icon WATER

Annual Drinking Water Quality Report

2016–17

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TTY for Hearing Impaired

133 677

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13 14 50, 24 hours

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மொழிபெயர்ப்பாளர் உதவிக்கு மேலே உள்ள இலக்கத்தை அழையுங்கள்
Nếu cần thông dịch viên, hãy gọi đến số trên đây

Information about Icon Water and an electronic version of this report can be found at iconwater.com.au.

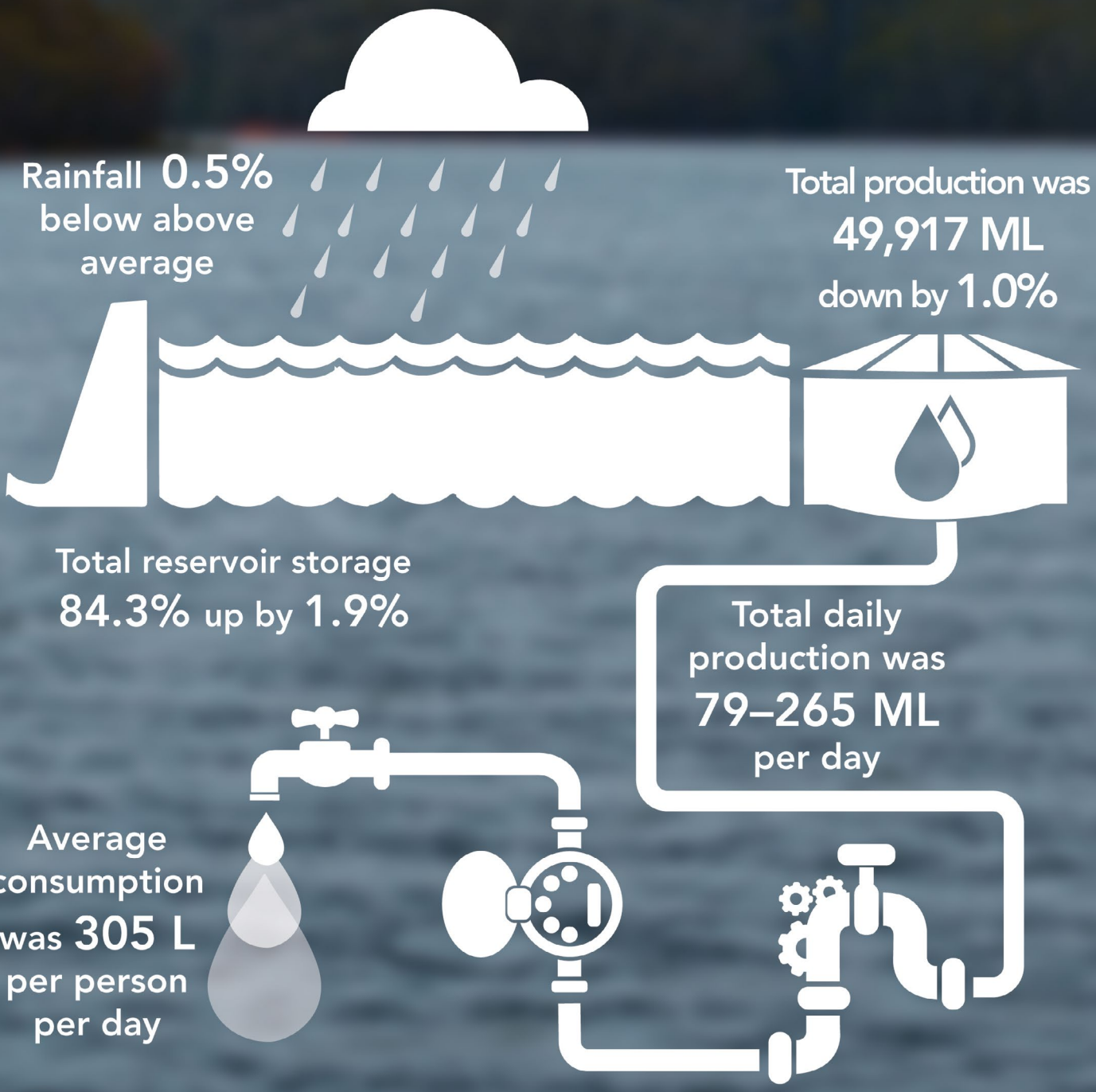
Contents

Summary

Icon Water supports and protects the community and the environment by providing safe, clean drinking water. Icon Water carries out an extensive drinking water quality monitoring program that includes the catchments and storage reservoirs, water treatment plants, service reservoirs and customers' taps. The information generated within this monitoring program assists Icon Water in its operations and ensures high quality water is delivered to Canberra and Queanbeyan.

At the end of June 2017, Canberra's four storage reservoirs were holding 84.3% of their total accessible capacity. Overall daily production of drinking water throughout the year ranged between 79 and 265 megalitres (ML) per day with a total of 49,917 ML of drinking water supplied to Canberra and Queanbeyan. Total consumption was 49,801 ML, which is a 1.2% decrease in the total water consumed by the community and equates to approximately 305 litres per person per day.

This report covers the period 1 July 2016 to 30 June 2017.



1 Canberra's drinking water supply system

Canberra's drinking water is primarily sourced from four storage reservoirs along the Cotter and Queanbeyan rivers. The Cotter River catchment is predominantly within the ACT and contains the Corin, Bendora and Cotter reservoirs. The Queanbeyan River catchment lies within NSW and has a single reservoir – Googong. In addition, water can be abstracted from the Murrumbidgee River. Icon Water works with the ACT/NSW Governments and the community to protect these catchments to ensure Canberra's drinking water supply remains amongst the best in the country.

Prior to distribution to the community, the water abstracted from the storage reservoirs is treated at water treatment plants operated by Icon Water. The Mount Stromlo Water Treatment Plant (WTP) has operated since 1967 and can treat water from the Cotter catchment and the Murrumbidgee River, whilst the Googong WTP has operated since 1979 and can treat water from the Queanbeyan catchment and indirectly from the Murrumbidgee River (via the Murrumbidgee to Googong Transfer Pipeline). The Googong WTP may be operated in conjunction with the Mount Stromlo WTP to supplement water supply during summer peak demands and allow essential maintenance to occur at the Mount Stromlo WTP.

Once treated, Icon Water distributes the water throughout Canberra using a complex network of approximately 3,400 km of pipes and 48 service reservoirs sites. This infrastructure is maintained and closely monitored to ensure the Canberra community receives high quality drinking water.

Icon Water also supplies bulk water to Queanbeyan-Palerang Regional Council (QPRC), which distributes the water to Queanbeyan and Googong Township.

During 2016–17 Icon Water supplied 49,917 ML of drinking water to Canberra and Queanbeyan.The average daily production ranged from 79 ML to 265 ML. Overall the total volume of water supplied represents a small decrease of approximately 1.0% from the previous year.

Urban development in Canberra and Queanbeyan continues to evolve and grow. The most recent estimates put Canberra's population at 406,000[1] and Queanbeyan at 41,000[2,3], representing an average annual population growth of 3.0%. Based on these figures, the average per capita consumption was 305 L/day.

[1] http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0
[2] http://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/3218.0
[3] http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/SSC11704?opendocument

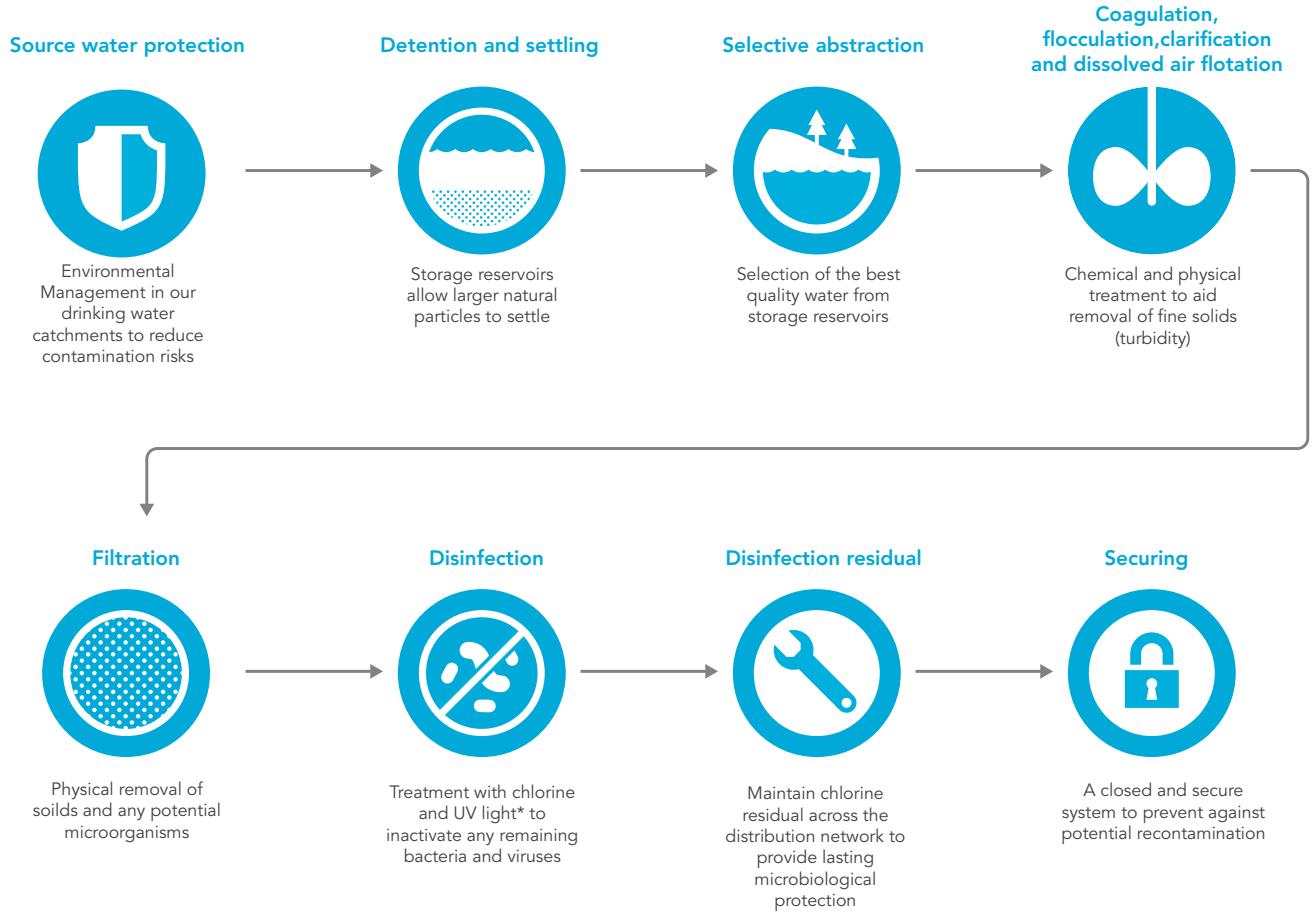
Googong Dam, 2017

2 Managing Canberra's drinking water supply

Multiple barrier approach

Icon Water supports and protects the community by providing safe, clean drinking water. A preventative risk management approach is used to ensure the risks to water quality are minimised and controlled. Throughout its operations Icon Water applies multiple barriers to protect the water supply from contaminants, including pathogenic microorganisms. This approach is consistent with the internationally recognised Hazard Analysis and Critical Control Point (HACCP) principles.

Figure 2-1 Drinking water supply barriers



* Mount Stromlo WTP only

The performance of these barriers is actively managed and monitored using a range of different measures to enable Icon Water to protect Canberra's water supply against potential risks to public health. This includes a source water protection program, real-time online analysers, internal laboratory testing and a routine verification sampling program conducted by a National Association of Testing Authorities (NATA) accredited independent laboratory.

The drinking water quality monitoring program measures physical, chemical and microbiological parameters of the water supplied to customers. The water quality testing results are verified for compliance with the Australian Drinking Water Guidelines (2011) (ADWG). The ADWG include two types of criteria that Icon Water use to manage and measure the performance of the water supply system, they are:

- a health guideline value; which is defined as the concentration or measure of a water quality characteristic that does not result in any significant risk to the consumer and is generally based on a lifetime of consumption
- a aesthetic guideline value; which is defined as the concentration or measure of a water quality characteristic that is associated with acceptability of water to the consumer; for example appearance, taste and odour.

Management framework

Icon Water holds the following licences for the operation of a drinking water distribution and supply service:

- Utilities Service Licence, issued by the Independent Competition and Regulatory Commission (ICRC) under the *Utilities Act 2000.*
- Drinking Water Utility Licence, issued by the ACT Health Directorate under the *Public Health Act 1997.*

Icon Water also complies with the Public Health (Drinking Water) Code of Practice (2007) (the Code), which is issued by ACT Health.

Icon Water operates the water supply system under an Integrated Management System (IMS) to meet quality, environmental, regulatory and workplace health and safety requirements. Icon Water maintains certification and complies with the following Australian and international standards:

- AS/NZS ISO 9001:2008. Quality management systems
- AS/NZS 4801:2001. Occupational health and safety management systems
- AS/NSZ ISO 14001:2004. Environmental management systems
- CAC/RCP 1 – 1969, REV.4 – 2003. General principles of food hygiene and guidelines for the application of the HACCP system.

Icon Water's drinking water quality management is based on the ADWG Framework for the Management of Drinking Water Quality and the HACCP system. Both systems cover water production from the source water catchment to the customer's tap. The externally certified HACCP system has been adapted to suit the water supply process. It enhances the organisation's ability to manage drinking water quality and ensures continuous evaluation and improvement. Icon Water maintained third-party certification of its HACCP–based risk management system for water quality management in 2016–17 and achieved a rating of Excellence in HACCP and Good Manufacturing Process (GMP).

Googong Dam spillway, 2016

Bendora Dam, 2016

3 Canberra's source water catchments

Source water supply

Canberra's source water catchments consist of Corin (70.9 GL), Bendora (11.5 GL) and Cotter (79.4 GL) storage reservoirs on the Cotter River; the Googong (121.1 GL) storage reservoir on the Queanbeyan River; and the Murrumbidgee River.

The majority of the Cotter River catchment is within the Namadgi National Park and is largely protected from pollutants (eg. faecal, pesticides etc.) that can be associated with more intensive land uses and activities such as agriculture, residential and recreation. The Cotter River reservoirs have an accessible combined full capacity of 158.4 GL and were 79.6% full at the end of June 2017. During 2016–17 the Cotter River reservoirs provided 87.7% of the water supplied to Canberra and Queanbeyan (Figure 3-1), of which Bendora reservoir contributed 87.2% and the Cotter reservoir supplied 0.5%.

The Queanbeyan River catchment, located to the south-east of Canberra, contains both developed and impacted land, which includes forestry reserves, rural pasture and rural residential properties. NSW state agencies and local government councils regulate land planning and manage activities in this catchment. The ACT Parks and Conservation Services (PCS) manage the immediate area around the Googong reservoir and recreational access to the water body and foreshore. The Googong reservoir on the Queanbeyan River is the largest of the four water supply reservoirs and represents 43.0% of Canberra's storage capacity. At the end of June 2017 Googong reservoir was at 90.4% capacity. The Googong reservoir provided 12.3% of the water supplied to Canberra and Queanbeyan during 2016–17 (Figure 3-1).

Finally, the Murrumbidgee catchment contains a wide variety of agricultural land uses, as well as the towns of Cooma, Numeralla, Bredbo and the Canberra district of Tuggeranong. During 2016–17 no water was abstracted from this source.

The climate and storage reservoir capacity

Weather patterns were variable during 2016–17, which commenced with a wet winter and spring and culminated in the driest June ever recorded. The rainfall at Canberra Airport was 0.5% below the long term average and total evaporation was approximately the same as the long term average. Inflows to the four storage reservoirs totalled 219 GL, which is 46.7% above the average of the last 15 years. As a result, Icon Water's storage reservoirs finished the year at a healthy 84.3%, a small increase on the 82.7% storage recorded at the end of 2015–16.

Table 3-1 Rainfall, evaporation and reservoir capacity 2016–17

Total rainfall (mm)	Long term average rainfall (mm)	Evaporation (mm)	Total reservoir volume 30 June 2017
614	617	1700	84.3%

Figure 3-1 Reservoir storage levels and drinking water production for 2016–17

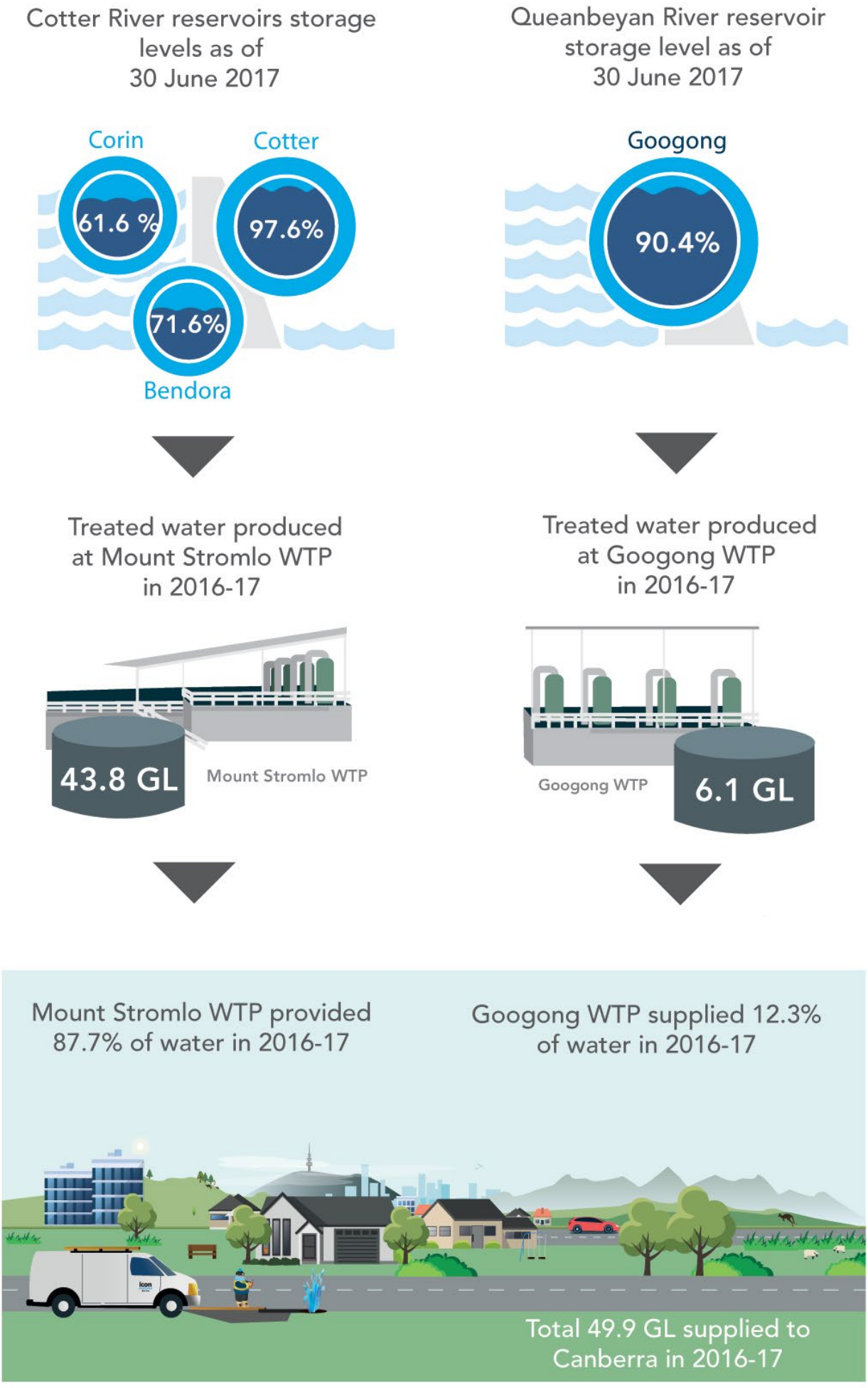
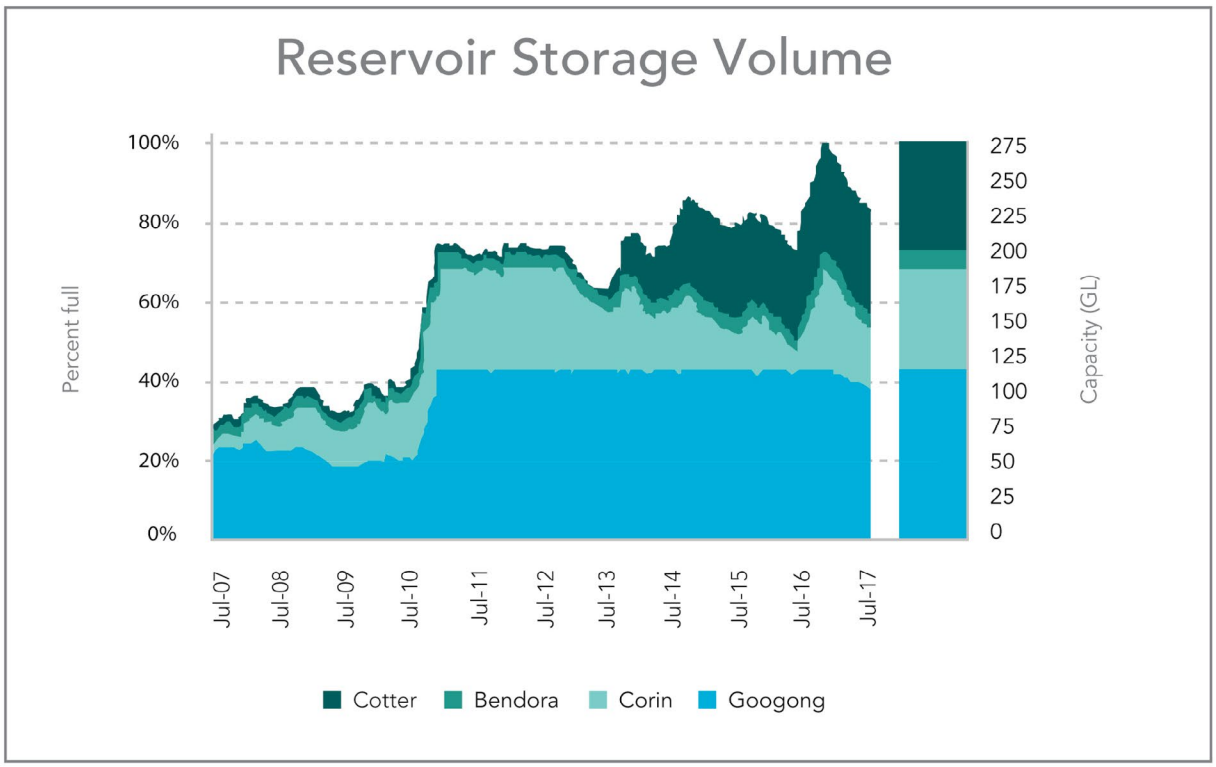


Figure 3-2 Combined storage levels of Corin, Bendora, Cotter and Googong reservoirs from 2007-17



Source water protection

In 2016–17 Icon Water continued to identify and mitigate potential contamination hazards within the catchments; the first barrier to protect the quality of water sources for potable water supply as defined in the Code and the ADWG.

Key activities undertaken by Icon Water for protection of source water in the 2016–17 year included:

- policy and legal protections and enhancements
- community engagement and education activities and campaigns
- on-ground works and monitoring of water quality and ecological condition.

Policy and legal protections

Icon Water has limited direct legislative power in land management of the ACT and region's water supply catchments. Icon Water's key objective is to influence the NSW and ACT regulatory frameworks which govern the water supply catchments.

In 2016–2017 Icon water reviewed non-residential development and recreational event proposals for the supply catchments, and workshopped with Government agencies an risk assessment to changes in fishing permits in Googong reservoir.

Icon Water also contributes to interagency groups established for the Lower Cotter catchment and the interjurisdictional regional catchment group.

Community engagement and education

Icon Water undertook a range of land manager engagement and community education activities throughout 2016–17 to influence land use and recreation, which included:

- the provision of financial support to allow for WaterWatch positions to be continued in the Cooma-Monaro and Southern ACT regions
- the implementation of the Googong Dam Education and Engagement Strategy providing water quality protection messages to the Googong Township community through cooperative delivery with the developers, school and the ACT Parks and Conservation Service. This included a community survey, attending public events and dissemination of education materials.


Corin Dam, 2016

On-ground works and monitoring

In the ACT and region's water supply catchments, opportunities can arise where the delivery of on-ground works can be an effective mechanism of controlling localised source water quality impacts. Such opportunities typically include partnerships with other projects or organisations.

Key on-ground works and water monitoring programs implemented by Icon Water in 2016–17 included the provision of funding to the Molonglo Catchment Group for delivery of the Burra Erosion Control Project over a two-year period, and delivery of a suite of ecological monitoring programs in all catchments.

Icon Water has also provided modelling and advice to the ACT Government to inform monitoring of pine forest removal techniques for the purpose of minimising soil movement and protecting the water quality of Condor Creek and the Cotter reservoir.

In 2016, Icon Water submitted the 2012–15 Sanitary Survey Report to ACT Health. The report summarises the condition of the ACT's drinking water catchments every three years to determine the nature and extent of likely contaminants. Water quality results for the catchments were generally consistent with the previous survey period and within the raw water supply specification for successful processing at the water treatment plants.

Water quality in the raw water source

Icon Water storage reservoirs are a fundamental part of the drinking water supply system. They allow water to be stored during low rainfall periods and assist to stabilise water quality through detention and settling of contaminants. This is particularly important after large rain events when inflows can transport large amounts of sediments and organics into the reservoir.

Mechanical mixers are operated in the Cotter and Googong reservoirs to reduce the degree of thermal stratification (Figure 3-3). By actively managing stratification (Figure 3-4) Icon Water has been able to increase the amount of oxygen (Figure 3-5) within each reservoir and in doing so reduce metal and nutrient concentrations. This makes available a greater volume of water for selective abstraction (CCP1) that is easier to treat and in the case of the Cotter reservoir helps to protect the population of the endangered Macquarie Perch.

Figure 3-3 Cycle of reservoir thermal stratification

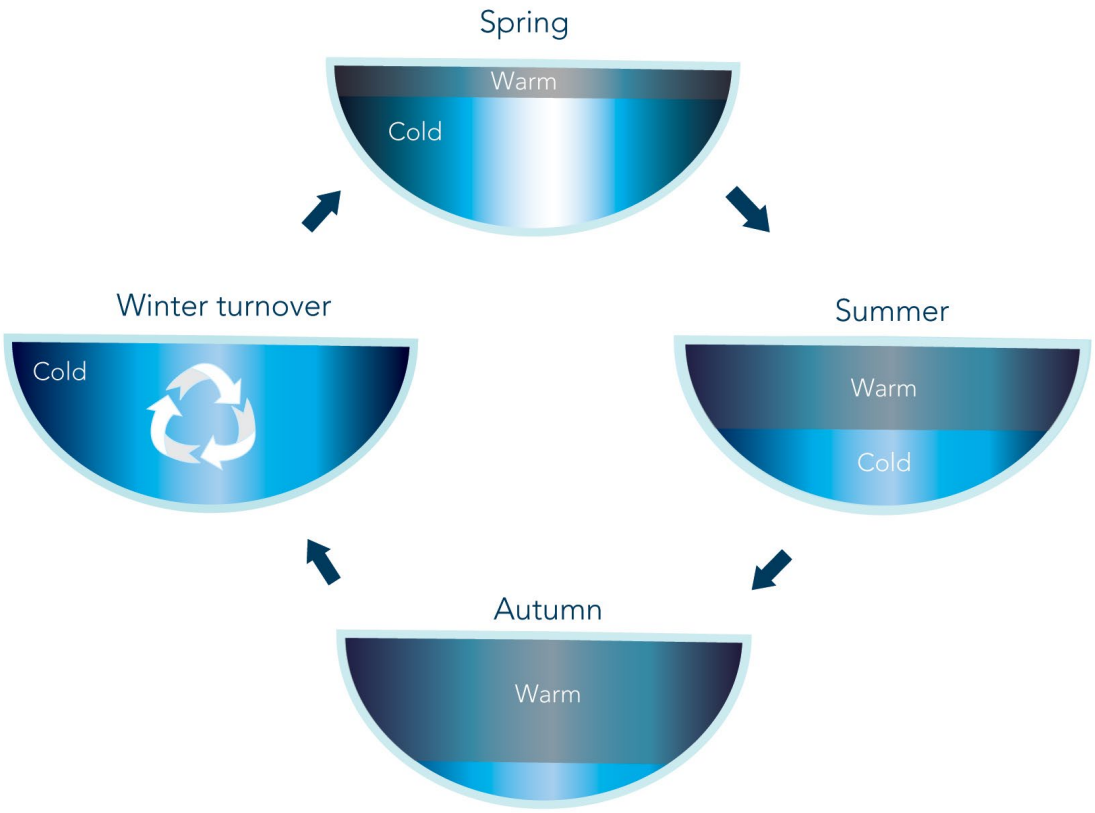


Figure 3-4 Cotter reservior thermal profile

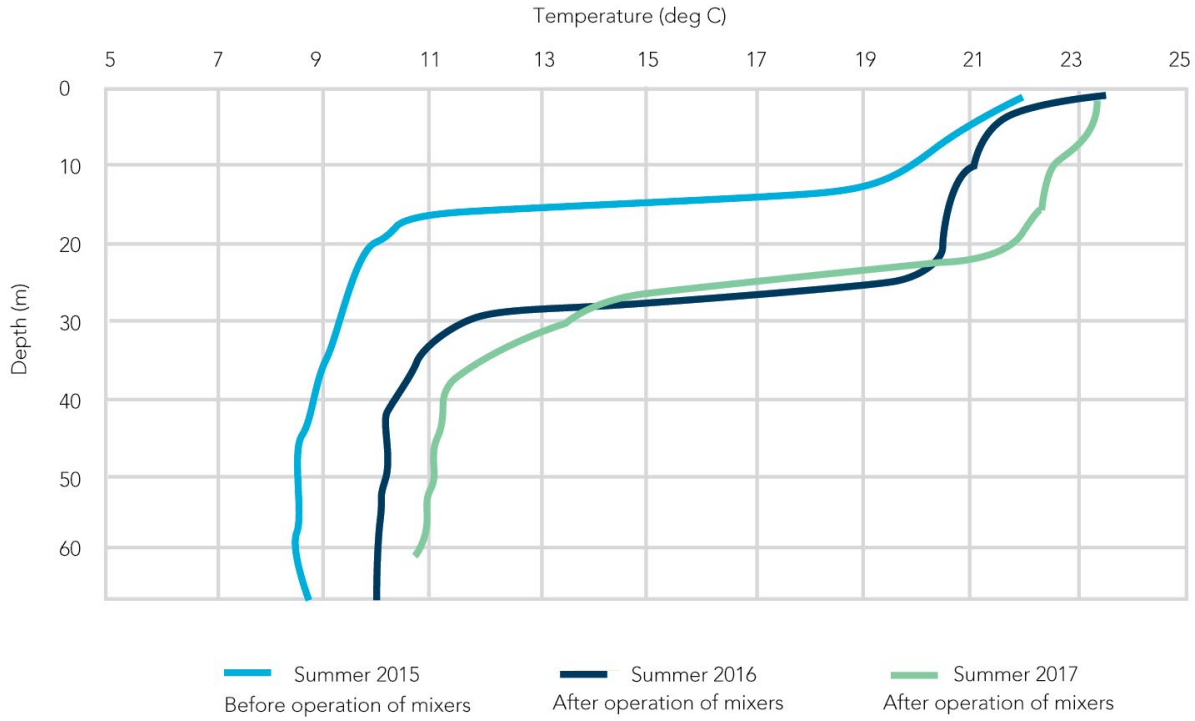
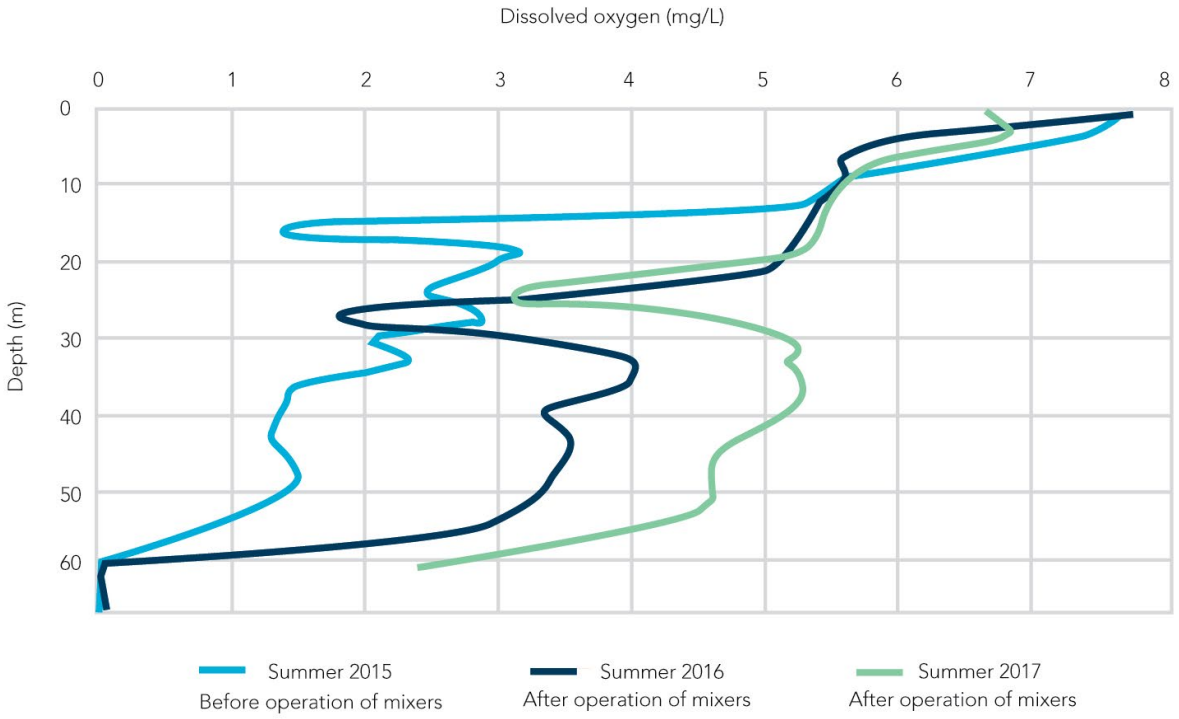


Figure 3-5 Cotter reservoir dissolved oxygen profile



Icon Water undertakes an extensive sampling and analysis program to monitor water quality in its storage reservoirs and the Murrumbidgee River. The program, which is developed in consultation with ACT Health, is adaptively managed to ensure it continues to adequately assess the quality of source waters and identify emerging issues that could affect the drinking water supply. The parameters routinely monitored within the raw water sources are detailed in Table 3-2. In addition, the raw water sources also have continuous online monitoring for select parameters. This enables Icon Water to react rapidly to changes in the raw water quality and ensure only the best quality water is abstracted for treatment at the WTPs.

Table 3-2 Parameters routinely monitored in raw water sources

Microbiological	Physical	Chemical
Cryptosporidium and *Giardia*	Colour	Alkalinity
Escherichia coli (E. coli)	Conductivity	Chlorophyll-a
Heterotrophic bacteria	Dissolved oxygen	Nutrients (e.g. nitrogen and phosphorous)
Phytoplankton incl. blue-green algae	pH	Organic compounds (including herbicides and pesticides)
Total coliforms	Temperature	Radionuclides
	Turbidity	Total and dissolved metals
	UV absorbance	Total and dissolved organic carbon

Cotter reservoir destratification system, 2016

Cyanobacteria (blue-green algae)

Cyanobacteria occurs naturally in water bodies, however, when the water is warm, calm and nutrient rich the conditions are most favourable and they can grow into excessive numbers, termed blooms. Our storage reservoirs, predominantly the Googong reservoir, occasionally experience blue-green algae blooms, typically of *Dolicospermum circinalis* and *Microcystis aeruginosa* which can produce taste and odour compounds and toxins that can be harmful to humans and animals.

Icon Water carries out regular monitoring of blue-green algae in all its raw water sources. The extent and frequency of monitoring varies with the season, but is generally at its most frequent in the warmer months when algal blooms are more likely. Agriculture and other development in the Queanbeyan and Murrumbidgee catchments increase the nutrient levels in the waterways making these raw water sources more susceptible to algal blooms.

In response to an elevated detection of blue-green algae Icon Water's blue-green algae response plan is activated and increased monitoring conducted within the reservoir and at the associated WTP. Under the Code, ACT Health is consulted if elevated levels of blue-green algae are detected. Details of the notifications provided to ACT Health, including blue-green algae are provided in Section 7 of this report.

Concentrations of blue-green algae *(Dolicopsermum circinalis)* in the Googong reservoir were higher in 2016–17 compared to 2015–16 with a persistent bloom in November 2016 and a smaller bloom in June 2017. In 2016–17 there were no cyanobacteria blooms detected in the Cotter catchment reservoirs or at the Murrumbidgee River abstraction point.

Cryptosporidium and *Giardia*

Cryptosporidium and *Giardia* are microorganisms that can cause gastroenteritis. Infected people show either no symptoms or can suffer diarrhoea, vomiting and fever, and healthy people usually recover fully. These naturally occurring organisms are usually spread through contact with pets, farm animals or people who are already infected. There is a background level of infection by *Cryptosporidium* and *Giardia* in the community.

Testing methods for *Cryptosporidium* and *Giardia* are complex and if detected, it is difficult to confirm whether they are infectious to humans. Icon Water undertakes a routine monitoring program for *Cryptosporidium* and *Giardia* in the storage reservoirs and the Murrumbidgee River, as well as at the WTPs.

Cryptosporidium and *Giardia* are generally not detected in the Cotter catchment storage reservoirs or the Googong reservoir. During 2016–17 they were not detected in the routine monitoring program samples collected.

Due to the lower levels of catchment protection and little detention time the Murrumbidgee River is more likely to contain *Cryptosporidium* and *Giardia*. The risk increases further during rainfall events with increased runoff and therefore, in addition to routine testing, extra monitoring may be conducted during these times. There were three positive detections of *Giardia* and one positive detection of *Cryptosporidium* within the Murrumbidgee River during 2016–17. During this period no water was abstracted from the Murrumbidgee River for drinking water use.

Pesticide and herbicide monitoring

Specific monitoring for selected pesticides and herbicides is undertaken in all drinking water sources using a risk-based approach. During 2016–17 there were no pesticide detections above ADWG health values in any of the four storage reservoirs or the Murrumbidgee River.

4 Water treatment operations

Icon Water operates two water treatment plants (WTPs), the Mount Stromlo WTP, which treats water from the Cotter catchment reservoirs and the Murrumbidgee River; and the Googong WTP, which treats water from Googong reservoir.

Mount Stromlo Water Treatment Plant

Mount Stromlo WTP has the capacity to treat 250 ML of water per day. The treatment process involves water passing through multiple treatment steps that are designed to remove contaminants from the water.

The WTP can operate in two treatment process modes; direct filtration or dissolved air flotation and filtration (DAFF). The dissolved air flotation step is an optional treatment step which enhances treatment capabilities to address periods when poorer raw water quality may need to be treated.

The treatment process is shown in Figure 4-1 and it involves:

- pre-treatment for pH adjustment and stabilisation with lime and carbon dioxide;
- coagulation by polyaluminium chloride and/or aluminium sulphate
- flocculation aided by polyelectrolyte
- optional dissolved air flotation
- filtration
- fluoridation by sodium fluorosilicate
- disinfection by ultraviolet (UV) light
- disinfection by chlorination
- pH adjustment and stabilisation with lime.

Figure 4-1 Water supply from catchment to Mount Stromlo WTP to customers' taps

Mount Stromlo WTP, 2016

Googong WTP clarifier, 2016

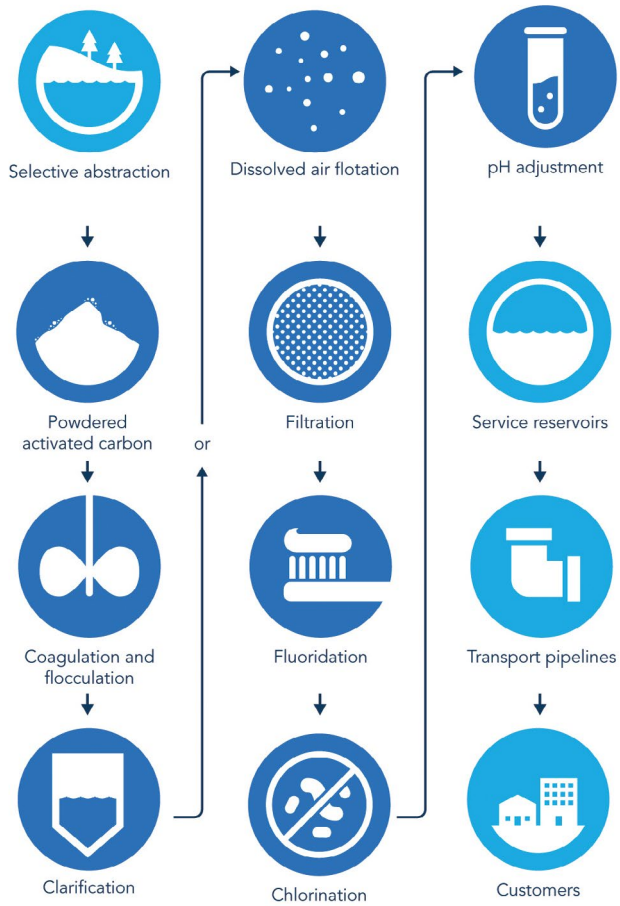
Googong Water Treatment Plant

Googong WTP has the capacity to treat 270 ML of water per day. Googong WTP is generally used in conjunction with Mount Stromlo WTP to meet summer peak demand and enable maintenance tasks to be carried out at Mount Stromlo WTP.

The water treatment process used at Googong WTP is as follows:

- powdered activated carbon (PAC) for taste and odour compound removal (if required)
- coagulation by aluminium sulphate
- flocculation aided by polyelectrolyte
- dissolved air flotation and filtration (augmented plant) or clarification and filtration (original plant), depending on operational mode
- fluoridation by sodium fluorosilicate
- disinfection by chlorination
- pH adjustment and stabilisation with lime.

Figure 4-2 Water supply process from catchment to Googong WTP to customers' taps



Cotter Dam wall, 2016

Water treatment plant performance

Extensive monitoring of process operations are required to ensure optimum performance of treatment barriers. Under Icon Water's HACCP-based water quality management system five critical control points are applied in the drinking water supply system to ensure Canberra and Queanbeyan receive high quality water. Four of these critical control points exist within the WTPs, highlighting the importance of the water treatment operations to the delivery of safe drinking water.

Both WTPs contain online analysers to enable continual monitoring of key water quality parameters so that changes in the raw or process water quality can be quickly identified and addressed. In addition, regular laboratory monitoring is performed and involves analysing for a range of parameters including, but not limited to, colour, turbidity, chlorine, pH, *Escherichia coli (E. coli)*, *Cryptosporidium* and *Giardia*. The online and laboratory monitoring results are relied upon to ensure that the treatment processes are operating correctly and producing high quality water within specification.

Table 4-1 shows a comparison between the ADWG and the average treated water quality values for key parameters at both WTPs for 2016–17. The ADWG health guideline is the concentration or measure of a water quality characteristic that, based on present knowledge, does not result in any significant risk to the health of the consumer and is generally based on a lifetime of consumption.

Table 4-1 Final treated water quality at WTPs

Parameter		Units	ADWG Health value	ADWG **Aesthetic value**	Mount Stromlo WTP Mean result	Googong WTP Mean result
Chlorine	Free	mg/L	-	-	1.38	1.79
	Total	mg/L	5	0.6	1.42	1.97
Colour	True	Pt.Co	-	15	0.73	1.75
Cryptosporidium		cells/L	-†	-	<0.01	<0.008
E. coli		MPN/100 mL	<1	-	<1	<1
Fluoride		mg/L	1.5	-	0.7	0.7
Giardia		cells/L	-†	-	<0.01	<0.008
pH		pH units	-	6.5-8.5	7.54	7.52
Turbidity		NTU	-	5	0.19	0.27

- no current ADWG health or aesthetic value

† no heath guideline has been set due to the lack of a routine method to identify human infectious strains in drinking water.

Turbidity

Turbidity is a measurement of the suspended and dissolved particulates in water. These include suspended colloidal particles, clay and silt. Water with a high level of turbidity often has a muddy or milky appearance. Continuous monitoring of turbidity at the WTPs is undertaken and is used as a key indicator of filter performance. The ADWG states "Where filtration alone is used as the water treatment process to address identified risks from *Cryptosporidium* and *Giardia*, it is essential that filtration is optimised and consequently the target for the turbidity leaving the individual filter should be less than 0.2 NTU, and should not exceed 0.5 NTU at any time". Icon Water utilise this guidance and optimises operations to meet these targets at the WTPs.

During 2016–17 the turbidity of the water produced by the filters at Mount Stromlo and Googong WTPs were below 0.2 NTU 99% of the time.

Microbiological

The greatest risk to the safety of drinking water is microbiological contaminants. Microbiological contaminants have the potential to multiply quickly and cause widespread illness. The treatment process is designed to remove microbiological contaminants that may be present in raw water sources.

E. coli

The faecal indicator bacteria *E. coli* is used to determine whether potential faecal contamination has occurred. If *E. coli* is present in drinking water, it may suggest that enteric pathogenic microorganisms are present. The ADWG suggest that *E. coli* should not be detected in a minimum 100 mL sample of drinking water.

During 2016–17 there were no *E. coli* detected in the treated water leaving the WTPs.

Cryptosporidium and *Giardia*

Icon Water undertakes a routine monitoring program for *Cryptosporidium* and *Giardia* in the raw water sources, in the raw water received at the WTPs and the final treated water. Any positive detection from the raw or treated water at the WTPs is reported to ACT Health.

Cryptosporidium and *Giardia* were not detected in any raw or final water being treated at both the Mount Stromlo and Googong WTPs during 2016–17.

Chlorine

All drinking water processed by the WTPs is disinfected using chlorine. Chlorine is widely used in treatment plants throughout the world to control microbiological contaminants, such as bacteria and viruses. Chlorine gas is added to Canberra's water at a concentration sufficient enough to disinfect the water leaving the WTPs and to provide a free chlorine residual that will continue to protect against contamination in the distribution system. The ADWG health guideline for chlorine is 5 mg/L and the aesthetic guideline is 0.6 mg/L, which is based on an odour threshold. Some customers are sensitive to the taste or smell of chlorine and Icon Water endeavours to manage chlorination to optimise the concentrations at the customers' tap.

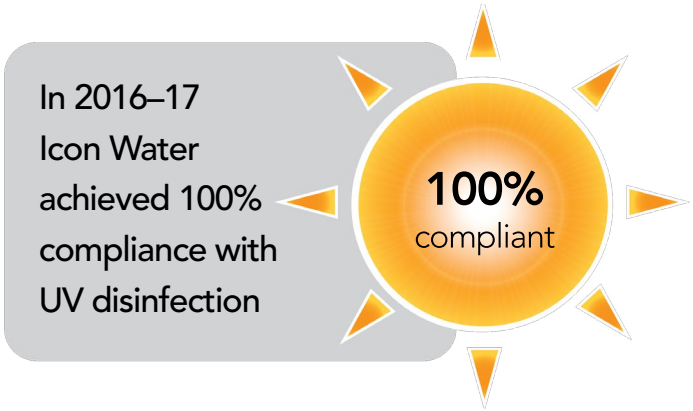
During 2016–17 free chlorine concentration in the treated water leaving Mount Stromlo WTP was maintained at an average of 1.38 mg/L. Due to its different raw water characteristics and geographical location, resulting in potential extended detention times within the distribution system, Googong WTP generally produces final treated water with a higher free chlorine concentration (average of 1.79 mg/L in 2016–17). Chloramine is not used within Canberra's water network.

Ultraviolet disinfection

UV disinfection is used at the Mount Stromlo WTP to further reduce the risk of pathogens entering the drinking water supply. The UV system contains three parallel treatment trains, each of which have three banks of high-intensity, medium-pressure ultraviolet lamps. The quality of filtered water passing through the units is monitored online and each UV reactor includes sensors to continuously measure the UV irradiance in the water to ensure that an adequate UV dose is achieved. The power of each lamp is automatically regulated to ensure the required dose is maintained based on flow rate.

The UV system should provide a dose of greater than 27 mJ/cm^2 for at least 95% of the treated water.

The system continued to exceed this performance objective and in 2016–17 100% of the water produced received a dose greater than 27 mJ/cm^2.



Fluoride

The Drinking Water Utility Licence, issued by ACT Health, requires fluoride to be added to the ACT's drinking water network at a concentration between 0.6 and 1.1 mg/L.

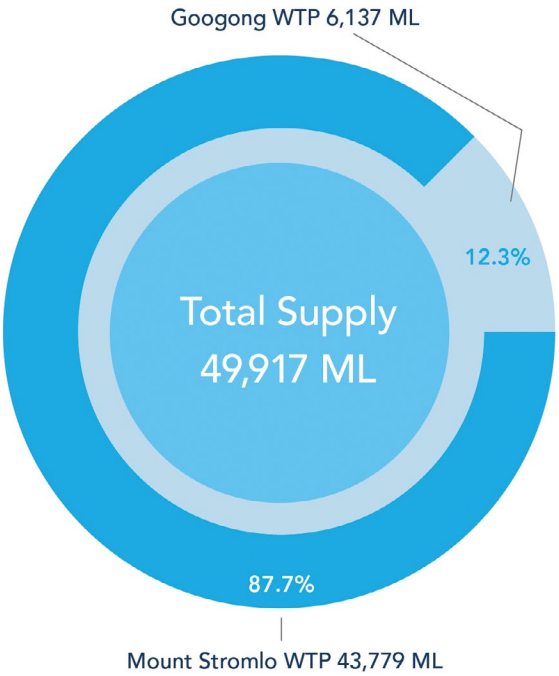
"The aim of water fluoridation is the adjustment of the natural fluoride concentration in fluoride deficient water to that recommended for optimal dental health" (NHMRC, 2007). In order to achieve compliance with the licence, Icon Water adds sodium fluorosilicate into the drinking water at the WTPs.

In 2016–17 fluoride concentrations were maintained in the final treated water at the WTPs at an average of 0.7 mg/L.

pH

The pH of the drinking water is adjusted at the beginning of the treatment process and again prior to leaving the WTP. The pH of the water prior to coagulation and flocculation is decreased to between 6.0 and 6.2 to ensure it is within the effective range of the coagulant utilised.

Figure 4-3 Total water produced by treatment plant during 2016–17



The ADWG advises that "chlorine disinfection efficiency is impaired above pH 8.0 whilst below 6.5 may be corrosive". As such the pH of the treated water is subsequently increased before distribution so it is within the optimal range to ensure effective disinfection potential whilst also preventing corrosion of the distribution pipelines. The optimal pH range targeted by Icon Water is 6.5–8.5. The average pH of the final treated water at both WTPs was 7.5 during 2016–17.

Water production

49,917 ML of water was produced during 2016–17 between the two WTPs, for distribution to the Canberra and Queanbeyan communities. The majority 43,779 ML (87.7%) of the water produced was treated by the Mount Stromlo WTP, whilst Googong WTP operated between August and October and produced 6,137 ML (12.3%) (Figure 4-3).

Mount Stromlo Water Treatment Plant
Balancing reservoir, 2016

5 The distribution system

Icon Water distributes water throughout Canberra using a complex network of pipelines and service reservoirs. Icon Water also supplies bulk water to Queanbeyan-Palerang Regional Council (QPRC), who distributes the water to Queanbeyan and the Googong Township.

Icon Water operates and maintains 48 service reservoir sites, 25 pump stations and approximately 3,400 km of water pipelines. This infrastructure is maintained and closely monitored to ensure the Canberra community receives high quality drinking water at their tap.

The drinking water distribution system is operated with a number of physical and chemical disinfection barriers in place to protect Canberra's water supply against potential contamination.

Some of the physical barriers include:

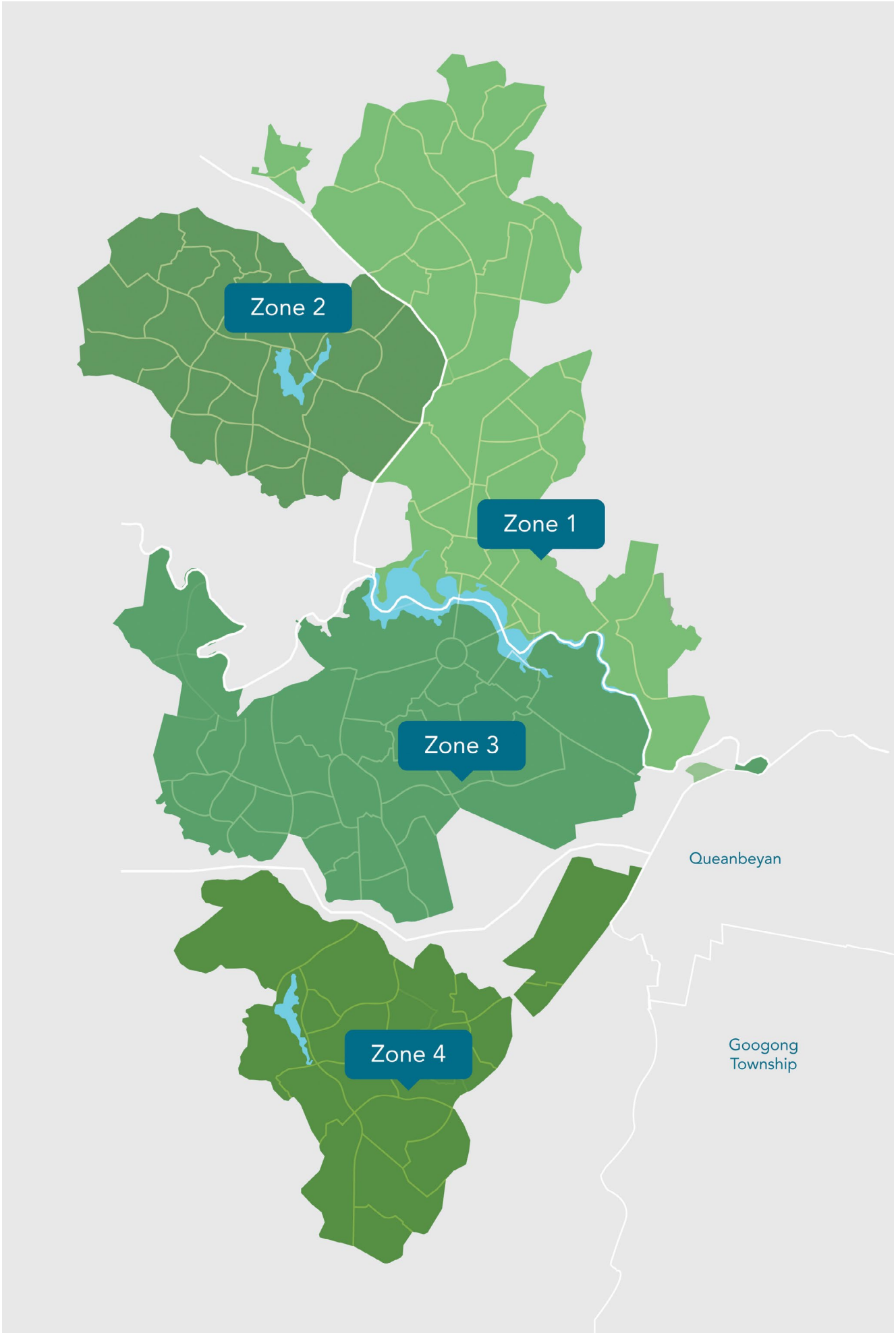
- the water distribution system is a closed network from the WTPs to customers' taps, preventing potential external contamination
- the water mains are operated under positive pressure to prevent contaminants entering the system
- backflow prevention devices are installed at customer supply points to protect against contaminants entering the system
- sewerage mains are generally located deeper than the water network, minimising the risk of contamination through groundwater.

In addition to the physical barriers, a free chlorine concentration is maintained within the water distribution system to protect against microbiological contamination of the water during its journey from the WTP via the service reservoirs to the customer's tap.

The Canberra distribution system is divided into four water quality supply zones based on population, hydraulic characteristics and geography. These zones are used in Icon Water operations to assess the quality of drinking water supplied to the customer's tap.

- Water quality zone 1 – North Canberra and Gungahlin
- Water quality zone 2 – Belconnen
- Water quality zone 3 – South Canberra, Woden and Weston Creek
- Water quality zone 4 – Tuggeranong

Figure 5-1 Water quality monitoring zone map



Service reservoirs

In 2016–17 Icon Water operated 48 service reservoirs sites located throughout Canberra. The reservoirs receive water from the WTPs via bulk supply and trunk mains and stored between 461 ML and 701 ML of water during the year. All Canberra service reservoirs are secure structures to ensure the integrity of the supply system is maintained and to prevent contamination from birds and animals.

Regular inspections are carried out to assess their external condition and the security of the site. Reservoir cleaning is also routinely undertaken with each reservoir being cleaned, on average once every five years. During the cleaning process, the reservoir is emptied, assessed, cleaned, inspected internally and maintenance performed as required. The reservoir is subsequently disinfected and the water tested before being returned to service.

Frequent water quality monitoring occurs at each reservoir which includes analysis for a range of parameters to verify that the water quality complies with the ADWG and to optimise system operations. A summary of water quality analysis undertaken at the service reservoirs across all four water quality supply zones is presented in the Table 5-1.

Table 5-1 Water quality at service reservoirs

Parameter		Units	ADWG	ADWG	Service reservoirs
			Health value	Aesthetic value	Mean result
Escherichia coli (E. coli)		MPN/100 mL	<1	-	<1
Total coliforms		MPN/100 mL	-	-	<1
Heterotrophic plate counts		CFU/mL	-	-	2
Chlorine	Free	mg/L	-	-	0.71
	Total	mg/L	5	0.6	0.78
pH		pH units	-	6.5-8.5	7.71
Temperature		Degrees Celsius	-	15.36	15.36

- no current ADWG health or aesthetic value

Routine inspection of Jacka service reservoir, 2012

Supply to customers' taps

As part of the commitment to provide high quality water Icon Water undertakes a comprehensive routine drinking water quality monitoring program based on the ADWG to verify the water quality throughout the distribution system. During 2016–17, a minimum of 100 random customer garden taps were monitored on a monthly basis from a pool in excess of 400 sites throughout Canberra suburbs. Garden taps are used as they are easily accessible, provide static sample points in the distribution system, allowing historical data acquisition and enable verification of the actual water received by customers. A range of microbiological, chemical and physical parameters are tested and the results are summarised in Table 5-2.

Ensuring that safe and aesthetically pleasing water is delivered to customers is a priority to Icon Water and in 2017 Icon Water won the Water Industry Operations Association (WIOA) IXOM NSW and ACT Water Taste Test for the best tasting water.

Table 5-2 Parameters monitored at customers' taps

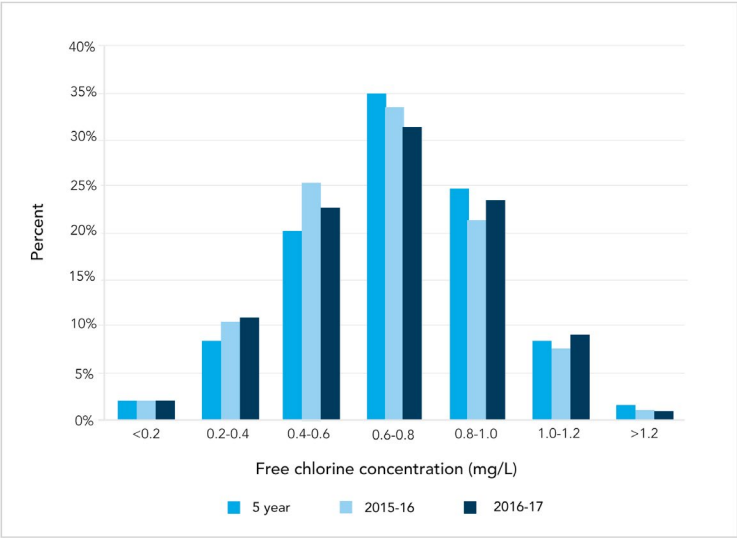
Microbiological	Physical	Chemical
Escherichia coli (E. coli)	Conductivity	Alkalinity
Heterotrophic bacteria	pH	Anions
	Total dissolved solids	Chlorine
	True Colour	Fluoride
	Turbidity	Haloacetic acids
	Asbestos	Hardness
		Metals
		Trihalomethanes (THM)
		Semi-Volatile Organic Compounds (SVOC)

Disinfection in the distribution system

Chlorine is added to water in the final stages of treatment at Mount Stromlo and Googong WTPs. Water entering the distribution system needs to contain an appropriate free chlorine concentration, termed disinfection residual, when delivered to customers' taps. This ensures that chlorine continues to provide protection against microbiological contamination in the distribution system. Chlorine and bacterial levels are frequently monitored in the distribution system.

In 2016–17 the concentrations of free chlorine at customers' taps across all four water quality supply zones were below the ADWG health guideline level (5 mg/L). The concentrations ranged from 0.05 mg/L to 1.38 mg/L. The distribution of chlorine results for customer taps across all four water supply zones is shown in Figure 5-2.

Figure 5-2 Free chlorine concentration at customers' taps



Microbiological monitoring

The WTPs are designed to remove any potential microbiological contaminants prior to distribution to customers; however, as the water moves through the water distribution system there remains a small potential for re-contamination. Therefore a chlorine residual is maintained within the network to provide ongoing disinfection potential.

Icon Water conducts verification monitoring of *E. coli* (faecal indicator) at customers' taps to ensure the water supplied is free from microbiological contamination. The ADWG suggests that *E. coli* should not be detected in a minimum 100 mL sample of drinking water.

During 2016–17, 100% of samples returned no detections of *E. coli* across all four water quality supply zones.

Physical and chemical monitoring

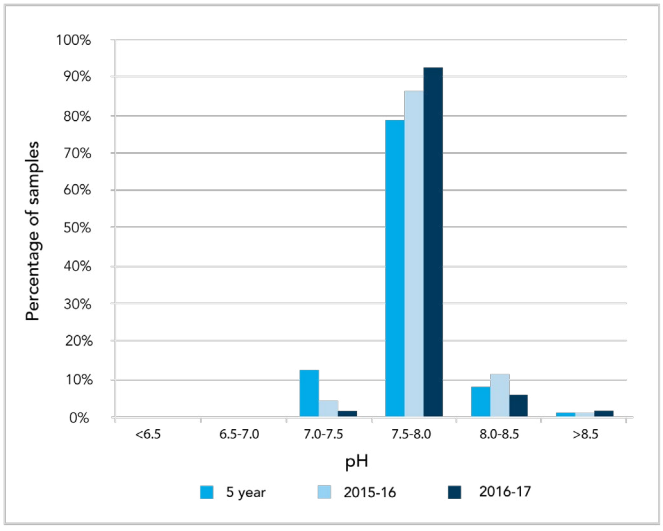
Icon Water monitors a wide range of both physical and chemical parameters as part of the customer tap water quality monitoring program. Detailed information for a selection of these parameters is provided below. Results for all parameters monitored are displayed in Section 9.

pH

pH of drinking water generally increases as it travels through the distribution system due to leaching of lime from cement lined pipes and concrete service reservoirs. This increase is generally proportional to the detention time of the water within the distribution system.

The buffering capacity of water at the WTPs has continued to provide a positive impact on management of pH within the distribution system. An ADWG aesthetic pH value in the range of 6.5 to 8.5 is optimal for water supply systems. The upper limit of 8.5 is set to minimise the potential for taste problems or scaling of water pipelines, however this is not of particular concern in Canberra due to the low mineral content of the drinking water.

Figure 5-3 pH at customers' taps



Chlorine disinfection is also affected by pH such that as pH increases the disinfection potential of chlorine decreases. However, as pH decreases the corrosion potential of the water increases, which may lead to increased levels of contaminants, for example heavy metals, in the water and cause damage to assets. It is therefore necessary to balance pH in the network to minimise corrosion while ensuring effective disinfection is maintained.

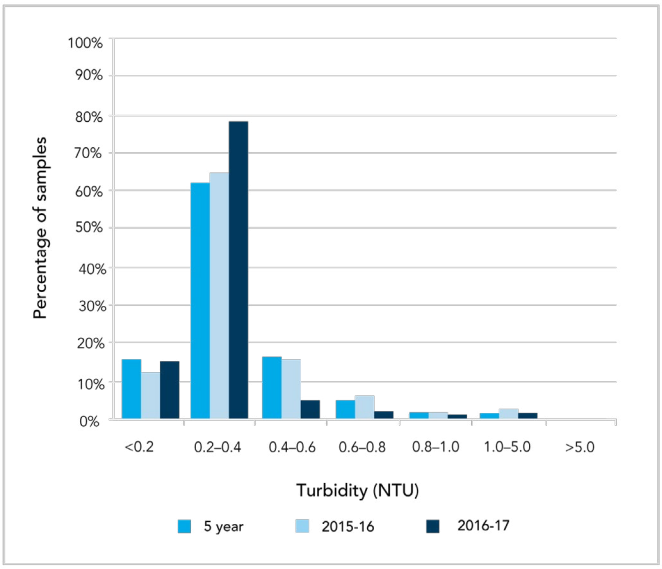
The distribution of pH results for customer taps across all four water supply zones is shown in Figure 5-3 and a summary of the results is listed in Table 5-3.

Turbidity

Turbidity is a measurement of the suspended and dissolved particulates in water. The ADWG does not outline a health guideline; however the aesthetic value is 5 nephelometric turbidity units (NTU)—a level of turbidity that is just noticeable in a glass.

During 2016–17 the turbidity level at customers' taps was lower compared with previous years. The distribution of turbidity results for customer taps across all four water supply zones is shown in Figure 5-4 and a summary of the results are in Table 5-3.

Figure 5-4 Turbidity at customers' taps



Colour

Colour is mainly present in the raw water due to a range of natural organic compounds from small hydrophilic acids, proteins and amino acids to larger humic and fulvic acids. These compounds originate from organic matter through, or over which, the water has passed in the catchment. The majority of natural organic matter is removed by coagulation in the water treatment process. The ADWG does not outline a health value, however the aesthetic guideline for apparent colour is based on what is just noticeable in a glass of water. Results are reported in platinum-cobalt units (Pt-Co) and the aesthetic guideline is 15 Pt-Co. A summary of the results are in Table 5-3.

Metals

Iron

Iron occurs naturally in raw water and can also be present in the water supply from the corrosion of iron or steel pipes or other components of a plumbing system. Icon Water undertakes an annual main renewal program to replace sections of corrode pipe, which helps lower metal concentrations.

The ADWG states that "insufficient data are available to determine a health-based guideline value for iron in drinking water". The ADWG aesthetic guideline value for iron is 0.3 mg/L, which is based on the taste threshold in water. A summary of the results are in Table 5-3.

Manganese

Water percolating through soil and rocks can dissolve minerals that contain manganese. The ADWG health guideline value for manganese is 0.5 mg/L. Levels above the ADWG aesthetic guideline level of 0.1 mg/L can cause an undesirable taste and stain clothes during washing.

At concentrations above 0.1 mg/L manganese can also contribute to the formation of biofilms on the insides of pipes, which may detach during high flows and appear as black particles. A summary of the results are in Table 5-3.

Copper

Copper is found naturally in raw water, generally in low concentrations. Drinking water from customers' taps may contain higher levels of copper if the water has been in contact with copper plumbing and fixtures. Copper levels may increase if water stagnates in the plumbing system for long periods; for example, during holidays when residents may be away from home for an extended time. Water which contains a high level of copper often has a blue/green appearance.

The ADWG sets an aesthetic limit of 1 mg/L for copper based on the potential for staining. Copper should not exceed 2 mg/L for health considerations. The guidelines state that "water that has been in stagnant contact (six hours or more) with copper pipes and fittings should not be used in the preparation of food and drink". A summary of the results are in Table 5-3.

Fluoride

Fluoride is added to Canberra's drinking water supply at the WTPs prior to distribution to our customers. Icon Water adds fluoride to Canberra's drinking water as directed by ACT Health under the Drinking Water Utility Licence at concentrations between 0.6 mg/L and 1.1 mg/L.

During 2016–17 the average fluoride concentration in the drinking water at customers' taps was 0.7 mg/L. A summary of the results is presented in Table 5-3.

Other compounds

Other substances that Icon Water monitors in the distribution system include a range of semi volatile organic compounds (SVOC). SVOCs include chemicals such as plasticisers and hydrocarbons. Plasticisers are used in a broad range of products including food packaging, whilst hydrocarbons are utilised in an array of industrial applications. Icon Water monitors for these compounds within the distribution system in line with the ADWG.

All routine monitoring results for these compounds were below the limit of reporting (i.e. not detected) during 2016–17. Full results are presented in Section 9.

Table 5-3 Summary of key physical and chemical parameters at customers' taps

Parameter	Units	ADWG Health value	ADWG Aesthetic value	Minimum concentration	Maximum concentration	Mean concentration	ADWG compliance Health value
pH	pH units	-	6.5 - 8.5	7.40	8.89	7.76	-
Colour	Pt-Co	-	15	<1	3	1	-
Turbidity	NTU	-	5	<0.1	2.3	0.3	-
Iron	mg/L	-	0.3	<0.01	0.18	<0.01	-
Manganese	mg/L	0.5	0.1	<0.001	0.117	0.007	✓
Copper	mg/L	2	1	<0.001	0.128	0.013	✓
Fluoride	mg/L	1.5	-	0.4	0.9	0.7	✓

- no current ADWG health or aesthetic value

“In 2017 the average Canberran used 305L of water per day.”

Burst water main Macarthur, 2017

6 Common water quality problems

Icon Water manages approximately 172,000 connections to the water network in the ACT. Occasionally customers experience problems with the quality of their water supply and contact Icon Water for advice. Any concerns expressed by the community are investigated to determine the likely cause and, if required, corrective actions are taken. Enquiries and complaints are recorded along with the actions taken to rectify any problem.

Often issues related to water quality are short-term and may be associated with water main bursts, maintenance work or a change in usage patterns within the water supply system. Valve operations required for maintenance work may reverse the direction of flow of water, causing shearing of pipe surfaces, which may result in discoloured water. Where customers are likely to be affected by planned maintenance activities, Icon Water endeavours to notify customers in advance.

Customers are urged to contact Icon Water if they have any questions relating to water quality.

During 2016–17 a total of 169 water quality complaints were received, representing a 26.5% reduction compared with the number of complaints received in 2015–16. Of the 169 complaints 47.9% of the cases were related to discoloured water. A summary of the types of complaints received are detailed in Figure 6-1 and Table 6-1.

Icon Water uses feedback from the community relating to water quality and network reviews following discoloured water events to better understand the network and the impact that our operations have on network performance. All complaints are taken seriously and we value feedback about our product.

Figure 6-1 Summary of water quality issues

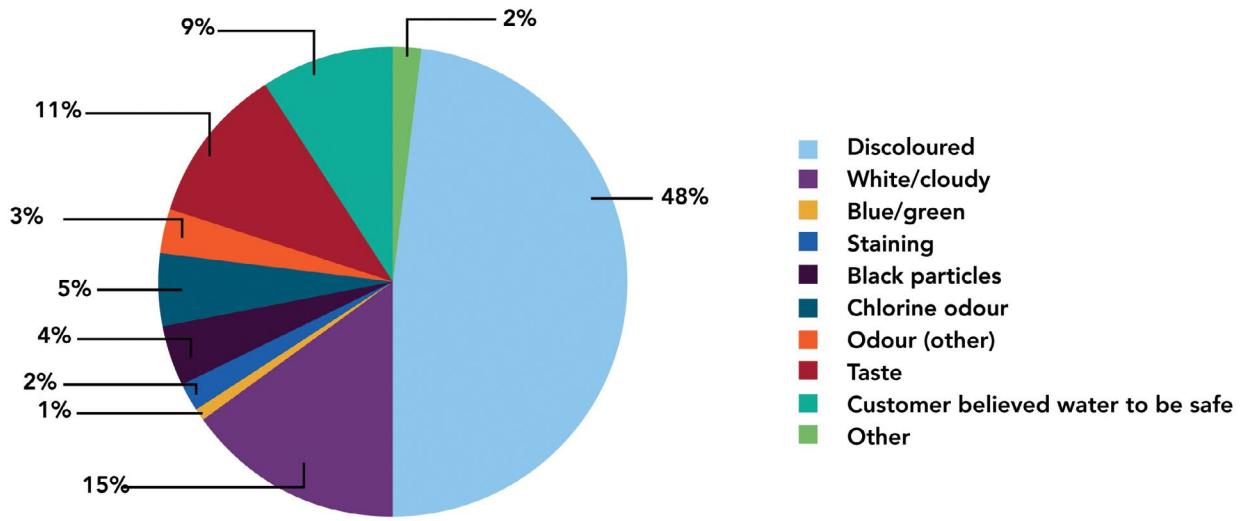


Table 6-1 Summary of water quality issues

Complaint	Frequency	Comments
Discoloured	81	Discoloured water is most often associated with maintenance work or a change in usage patterns but may also be associated with internal plumbing. Discoloured water resulting from maintenance work generally clears within a short period, however if a customer continues to experience problems Icon Water may flush the mains to minimise further inconvenience.
White/cloudy	25	This usually presents as cloudy water resulting from air bubbles generated by flushing of the mains, hot water units or aerators on taps. If this does not clear over a short period of time the customer is invited to contact Icon Water for further advice.
Blue/green	2	Blue or green water can often be associated with the corrosion of copper pipes.
Staining	3	Deposits dislodged from domestic plumbing or from the water main can cause staining of washing.
Black particles	6	Black particles may originate from degrading plumbing fittings such as flexible rubber hoses, flick-mixers, rubber washers and internal hot water system components.
Chlorine odour	9	Chlorination is necessary for the disinfection of the water supply. Usually these enquiries relate to a change (increase) in the level of chlorine that a customer is receiving. These problems are usually aesthetic and short-term.
Odour (other)	5	Miscellaneous odour enquires are investigated individually. These problems are usually short-term.
Taste	19	Miscellaneous taste enquiries are investigated individually. This also includes bitter and metallic tastes experienced by customers.
Customer believed water to be unsafe	16	Customers may raise concern that the water is unsafe to drink. In most cases water is tested by an independent laboratory to ensure compliance with the Australian Drinking Water Guidelines.
Other	3	Issues not otherwise categorised.
TOTAL	169	

Mount Stromlo WTP Balancing reservoir, 2016

7 Icon Water and ACT Health

Icon Water complies with the *Public Health (Drinking Water) Code of Practice (2007)* (the Code) which was issued by ACT Health. Copies of the Code are available from the ACT Health website at health.act.gov.au.

The Code sets out operational, communication, reporting and response requirements for both Icon Water and ACT Health to ensure the supply of safe drinking water. The Code also sets out specific water quality events or incidents that Icon Water must notify to ACT Health.

During the 2016–17 year, a number of notifications to ACT Health were issued. These notifiable incidents are captured in Table 7-1.

Table 7-1 Summary of notifications and action taken by Icon Water

Source	Date	Criteria	Incident and Action Taken
Water within the distribution system at customer point of supply	12/07/16	Lead	Lead was detected above the Australian Drinking Water Guideline (ADWG) health value in a sample at a customer's tap collected as part of an investigation into white particulate matter. The subsequent investigation did not detect any particulate matter. The customer was asked to call back if the problem occurred again.
Raw water in the storage reservoir	21/11/16	Cyanobacteria	High risk cyanobacteria, *Dolicospermum*, was detected in two samples collected within the Googong reservoir. At the offtake tower site 4,352 cells/mL were recorded, whilst there were 2,752 cells/mL detected at a site approximately 2.5 km upstream of the offtake tower. Googong Water Treatment Plant was offline at the time of sampling. Water quality monitoring continued at the storage reservoir as per the routine monitoring program. No further action was required.
Water within the distribution system at customer point of supply	06/03/17	Nickel (part of lead investigation)	Nickel was detected at a concentration above the ADWG health guideline in response to a water quality investigation. Subsequent testing indicates that the issue is confined to an isolated area. The affected customer is aware of the water quality and a project is underway to rectify the issue.
Water within the distribution system at customer point of supply	30/03/17	Cross connection	During a project to remove a valve, treated water was supplied via a raw water main to a small number of customers. As soon as the cross connection was realised, it was reversed and the affected customers were provided bottled water. Samples were collected to verify the quality of the water had returned to within specification. A full investigation of this incident resulted in a number of corrective actions to prevent a similar incident occurring again.

Source	Date	Criteria	Incident and Action Taken
Water within the distribution system at customer point of supply	07/04/17	Plasticiser	A plasticiser was detected above the ADWG health value (10 µg/L) in a routine water sample. Retesting of the site returned results under the ADWG health values for all parameters. Icon Water is continuing to monitor plasticiser levels as part of the routine monitoring program.
Water within the distribution system at customer point of supply	02/05/17	*E. coli*	*E. coli* was detected in a sample collected as part of an ongoing investigation on an isolated part of the network. Icon Water contacted the potentially affected customer. Bottled water was provided to customers whilst the investigation was conducted. Works are underway to resolve this issue.
Water within the distribution system at customer point of supply	5/05/17	Incorrect non-potable connection at LMWQCC	During a project at an Icon Water site, non-potable water was incorrectly connected to the potable water supply. As soon as the error was recognised the connection was corrected, the pipes disinfected and testing undertaken. All staff that may have had contact with the non-potable water were advised of the error. No attributable illnesses were reported. A full investigation of this incident resulted in a number of corrective actions to prevent a similar incident occurring again.
Raw water in the storage reservoir	28/06/17	Cyanobacteria	High risk cyanobacteria, *Dolicospermum*, was detected at concentrations of 3,128 cells/mL and 2,476 cells/mL in the surface samples at two sites. Each site is located at an inlet to the Googong reservoir and are upstream from the offtake tower. Googong Water Treatment Plant was offline at the time of sampling. Water quality monitoring continued at the storage reservoir as per the routine monitoring program. Data from the program was used to determine whether additional treatment would be utilised once the plant came online.

Cotter reservoir, 2017

8 Managing Canberra's water quality into the future

Icon Water is committed to the continuous improvement of water quality management practices. The Strategic Water Quality Improvement Plan summarises the drinking water quality improvement activities, which are proposed or underway throughout the ACT water supply system, that address identified strategic risks associated with drinking water supply.

There are no systemic issues that result in poor quality treated water within Icon Water's supply network and as such the majority of the current and proposed water quality improvement projects relate to maintenance, risk management, or continual improvement. Many of these are longer term projects and updates on the status of these projects along with any new projects are outlined in this plan. A selection of projects from 2016–17 and those underway in 2017–18 are detailed below.

Future water quality issues

There are a number of policies, plans and projects (proposed or underway) by third parties within or near our catchments that could impact on water quality. Icon Water maintains an active interest in these developments to ensure we can continue to adequately protect our water quality into the future.

Water quality risk management

Health based targets

It is anticipated that the National Health and Medical Council will include health based performance targets (HBTs) for microbial drinking water quality in the next revision of the ADWG.

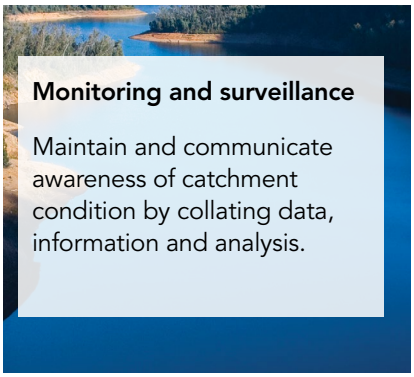
A draft methodology has been developed by Water Services Association of Australia (WSAA) for performing HBTs assessments of source waters and water treatment plants. The approach considers the performance of the water treatment plant in relation to the condition of the catchments and where it sits on the 'Water Safety Continuum'.

Icon Water has trialled the methodology on the Googong Water Treatment Plant direct filtration stream. The WTP met the target requirement, placing the direct filtration stream of the plant in the 'safe' part of the continuum. Icon Water will conduct assessments of all supplies once HBTs are introduced.

Source water protection

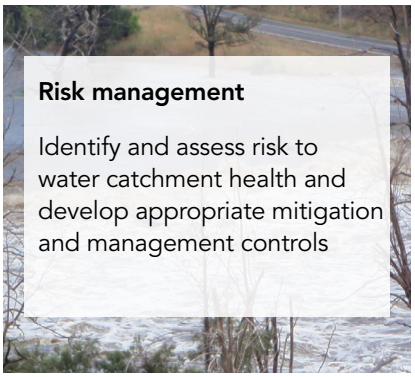
Source Water Protection Strategy

Icon Water is currently revising the Source Water Protection Strategy. The updated strategy will set out Icon Water's approach to ensure high quality raw water supplies are available for the treatment and supply of drinking water for the Canberra region through the three approaches outlined below.



Monitoring and surveillance

Maintain and communicate awareness of catchment condition by collating data, information and analysis.



Risk management

Identify and assess risk to water catchment health and develop appropriate mitigation and management controls

Stakeholder engagement

Build partnerships with stakeholders and land managers to ensure appropriate planning and management of activities

Water treatment plants

Googong WTP Clarifer System Asset Renewal

Clarification is an important stage of the water treatment process (CCP 4). The Googong WTP clarifiers have been in service for many years and much of the equipment is nearing the end of its anticipated service life. Planning is underway to investigate options to remediate or replace the clarifiers and ensure the process will continue to operate well into the future.

Chlorine dosing system upgrades

Chlorine dosing is recognised as a Critical Control Point (CCP) in Icon Water's HACCP-based drinking water quality risk management system. The chlorine system is critical to the operation of the WTPs and ensures disinfection is continued into the reticulation network. This project will provide renewal of aged assets and upgrades to the existing systems at both the Mount Stromlo and Googong WTPs to ensure their ongoing serviceability and reliability. The upgrade of the chlorine system at the Googong WTP is well underway with Mount Stromlo WTP scheduled to begin shortly. The project is expected to be completed late 2017.

Applied research and development projects

Smart Control of Water Systems to Improve the Management of Drinking Water Quality

Icon Water provided input into the Water Services Association of Australia (WSAA) project to develop a comprehensive position paper that identifies: the current state of monitoring and control implementation, issues that may be addressed through monitoring and control, technologies available in the market, opportunities for implementation, relative costs, potential efficiencies gained and technology gaps.

This paper will assist Icon Water in its continuous development towards a higher level of automation which will deliver improved service, improved water quality and lower operating costs.

Googong Water Treatment Plant clarifer, 2016

Water Quality Monitoring and Control

The implementation of an Intelligent Water Network (IWN) would enhance water quality monitoring capability in the water network by enabling cheap transmission of large volumes of data in real time. This will provide greater understanding of water quality behaviors within the water network, enable predictive models, more reliable forecasting and even automate control of functions that manage water quality.

Icon Water has performed modelling to identify at what stage it may be feasible and prudent to install an IWN. The findings of the investigation are currently being incorporated into a strategy document.

Distribution system

Adoption of the WSAA Codes

Icon Water identified that the adoption of water and sewage WSAA Codes would improve the management of Icon Water's assets and better align with the rest of the urban water industry.

A gap analysis was performed between Icon Water's current standards and the WSAA Codes. The information from this assessment led to several adjustments to our current standards to facilitate the transition to the new codes. The adoption of the WSAA Codes will require the creation of new Icon Water specific clauses and drawings. Throughout the project there will be extensive consultation with internal and external stakeholders. Transition to the new standards is expected to begin in late 2017.

Network Chlorine Residual Improvement

Chlorine disinfection is an integral part of the water treatment process at Icon Water's Mount Stromlo and Googong water treatment plants. Water leaving the WTPs is dosed with a suitable quantity of chlorine to provide disinfection and to maintain a residual chlorine level in the distribution system. Maintaining chlorine residual in the distribution system is important to safeguard the drinking water from possible contamination after the completion of the treatment process.

To improve the chlorine residual across the distributions system and address a number of service reservoirs that have difficultly maintaining an adequate chlorine residual, a project is being considered to model the entire system. The information from the model will identify the root causes of the issues and inform the development of bespoke targeted solutions for each reservoir in order to address the maintenance of chlorine residual across the entire distribution system.

Service reservoir sample point, 2016

9 Laboratory analysis

Icon Water contracts ALS Global to collect and analyse drinking water samples. The monitoring program is defined by a Service Level Agreement, which is revised annually to reflect Icon Water's changing needs and priorities.

ALS Global operates a NATA-registered laboratory. NATA provides specific technical evaluation combined with international recognition by its overseas counterparts, enabling laboratories accredited by NATA to be recognised worldwide.

As part of its NATA registration, ALS Global participates in regular audits and proficiency testing whereby results for identical samples are compared with other NATA-registered laboratories. The most recent NATA audits were carried out in the chemistry area in September 2015 and in the biological area in June 2016. The facility complies with the criteria of NATA Policy Circular 1 – Corporate Accreditation.

A summary of the laboratory analysis completed for the customer tap water quality monitoring program is presented in the following tables.

- Table 9-1 Summary data for all water quality zones
- Table 9-2 Summary data for water quality zone 1: North Canberra and Gungahlin
- Table 9-3 Summary data for water quality zone 2: Belconnen
- Table 9-4 Summary data for water quality zone 3: South Canberra, Woden and Weston Creek
- Table 9-5 Summary data for water quality zone 4: Tuggeranong

Table 9-1 Summary data for all water quality zones

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Microbiological									
E. coli	APHA 9223 B	MPN/100mL	<1	<1	1200	<1	<1	<1	<1
Total coliforms	APHA 9223 B	MPN/100mL	-	<1	1200	<1	16	<1	<1
Heterotrophic plate count	APHA 9215 B	CFU/mL	-	<1	1200	<1	1280	3	5
Physical									
Conductivity	APHA 2510 B	µS/cm	-	<2	120	71	174	97	159
pH	APHA 4500-H B	pH units	-	<0.01	1200	7.40	8.89	7.76	8.05
Temperature	APHA 4500-H B	deg.C	-	<0.1	240	8.0	27.0	16.7	24.4
Total dissolved salts	APHA 2540 C	mg/L	-	<20	120	24	127	64	102
True colour	Lachat QuikChem Method, Colour in Waters 10-308-00-1-A	Pt-Co	-	<1	240	<1	3	<1	2
Turbidity	APHA 2130 B	NTU	-	<0.1	240	<0.1	2.3	0.3	0.6
Inorganic									
Alkalinity bicarb	APHA 2320 A/B	mg/L	-	<0.1	240	26.7	48.8	38.3	44.3
Alkalinity carb	APHA 2320 A/B	mg/L	-	<0.1	240	<0.1	38.9	0.2	<0.1
Alkalinity hydrox	APHA 2320 A/B	mg/L	-	<0.1	240	<0.1	<0.1	<0.1	<0.1
Alkalinity total	APHA 2320 A/B	mg/L	-	<1	240	27	49	38	44
Aluminium acid soluble	USEPA 200.8	µg/L	-	<5	120	15	98	30	45
Asbestos	AS4964-2000	Present/ Absent	-	Absent	48	Absent	Present	-	-
Calcium dissolved	USEPA 200.7	mg/L	-	<0.05	120	9.43	17.80	12.62	16.21
Chloride	APHA 21st Ed. 2005, Part 4110 B	mg/L	-	<0.1	48	3.0	7.7	4.0	6.7
Chlorine combined	APHA 4500 -CL G	mg/L	-	<0.03	1200	<0.03	0.43	0.07	0.17
Chlorine free	APHA 4500 -CL G	mg/L	-	<0.03	1200	0.05	1.38	0.69	1.08
Chlorine total	APHA 4500 -CL G	mg/L	5	<0.03	1200	0.07	1.47	0.76	1.15
Cyanide	APHA 4500_CN	mg/L	0.08	<0.004	48	<0.004	<0.004	<0.004	<0.004
Fluoride	APHA 21st Ed. 2005, Part 4110 B	mg/L	1.5	<0.1	113	0.4	0.9	0.7	0.8
Fluoride	APHA 21st Ed. 2005, Part 4500F-C	mg/L	1.5	<0.05	7	0.69	0.79	0.76	0.79
Hardness total	APHA 2340 B	mg/L	-	<0.1	120	27.0	56.0	36.7	53.1
Iodide	VIC-CM078	mg/L	0.5	<0.01	48	<0.01	0.01	<0.01	<0.01
Magnesium dissolved	USEPA 200.7	mg/L	-	<0.05	120	0.72	3.65	1.24	3.34
Nitrate	APHA 21st Ed. 2005, Part 4110 B	mg/L	50	<0.1	48	<0.1	0.1	<0.1	0.1
Potassium dissolved	USEPA 200.7	mg/L	-	<0.1	48	0.4	1.7	0.6	1.6
Sodium dissolved	USEPA 200.7	mg/L	-	<0.1	48	2.2	7.6	3.4	7.4
Sulphate	APHA 21st Ed. 2005, Part 4110 B	mg/L	500	<0.4	48	0.6	25.7	4.2	22.4
Total metals									
Aluminium total	USEPA 200.8	µg/L	-	<9	120	17	95	34	46
Antimony total	USEPA 200.8	µg/L	3	<3	120	<3	<3	<3	<3
Arsenic total	USEPA 200.8	µg/L	10	<1	120	<1	<1	<1	<1
Barium total	USEPA 200.8	µg/L	2000	<2	120	3	8	4	6
Beryllium total	USEPA 200.8	µg/L	60	<0.1	120	<0.1	0.2	<0.1	<0.1
Boron total	USEPA 200.7	mg/L	4	<0.01	48	<0.01	0.01	<0.01	0.01
Cadmium total	USEPA 200.8	µg/L	2	<0.05	120	<0.05	<0.05	<0.05	<0.05
Chromium total	USEPA 200.8	µg/L	-	<2	120	1	3	<2	<2
Cobalt total	USEPA 200.8	µg/L	-	<0.2	120	<0.2	<0.2	<0.2	<0.2

Table 9-1 Summary data for all water quality zones (cont.)

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Total metals (cont.)									
Copper total	USEPA 200.8	µg/L	2000	<1	240	<1	128	13	39
Iron total	USEPA 200.7	mg/L	-	<0.01	240	<0.01	0.18	<0.01	0.02
Lead total	USEPA 200.8	µg/L	10	<0.2	240	<0.2	7.7	0.3	0.8
Manganese total	USEPA 200.7	mg/L	0.5	<0.001	240	<0.001	0.117	0.007	0.021
Mercury total	USEPA 200.8	µg/L	1	<0.1	48	<0.1	<0.1	<0.1	<0.1
Molybdenium total	USEPA 200.8	µg/L	50	<1	120	<1	<1	<1	<1
Nickel total	USEPA 200.8	µg/L	20	<1	120	<1	3	1	2
Selenium total	USEPA 200.8	µg/L	10	<1	120	<1	1	<1	<1
Silver total	USEPA 200.8	µg/L	100	<1	120	<1	<1	<1	<1
Zinc total	USEPA 200.8	µg/L	-	<5	120	<5	74	<5	9
Haloacetic acids									
Bromoacetic acid	ALS: Headspace GCMS	µg/L	-	<5	120	<5	<5	<5	<5
Bromochloroacetic acid	ALS: Headspace GCMS	µg/L	-	<1	120	<1	4	1	3
Bromodichloroacetic acid	ALS: Headspace GCMS	µg/L	-	<1	120	<1	6	1	4
Dibromoacetic acid	ALS: Headspace GCMS	µg/L	-	<1	120	<1	2	<1	<1
Dibromochloroacetic acid	ALS: Headspace GCMS	µg/L	-	<10	120	<10	<10	<10	<10
Dichloroacetic acid	ALS: Headspace GCMS	µg/L	100	<1	120	<1	38	16	33
Monochloroacetic acid	ALS: Headspace GCMS	µg/L	150	<1	120	<1	4	<1	3
Tribromoacetic acid	ALS: Headspace GCMS	µg/L	-	<10	120	<10	<10	<10	<10
Trichloroacetic acid	ALS: Headspace GCMS	µg/L	100	<1	120	<1	52	25	44
Sum of haloacetic acid	ALS: Headspace GCMS	µg/L	-	<1	120	<1	95	44	86
Trihalomethanes									
Bromoform	VIC-CM047	mg/L	-	<0.001	119	<0.001	<0.001	<0.001	<0.001
Chloroform	VIC-CM047	mg/L	-	<0.001	119	0.021	0.096	0.041	0.077
Dibromochloromethane	VIC-CM047	mg/L	-	<0.001	119	<0.001	<0.001	<0.001	<0.001
Dichlorobromomethane	VIC-CM047	mg/L	-	<0.001	119	0.001	0.010	0.003	0.008
Trihalomethanes total	VIC-CM047	mg/L	0.25	<0.001	119	0.022	0.110	0.044	0.085
Semi Volatile Organic Compounds (SVOC)									
Anilines and Benzidines									
2 Nitroaniline	US EPA 3510/8270	µg/L	-	<4	120	<4	<4	<4	<4
3 Nitroaniline	US EPA 3510/8270	µg/L	-	<4	120	<4	<4	<4	<4
3,3 Dichlorobenzidine	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
4 Chloroaniline	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
4 Nitroaniline	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Aniline	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Carbazole	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Dibenzofuran	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Chlorinated hydrocarbons									
1,2 Dichlorobenzene	US EPA 3510/8270	µg/L	1500	<2	120	<2	<2	<2	<2
1,2,4 Trichlorobenzene	US EPA 3510/8270	µg/L	30	<2	120	<2	<2	<2	<2
1,3 Dichlorobenzene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
1,4 Dichlorobenzene	US EPA 3510/8270	µg/L	40	<2	120	<2	<2	<2	<2

Table 9-1 Summary data for all water quality zones (cont.)

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Hexachlorobenzene	US EPA 3510/8270	µg/L	-	<4	120	<4	<4	<4	<4
Hexachlorobutadiene	US EPA 3510/8270	µg/L	0.7	<2	120	<2	<2	<2	<2
Hexachlorocyclopentadiene	US EPA 3510/8270	µg/L	-	<10	120	<10	<10	<10	<10
Hexachloroethane	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Hexachloropropylene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Pentachlorobenzene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Haloethers									
4 Bromophenyl phenyl ether	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
4 Chlorophenyl phenyl ether	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Bis(2-chloroethoxy) methane	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Bis(2-chloroethyl) ether	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Nitroaromatics and Ketones									
1 Naphthylamine	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
1,3,5 Trinitrobenzene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
2 Picoline	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
2,4 Dinitrotoluene	US EPA 3510/8270	µg/L	-	<4	120	<4	<4	<4	<4
2,6 Dinitrotoluene	US EPA 3510/8270	µg/L	-	<4	120	<4	<4	<4	<4
4 Aminobiphenyl	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
4 Nitroquinoline-n-oxide	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
5 Nitro-o-toluidine	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Acetophenone	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Azobenzene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Chlorobenzilate	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Dimethylaminoazobenzene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Isophorone	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Nitrobenzene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Pentachloronitrobenzene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Phenacetin	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Pronamide	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Nitrosamines									
Methapyrilene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
N-nitrosodibutylamine	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
N-nitrosodiethylamine	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
N-nitrosodi-n-propylamine	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
N-nitrosodiphenyl & diphenylamine	US EPA 3510/8270	µg/L	-	<4	120	<4	<4	<4	<4
N-nitrosomethylethylamine	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
N-nitrosomorpholine	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
N-nitrosopiperidine	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
N-nitrosopyrrolidine	US EPA 3510/8270	µg/L	-	<4	120	<4	<4	<4	<4
Organochlorine pesticides									
4,4 Ddd	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
4,4 Dde	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
4,4 Ddt	US EPA 3510/8270	µg/L	9	<4	120	<4	<4	<4	<4
Aldrin	US EPA 3510/8270	µg/L	0.3	<2	120	<2	<2	<2	<2
Alpha bhc	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Alpha endosulfan	US EPA 3510/8270	µg/L	20	<2	120	<2	<2	<2	<2
Beta bhc	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Beta endosulfan	US EPA 3510/8270	µg/L	20	<2	120	<2	<2	<2	<2

Table 9-1 Summary data for all water quality zones (cont.)

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Organochlorine pesticides (cont.)									
delta BHC	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Dieldrin	US EPA 3510/8270	µg/L	0.3	<2	120	<2	<2	<2	<2
Endrin	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Endosulfan sulfate	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Gamma bhc	US EPA 3510/8270	µg/L	10	<2	120	<2	<2	<2	<2
Heptachlor	US EPA 3510/8270	µg/L	0.3	<2	120	<2	<2	<2	<2
Heptachlor epoxide	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Organophosphorous pesticides									
Chlorfenvinphos	US EPA 3510/8270	µg/L	2	<2	120	<2	<2	<2	<2
Chlorpyrifos	US EPA 3510/8270	µg/L	10	<2	120	<2	<2	<2	<2
Chlorpyrifos-methyl	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Diazinon	US EPA 3510/8270	µg/L	4	<2	120	<2	<2	<2	<2
Dichlorvos	US EPA 3510/8270	µg/L	5	<2	120	<2	<2	<2	<2
Dimethoate	US EPA 3510/8270	µg/L	7	<2	120	<2	<2	<2	<2
Ethion	US EPA 3510/8270	µg/L	4	<2	120	<2	<2	<2	<2
Fenthion	US EPA 3510/8270	µg/L	7	<2	120	<2	<2	<2	<2
Malathion	US EPA 3510/8270	µg/L	70	<2	120	<2	<2	<2	<2
Pirimiphos-ethyl	US EPA 3510/8270	µg/L	0.5	<2	120	<2	<2	<2	<2
Prothiofos	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Phenolic compounds									
2,3,4,6 Tetrachlorophenol	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
2,4 Dichlorophenol	US EPA 3510/8270	µg/L	200	<2	120	<2	<2	<2	<2
2,4 Dimethylphenol	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
2,4,5 Trichlorophenol	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
2,4,6 Trichlorophenol	US EPA 3510/8270	µg/L	20	<2	120	<2	<2	<2	<2
2,6 Dichlorophenol	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
2 Chlorophenol	US EPA 3510/8270	µg/L	300	<2	120	<2	<2	<2	<2
2 Methylphenol	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
2 Nitrophenol	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
3 & 4 Methylphenol	US EPA 3510/8270	µg/L	-	<4	120	<4	<4	<4	<4
4 Chloro-3-methylphenol	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Pentachlorophenol	US EPA 3510/8270	µg/L	10	<4	120	<4	<4	<4	<4
Phenol	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Phthalates									
Bis(2-ethylhexyl) phthalate	US EPA 3510/8270	µg/L	10	<10	120	<10	<10	<10	<10
Bis(2-ethylhexyl) phthalate	US EPA 8270D	µg/L	10	<10	120	<10	22	<10	<10
Butyl benzyl phthalate	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Butyl benzyl phthalate	US EPA 8270D	µg/L	-	<2	120	<2	<2	<2	<2
Diethyl phthalate	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Diethyl phthalate	US EPA 8270D	µg/L	-	<2	120	<2	<2	<2	<2
Dimethyl phthalate	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Dimethyl phthalate	US EPA 8270D	µg/L	-	<2	120	<2	<2	<2	<2
Di-n-butyl phthalate	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Di-n-butyl phthalate	US EPA 8270D	µg/L	-	<2	120	<2	<2	<2	<2
Di-n-octylphthalate	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Di-n-octylphthalate	US EPA 8270D	µg/L	-	<2	120	<2	<2	<2	<2

Table 9-1 Summary data for all water quality zones (cont.)

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Polycyclic Aromatic Hydrocarbons									
2 Chloronaphthalene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
2 Methylnaphthalene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
3 Methylcholanthrene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
7.12-Dimethylbenz(a)anthracene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Acenaphthene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Acenaphthene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Acenaphthylene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Acenaphthylene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Anthracene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Anthracene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Benz(a)anthracene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Benz(a)anthracene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Benzo(a)pyrene	US EPA 3510/8270	µg/L	0.01	<0.5	120	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	US EPA 3510/8270	µg/L	0.01	<2	120	<2	<2	<2	<2
Benzo(b) fluoranthene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Benzo(k) fluoranthene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Benzo(b) & benzo(k)fluoranthene	US EPA 3510/8270	µg/L	-	<4	120	<4	<4	<4	<4
Benzo(g.H.I)perylene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Benzo(g.H.I)perylene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Chrysene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Chrysene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Dibenz(a.H)anthracene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Dibenz(a.H)anthracene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Fluoranthene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Fluoranthene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Fluorene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Fluorene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Indeno(1.2.3.Cd)pyrene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Indeno(1.2.3-Cd)pyrene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
N-2-fluorenyl acetamide	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Naphthalene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Naphthalene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Phenanthrene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Phenanthrene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
Pyrene	US EPA 3510/8270	µg/L	-	<1	120	<1	<1	<1	<1
Pyrene	US EPA 3510/8270	µg/L	-	<2	120	<2	<2	<2	<2
PAH (total)	US EPA 3510/8270	µg/L	-	<0.5	120	<0.5	<0.5	<0.5	<0.5

ADWG (Health)	Australian Drinking Water Guidelines – Health Guideline Value
CFU/mL	colony forming units per millilitre
Deg.C	degrees Celsius
µg/L	micrograms per litre
mg/L	milligrams per litre
µS/cm	micro siemens per centimetre
MPN	most probable number
NTU	nephelometric units
Pt-Co	platinum-cobalt units

The 95th percentile is a statistical calculation based on 'normal' distribution. In the context of this report, it estimates the value for which 95% of all the water that passes through the distribution system in this 12 month period falls below.

Table 9-2 Summary data for water quality zone 1: North Canberra and Gungahlin

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Microbiological									
E. coli	APHA 9223 B	MPN/100mL	<1	<1	348	<1	<1	<1	<1
Total coliforms	APHA 9223 B	MPN/100mL	-	<1	348	<1	4	<1	<1
Heterotrophic plate count	APHA 9215 B	CFU/mL	-	<1	348	<1	1280	5	5
Physical									
Conductivity	APHA 2510 B	µS/cm	-	<2	36	71	174	99	163
pH	APHA 4500-H B	pH units	-	<0.01	348	7.41	8.05	7.69	7.88
Temperature	APHA 4500-H B	deg.C	-	<0.1	72	9.8	25.4	16.6	24.2
Total dissolved salts	APHA 2540 C	mg/L	-	<20	36	24	104	61	97
True colour	Lachat QuikChem Method, Colour in Waters 10-308-00-1-A	Pt-Co	-	<1	72	<1	2	<1	2
Turbidity	APHA 2130 B	NTU	-	<0.1	72	0.1	2.3	0.3	0.6
Inorganic									
Alkalinity bicarb	APHA 2320 A/B	mg/L	-	<0.1	72	29.2	46.9	38.4	44.2
Alkalinity carb	APHA 2320 A/B	mg/L	-	<0.1	72	<0.1	<0.1	<0.1	<0.1
Alkalinity hydrox	APHA 2320 A/B	mg/L	-	<0.1	72	<0.1	<0.1	<0.1	<0.1
Alkalinity total	APHA 2320 A/B	mg/L	-	<1	72	29	47	38	44
Aluminium acid soluble	USEPA 200.8	µg/L	-	<5	36	15	60	28	45
Asbestos	AS4964-2000	Present/ Absent	-	Absent	12	Absent	Absent	-	-
Calcium dissolved	USEPA 200.7	mg/L	-	<0.05	36	10.30	17.00	12.66	15.95
Chloride	APHA 21st Ed. 2005, Part 4110 B	mg/L	-	<0.1	12	3.0	7.7	4.2	7.0
Chlorine combined	APHA 4500 -CL G	mg/L	-	<0.03	348	<0.03	0.43	0.07	0.17
Chlorine free	APHA 4500 -CL G	mg/L	-	<0.03	348	0.12	1.38	0.78	1.14
Chlorine total	APHA 4500 -CL G	mg/L	5	<0.03	348	0.14	1.45	0.85	1.20
Cyanide	APHA 4500_CN	mg/L	0.08	<0.004	12	<0.004	<0.004	<0.004	<0.004
Fluoride	APHA 21st Ed. 2005, Part 4110 B	mg/L	1.5	<0.1	35	0.4	0.9	0.7	0.8
Fluoride	APHA 21st Ed. 2005, Part 4500F-C	mg/L	1.5	<0.05	1	0.69	0.69	0.69	0.69
Hardness total	APHA 2340 B	mg/L	-	<0.1	36	29.0	56.0	36.8	52.3
Iodide	VIC-CM078	mg/L	0.5	<0.01	12	<0.01	<0.01	<0.01	<0.01
Magnesium dissolved	USEPA 200.7	mg/L	-	<0.05	36	0.75	3.47	1.27	3.42
Nitrate	APHA 21st Ed. 2005, Part 4110 B	mg/L	50	<0.1	12	<0.1	0.1	<0.1	0.1
Potassium dissolved	USEPA 200.7	mg/L	-	<0.1	12	0.4	1.6	0.7	1.6
Sodium dissolved	USEPA 200.7	mg/L	-	<0.1	12	2.4	7.6	3.6	7.3
Sulphate	APHA 21st Ed. 2005, Part 4110 B	mg/L	500	<0.4	12	0.6	25.7	4.5	22.8
Total metals									
Aluminium total	USEPA 200.8	µg/L	-	<9	36	18	60	33	51
Antimony total	USEPA 200.8	µg/L	3	<3	36	<3	<3	<3	<3
Arsenic total	USEPA 200.8	µg/L	10	<1	36	<1	<1	<1	<1
Barium total	USEPA 200.8	µg/L	2000	<2	36	3	8	4	7
Beryllium total	USEPA 200.8	µg/L	60	<0.1	36	<0.1	<0.1	<0.1	<0.1
Boron total	USEPA 200.7	mg/L	4	<0.01	12	<0.01	0.01	<0.01	<0.01
Cadmium total	USEPA 200.8	µg/L	2	<0.05	36	<0.05	<0.05	<0.05	<0.05
Chromium total	USEPA 200.8	µg/L	-	<2	36	<2	<2	<2	<2
Cobalt total	USEPA 200.8	µg/L	-	<0.2	36	<0.2	<0.2	<0.2	<0.2
Copper total	USEPA 200.8	µg/L	2000	<1	72	<1	75	13	41

Table 9-2 Summary data for water quality zone 1: North Canberra and Gungahlin (cont.)

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Total metals (cont.)									
Iron total	USEPA 200.7	mg/L	-	<0.01	72	<0.01	0.18	0.01	0.04
Lead total	USEPA 200.8	µg/L	10	<0.2	72	<0.2	7.7	0.5	1.6
Manganese total	USEPA 200.7	mg/L	0.5	<0.001	72	<0.001	0.117	0.009	0.024
Mercury total	USEPA 200.8	µg/L	1	<0.1	12	<0.1	<0.1	<0.1	<0.1
Molybdenium total	USEPA 200.8	µg/L	50	<1	36	<1	<1	<1	<1
Nickel total	USEPA 200.8	µg/L	20	<1	36	<1	2	1	2
Selenium total	USEPA 200.8	µg/L	10	<1	36	<1	<1	<1	<1
Silver total	USEPA 200.8	µg/L	100	<1	36	<1	<1	<1	<1
Zinc total	USEPA 200.8	µg/L	-	<5	36	<5	20	<5	9
Haloacetic acids									
Bromoacetic acid	ALS: Headspace GCMS	µg/L	-	<5	36	<5	<5	<5	<5
Bromochloroacetic acid	ALS: Headspace GCMS	µg/L	-	<1	36	<1	4	1	3
Bromodichloroacetic acid	ALS: Headspace GCMS	µg/L	-	<1	36	<1	6	1	4
Dibromoacetic acid	ALS: Headspace GCMS	µg/L	-	<1	36	<1	2	<1	<1
Dibromochloroacetic acid	ALS: Headspace GCMS	µg/L	-	<10	36	<10	<10	<10	<10
Dichloroacetic acid	ALS: Headspace GCMS	µg/L	100	<1	36	4	38	18	37
Monochloroacetic acid	ALS: Headspace GCMS	µg/L	150	<1	36	<1	4	1	3
Tribromoacetic acid	ALS: Headspace GCMS	µg/L	-	<10	36	<10	<10	<10	<10
Trichloroacetic acid	ALS: Headspace GCMS	µg/L	100	<1	36	5	52	26	45
Sum of haloacetic acid	ALS: Headspace GCMS	µg/L	-	<1	36	<1	95	44	90
Trihalomethanes									
Bromoform	VIC-CM047	mg/L	-	<0.001	36	<0.001	<0.001	<0.001	<0.001
Chloroform	VIC-CM047	mg/L	-	<0.001	36	0.024	0.096	0.042	0.080
Dibromochloromethane	VIC-CM047	mg/L	-	<0.001	36	<0.001	<0.001	<0.001	<0.001
Dichlorobromomethane	VIC-CM047	mg/L	-	<0.001	36	0.001	0.010	0.003	0.009
Trihalomethanes total	VIC-CM047	mg/L	0.25	<0.001	36	0.025	0.110	0.046	0.089
Semi Volatile Organic Compounds (SVOC)									
Anilines and Benzidines	US EPA 3510/8270	µg/L	All results < LOR						
Chlorinated hydrocarbons	US EPA 3510/8270	µg/L							
Haloethers	US EPA 3510/8270	µg/L							
Nitroaromatics and Ketones	US EPA 3510/8270	µg/L							
Nitrosamines	US EPA 3510/8270	µg/L							
Organochlorine pesticides	US EPA 3510/8270	µg/L							
Organophosphorous pesticides	US EPA 3510/8270	µg/L							
Phenolic compounds	US EPA 3510/8270	µg/L							
Phthalates									
Bis(2-ethylhexyl) phthalate	US EPA 3510/8270	µg/L	10	<10	36	<10	<10	<10	<10
Bis(2-ethylhexyl) phthalate	US EPA 8270D	µg/L	10	<10	36	<10	22	<10	<10
Butyl benzyl phthalate	US EPA 3510/8270	µg/L	-	<2	36	<2	<2	<2	<2
Butyl benzyl phthalate	US EPA 8270D	µg/L	-	<2	36	<2	<2	<2	<2
Diethyl phthalate	US EPA 3510/8270	µg/L	-	<2	36	<2	<2	<2	<2
Diethyl phthalate	US EPA 8270D	µg/L	-	<2	36	<2	<2	<2	<2
Dimethyl phthalate	US EPA 3510/8270	µg/L	-	<2	36	<2	<2	<2	<2
Dimethyl phthalate	US EPA 8270D	µg/L	-	<2	36	<2	<2	<2	<2
Di-n-butyl phthalate	US EPA 3510/8270	µg/L	-	<2	36	<2	<2	<2	<2

Table 9-2 Summary data for water quality zone 1: North Canberra and Gungahlin (cont.)

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Phthalates (cont.)									
Di-n-butyl phthalate	US EPA 8270D	µg/L	-	<2	36	<2	<2	<2	<2
Di-n-octylphthalate	US EPA 3510/8270	µg/L	-	<2	36	<2	<2	<2	<2
Di-n-octylphthalate	US EPA 8270D	µg/L	-	<2	36	<2	<2	<2	<2
Polycyclic Aromatic Hydrocarbons	US EPA 3510/8270	µg/L	All results < LOR						

ADWG (Health)	Australian Drinking Water Guidelines – Health Guideline Value
CFU/mL	colony forming units per millilitre
Deg.C	degrees Celsius
µg/L	micrograms per litre
mg/L	milligrams per litre
µS/cm	micro siemens per centimetre
MPN	most probable number
NTU	nephelometric units
Pt-Co	platinum-cobalt units

The 95th percentile is a statistical calculation based on 'normal' distribution. In the context of this report, it estimates the value for which 95% of all the water that passes through the distribution system in this 12 month period falls below.

Table 9-3 Summary data for water quality zone 2: Belconnen

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Microbiological									
E. coli	APHA 9223 B	MPN/100mL	<1	<1	324	<1	<1	<1	<1
Total Coliforms	APHA 9223 B	MPN/100mL	-	<1	324	<1	1	<1	<1
Heterotrophic Plate Count	APHA 9215 B	CFU/mL	-	<1	324	<1	54	2	5
Physical									
Conductivity	APHA 2510 B	µS/cm	-	<2	36	76	159	94	148
pH	APHA 4500-H B	pH units	-	<0.01	324	7.40	8.42	7.78	8.09
Temperature	APHA 4500-H B	deg.C	-	<0.1	72	9.3	25.9	17.0	24.4
Total Dissolved Salts	APHA 2540 C	mg/L	-	<20	36	34	127	66	98
True colour	Lachat QuikChem Method, Colour in Waters 10-308-00-1-A	Pt-Co	-	<1	72	<1	2	<1	2
Turbidity	APHA 2130 B	NTU	-	<0.1	72	0.1	0.7	0.2	0.5
Inorganic									
Alkalinity bicarb	APHA 2320 A/B	mg/L	-	<0.1	72	31.6	48.8	37.9	42.3
Alkalinity carb	APHA 2320 A/B	mg/L	-	<0.1	72	<0.1	<0.1	<0.1	<0.1
Alkalinity hydrox	APHA 2320 A/B	mg/L	-	<0.1	72	<0.1	<0.1	<0.1	<0.1
Alkalinity total	APHA 2320 A/B	mg/L	-	<1	72	32	49	38	42
Aluminium acid soluble	USEPA 200.8	µg/L	-	<5	36	18	83	30	45
Asbestos	AS4964-2000	Present/ Absent	-	Absent	12	Absent	Present	-	-
Calcium dissolved	USEPA 200.7	mg/L	-	<0.05	36	10.10	17.80	12.41	16.50
Chloride	APHA 21st Ed. 2005, Part 4110 B	mg/L	-	<0.1	12	3.2	5.4	3.9	4.9
Chlorine combined	APHA 4500 -CL G	mg/L	-	<0.03	324	<0.03	0.29	0.07	0.18
Chlorine free	APHA 4500 -CL G	mg/L	-	<0.03	324	0.10	1.12	0.62	0.91
Chlorine total	APHA 4500 -CL G	mg/L	5	<0.03	324	0.20	1.20	0.69	0.98
Cyanide	APHA 4500_CN	mg/L	0.08	<0.004	12	<0.004	<0.004	<0.004	<0.004
Fluoride	APHA 21st Ed. 2005, Part 4110 B	mg/L	1.5	<0.1	33	0.6	0.9	0.7	0.8
Fluoride	APHA 21st Ed. 2005, Part 4500F-C	mg/L	1.5	<0.05	3	0.74	0.76	0.75	0.76
Hardness total	APHA 2340 B	mg/L	-	<0.1	36	29.0	55.0	36.1	52.5
Iodide	VIC-CM078	mg/L	0.5	<0.01	12	<0.01	0.01	<0.01	<0.01
Magnesium dissolved	USEPA 200.7	mg/L	-	<0.05	36	0.75	2.74	1.19	2.65
Nitrate	APHA 21st Ed. 2005, Part 4110 B	mg/L	50	<0.1	12	<0.1	0.1	<0.1	<0.1
Potassium dissolved	USEPA 200.7	mg/L	-	<0.1	12	0.4	1.5	0.6	1.1
Sodium dissolved	USEPA 200.7	mg/L	-	<0.1	12	2.4	7.1	3.3	5.2
Sulphate	APHA 21st Ed. 2005, Part 4110 B	mg/L	500	<0.4	12	0.6	19.1	3.0	11.8
Total metals									
Aluminium total	USEPA 200.8	µg/L	-	<9	36	22	86	34	46
Antimony total	USEPA 200.8	µg/L	3	<3	36	<3	<3	<3	<3
Arsenic total	USEPA 200.8	µg/L	10	<1	36	<1	<1	<1	<1
Barium total	USEPA 200.8	µg/L	2000	<2	36	3	7	4	6
Beryllium total	USEPA 200.8	µg/L	60	<0.1	36	<0.1	<0.1	<0.1	<0.1
Boron total	USEPA 200.7	mg/L	4	<0.01	12	<0.01	<0.01	<0.01	<0.01
Cadmium total	USEPA 200.8	µg/L	2	<0.05	36	<0.05	<0.05	<0.05	<0.05
Chromium total	USEPA 200.8	µg/L	-	<2	36	<2	<2	<2	<2

Table 9-3 Summary data for water quality zone 2: Belconnen (cont.)

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Total metals (cont.)									
Cobalt total	USEPA 200.8	µg/L	-	<0.2	36	<0.2	<0.2	<0.2	<0.2
Copper total	USEPA 200.8	µg/L	2000	<1	72	<1	83	13	39
Iron total	USEPA 200.7	mg/L	-	<0.01	72	<0.01	0.04	<0.01	0.01
Lead total	USEPA 200.8	µg/L	10	<0.2	72	<0.2	4.6	0.2	0.4
Manganese total	USEPA 200.7	mg/L	0.5	<0.001	72	<0.001	0.059	0.005	0.010
Mercury total	USEPA 200.8	µg/L	1	<0.1	12	<0.1	<0.1	<0.1	<0.1
Molybdenium total	USEPA 200.8	µg/L	50	<1	36	<1	<1	<1	<1
Nickel total	USEPA 200.8	µg/L	20	<1	36	<1	3	1	2
Selenium total	USEPA 200.8	µg/L	10	<1	36	<1	1	<1	1
Silver total	USEPA 200.8	µg/L	100	<1	36	<1	<1	<1	<1
Zinc total	USEPA 200.8	µg/L	-	<5	36	<5	74	5	9
Haloacetic acid									
Bromoacetic acid	ALS: Headspace GCMS	µg/L	-	<5	36	<5	<5	<5	<5
Bromochloroacetic acid	ALS: Headspace GCMS	µg/L	-	<1	36	<1	3	<1	2
Bromodichloroacetic acid	ALS: Headspace GCMS	µg/L	-	<1	36	<1	4	1	4
Dibromoacetic acid	ALS: Headspace GCMS	µg/L	-	<1	36	<1	<1	<1	<1
Dibromochloroacetic acid	ALS: Headspace GCMS	µg/L	-	<10	36	<10	<10	<10	<10
Dichloroacetic acid	ALS: Headspace GCMS	µg/L	100	<1	36	4	33	15	28
Monochloroacetic acid	ALS: Headspace GCMS	µg/L	150	<1	36	<1	2	<1	1
Tribromoacetic acid	ALS: Headspace GCMS	µg/L	-	<10	36	<10	<10	<10	<10
Trichloroacetic acid	ALS: Headspace GCMS	µg/L	100	<1	36	5	49	26	41
Sum of haloacetic acid	ALS: Headspace GCMS	µg/L	-	<1	36	25	86	43	72
Trihalomethanes									
Bromoform	VIC-CM047	mg/L	-	<0.001	36	<0.001	<0.001	<0.001	<0.001
Chloroform	VIC-CM047	mg/L	-	<0.001	36	0.023	0.078	0.039	0.069
Dibromochloromethane	VIC-CM047	mg/L	-	<0.001	36	<0.001	<0.001	<0.001	<0.001
Dichlorobromomethane	VIC-CM047	mg/L	-	<0.001	36	0.001	0.008	0.003	0.007
Trihalomethanes total	VIC-CM047	mg/L	0.25	<0.001	36	0.024	0.086	0.042	0.076
Semi Volatile Organic Compounds (SVOC)									
Anilines and Benzidines	US EPA 3510/8270	µg/L	All results < LOR						
Chlorinated hydrocarbons	US EPA 3510/8270	µg/L							
Haloethers	US EPA 3510/8270	µg/L							
Nitroaromatics and Ketones	US EPA 3510/8270	µg/L							
Nitrosamines	US EPA 3510/8270	µg/L							
Organochlorine pesticides	US EPA 3510/8270	µg/L							
Organophosphorous pesticides	US EPA 3510/8270	µg/L							
Phenolic compounds	US EPA 3510/8270	µg/L							
Phthalates	US EPA 3510/8270	µg/L							
Polycyclic Aromatic Hydrocarbons	US EPA 3510/8270	µg/L							

ADWG (Health)	Australian Drinking Water Guidelines – Health Guideline Value
CFU/mL	colony forming units per millilitre
Deg.C	degrees Celsius
µg/L	micrograms per litre
mg/L	milligrams per litre
µS/cm	micro siemens per centimetre
MPN	most probable number
NTU	nephelometric units
Pt-Co	platinum-cobalt units

The 95th percentile is a statistical calculation based on 'normal' distribution. In the context of this report, it estimates the value for which 95% of all the water that passes through the distribution system in this 12 month period falls below.

Table 9-4 Summary data for water quality zone 3: South Canberra, Woden and Weston Creek

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Mircrobiological									
E. coli	APHA 9223 B	MPN/100mL	<1	<1	264	<1	<1	<1	<1
Total coliforms	APHA 9223 B	MPN/100mL	-	<1	264	<1	16	<1	<1
Heterotrophic plate count	APHA 9215 B	CFU/mL	-	<1	264	<1	51	2	3
Physical									
Conductivity	APHA 2510 B	µS/cm	-	<2	24	76	163	100	162
pH	APHA 4500-H B	pH units	-	<0.01	264	7.47	8.82	7.71	7.87
Temperature	APHA 4500-H B	deg.C	-	<0.1	48	8.0	27.0	16.4	23.8
Total dissolved salts	APHA 2540 C	mg/L	-	<20	24	26	112	63	101
True colour	Lachat QuikChem Method, Colour in Waters 10-308-00-1-A	Pt-Co	-	<1	48	<1	2	<1	2
Turbidity	APHA 2130 B	NTU	-	<0.1	48	<0.1	1.4	0.3	0.7
Inorganic									
Alkalinity bicarb	APHA 2320 A/B	mg/L	-	<0.1	48	26.7	45.8	38.1	44.5
Alkalinity carb	APHA 2320 A/B	mg/L	-	<0.1	48	<0.1	38.9	0.9	<0.1
Alkalinity hydrox	APHA 2320 A/B	mg/L	-	<0.1	48	<0.1	<0.1	<0.1	<0.1
Alkalinity total	APHA 2320 A/B	mg/L	-	<1	48	27	46	38	44
Aluminium acid soluble	USEPA 200.8	µg/L	-	<5	24	20	98	33	68
Asbestos	AS4964-2000	Present/ Absent	-	Absent	0	Absent	Absent	-	-
Calcium dissolved	USEPA 200.7	mg/L	-	<0.05	24	9.43	17.10	12.59	16.19
Chloride	APHA 21st Ed. 2005, Part 4110 B	mg/L	-	<0.1	12	3.0	7.4	4.1	6.6
Chlorine combined	APHA 4500 -CL G	mg/L	-	<0.03	264	<0.03	0.23	0.07	0.16
Chlorine free	APHA 4500 -CL G	mg/L	-	<0.03	264	0.08	1.33	0.70	1.07
Chlorine total	APHA 4500 -CL G	mg/L	5	<0.03	264	0.11	1.47	0.78	1.12
Cyanide	APHA 4500_CN	mg/L	0.08	<0.004	12	<0.004	<0.004	<0.004	<0.004
Fluoride	APHA 21st Ed. 2005, Part 4110 B	mg/L	1.5	<0.1	22	0.5	0.9	0.7	0.8
Fluoride	APHA 21st Ed. 2005, Part 4500F-C	mg/L	1.5	<0.05	2	0.77	0.79	0.78	0.79
Hardness total	APHA 2340 B	mg/L	-	<0.1	24	27.0	54.0	37.0	53.0
Iodide	VIC-CM078	mg/L	0.5	<0.01	12	<0.01	<0.01	<0.01	<0.01
Magnesium dissolved	USEPA 200.7	mg/L	-	<0.05	24	0.80	3.55	1.36	3.30
Nitrate	APHA 21st Ed. 2005, Part 4110 B	mg/L	50	<0.1	12	<0.1	0.1	<0.1	<0.1
Potassium dissolved	USEPA 200.7	mg/L	-	<0.1	12	0.4	1.6	0.7	1.6
Sodium dissolved	USEPA 200.7	mg/L	-	<0.1	12	2.4	7.5	3.5	7.2
Sulphate	APHA 21st Ed. 2005, Part 4110 B	mg/L	500	<0.4	12	0.6	24.8	4.3	21.7
Total metals									
Aluminium total	USEPA 200.8	µg/L	-	<9	24	17	95	36	76
Antimony total	USEPA 200.8	µg/L	3	<3	24	<3	<3	<3	<3
Arsenic total	USEPA 200.8	µg/L	10	<1	24	<1	<1	<1	<1
Barium total	USEPA 200.8	µg/L	2000	<2	24	3	7	4	6
Beryllium total	USEPA 200.8	µg/L	60	<0.1	24	<0.1	0.2	<0.1	<0.1
Boron total	USEPA 200.7	mg/L	4	<0.01	12	<0.01	0.01	<0.01	<0.01
Cadmium total	USEPA 200.8	µg/L	2	<0.05	24	<0.05	<0.05	<0.05	<0.05
Chromium total	USEPA 200.8	µg/L	-	<2	24	<2	<2	<2	<2
Cobalt total	USEPA 200.8	µg/L	-	<0.2	24	<0.2	<0.2	<0.2	<0.2
Copper total	USEPA 200.8	µg/L	2000	<1	48	2	128	16	34

Table 9-4 Summary data for water quality zone 3: South Canberra, Woden and Weston Creek (cont)

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Total metals (cont.)									
Iron total	USEPA 200.7	mg/L	-	<0.01	48	<0.01	0.06	0.01	0.04
Lead total	USEPA 200.8	µg/L	10	<0.2	48	<0.2	2.3	0.3	1.3
Manganese total	USEPA 200.7	mg/L	0.5	<0.001	48	<0.001	0.082	0.009	0.040
Mercury total	USEPA 200.8	µg/L	1	<0.1	12	<0.1	<0.1	<0.1	<0.1
Molybdenium total	USEPA 200.8	µg/L	50	<1	24	<1	<1	<1	<1
Nickel total	USEPA 200.8	µg/L	20	<1	24	<1	2	1	2
Selenium total	USEPA 200.8	µg/L	10	<1	24	<1	<1	<1	<1
Silver total	USEPA 200.8	µg/L	100	<1	24	<1	<1	<1	<1
Zinc total	USEPA 200.8	µg/L	-	<5	24	<5	7	<5	5
Haloacetic acid									
Bromoacetic acid	ALS: Headspace GCMS	µg/L	-	<5	24	<5	<5	<5	<5
Bromochloroacetic acid	ALS: Headspace GCMS	µg/L	-	<1	24	<1	4	1	3
Bromodichloroacetic acid	ALS: Headspace GCMS	µg/L	-	<1	24	<1	6	2	4
Dibromoacetic acid	ALS: Headspace GCMS	µg/L	-	<1	24	<1	1	<1	<1
Dibromochloroacetic acid	ALS: Headspace GCMS	µg/L	-	<10	24	<10	<10	<10	<10
Dichloroacetic acid	ALS: Headspace GCMS	µg/L	100	<1	24	<1	36	17	34
Monochloroacetic acid	ALS: Headspace GCMS	µg/L	150	<1	24	<1	4	<1	2
Tribromoacetic acid	ALS: Headspace GCMS	µg/L	-	<10	24	<10	<10	<10	<10
Trichloroacetic acid	ALS: Headspace GCMS	µg/L	100	<1	24	<1	45	25	43
Sum of haloacetic acid	ALS: Headspace GCMS	µg/L	-	<1	24	<1	92	46	86
Trihalomethanes									
Bromoform	VIC-CM047	mg/L	-	<0.001	23	<0.001	<0.001	<0.001	<0.001
Chloroform	VIC-CM047	mg/L	-	<0.001	23	0.026	0.078	0.043	0.077
Dibromochloromethane	VIC-CM047	mg/L	-	<0.001	23	<0.001	<0.001	<0.001	<0.001
Dichlorobromomethane	VIC-CM047	mg/L	-	<0.001	23	0.001	0.009	0.003	0.008
Trihalomethanes total	VIC-CM047	mg/L	0.25	<0.001	23	0.027	0.087	0.047	0.085
Semi Volatile Organic Compounds (SVOC)									
Anilines and Benzidines	US EPA 3510/8270	µg/L	All results < LOR						
Chlorinated Hydrocarbons	US EPA 3510/8270	µg/L							
Haloethers	US EPA 3510/8270	µg/L							
Nitroaromatics and Ketones	US EPA 3510/8270	µg/L							
Nitrosamines	US EPA 3510/8270	µg/L							
Organochlorine Pesticides	US EPA 3510/8270	µg/L							
Organophosphorous Pesticides	US EPA 3510/8270	µg/L							
Phenolic Compounds	US EPA 3510/8270	µg/L							
Phthalates	US EPA 3510/8270	µg/L							
Polycyclic Aromatic Hydrocarbons	US EPA 3510/8270	µg/L							

ADWG (Health)	Australian Drinking Water Guidelines – Health Guideline Value
CFU/mL	colony forming units per millilitre
Deg.C	degrees Celsius
µg/L	micrograms per litre
mg/L	milligrams per litre
µS/cm	micro siemens per centimetre
MPN	most probable number
NTU	nephelometric units
Pt-Co	platinum-cobalt units

The 95th percentile is a statistical calculation based on 'normal' distribution. In the context of this report, it estimates the value for which 95% of all the water that passes through the distribution system in this 12 month period falls below.

Table 9-5 Summary data for water quality zone 4: Tuggeranong

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Microbiological									
E. coli	APHA 9223 B	MPN/100mL	<1	<1	264	<1	<1	<1	<1
Total Coliforms	APHA 9223 B	MPN/100mL	-	<1	264	<1	1	<1	<1
Heterotrophic Plate Count	APHA 9215 B	CFU/mL	-	<1	264	<1	885	5	6
Physical									
Conductivity	APHA 2510 B	µS/cm	-	<2	24	76	161	98	155
pH	APHA 4500-H B	pH units	-	<0.01	264	7.49	8.89	7.87	8.50
Temperature	APHA 4500-H B	deg.C	-	<0.1	48	9.5	25.0	16.7	24.2
Total Dissolved Salts	APHA 2540 C	mg/L	-	<20	24	40	125	67	113
True colour	Lachat QuikChem Method, Colour in Waters 10-308-00-1-A	Pt-Co	-	<1	48	<1	3	<1	2
Turbidity	APHA 2130 B	NTU	-	<0.1	48	0.1	0.6	0.2	0.4
Inorganic									
Alkalinity bicarb	APHA 2320 A/B	mg/L	-	<0.1	48	31.0	46.6	38.8	44.5
Alkalinity carb	APHA 2320 A/B	mg/L	-	<0.1	48	<0.1	<0.1	<0.1	<0.1
Alkalinity hydrox	APHA 2320 A/B	mg/L	-	<0.1	48	<0.1	<0.1	<0.1	<0.1
Alkalinity total	APHA 2320 A/B	mg/L	-	<1	48	31	46	39	44
Aluminium Acid Soluble	USEPA 200.8	µg/L	-	<5	24	21	38	29	35
Asbestos	AS4964-2000	Present/ Absent	-	Absent	0	Absent	Absent	-	-
Calcium Dissolved	USEPA 200.7	mg/L	-	<0.05	24	10.50	16.80	12.90	15.59
Chloride	APHA 21st Ed. 2005, Part 4110 B	mg/L	-	<0.1	12	3.0	6.9	4.0	6.6
Chlorine Combined	APHA 4500 -CL G	mg/L	-	<0.03	264	<0.03	0.28	0.07	0.17
Chlorine Free	APHA 4500 -CL G	mg/L	-	<0.03	264	0.05	1.34	0.67	1.10
Chlorine Total	APHA 4500 -CL G	mg/L	5	<0.03	264	0.07	1.46	0.74	1.20
Cyanide	APHA 4500_CN	mg/L	0.08	<0.004	12	<0.004	<0.004	<0.004	<0.004
Fluoride	APHA 21st Ed. 2005, Part 4110 B	mg/L	1.5	<0.1	23	0.6	0.8	0.7	0.8
Fluoride	APHA 21st Ed. 2005, Part 4500F-C	mg/L	1.5	<0.05	1	0.78	0.78	0.78	0.78
Hardness Total	APHA 2340 B	mg/L	-	<0.1	24	30.0	54.0	37.0	53.4
Iodide	VIC-CM078	mg/L	0.5	<0.01	12	<0.01	<0.01	<0.01	<0.01
Magnesium Dissolved	USEPA 200.7	mg/L	-	<0.05	24	0.72	3.65	1.17	3.42
Nitrate	APHA 21st Ed. 2005, Part 4110 B	mg/L	50	<0.1	12	<0.1	0.1	<0.1	0.1
Potassium Dissolved	USEPA 200.7	mg/L	-	<0.1	12	0.4	1.7	0.6	1.5
Sodium Dissolved	USEPA 200.7	mg/L	-	<0.1	12	2.2	7.6	3.4	6.2
Sulphate	APHA 21st Ed. 2005, Part 4110 B	mg/L	500	<0.4	12	0.6	23.4	5.3	21.9
Total metals									
Aluminium Total	USEPA 200.8	µg/L	-	<9	24	22	41	33	41
Antimony Total	USEPA 200.8	µg/L	3	<3	24	<3	<3	<3	<3
Arsenic Total	USEPA 200.8	µg/L	10	<1	24	<1	<1	<1	<1
Barium Total	USEPA 200.8	µg/L	2000	<2	24	3	7	4	6
Beryllium Total	USEPA 200.8	µg/L	60	<0.1	24	<0.1	0.2	<0.1	<0.1
Boron Total	USEPA 200.7	mg/L	4	<0.01	12	<0.01	0.01	<0.01	0.01
Cadmium Total	USEPA 200.8	µg/L	2	<0.05	24	<0.05	<0.05	<0.05	<0.05
Chromium Total	USEPA 200.8	µg/L	-	<2	24	<2	3	<2	<2
Cobalt Total	USEPA 200.8	µg/L	-	<0.2	24	<0.2	<0.2	<0.2	<0.2

Table 9-5 Summary data for water quality zone 4: Tuggeranong (cont.)

Analyte	Method ID	Units	ADWG (Health)	Limit of Reporting	Number of Samples	Minimum	Maximum	Mean	95th Percentile
Total metals (cont.)									
Copper Total	USEPA 200.8	µg/L	2000	<1	48	<1	67	12	28
Iron Total	USEPA 200.7	mg/L	-	<0.01	48	<0.01	0.03	<0.01	0.02
Lead Total	USEPA 200.8	µg/L	10	<0.2	48	<0.2	0.6	<0.2	0.4
Manganese Total	USEPA 200.7	mg/L	0.5	<0.001	48	<0.001	0.026	0.005	0.011
Mercury Total	USEPA 200.8	µg/L	1	<0.1	12	<0.1	<0.1	<0.1	<0.1
Molybdenium Total	USEPA 200.8	µg/L	50	<1	24	<1	<1	<1	<1
Nickel Total	USEPA 200.8	µg/L	20	<1	24	<1	2	1	2
Selenium Total	USEPA 200.8	µg/L	10	<1	24	<1	1	<1	<1
Silver Total	USEPA 200.8	µg/L	100	<1	24	<1	<1	<1	<1
Zinc Total	USEPA 200.8	µg/L	-	<5	24	<5	47	6	28
Haloacetic acids									
Bromoacetic acid	ALS: Headspace GCMS	µg/L	-	<5	24	<5	<5	<5	<5
Bromochloroacetic acid	ALS: Headspace GCMS	µg/L	-	<1	24	<1	4	1	3
Bromodichloroacetic acid	ALS: Headspace GCMS	µg/L	-	<1	24	<1	5	1	4
Dibromoacetic acid	ALS: Headspace GCMS	µg/L	-	<1	24	<1	<1	<1	<1
Dibromochloroacetic acid	ALS: Headspace GCMS	µg/L	-	<10	24	<10	<10	<10	<10
Dichloroacetic acid	ALS: Headspace GCMS	µg/L	100	<1	24	5	33	15	29
Monochloroacetic acid	ALS: Headspace GCMS	µg/L	150	<1	24	<1	3	<1	3
Tribromoacetic acid	ALS: Headspace GCMS	µg/L	-	<10	24	<10	<10	<10	<10
Trichloroacetic acid	ALS: Headspace GCMS	µg/L	100	<1	24	12	49	24	36
Sum of haloacetic acid	ALS: Headspace GCMS	µg/L	-	<1	24	21	93	41	74
Trihalomethanes									
Bromoform	VIC-CM047	mg/L	-	<0.001	24	<0.001	<0.001	<0.001	<0.001
Chloroform	VIC-CM047	mg/L	-	<0.001	24	0.021	0.084	0.041	0.073
Dibromochloromethane	VIC-CM047	mg/L	-	<0.001	24	<0.001	<0.001	<0.001	<0.001
Dichlorobromomethane	VIC-CM047	mg/L	-	<0.001	24	0.001	0.008	0.003	0.008
Trihalomethanes total	VIC-CM047	mg/L	0.25	<0.001	24	0.022	0.092	0.044	0.081
Semi Volatile Organic Compounds (SVOC)									
Anilines And Benzidines	US EPA 3510/8270	µg/L	All results < LOR						
Chlorinated Hydrocarbons	US EPA 3510/8270	µg/L							
Haloethers	US EPA 3510/8270	µg/L							
Nitroaromatics And Ketones	US EPA 3510/8270	µg/L							
Nitrosamines	US EPA 3510/8270	µg/L							
Organochlorine Pesticides	US EPA 3510/8270	µg/L							
Organophosphorous Pesticides	US EPA 3510/8270	µg/L							
Phenolic Compounds	US EPA 3510/8270	µg/L							
Phthalates	US EPA 3510/8270	µg/L							
Polycyclic Aromatic Hydrocarbons	US EPA 3510/8270	µg/L							

ADWG (Health)	Australian Drinking Water Guidelines – Health Guideline Value
CFU/mL	colony forming units per millilitre
Deg.C	degrees Celsius
µg/L	micrograms per litre
mg/L	milligrams per litre
µS/cm	micro siemens per centimetre
MPN	most probable number
NTU	nephelometric units
Pt-Co	platinum-cobalt units

The 95th percentile is a statistical calculation based on 'normal' distribution. In the context of this report, it estimates the value for which 95% of all the water that passes through the distribution system in this 12 month period falls below.

Mount Stromlo WTP, 2017

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11 Abbreviations

ACT	Australian Capital Territory
ACT Heath	ACT Health Directorate
ADWG	Australian Drinking Water Guidelines (2011)
ALS	ALS Global
AS/NZS	Australian Standards/New Zealand Standards
CCP	critical control point
CFU	colony forming units
cm^2	centimeters squared
DAFF	dissolved air flotation and filtration
DALY	disability-adjusted life year
GL	gigalitre
GMP	Good Manufacturing Process
HACCP	Hazard Analysis and Critical Control Point
ICRC	Independent Competition and Regulatory Commission
IMS	Integrated Management System
ISO	International Standards Organisation
km	kilometre
L	litre
LOR	limit of reporting
mg	milligram
mJ	megajoule
ML	megalitre
mL	millilitre
mm	millimetre
mm^3	millimetres cubed
MPN	most probable number
µg	micrograms
µS	micro Siemens
NATA	National Association of Testing Authorities
ND	not detected
NHMRC/NRMMC	National Health and Medical Research Council/ Natural Resource Management Ministerial Council
NSW	New South Wales
NTU	nephelometric turbidity units
PAC	powdered activated carbon
PAH	Polycyclic Aromatic Hydrocarbons
PCS	Parks and Conservation Services
Pt-Co	platinum-cobalt units
%	percent
QPRCC	Queanbeyan - Palerang Regional Council
SVOC	Semi Volatile Organic Compound
The Code	Public Health (Drinking Water) Code of Practice (2007)
THM	trihalomethanes
UV	ultraviolet light
WSAA	Water Services Association of Australia
WTP	Water Treatment Plant


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