	Compounds required for growth by plants and other organisms. Major nutrients for plant growth are phosphorous and nitrogen.
Pathogens	Disease causing organisms such as bacteria and viruses.
pH	The pH value indicates if a substance is acidic, neutral or alkaline, calculated from the number of hydrogen ions present. It 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).
Raw water	Water that has not been treated in any way.
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 prior to any treatment or disinfection.
Total dissolved solids (TDS)	A measure of inorganic 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 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.

Index

WESTERN WATER

Contact us at:
Address **36 Macedon Street, Sunbury**
Hours **8.15am to 5pm**
Website **www.westernwater.com.au**
Email **mail@westernwater.com.au**
Telephone **1300 650 425**
Mobile telephones and interstate callers **03 9218 5400**
Facsimile **03 9218 5444**

Mailing address **Western Water, PO Box 2371, Sunbury DC, Victoria 3429**