WESTERN WATER

optimising local resources

WATER QUALITY REPORT 2012/13

Contents

Cover: Reservoir B on Mount Macedon was renamed Graham Brock Reservoir in July 2013 after employee, Graham Brock, who passed away in 2012.

About Western Water

Western Water provides drinking water, recycled water and sewerage services to 58,200 properties, with a population of 158,300 across a region of 3,000 square kilometres to the north west of Melbourne.

Western Water's service area is one of the fastest growing regions in Victoria, with housing development in Melton and Sunbury attracting many new residents. Over the past decade, annual population increases have averaged 3-4%. Population growth in the past year was slower, with serviced properties increasing by 2.1%.

Manner of establishment and the 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 2012 to 30 June 2013, 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 (formerly the Department of Sustainability and Environment). The Department of Treasury and Finance also has a shareholder governance role.

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

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

Objectives and functions

Under sections 93 and 94 of the *Water Act 1989*, Western Water must have regard to the following principles:

- the need to ensure that water resources are conserved and properly managed for sustainable use and for the benefit of present and future generations
- the need to encourage and facilitate community involvement in the making and implementation of arrangements relating to the use, conservation and management of water resources
- the need to integrate both long term and short term economic, environmental, social and equitable considerations
- the need for the conservation of biological diversity and ecological integrity to be a fundamental consideration
- if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to address these threats.

Service area map

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 Water Program 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
- ensuring compliance with the Australian Drinking Water Guidelines 2011 to ensure customer safety.

Highlights 2012/13

- Safe, reliable supply of 12,788 million litres of drinking water to over 58,000 properties
- 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 177 water quality complaints, working with customers to understand the root cause and addressing issues identified
- Upgrades at Merrimu, Rosslynne and Romsey water filtration plants to improve water quality delivery
- Renaming Mount Macedon's Reservoir B after past employee, Graham Brock.

Graham Brock Reservoir, Mount Macedon

Vision, values, mission and strategic themes

Vision

To be a leading service provider working with our community towards a sustainable future.

Western Water's vision reflects principles and practices of sustainability that are embedded throughout the corporation. It is based on the belief that all people, as individuals and communities, must play a part in protecting and preserving our finite water resources. For this reason, our vision maintains a strong community focus.

Values

Our values embody how we will act and define our behaviours. They shape the way we want to interact with staff, customers and stakeholders.

- *Commitment*
- *Accountability*
- *Integrity*
- *Sustainability*
- *Fairness*
- *Inclusiveness*
- *Leadership*

Mission

The Board reaffirmed the vision and values of Western Water during 2012/13, as part of the development of the Strategic Plan. In order to further clarify what Western Water must do, the corporation's fundamental purpose has been defined in the following mission statement:

To retail secure, safe, healthy and reliable water and sewerage services that meet community needs in an efficient and sustainable manner.

Strategic themes

Our strategic themes were also established from the strategic planning process and have now changed to ensure the organisational focus is on three key areas: efficiency, engagement and innovation.

- *Secure the efficiencies needed to help fund growth and drive customer value*
- *Higher levels of engagement with customers, stakeholders and staff in authentic, informed and responsive ways*
- *Build the capacity for, and encourage, innovation, particularly to improve liveability and to deliver efficient solutions.*

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 drinking water, sewerage and recycled water services and maintaining high levels of customer satisfaction.

During 2012/13, Western Water safely delivered 12,788 million litres of drinking water to a population of 158,300 from a combination of local water supplies and the Melbourne supply system, under our bulk entitlement to the Melbourne Headworks System.

Like much of the state, Western Water's service area is subject to increasing climate variability. We must also meet the challenge of accelerating demand as the population grows. To guarantee future supply, it is essential that we make the most of our local water resources and also have the flexibility of being connected to the Melbourne system.

Managing Director, Neil Brennan

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 by an external audit of our Hazard Analysis and Critical Control Points in February 2013, and upgrades took place at several of our water filtration plants to further drive the delivery of quality water supply.

During the year, Western Water enhanced its focus on community engagement, expanding its online consultation panel, and launching social media channels to ensure quick consultation and feedback on any concerns about any aspect of our service delivery.

Proactively managing risk

Western Water is aware of the great 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 17 years. It is with pleasure that we submit Western Water's 2012/13 Water Quality Report to customers, stakeholders and regulators.

Neil Brennan, Managing Director

30 September 2013

COMMITMENT TO DRINKING WATER MANAGEMENT

Western Water closely monitors the quality of drinking water to ensure compliance with standards and other industry guidelines.

Commitment to drinking water management

Western Water closely monitors the quality of its drinking water supplies to ensure compliance with the standards set out in the Safe Drinking Water Regulations 2005. We also adopt other industry guidelines associated with the 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 was endorsed by the Board in August 2008 and updated in 2011. The policy reflects current practice in the delivery of safe drinking water, with procedures and initiatives supporting policy implementation.

This includes the continual application of the Drinking Water Quality Management System (DWQMS), and associated Water Quality Management Plans, to manage and protect water quality. The Drinking Water Policy also outlines Western Water's aim to continuously improve processes, and meet the requirements of the *Safe Drinking Water Act 2003* and subordinate legislation.

The Drinking Water Policy is displayed on noticeboards in the Sunbury office and at all Water Filtration Plants, and is included in inductions for new staff. A copy of the policy is contained in Appendix 1.

Implementation

Western Water will implement this policy through:

- Application of the Drinking Water QMS
- Delivery of Water Plan 2008-2013 actions and initiatives
- Communicating the content and intent of this policy to our employees, customers and stakeholders
- Proactive involvement in catchment management strategies and initiatives
- Adding value to customers and stakeholders through education in appropriate use of water as a precious resource
- Continual improvement of customer satisfaction in relation to drinking water quality
- Maintaining technical and strategic forums with our water storage managers
- 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. This includes Federal and State Legislation, codes of practice, standards, service level agreements, contracts and operating agreements that are relevant to the delivery of safe drinking water. A full list of Western Water's Regulatory and Formal Requirements can be found in Appendix 2.

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. Western Water's HACCP system received independent certification again in the reporting period.

In February 2013, Western Water passed an external audit of its HACCP system which validated our multi-barrier approach to protecting drinking water quality.

Engaging stakeholders

Western Water is committed to building positive and 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.

Established processes are in place to engage with key stakeholders, prompting their involvement and commitment. These include community representatives, customer groups, regulatory bodies and others. This process is tracked through our Balanced Scorecard and reported monthly.

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. Members of the network participate in regular meetings across the service region.

Western Water's online consultation panel has extended the customer base for this network with over 1100 members at the end of the financial year. The advisory network and panel played significant roles in developing Water Plan 2013-2018, with a total of 500 customers providing input on our future direction.

Major external stakeholders include regulatory bodies such as the EPA, DH, DEPI and the ESC as well as water storage managers, 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.

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

Water Plan 2008-2013: Major water quality improvement works

The period of Water Plan 2008-13 saw the Western Water region subject to, and then recover from, a prolonged period of drought that had necessitated interconnection with the Melbourne water supply system. In 2008/09, 94% of the region's drinking water was sourced from Melbourne supplies.

During the five year period, Western Water's customer base grew by 17.4%, from 134,810 at the end of 2007/08 to reach 158,290 this past financial year.

Early in the Water Plan, water quality improvement works focussed on smaller supply systems. However, with the breaking of the drought in 2009/10, Western Water efforts turned to works aimed at upgrading and recommissioning our two major water filtration plants, Rosslynne WFP and Merrimu WFP.

In 2008/09, Western Water undertook catchment protection works at Lancefield Basin, constructed a 3.5 million litre storage tank at Loch Road in Mount Macedon, and replaced the membrane filters at Romsey WFP.

In 2010/11, following the breaking of the drought and subsequent recovery of local reservoirs, Western Water recommissioned both the Rosslynne and Merrimu WFPs.

At Merrimu WFP, works included replacing filter media, upgrading the PLC and SCADA systems, replacing chemical dosing and process monitoring equipment, and constructing a ten million litre water storage tank.

At Rosslynne WFP, works included constructing a filter to reservoir pipeline, overhauling the PLC, upgrading computer systems, replacing chemical dosing pumps and equipment and constructing a ten million litre water storage tank.

With water in the reservoirs once again, Western Water also reintroduced large scale mains cleaning by air scouring this year.

In 2011/12, Western Water works included equipment upgrades at Merrimu WFP to recommission the fluoridation plant and continued the ongoing large scale mains cleaning by air scouring.

Western Water also completed construction of two large water mains to supply Toolern (at Coburns Road and Exford Road) connecting the existing supply system in Melton to the new suburb which may be home to as many as 60,000 people in the coming decade.

In 2012/13, Western Water commenced further upgrades at Rosslynne WFP including constructing a Powdered Activated Carbon (PAC) treatment plant to address the high dissolved organic carbon levels in the local supply, and also commenced works to establish a fluoridation system at the plant.

New 10 million litre storage tank, Rosslynne WFP

ASSESSMENT OF THE DRINKING WATER SUPPLY SYSTEM

Connection to the Melbourne supply system will remain critical to ensure future supply in the face of rapid population growth and an uncertain climate.

Assessment of the drinking water supply system

Water supply system analysis

Western Water addresses multiple challenges to provide quality drinking water. However, over the past 17 years, one of the most significant challenges has been ensuring water supply security.

The impact of drought in the 2000s, combined with ongoing strong population growth, resulted in increasing demand for water from dwindling local supplies. As a result, Western Water's became reliant on water sourced from Melbourne's water system.

Drought conditions also impacted the delivery of quality drinking water. Ground movement in the highly reactive soils of the region is a key cause of water main breaks. When a major break occurs, the resulting rapid flow rate has potential to stir up silt that has built up in the mains.

In the past this silt would have been removed through routine water mains flushing. However, Western Water's drought policy was to not employ this practice because it consumes high volumes of water.

During recent years, significant levels of rainfall have seen local water storages recover to full capacity. This improvement in water supply security has reduced Western Water's reliance on external water supply sources and has also provided the opportunity to recommence targeted mains cleaning.

Through the new Water Supply Demand Strategy, Western Water is focussing on integrated water cycle management – optimising local water sources first, then utilising alternate sources for drinking water substitution, to ensure the sustainability of water supply in the region.

Alongside these measures, the region's connection to the Melbourne supply system will remain critical to ensure future supply in the face of rapid population growth and an uncertain climate.

Water supply system

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

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

Table 1: Drinking water supply

	2011/12	2012/13
Connected water customers	54,073	55,481
- Residential	51,123	52,534
- Non-residential*	2,950	2,947
Water consumption (ML)	11,260	12,830
- Residential	8,634	9,525
- Non-residential	1,673	1,680
- Water losses	953	1,070
Water mains (km)	1,800	1,823
Water filtration plants	7	7
Chlorination plants	14	14

** Non-residential numbers decreased due to data record improvements brought about by the new billing system.*

Water sampling localities

Six water supply systems are located in the region:

- Rosslynne/Sunbury
- Merrimu
- Romsey
- Lancefield
- Woodend
- 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.

Table 2: Water sampling localities and towns			
Water Sampling Locality	Towns	Residential Population 2011/12	Residential Population 2012/13
Bulla	Bulla, Oaklands Junction	760	800
Darley	Darley, Pentland Hills	8,390	8,600
Diggers Rest	Diggers Rest	2,620	2,670
Eynesbury	Eynesbury	1,440	1,840
Gisborne	Gisborne, New Gisborne, Gisborne South, Bullengarook	10,240	10,410
Lancefield	Lancefield	2,120	2,220
Lerderderg	Bacchus Marsh, Merrimu, Coimadai	8,550	8,810
Macedon	Macedon	1,870	1,870
Maddingley	Maddingley, Parwan, Balliang, Balliang East, Rowsley	3,180	3,350
Melton South	Melton, Melton South, Brookfield, Hopetoun Park	31,040	31,500
Merrimu	Melton West, Kurunjang, Long Forest	27,660	27,900
Mount Macedon	Mount Macedon	1,590	1,620
Myrniong	Myrniong	280	300
Riddells Creek	Riddells Creek	3,630	3,740
Rockbank	Rockbank	1,390	1,570
Romsey	Romsey, Kerrie, Monegeetta	4,690	4,760
Sunbury	Sunbury, Goonawarra, Jacksons Hill, Clarkefield	40, 040	40,240
Toolern Vale	Toolern Vale	480	490
Woodend	Woodend	5,460	5,610
Total		155,430	158,300

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

DRINKING WATER SOURCES

Western Water supplies customers with treated drinking water from surface water storages, such as reservoirs and basins, and from groundwater. Our major local water sources are Merrimu Reservoir and Rosslynne Reservoir, both of which were close to capacity at the end of 2012/13.

Water from these reservoirs is supplied through a bulk water agreement with Southern Rural Water (SRW), who manage the reservoirs. Agreements also exist for a number of smaller local storages and reservoirs.

In the past year, local water sources provided a fifth of the region's water supply, with the rest sourced from the Melbourne system.

Melbourne water supplies

Western Water has a bulk entitlement with Melbourne Water to access water from the Melbourne Headworks system. This entitlement is critical during periods of drought and continues to provide a large proportion of drinking water to the region.

Water in the Melbourne system is sourced from protected natural catchments (Upper Yarra Thomson and the Yarra Valley tributaries) and transferred from Silvan Reservoir to Greenvale Reservoir.

In 2012/13, Melbourne Water also supplied Western Water with a small amount of water from the Winneke Treatment Plant, which is supplied from the Yarra River and Maroondah Reservoir via Sugarloaf Reservoir.

The water sources for Sugarloaf Reservoir are not from an entirely protected natural catchment and therefore receive full treatment at Winneke Treatment Plant.

These sources feed the Sunbury/Rosslynne supply system from the 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 3: Major reservoir levels (% capacity) - 10 years										
	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Rosslynne Reservoir	6%	14%	7%	4%	3%	3%	5%	66%	72%	85%
Merrimu Reservoir	7%	22%	17%	13%	13%	10%	9%	85%	78%	83%

Merrimu Reservoir

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, Mt Cottrell	Greenvale Reservoir	Yan Yean and Upper Yarra
	Merrimu Reservior	Lerderderg River, Goodman Creek, Pyrites Creek
	Djerriwarrh Reservoir	Djerriwarrh
Gisborne, New Gisborne, Gisborne South, Bullengarook, Mount Macedon, Macedon and Riddells Creek	Greenvale Reservoir	Yan Yean and Upper Yarra
	Rosslynne Reservoir	Jacksons Creek
Sunbury, Goonawarra, Jacksons Hill, Clarkefield, Bulla, Oaklands Junction, Diggers Rest	Greenvale Reservoir	Yan Yean and Upper Yarra
Woodend	Graham Brock Reservoir (renamed during reporting period) and Reservoir C	Falls/Smokers Creek, Graham Brock Reservoir and Reservoir C
	Campaspe Reservoir	Campaspe River
	Greenvale Reservoir	Yan Yean and Upper Yarra
Myrniong	Pykes Creek Reservoir	Werribee River and Pykes Creek
	Greenvale Reservoir	Yan Yean and Upper Yarra
	Merrimu Reservoir	Lerderderg River, Goodman Creek, Pyrites Creek
Romsey, Kerrie, Monegeeta	Kerrie Reservoir	Upper Bolinda Creek
	Greenvale Reservoir	Yan Yean and Upper Yarra
	Romsey Bore	Romsey groundwater aquifer
Lancefield	Garden Hut Reservoir	Deep Creek
	Monument Creek Weir	Monument Creek
	Bore Number 3	Lancefield groundwater aquifer

SMALLER TOWN SUPPLY SYSTEMS

The towns of Woodend, Romsey, Lancefield and Myrniong have their own supply systems, with additional water supplemented from s in nearby systems. In times of drought, the bulk entitlement from Melbourne supplements these local supplies.

During 2012/13, supplementary water was required from the Melbourne system for Myrniong (240KL of water was cartered from Bacchus Marsh) and Romsey (64 ML of Melbourne water via Riddells Creek).

Woodend

Woodend receives treated water from the local Campaspe Reservoir, via the Marriages Water Filtration Plant (WFP), as well as water from the Macedon Ranges, via the Reservoir C WFP. During 2012/13, 475ML was taken from the Woodend storages, which included 250ML from the Macedon bulk entitlement.

Romsey

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

During the reporting period, 371ML was taken from the local storage, with another 88ML added to the storage's drought reserve.

Upgrades were completed at the Romsey WFP during 2012/13 to accommodate connection to the Romsey Borefield. The plant is now able to supply bore water to the town as an additional source of local drinking water when surface water supplies are low.

Myrniong

Myrniong receives its water supply from Pykes Creek Reservoir, after treatment at the Myrniong WFP. A total of 39ML was taken from the storage during the reporting period in compliance with its bulk entitlement.

Graham Brock Reservoir commemorates dedicated employee

Woodend's Reservoir B on Mount Macedon was officially renamed Graham Brock Reservoir in 2013 after past employee Graham Brock. For 18 years, Graham worked as a dam surveillance officer at Western Water, monitoring water levels and identifying any signs of damage that could potentially affect water quality or safety. He was renowned throughout the organisation for his dedication and loyalty.

When Graham was diagnosed with cancer, his colleagues felt naming the reservoir after him would be the best way to pay tribute to his hard work and friendship over so many years. Sadly, Graham passed away in 2012 but he was aware of plans to name the reservoir after him.

After a lengthy process involving the local council and state government departments, the reservoir was officially renamed Graham Brock Reservoir in 2013 and Mr Brock's family were guests of honour at an unveiling event for the sign bearing the reservoir's new name in July.

Graham Brock

Graham Brock Reservoir, Mount Macedon

Lancefield

The Lancefield Water Filtration Plant can receive and treat surface water, bore water or a mixture of both. In the past drought, there were times when all water supplied in Lancefield was from the bore.

Since January 2013, low surface water storage levels have meant that bore water has made up around two thirds of Lancefield's drinking water supply. Because Lancefield's bore water has unique characteristics, Western Water undertook extensive community engagement about the change in supply – putting up posters in town, attending the local farmers' market, direct mailing all customers and providing electronic advice to Lancefield members of our online panel and Facebook friends.

During the year, 122 ML of water was taken from local surface water storages at Lancefield with another 66 ML taken from Lancefield's bore water supplies.

New water source required for Lancefield

In January 2013, the combined effect of extended hot weather, low rainfall and lack of water restrictions led to a rapid decline in Lancefield's surface water storages, necessitating the reintroduction of bore water into the drinking water supply. Since then, bore water has made up around two thirds of Lancefield's drinking water supply.

Western Water has rights to draw water from two bores in Lancefield. Access to the bores is essential to ensure the town has a reliable drinking water supply. During the past drought, there were periods when Lancefield's entire water supply was bore water as all the local surface water had dried up.

Unfortunately, Lancefield's Bore 2 is no longer a viable source for supplying drinking water. This was discovered as a result of extensive testing of the bore's water characteristics during the reporting period. Notably, the loss of Bore 2 leaves the town in the risky position of having only one bore available for supply.

As a result, Western Water is in discussions with Department of Environment and Primary Industries to explore opportunities to use their local bores to increase local supply security. We are also exploring the viability of carting drinking water into the town as a temporary measure if required.

There is no doubt that a longer term solution is required for Lancefield. Detailed consideration of several options has identified that the most viable solution for the town will be to connect to the Romsey water supply system. In doing so, Lancefield will also be indirectly connected to Western Water's wider supply network including both the Rosslynne and Melbourne Water supply systems.

Assessment of water quality data

Western Water collects extensive history of water quality at water source, treatment plants and customer taps. Samples are both scheduled and collected by an independent NATA accredited laboratory. Once analysed, results are sent directly to our Water Information Management System (WIMS) database which allows 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. In the case of drinking water samples, the limits are based upon the ADWG 2011. In addition, the contracted laboratory is required to immediately notify Western Water of any health-related exceedances detected in drinking water samples.

Western Water uses water quality data obtained from the WIMS database to monitor trends (e.g. monthly reporting for our Balanced Scorecard) and also data from SCADA to review trends of water systems on an as needed basis (e.g. customer complaint investigations).

Hazard identification and risk management

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

The RMP defines Western Water's water quality commitments and obligations, and describes each supply system, focussing on water quality management. The RMP identifies and assesses risks to the quality of drinking water in all systems.

Control measures are included to ensure risk management processes are in place to manage potential deviations from any ineffective treatment of the water supply. The RMP is designed to be periodically reviewed and assessed to ensure long-term effectiveness.

Full systems analysis for proactive water supply management

During the reporting period, Western Water undertook a full systems analysis of water quality from a microbiological perspective, utilising information from the WIMS database and exceedances reported from the independent laboratory that monitors water quality for Western Water.

By looking at trends over the past five years of reporting, the analysis aimed to identify why *E. coli* detections occasionally occurred in the absence of any apparent reason. The research looked at 16,860 samples for *E. coli* and found that of the 50 positive detections, 94% occurred where samples were taken from garden-tap style fittings (i.e. the sort of garden tap device you would find in any front yard).

Western Water currently uses both specialised "plug-in fitting" sampling points and garden-taps. The dominant industry practise is to use the specialist "plug-in fittings", as they provide improved ability to sterilise the sampling equipment prior to taking an actual water sample.

Whilst around half of sample points are "garden-taps", the finding that they accounted for 94% of detections supported anecdotal evidence that it was difficult to secure an uncontaminated sample when using garden tap sites.

As a result of the analysis, Western Water is now planning to progressively replace all routine water quality sample points with click-in fittings in order to reduce the likelihood of future "false-positive" detections.

PREVENTATIVE MEASURES FOR DRINKING WATER SUPPLY

Western Water adopts a number of processes to ensure delivery of safe, high quality drinking water supplies.

Preventative measures for drinking water supply

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

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

The last independent external audit by the Department of Health took place In November 2011 and confirmed Western Water is fully compliant with the *Safe Drinking Water Act 2003* requirements. The next audit will take place in early 2014.

Divers testing water quality in Romsey raw water basin

During the reporting period, Western Water engaged divers to assess the condition of a raw water basin that supplies the town of Romsey. This investigation occurred as a result of four complaints arising from the town in a short space of time.

The divers were able to obtain grab samples from various points within the raw water basin. These samples were sent away for biological and chemical analysis. Results found that large macrophytes (plants) had grown in the basin and these plants were causing a change in the taste of the raw water which was detected in the drinking water supply.

Western Water will consider the best approach to dredge and clean the bottom of the basin.

Diver assessing the condition of the Romsey raw water basin

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 Water Catchment Protection Policy 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
- delivery of training and competence assessment of operators through registered training organisations.

Catchment protection

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

Protected reservoirs

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 and this is supported by security patrols. Water quality at reservoirs is also monitored to ensure safety.

Inside Minns Road tank

Storage tanks

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.

During 2012/13, a review of the water quality monitoring program identified a number of small tanks were not included in the program - the Dicksons Tanks, Wilkies Tank and the Williams Rise Tank. Located at the end of the system, these tanks were historically not monitored due to the low populations they supply.

However, in accordance with Western Water's HACCP system, each of these tanks is now monitored weekly for a range of water quality parameters.

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.

Minns Road tank maintenance

During the reporting period, the main Minns Road tank in West Melton was drained and cleaned as part of Western Water's routine inspection and maintenance program.

The largest of three drinking water tanks in Minns Rd, the tank holds 35 million litres of water and usually supplies customers in Melton, Eynesbury, Rockbank and Hopetoun Park.

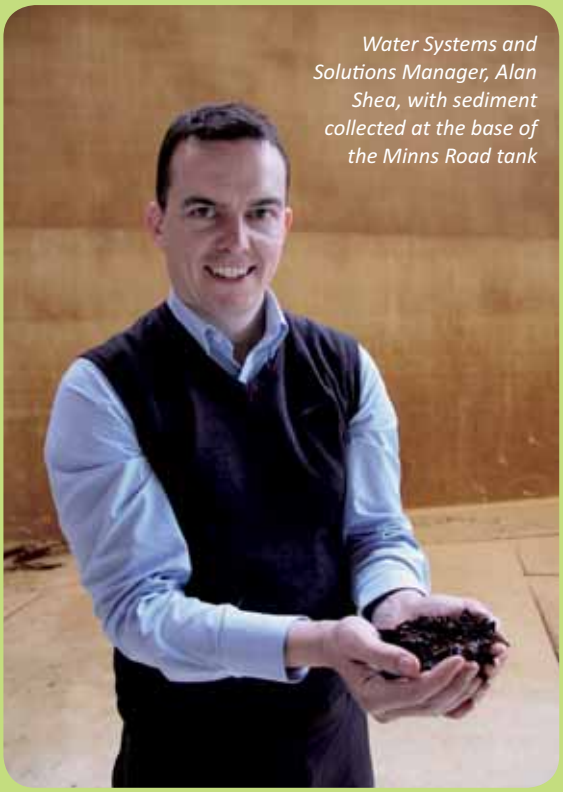
Virtually all water in the tank was consumed as normal in the drinking water supply system before the remaining water was drained onto a nearby paddock.

The internal walls and floor of the tank were then cleaned using high pressure water to remove any fine sediment that had settled over time.

While the tank was out of service, the remaining two tanks at Minns Rd were used to supply the area.

Since then, remedial works have been conducted at the tank to modify spot dosing facilities and install a new outlet on the tank.

The tank will be refilled in the lead up to summer, ensuring full storage capacity to address demand over the coming 2013/14 summer.



Water Systems and Solutions Manager, Alan Shea, with sediment collected at the base of the Minns Road tank

Table 5: Water treatment chemicals and processes by locality

Sampling locality	System	Treatment process	Added substances	Comments
Melton South Lerderderg Maddingley Darley Merrimu Rockbank Toolern Vale Eynesbury	Merrimu system (Merrimu Reservoir via Merrimu Water Filtration Plant)	Coagulation Clarification/ filtration pH correction Fluoridation Chlorination Additional chlorination by booster chlorinators along reticulation system as required	Aluminium Sulphate, Polyelectrolyte, Lime, Chlorine Gas, Sodium Silicofluoride, Sodium Hypochlorite3	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	Rosslynne system (Rosslynne Reservoir via Rosslynne Water Filtration Plant)	Oxidation Coagulation pH correction Dissolved Air Flotation Filtration Chlorination Additional chlorination	Aluminium Sulphate, Potassium Permanganate, Polyelectrolyte, Lime[2], Carbon Dioxide[2], Chlorine Gas, Sodium Hypochlorite[3]	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 the Rosslynne Water Filtration Plant and associated infrastructure are maintained. This supply is further chlorinated at Macedon, Mount Macedon and Riddells Creek.
	Rosslynne system (Greenvale Reservoir via Riddell Road Pump Station)	Fluoridation and primary chlorination by Melbourne Water Secondary disinfection (Chloramination) at Loemans Rd Pump Station Additional chlorination by booster chlorinators along reticulation system as required	Sodium Hexafluorosilicate[1], Chlorine Gas, Lime[2], Carbon Dioxide[2], Sodium Hypochlorite[2 3], Aqueous Ammonia	
Sunbury Bulla Diggers Rest	Sunbury system (Greenvale Reservoir via Loemans Road Pump Station)	Fluoridation and Primary chlorination by Melbourne Water Secondary disinfection (Chloramination) at Loemans Rd Pump Station	Sodium Hexafluorosilicate[1], Lime, Carbon Dioxide, Sodium Hypochlorite[2] , Aqueous Ammonia	
Woodend	Woodend system (Campaspe Reservoir via Marriages Water Filtration Plant and Graham Brock Reservoir, Reservoir C & Greenvale Reservoir via Reservoir C Water Filtration Plant)	Coagulation pH correction Dissolved Air Flotation Filtration Chlorination	Powdered Activated Carbon (as required at Marriages Water Filtration Plant), Aluminium Sulphate, Polyelectrolyte, Sodium Carbonate ('Soda Ash'), Sodium Hypochlorite,	Supply is fully treated at the Marriages Water Filtration Plant and Reservoir C Water Filtration Plant. 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, disinfection regime was switched from chloramination to chlorination.
Romsey	Romsey system (Kerrie Reservoir & 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	
Lancefield	Lancefield system (Garden Hut Reservoir and groundwater)	Coagulation pH Correction Filtration Dissolved Air Flotation Chlorination	Aluminium Chlorohydrate (as required), Sodium Hydroxide (Caustic Soda), Potassium Permanganate, Powdered Activated Carbon (PAC), Sodium Hypochlorite	During drought, surface water supplies diminish. In extreme drought, water supply can be solely derived from bore water.
Myrniong	Pykes Creek Reservoir	Coagulation Oxidation pH correction Dissolved Air Floatation 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).

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.

Filtration

Western Water operates seven water filtration plants (WFPs), and an additional 14 water treatment facilities which booster chlorinate the water. All but two WFPs employ dissolved air flotation filtration (DAFF). 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.

Coagulation

Before filtration, water undergoes a process where particles in the raw water supply are brought together forming floc to aid the filtration process. The addition of a coagulant such as aluminium sulphate (alum) and polyelectrolytes assists in the formation of floc. This maximises removal of colour and particulates in the latter stages of the treatment process.

Treatment also removes the dosed coagulants, confirmed through regular testing of treated water for treatment chemical residuals, specifically acid-soluble aluminium. These test results are provided to DH on a monthly basis. Coagulation is undertaken at the Rosslynne, Merrimu, Marriages, Reservoir C, Myrniong and Lancefield WFPs.

Dissolved air flotation filtration (DAFF)

The DAFF water treatment process involves coagulated/flocculated water passing through a set of diffusers, releasing a stream of water saturated with dissolved air. As air is released, micro bubbles float to the surface collecting flocculated particles on the way.

This causes a separation between floc on the surface and clear water underneath and floc is then removed. The remaining clear water is filtered through a multimedia filter bed to remove any remaining particles.

DAFF treatment is used at the Rosslynne, Marriages, Res C, Lancefield and Myrniong WFPs.

Sedimentation/filtration

This process involves coagulated water travelling through a floc blanket, trapping large suspended particles. This floc eventually sinks to the bottom of the sedimentation tank and is drawn off as inert slurry. The remaining clarified water is collected in a series of channels, allowing the water to pass through multimedia filters.

Filtration is used to remove dirt, pathogens and other materials from water. It is a key treatment process for surface water supplies that may not be adequately protected at their source.

The Merrimu WFP incorporates sedimentation/filtration processes to treat and filter water from the Merrimu and Djerriwarrh Reservoirs. The Merrimu WFP has the capacity to supply Melton South, Eynesbury, Lerderderg, Darley, Maddingley, Rockbank, Toolern Vale and Merrimu water quality localities.

Microfiltration

Romsey's supply is treated using microfiltration, where membranes filter water from Kerrie Reservoir. Water is pumped through small porous membranes designed to capture naturally occurring small particles and organisms.

Merrimu WFP

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 Melbourne Headworks System water. Lime, carbon dioxide or sodium carbonate may also be added to the water to adjust the pH level.

Chlorination

Chlorine is the most widely used disinfectant for drinking water in Australia, and is added to the water supply in accordance with the ADWG.

Small amounts of chlorine (either in the form of chlorine gas or sodium hypochlorite solution) are added to the water supply to destroy any bacteria or viruses that may cause illness. Chlorine may also be added at selected water pump stations or water storage tanks as it is important to maintain a minimal amount of chlorine throughout the entire system.

The water supply is carefully monitored throughout the distribution system in accordance with the requirements of the Safe Drinking Water Regulations 2005 and chlorine levels are normally maintained at levels below that which can be detected by customers. However, changes in chlorine levels causing noticeable taste and odour issues may occur, for example, if there are sudden increases in the demand for water during hot weather.

Localities using chlorine disinfection include those within the Merrimu water supply system (Melton South, Lerderderg, Darley, Maddingley, Rockbank, Toolern Vale, Merrimu and Eynesbury), Myrniong, Lancefield and Woodend. Gisborne, Riddells Creek, Macedon and Mount Macedon have additional disinfection capabilities via chlorine booster stations located within their distribution systems.

Chloramination

Chloramination is a different form of disinfection. A small amount of ammonia is added to the water just prior to the chlorine to form monochloramines. These chloramines provide a less active, but longer lasting, disinfecting affect. This has the advantage of enabling the disinfecting chemicals to last longer, thereby penetrating further and more effectively into the water supply system. In addition, the resulting taste and odour is less intense. Chloramination is preferred in areas where water travels over long distances or is stored for an extended period before it reaches customer taps.

Chloraminated supplies include the Romsey, Sunbury, Diggers Rest and Bulla systems. Whilst the Rosslynne, Lancefield and Woodend systems have the capacity to be chloraminated, they are currently chlorinated.

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 supplies fluoridated local water from Merrimu WFP. The existing fluoridation plant was upgraded and approved for use by the Department of Health in the last reporting period, and Western Water has committed to building a new fluoride plant at the Merrimu WFP within the next 5 years.

A fluoride plant is currently under construction at Rosslynne WFP, with the financial assistance of the Department of Health, in readiness for returning customers in the Rosslynne supply system to local water supplies in late 2013.

None of Western Water's smaller WFPs currently add fluoride to their water supply.

Water from the Melbourne supply is fluoridated by Melbourne Water and this accounted for 80% of the region's drinking water in 2012/13. Fluoride (dosed as sodium hexafluorosilicate or hydro-fluorosilic acid) 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 fluoridated only when local supplies are supplemented with water from the Melbourne supply system.

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#	

** These towns received fluoridated water when supplied with water from the Melbourne Headworks system.*
 # These localities occasionally received fluoridated water from the Melbourne Headworks system.

pH correction

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

Water's pH level may be corrected by adding lime and carbon dioxide, or sodium carbonate, at the start of the treatment process to assist with coagulation. The pH may be adjusted again at the end of the process to ensure effective disinfection and limit final water corrosiveness.

The pH of water sourced from Melbourne must be maintained within the ADWG specified range of 6.5-8.5 pH units. However, the pH levels at the system's extremities, Macedon and Mount Macedon, were consistently over these limits during the reporting period and this situation will be resolved when the towns are returned to local water supply from Rosslynne Reservoir, planned for late 2013. Returning to local water production will reduce pH variation, as the overall age of the water supplied will decrease.

WFP upgrades improving water quality

During the reporting period, Western Water invested in a series of upgrades at local water filtration plants (WFPs) to improve the quality of water supplied.

At Merrimu WFP, improvements were made to both the sludge beds and the fluoridation system, in preparation for the plant returning to full supply operation in July 2013.

At Rosslynne WFP, upgrades are ongoing, 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 existing treatment process. A fluoridation system has also been added to Rosslynne's water treatment practices, to bring the plant in line with State Government fluoridation policy. Rosslynne WFP will be back in full supply operation by the end of 2013.

Improvements have also taken place at Romsey WFP to ensure the additional bore water supply is incorporated into the water treatment process at the plant.

Finally, Western Water disconnected all raw water interconnections at Rosslynne and Merrimu WFPs, removing potential for inadvertent direct contamination events from raw water, and further ensuring the safety of the local water supply.

PAC tanks under construction at Rosslyne WFP

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 of positive pressure

Western Water maintains 1,823 km of water mains, with 23km of new mains added to the system during the reporting period. Our extensive reticulation system is operated and maintained with actions including valve exercising, complaint triggered mains flushing and condition assessment. These help reduce water loss through leakage and burst pipes, and assist in maintaining water quality.

The number of burst water mains in 2012/13 was above the prior year. Water mains are highly sensitive to ground movement with bursts more likely to result in periods of high seasonal variation. Nonetheless, the number of bursts per 100km of water main remains well below the Essential Service Commission's target.

The recovery of local storage levels led to Western Water reinstating its proactive mains cleaning program in the last two reporting periods. Towns benefiting from mains flushing during 2012/13 included Bacchus Marsh, Long Forest, Emu Bottom, Gisborne and New Gisborne.

Table 7: Water mains bursts - 5 years

	2008/09	2009/10	2010/11	2011/12	2012/13
Water mains bursts	290	202	253	334	358

Storage tank integrity and cleaning

Western Water has a routine cleaning program for storage tanks in the distribution system, which involves use of scuba divers and specialised underwater cleaning equipment. This removes 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

Western Water has a dedicated backflow prevention officer to help target and reduce the likelihood of backflow occurrences in the system. The backflow role is part of Western Water's HACCP team and potential backflow detections are assessed by a risk-based process within the HACCP system. Backflow auditing is continuing in partnership with Casey Inspections and Western Water is reviewing its customer communication process for backflow prevention.

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 deployed to manage significant risks at key points in the 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. There are 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.

Western Water achieved HACCP Accreditation to Codex Alimentarius Alinorm 97/13A for all its drinking water supplies in May 2006, and this is maintained by regular external audits. This accreditation is in line with Western Water's vision for continuous improvement and water quality protection.

During 2012/13, Western Water continued its improvement of its HACCP system by implementing a scope for the system as a whole verifying the catchment to tap approach. Each water treatment plant was audited internally against current HACCP plans, and any deficiency in an individual plan was rectified by due process through the HACCP team. The Critical Control Points within the HACCP system all focus on process control, with alarmed alert limits and plant shut downs for critical limits.

Improvements identified, and subsequently made, as a result of the internal audit process include upgrades to PLC controllers at remote sites, installation of inline equipment at water treatment plants, and changes to chlorine dosing set points to help address customer concerns regarding taste and odour.

In February 2013, Western Water successfully maintained independent certification of its Hazard Analysis and Critical Control Point system. The certificate is included in Appendix 3.

OPERATIONAL PROCEDURES AND PROCESS CONTROL

Formal operational procedures ensure the consistent delivery of quality drinking water across the region.

Operational procedures and process control

Operational procedures

Western Water understands that formal operational procedures are critical to ensuring 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:

- Flow Tests for Chemical Dosing Pumps
- Chlorine Strength Test Work Instructions
- Calibration Procedures and Schedules
- Laboratory Test Work Instructions
- Internal Auditing Procedure and Scheduling
- Non Conformance Procedures.

Western Water's Integrated Management System (IMS) addresses and links various business practices, including Occupational Health & Safety (OH&S), QMS, HACCP, Environmental Management System (EMS) and Risk Management. As issues, events, audits, incidents or improvement actions are required, they are captured in 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 2012/13.

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.

SCADA coordinator celebrates 15 years' service

Wes Wittick began his career with Western Water at the Merrimu Water Filtration Plant over 15 years ago, not long after the authority came into being.

Initially, Wes took on a key function in plant operations and maintenance, in a team of three that operated both the Merrimu and Bacchus Marsh plants. He received extensive training in water operations from Geelong's Water Industry Training Centre.

Wes believes the greatest change he has noticed during his time at Western Water was the connection to Melbourne water supplies. Wes was heavily involved in the project, particularly with the Hillside connection point.

For over three years now, Wes has taken on coordination of Western Water's extensive SCADA network, which comprises a multitude of data monitoring and transmitting devices across the supply system, including radios and remote terminal units. In total, there are over 150 remote sites on the SCADA network including plants, water and sewer pump stations as well as weather monitoring stations.

The SCADA system really captured Wes' imagination when it was introduced to Western Water over a decade ago, and he continues to marvel at the technology that allows remote monitoring of system performance at any time.

Wes appreciates the opportunity via SCADA to work across all Western Water's assets – drinking water, sewer and recycled water. He is looking forward to continuing his service with Western Water in this interesting, evolving and valuable field of work.

SCADA coordinator, Wes Wittick

VERIFICATION OF DRINKING WATER QUALITY

The health and aesthetic quality of drinking water is ensured through a rigorous process of monitoring and reporting.

Verification of drinking water quality

The Water Program at the Department of Health (DH) 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.

The guideline values in the ADWG 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 Associations (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, as well as Western Water's HACCP system, which ensures the approved chemicals are used throughout the treatment process within specifications.

Drinking water quality compliance

During 2012/13, 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.

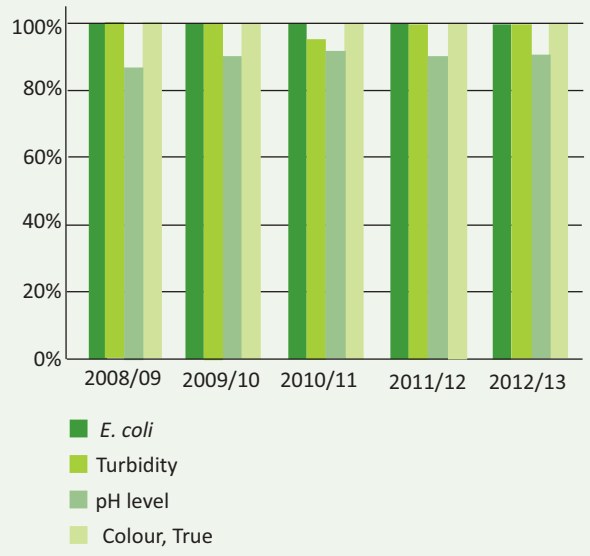
Table 8 and Chart 1 provide a snapshot of Western Water's compliance on key health and aesthetic parameters for drinking water quality. *E. coli* and turbidity are core indicators of drinking water health, and turbidity, pH level and true colour are core indicators of drinking water aesthetics.

In November 2011, 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 January 2014.

Table 8: Drinking water quality compliance - 5 years

Compliance	2008/09	2009/10	2010/11	2011/12	2012/13
E. coli	99.9%	100.0%	99.9%	100.0%	99.1%
Turbidity	100.0%	100.0%	94.8%	100.0%	100.0%
pH level	87.0%	92.1%	91.0%	89.5%	89.5%
Colour, true	100.0%	100.0%	99.0%	100.0%	100.0%

Chart 1: Drinking water quality compliance - 5 years



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

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

Drinking water aesthetics

Western Water tests for parameters in the drinking water supply that may affect the appearance, or the taste and odour of drinking water, 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 pH level, iron, hardness, calcium, magnesium, ammonia, true colour, sodium, total dissolved solids, and sulphate.

These results are measured against the aesthetic and health guideline values 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 4.

The majority of drinking water aesthetics parameters were compliant during 2012/13, with the exception of the pH levels for both Macedon and Mount Macedon. The levels in these two zones were not compliant (based on mean results for the year) because they received water travelling long distances from the Melbourne supply. Rosslynne Reservoir will recommence supplying local drinking water in late 2013 and this should address pH level compliance in both towns.

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 2012/13. An overview of the parameters tested, and frequency of testing at each sampling location, for pesticides, chemicals (organics and in-organics), metals, physical and radiological parameters and their results are detailed in Appendix 4.

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 2012/13. 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.

Western Water and Southern Rural Water share monitoring results for Pykes Creek, Merrimu and Rosslynne Reservoirs as a means of increasing stakeholder communication and awareness.

Western Water received regular results on BGA numbers in the three reservoirs during the reporting period, allowing for the timely assessment of adverse impacts on our ability to treat and provide safe drinking water to customers.

Melbourne Water is required to notify Western Water of any major changes in treated water quality for water supplied 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.

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.

Table 9: Blue green algae notifications from SRW			
Location	Nature of Incident	Drinking water supply potentially affected	Date and duration
Merrimu Reservoir	Level 2 Bloom	Melton South, Bacchus Marsh, Eynesbury, Toolern Vale, Rockbank	10 Sept 2012 1 week
Merrimu Reservoir	Level 2 Bloom	Melton South, Bacchus Marsh, Eynesbury, Toolern Vale, Rockbank	17 Dec 2012 1 week
Pykes Creek Reservoir	Level 2 Bloom	Myrniong	11 Mar 2013 1 week
Pykes Creek Reservoir	Level 2 Bloom	Myrniong	25 Mar 2013 1 week
Merrimu Reservoir	Level 2 Bloom	Melton South, Bacchus Marsh, Eynesbury, Toolern Vale, Rockbank	11 Mar 2013 1 week
Merrimu Reservoir	Level 2 Bloom	Melton South, Bacchus Marsh, Eynesbury, Toolern Vale, Rockbank	13 May 2013 1 week
Pykes Creek Reservoir	Level 2 Bloom	Myrniong	11 June 2013 1 week

Each of the BGA notifications listed above triggered Western Water's HACCP plan alert limits. Every instance of a level 2 bloom means that Western Water then conducts follow up sampling of the reservoir to ascertain the water quality at the off take to the treatment plant. On each occasion, sampling revealed that, whilst there was a bloom occurring on the surface, this was not the case at the off take (6m below the surface).

As a further precaution, the Blue Green Algae Quality Control plan was linked to the disinfection Critical Control Point to ensure adequate disinfection was occurring during the changeable raw water quality conditions.

Customer satisfaction

Water quality complaints

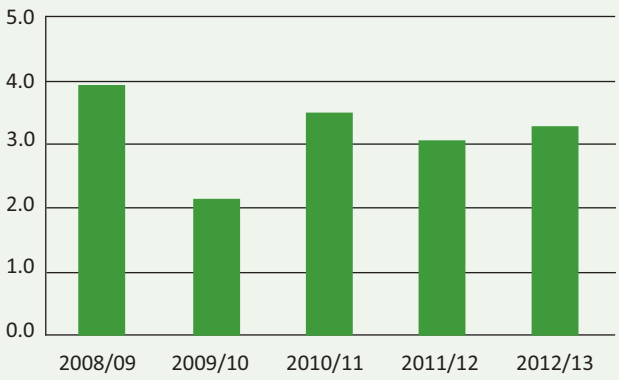
Western Water's holistic approach to managing correspondence and complaints manages any complaint from receipt to resolution to ensure fast and effective resolution, and minimal adverse customer impact. Action is taken on all water quality related complaints. This action can include verbal advice, further 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 2012/13, with Western Water receiving 3.25 complaints per 1,000 customers (or 0.325 complaints per 100 properties as per DH reporting requirements).

Table 10: Water quality complaints per 1,000 customers – 5 years				
2008/09	2009/10	2010/11	2011/12	2012/13
3.92	2.14	3.48	3.07	3.25

Western Water measures compliance of complaints according to the ADWG, which measures complaints per 1,000 customers. For this reporting format, a customer is one customer property. Complaints are tracked through internal business performance reporting.

Chart 2: Water quality complaints per 1,000 customers - 5 years



During 2012/13, Western Water recorded more water quality complaints in comparison to the prior year. A contributing factor to this may be the changing of source water supply during the reporting period, from Merrimu water to Melbourne water, and then back again. Complaint numbers often spike during supply system changes.

Table 11: Water quality complaints per locality		
Locality	Complaints	Complaints per 100 customers[1]
Bulla	1	0.002
Darley	12	0.020
Diggers Rest	1	0.002
Eynesbury	4	0.007
Gisborne	19	0.034
Lancefield	4	0.007
Lerderderg	2	0.004
Macedon	4	0.007
Maddingley	7	0.013
Melton South	46	0.083
Merrimu	1	0.002
Mt Macedon	7	0.013
Myrniong	1	0.007
Riddells Creek	8	0.014
Rockbank	2	0.004
Romsey	5	0.009
Sunbury	46	0.083
Toolern Vale	1	0.007
Woodend	6	0.011

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

Table 12: Water quality complaints by type					
Complaint type	Complaints	Complaints per 100 customers	Localities by highest number of complaints		
			1st	2nd	3rd
Taste / odour	44	0.08	Sunbury	Melton South	Gisborne
Dirty / discoloured	105	0.19	Melton South	Sunbury	Gisborne
White water	16	0.02	Melton South	Sunbury	Darley
Illness	4	0.007	Melton South	Mount Macedon	Woodend
Other	8	0.014	Sunbury	Melton South	Woodend
Total	177	0.32			

Water quality complaints by locality

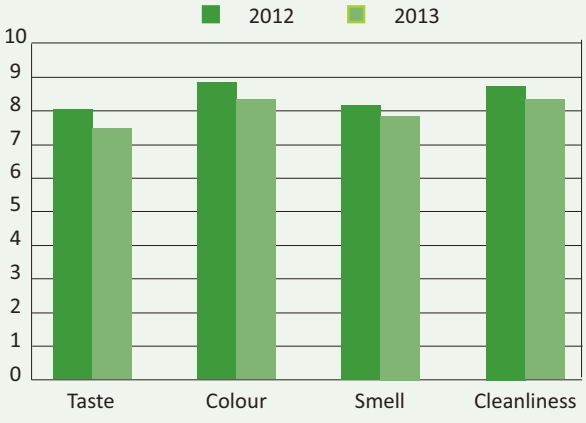
In 2012/13, four localities recorded 10 or more complaints. The highest level of complaints per 100 customers was recorded in both Melton South and Sunbury due to two major distribution disturbances causing an increase in dirty water and white water complaints.

Customer satisfaction research

In May 2013, results from the annual customer satisfaction research remained very high, with 89% of the 600 residential customers interviewed being satisfied with the overall service provided by Western Water. The average rating of 8.2 out of 10 demonstrates strong and stable satisfaction with service delivery over many years.

Satisfaction with overall water quality remains high, although satisfaction with all quality indicators slightly declined in 2013. Western Water is well perceived as a valuable member of the community. The main concern for customers not satisfied with Western Water related to the cost of services.

Chart 3: Customer satisfaction with water quality aspects (score out of 10), 2012 vs 2013



INCIDENT MANAGEMENT AND EMERGENCY RESPONSE

Western Water has systems and resources ready to respond to emergencies 24 hours a day, 7 days a week.

Western Water is trialling innovative pipe rover technology to assess internal condition of drinking water mains to proactively manage system maintenance

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.

Responding to urgent situations is a familiar task for Western Water. When an emergency is considered significant, it is escalated to an incident. Western Water has standard procedures in place to escalate any business situations that threaten customers, assets or the environment. This ensures that the business is focussed on responding appropriately to the situation at hand to minimise risk.

Each year several situations are escalated to an incident, in which case established reporting 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*

E. coli *detected at customer tap (November 2012)*

Routine water quality monitoring at a customer tap in Melton South resulted in an *E. coli* detection of >200 organisms per 100mL, in the presence of 0.32mg/L of free chlorine and 0.47mg/L of total chlorine. Sampling was conducted via a click in fitting.

All other reticulation sites for the same water quality locality, sampled on the same day, along with associated storages, were free of *E. coli* and coliforms.

Response to incident

Upon receiving the exceedance report, Western Water attended the site and investigated the sample tap. The sampler had identified that the protective cover for that sample point had been damaged, leaving the fitting exposed to the environment.

It was quickly ascertained that the positive *E. coli* result was due to dead insects inside the fitting itself rather than the water supply.

This was confirmed by follow up sampling that occurred over the next three days, as well as the absence of other positive detections across the region.

The sample tap was replaced with a new protective cover in place. Follow up meetings were conducted with the laboratory and samplers to confirm that if there is suspected contamination of the sample tap, including damaged covers, then the sampler should move onto another customer tap within the same water sampling locality.

E.coli *detection at Williams Rise tank (February 2013)*

Routine sampling resulted in a single *E.coli* detection at the Williams Rise tank.

Response to incident

Investigations were carried out to determine the water age in the tank and the number of properties supplied by the tank.

The tank has a very long inlet main and only supplies a small number of properties so usage is very low. Therefore, maintaining adequate chlorine residuals into the tank is difficult.

Due to the single detection, it was thought the result may be due to sample tap contamination or a recent heavy rain event.

The tank was spot dosed to bring chlorine residuals up and sampling at the tank was conducted for three consecutive days. All results were clear for microbiological contaminants.

Continual monitoring of the tank on a weekly basis showed clear results for the remainder of the month until a further single *E. coli* detection occurred during March.

E. coli *detected at Williams Rise tank (March 2013)*

Routine sampling resulted in a single *E. coli* detection at the Williams Rise tank. The tank had only been placed on the routine monitoring program in January 2013.

Response to incident

The Williams Rise tank is located at the end of a very long inlet main, making it difficult to maintain chlorine residuals, so it was spot dosed to bring chlorine residuals up and investigation was conducted into the reticulation that feeds the tank. In addition, the system was manipulated to draw freshly chlorinated water from another tank above the Williams Rise tank, and extensive flushing was conducted to draw that water all the way through the long inlet main into Williams Rise.

The tank was then sampled for three consecutive days and remained clear of any *E.coli* detections. However, faecal streptococci were detected in the last sample. Due to the nature of this test, results were not issued until five days after the initial sampling.

It was originally suspected that the garden type sampling tap was the source of the detection because it was a single detection. Hence, sampling focused around the tank and not in the reticulation.

With this new detection, however, a sweep of the reticulation both before and after the tank was conducted. Results from this sampling produced a positive *E. coli* at a non-routine customer tap. As a result, Western Water declared an incident.

Because this detection was downstream of the Williams Rise tank, the tank became the focus of further investigations and it was found that the gantry was positioned directly above the lip of the access hatch.

There were bird droppings in a concentrated area of the roof, near the access hatch, indicating that birds were roosting on the gantry.

With the amount of droppings on the roof, it was conceivable that with heavy rain the droppings could be washed into the tank.

As a result, the gantry was moved away from the roof of the tank and the droppings were soaked in sodium hypochlorite and scrubbed off. The tank was spot dosed again and the reticulation system below the tank was flushed.

As a precaution, a boil water notice was prepared and an incident team placed on standby for the long weekend. All follow up testing remained clear of microbiological contaminants, and the boil water notice was not issued.

Faecal streptococci detections at Dicksons tanks and overpass (March 2013)

The Dicksons tanks were a new addition to the routine monitoring program in 2013 and in March 2013, routine sampling revealed positive detection for faecal streptococci, both at the tanks and at an outlet sample point.

Response to incident

Western Water responded immediately upon receiving presumptive positive detections, which the laboratory confirmed the following day.

Dicksons tanks (north and south), along with Wilkie tank (a small tank below the Dicksons tanks), were spot dosed with sodium hypochlorite and the entire system was flushed to pull freshly chlorinated water through.

Follow up sampling occurred after the remedial works and results were clear for faecal streptococci. However, there remained a high coliform count at the overpass sample point. This prompted further actions.

The tanks were monitored closely for chlorine residuals and spot dosed accordingly. Sampling continued until three consecutive days of clear results were obtained.

It was suspected that the issue in this remote part of the system was due to backflow. All properties being fed from this system were checked for appropriate water meters (double check valves) and all single check meters were replaced with double checks.

The entire system was flushed fully to ascertain the timeframe for system turn over. This was done in preparation for further flushing works, so the system could be further analysed for backflow. Ongoing backflow investigations are occurring to assess backflow potential in that system and a new booster chlorination site is being commissioned.

Faecal streptococci detection at Maloneys Road tank (March 2013)

A routine tank sample returned a positive faecal streptococci result of 1organisms/100mL in the presence of 0.86mg/L free chlorine and 1.16mg/L total chlorine. The sample point type is a garden tap.

Response to incident

This detection seemed to be false, given the high levels of chlorine associated with the sample. However, follow up actions remained as per procedure. A full inspection of the tank was conducted to identify potential entry points for contaminants (e.g. droppings, vermin). The tank integrity was sound.

Chlorine residuals were checked via SCADA for the days leading up to the sample collection and the plant process was assessed. It was found that all systems had been operating normally. A chlorine residual was then taken at the sample tap to confirm that SCADA was accurate.

The system was flushed and resampling occurred upstream, at the tank and downstream. This sampling effort was conducted over three consecutive days with clear results obtained for each day.

A system wide analysis of positive microbial detections over the last five years was conducted as a result of this spate of detections, demonstrating a strong correlation between false detections and garden type fittings on tanks.

Faecal streptococci detection at sentinel sampling site (April 2013)

A single faecal streptococci was detected at a weekly sampling site, in the presence of 0.24mg/L free chlorine and 0.38mg/L of total chlorine. All other sites for the same system collected on the same day were clear.

Response to incident

The Department of Health was notified based on the presumptive report. Systems checks then confirmed free chlorine residual of 0.2mg/L was present and flushing occurred for approximately two hours, purging 80,000L of water.

Repeat sampling was undertaken at both the sample tap and the pump station that supplies the zone, with clear results for both sites.

Electrical conductivity results indicated that the water was from the Marriages WFP, therefore the basin was also tested and confirmed clear.

Sunbury mains break, January 2013

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

Sunbury mains break (January 2013)

The incident was caused by the failure of a bend in a large 525mm transfer main from a 3 megalitre tank in Sunbury to a critical 20 megalitre tank required for supply to four towns.

The timing of the failure (late at night) and a subsequent alarm system failure caused the tank to completely empty. Over 25 million litres of water was estimated to be lost during the incident.

Response to incident

Western Water's response to significant mains breaks is to isolate the main as quickly as possible. An incident team was formed and objectives put in place to evaluate the situation and return the main to operation in the shortest possible time. The incident action plan had a number of tasks to carry out.

The first priority was to fill the emptied 20 megalitre tank. This was critical as the stresses on water resources in the coming days was potentially very high - a combined result of hot weather, high expected demand and bushfire risk. To ensure the supply system continued operating whilst the tank refilled, water was rerouted through the reticulation network.

The next priority was to address the mains break. A risk assessment determined the adequacy of the disinfection mode in the system, the size of the break and the potential for contamination to have entered the drinking water main.

The initial assessment found it was necessary to disinfect the main. However, a subsequent assessment confirmed super chlorination wasn't necessary due to the lower pathogen risk and the urgent need to reinstate the main.

As a result, a cautious disinfection approach was adopted, keeping the dose rate at 2mg/L and holding it for an extended period of time. This approach meant disinfection of the main was carried out without impact on customers.

Follow up sampling in the reticulation proved it was clear of microbiological contaminants.

A major achievement of Western Water's incident response was that there was no noticeable impact on water supply to customers.

The episode highlighted how well Western Water teams, from senior management to field staff, can work together. It has led to a review of disinfection of water mains after breaks, and the lessons learned from this event will be used to develop a more robust procedure.

A full article on disinfection related to this break will be published in *Water Works* (WIOA, November 2013).

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 2012/13, Western Water documented 28 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.

Dodemaide tank high iron excursion (April 2013)

Routine water quality results at the Dodemaide tank returned an iron result of 0.4mg/L, which is above the ADWG aesthetic guideline value. This result prompted a site visit to confirm results and, upon inspection of the sample tap, it was found to be rusted. Sampling at the tank found that, upon first capture, the iron levels were 0.24mg/L. After five minutes of flushing, the results dropped to 0.12mg/L.

An excursion was raised and follow up actions to get the sample tap replaced were documented in Western Water's IMS database.

High treated water turbidity at Merrimu WFP (August 2012)

The HACCP system alert limits detected breaches for treated water turbidity and pH at the Merrimu WFP. The quality control points on treated water turbidity and treated water pH were recorded by operational staff as high. Upon further investigation, it was suspected that the recently delivered lime was causing the issue (as all other operational parameters prior to the post dosing of lime were normal).

Samples of the lime were sent away for independent laboratory analysis and those results confirmed that the batch of lime delivered was higher in magnesium than usual. Once the next batch of lime was delivered, post treatment turbidity returned to normal levels.

Campaspe Reservoir blue green algae bloom (May 2013)

Routine biological analysis of Campaspe Reservoir returned biovolume results for blue green algae above the HACCP alert limit of 0.2mm3/L.

As a result, Western Water ceased drinking water production from that reservoir until the bloom had ceased. The excursion was open for three months. During that time, no drinking water was produced from Campaspe Reservoir.

The excursion form documented ongoing analysis during the three month period. All associated staff members were kept up to date via the excursion form.

Blue green algae (BGA)

During 2012/13, Western Water received seven raw water quality and blue green algae bloom notifications from SRW for the Merrimu, Rosslynne and Pykes Creek Reservoirs. Further details on these notifications is discussed on page 27.

Coimadai boil water incident update

In February 2012, over 80 customers connected to the Bence's Road water supply system near Bacchus Marsh received a boil water alert due to low level detections of faecal streptococci bacteria at multiple sites in the system.

At the time, Western Water undertook extensive investigations to identify the source of contamination. Having ruled out obvious causes, the solution was to invest in a new booster chlorination system at Gisborne Road pump station to ensure ongoing safety of supply. This site was then included as a critical control point in Western Water's HACCP system.

Since the booster was introduced, the Bence's Road system has remained compliant with all drinking water quality parameters. Nonetheless, Western Water intends to completely replace the drinking water mains in the Bence's Road system in 2014/15, subject to Board approval.

Engagement providing learnings for future incidents

Western Water's incident response centred around customer engagement, to ensure the affected customers were fully informed of the situation and given the appropriate support and advice.

Some months after the incident, Western Water commissioned detailed qualitative research to assess how our customers responded, and if there were any long term impacts.

This research showed that although most customers perceived the incident was handled well by Western Water, there were areas for improvement.

Although Western Water had supplied detailed information, some customers did not absorb the detail, or tended to forget advice in relation to specific uses, and a more creative approach may be needed in future.

The research also found that a common approach to all customers, no matter how robust, will not satisfy everyone, and a tailored approach is needed for vulnerable customers, with extra support and help.

Bence's Road tanks, Coimadai

EMPLOYEE AWARENESS AND TRAINING

Western Water is committed to ensuring all employees are fully aware of their responsibilities and trained appropriately.

Merrimum WFP team at Minns Road tanks

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. During 2012/13, the Water Quality team consisted of ten staff, with two based in the Sunbury office, four based at Rosslynne Water Filtration Plant and another four based at Merrimu Water Filtration Plant.

Many members of the treatment plant operating staff have now built up decades of experience with the unique and varied water supply systems found across Western Water's service region. Committed staff, who understand the unique needs of our supply system, is critical to Western Water's success in delivering safe, reliable drinking water.

Water Quality staff members are adept at managing Western Water's diverse water supplies, which include waters sourced from Melbourne, as well as both local surface and groundwater.

New staff are brought into the team to cater for the demands of the region's fast growing population, injecting fresh ideas to the business and ensuring the long term future of quality water supply. During the reporting period, Tom Jenkins, began work at Merrimu WFP as a trainee in the water treatment team.

Western Water's water quality team are a significant asset to the business with their experience, skills and training, ensuring the ongoing safe delivery of drinking water across the region.

Employee awareness and involvement

Our internal communication program provides tools that build a genuine sense of team spirit and cooperation, and ensure that employee information needs are met.

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.

In addition, the Managing Director regularly meets employees at each site, attending meetings, safety presentations and functions throughout the business. Western Water reinforces key safety messages via safety alerts, the intranet and site/toolbox meetings.

The following staff are accountable for implementation of Western Water's Drinking Water Policy:

- Board
- Managing Director
- General Managers
- Manager Water Systems
- All Teams

There is regular discussion on any water quality issues arising between the customer service and water quality teams. This ensures a speedy response to customer service issues relating to water quality.

Rosslynne WFP staff

Employee training

All water quality team members undertook training during the year, with some attending the Water Industry Training Centre, Geelong, and Goulburn Murray Water Training Services.

In addition to formal training, ongoing training and reskilling is required as procedures are revised due to new equipment or techniques. This ensures the safety of both employees and the community.

The following training was undertaken by members of the water quality team in 2012/13:

- Confined space entry
- Incident controller level 2
- Bushfire awareness refresher
- Critical conversations and credible communication
- Strategies for sustainable funding seminar
- Introduction to writing winning grant applications
- Water industry guidelines specialist calculator
- Introduction to AIIMS
- Equal employment opportunity
- Windows 7 and Office 2010
- Excel 2010 intermediate
- Dissolved air flotation
- Distribution system management for safe water.

Water industry operations

Western Water strongly encourages operational staff to obtain their Certificate II and Certificate III 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.

In addition, water quality staff attended various seminars and presentations as part of their ongoing commitment to improving their understanding of quality water delivery including:

- Membrane filtration
- Chlorination
- Dissolved air flotation
- Water quality and the environment
- Water treatment
- Reverse osmosis
- Laboratory skills
- Fluoridation
- Water quality awareness in the distribution system
- Water industry operators conference.

Western Water continues its commitment to employee learning and development through a range of training advisory bodies, including:

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

New Senior Coordinator, Treatment Teams, Rod Curtis

New position created to drive innovation

After 15 years working for the same employer some people might become a little jaded. Not Rod Curtis, who is still excited by the possibilities of his job every day. "I live and breathe innovation," says Rod, who was appointed Western Water's first Senior Coordinator, Treatment Teams, in June.

Rod took a job as a plant operator at the Melton Recycled Water Plant in 1997 - a short-term move that "turned into a career", he says. That career has included being awarded the 2012 Kwatye Prize for innovation by the Water Industry Operators Association. The prize led to him travelling to Europe on a research tour and presenting on innovation at the Melton plant to operators at London's Thames Water.

Rod's new role will focus on improving efficiency and innovation across Western Water's treatment plants, beginning with a project to benchmark the plants' current performance to measure future improvements. "It's about getting a bit more robust in how we do things," he says.

COMMUNITY INVOLVEMENT AND AWARENESS

Western Water's commitment to be a leading service provider working with our community has intensified.

Community involvement and awareness

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

Community involvement

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

As population growth continues in the region, Western Water's commitment to be a leading service provider working with our community has intensified. The reporting period saw a significant number of local community events and organisations supported across the region and the continuation of the Community Garden, School Garden and Environment Grants program.

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

Consultation

Western Water has an established customer advisory network that provides ongoing advice to the Board on issues important to the achievement of Western Water's vision. We have one Customer Advisory Group (CAG) and three Community Reference Groups (CRGs), representing key locales within the service area: Sunbury, Macedon Ranges and Melton/Bacchus Marsh.

Across the year, group members met 14 times, with input sought on major projects and water supply security. In July 2012, the CAG and CRG members attended a Strategic Planning Day centred on helping develop Water Plan 2013-18. In addition to the CAG and CRGs, Western Water actively consults with a range of local community and government groups regarding specific actions and initiatives.

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.

Western Water's online customer panel provides a significant additional resource for community consultation and now totals 1,100 members.

We have further extended our means of consulting with the community by developing social media sites for Western Water during the reporting period. The Facebook site has proven particularly useful during incidents and water supply interruptions.

Education programs

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

Presentations, programs and teacher resources for children are offered at the preschool, prep, primary and secondary school levels. During the year, almost 10,000 students from across the region attended Western Water primary school education presentations.

Tours and presentations

Western Water offers free tours and presentations to schools and community groups. Free guided tours are offered at our largest treatment plants at Gisborne, Sunbury and Melton. In 2012/13, educational tours and community presentations were conducted for a range of groups, including primary, secondary, tertiary and community groups.

Sponsorship and grants

Western Water builds and strengthens local community relations through sponsorships and offering grants across the service region. We attended numerous events in 2012/13 and Western Water promotes the health benefits and quality of our drinking water at all events.

In addition, our 1,000 litre mobile water tanks are made available free of charge to various community activities across the region.

Publications

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

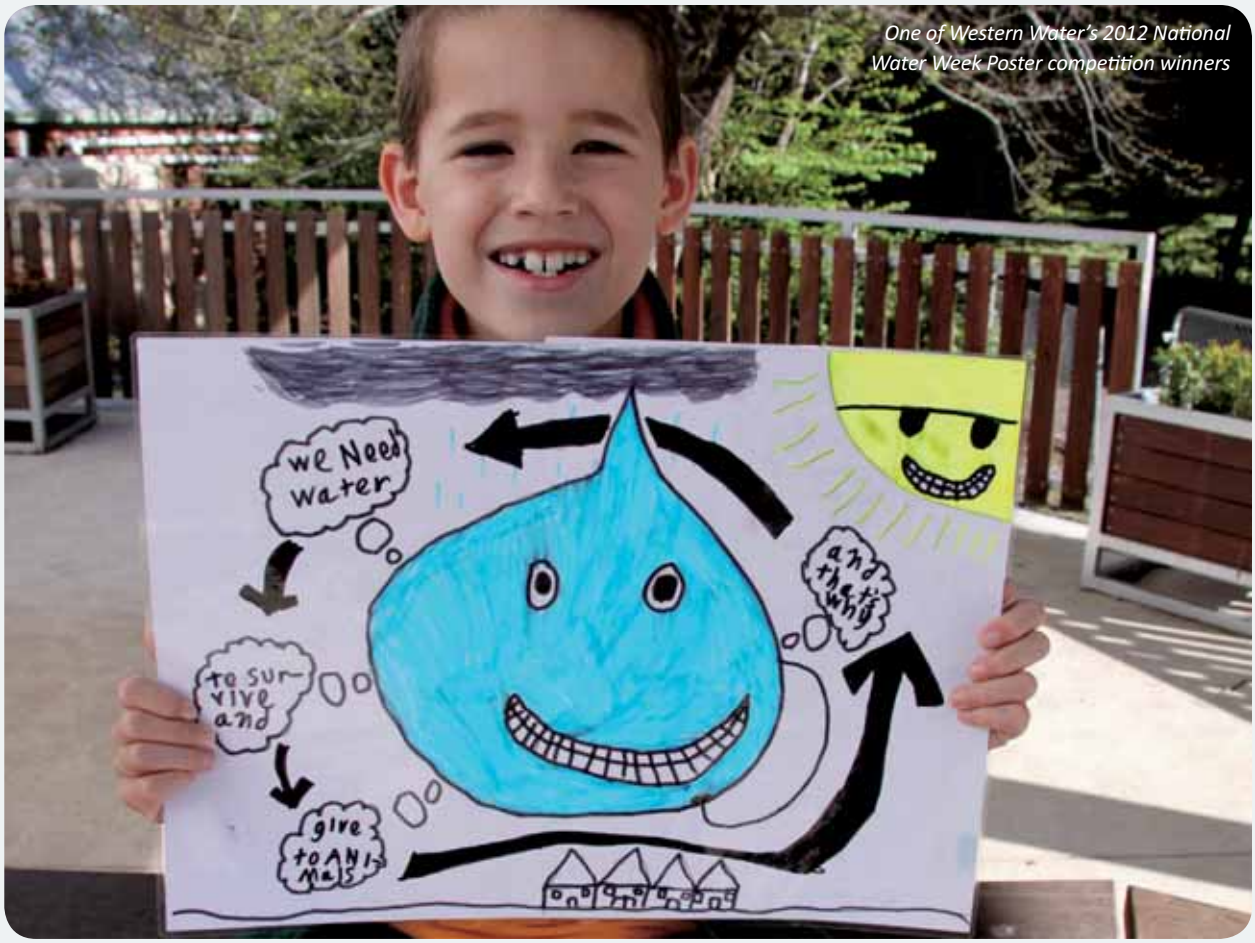
- Disinfection of your water supply
- Melton recycled water plant
- Merrimu water filtration plant
- Rosslynne water filtration plant
- Sunbury recycled water plant
- Water filters
- Water treatment
- Your water supply.

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 newsletter, H2Info, 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 go beyond traditional channels by offering very timely, direct, two way communication.



One of Western Water's 2012 National Water Week Poster competition winners

RESEARCH AND DEVELOPMENT

Western Water is committed to improving understanding and delivery of quality drinking water.

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.

PAC trial at Rosslynne WFP

In March 2013, Western Water commenced construction of Powdered Activated Carbon (PAC) dosing facilities at the Rosslynne WFP, to reduce the concentration of dissolved organic carbon (DOC) in the water from Rosslynne Reservoir.

The high DOC concentration is due to submerged vegetation in the reservoir basin, which occurred when drought-breaking rains refilled the almost-empty reservoir. Western Water will continuously dose with PAC while high DOC concentrations persist in the reservoir to ensure the local water can be used.

Initial laboratory testing was carried out to select the most effective type of PAC, and to establish other design parameters, such as dosing rates and contact times. This testing indicated that PAC dosing rates in excess of 50 mg/L may be required. As this is well in excess of common industry practice, it was critical to evaluate the ability of the existing dissolved air flotation and filtration process at Rosslynne WFP to handle the additional solids loading resulting from PAC dosing.

A full scale trial, using a temporary PAC dosing system, was established and this produced useful data, informing both the detailed design of the PAC dosing facility, as well as the future operation of the upgraded plant. Rosslynne Water Filtration Plant is due to be fully operational by the end of October 2013.

Western Water has PAC dosing facilities at its Lancefield and Woodend water filtration plants, where PAC dosing rates are in the order of 15-20mg/L when seasonal taste and odour issues need to be addressed.

PAC dosing is a common practice in water treatment, particularly when it is required to address algae-generated taste and odour issues in surface water. These raw water quality excursions are often of a short duration and tend to be seasonal, related to the onset of warmer spring weather.

Industry knowledge

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 on 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 the Australian Water Association (AWA), Water Quality Research Australia (WQRA), Institute of Water Administration (IWA), VicWater and the Water Industry Operators Association (WIOA).

In addition, Western Water has a small library of 170 core reference texts and research papers on water quality and other matters to assist with staff understanding of what is an area of ever increasing knowledge.

Rosslynne WFP's new PAC treatment plant under construction

DOCUMENTATION AND REPORTING

Reporting water quality data and performance is an integral component of Western Water's water quality management system.

Documentation and reporting

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 2012/13 include:

- Customer Tap HACCP plan
- Myrniong WFP HACCP Plan
- Merrimu WFP HACCP plan
- Romsey WFP HACCP plan
- Romsey CIP Procedure.

An annual review of the following sites was carried out:

- Romsey WFP
- Loemans Rd Pump Station
- Shepherds Lane Pump Station
- Hillside Pumps Station
- Lancefield WTP
- Marriages WTP
- Res C WTP
- Rosslynne 3ML Tank
- Salisbury Rd Pump Station
- Norton Rd Pump Station
- Swans Rd Pump Station
- Darley High Pump Station
- Gisborne Rd Pump Station
- Underbank Pump Station
- Settlement Rd Pump Station
- Sandy Creek Tank.

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 be a leading service provider working with our community towards a sustainable future".

Through BSC reporting, key objectives, actions and system performance are monitored by the Board and 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 reporting is undertaken by Western Water:

- Monthly reporting to DH 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 Drinking Water Quality report provides a key component in meeting our reporting requirements for DH, and by extension, our customers
- Immediate reporting of certain water quality issues to DH, as required by the *Safe Drinking Water Act 2003*.

Lancefield WFP

EVALUATION AND AUDIT

Long term evaluation is essential to identify and understand risks to water quality and possible solutions.

Evaluation and audit

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

Long term evaluation

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

Audit of drinking water quality management

Audits ensure that operational procedures and processes are in place so that accurate water quality data is collected and appropriate management systems are maintained.

One external recertification audit was conducted by a certified auditor in February 2013, achieving confirmation of ongoing HACCP certification.

In 2012/13, 23 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 of the 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 third DH Regulatory Audit for Drinking Water Risk in November 2011. 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 2014.

REVIEW AND CONTINUAL IMPROVEMENT

Water quality is viewed as a vital performance issue for Western Water at the most senior level.

Review and continual improvement

Management reviews

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

General Managers are aware of all incidents, and the General Manager Customer and Community Relations reviews every water quality complaint recorded in the Customer Relationship Management (CARE) system.

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).

As the key strategic reporting system, the Balanced Scorecard identifies key water quality reporting indicators to the Board, management and staff.

Drinking water quality management improvement plan

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

Water supply – capital works improvement

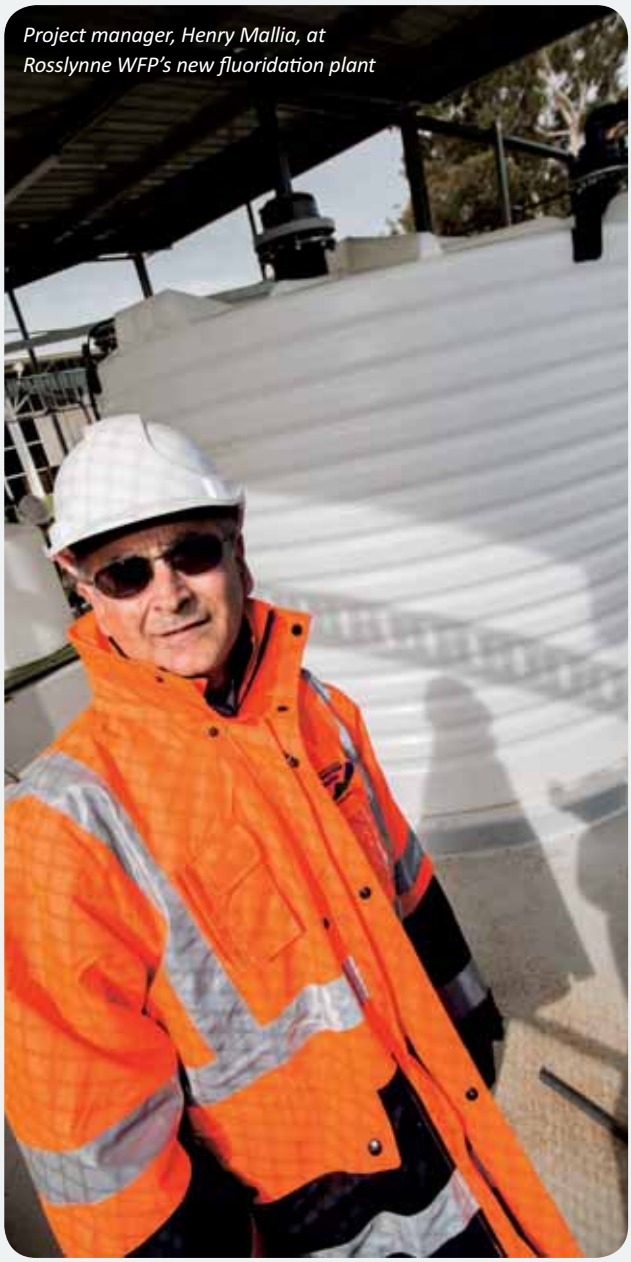
The following is an overview of the significant water supply works undertaken in 2012/13:

Rosslynne WFP upgrade

During the reporting period, a $3.5 million upgrade commenced for the Rosslynne Water Filtration Plant to improve management of dissolved organic carbon (DOC) levels and establish a water fluoridation system (following funding from the Department of Health). The Rosslynne WFP is expected to fully supply water again in late 2013.

Ongoing mains replacements and renewals

During the reporting period, 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. A total of 23 km of water mains were added to Western Water's supply system in 2012/13.



Project manager, Henry Mallia, at Rosslynne WFP's new fluoridation plant

NON-POTABLE WATER SUPPLY

Non-potable water includes raw (untreated) water direct from reservoirs as well as partially treated water.

Non-potable water 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 2012/13, 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 the 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 outlined in the Victorian Government's "Our Water Our Future" strategy.

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

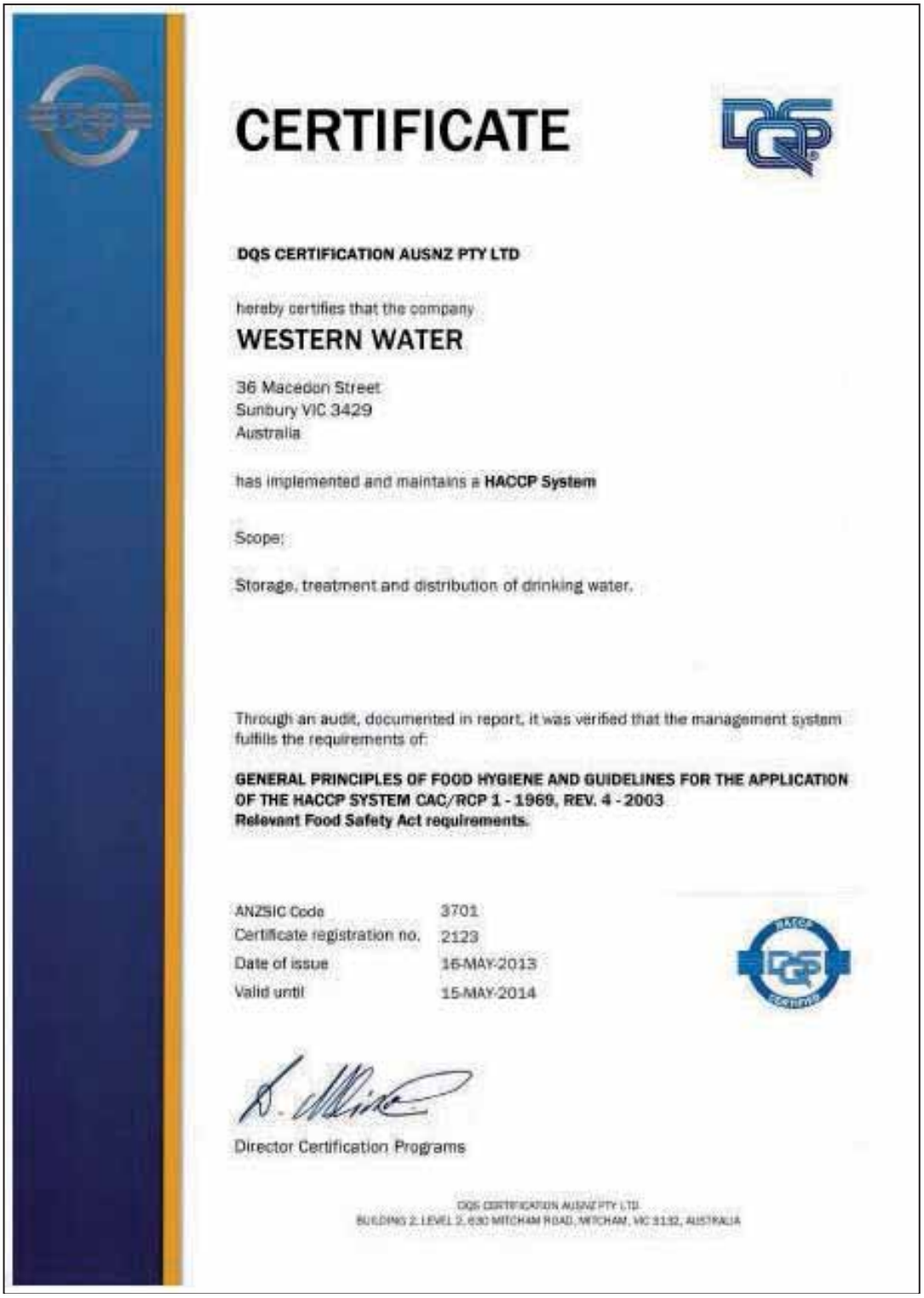
Western Water will communicate with customers to support the maintaining of public confidence in the safety of drinking water supply. This includes information on the impact of drought on water sources, water quality and water system maintenance.

Appendix 2 - Regulatory and formal requirements for drinking water

Related legislation, policies, systems and procedures include:

- *Safe Drinking Water Act 2003*
- *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/NRMMC Australian Drinking Water Guidelines 2011
- Risk Management (AS4360)
- Relevant State Environment Protection Policies (SEPPs)
- Environmental Management System - ISO 14001
- Quality Management System – ISO 9001
- Occupational Health & Safety Management System - AS 4801
- Drinking Water Quality Management System
- HACCP Principles & Systems Procedures
- Integrated Management System procedures
- All relevant policies contained in the Policy Manual

Appendix 3 - HACCP Certification



CERTIFICATE

DQS CERTIFICATION AUSNZ PTY LTD

hereby certifies that the company

WESTERN WATER

36 Macedon Street
Sunbury VIC 3429
Australia

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.

ANZSIC Code	3701
Certificate registration no.	2123
Date of issue	16-MAY-2013
Valid until	15-MAY-2014

Director Certification Programs

DQS CERTIFICATION AUSNZ PTY LTD
BUILDING 2, LEVEL 2, 630 MITCHAM ROAD, MITCHAM, VIC 3132, AUSTRALIA

Appendix 4 – Water quality results

Water quality compliance results

The following reports on 2012/13 compliance with the Water quality standards outlined 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)

A.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*	Number of samples	No. of samples containing *E.coli*	Max result (orgs/mL)	% Samples with no *E.coli*	Complying (Yes/No)
Bulla	Weekly	52	0	0	100%	Yes
Darley	Weekly	53	0	0	100%	Yes
Diggers Rest	Weekly	52	0	0	100%	Yes
Eynesbury	Weekly	52	0	0	100%	Yes
Gisborne	Weekly	63	0	0	100%	Yes
Lancefield	Weekly	52	0	0	100%	Yes
Lerderderg	64/year	63	0	0	100%	Yes
Macedon#	Weekly	51	0	0	100%	Yes
Maddingley	Weekly	52	0	0	100%	Yes
Melton South	112/year	112	1	>200	99.1%	Yes
Merrimu	64/year	64	0	0	100%	Yes
Mount Macedon#	Weekly	51	0	0	100%	Yes
Myrniong	Weekly	52	0	0	100%	Yes
Riddells Creek#	Weekly	51	0	0	100%	Yes
Rockbank#	Weekly	51	0	0	100%	Yes
Romsey	Weekly	52	0	0	100%	Yes
Sunbury	112/Year	130	0	0	100%	Yes
Toolern Vale#	Weekly	51	0	0	100%	Yes
Woodend	64/year	68	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 ". # These localities missed one set of samples due to total fire bans in January 2013. Other reticulation sites supplied by the same water remained clear of microbiological detections.*

A.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 2012/13 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	0.025	0.012	Yes
Darley	Monthly	12	0	0.140	0.035	Yes
Diggers Rest	Monthly	12	0	0.022	0.014	Yes
Eynesbury	Monthly	12	0	0.140	0.029	Yes
Gisborne	Monthly	12	0	0.044	0.018	Yes
Lancefield	Monthly	12	0	0.130	0.061	Yes
Lerderderg	Monthly	12	0	0.100	0.038	Yes
Macedon	Monthly	12	0	0.078	0.043	Yes
Maddingley	Monthly	12	0	0.140	0.039	Yes
Melton South	Monthly	12	0	0.110	0.017	Yes
Merrimu	Monthly	12	0	0.100	0.019	Yes
Mount Macedon	Monthly	12	0	0.110	0.049	Yes
Myrniong	Monthly	12	0	0.110	0.067	Yes
Riddells Creek	Monthly	12	0	0.045	0.015	Yes
Rockbank	Monthly	12	0	0.120	0.018	Yes
Romsey	Monthly	12	0	0.012	0.002	Yes
Sunbury	Monthly	12	0	0.021	0.011	Yes
Toolern Vale	Monthly	12	0	0.110	0.034	Yes
Woodend	Monthly	12	0	0.085	0.018	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	<0.005	<0.002	Yes
Darley	Monthly	12	0	<0.005	<0.002	Yes
Diggers Rest	Monthly	12	0	<0.005	<0.002	Yes
Eynesbury	Monthly	12	0	<0.005	<0.002	Yes
Gisborne	Monthly	12	0	<0.005	<0.002	Yes
Lancefield	Monthly	12	0	<0.005	<0.002	Yes
Lerderderg	Monthly	12	0	<0.005	<0.002	Yes
Macedon	Monthly	12	0	<0.005	<0.002	Yes
Maddingley	Monthly	12	0	<0.005	<0.002	Yes
Melton South	Monthly	12	0	<0.005	<0.002	Yes
Merrimu	Monthly	12	0	<0.005	<0.002	Yes
Mount Macedon	Monthly	12	0	<0.005	<0.002	Yes
Myrniong	Monthly	12	0	<0.005	<0.002	Yes
Riddells Creek	Monthly	12	0	<0.005	<0.002	Yes
Rockbank	Monthly	12	0	<0.005	<0.002	Yes
Romsey	Monthly	12	0	<0.005	<0.002	Yes
Sunbury	Monthly	12	0	<0.005	<0.002	Yes
Toolern Vale	Monthly	12	0	<0.005	<0.002	Yes
Woodend	Monthly	12	0	<0.005	<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 humic and fulvic acids which naturally occur 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	0.004	0.002	Yes
Darley	Monthly	12	0	0.017	0.005	Yes
Diggers Rest	Monthly	12	0	0.006	0.003	Yes
Eynesbury	Monthly	12	0	0.005	0.002	Yes
Gisborne	Monthly	12	0	0.008	0.003	Yes
Lancefield	Monthly	12	0	0.013	0.002	Yes
Lerderderg	Monthly	12	0	0.017	0.003	Yes
Macedon	Monthly	12	0	0.018	0.005	Yes
Maddingley	Monthly	12	0	0.016	0.004	Yes
Melton South	Monthly	12	0	0.011	0.004	Yes
Merrimu	Monthly	12	0	0.017	0.003	Yes
Mount Macedon	Monthly	12	0	0.020	0.005	Yes
Myrniong	Monthly	12	0	0.005	0.002	Yes
Riddells Creek	Monthly	12	0	0.012	0.002	Yes
Rockbank	Monthly	12	0	0.009	0.004	Yes
Romsey	Monthly	12	0	0.009	0.002	Yes
Sunbury	Monthly	12	0	0.008	0.003	Yes
Toolern Vale	Monthly	12	0	0.013	0.004	Yes
Woodend	Monthly	12	0	0.010	0.004	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	0.009	0.003	Yes
Darley	Monthly	12	0	0.031	0.008	Yes
Diggers Rest	Monthly	12	0	0.009	0.003	Yes
Eynesbury	Monthly	12	0	0.005	0.002	Yes
Gisborne	Monthly	12	0	0.009	0.003	Yes
Lancefield	Monthly	12	0	0.015	0.002	Yes
Lerderderg	Monthly	12	0	0.020	0.006	Yes
Macedon	Monthly	12	0	0.012	0.005	Yes
Maddingley	Monthly	12	0	0.026	0.011	Yes
Melton South	Monthly	12	0	0.018	0.005	Yes
Merrimu	Monthly	12	0	0.020	0.005	Yes
Mount Macedon	Monthly	12	0	0.014	0.006	Yes
Myrniong	Monthly	12	0	0.006	0.002	Yes
Riddells Creek	Monthly	12	0	0.014	0.002	Yes
Rockbank	Monthly	12	0	0.017	0.005	Yes
Romsey	Monthly	12	0	0.005	0.002	Yes
Sunbury	Monthly	12	0	0.011	0.003	Yes
Toolern Vale	Monthly	12	0	0.020	0.005	Yes
Woodend	Monthly	12	0	0.015	0.005	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.

A3 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 2012/13 reporting period.

A4 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	0.23	0.14	Yes
Darley	Monthly	12	0	0.20	0.02	Yes
Diggers Rest	Monthly	12	0	0.21	0.14	Yes
Eynesbury	Monthly	12	0	0.21	0.01	Yes
Gisborne	Monthly	12	0	0.24	0.13	Yes
Lancefield	Monthly	12	0	0.17	0.01	Yes
Lerderderg	Monthly	12	0	0.22	0.04	Yes
Macedon	Monthly	12	0	0.22	0.15	Yes
Maddingley	Monthly	12	0	0.21	0.04	Yes
Melton South	Monthly	12	0	0.22	0.03	Yes
Merrimu	Monthly	12	0	0.22	0.02	Yes
Mount Macedon	Monthly	12	0	0.22	0.15	Yes
Myrniong	Monthly	12	0	0.04	0.01	Yes
Riddells Creek	Monthly	12	0	0.24	0.14	Yes
Rockbank	Monthly	12	0	0.22	0.01	Yes
Romsey	Monthly	12	0	0.01	0.01	Yes
Sunbury	Monthly	12	0	0.23	0.11	Yes
Toolern Vale	Monthly	12	0	0.23	0.06	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 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 2012/13 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	No. of non-complying samples	Max NTU	Min NTU	95% UCL of mean	Complying* (Yes/No)
Bulla^	Weekly	52	0	1.9	0.9	1.3	Yes
Darley^	Weekly	53	0	1.5	0.1	0.9	Yes
Diggers Rest	Weekly	64	0	1.9	0.8	1.3	Yes
Eynesbury^	Weekly	52	0	1.6	0.1	0.9	Yes
Gisborne	Weekly	52	0	1.5	0.5	1.2	Yes
Lancefield	Weekly	52	0	0.4	0.1	0.1	Yes
Lerderderg^	Weekly	52	0	3.2	0.2	1.1	Yes
Macedon	Weekly	52	0	3.6	0.3	1.4	Yes
Maddingley^	Weekly	52	0	1.7	0.1	1.0	Yes
Melton South^	Weekly	52	0	1.8	0.1	1.2	Yes
Merrimu^	Weekly	52	0	1.6	0.1	0.9	Yes
Mount Macedon	Weekly	52	0	1.8	0.2	1.3	Yes
Myrniong	Weekly	52	0	2.3	0.1	0.4	Yes
Riddells Creek	Weekly	52	0	2.0	0.2	1.4	Yes
Rockbank# ^	Weekly	51	0	1.9	0.1	1.2	Yes
Romsey	Weekly	52	0	0.5	0.1	0.2	Yes
Sunbury	Weekly	71	0	1.9	0.7	1.3	Yes
Toolern Vale# ^	Weekly	51	0	2.2	0.1	1.0	Yes
Woodend	Weekly	57	0	0.5	0.1	0.2	Yes

NTU: nephelometric turbidity unit
UCL: upper confidence limit
Samples missed during a week of total fire ban in January 2013. Water supplied to the localities of Melton South, Darley, Lerderderg, Maddingley and Merrimu are representative of the water supplied to Rockbank and Toolern Vale.
^ These sites showed an increase of 0.2NTU of more of the UCL during the reporting period due to the change from a local filtered water supply to Melbourne water supplies for six months during the reporting period.

All water localities were compliant for turbidity in 2012/13.

During the reporting period, an increase of 0.2NTU or greater for the 95% UCL was observed in all zones supplied with water from Melbourne. These zones include Bulla, Diggers Rest, Gisborne, Macedon, Mount Macedon and Sunbury. An increase of 0.2 NTU or greater for the 95% UCL of the mean turbidity was observed in the localities of Darley, Eynesbury, Lerderderg, Merrimu, Melton South, Rockbank and Toolern Vale. The increase in the Merrimu system localities can be attributed to the change from a filtered local water supply (from Merrimu) to the Melbourne water (unfiltered source) supply. This change occurred for six months during the reporting period, from January until July 2013.

A6 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[1]	Fortnightly	26	0.97	0.90	0.93	Yes
Darley	Fortnightly	26	0.98	0.80	0.91	Yes
Diggers Rest[1]	Fortnightly	26	0.97	0.89	0.93	Yes
Eynesbury	Fortnightly	26	1.00	0.82	0.92	Yes
Gisborne[1]	Fortnightly	26	0.98	0.42	0.90	Yes
Lancefield[2]	Twice yearly	2	0.12	0.09	0.10	Yes
Lerderderg	Fortnightly	27	0.98	0.51	0.90	Yes
Macedon[1]	Fortnightly	26	0.97	0.82	0.91	Yes
Maddingley	Fortnightly	26	0.99	0.56	0.90	Yes
Melton South	Fortnightly	27	1.00	0.75	0.91	Yes
Merrimu	Fortnightly	27	1.00	0.77	0.91	Yes
Mount Macedon[1]	Fortnightly	27	0.98	0.82	0.92	Yes
Myrniong[2 3]	Monthly	12	0.21	0.05	0.07	Yes
Riddells Creek[1]	Fortnightly	26	0.99	0.86	0.93	Yes
Rockbank	Fortnightly	27	1.10	0.78	0.92	Yes
Romsey[2]	Fortnightly	26	0.10	0.06	0.07	Yes
Sunbury[1]	Fortnightly	24	0.98	0.89	0.92	Yes
Toolern Vale	Fortnightly	27	0.97	0.74	0.88	Yes
Woodend[2]	Fortnightly	26	0.05	0.05	0.05	Yes

** Compliance as measured against the Health (Fluoridation) Act 1973 and Department of Health's requirements for annual average fluoride value not exceeding 1 mg/L (fluoridated supply) and any individual maximum results not exceeding 1.5 mg/L (fluoridated and non-fluoridated supply).*

[1] Drinking water is fluoridated when supplied by Melbourne Water. Sunbury fluoride samples were scheduled as two samples per month, whilst other sites were scheduled as 52 weeks divided by 2 samples, hence the difference in final sampling numbers.

[2] Non-fluoridated supply for 2012/13 reporting period.

[3] This locality was tested monthly due to periodic carting of water from the Merrimu system.

A7 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 2012/13 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.

A7.1 Manganese

Table A10: Manganese (total as Mn) results

Water sampling locality	Sampling frequency#	No of Samples	Max (mg/L)	Min (mg/L)	Complying* (Yes/No)
Bulla	Bi-monthly	6	0.003	0.002	Yes
Darley	Bi-monthly	6	0.003	0.001	Yes
Diggers Rest	Bi-monthly	6	0.003	0.002	Yes
Eynesbury	Bi-monthly	6	0.003	0.001	Yes
Gisborne	Bi-monthly	6	0.002	0.001	Yes
Lancefield	Bi-monthly	6	0.001	0.001	Yes
Lerderderg	Bi-monthly	6	0.003	0.002	Yes
Macedon	Bi-monthly	6	0.004	0.002	Yes
Maddingley	Bi-monthly	6	0.002	0.001	Yes
Melton South	Bi-monthly	6	0.002	0.002	Yes
Merrimu	Bi-monthly	6	0.002	0.002	Yes
Mount Macedon	Bi-monthly	6	0.006	0.002	Yes
Myrniong	Bi-monthly	6	0.003	0.001	Yes
Riddells Creek	Bi-monthly	6	0.005	0.001	Yes
Rockbank	Bi-monthly	6	0.005	0.001	Yes
Romsey	Bi-monthly	6	0.025	0.001	Yes
Sunbury	Bi-monthly	6	0.003	0.002	Yes
Toolern Vale	Bi-monthly	6	0.044	0.001	Yes
Woodend	Bi-monthly	6	0.001	0.001	Yes

 # A reduction in reticulation sampling occurred as a result of a review of Western Water's sampling program. Manganese was monitored more frequently at water source and at treatment plant production.
**Compliance as measured against the guideline values set out in ADWG for manganese in drinking water (base on aesthetic considerations result should not exceed 0.1 mg/L and on health considerations should not exceed 0.5 mg/L).*

A7.2 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	Six monthly	2	0.001	0.001	Yes
Darley	Six monthly	2	0.001	0.001	Yes
Diggers Rest	Six monthly	2	0.001	0.001	Yes
Eynesbury	Six monthly	2	0.001	0.001	Yes
Gisborne	Six monthly	2	0.001	0.001	Yes
Lancefield	Six monthly	2	0.001	0.001	Yes
Lerderderg	Six monthly	2	0.001	0.001	Yes
Macedon	Six monthly	2	0.001	0.001	Yes
Maddingley	Six monthly	2	0.001	0.001	Yes
Melton South	Six monthly	2	0.001	0.001	Yes
Merrimu	Six monthly	2	0.001	0.001	Yes
Mount Macedon	Six monthly	2	0.001	0.001	Yes
Myrniong	Six monthly	2	0.001	0.001	Yes
Riddells Creek	Six monthly	2	0.001	0.001	Yes
Rockbank	Six monthly	2	0.001	0.001	Yes
Romsey	Six monthly	2	0.001	0.001	Yes
Sunbury	Six monthly	2	0.001	0.001	Yes
Toolern Vale	Six monthly	2	0.001	0.001	Yes
Woodend	Six monthly	2	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.*

A7.3 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	Six monthly	2	0.009	0.001	Yes
Darley	Six monthly	2	0.003	0.002	Yes
Diggers Rest	Six monthly	2	0.005	0.002	Yes
Eynesbury	Six monthly	2	0.012	0.006	Yes
Gisborne	Six monthly	1	0.005	0.003	Yes
Lancefield	Six monthly	2	0.003	0.001	Yes
Lerderderg	Six monthly	2	0.003	0.002	Yes
Macedon	Six monthly	2	0.002	0.001	Yes
Maddingley	Six monthly	2	0.006	0.002	Yes
Melton South	Six monthly	2	0.005	0.001	Yes
Merrimu	Six monthly	2	0.002	0.001	Yes
Mount Macedon	Six monthly	2	0.001	0.001	Yes
Myrniong	Six monthly	2	0.038	0.009	Yes
Riddells Creek	Six monthly	2	0.006	0.004	Yes
Rockbank	Six monthly	2	0.003	0.002	Yes
Romsey	Six monthly	2	0.005	0.002	Yes
Sunbury	Six monthly	2	0.017	0.006	Yes
Toolern Vale	Six monthly	2	0.007	0.001	Yes
Woodend	Six monthly	2	0.002	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.*

A7.4 Arsenic

Table A13: Arsenic results

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

**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.*

[1]The sampling for the presence of arsenic in drinking water at customer tap sites was schedule on a per water supply system basis rather than on an individual locality basis. Results indicate all nineteen localities were compliant for arsenic during the reporting period.

A7.5 Chlorite

Chlorite is a by-product of chlorine dioxide disinfection. Western Water does not use chlorine dioxide as a disinfectant for drinking water. For this reason, is unlikely to be present in the drinking water supplied by Western Water as it does not occur naturally. As a result, sampling for chlorite was not undertaken in the 2012/13 reporting period.

A7.6 Monochloramine

Table A14: Monochloramine results

Water sampling locality	Sampling frequency	No of Samples	Max (mg/L)	Min (mg/L)	Complying* (Yes/No)
Bulla	Weekly	52	0.57	0.01	Yes
Diggers Rest	Weekly	52	0.66	0.01	Yes
Romsey	Weekly	52	0.97	0.01	Yes
Sunbury	110 per year	110	0.67	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.

A7.7 Nickel

Table A15: Nickel (total as Ni) results

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

A7.8 Chlorine

Table A16: Total chlorine results

Water sampling locality	Sampling frequency	No of Samples	Max (mg/L)	Min (mg/L)	Complying* (Yes/No)
Bulla	Weekly	52	0.88	0.03	Yes
Darley	Weekly	53	1.60	0.28	Yes
Diggers Rest	Weekly	52	0.89	0.04	Yes
Eynesbury	Weekly	52	0.12	0.02	Yes
Gisborne	64/year	63	1.00	0.04	Yes
Lancefield	Weekly	52	1.10	0.21	Yes
Lerderderg	64/year	63	1.20	0.05	Yes
Macedon	Weekly	52	1.10	0.08	Yes
Maddingley	Weekly	52	1.80	0.17	Yes
Melton South	112/year	112	1.00	0.06	Yes
Merrimu	64/year	64	1.00	0.04	Yes
Mount Macedon	Weekly	52	1.10	0.16	Yes
Myrniong	Weekly	52	0.30	0.02	Yes
Riddells Creek	Weekly	52	1.20	0.06	Yes
Rockbank	Weekly	52	0.79	0.05	Yes
Romsey	Weekly	52	0.99	0.10	Yes
Sunbury	110/year	110	1.00	0.05	Yes
Toolern Vale	Weekly	52	1.00	0.05	Yes
Woodend	60/year	60	1.10	0.19	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.*

A7.9 Chromium

Table A17: Chromium (total as Cr) results

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

A7.10 Cyanide

Table A18: Cyanide results

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

A7.11 Mercury

Table A19: Mercury results

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

A7.12 Nitrate

Table A20: Nitrate results

Water sampling locality	Sampling frequency	No of Samples	Max (mg/L)	Min (mg/L)	Complying* (Yes/No)
Bulla	Monthly	12	0.31	0.17	Yes
Darley	Monthly	12	0.26	0.16	Yes
Diggers Rest	Monthly	12	0.21	0.17	Yes
Eynesbury	Monthly	12	0.25	0.17	Yes
Gisborne#	Monthly	7	0.31	0.26	Yes
Lancefield	Monthly	12	0.13	0.008	Yes
Lerderderg	Monthly	12	0.26	0.17	Yes
Macedon#	Monthly	7	0.3	0.28	Yes
Maddingley	Monthly	12	0.26	0.17	Yes
Melton South	Monthly	12	0.25	0.16	Yes
Merrimu	Monthly	12	0.25	0.16	Yes
Mount Macedon#	Monthly	7	0.32	0.28	Yes
Myrniong	Monthly	12	0.51	0.27	Yes
Riddells Creek#	Monthly	7	0.28	0.22	Yes
Rockbank	Monthly	12	0.25	0.16	Yes
Romsey	Monthly	12	0.13	0.074	Yes
Sunbury	Monthly	12	0.24	0.17	Yes
Toolern Vale	Monthly	12	0.25	0.17	Yes
Woodend	Monthly	12	0.083	0.004	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.*

These localities received monthly testing until January 2013 when a review of the sampling program deemed it was no longer necessary due to the disinfection mode in that system.

A7.13 Nitrite

Table A21: Nitrite results

Water sampling locality	Sampling frequency	No of Samples	Max (mg/L)	Min (mg/L)	Complying* (Yes/No)
Bulla	Monthly	12	0.045	0.002	Yes
Darley	Monthly	12	0.002	0.002	Yes
Diggers Rest	Monthly	12	0.059	0.002	Yes
Eynesbury	Monthly	12	0.002	0.002	Yes
Gisborne#	Monthly	7	0.002	0.002	Yes
Lancefield	Monthly	12	0.002	0.002	Yes
Lerderderg	Monthly	12	0.002	0.002	Yes
Macedon#	Monthly	7	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#	Monthly	7	0.002	0.002	Yes
Myrniong	Monthly	12	0.002	0.002	Yes
Riddells Creek#	Monthly	7	0.002	0.002	Yes
Rockbank	Monthly	12	0.002	0.002	Yes
Romsey	Monthly	12	0.180	0.002	Yes
Sunbury	Monthly	12	0.017	0.002	Yes
Toolern Vale	Monthly	12	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*

These localities received monthly testing until January 2013 when a review of the sampling program deemed it was no longer necessary due to the disinfection mode in that system.

A7.14 Selenium

Table A22: Selenium results

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

A7.15 Carbon tetrachloride

Table A23: Carbon tetrachloride results

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

** Compliance as measured against the health related guideline value set out in ADWG for carbon tetrachloride in drinking water should not exceed 0.003 mg/L.*
 # Sampling frequency has been six monthly. A review of monitoring program occurred during the reporting period. Results had historically been always below detection limits so sampling frequency was reduced.

A7.16 Cadmium

Table A24: Cadmium results

Water sampling locality	Sampling frequency	No of Samples	Max (mg/L)	Min (mg/L)	Complying* (Yes/No)
Bulla	Six monthly	2	<0.002	<0.002	Yes
Darley	Six monthly	2	<0.002	<0.002	Yes
Diggers Rest	Six monthly	2	<0.002	<0.002	Yes
Eynesbury	Six monthly	2	<0.002	<0.002	Yes
Gisborne	Six monthly	2	<0.002	<0.002	Yes
Lancefield	Six monthly	2	<0.002	<0.002	Yes
Lerderderg	Six monthly	2	<0.002	<0.002	Yes
Macedon	Six monthly	2	<0.002	<0.002	Yes
Maddingley	Six monthly	2	<0.002	<0.002	Yes
Melton South	Six monthly	2	<0.002	<0.002	Yes
Merrimu	Six monthly	2	<0.002	<0.002	Yes
Mount Macedon	Six monthly	2	<0.002	<0.002	Yes
Myrniong	Six monthly	2	<0.002	<0.002	Yes
Riddells Creek	Six monthly	2	<0.002	<0.002	Yes
Rockbank	Six monthly	2	<0.002	<0.002	Yes
Romsey	Six monthly	2	<0.002	<0.002	Yes
Sunbury	Six monthly	2	<0.002	<0.002	Yes
Toolern Vale	Six monthly	2	<0.002	<0.002	Yes
Woodend	Six monthly	2	<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.*

A8 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. Further descriptions of the aesthetic parameters can be found in Appendix 3.

A8.1 pH

Table A25: pH results

Water sampling locality	Sampling frequency#	No of Samples	Max	Min	Mean	Complying* (Yes/No)
Bulla	Weekly	32	9.1	7.3	7.8	Yes
Darley	Weekly	32	7.9	7.2	7.5	Yes
Diggers Rest	Weekly	32	8.0	7.1	7.3	Yes
Eynesbury	Weekly	32	7.5	7.1	7.3	Yes
Gisborne	Weekly	32	9.3	7.3	7.7	Yes
Lancefield	Weekly	31	8.3	7.6	7.9	Yes
Lerderderg	Weekly	30	8.0	7.2	7.4	Yes
Macedon[1]	Weekly	31	9.5	7.6	9.0	No
Maddingley	Weekly	31	8.1	7.2	7.6	Yes
Melton South	Weekly	32	7.7	7.1	7.3	Yes
Merrimu	Weekly	32	9.1	7.0	7.8	Yes
Mount Macedon[1]	Weekly	31	9.4	8.3	9.0	No
Myrniong	Weekly	31	7.9	7.2	7.5	Yes
Riddells Creek	Weekly	32	9.2	7.2	7.9	Yes
Rockbank	Weekly	31	8.6	7.1	7.4	Yes
Romsey	Weekly	31	8.3	7.6	7.9	Yes
Sunbury	Weekly	32	8.5	7.1	7.3	Yes
Toolern Vale	Weekly	31	8.9	7.1	7.8	Yes
Woodend	Weekly	31	8.6	7.1	7.4	Yes

 # Sampling frequency changed from monthly to weekly in January 2013 as a result of a schedule review.

** 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 2011/12.*

[1] Macedon and Mount Macedon consistently experienced high pH results above the recommended upper limit guideline value of 8.5 during 2012/13. The aesthetic guideline range for pH is recommended as reducing the likelihood of corrosion to pipes and fittings. A high pH up to 9.2 is stated in the ADWG as tolerable, so long as there ware no deterioration in the microbiological quality of the water supplied. No deterioration in the microbiological quality of the water was experienced in Macedon or Mount Macedon.

In 2012/13, the Macedon and Mount Macedon water sampling localities laid outside the pH range of 6.5-8.5, based on the mean result. Varying pH levels were detected in most localities. Elevated pH levels are expected in the Riddells Creek, Macedon and Mount Macedon localities until the issue is addressed by recommissioning the Rosslynne Water Filtration Plant, expected in late 2013.

A8.2 Iron

Table A26: Iron results

Water sampling locality	Sampling frequency#	No of Samples	Max (mg/L)	Min (mg/L)	Mean (mg/L)	Complying* (Yes/No)
Bulla	Quarterly	8	0.15	0.10	0.13	Yes
Darley	Quarterly	8	0.14	0.02	0.08	Yes
Diggers Rest	Quarterly	8	0.15	0.10	0.13	Yes
Eynesbury	Quarterly	8	0.14	0.01	0.08	Yes
Gisborne	Quarterly	8	0.15	0.1	0.12	Yes
Lancefield	Quarterly	8	0.02	0.01	0.01	Yes
Lerderderg	Quarterly	8	0.15	0.02	0.07	Yes
Macedon	Quarterly	8	0.15	0.11	0.13	Yes
Maddingley	Quarterly	8	0.14	0.02	0.07	Yes
Melton South	Quarterly	8	0.15	0.01	0.09	Yes
Merrimu	Quarterly	8	0.13	0.02	0.07	Yes
Mount Macedon	Quarterly	8	0.16	0.12	0.14	Yes
Myrniong	Quarterly	8	0.05	0.01	0.03	Yes
Riddells Creek	Quarterly	8	0.15	0.10	0.12	Yes
Rockbank	Quarterly	8	0.18	0.01	0.10	Yes
Romsey	Quarterly	8	0.02	0.01	0.01	Yes
Sunbury	Quarterly	8	0.14	0.08	0.12	Yes
Toolern Vale	Quarterly	8	0.28	0.05	0.12	Yes
Woodend	Quarterly	8	0.04	0.01	0.02	Yes

 # Sampling frequency changed from monthly to quarterly in January 2013.

** 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.*

A8.3 Total hardness

Table A27: 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	8	25	11	18	Yes
Darley	Monthly	8	99	15	30	Yes
Diggers Rest	Monthly	8	20	10	16	Yes
Eynesbury	Monthly	8	110	11	29	Yes
Gisborne	Monthly	8	23	13	19	Yes
Lancefield	Monthly	8	130	49	102	Yes
Lerderderg	Monthly	8	97	14	41	Yes
Macedon	Monthly	8	30	15	26	Yes
Maddingley	Monthly	8	110	17	38	Yes
Melton South	Monthly	8	92	14	27	Yes
Merrimu	Monthly	8	110	13	38	Yes
Mount Macedon	Monthly	8	32	16	26	Yes
Myrniong^	Monthly	12	130	79	105	Yes
Riddells Creek	Monthly	8	21	14	18	Yes
Rockbank	Monthly	8	91	16	29	Yes
Romsey	Monthly	8	23	13	18	Yes
Sunbury	Monthly	8	20	10	16	Yes
Toolern Vale	Monthly	8	97	19	32	Yes
Woodend	Monthly	8	43	15	25	Yes

#Frequency of sampling was increased from quarterly to monthly in January 2013.

** 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 2011/12. Note, the unit milligrams per litre (mg/L) is equivalent to parts per million (ppm). For conversion from mg/L to ºdH (German Hardness), multiply mg/L by 0.056. Conversely, multiply ºdH by 17.9 for conversion to mg/L or ppm.*

^ Myrniong remained on monthly sampling as a result of high TDS in the raw water source during the drought years.

A8.4 Calcium

Table A28: Total calcium (as Ca) results

Water sampling locality	Sampling frequency#	No of Samples	Max (mg/L)	Min (mg/L)	Mean (mg/L)*
Bulla	Monthly	7	9.0	4.2	6.2
Darley	Monthly	7	17.0	3.6	6.7
Diggers Rest	Monthly	7	5.5	3.4	4.7
Eynesbury	Monthly	7	21.0	3.3	7.5
Gisborne	Monthly	7	6.8	5.1	5.9
Lancefield	Monthly	7	17.0	7.9	14.4
Lerderderg	Monthly	7	16.0	3.4	7.1
Macedon	Monthly	7	10.0	4.7	8.2
Maddingley	Monthly	7	19.0	4.2	7.5
Melton South	Monthly	7	16.0	3.7	6.5
Merrimu	Monthly	7	18.0	3.2	7.8
Mount Macedon	Monthly	7	10.0	5.1	8.6
Myrniong	Monthly	12	22.0	11.0	16.6
Riddells Creek	Monthly	7	6.4	4.7	5.4
Rockbank	Monthly	7	16.0	4.3	7.1
Romsey	Monthly	7	4.8	2.2	3.4
Sunbury	Monthly	7	5.4	2.6	4.6
Toolern Vale	Monthly	7	19.0	5.2	8.2
Woodend	Monthly	7	5.5	3.0	4.2

Sampling increased from Six monthly to monthly in January 2013.
* There is currently no recommended guideline value set out for the concentration of calcium in drinking water.

A8.5 Magnesium

Table A29: 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

Sampling frequency increased from Six monthly to monthly in January 2013.
* There is currently no recommended guideline value set out for the concentration of magnesium in drinking water.

A8.6 Ammonia

Table A30: 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	0.150	0.006	0.048	Yes
Darley	Monthly	12	0.007	0.002	0.003	Yes
Diggers Rest	Monthly	12	0.150	0.021	0.080	Yes
Eynesbury	Monthly	12	0.004	0.002	0.003	Yes
Gisborne#	Monthly	7	0.002	0.002	0.002	Yes
Lancefield	Monthly	12	0.011	0.002	0.004	Yes
Lerderderg	Monthly	12	0.008	0.002	0.003	Yes
Macedon#	Monthly	7	0.003	0.002	0.002	Yes
Maddingley	Monthly	12	0.006	0.002	0.003	Yes
Melton South	Monthly	12	0.006	0.002	0.003	Yes
Merrimu	Monthly	12	0.009	0.002	0.004	Yes
Mount Macedon#	Monthly	7	0.007	0.002	0.003	Yes
Myrniong	Monthly	12	0.011	0.003	0.006	Yes
Riddells Creek#	Monthly	7	0.002	0.002	0.002	Yes
Rockbank	Monthly	12	0.006	0.002	0.003	Yes
Romsey	Monthly	12	0.220	0.036	0.144	Yes
Sunbury	Monthly	12	0.150	0.025	0.106	Yes
Toolern Vale	Monthly	12	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 microorganisms.*
 # These localities received monthly testing until January 2013 when it was deemed no longer necessary due to the disinfection mode in that system.

A8.7 True colour

Table A31: True colour results

Water sampling locality	Sampling frequency#	No of Samples	Max (TCU)	Min (TCU)	Mean (TCU)	Complying* (Yes/No)
Bulla	Weekly	32	6	2	3	Yes
Darley	Weekly	32	5	2	3	Yes
Diggers Rest	Weekly	32	6	2	3	Yes
Eynesbury	Weekly	32	5	2	3	Yes
Gisborne	Weekly	32	6	2	3	Yes
Lancefield	Weekly	31	2	2	2	Yes
Lerderderg	Weekly	30	4	2	2	Yes
Macedon	Weekly	31	5	2	3	Yes
Maddingley	Weekly	31	4	2	2	Yes
Melton South	Weekly	32	4	2	3	Yes
Merrimu	Weekly	32	5	2	3	Yes
Mount Macedon	Weekly	31	6	2	3	Yes
Myrniong	Weekly	31	4	2	2	Yes
Riddells Creek	Weekly	32	6	2	3	Yes
Rockbank	Weekly	31	6	2	3	Yes
Romsey	Weekly	31	8	2	5	Yes
Sunbury	Weekly	32	6	2	3	Yes
Toolern Vale	Weekly	31	4	2	3	Yes
Woodend	Weekly	31	4	2	2	Yes

 # Sampling frequency increased from monthly to weekly in January 2013.
** 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).*

A8.8 Sodium

Table A32: 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	Six monthly	2	5.4	4.7	5	Yes
Darley	Six monthly	2	41	8	25	Yes
Diggers Rest	Six monthly	2	5.4	4.8	5	Yes
Eynesbury	Six monthly	2	41	4.6	23	Yes
Gisborne	Six monthly	2	6.8	5.7	6	Yes
Lancefield	Six monthly	2	46	45	46	Yes
Lerderderg	Six monthly	2	38	7	23	Yes
Macedon	Six monthly	2	7.7	6.6	7	Yes
Maddingley	Six monthly	2	43	8.8	26	Yes
Melton South	Six monthly	2	35	4.7	20	Yes
Merrimu	Six monthly	2	41	5.4	23	Yes
Mount Macedon	Six monthly	2	8.3	7.1	8	Yes
Myrniong	Six monthly	2	48	36	42	Yes
Riddells Creek	Six monthly	2	7.2	6.2	7	Yes
Rockbank	Six monthly	2	37	4.7	21	Yes
Romsey	Six monthly	2	22	19	21	Yes
Sunbury	Six monthly	2	5.9	4.8	5	Yes
Toolern Vale	Six monthly	2	36	4.9	20	Yes
Woodend	Six monthly	2	52	17	35	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).*

A8.9 Total dissolved solids

Table A33: Total dissolved solids results

Water sampling locality	Sampling frequency#	No of Samples	Max (mg/L)	Min (mg/L)	Mean (mg/L)	Complying* (Yes/No)
Bulla	Six monthly	2	110	41	76	Yes
Darley	Six monthly	2	300	68	184	Yes
Diggers Rest	Six monthly	2	78	44	61	Yes
Eynesbury	Six monthly	2	310	46	178	Yes
Gisborne	Six monthly	2	52	40	46	Yes
Lancefield	Six monthly	2	190	180	185	Yes
Lerderderg	Six monthly	2	330	210	270	Yes
Macedon	Six monthly	2	64	38	51	Yes
Maddingley	Six monthly	2	320	110	215	Yes
Melton South	Six monthly	2	310	46	178	Yes
Merrimu	Six monthly	2	360	180	270	Yes
Mount Macedon	Six monthly	2	61	60	61	Yes
Myrniong#	Six monthly	6	300	220	263	Yes
Riddells Creek	Six monthly	2	70	58	64	Yes
Rockbank	Six monthly	2	260	44	152	Yes
Romsey	Six monthly	2	100	90	95	Yes
Sunbury	Six monthly	2	52	45	49	Yes
Toolern Vale	Six monthly	2	270	44	157	Yes
Woodend	Six monthly	2	81	65	73	Yes

 # Sampling frequency for this locality remained higher than others due to high TDS in source water through the drought years.
** Compliance as measured against the aesthetic (taste) guideline value set out in ADWG for the mean total dissolved solids (TDS) in drinking water should not exceed 600 mg/L.*

A8.10 Zinc

Table A34: 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	Six monthly	2	0.002	0.002	0.002	Yes
Darley	Six monthly	2	0.003	0.002	0.003	Yes
Diggers Rest	Six monthly	2	0.002	0.002	0.002	Yes
Eynesbury	Six monthly	2	0.007	0.005	0.006	Yes
Gisborne	Six monthly	2	0.002	0.002	0.002	Yes
Lancefield	Six monthly	2	0.004	0.004	0.004	Yes
Lerderderg	Six monthly	2	0.004	0.002	0.003	Yes
Macedon	Six monthly	2	0.001	0.001	0.001	Yes
Maddingley	Six monthly	2	0.005	0.003	0.004	Yes
Melton South	Six monthly	2	0.004	0.002	0.003	Yes
Merrimu	Six monthly	2	0.002	0.001	0.002	Yes
Mount Macedon	Six monthly	2	0.001	0.001	0.001	Yes
Myrniong	Six monthly	2	0.005	0.004	0.005	Yes
Riddells Creek	Six monthly	2	0.007	0.003	0.005	Yes
Rockbank	Six monthly	2	0.002	0.001	0.002	Yes
Romsey	Six monthly	2	0.001	0.001	0.001	Yes
Sunbury	Six monthly	2	0.006	0.002	0.004	Yes
Toolern Vale	Six monthly	2	0.015	0.002	0.009	Yes
Woodend	Six monthly	2	0.003	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.*

A8.11 Sulfate

Table A35: 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	Six monthly	2	2.0	1.9	2.0	Yes
Darley	Six monthly	2	54.0	3.0	28.5	Yes
Diggers Rest	Six monthly	2	2.0	1.9	2.0	Yes
Eynesbury	Six monthly	2	65.0	2.0	33.5	Yes
Gisborne	Six monthly	2	9.0	1.8	5.4	Yes
Lancefield	Six monthly	2	5.0	4.6	4.8	Yes
Lerderderg	Six monthly	2	55.0	2.0	28.5	Yes
Macedon	Six monthly	2	2.3	2.0	2.2	Yes
Maddingley	Six monthly	2	57.0	4.0	30.5	Yes
Melton South	Six monthly	2	56.0	2.0	29.0	Yes
Merrimu	Six monthly	2	64.0	3.0	33.5	Yes
Mount Macedon	Six monthly	2	2.7	2.0	2.4	Yes
Myrniong	Six monthly	2	45.0	44.0	44.5	Yes
Riddells Creek	Six monthly	2	2.0	1.7	1.9	Yes
Rockbank	Six monthly	2	55.0	2.0	28.5	Yes
Romsey	Six monthly	2	1.8	1.0	1.4	Yes
Sunbury	Six monthly	2	2.0	1.7	1.9	Yes
Toolern Vale	Six monthly	2	55.0	2.0	28.5	Yes
Woodend	Six monthly	2	51.0	12.0	31.5	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 5 – 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 2012/13 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 2011/12. 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. The following table is a list of all parameters monitored during 2012/13.

Table A36: List of all raw water parameters monitored during 2012/13

Type	Parameter	Type	Parameter
Chemical organics	1,1-Dichloroethane	Physical	Alkalinity, Total as $CaCO_3$
	1,2-Dichloroethane		Colour, True
	Benzene		Dissolved Oxygen
	Dissolved Organic Carbon		Electrical Conductivity @ 25ºC
	Heptachlor		Hardness, as $CaCO_3$
	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 SiO_2*		*Cryptosporidium spp.*
	Silicon*		*Escherichia coli*
	Silica, Total as SiO_2*		*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.*

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. Seven notifications of Level 2 BGA blooms was received for Merrimu and Pykes Creek reservoirs from Southern Rural Water during 2012/13, none which resulted in an incident.

Water sourced from Melbourne Water prior to the off-take entry point to Western Water's region was monitored by Melbourne Water during 2012/13. 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.

GLOSSARY

Algae	Simple types of plant with no root, stems of leaves. They occur mostly in freshwater and marine environments.
Algal bloom	A rapid growth of algae in aquatic environments often triggered by an input of high levels of nutrients and an increase in temperature. Blue-green algae (or cyanobacteria) are of most concern.
Alum	An aluminium sulphate based chemical used as a coagulant in the water treatment process.
Aluminium (Al)	A naturally occurring element in soils which can enter water from catchments.
Ammonia (NH_3)	A highly soluble compound resulting from the decomposition of organic matter containing nitrogen. Usually only found in small concentrations in surface waters.
Aquifer	A layer or section of earth or rock that contains freshwater (known as groundwater), any water that is stored naturally underground or that flows through rock or soil, supplying springs and wells.
ADWG	National Health and Medical Research Council's Australian Drinking Water Guidelines 2004* **The ADWG is freely available at www.nhmrc.gov.au/publications/synopses/eh19syn.htm*
AWA	Australian Water Association
Blue-green algae (cyanobacteria) (BGA)	Single celled, filamentous or colony-forming organisms which are widely distributed in the freshwater and marine environments. Under favourable conditions of light, temperature and nutrient supply, extensive growth of blue green algae may occur, leading to blooms. These can result in environmental problems and can create challenges for water treatment.
Bulk entitlement (BE)	An agreement that outlines the conditions for supply of bulk drinking water from reservoirs managed by Southern Rural Water and drinking water supplied by the Melbourne Water Corporation to Western Water.
Calcium (Ca)	A naturally occurring element which can enter water from catchments. It may also be added to water in the treatment process to reduce the acidity levels or increase the capacity of water to buffer pH changes.
Catchment	An area of land surrounding a water storage. The runoff water from rain falling over the catchment drains into the storage and may collect nutrients, minerals and other contaminants including microorganisms from the surface of the land.
Chlorination	The disinfection of water, wastewater and industrial waste through the application of chlorine (Cl) as part of the water treatment process. Chlorination kills microorganisms and oxidises undesirable compounds.
Chloramination	The application of the chlorine followed by ammonia to create monochloramine (NH_2Cl), a stable disinfectant that is added to drinking water to kill bacteria or to oxidise undesirable compounds. Chloramines persist for a longer time than chlorine and as a result are used in longer water distribution systems.
Coliforms	Coliform bacteria are used as one of the indicators of the quality of drinking water and the possible presence of disease-causing microorganisms. These bacteria are killed by chlorine.
Cryptosporidium	A parasitic protozoan (microorganism) which causes gastroenteritis in humans. These organisms occur in the gut of infected warm-blooded animals and can be introduced into source water through faecal contamination.
DH	Department of Health
Disinfection	Inactivation (killing) of pathogens or organisms capable of causing infectious disease by chemical or physical processes, including chlorination.
Drinking Water Quality Management System (DWQMS)	Western Water's DWQMS is used to ensure our drinking water supplies are managed effectively to provide high quality drinking water and to ensure the protection of public health.
EPA	Environment Protection Authority
ESC	Essential Services Commission
Escherichia coli (E. coli)	The most common heat tolerant coliform present in faeces, which is regarded as the most specific indicator of recent faecal contamination. *E. coli* can be killed by standard disinfection practices.
Filtration	A process for removing particles from water by passing through a porous barrier, such as a screen, membrane, sand or gravel. Often used in conjunction with a coagulant to settle contaminants.
Fluoride (F)	Fluoride is regarded as a useful constituent of drinking water, particularly for the prevention of tooth decay. Fluoride is added to the 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.
IWA	Institute of Water Administration
kL	kilolitres (thousand litres)
Manganese (Mn)	Manganese in a water supply may affect taste, cause staining of clothes, produce deposits in pipes and contribute to turbidity.

mg/L	milligrams per litre
ML	megalitres (million litres)
µg/L	micrograms per litre
National Association of Testing Authorities (NATA)	NATA is Australia's national laboratory accreditation authority. NATA accreditation recognises and promotes facilities competent in specific types of testing, measurement, inspection and calibration.
National Health and Medical Research Council (NHMRC)	NHMRC is Australia's peak body for supporting health and medical research for developing health advice for the Australian community, health professionals and governments.
Nitrogen (N)	Nitrogen is an essential nutrient for plant growth. It is used in fertilisers and is present in sewage effluent. High levels of nutrients can lead to excessive algal growth.
Nitrate ($N0_{3-}$)	The most stable form of combined nitrogen in water. Present in surface waters in small amounts, the major sources are from human and animal wastes.
Nephelometric turbidity unit (NTU)	A measure of the turbidity in water.
Nutrients	Compounds required for growth by plants and other organisms. Major nutrients for plant growth are phosphorous and nitrogen.
Pathogens	Disease causing organisms such as bacteria and viruses.
pH	The pH value indicates if a substance is acidic, neutral or alkaline, 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).
QMS	Quality Management System
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
SRW	Southern Rural Water
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.
WIOA	Water Industry Operators Association
WSAA	Water Services Association of Australia

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We welcome your feedback

Section 23 of the *Safe Drinking Water Act 2003* requires that Western Water makes available for inspection by the public the results of any water quality monitoring program that is conducted on any drinking water supplied by Western Water.

Customers and members of the public may access drinking water quality data by contacting us as below.

Telephone 1300 650 425

Email mail@westernwater.com.au

Mail Drinking Water Quality Report Officer, Western Water, PO Box 2371 Sunbury DC Victoria 3429

Western Water welcomes your feedback on our performance and the content of this report.

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**