



Water Quality Annual Report

2020-21

Melbourne Water

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Melbourne Water is owned by the Victorian Government. We manage Melbourne's water supply catchments, remove and treat most of Melbourne's sewage, and manage rivers and creeks and major drainage systems throughout the Port Phillip and Westernport region.





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This report is provided to the Secretary of the Department of Health (DH) in accordance with Section 26 of the *Safe Drinking Water Act 2003* (Vic) for the 2020-21 financial year.

Melbourne Water (MW) makes a vital contribution to the renowned Melbourne lifestyle by underpinning human health, enhancing community well-being, supporting economic growth and balancing the natural and man-made environment.

The organisation is responsible for the supply of affordable, high-quality water, reliable sewerage, healthy waterways, integrated drainage and flood management services and cooler greener spaces, helping make greater Melbourne a fantastic place to live.

Today, the organisation employs a passionate, truly diverse, future-focused team of experts, who collaborate with a wide range of partners to skilfully balance the social, economic and liveability needs of the community with the long-term benefit of the environment.

Melbourne Water has a solid history of foresight, ingenuity and best practice. Today, with a strong commitment to understanding and delivering to the needs of customers and the community, we are a leader in the delivery of an outstanding integrated system that is secure, efficient, affordable and sustainable.

Our key stakeholders are customers, government, regulators, other water businesses, land developers, the community and suppliers. These stakeholders and our other strategic partners, including our construction and maintenance partners and research organisations, help us achieve our objectives. We consider social, environmental and financial effects and short-term and long-term implications in all our business decisions.

We are owned by the Victorian Government, with an independent Board of Directors responsible for governance. The responsible Minister is the Minister for Water.

The Environmental Protection Authority Victoria (EPA) and the Department of Health (DH) Victoria regulate the environmental and public health aspects of our business. The Essential Services Commission (ESC) regulates prices and monitors service performance. We work across several arms of the Victorian Government, including the Department of Environment, Land, Water and Planning (DELWP) and the Department of Treasury and Finance.

Our customers include Melbourne's retail water companies (City West Water, CWW¹; South East Water, SEW; and Yarra Valley Water, YVW), regional water authorities (South Gippsland Water, SGW; Gippsland Water, GW; Westernport Water, WPW; Western Water, WW and Barwon Water, BW), local councils, land developers, and businesses that divert river water.

Melbourne Water and the retail water companies have developed risk management systems for drinking water quality using the principles of HACCP (Hazard Analysis Critical Control Point) and the quality management system standard ISO 9001. The HACCP process systematically analyses hazards and establishes measures for their control in order to ensure product quality and safety. Our commitment to delivering safe and secure high quality drinking water that meets or exceeds regulatory and customer service standards is set out in our board approved Public Health Policy.

¹ City West Water and Western Water merged on the 1st of July 2021. This change will be reflected in next year's report.

Water Supply System

We manage the harvesting of water from catchments, storage of harvest, bulk water transfer, the treatment of water, and the delivery of treated water to numerous interface points with City West Water, South East Water, Yarra Valley Water, Western Water, Barwon Water, South Gippsland Water and Westernport Water (SGW and WPW receive water via the Victorian Desalination Pipeline). Gippsland Water receives untreated water. In total, we supplied 439 billion litres of water in 2020-21, which is 2% less than last year. This volume included a small volume of untreated water directly from our aqueducts to connected customers supplied by Melbourne's retail water companies.

Source Water

The drinking water we supply is sourced from a combination of protected surface water catchments, unprotected surface water catchments, and seawater. Each of these source waters requires a different type of treatment to ensure that the treated water is appropriate for human consumption.

Approximately half of Melbourne's water is sourced from forested, protected catchments. The catchment system consists of 11 water supply catchments and five water holding storages. The catchments located within National Parks are co-managed with Parks Victoria, with management arrangements outlined in a National Parks Agreement. The catchments located within State Forest are co-managed with DELWP, a Memorandum of Understanding details the arrangements to effectively manage human activity and land use for the purposes of protecting water resources in State Forest. The five water holding storages are solely managed by Melbourne Water. Most of Melbourne's water is supplied via Silvan Reservoir which receives inflows from Thomson Reservoir, Upper Yarra Reservoir, O'Shannassy Reservoir and other small tributaries to the Yarra River. Historically Cardinia Reservoir has been supplied by the Silvan system however in recent years has received a significant share of its water from the Victorian Desalination Plant (VDP), some of this water can then be used to supplement Silvan demand. Greenvale Reservoir continues to be supplied by the Silvan system. These sources are supplied to Melbourne's retail water companies unfiltered because of the high quality of water drawn from the protected catchments and large storages. As is reflected in our board approved Public Health Policy Melbourne Water is committed to "Protect Melbourne's existing drinking water sources through sustainable catchment management practices".

On average over the last 10 years approximately 25 per cent of Melbourne's drinking water has been sourced from open catchments that have mixed land uses including farming, rural properties and state forests that are open to activities such as camping and four-wheel driving. Water sourced from these catchments undergoes additional treatment to that sourced from protected catchments in order to ensure the safety of the drinking water supply.

The Tarago water supply catchment contains land that is privately owned, with a variety of agricultural uses. We have an interest in the protection and improvement of water quality on this private land and have worked with stakeholders, including the Baw Baw Shire Council and the Neerim District Landcare Group, to develop a Tarago Catchment Management Plan. Following the completion of Melbourne Water's Catchment Management Optimisation Program, and in line with the State Government's position in Water for Victoria, Melbourne Water has been investigating potential options for some forms of community recreation at Yan Yean and Tarago Reservoirs. Melbourne Water supports a balanced approach to recreation in our catchments where community benefits outweigh costs, and where any risks can be appropriately managed. Where benefits do not outweigh costs, and where risks can be appropriately managed, Melbourne Water supports a 'beneficiary pays' approach to advancing recreational opportunities.

The open mid-Yarra River catchment feeds into Sugarloaf Reservoir, where it mixes with water from the protected Maroondah catchment before being treated at the Winneke Treatment Plant. The Yarra Glen supply is also fed from the Maroondah catchment; however, the transfer aqueduct is not protected, meaning that a greater degree of treatment is required prior to supply.

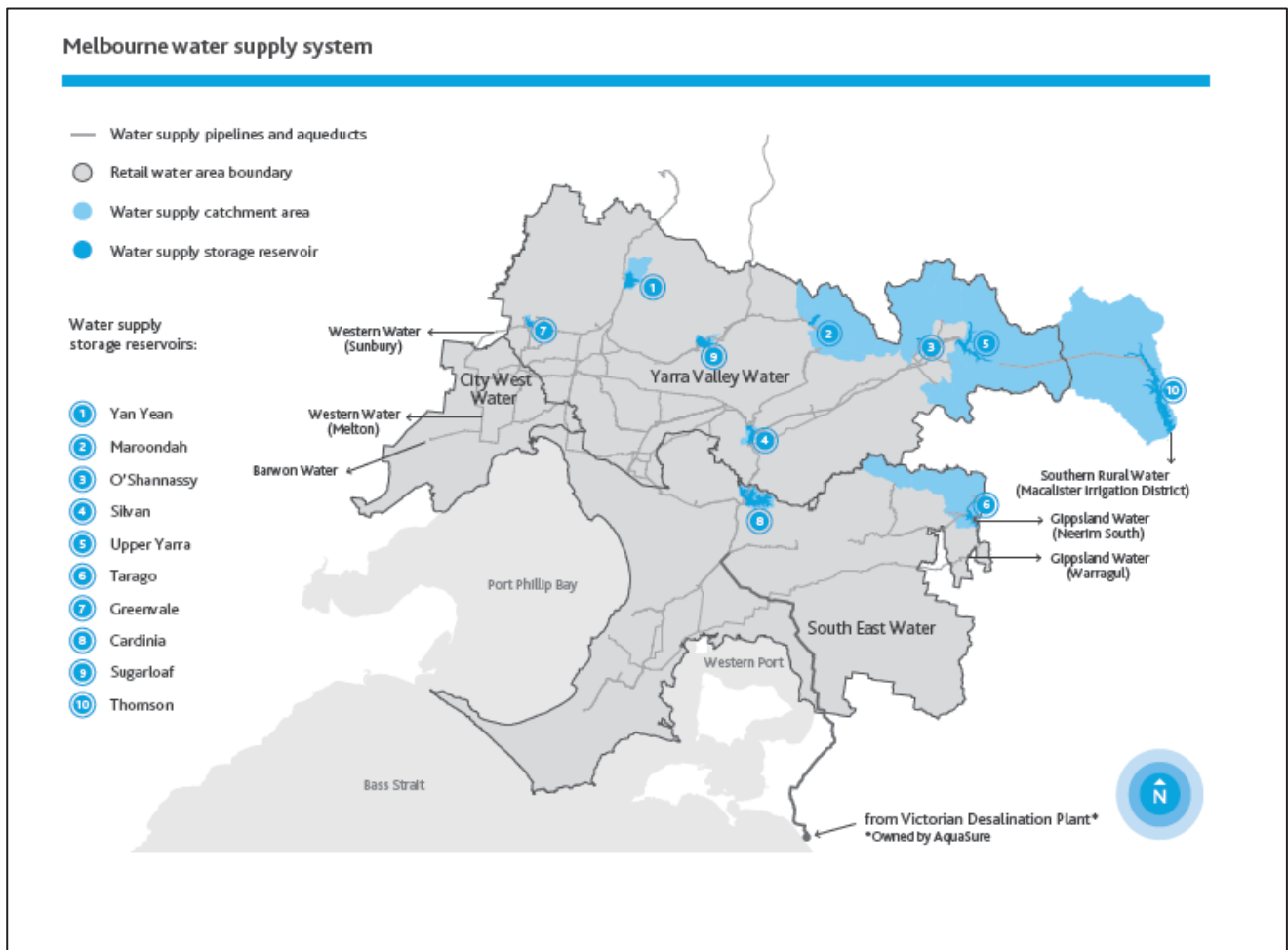
The Healesville supplies are from nominally protected catchments, however, water from these sources travels via open aqueducts prior to treatment at Frogley and Cresswell Treatment Plants. To mitigate the water quality risks posed by ingress during transit these sites also have additional treatment barriers, which remove colour and turbidity as well as potential pathogens.

Depending on the volume of water stored in Melbourne's reservoirs, Cardinia Reservoir can also receive desalinated water. The Victorian Desalination Project comprises a 150 gigalitre reverse osmosis plant at Wonthaggi, an 84-kilometre underground, two-way transfer pipeline to Berwick and an 87 kilometre underground dedicated power supply from Cranbourne. The plant extracts seawater from Bass Strait near Wonthaggi. Water is fully treated via a series of processes (refer to Table 1 and Table 2 for further details). Water enters an underground transfer pipeline which connects the plant to our existing water supply network, enabling supply to Cardinia Reservoir, directly into the water network at Berwick and to offtakes along the pipeline. The pipeline is two-way, so when the plant is not in use, the pipeline can transfer water from our distribution network to connected regional water businesses, thereby ensuring security of supply.

In the 2020-21 financial year, 125 billion litres was supplied by the Victorian Desalination Plant. There were no major changes in the arrangements for water supply compared to the previous financial year and the relative contribution from each source was similar to the previous year. We continued to optimise which sources we harvested from throughout the year to meet forecast demand and climate variability, as per regularly updated plans.

Figure 1 shows our supply area, supply systems and treatment processes are described in Table 11 and 2.

Figure 1 - Melbourne's water supply system



We manage the catchments and source water storages used for the supply of drinking water to the Melbourne metropolitan area. Untreated and treated drinking water is supplied to consumers by Melbourne’s retail water companies. The water is monitored from catchments, through major storages and treatment plants to the interface points with the retail water companies to ensure that it meets the requirements of relevant drinking water quality guidelines and agreements with these companies.

We prioritise our actions to protect source water from contamination using our drinking water quality risk assessment. The risk assessment covers catchments, storage and service reservoirs, treatment and bulk water transfer to the interface with the retail water companies. Operational monitoring is used to provide early warning of issues which could affect drinking water quality, before critical limits are reached. Examples of this monitoring include catchment inspections, manual water quality sampling and online monitoring.

We routinely monitor the water quality within the catchments and distribution system through regular sampling and analysis according to a risk-based laboratory monitoring program. The sampling and analysis is contracted out to external National Association of Testing Authorities (NATA) accredited Laboratories. The level of monitoring is designed to complement risk management and HACCP systems, meet the requirements of the Bulk Water Supply Agreements (BWSAs), monitor treatment processes and assist Melbourne’s retail water companies and regional water authorities’ needs in meeting the *Safe Drinking Water Regulations 2015*.

We maintain a certified management system, Hazards Analysis Critical Control Points (HACCP), for operation of the water treatment plants and supply system to ensure the delivery of safe drinking water. This risk-based management system verifies that treatment processes are operating in accordance with design intent and are achieving the required level of pathogen reduction.

The supply areas of Melbourne's retail water companies are divided into water quality zones and these zones can have one or more water sources during the day or year due to the demand, seasonal variation and complexity of our water supply system. The retail water companies must comply with the Safe Drinking Water Regulations at their customer's taps in these zones as part of their licence agreement with the Essential Services Commission.

Drinking Water Treatment Processes

The water we supply to retail water companies is potable water, with the exception of:

- Gippsland Water - Untreated water from our Tarago Reservoir is fed into Gippsland Water's treatment plants and then into supply for consumption by the customers.
- South Gippsland Water – Water from the VDP is supplied to South Gippsland Water via the Victorian Desalination Pipeline. This water is retreated in South Gippsland Water's treatment plants prior to being supplied to customers to ensure it meets water quality standards.
- Supply by Agreement Customers – some customers directly connect to our untreated water assets. The retail water companies have processes to ensure these customers are informed that their water is not suitable for drinking.

Water treatment plants are located where water from open storages first enters the distribution system. Whilst long retention times in storage reservoirs and primary disinfection plants help inactivate microorganisms such as pathogenic bacteria, protozoa and viruses in the untreated water, additional treatment barriers are required depending on the risk level of the water.

Chlorination and ultraviolet (UV) irradiation are the methods we use to disinfect the water. Chlorination is the most common form of disinfection used to treat Melbourne's water supply, with chlorination plants located at all of the major water treatment plants. Chlorination primary disinfection is effective against viruses and bacteria, and also provides a residual to control biofilm growth in the downstream network. We also operate six UV irradiation disinfection plants, which provide effective initial disinfection, but do not provide a disinfection residual for protection against downstream biofilm growth. UV disinfection at Tarago is discussed below. At Warburton (Martyr Road), Woori Yallock and Launching Place (Lusatia Park), East Warburton (Brahams Road and Lyrebird Avenue) and Yarra Junction, UV disinfection at each site provides primary disinfection, and sodium hypochlorite addition provides secondary disinfection to control biofilm growth and protect against minor ingress events.

Water from unprotected catchments is treated by filtration in addition to chlorine disinfection, to ensure protozoa removal. We operate two large filtration plants. Winneke is a sand filtration plant that treats water at the outlet of Sugarloaf Reservoir. It incorporates processes including coagulation, clarification, filtration and chemical addition for fluoridation, chlorination and pH correction. The Tarago Water Treatment Plant at Drouin West is gravity fed and incorporates processes including permanganate pre-dosing, coagulation, Dissolved Air Flotation and Filtration (DAFF), UV irradiation and chemical addition for pH correction, fluoridation and chlorination. At the Tarago Water Treatment Plant, UV irradiation is used as an additional barrier downstream of filtration to ensure the inactivation of protozoa.

There are three membrane filtration plants; two that supply Healesville (Frogley and Cresswell Water Treatment Plants) and one that supplies Yarra Glen. These plants remove particles in

the untreated water from their respective aqueduct sources to ensure that parameters such as turbidity and colour are reduced to acceptable levels, particularly during storm events. In addition, pathogens attached to the filtered particles are removed. Reducing the turbidity to below 1 nephelometric turbidity unit (NTU) also ensures more effective chlorine disinfection of the filtered water.

Water from the Victorian Desalination Plant is treated via a series of processes which include filtration, reverse osmosis, disinfection and fluoridation.

The Yan Yean Water Treatment Plant was privately owned and operated and could supply treated water into the water supply system under our direction, since July 2019 Melbourne Water has been responsible for its operation. The plant is not currently in operation while a capital project to upgrade the plant and reintroduce treated Yan Yean water into supply during 2022 continues to progress.

Eleven fluoridation plants are operated at the direction of the Department of Health to promote improved dental health outcomes in the community. The operation of the fluoridation plants is a statutory requirement under the *Health (Fluoridation) Act 1973 (Vic)*. These 11 plants are:

- Seven fluorosilicic acid plants operating at: Silvan (three plants), Cardinia (two plants), Winneke (one plant) and Tarago (one plant)
- Two sodium fluoride solution plants operating at Monbulk and Kallista
- The Yan Yean fluorosilicic acid plant (not currently in operation).
- The Victorian Desalination Plant which uses fluorosilicic acid. AquaSure operates the Victorian Desalination Plant under a public private partnership project managed by DELWP.

Secondary disinfection chlorination plants are also located at a number of points within the treated water network. The primary purpose of secondary disinfection is to provide an additional barrier to protect against minor ingress into the distribution network. Secondary benefits include increased chlorine residuals downstream of treated water storages, prevention of taste and odour problems and minimisation of biofilm growth within the closed distribution system where the water has already been treated by primary disinfection.

Tables 1 – 2 describe the water treatment sources, treatment processes and substances added at each treatment plant.

Table 1: Summary of water supply systems and areas serviced

Water Supply System	Source Water / Catchment	Storage	Treatment Plant	Treatment Storages	Area Supplied <i>(Retail water company supplied)</i>
Cardinia	Transfer from Silvan Reservoir without being treated at Silvan water treatment plant Treated water from Desalination plant	Cardinia Reservoir	Cardinia	N/A	Mornington Peninsula and south eastern suburbs. Note: pump station at Cardinia can also pump water back to Silvan Reservoir <i>(South East Water, Yarra Valley Water, South Gippsland Water and Westernport Water)</i>
Victorian Desalination Plant	Desalination plant offtake from Bass Strait	Direct to supply or Cardinia Reservoir	Wonthaggi Desalination Plant	Cardinia Reservoir / direct supply to townships	Capable of supplying primarily Mornington Peninsula, south eastern suburbs and South Gippsland area through direct delivery points and contributing to water businesses connected to the Melbourne Water supply through Cardinia Reservoir which is blended with catchment supplies. <i>(South East Water, Yarra Valley Water, South Gippsland Water and Westernport Water)</i>
Greenvale	Transfer from Silvan Reservoir (after treated at Silvan), or from Winneke water treatment plant. See Silvan and Winneke water supply systems	Greenvale Reservoir	Greenvale St Albans	N/A	Western suburbs and Sunbury/Melton <i>(City West Water, Yarra Valley Water, Western Water, Barwon Water)</i>
			Greenvale-Yuroke	N/A	
Lower Yarra Valley Townships	Maroondah Catchment	Maroondah Reservoir	Yarra Glen	Yarra Glen Service Reservoir	Yarra Glen <i>(Yarra Valley Water)</i>
Lower Yarra Valley Townships	Coranderrk and Graceburn Catchments	N/A	Cresswell	Cresswell Service Reservoir	Healesville <i>(Yarra Valley Water)</i>
			Frogley	Frogley Service Reservoir	

Water Supply System	Source Water / Catchment	Storage	Treatment Plant	Treatment Storages	Area Supplied <i>(Retail water company supplied)</i>
Silvan	Thomson Catchment Upper Yarra Catchment O'Shannassy Catchment Armstrong Catchment McMahons Catchment Starvation Catchment Coranderrk Catchment Treated water from Desalination plant via Cardinia	Silvan Reservoir	Silvan-Olinda Silvan-Preston Silvan-Waverley	N/A	Eastern, central, northern & western suburbs, including Seville and Wandin <i>(City West Water, South East Water, Yarra Valley Water)</i>
			Monbulk	Monbulk Service Reservoir 1 & 2	Monbulk, Silvan, Sherbrooke, Sassafras, Ferny Creek, Olinda, Mount Dandenong <i>(Yarra Valley Water)</i>
			Kallista	Johns Hill Service Reservoir	Emerald, Kallista, Menzies Creek, Cockatoo <i>(Yarra Valley Water)</i>
Tarago	Tarago Catchment	Tarago Reservoir	Tarago	Tarago Clearwater Reservoir	Neerim South, Drouin/Warragul <i>(Gippsland Water)</i> Mornington Peninsula, West Gippsland townships, southern suburbs <i>(South East Water)</i>
Upper Yarra Valley Townships	Thomson Catchment Upper Yarra Catchment	Thomson Reservoir Upper Yarra Reservoir	Brahams Rd Lusatia Park Lyrebird Martyr Rd Yarra Junction	N/A	Woori Yallock, Launching Place, Yarra Junction, Warburton, East Warburton <i>(Yarra Valley Water)</i> ²
Winneke	Transfer from Maroondah Reservoir, Yarra River, Goulburn River ³	Sugarloaf Reservoir	Winneke	Winneke Clearwater Reservoir	Northern, eastern, central & western suburbs <i>(City West Water, South East Water, Yarra Valley Water)</i>

² Alternate supply arrangements to the Upper Yarra Valley Townships from Silvan Treatment Plant via Monbulk pump station began June 18th 2021. Fluoride was not detected at Lusatia Park Treatment Plant (nearest Treatment Plant to Monbulk) until July 5th indicating that Silvan water did not reach the Upper Yarra Valley Townships until after the end of the financial year, this will be reflected in next year's report.

³ This source is only used when the relevant conditions specified in the Statement of Obligations (System Management) are met, and was not used this year.

Table 2: Water treatment processes and added substances at each drinking water treatment plant

Water Supply System	Treatment Plant	Treatment Process	Added Substances	Role of Each Process
Cardinia	Cardinia 1400 Cardinia 1700	Chlorination	Chlorine gas / Sodium hypochlorite ⁴	Disinfection
		Fluoridation	Fluorosilicic acid	Provide dental health benefit
		pH Correction	Lime	pH correction
Victorian Desalination Plant	Wonthaggi Desalination Plant	Coagulation /Flocculation	Ferric sulphate / Sulphuric acid / Polydadmac	Improve performance of filtration
		Filtration (Drum screens, dual media pressure filters, cartridge filters)	-	Protect RO membranes
		Reverse Osmosis	Antiscalant / Sodium hydroxide/ Sodium bisulfite	Removal of salts from the water
		Reverse Osmosis Cleaning	Membrane cleaning chemicals (caustic, detergent, acid)	Maximise performance of RO
		Chlorination	Chlorine gas	Disinfection
		Fluoridation	Fluorosilicic acid	Provide dental health benefit
		Remineralisation	Hydrated lime / Carbon dioxide	Stabilise water and pH correction
		Membrane preservation	Sodium bisulfite	Protect membranes when not in use
		Sludge thickening/dewatering	Polymer	Washwater recovery
Greenvale	Greenvale St Albans Greenvale Yuroke	Chlorination	Sodium hypochlorite	Disinfection
Lower Yarra Valley Townships	Cresswell Frogley Yarra Glen	Coagulation / flocculation	Aluminium chlorohydrate	Colour & organics removal
		Membrane ultrafiltration	-	Remove pathogens/turbidity
		Membrane cleaning	Citric acid / Sodium hypochlorite	Optimise membrane performance
		Chlorination	Sodium hypochlorite	Disinfection
		pH correction	Sodium carbonate	pH correction
Silvan	Silvan-Olinda Silvan-Preston Silvan-Waverley	Chlorination	Chlorine gas / Sodium hypochlorite ⁴	Disinfection
		Fluoridation	Fluorosilicic acid	Provide dental health benefit
		pH correction	Lime	pH correction
	Monbulk	Chlorination	Sodium hypochlorite	Disinfection

⁴ Occasional use of Sodium hypochlorite when required as additional residual or when Chlorine gas dosing is offline.

Water Supply System	Treatment Plant	Treatment Process	Added Substances	Role of Each Process
	Kallista	Fluoridation	Sodium fluoride	Provide dental health benefit
Tarago	Tarago	Pre-treatment chemical dosing	Powdered activated carbon / lime / carbon dioxide	Optimise treatment plant performance
		Coagulation/flocculation	Aluminium chlorohydrate / PolyDADMAC / Polyacrylamide	Improve filter performance
		Dissolved air flotation filtration (DAFF)	-	Removal of pathogens/turbidity
		Chlorination	Chlorine gas	Disinfection
		Ultraviolet (UV) irradiation	-	Disinfection
		Fluoridation	Fluorosilic acid	Provide dental health benefit
		pH correction	Lime / Carbon dioxide	pH correction
		Sludge thickening / dewatering	Polyacrylamide	Washwater recovery
		Iron / manganese removal	Potassium permanganate	Removal of iron and manganese
Upper Yarra Valley Townships	Brahams Rd Lusatia Park Lyrebird Ave Martyr Rd Yarra Junction	Ultraviolet (UV) irradiation	-	Disinfection
		Chlorination	Sodium hypochlorite	Secondary disinfection to provide a chlorine residual to customer tap
Winneke	Winneke Treatment Plant	Coagulation / flocculation	Aluminium sulphate / Polymer	Colour & organics removal
		Clarification	-	Remove pathogens / turbidity
		Rapid media filtration	-	Remove pathogens / turbidity
		Chlorination	Sodium Hypochlorite	Disinfection
		Fluoridation	Fluorosilic acid	Provide dental health benefit
		pH correction	Lime	Optimise disinfection, and pH correction
		Sludge thickening / dewatering	Polyacrylamide	Washwater recovery

Improvement Initiatives

A number of improvement initiatives significant to water quality were approved, planned or delivered over the 2020-21 period.

Approved Improvement Projects

Treatment Upgrades

Water is treated at 16 primary water treatment plants across our system, to achieve the strict water quality targets for public health protection. During 2020-21, Melbourne Water's Board approved a new Water Treatment Plant at Mt Evelyn. This new primary disinfection plant will be able to treat water supplied from Silvan Reservoir, downstream of the existing Silvan water treatment plant. This will enable continuity of primary disinfection for water supplied from Silvan Reservoir during future planned and unplanned outages of the existing disinfection plant. Concept design was completed in 2020 and functional design is currently underway with completion of construction and commissioning anticipated in 2023.

Also during 2020-21, Melbourne Water's Board approved a new ultraviolet (UV) treatment plant at Winneke. This will provide a second disinfection barrier and second protozoa barrier for water supplied from Sugarloaf Reservoir, which is partly sourced from the forested Maroondah Reservoir catchment and from the open Yarra River catchment. This new UV treatment plant will ensure achievement of the internationally-accepted microbial health based target, one microDALY per person per year, adopted in Melbourne Water's 2017 Drinking Water Quality Strategy. Funding was allocated in the 2021 pricing submission and we anticipate completion of construction and commissioning in 2024.

Catchment Management

Guided by the Catchment Management Optimisation Program finalised in 2019, Melbourne Water's plan for enhanced catchment management (focused on unauthorised entry, pest animal control, and bushfire management) has commenced. A security specialist has been recruited and a number of initiatives including enhanced security patrols, upgraded CCTV and monitoring of movement within protected catchments are underway.

Strategic Planning

Bushfire Resilience

Bushfires have long been recognised as a key risk for the water supply system in Melbourne, especially given the protected, forested water supply catchments which enable us to supply safe, affordable drinking water to the majority of Melbourne without filtration treatment. In the future, the severity and frequency of bushfires is likely to increase, and despite heavy investment in bushfire prevention and management activities, we need to be prepared for the possibility of future bushfires that could affect our water supply catchments. In 2020-21 we delivered a project which assessed the resilience of our water supply system against future bushfires, and identified a number of potential adaptive investment pathways to ensure strategic resilience is maintained over the short, medium, and long term. Implementation planning is currently underway.

Disinfection Controls Effectiveness Review

The Disinfection Controls Effectiveness Review project is designed to conduct a system-wide analysis of primary disinfection risks and controls using bow tie analysis. The project aims to critically review and validate disinfection controls, and assess their effectiveness in managing

the risk to public health, including under various system failure modes. Opportunities and areas for improvement identified will be prioritised to further improve the resilience and robustness of the disinfection controls.

Strategic Review of our Drinking Water Quality Management System

A strategic review of our Drinking Water Quality Management System commenced during 2020-21. Whilst our current system is adequate, as evidenced by compliance with external audits, it is acknowledged that there is opportunity to move beyond compliance. This work program aims to identify and prioritise opportunities for improvement.

The first phase to be completed in 2021-22 is a visioning and benchmarking exercise involving both a literature review and interviews with people across Melbourne Water, retail water companies, industry leaders and the Department of Health. Feedback from these interviews and review process will inform the implementation phase of the project.

Implementing Upgrades and Renewals

A number of significant plant upgrades and renewal works have been completed across 2020-21 to enhance operational management of drinking water quality.

- The Silvan and Cardinia chlorine plants were upgraded as part of the broader Chlorine Risk Reduction project across Melbourne Water sites, and both were completed in January 2021.
- Emergency dosing units supported by independent generators were established downstream of the Silvan treatment plant to build greater primary disinfection resilience.
- Enhanced monitoring in two of our major water storage reservoirs was introduced to supplement and provide real time monitoring data within Upper Yarra and O'Shannassy reservoirs.

In July 2019, Melbourne Water took over the Yan Yean treatment plant, previously owned by Trility Pty Ltd. The plant is not currently in operation while a capital project to upgrade the plant and reintroduce treated Yan Yean water into supply during 2022 continues to progress.

Issues

Widespread Customer Complaints

Melbourne Water reported one occasion of potential widespread customer complaint to DH under section 22 of the *Safe Drinking Water Act 2003* over the 2020-21 financial year related to elevated chlorine concentration in the Silvan-Waverly main. No customer complaints were ultimately received, refer below for more information.

Melbourne Water were responsible for 187 complaints received by the Melbourne metropolitan retail water companies in relation to the Silvan primary disinfection failure boil water advisory issued 28 August 2020, further detail is provided below.

Fluoride Notifications

Melbourne Water notified DH and the retail water companies of one occasion when the concentration of fluoride supplied was less than 0.6 mg/L for longer than 72 hours, and therefore notification was required under the *Code of Practice for Fluoridation of Drinking Water Supplies* (Vic). This occurred at Monbulk treatment plant in June 2021 as a result of impacts to water quality in the Upper Yarra Reservoir caused by extreme weather event and subsequent need to reverse flows in the Yarra Valley Conduit supplying from Monbulk. As this

reverse flow arrangement necessitated operation outside normal operating conditions fluoride dosing was ceased as a precaution against overdosing. Fluoride dosing will be reinstated once normal water supply arrangements have resumed.

Melbourne Water notified DH and the retail water companies of three occasions when the 12 month annual rolling average fluoride concentration dropped below the target operating range of 0.8-1.0mg/L.

- The Monbulk fluoride plant 12 month rolling average fluoride concentration was impacted by the contingency plan requirements during both Upper Yarra Turbidity events in August 2020 and June 2021 when Fluoride dosing was ceased. Melbourne Water anticipates that once the contingency supply arrangements are no longer required the 12 month rolling annual average fluoride concentration will return to the target operating range without further intervention.
- Asset renewals required a fluoride plant outage at Silvan treatment plant, which resulted in the Silvan-Preston rolling fluoride average concentration dropping below the target operating range from September 2020 to January 2021. Since completing asset renewals at Silvan treatment plant the Silvan-Preston rolling average has returned to the target operating range.

Melbourne Water notified DH and the retail water companies of three occasions where online monitoring detected an elevated fluoride concentration for a short time and subsequently the fluoride plant shut down automatically.

- The Kallista fluoride plant automatically shut down after measuring an elevated fluoride concentration above the emergency process limit of 1.5mg/L on 27 November 2020. The concentration remained above 1.5mg/l for 5 minutes peaking at 3.3mg/l. Testing confirmed that dilution in the John's Hill service reservoir prevented elevated fluoride concentrations entering the distribution network and reaching customers. Root cause investigation determined that degradation in asset condition and performance of the carrier water system was responsible for the overdose. An overhaul of the carrier water system was carried out along with additional monitoring and introduction of further shutdown conditions to correct the issue and prevent recurrence.
- The Winneke fluoride plant automatically shut down following an increase in fluoride concentration above the emergency process limit of 1.5mg/L on 17 February 2021. The excursion lasted less than a minute with a peak concentration of 1.5mg/L following a rapid flow change through the Winneke water treatment plant. The outlet concentration of the Winneke Clearwater storage reservoir was monitored throughout and remained within the target operating range and therefore there was no impact to customers supplied by this treatment plant. The fluoride plant remained offline until upgrades to the control system could be made to accommodate a rapid change in flow and prevent recurrence of this issue.
- Kallista fluoride plant automatically shut down following an increase in fluoride concentration above the emergency process limit of 1.5mg/L on 28 March 2021. The fluoride concentration remained above 1.5mg/L for 13 minutes with a peak reading of 1.7mg/L following a short communications failure at the site. The impacted water was scoured from the main at the time and did not enter the service reservoir and therefore there was no impact to the water supplied to customers in the areas supplied by the treatment plant. Upgrades to the treatment plant were made so that there was an extended delay before the pump station and fluoride plant would start up following a communications failure to prevent recurrence of this issue.

The changes made as a result of these instances have proven effective to prevent the likelihood of additional elevated fluoride concentration measured at the treatment plants. The

fluoride concentration on the outlet of impacted service reservoirs was confirmed to be normal on all occasions so there was deemed to have been no impact to customers.

Emergency, Incident and Event Management

Issues with Known or Suspected Water Contamination

Silvan Primary Disinfection Failure

As a result of a severe storm on Thursday, 27 August 2020, power outages caused disruption to Melbourne Water's Silvan water treatment plant power supply. The onsite backup generator was able to maintain power to the site before failing late that night, in turn causing intermittent disinfection failure over a period of approximately 7 hours. This resulted in approximately 100 ML of non-disinfected water entering the supply network impacting Yarra Valley Water and South East Water customers in water quality zones supplied by the Silvan-Waverly, Silvan-Preston and Silvan Olinda mains across 98 suburbs in Melbourne's outer East.

The Melbourne Water Incident Management Team worked closely with Yarra Valley Water, South East Water, City West Water, DELWP and the Department of Health on a coordinated response to the incident. Corrective actions taken in response to the issue and to mitigate water quality risks included:

- Restoration of emergency power and disinfection processes by approximately 6:30am on Friday 28 August.
- Submission of a report to the Department of Health under Section 22 of the *Safe Drinking Water Act 2003*.
- Issuance of precautionary Boil Water Advisory (BWA) notices supported by extensive customer communication through multiple digital and media channels by Yarra Valley Water and South East Water for impacted areas.
- Development and implementation of a plan to return network to normal operational service in conjunction with retail water companies.
- Targeted chlorine dosing and extensive water quality testing to ensure the water was safe to drink before lifting BWAs.

Melbourne Water takes its responsibility to public health extremely seriously, an extensive internal post incident investigation was completed to ensure the root cause was established and countermeasures implemented to prevent a recurrence of this issue including:

- Asset upgrades and improvements including provision of immediate additional generator capacity at Silvan and installation of permanent, automatic emergency dosing units for each main supplied by Silvan.
- Improvement to generator and chlorine dosing preventative maintenance regimes.
- Improvements to contingency plans including review of triggers for escalation and criteria for issue of Boil Water Advisory notices.
- Ongoing comprehensive review of disinfection control effectiveness at all Water Treatment Plants in Melbourne Water's system to identify and correct any potential systemic issues.
- Approval of a new Mt Evelyn Water Treatment Plant. This new primary disinfection plant will be able to treat water supplied from Silvan Reservoir, downstream of the existing Silvan

water treatment plant to enable continuity of primary disinfection for water supplied from Silvan Reservoir during future planned and unplanned outages of the existing disinfection plant

Melbourne Water also contributed to a joint water company debriefing process alongside Yarra Valley Water, South East Water and City West Water which identified joint learnings and a collective industry improvement plan that aims to improve joint emergency response plans, communication protocols and water distribution management. Finally Melbourne Water continues to work with the Department of Health on their independent investigation.

High Chlorine Dose in Silvan-Waverly Main

A Section 22 report was submitted to DH on 21 April 2021 to report the potential for widespread public complaint due to elevated chlorine residual concentration impacting 37ML of water in the Silvan-Waverly main over approximately 7 hours starting on 19 April 2021. Chlorine levels reached a maximum residual concentration of approximately 1.9mg/L at the nearest chlorine analyser relative to a typical residual of 0.6 – 0.8mg/l. Natural dilution in the network and service reservoirs reduced the concentration such that the chlorine concentration remained well below the Australian Drinking Water Guidelines (ADWG) health guideline value of 5.0mg/L and therefore did not pose a risk to public health. Information provided by Yarra Valley Water showed no customer complaints were ultimately received due to this event.

Upon identification of the elevated chlorine residual, the temporary dosing unit was immediately isolated from the system and Yarra Valley Water notified of the issue. Melbourne Water worked with Yarra Valley Water to track and minimise the spread of elevated chlorine water through the network including sampling to determine network chlorine concentration and extend of spread, a joint communication plan for potential escalation of customer complaints was also developed.

Following a comprehensive investigation the root cause was found to be incorrect configuration of the chlorine dosing pump and communications within the pump control panel, which was corrected and tested during the investigation of this incident. Improvements were made to installation procedures, remote visibility and functionality of the dosing unit and updates to the standard operating procedures to prevent reoccurrence of this issue.

A debrief was held with the Department of Health and Yarra Valley Water to share the investigation findings, corrective and preventative actions.

Issues with Potential to Impact Water Supply

COVID-19

In the first quarter of 2020 Melbourne Water responded accordingly to assess the risk of COVID-19 to staff health and safety, customers and the community. As the pandemic evolved, we adapted our operations and emergency management response to ensure we continued to provide our valued services.

Over the 2020-21 financial year working arrangements have continued to flex with changing State Government advice. This has included segregation arrangements for field-based staff, prioritisation of maintenance and capital works, limiting movement between sites and remote working where possible.

These strategies along with the wider Victorian restrictions have limited the risk of transmission to our essential workers and allowed us to fully satisfy the requirements of our Risk Management Plan and continue to provide reliable, safe drinking water throughout the pandemic.

Upper Yarra Reservoir Turbidity Events

August 2020

In late August 2020 heavy rainfall and wind in the Upper Yarra Reservoir catchment, combined with wave action in the reservoir and planned very low drawdown due to dam safety works led to elevated turbidity in the Yarra Valley Conduit supplying the Yarra Valley Township Treatment Plants. This necessitated a number of operational changes to mitigate the impact on both the township treatment plants and wider water supply network. This included reduction of flows from UY Reservoir to Silvan Reservoir and short term shandying of water supplied to the Upper Yarra township plants from the reservoir with water from the O'Shannassy Reservoir to reduce turbidity to acceptable levels.

Melbourne Water worked closely with YVW and DH throughout the event to manage water quality impacts and communications to customers. There was no elevated health risk associated with this event however some aesthetic degradation may have impacted customers nearby to the UY reservoir. YVW and MW did not receive any customer complaints relating to aesthetic degradation caused by this event.

June 2021

Melbourne Water's operational area was impacted by heavy rainfall and very strong winds over several consecutive days beginning 9 June 2021.

Strong winds disrupted mains power supply to 10 water treatment sites and three pump stations for periods of up to 14 days. Access to these sites was also difficult and hazardous due to falling trees. Safety of staff, generator fuel supply and monitoring of water supply quantity and quality were critical components of the first stage of the incident.

Catchment runoff following heavy rain impacted on raw water quality, most significantly in the Upper Yarra Reservoir where high turbidity restricted its use for drinking water for a period of time due to the inability to guarantee treatment efficacy and aesthetic concerns. Melbourne Water worked closely with YVW and DH to establish a contingent supply of water to the Yarra Valley townships from the Silvan Reservoir via reverse flow pumping arrangements up the Yarra Valley Conduit, rather than the normal gravity fed supply from Upper Yarra Reservoir. This reverse flow arrangement commenced on 18 June 2021. However this alternative supply did not reach the first potable water supply customers until 5 July 2021, as evidenced by fluoride monitoring at Lusatia Park treatment plant⁵. Melbourne Water worked closely with Yarra Valley Water on a joint communications plan.

Ultimately Melbourne Water, working closely with the State Incident Command, YVW, DELWP and DH were able to successfully prevent deterioration of water quality reaching customers.

⁵ Alternate supply arrangements to the Upper Yarra Valley Townships from Silvan Treatment Plant via Monbulk pump station began 18 June 2021. Fluoride was not detected at Lusatia Park Treatment Plant (nearest Treatment Plant to Monbulk) until July 5th indicating that Silvan water did not reach the Upper Yarra Valley Townships until after the end of the financial year, this will be reflected in next year's report.

Risk Management Plan Audit Results

Melbourne Water's drinking water risk management plan was audited against the requirements of the *Safe Drinking Water Act 2003* (the Act) and *Safe Drinking Water Regulations 2015* for the period 31 May 2018 to 28 August 2020. The audit found Melbourne Water to be fully compliant with the requirements of the Act and Regulations. A copy of the certificate is provided in the appendix to this document.

The audit identified and made recommendations in relation to ten Opportunities For Improvement, these are summarised in Table 3 along with the associated corrective actions.

Table 3: 2020 RMP Audit Opportunities for Improvement

Opportunity for Improvement	Corrective Action
Develop improved condition monitoring, metrics and maintenance program for aqueduct catch drains.	Melbourne Water has an existing asset management inspection and maintenance regime in place for aqueducts which includes consideration of catch drain performance. An additional independent review of critical catch drain condition has also been completed and follow up remedial actions including a priority capacity upgrade project are under way targeting completion in December 2021.
Develop improved monitoring and metrics for activity in protected catchments and ensure activity is as low as reasonably practicable.	In addition to the expanded security program noted in the improvement initiatives section of this report above, increased interim security measures were put in place by November 2020 including enhanced security patrols, inspections and CCTV.
Implement a system to ensure outdated reagents and standards are not used.	Relevant SOPs require operators to check that reagents are in date before use. A review of reagents stored on site was completed and expired reagents safely disposed of following audit in August 2020.
Consider covering or increasing launder cleaning of Winneke clarifiers.	A new launder cleaning methodology has been established and an appropriate cleaning frequency in line with other clarifier maintenance determined. Internal launder cleaning was completed for the first clarifier in July 2021 with the remainder to be completed during planned clarifier shutdowns over coming maintenance periods targeting completion of all clarifiers in F23-24.

Opportunity for Improvement	Corrective Action
Develop a process for rapid alignment between SCADA set points and RMP documentation where either of them change.	HACCP set points and targets were reviewed and updated at all treatment plants to standardise the controls and verify RMP documentation is accurate following the audit which was completed in December 2020. Three yearly preventative maintenance tasks to review set points have also been established for each primary treatment site to compare SCADA set points and documentation to prevent recurrence of this issue.
Set clear and tangible metrics relating to Winneke clear water storage protection against ingress.	Melbourne Water has an existing condition assessment program in place for the Winneke clear water storage that sets inspection dates based on risk. The West tank is not due for another inspection until 2023, planning for inspection of the East tank in 2021 is underway. A review of the Strategic Asset Management Plan is underway targeting completion in December 2021.
Enhance SOP for reservoir and aqueduct inspections with respect to ingress protection ⁶	In addition to enhancements to the SOP due to be published in September 2021 a service reservoir inspection blitz is underway to proactively identify and address issues targeting completion in January 2022. The preventative maintenance program for reservoirs is also under review due for completion October 21 followed by update of the Strategic Asset Management Plan in December 21.
Enhance SOP for reservoir and aqueduct inspections with respect to vegetation and debris management ⁶	Actions to address this OFI will completed alongside the actions detailed above.
Consider implementing system to improve logbook clarity.	Planned transition to digital forms is underway targeting completion in F22-23
Consider benchmarking chlorate and organic DBPs against global norms.	Melbourne Water has a detailed dataset, which is compliant with Australian regulations. A project to review our dataset and benchmark it against both Australian and International guidelines has been initiated targeting completion in F21-22.

⁶ Continuation of unclosed OFI from 2018 audit

As noted in the improvement initiatives section above Melbourne Water are undertaking a comprehensive external review and benchmarking of our Drinking Water Quality Risk Management framework to ensure that any systematic problems are found and proactively addressed.

At the previous audit in 2018 three OFIs were identified and action plans developed aligned to their risk. One OFI has since been closed out and two continue to be progressed, these are incorporated in the table above as OFIs identified in the 2020 audit were directly related to unclosed OFIs from the 2018 audit.

Melbourne Water's integrated management system was also recertified including continuation of our third-party HACCP certification, with the certificate shown in the appendix.

Exemptions under Section 8 of the Act

No exemptions were in place during the year.

Undertakings under Section 30 of the Act

No undertakings were entered into or completed during the year and there were none in place from previous years.

Further information

This report and further information regarding drinking water quality is available on our website at www.melbournewater.com.au or by contacting the customer service team:

Telephone: 131 722
Translation Service: 131 450
Speak and Listen: 1300 555 727
Fax: (03) 9600 1192
Email: enquiry@melbournewater.com.au
Mail: Melbourne Water
PO Box 4342
Melbourne, Victoria 3001

Appendix

Risk management plan audit certificate

Safe Drinking Water Regulations 2015 - Regulation 10

Certificate Number: 168

Audit period: 31 May 2018 to 28 August 2020

To: Sylvia Campbell, Technical Management Systems Lead

Melbourne Water, 990 La Trobe Street, Docklands, Melbourne 3008

Australian Business Number (ABN): 81 945 386 953

I, Dr Daniel Deere, after conducting a risk management plan audit of the water supplied by Melbourne Water am of the opinion that -

Melbourne Water has complied with the obligations imposed by section 8(1) of the *Safe Drinking Water Act 2003* during the audit period.

Signature of approved auditor: DDeere Date: 28 Aug 2020



Certificate of Registration

CODEX HACCP: 2003

This is to certify that:

Melbourne Water Corporation
990 La Trobe Street
Docklands, Melbourne VIC 3008

Holds Certificate Number:

HACCP 694181

and have implemented a HACCP system according to the Codex Recommended International Code of Practice - General Principles of Food Hygiene - CAC/RCP 1-1969 (Rev. 4-2003) for the following scope:

Management of catchments, reservoirs, treatment facilities and transfer networks for the wholesale supply of drinking water and treatment facilities for the supply of Class A recycled water.

For and on behalf of BSI:



Marc Barnes, Managing Director, BSI Group ANZ

Original Registration Date: 2018-11-06

Latest Revision Date: 2021-07-30

Effective Date: 2021-03-03

Expiry Date: 2023-09-30

Page: 1 of 1

...making excellence a habit.™

This certificate was issued electronically and remains the property of BSI Group ANZ Pty Limited, ACN 078 659 211 and is bound by the conditions of contract. This certificate can be verified at www.bsi-global.com/clientdirectory. Printed copies can be validated at www.bsi-global.com/ClientDirectory. Further clarifications regarding the scope of this certificate and the applicability of CODEX HACCP: 2003 requirements may be obtained by consulting the organization. This certificate is valid only if provided original copies are in complete set.

Information and Contact: BSI Group ANZ Pty Limited, ACN 078 659 211: Suite 1, Level 1, 54 Waterloo Road, Macquarie Park, NSW 2113
A Member of the BSI Group of Companies.

Glossary

Term	Definition
Air valve	Valves installed at high points in water main which allow air trapped in mains to escape while preventing water from escaping
Aqueduct	An open channel used for water transfer between harvesting reservoirs and storage reservoirs
Bulk Water Supply Agreement	Agreements between Melbourne Water and retail water companies which outline the drinking water quality specifications required for treated water at the interface points with retail water companies.
Bulk water transfer	Transfer of raw or treated water between storage reservoirs
COVID-19	A novel Coronavirus discovered in December 2019 which was implicated in a global pandemic in 2020
<i>E. coli</i>	<i>Escherichia coli</i> , a bacteria found in the intestines of humans and animals. <i>E. coli</i> is used as an indicator for the presence of other more harmful bacteria
HACCP	Hazard Analysis Critical Control Point – a set of principles to manage risk in product quality of food and water production
Holding storage	A reservoir that receives water from a harvesting reservoir, that is used to store water prior to treatment. Water level in holding storages is controlled by Melbourne Water to meet drinking water demands.
ISO 9001	An international standard for certification of a quality management system. The standard is used by organizations to demonstrate their ability to consistently provide products and services that meet customer and regulatory requirements and to demonstrate continuous improvement.
Microbial Health-Based Target	Health-based targets are measurable health, water quality or performance objectives that are established based on a judgement of safety and on risk assessments of waterborne hazards, in this case microbial hazards.
MicroDALY	DALY stands for Disability Adjusted Life Years. It is a metric used by the World Health Organisation to quantify the impact of a burden of disease on a population. A microDALY is one millionth of one DALY.
Pathogen	A microbe (bacteria, virus or protozoa) that can cause illness or disease
Raw Water	Water that has not yet been treated
Retail water company	Water Agencies that receive treated drinking water from Melbourne Water's transfer network and supply it to customers via distribution mains
Source water	Raw water that feeds into a treatment plant which may originate from different sources (eg protected or unprotected catchments)