ANNUAL DRINKING WATER QUALITY REPORT 2018-19

South Gippsland Region Water Corporation

South Gippsland Water

Front page image of Korumburra's Coalition Creek Reservoir courtesy of David Barton.
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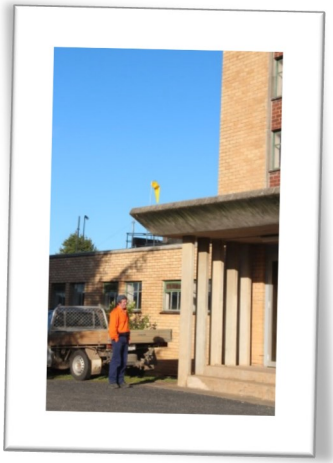

Photos: Imagery of Leongatha water treatment plant

1. Introduction

Welcome to South Gippsland Water's annual drinking water quality report for the year ending 30th June 2019. In accordance with requirements of the Safe Drinking Water Act 2003 ("the Act"), this report summarises our performance against water quality standards, provides an overview of our management practices, and describes how we respond to water quality challenges as they arise.

"Committed to the management of our water supply systems for the provision of safe, high-quality drinking water for all customers"

As part of South Gippsland Water's commitment to quality, we maintain a drinking water management system based on Hazard Analysis and Critical Control Point (HACCP) principles and the Australian Drinking Water Guidelines[1]. The system incorporates a catchment-to-tap monitoring program to ensure drinking water consistently meets legislative requirements of the Act and associated Safe Drinking Water Regulations 2015 ("the Regulations"). More information on water treatment, quality management systems and operational improvements can be found in part 2 of this report.

For the 2018-19 financial year, South Gippsland Water achieved 100 % compliance with the prescribed standards of the Regulations for turbidity and trihalomethanes. Compliance with the water quality standard for *Escherichia coli* declined slightly from last year to 97.5 %. Part 3 provides details on the related *Escherichia coli* detection and outlines corrective actions taken to address this and other water quality issues. A full summary of results from our comprehensive monitoring program is provided in Part 4.

Customer satisfaction is very important to us at South Gippsland Water and we strive to meet expectations in in terms of supplying water that is both safe *and* pleasant to drink. In doing so, we take pride in giving prompt and helpful service in response to water quality concerns. Details on the number of customer calls received in relation to drinking water quality in 2018-19, as well as information on how complaints are addressed, are provided in Part 5.

A great success story in terms of operational improvements for the 2018-19 year is the commissioning of the Lance Creek water connection pipeline. The pipeline connects the towns of Korumburra, Poowong, Loch and Nyora to the Lance Creek system, which also supplies the localities of Wonthaggi, Inverloch and Cape Paterson. With the Lance Creek system now connected to the Melbourne water supply grid, customers in all these towns are benefiting from greater water surety, reduced potential for aesthetic water quality issues, and the dental health advantages of fluoridation.

We trust you will find this report informative. For additional information on anything presented within, we invite you to contact us by phoning 1300 851 636 or emailing sgwater@sgwater.com.au

1 National Health and Medical Research Council Australian Drinking Water Guidelines 2011

Characterisation of the System

Source water system

As part of the catchment-to-tap approach to providing safe drinking water, South Gippsland Water monitors for hazards in all water supply catchments. This approach is underpinned by the preventative and multiple barrier principles described in the *Australian Drinking Water Guidelines* 2011 (ADWG). The ADWG states that "prevention of contamination provides greater surety than removal of contaminants by treatments, so the most effective barrier is protection of source waters to the maximum degree practicable."

South Gippsland Water is reliant on "open" catchments for all source water. An open catchment is one in which part or all of the rainfall catchment area is in private ownership and land usage and public access is largely unrestricted. This presents a challenge in that complete protection of source water from farm and other run-off is not possible. Crucial to our role as a water supplier is improving our catchments as much as is achievable both within our own control and by engagement with other stakeholders.

Where hazards cannot be prevented, they are managed with robust and reliable barriers. Examples of these measures are documented in our Water Supply Catchment Monitoring Assessment and Improvement Program which is integrated into the Water Safety Plan and the Drinking Water Quality Management System. The program involves coordination of activities, including catchment surveillance, river health monitoring, land use planning assessment, and Source Water and Health-Based Target reporting. The Corporation also undertakes various catchment improvement works, including tree plantings and weed control, as well as promoting the importance of source water protection to the community via stakeholder engagement programs.

South Gippsland Water system and major changes for 2018-19

The service area of South Gippsland Water (SGW) covers approximately 4,000 square kilometres of the South Gippsland region, from Wonthaggi in the west to Yarram in the east; refer to Figure 1 – Map of South Gippsland Water water supply area and systems. The total water supply operation in its entirety for 2018-19 comprised:

- 1,234 square kilometres of total catchment area
- 13 reservoirs and 4 raw water storage basins or tanks
- 10 water treatment plants
- 26 treated water distribution storages
- 18 water pumps
- 772 kilometres of water mains
- 20,550 connected properties supplying a population of approximately 37,000 permanent residents
- 4,590 megalitres (million litres) of metered water supplied to customers
- A connection pipeline from the Melbourne water grid to the Lance Creek water treatment plant

Drinking water was supplied to 22 rural centres via ten separate supply systems until late 2018. Following commencement of supply from Lance Creek water treatment plant to the Korumburra and Poowong clear water storages in November and December respectively, the Korumburra and Poowong water treatment plants

were shut-down and the total number of separate supply systems was reduced to eight; refer to Figure 1 (map).

With the decommissioning of the Korumburra and Poowong water treatment plants, the number of on-line reservoirs has also reduced from 13 to nine. While still under South Gippsland Water management, the Coalition Creek, Ness Gully, Bellview, and Little Bass Reservoirs are no longer needed for drinking water supply. The "Rethinking Reservoirs" project was initiated to determine the most appropriate outcome for each of these water bodies in terms of either continued operation and management for recreational purposes, or decommissioning for restoration of natural water courses. The project has involved consultation with community members, regulators and experts.

Another major change related to the above was the commencement in August 2018 of supply from the Melbourne water grid to the Lance Creek system. Accessed via Delivery Point 5 of the pipeline that connects the Victorian Desalination Plant at Wonthaggi to Cardinia Reservoir at Emerald, this potable water supply allows for supplementation of water treated at the Lance Creek water treatment plant. The supplementary Melbourne water —which may be of either desalination plant or Cardinia Reservoir source— is mixed with Lance Creek treated water in the clear water storage tank at the plant. Blend ratios can be altered dependent on demand and raw water quality in Lance Creek Reservoir. The ability to blend or operate exclusively with Melbourne water has allowed for better management of aesthetic water quality issues related to growth of cyanobacteria (blue-green algae) in Lance Creek Reservoir; a decline in taste and odour complaints for that system has already been observed. Details on localities and water supply systems are provided in Table 1.

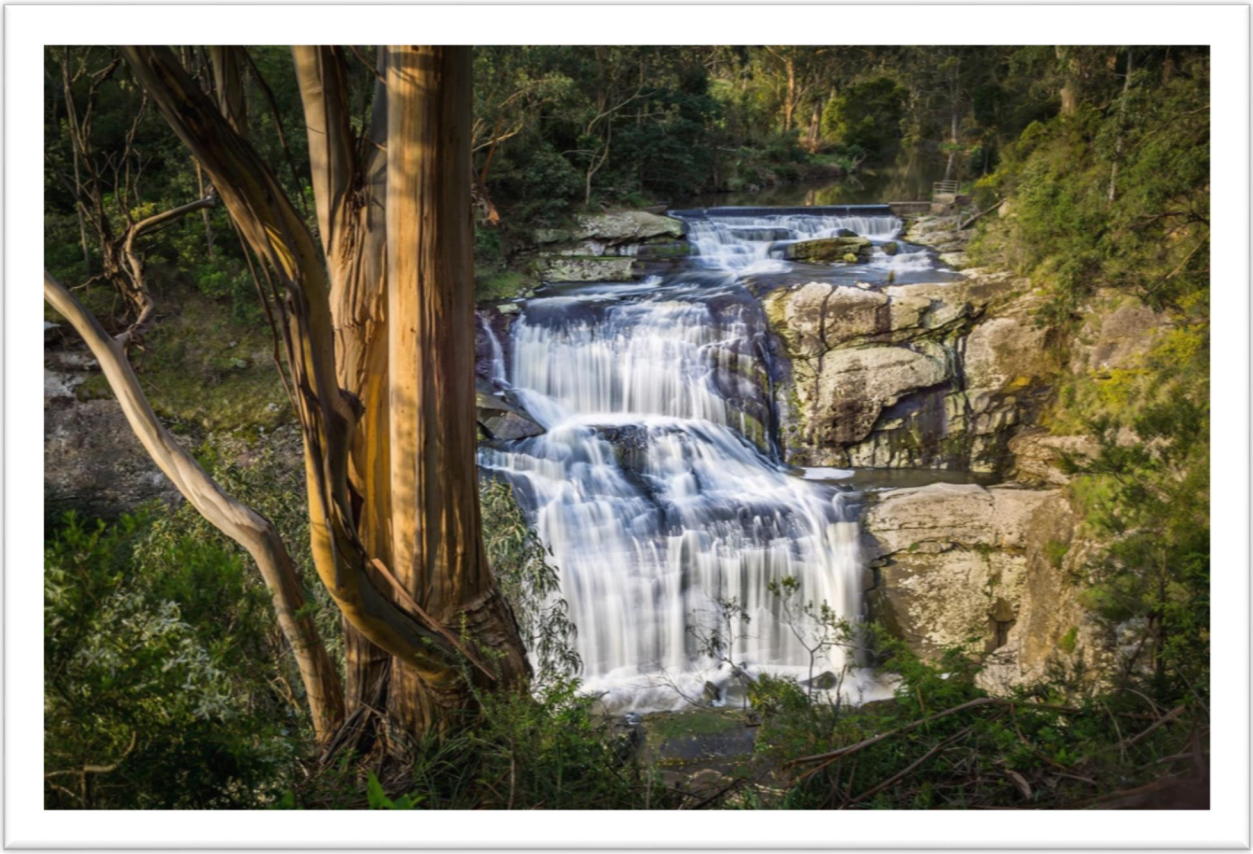

Photo: Agnes Falls (Image credit: David Barton)

Table 1: South Gippsland Water water sampling localities and supply sources

Localities supplied	Population serviced[2]	Principal raw water supply sources	Supplementary source water supply sources	Raw water storage	Water treatment plant
Alberton Yarram	560 2,480	Tarra River	Gippsland Basin groundwater aquifer (via bore, Devon North)	Devon North Raw Water Basin	Devon North
Dumbalk	410	Tarwin River (east branch)		Dumbalk Raw Water Tank	Dumbalk
Fish Creek	830	Battery Creek		Battery Creek Reservoir	Fish Creek
Foster	1,840	Deep Creek		Deep Creek Reservoir; Foster Dam; Foster Raw Water Basin	Foster
Korumburra	4,470	Coalition Creek; Bellview Creek; Ness Creek.	Tarwin River (West Branch)	Coalition Creek Reservoir; Bellview Reservoir; Ness Gully Reservoir	Korumburra[3]
Cape Paterson Inverloch Lance Creek Wonthaggi	890 5,390 100 8,680	Lance Creek	Potable water also received from Cardinia Reservoir and Victorian Desalination Plant	Lance Creek Reservoir	Lance Creek
Koonwarra Leongatha	400 5,650	Ruby Creek		No. 1 Reservoir; No. 2 Reservoir; No. 3 Reservoir (Hyland); No. 4 Reservoir (Western)	Leongatha
Meeniyan	770	Tarwin River		Meeniyan Raw Water Basin	Meeniyan
Loch Nyora Poowong	640 1,530 640	Little Bass River		Little Bass Reservoir	Poowong[4]
Port Franklin Welshpool Toora	130 540 780	Agnes River		Cooks Dam	Toora

2 Population Served based on ABS 2017 Census data. The ABS method of calculation of population is based on State Suburbs (SSC) and may not always reflect the exact sewer/water district.
3 Supply from Korumburra water treatment plant and associated reservoirs ceased November 2018 when connection to Lance Creek system was brought into operation
4 Supply from Poowong water treatment plant and Little Bass Reservoir ceased December 2018 when connection to Lance Creek system was brought into operation

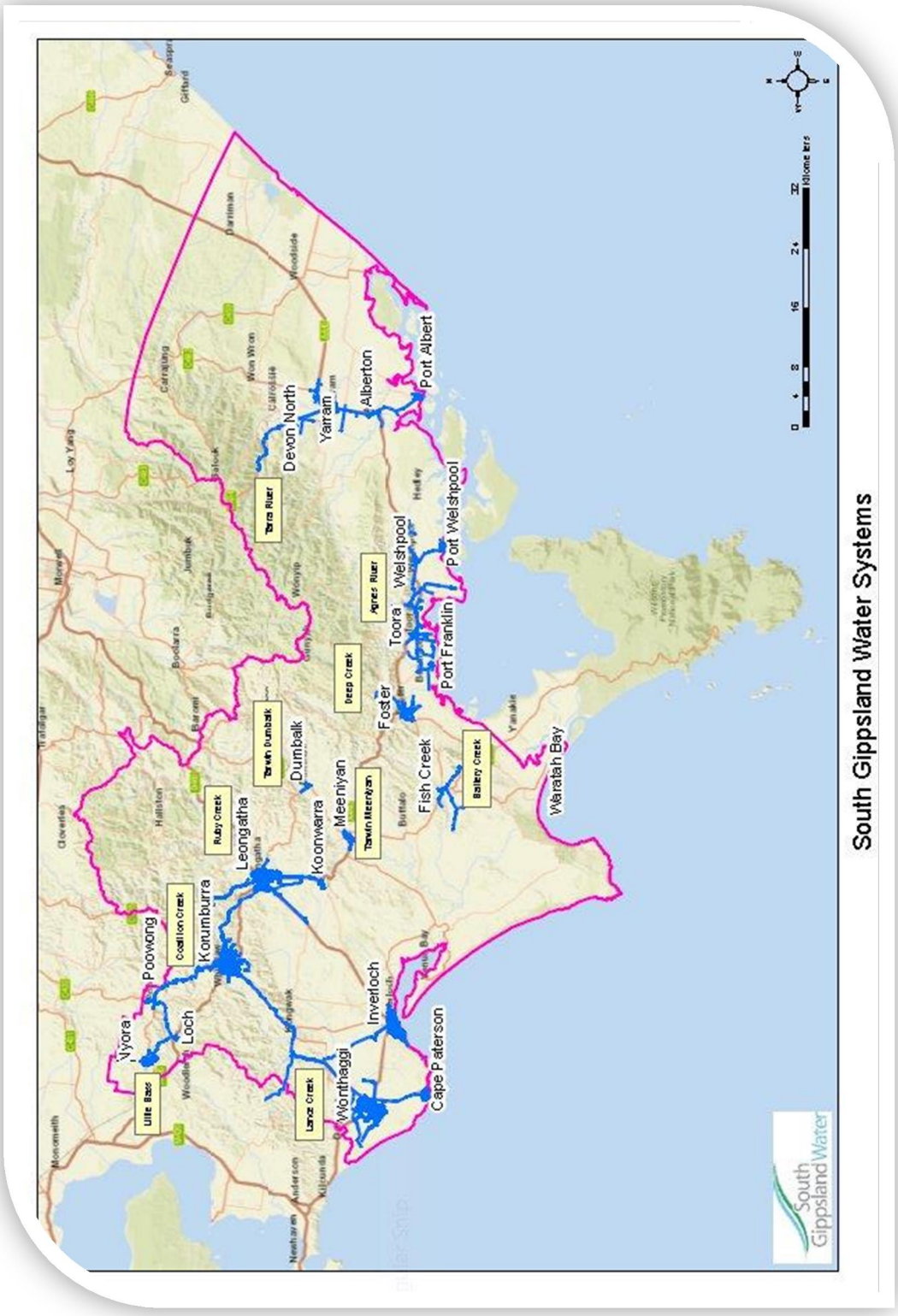

Figure 1: South Gippsland Water water supply area and systems

2. Water Treatment and Quality Management Systems

Water treatment overview

Conventional water treatment is a process whereby water is purified to a level suitable for human consumption. It generally begins with raw source water being allowed to settle in a reservoir so that natural sedimentation of large particulate matter can occur. The next step involves oxidation and precipitation of dissolved substances using aeration devices. Chemical agents are added as water flows through pipes from reservoir to the water treatment plant (WTP). The agents cause small particles to clump together into large insoluble masses known as floc in the processes of coagulation and flocculation. The floc formed is separated from water via gravitational settling or flotation. Filtration of the clarified water further reduces the load of small particles, microorganisms and other contaminants. The final step in the process is disinfection. This commonly involves the addition of chlorine-based disinfectants, but other chemical agents or ultra-violet light may also be used to ensure water supplied to customers is free of harmful microorganisms.

A summary of the processes by which the drinking water supplied by South Gippsland Water (SGW) is treated and disinfected is provided in Table 2.

Changes in water treatment and supply conditions

Lance Creek Water Connection and cessation of Korumburra and Poowong WTPs

Water treatment regimes for existing South Gippsland Water treatment plants have not varied since the previous reporting period, but there were important changes in supply conditions and water characteristics for two systems in 2018-19. These related to the termination of supply from the Korumburra and Poowong water treatment plants in late 2018 following commissioning of the newly-constructed Lance Creek water connection pipeline. The pipeline allows water to be pumped from the Lance Creek clear water storage (CWS) tank to the Korumburra CWS tank and from there to the Poowong CWS basin.

The Lance Creek supply is disinfected with monochloramine (a compound produced by mixing chlorine with ammonia) and is fluoridated by addition of fluorosilicic acid. While the towns of Poowong, Loch and Nyora were previously supplied with similarly chloraminated water from the Poowong water treatment plant, the Korumburra supply was disinfected with gaseous chlorine only. The supply of water that is fluoridated to all the above-mentioned towns also represents a major change. A community notification process preceded the introduction of fluoridation and chloramination.

Supplementary supply to Lance Creek clear water storage from Melbourne Water

In August 2018 the Lance Creek CWS tank began receiving water from the Melbourne water supply system via Delivery Point 5 (DP5) of the desalination pipeline. This supplemental source of water can be via either "forward flow" from the Victorian Desalination Plant at Wonthaggi or "reverse flow" from Cardinia Reservoir

at Emerald. While the treatment regime varies dependent on source, flow from either direction provides potable water which has been purified, chlorinated, fluoridated and pH-corrected. The supplementary supply can be either blended with water treated at Lance Creek WTP, used exclusively, or not used at all dependent on water demand, raw water quality in Lance Creek Reservoir and bulk entitlement limitations. Prior to entering the CWS tank, water received via DP5 can be re-chlorinated and pH corrected as required. There is also capacity to divert water received from DP5 to Lance Creek Reservoir.

Photos: Imagery of Lance Creek reservoir, water treatment plant and clear water storage tank

Table 2: List of processes and chemicals used to treat and disinfect water supplied by SGW[5]

Water Treatment Plant (WTP)	Localities supplied	Treatment process	Treatment frequency	Added substances
Devon North	Alberton Yarram	Pre-treatment pH correction Manganese oxidation Coagulation and flocculation Dissolved air flotation clarification Filtration by granular medium Chloramine disinfection Dewatering of waste water	As required As required Regular Regular Regular Regular Regular	Sodium carbonate Potassium permanganate Aluminium sulphate / aluminium chlorohydrate - - Sodium hypochlorite and ammonia -
Dumbalk	Dumbalk	Pre-treatment pH correction Manganese oxidation Coagulation and flocculation Sedimentation clarification Filtration by granular medium Ultraviolet (UV) disinfection Primary chlorination disinfection Secondary chlorination disinfection Removal of volatile organics by aeration Dewatering of waste water	Regular As required Regular Regular Regular Regular Regular Regular Regular Regular	Sodium carbonate Potassium permanganate Aluminium chlorohydrate - - - Sodium hypochlorite Sodium hypochlorite - Anionic polyacrylamide
Fish Creek	Fish Creek	Pre-treatment pH correction Manganese oxidation Coagulation and flocculation Sedimentation clarification Filtration by granular medium Post-treatment pH correction Primary chlorination disinfection Removal of volatile organics by aeration Secondary chlorination disinfection Dewatering of waste water	Regular As required Regular Regular Regular Regular Regular Regular Regular Regular	Sodium carbonate Potassium permanganate Aluminium sulphate - Anionic polyacrylamide Sodium carbonate Sodium hypochlorite - Sodium hypochlorite -
Foster	Foster	Taste and odour control Pre-treatment pH correction Manganese oxidation Coagulation and flocculation Sedimentation clarification Filtration by granular medium Post-treatment pH correction Primary chlorination disinfection Secondary chlorination disinfection Dewatering of waste water	As required Regular As required Regular Regular Regular Regular Regular Regular Regular	Powdered activated carbon Sodium carbonate Potassium permanganate Aluminium sulphate / aluminium chlorohydrate - - Sodium carbonate Chlorine (gas) Sodium hypochlorite -
Korumburra[6]	Korumburra	Taste and odour control Pre-treatment pH correction Manganese oxidation Coagulation and flocculation Sedimentation clarification Filtration by granular medium Manganese sequestration Primary chlorination disinfection Secondary chlorination disinfection Dewatering of waste water	As required Regular As required Regular Regular Regular As required Regular Regular Regular	Powdered activated carbon Sodium carbonate Potassium permanganate Aluminium chlorohydrate Cationic polyacrylamide - Sodium hexametaphosphate Chlorine (gas) Chlorine (gas) -

Table 2 continues over page

[5] Refer to Glossary at end of report for further information

[6] Korumburra WTP operation ceased November 2018 following commencement of water supply from Lance Creek WTP

Table 2 (continued): List of processes and chemicals used to treat and disinfect water supplied by SGW

Water Treatment Plant (WTP)	Localities supplied	Treatment process	Treatment frequency	Added substances
Lance Creek	**Cape Paterson Inverloch Lance Creek Wonthaggi**	**Taste and odour control** **Pre-treatment pH correction** **Manganese oxidation** **Coagulation and flocculation** **Dissolved air flotation clarification** **Filtration by granular medium** **Post-treatment pH correction** **Fluoridation** **Primary chlorination disinfection*** **Secondary chloramination disinfection** **Dewatering of waste water**	As required As required As required Regular Regular Regular Regular Regular Regular Regular Regular	**Powdered activated carbon** **Sodium hydroxide / hydrochloric acid** **Potassium permanganate** **Aluminium sulphate / aluminium chlorohydrate** **-** **-** **Sodium hydroxide** **Hexafluorosilicic acid** **Chlorine (gas)** **Chlorine (gas) and ammonia** **Anionic polyacrylamide**
Leongatha	**Koonwarra Leongatha**	**Taste and odour control** **Pre-treatment pH correction** **Manganese oxidation** **Coagulation and flocculation** **Sedimentation clarification** **Filtration by granular medium** **Post-treatment pH correction** **Primary chlorination disinfection** **Secondary chlorination disinfection** **Dewatering of waste water**	As required Regular As required Regular Regular Regular Regular Regular Regular Regular	**Powdered activated carbon** **Sodium hydroxide** **Potassium permanganate** **Aluminium sulphate** **-** **-** **Sodium hydroxide** **Chlorine (gas)** **Chlorine (gas)** **-**
Meeniyan	**Meeniyan**	**Manganese oxidation** **Coagulation and flocculation** **Sedimentation clarification** **Filtration by granular medium** **Chlorination disinfection** **Ultraviolet (UV) disinfection** **Removal of volatile organics by aeration** **Dewatering of waste water**	As required Regular Regular Regular Regular Regular Regular Regular	**Sodium hypochlorite** **Aluminium chlorohydrate** **Anionic polyacrylamide** **-** **Sodium hypochlorite** **-** **-** **Anionic polyacrylamide**
Poowong[7]	**Loch Nyora Poowong**	**Taste and odour control** **Pre-treatment pH correction** **Manganese oxidation** **Coagulation and flocculation** **Sedimentation clarification** **Filtration by granular medium** **Post treatment pH correction** **Chloramination disinfection** **Dewatering of waste water**	As required As required As required Regular Regular Regular Regular Regular Regular	**Powdered activated carbon** **Sodium carbonate** **Potassium permanganate** **Aluminium sulphate** **Anionic polyacrylamide** **-** **Sodium hypochlorite** **Sodium hypochlorite and ammonia** **-**
Toora	**Port Franklin Port Welshpool Toora**	**Taste and odour control** **Pre-treatment pH correction** **Manganese oxidation** **Coagulation and flocculation** **Sedimentation clarification** **Filtration by granular medium** **Post treatment pH correction** **Chlorination disinfection** **Dewatering of waste water**	As required As required As required Regular Regular Regular Regular Regular Regular	**Powdered activated carbon** **Sodium carbonate** **Potassium permanganate** **Aluminium sulphate** **-** **-** **Sodium hypochlorite** **Chlorine (gas)** **-**

[7] **Poowong WTP operation ceased December 2018 following commencement of water supply from Lance Creek WTP**

Table 3: List of processes and chemicals used to treat and disinfect supplementary supply from Melbourne Water to Lance Creek clear water storage

Source water / Catchment	Storage / Transfer	Treatment process	Treatment frequency	Added substances
Transfer from Silvan Reservoir without being treated at Silvan WTP	**Cardinia Reservoir**	**Disinfection** **Fluoridation** **pH Correction** **Secondary disinfection** **Secondary pH correction**	**Regular** **Regular** **Regular** **Regular** **Regular**	**Chlorine gas (Cl_2)** **Fluorosilicic acid (FSA)** **Lime (Calcium oxide)** **Sodium hypochlorite** **Carbon dioxide**
Bass Strait sea water via Desalination Plant offtake	**Direct to supply or Cardinia Reservoir**	**Coagulation** **Filtration** **Reverse osmosis** **Remineralisation** **Fluoridation** **Disinfection** **Sludge thickening** **Membrane preservations**	**Regular** **Regular** **Regular** **Regular** **Regular** **Regular** **Regular** **Regular**	**Ferric sulphate, Sulfuric acid, PolyDADMAC*** **--** **Antiscalant, Sodium hydroxide** **Hydrated lime (Calcium dioxide), Carbon dioxide** **Fluorosilicic acid (FSA)** **Sodium hypochlorite** **Ferric sulphate. Polyacrylamide** **Sodium bisulphite**
Melbourne Water Delivery point 5 (DP5) of desalination pipeline	**Transfer pipeline from DP5 to Lance Creek clear water storage tank**	**pH Correction** **Disinfection**	**As required** **As required**	**Hydrochloric Acid, Sodium hydroxide** **Chlorine gas (Cl_2)**

***Polydiallydimethylammonium chloride**

Water Treatment Issues

Continual process monitoring and jar tests are used in water treatment plant laboratories to simulate plant conditions and ensure correct dosage of treatment chemicals. This enables optimisation of treatment processes in response to changes in raw water quality and other factors. Occasionally issues arise out of the application of water treatment processes and corrective actions must be taken.

There were three fluoridation outages for periods greater than 72 hours at Lance Creek water treatment plant (WTP) 2018-19. These were reported to the Department of Health and Human Services in accordance with the Code of practice for fluoridation of drinking water supplies. The outages related to intentional shut-downs of the fluorosilicic acid dosing system; refer to Table 4.

Table 4: Water Treatment Issues

Issue	Location	Date	Summary
Fluoridation outage greater than 72 hours	Lance Creek WTP	2/11/2018 to 15/11/2018	Fluoride analyser fault – replacement required
Fluoridation outage greater than 72 hours	Lance Creek WTP	20/12/2018 to 07/01/2019	Fluoride dosing pump failure - replacement required
Fluoridation outage greater than 72 hours	Lance Creek WTP	6/06/2019 to 28/06/2019	Safety concern for operators due to expiry of hexafluoride extinguishers – new extinguishers procured

Quality Management Systems and Continual Improvement

The risk management approach adopted by South Gippsland Water is based on the twelve elements of the Framework for Management of Drinking Water Quality as described in the *Australian Drinking Water Guidelines.* A number of on-going programs and practices form part of the risk management system. These are designed to ensure treatment plants and water supply distribution systems are operating optimally at all times; examples are as follows:

- Filter management program
- Backflow prevention program
- Regular site security checks of all water treatment facilities and distribution system water storages
- Procedures in relation to hygienic mains break repair and replacement
- Proactive mains flushing and air-scouring programs
- Hydrant replacement program

The risk management system also includes a commitment to continual improvement, with the aim of achieving best practice in the delivery of drinking water to customers. Training, attendance at seminars, and membership of peak industry bodies (including the Australian Water Association, the Water Industry Operators Association, and the Water Services Association of Australia) ensure all employees involved in water treatment and quality assurance are well-informed about drinking water-related research, and advances in technologies and practices.

Photo: Water Treatment Plant Operator conducts a jar test

3. Emergency, Incident and Event Management

Incidents reported under the Safe Drinking Water Act

Section 22 of the *Safe Drinking Water Act* 2003 (the Act) requires a water supplier to immediately notify the Department of Health and Human Services (the Department) of any circumstances where it is believed that drinking water supplied to the public may be the cause of an illness, pose a risk to human health or cause widespread public complaint. Section 18 of the Act requires a water supplier to notify the Department when it becomes aware that the drinking water it is supplying to another person does not comply, or is not likely to comply, with any relevant water quality standard. Based on this requirement, the incidents described in this section have been reported to the Department in the 2018-19 reporting period. Table 5 provides a summary of the events reported under sections 22 and 18 of the Act.

Table 5: Summary of events reported to the Department of Health and Human Services under sections 22 and 18 of the Safe Drinking Water Act 2003

Water sampling locality affected	Type of notification	Date of incident	Location of Incident	Nature of incident	Nature of known or suspected contamination / cause of incident
Poowong	Section 22	23/4/2019 to 24/4/2019	Poowong water tower outlet	*Escherichia coli* (*E. coli*) detection for routinely-collected sample	Isolated, low-level (2 orgs/100mL) *E. coli* detection – source unknown. Possible entry through hole in tank roof
Poowong	Section 18 (related to above section 22 reported incident)	As above	As above	Water sampling locality of Poowong not compliant with drinking water quality standard for *Escherichia coli*	As above
Leongatha	Section 22	23/5/2019 to 12/6/2019	Leongatha distribution system	Widespread customer complaint due to earthy taste and odour	Geosmin – cyanobacterial metabolite. Low reservoir storage volume a likely contributor to the issue.

Escherichia coli detection – Poowong

The Department of Health and Human Services was notified in accordance with section 22 of the Safe Drinking Water Act of *Escherichia coli* (*E. coli*) detection at the Poowong water tower outlet. The detection of the bacterium at a level of 2 orgs/100 ml was recorded for a routine weekly sample collected on the 23rd April 2019. Immediate corrective actions involved flushing 20,000 litres of water in the tower to waste for replacement with water from the Poowong clear water storage basin.

There were no other detections for routine samples collected at two sites in Poowong on the same day as the non-conforming sample, nor were there any for investigative samples collected at four sites (including the tower outlet) in the town the following day. While this suggested the presence of *E. coli* was isolated in terms of duration and location, and no treatment failures at the supplying Lance Creek water treatment plant were indicated, the incident was recorded as a non-compliance with the water quality standard for Poowong. A notification under section 18 of the Act was submitted to the department accordingly.

It was determined from investigation that the presence of *E. coli* could most likely be attributed to low water turnover in the tower, consequent loss of disinfection residual, and possible ingress of contaminants through a small hole in the tank roof.

With the hole now repaired, close monitoring and management of disinfection residual with proactive flushing is in place while longer-term options for hydraulics improvement are investigated.

Widespread customer complaint due to taste and odour – Leongatha

The Department was informed of widespread public complaint due to unpleasant taste and odour for Leongatha in May 2019. The taste and odour can be attributed to the presence of geosmin in the supplying Ruby Creek reservoir system at a level above the human taste threshold. Geosmin is a non-toxic, earthy-flavoured compound produced by cyanobacteria (blue-green algae) and other microorganisms. Mild autumn conditions, low rainfall and consequent reduced storage volume in the reservoir system is likely to have contributed to the issue. Such conditions tend to favour cyanobacterial growth and concentration of algal compounds within the water body.

In response to the taste and odour issue, powdered activated carbon (PAC) dosing was implemented at the Leongatha water treatment plant. Geosmin molecules adsorb to the surfaces of the activated carbon particles and are effectively removed from the water. A directed water main flushing program was also carried out to expedite replacement of earthy-tasting water in the system.

There were 17 complaints in relation to the issue received in the period 23rd May to 12th June 2019. Refer to Part 5 for information on customer complaint management.

4. Drinking Water Quality Standards

During the 2018-19 reporting period, South Gippsland Water implemented water quality monitoring programs consistent with requirements of the *Safe Drinking Water Act 2003* (the Act) and associated Safe Drinking Water Regulations 2015 (the Regulations).

Schedule 2 of the Regulations lists three water quality parameters —*Escherichia coli*, trihalomethanes (total), and turbidity —and stipulates both the sampling frequency required for each parameter and the acceptable standard with which collected and tested samples must comply. As specified in the Regulations, mandatory samples must be collected from the drinking water supply at relevant frequencies and analysed for performance against water quality standards as shown in Table 6 below.

Table 6: Drinking water quality standards and required sampling frequencies as defined in Schedule 2 of the Safe Drinking Water Regulations 2015

Parameter	Relevant sampling frequency for each water sampling locality	Quality standard for each water sampling locality
Escherichia coli	One sample per week	All samples of drinking water collected are found to contain no Escherichia coli per 100 millilitres of drinking water, with the exception of any false positive sample. For the purposes of this quality standard, ***a false positive sample*** means a sample that is found, after an analysis conducted in accordance with regulation 14, to contain *Escherichia coli* per 100 millilitres of drinking water, if--- **a)** following the analysis, the water supplier has conducted an investigation, which has been conducted in accordance with any guidelines issued by the Secretary in relation to such investigations, including any timeframes for commencement and completion of the investigations, to ascertain whether the results for the analysis are representative of water in the relevant sampling locality; and **b)** the water supplier has reported the results of the investigation to the Secretary in relation to such reports, including any timeframes for provision of the report; and **c)** the investigation has concluded that the results of the analysis conducted in accordance with regulation 14 were not representative of the water in the relevant water sampling locality because the investigation established that— (i) all other factors that would indicate the presence of *Escherichia coli* are not present in that water in the water sampling locality at the time of the investigation; and (ii) the drinking water treatment process applied, or other specified actions taken by the water supplier, are such as would be reasonably expected to have eliminated the presence of Escherichia coli in the water sampling locality at the relevant time; and (iii) all plant and infrastructure associated with the water treatment process were operating to specification at all relevant times; and (iv) there were no issues arising from degradation of plant or infrastructure in or around the relevant water sampling locality that could reasonably be suspected to have contributed to the presence of *Escherichia coli* in the drinking water in that water sampling locality. A sample analysed in accordance with regulation 14 that is found, on that analysis, to contain *Escherichia coli* per 100 millilitres of drinking water is not a false positive sample unless all of the circumstances in paragraphs (a), (b) and (c) apply.
Trihalomethanes (total)	One sample per month	Less than or equal to 0.25 milligrams per litre of drinking water
Turbidity	One sample per week	The 95 percentile of results for samples in any 12-month period must be less than or equal to 5.0 Nephelometric Turbidity Units

Analysis Results – Schedule 2 parameters

The results of analysis for Schedule 2 parameters for 2018-19 are summarised in Tables 7 to 9.

Section 23 of the Act requires that a water supplier make available for inspection by the public the results of any water quality monitoring program that is conducted on any drinking water it supplies. Customers and members of the public may access drinking water quality data by telephoning South Gippsland Water Customer Service on 1300 851 636, or by emailing **sgwater@sgwater.com.au**

Escherichia coli

Escherichia coli (E. coli) is used as a specific indicator of faecal contamination to determine the safety of water for drinking. For the quality standard for each water sampling locality to be met with respect to *E. coli*, then all samples of drinking water collected must have been found to contain no *E. coli* per 100 millilitres of drinking water, with the exception of any false positive sample (refer to Table 6 above for definition of "*false positive sample*").

Results: *Escherichia coli*

Monitoring for *E. coli* for the 2018-19 reporting period was conducted in accordance with requirements of the Regulations and South Gippsland Water's risk-based monitoring program. The program specifies which sites are to be sampled and at what frequencies. Samples for *E. coli* analysis are collected weekly from a range of different sampling sites and locations including dedicated customer tap sites, clear water storages (CWS), and process water from water treatment plants. Other sites in distribution systems, such as upstream and downstream of secondary disinfection dosing units, and at the inlets and outlets of CWS tanks and basins are also sampled on a weekly or less-frequent basis.

Compliance with the water quality standard for *E. coli* is based on monitoring of drinking water as it is supplied to customers. For some localities, this includes the results of distribution clear water storage sample analysis (where there is not a more representative site downstream of the storage) in addition to those from customer tap sample analysis. All but one sample of drinking water collected were found to contain no *Escherichia coli* per 100 millilitres of drinking water. Results of *E. coli* compliance monitoring are presented in Table 7. Refer to part 3 for details on the detection of *E. coli* in the water sampling locality of Poowong in April 2019.

Table 7: Escherichia coli results for 2018-19

Water Sampling Locality	Minimum Customer tap sampling frequency (samples per time period)	Minimum Clear water storage outlet sampling frequency (samples per time period)	Total number of samples collected in compliance period	Average result (Orgs/100mL)	Maximum result (Orgs/100mL)	Number of samples where standard was not met
Alberton	one/week	-	52	0	0	0
Cape Paterson	one/week	one/week	104	0	0	0
Dumbalk	one/week	one/week	104	0	0	0
Fish Creek	one/week	one/week	104	0	0	0
Foster	one/week	one/week	104	0	0	0
Inverloch	two/week	one/week	155*	0	0	0
Koonwarra	one/week	-	52	0	0	0
Korumburra	one/week	two/week	156	0	0	0
Lance Creek	one/week	one/week	104	0	0	0
Leongatha	two/week	one/week	156	0	0	0
Loch	one/week	one/week	104	0	0	0
Meeniyan	one/week	one/week	104	0	0	0
Nyora	one/week	-	52	0	0	0
Poowong	one/week	two/week	162	0	2	1
Port Franklin	one/week	-	52	0	0	0
Port Welshpool	one/week	-	52	0	0	0
Toora	one/week	two/week	156	0	0	0
Wonthaggi	two/week	one/week	156	0	0	0
Yarram	one/week	one/week	104	0	0	0

*One sample was not taken from the Inverloch tank outlet site due to site access safety concerns –refer to comment below.

Non-compliance with Regulation 13(1) of the Safe Drinking water Regulations

The Safe Drinking Water Regulations 2015 - regulation 13(1) states that in relation to the frequency of sampling for drinking water, "*A water supplier must collect, or cause to be collected, samples of drinking water, in accordance with the sampling program set out in the water supplier's current risk management plan, and in any case at a frequency not less than the relevant sampling frequency.*"

One sample was not taken from the Inverloch tank outlet site in accordance with SGW's risk-based monitoring program, and hence a non-compliance with Regulation 13(1) has been recorded with the Department of Health and Human Services. The site could not be accessed due to concerns that livestock hovering around an access gate would escape and cause a safety issue. Given that two customer tap samples from Inverloch were taken in accordance with the Regulations on this day and that these samples were representative of the water supply, the non-collection of one sample is not deemed significant from a drinking water safety perspective. South Gippsland Water's risk-based monitoring program will be updated to incorporate some flexibility with respect to sampling from clear water storage sites where there are occasional access difficulties and no alternative site can be sampled.

Photos: Water Quality Officers carry out routine weekly water supply monitoring in Loch

Trihalomethanes

Trihalomethanes (THMs) are organic chemical compounds in which three of the four hydrogen atoms of methane (CH_4) are replaced by halogen atoms. The compounds may be present in drinking water principally as a result of chlorination or, to a much lesser extent, chloramination. Chlorine forms hypochlorous acid when added to water, and can react with naturally-occurring organic material to produce the trihalomethane species trichloromethane (chloroform), bromodichloromethane, dibromochloromethane, and tribromomethane (bromoform)

The ADWG states that, "Based on health considerations, the concentration of trihalomethanes, either individually or in total, in drinking water should not exceed 0.25 mg/L. Trihalomethane concentrations fluctuating occasionally (for a day or two annually) up to 1 mg/L are unlikely to pose a significant health risk. Action to reduce trihalomethanes is encouraged, but must not compromise disinfection, as non-disinfected water poses significantly greater risk than Trihalomethanes."

Total trihalomethanes results for 2018-19

For the year ending 30th June 2019, testing for trihalomethanes was conducted in accordance with the Regulations and South Gippsland Water's risk-based monitoring program. There were no exceedances of the regulatory limit of 0.25 mg/L; results are presented in Table 8.

Table 8: Trihalomethanes (total) results for 2018-19

Water Sampling Locality	Customer tap sampling frequency (samples per time period)	Number of Clear water storage Outlet samples taken	Total number of samples collected in compliance period	Average result (mg/L)	Maximum result (mg/L)	Number of samples where standard was not met
Alberton	**one/month**	**0**	**12**	**0.059**	**0.130**	**0**
Cape Paterson	**one/month**	**0**	**12**	**0.095**	**0.130**	**0**
Dumbalk	**one/month**	**0**	**12**	**0.091**	**0.170**	**0**
Fish Creek	**one/month**	**24**	**36**	**0.132**	**0.200**	**0**
Foster	**one/month**	**0**	**12**	**0.106**	**0.140**	**0**
Inverloch	**one/month**	**0**	**12**	**0.098**	**0.130**	**0**
Koonwarra	**one/month**	**0**	**12**	**0.123**	**0.160**	**0**
Korumburra	**one/month**	**0**	**12**	**0.077**	**0.110**	**0**
Lance Creek	**one/month**	**0**	**12**	**0.098**	**0.120**	**0**
Leongatha	**one/month**	**0**	**12**	**0.104**	**0.140**	**0**
Loch	**one/month**	**0**	**12**	**0.034**	**0.070**	**0**
Meeniyan	**one/month**	**0**	**12**	**0.104**	**0.170**	**0**
Nyora	**one/month**	**0**	**12**	**0.045**	**0.098**	**0**
Poowong	**one/month**	**0**	**12**	**0.036**	**0.096**	**0**
Port Franklin	**one/month**	**0**	**12**	**0.099**	**0.140**	**0**
Port Welshpool	**one/month**	**0**	**12**	**0.075**	**0.110**	**0**
Toora	**one/month**	**0**	**12**	**0.076**	**0.120**	**0**
Wonthaggi	**one/month**	**0**	**12**	**0.098**	**0.130**	**0**
Yarram	**one/month**	**0**	**12**	**0.059**	**0.140**	**0**

Turbidity

Turbidity is the measurement of the light-scattering property of water which is dependent on the amount, size and composition of fine suspended matter. The Safe Drinking Water Regulations 2015 specify that the 95th percentile of results for samples in any 12-month period must be less than or equal to 5.0 Nephelometric Turbidity Units (NTU).

Results: Turbidity

Monitoring for compliance with the water quality standard for turbidity was conducted in accordance with the Regulations and South Gippsland Water's risk-based monitoring program. Turbidity results are presented in Table 9.

Table 9: Turbidity Results 2018-19

Water Sampling Locality	Customer tap sampling frequency (samples per time period)	Total number of samples collected in compliance period	Maximum turbidity in a sample (NTU)	Maximum 95th percentile of turbidity results in any 12 months	Number of 95th percentile of results in any 12 months above standard
Alberton	**one/week**	**52**	**0.4**	**0.2**	**0**
Cape Paterson	**one/week**	**52**	**0.4**	**0.2**	**0**
Dumbalk	**one/week**	**52**	**0.4**	**0.2**	**0**
Fish Creek	**one/week**	**52**	**0.9**	**0.2**	**0**
Foster	**one/week**	**52**	**0.2**	**0.2**	**0**
Inverloch	**two/week**	**104**	**0.3**	**0.2**	**0**
Koonwarra	**one/week**	**52**	**0.4**	**0.1**	**0**
Korumburra	**one/week**	**52**	**1.0**	**0.3**	**0**
Lance Creek	**one/week**	**52**	**1.5**	**0.3**	**0**
Leongatha	**two/week**	**104**	**0.4**	**0.2**	**0**
Loch	**one/week**	**52**	**0.2**	**0.2**	**0**
Meeniyan	**one/week**	**52**	**0.4**	**0.2**	**0**
Nyora	**one/week**	**52**	**0.3**	**0.2**	**0**
Poowong	**one/week**	**52**	**0.4**	**0.2**	**0**
Port Franklin	**one/week**	**52**	**0.2**	**0.2**	**0**
Pt Welshpool	**one/week**	**52**	**0.4**	**0.2**	**0**
Toora	**one/week**	**52**	**0.5**	**0.3**	**0**
Wonthaggi	**two/week**	**104**	**0.5**	**0.2**	**0**
Yarram	**one/week**	**52**	**0.3**	**0.2**	**0**

Analysis Results - Other water quality standards (algal toxin, pathogen, chemical or substance that may pose a risk to human health)

As part of South Gippsland Water's drinking water quality management system, specific water quality parameters that have the potential to affect human health are monitored. These parameters are measured against standard values defined in the *Australian Drinking Water Guidelines 2011* (ADWG). As many of these parameters do not change significantly over time or through water supply systems, frequent monitoring is not required. Results are summarised in Tables 10 to 26.

Section 23 of the Act requires that a water supplier make available for inspection by the public the results of any water quality monitoring program that is conducted on any drinking water it supplies. Customers and members of the public may access drinking water quality data by telephoning South Gippsland Water Customer Service on 1300 851 636, or by emailing **sgwater@sgwater.com.au**

Aluminium (acid-soluble and total)

Aluminium may be present in drinking water where aluminium salts are used as coagulants in water treatment processes to destabilise particles in water. Water quality performance with respect to aluminium was measured against the ADWG aesthetic guideline value of 0.2 mg/L. As stated in the ADWG, "no health-based guideline is set for aluminium at this time but this issue will be kept under review." A summary of aluminium results is presented in Tables 10 and 11.

Change to aluminium monitoring

Aluminium is monitored in accordance with South Gippsland Water's risk-based monitoring program. With a view to reducing analysis costs, monthly monitoring for acid-soluble aluminium at customer tap sites was replaced with monthly monitoring for total aluminium. Weekly monitoring of acid-soluble aluminium at water treatment plant clear water storage sites was not changed. For further information regarding aluminium in drinking water, refer to the ADWG.

Photos: Water Quality Officers carry out routine weekly water supply monitoring in Loch

Table 10: Aluminium (acid-soluble) results in the period 1st July to 31st Dec 2018

Water Sampling Locality	Minimum frequency of sampling (samples per time period)	Customer Tap samples collected	Aesthetic drinking water quality guideline (mg/L)	Average result (mg/L)	Maximum Result (mg/L)	Number of samples where guideline was not met
Alberton	one/month	6	0.2	0.04	0.12	0
Cape Paterson	one/month	6	0.2	0.03	0.04	0
Dumbalk	one/month	6	0.2	0.01	0.02	0
Fish Creek	one/month	6	0.2	0.02	0.03	0
Foster	one/month	6	0.2	<0.01	<0.01	0
Inverloch	one/month	6	0.2	0.03	0.05	0
Koonwarra	one/month	6	0.2	<0.01	<0.01	0
Korumburra	one/month	6	0.2	0.02	0.04	0
Lance Creek	one/month	6	0.2	0.03	0.06	0
Leongatha	one/month	6	0.2	0.01	0.02	0
Loch	one/month	6	0.2	0.02	0.03	0
Meeniyan	two/month	9	0.2	0.07	0.14	0
Nyora	one/month	6	0.2	0.01	0.05	0
Poowong	one/month	6	0.2	0.02	0.04	0
Port Franklin	one/month	6	0.2	0.01	0.02	0
Port Welshpool	one/month	6	0.2	<0.01	<0.01	0
Toora	one/month	6	0.2	0.01	0.02	0
Wonthaggi	one/month	6	0.2	0.02	0.06	0
Yarram	one/month	6	0.2	0.01	0.05	0

Table 11: Aluminium –Total results in the period 1st Jan to 30th June 2019

Water Sampling Locality	Frequency of sampling (samples per time period)	Customer Tap samples collected	Aesthetic drinking water quality guideline (mg/L)	Average result (mg/L)	Maximum Result (mg/L)	Number of samples where guideline was not met
Alberton	one/month	6	0.2	0.02	0.22	0
Cape Paterson	one/month	6	0.2	0.03	0.05	0
Dumbalk	one/month	6	0.2	<0.01	<0.01	0
Fish Creek	one/month	6	0.2	0.03	0.08	0
Foster	one/month	6	0.2	<0.01	<0.01	0
Inverloch	one/month	6	0.2	0.03	0.04	0
Koonwarra	one/month	6	0.2	0.01	0.02	0
Korumburra	one/month	6	0.2	0.04	0.05	0
Lance Creek	one/month	6	0.2	0.03	0.04	0
Leongatha	one/month	6	0.2	0.01	0.02	0
Loch	one/month	6	0.2	0.03	0.04	0
Meeniyan	one/month	6	0.2	0.06	0.10	0
Nyora	one/month	6	0.2	0.03	0.04	0
Poowong	one/month	6	0.2	0.03	0.05	0
Port Franklin	one/month	6	0.2	0.02	0.02	0
Port Welshpool	one/month	6	0.2	0.02	0.03	0
Toora	one/month	6	0.2	0.02	0.03	0
Wonthaggi	one/month	6	0.2	0.03	0.04	0
Yarram	one/month	6	0.2	0.09	0.17	0

Arsenic

Arsenic is a naturally-occurring element which can be introduced to water through dissolution of minerals and ores, or from industrial effluent, atmospheric deposition, drainage from old gold mines or the use of some types of sheep dip. The ADWG specify that, from a health perspective, the concentration of arsenic should not exceed 0.01 mg/L. Water supplied by South Gippsland water complied with the ADWG guideline value for arsenic, with all results indicating levels were below detection limits; refer to Table 12.

Table 12: Arsenic results for 2018-19

Water treatment plant / system	Locality supplied	Sampling frequency (samples per time period)	Total number of samples	Drinking water quality guideline (mg/L)	Result (mg/L)	Number of samples where guideline was not met
Devon North	Alberton Yarram	one/year	1	0.01	<0.001	0
Dumbalk	Dumbalk	one/year	1	0.01	<0.001	0
Fish Creek	Fish Creek	one/year	1	0.01	<0.001	0
Foster	Foster	one/year	1	0.01	<0.001	0
Korumburra	Korumburra	one/year	1	0.01	<0.001	0
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	one/year	1	0.01	<0.001	0
Leongatha	Leongatha Koonwarra	one/year	1	0.01	<0.001	0
Meeniyan	Meeniyan	one/year	1	0.01	<0.001	0
Poowong	Loch Nyora Poowong	one/year	1	0.01	<0.001	0
Toora	Port Franklin Port Welshpool Toora	one/year	1	0.01	<0.001	0

Copper

Copper is naturally distributed in rocks and soils. It may also be present in drinking water where aggressive waters of low pH and hardness induce corrosion of copper pipes. The ADWG specify that the concentration of copper should not exceed 1 mg/L based on aesthetic considerations, and 2 mg/L based on health considerations. Water supplied by South Gippsland Water complied with both the aesthetic-based and health-based guideline values for copper; refer to Table 13.

Table 13: Copper results for 2018-19

Water Sampling Locality	Frequency of sampling (samples per time period)	Customer Tap samples collected	Drinking water quality health guideline (mg/L)	Average result (mg/L)	Maximum result (mg/L)	Number of samples where guideline was not met
Alberton	**one/quarter**	**4**	**2**	**0.002**	**0.002**	**0**
Cape Paterson	**one/quarter**	**4**	**2**	**0.006**	**0.008**	**0**
Dumbalk	**one/quarter**	**4**	**2**	**0.007**	**0.013**	**0**
Fish Creek	**one/quarter**	**4**	**2**	**0.005**	**0.009**	**0**
Foster	**one/quarter**	**4**	**2**	**0.008**	**0.014**	**0**
Inverloch	**one/quarter**	**4**	**2**	**0.007**	**0.010**	**0**
Koonwarra	**one/quarter**	**4**	**2**	**0.010**	**0.012**	**0**
Korumburra	**one/quarter**	**4**	**2**	**0.008**	**0.010**	**0**
Lance Creek	**one/quarter**	**4**	**2**	**0.019**	**0.025**	**0**
Leongatha	**one/quarter**	**4**	**2**	**0.014**	**0.022**	**0**
Loch	**one/quarter**	**4**	**2**	**0.007**	**0.014**	**0**
Meeniyan	**one/quarter**	**4**	**2**	**0.012**	**0.022**	**0**
Nyora	**one/quarter**	**4**	**2**	**0.007**	**0.008**	**0**
Poowong	**one/quarter**	**4**	**2**	**0.005**	**0.006**	**0**
Port Franklin	**one/quarter**	**4**	**2**	**0.003**	**0.005**	**0**
Port Welshpool	**one/quarter**	**4**	**2**	**0.007**	**0.013**	**0**
Toora	**one/quarter**	**4**	**2**	**0.010**	**0.010**	**0**
Wonthaggi	**one/quarter**	**4**	**2**	**0.008**	**0.010**	**0**
Yarram	**one/quarter**	**4**	**2**	**0.002**	**0.002**	**0**

Note: Samples are taken for analysis from the reticulation system. Copper levels may be higher at the customers' internal taps if copper plumbing is used in the domestic system. Customers experiencing blue copper staining of fixtures or discolouration of water are advised to call South Gippsland Water Customer Service on 1300 851 636.

Cyanogen chloride

Cyanogen chloride is a byproduct of chloramination that can be formed through the reaction between organic precursors with hypochlorous acid in the presence of the ammonium ion. Based on health considerations, the ADWG specify that the concentration of total cyanogenic compounds in drinking water should not exceed 0.08 mg/L.

Monitoring of chloraminated water systems confirmed that water supplied by South Gippsland Water complied with the guideline value for cyanogen chloride, with all results indicating levels were below the detection limit; refer to Table 14.

Table 14: Cyanogen chloride for 2018-19: chloraminated systems only

Water Treatment plant / system	Locality supplied	Frequency of sampling (samples per time period)	Number of samples collected	Drinking water quality guideline (mg/L)	Result (mg/L)	Number of samples where guideline was not met
Devon North	**Alberton Yarram**	**one/year**	**1**	**0.01**	**<0.05**	**0**
Lance Creek	**Cape Paterson Inverloch Lance Creek Wonthaggi**	**one/year**	**1**	**0.01**	**<0.05**	**0**
Lance Creek	**Loch Nyora Poowong**	**one/year**	**1**	**0.01**	**<0.05**	**0**
Lance Creek	**Korumburra**	**one/year**	**1**	**0.01**	**<0.05**	**0**

Chlorine disinfection residual (Free or Total Chlorine)

Disinfection is a critical part of water treatment. Not all microorganisms can be removed during clarification and filtration processes so an additional "kill-step" is required to ensure drinking water safety. Chlorine and chloramine (compounds formed from chlorine and ammonia) are the most commonly used agents. These are applied in carefully controlled dosages at treatment plants in the process known as primary disinfection.

The actual amount of disinfection agent dosed is very small (to visualise, think of about a cup's worth in a swimming pool). It is just adequate to both inactivate microorganisms that have made it through the purification process, and to confer a disinfection residual on the water. The residual helps to protect water as it passes through the pipes and storages of the distribution system. Chlorine and, to a lesser extent, chloramine tend to dissipate with time and distance through a water supply network so secondary dosing units may be used to ensure water remains protected to the ends of the system.

Disinfection agent dosing is automatically controlled by on-line monitoring systems which shut-down treatment plant operation in the event of levels being either too low or too high. This prevents out-of-specification water from being produced while the problem is addressed. With these controls in place, water supplied to customers is unlikely to ever exceed the ADWG guideline. The main purpose of disinfection residual monitoring is to ensure that it remains at an adequate level throughout the distribution system. There is no guideline for minimum disinfection residual and what is considered acceptable is particular to an individual water supply system based on its size and components, as well as the results of microbiological monitoring results.

South Gippsland Water uses both chlorine and chloramine disinfection. Chlorine dissociates in water to form free chlorine, which consists of aqueous molecular chlorine, hypochlorous acid and hypochlorite ion. Free chlorine is monitored in the reticulation systems of chlorinated supplies on a (minimum) weekly basis during routine sampling. For the chloraminated supplies, total chlorine is monitored. Total chlorine is the sum of chlorine in combined form (with ammonia and other nitrogenous or organic compounds) and free chlorine.

Based on health considerations, the ADWG guideline value for total chlorine in drinking water is 5 mg/L. There is no specific guideline for free chlorine; however, in chlorinated systems free chlorine generally approximates total chlorine. As both total and free chlorine levels are well below 5 mg/L, all localities can be assumed to be compliant with the water quality guideline for total chlorine; refer to tables 15 and 16.

Table 15: Free Residual Chlorine for 2018-19 (chlorinated localities)

Water sampling locality	Minimum sampling frequency (samples per time period)	Total number of samples	Minimum result (mg/L)	Average result (mg/L)	Maximum result (mg/L)	Number of samples where guideline was not met
Dumbalk	one/week	52	0.05	0.36	0.99	0
Fish Creek	one/week	52	0.04	0.37	0.76	0
Foster	one/week	52	0.01	0.36	1.06	0
Koonwarra	one/week	52	0.00	0.02	0.19	0
Korumburra	two/week*	33	0.00	0.71	1.20	0
Leongatha	two/week	104	0.00	0.58	1.18	0
Meeniyan	one/week	52	0.10	0.43	0.94	0
Port Franklin	one/week	52	0.01	0.55	0.96	0
Port Welshpool	one to two/week	98	0.00	0.88	2.5	0
Toora	one/week	52	0.54	0.97	1.58	0

***** *Pre connection to Lance Creek Supply System*

Table 16: Total Chlorine for 2018-19 (chloraminated localities)

Water sampling locality	Minimum sampling frequency (samples per time period)	Total number of samples	Minimum result (mg/L)	Average result (mg/L)	Maximum result (mg/L)	Number of samples where standard was not met
Alberton	one/week	63	0.92	2.38	3.6	0
Cape Paterson	one/week	52	0.11	1.23	1.9	0
Inverloch	two/week	114	0.73	1.79	2.7	0
Korumburra	two/week*	59	1.48	2.16	2.8	0
Lance Creek	one/week	52	1.33	2.61	3.6	0
Loch	one/week	61	0.90	1.98	3.4	0
Nyora	one/week	61	1.15	2.26	4.5	0
Poowong	one/week	58	0.08	1.57	3.5	0
Wonthaggi	two/week	104	0.42	1.70	2.5	0
Yarram	one/week	62	0.93	2.49	4.7	0

**Post connection to Lance Creek Supply System*

Fluoride

Naturally-occurring fluoride concentrations in drinking water are largely dependent on the type soil and rock through which source water drains. Fluoride may also be added to drinking water supplies as a public health measure for the prevention of dental decay. The Australian Drinking Water Guidelines 2011 (ADWG) specify that the maximum concentration of fluoride in drinking water should not exceed 1.5 mg/L. The Code of practice for fluoridation of drinking water supplies (2018) made under the *Health (Fluoridation) Act 1973* states that a water agency must not add fluoride to an extent that results in an average optimum concentration in excess of one part fluoride per million parts of water (1.0 mg/L) over any 12-month period in any water sampling locality.

Under the *Health (fluoridation) Act*, an obligation is imposed on suppliers of fluoridated water to achieve a dose rate that confers a dental health benefit on consumers. Based on annual average maximum daily air temperature (which has been show to correlate closely with water consumption), and as specified in the Code of practice for fluoridation of drinking water supplies, the optimal fluoride concentration for drinking water supplied in the South Gippsland region is 0.9 mg/L. While fluoridated water suppliers must aim for the specified optimal concentration, an annual average fluoride concentration of greater than or equal to 0.6 mg/L (which is the minimum concentration that confers a dental health benefit) is deemed as meeting the obligation.

Results: Fluoride in non-fluoridated supplies

Monitoring of non-fluoridated drinking water is conducted annually to verify continued low levels of naturally-occurring fluoride, as have been recorded historically. Results of fluoride monitoring for non-fluoridated supplies are provided in Table 17.

Table 17: Fluoride results for non-fluoridated supplies for 2018-19

Water treatment plant / system	Locality supplied	Sampling frequency (samples per time period)	Total number of samples	Drinking water quality guideline (mg/L)	Result (mg/L)	Number of samples where guideline was not met
Devon North	**Alberton Yarram**	**one/year**	**1**	**1.5**	**<0.05**	**0**
Dumbalk	**Dumbalk**	**one/year**	**1**	**1.5**	**0.08**	**0**
Fish Creek	**Fish Creek**	**one/year**	**1**	**1.5**	**<0.05**	**0**
Foster	**Foster**	**one/year**	**1**	**1.5**	**<0.05**	**0**
Leongatha	**Leongatha Koonwarra**	**one/year**	**1**	**1.5**	**0.05**	**0**
Meeniyan	**Meeniyan**	**one/year**	**1**	**1.5**	**0.08**	**0**
Toora	**Port Franklin Port Welshpool Toora**	**one/year**	**1**	**1.5**	**<0.05**	**0**

Results: Fluoride in fluoridated supplies

For the fluoridated supply system of Lance Creek, monitoring is conducted in accordance with the Code of practice for fluoridation of drinking water supplies (2018) under the *Health (fluoridation) Act 1973*. Drinking water in all fluoridated localities complied with the *Health (Fluoridation) Act* for allowable fluoride concentration. Based on the requirement that the annual average fluoride concentration be greater than or equal to 0.6 mg/L, the obligation imposed by the *Health* (Fluoridation) Act with regard to conferring a dental health benefit was also fulfilled. Refer to Table 18 for results.

Table 18: Results: Fluoride in fluoridated supply for 2018-19

Water sampling locality	Frequency of sampling (samples per time period)	Total Number of samples	Operating target range mg/L	Min. result mg/L	Max. result mg/L	Average result mg/L	Complying with regulation (yes/no)	Meeting obligation (yes/no)
Cape Paterson	one/week	52	0.9±0.1	0.22	0.90	0.70	yes	yes
Inverloch	one/week	52	0.9±0.1	0.19	0.89	0.71	yes	yes
Korumburra[8]	one/week	32	0.9±0.1	0.15	0.86	0.66	yes	yes
Lance Creek	one/week	52	0.9±0.1	0.13	0.90	0.68	yes	yes
Loch[9]	one/week*	28	0.9±0.1	0.14	0.80	0.63	yes	yes
Nyora[7]	one/week*	28	0.9±0.1	0.07	0.81	0.63	yes	yes
Poowong[7]	one/week*	28	0.9±0.1	0.11	0.81	0.64	yes	yes
Wonthaggi	one/week	52	0.9±0.1	0.19	0.89	0.71	yes	yes

**Post connection to Lance Creek Supply System*

[8] Results are for the period 26th November 2018 to 30th June 2019 following commencement of supply from the Lance Creek system to the Korumburra clear water storage tank

9 Results are for the period 17th December 2018 to 30th June 2019 following commencement of supply from the Lance Creek system to the Poowong clear water storage basin via the Korumburra clear water storage tank.

Lead

Lead may be detected in drinking water as a result of dissolution from natural sources or from household plumbing systems containing lead. The ADWG specify that, from a health perspective, the concentration of lead should not exceed 0.01 mg/L. Water supplied by South Gippsland Water complied with the ADWG guideline value; refer to Table 19.

Table 19: Lead results for 2018-19

Water sampling locality	Frequency of sampling (samples per time period)	Total number of samples	Drinking water quality guideline (mg/L)	Minimum result (mg/L	Maximum result (mg/L)	Number of samples where standard was not met
Alberton	one/quarter	4	0.01	<0.001	<0.001	0
Cape Paterson	one/quarter	4	0.01	<0.001	<0.001	0
Dumbalk	one/quarter	4	0.01	<0.001	<0.001	0
Fish Creek	one/quarter	4	0.01	<0.001	<0.001	0
Foster	one/quarter	4	0.01	<0.001	<0.001	0
Inverloch	one/quarter	4	0.01	<0.001	<0.001	0
Koonwarra	one/quarter	4	0.01	<0.001	<0.001	0
Korumburra	one/quarter	4	0.01	<0.001	<0.001	0
Lance Creek	one/quarter	4	0.01	<0.001	<0.001	0
Leongatha	one/quarter	4	0.01	<0.001	<0.001	0
Loch	one/quarter	4	0.01	<0.001	<0.001	0
Meeniyan	one/quarter	4	0.01	<0.001	0.001	0
Nyora	one/quarter	4	0.01	<0.001	<0.001	0
Poowong	one/quarter	4	0.01	<0.001	<0.001	0
Port Franklin	one/quarter	4	0.01	<0.001	<0.001	0
Port Welshpool	one/quarter	4	0.01	<0.001	<0.001	0
Toora	one/quarter	4	0.01	<0.001	<0.001	0
Wonthaggi	one/quarter	4	0.01	<0.001	<0.001	0
Yarram	one/quarter	4	0.01	<0.001	<0.001	0

Manganese

Manganese may be present in source waters as a result of dissolution form natural sources. Concentrations may be reduced in drinking water by converting soluble forms of the element to insoluble precipitates followed by physical removal using filtration. The ADWG specify that the concentration of manganese should not exceed 0.1 mg/L based on aesthetic considerations, and 0.5 mg/L based on health considerations. Drinking water supplied by South Gippsland Water complied with both the health and aesthetic guideline values for manganese; refer to Table 20.

Table 20: Manganese for 2018-19

Water sampling locality	Minimum Frequency of sampling (samples per time period)	Total number of samples collected*	Drinking water quality health guideline (mg/L)	Minimum result (mg/L)	Average result (mg/L)	Maximum result (mg/L)	Number of samples where guideline was not met
Alberton	one/month	12	0.5	<0.001	0.004	0.024	0
Cape Paterson	one/month	12	0.5	0.002	0.003	0.004	0
Dumbalk	one/month	12	0.5	<0.001	<0.001	<0.001	0
Fish Creek	one/month	12	0.5	0.002	0.007	0.018	0
Foster	one/month	12	0.5	<0.001	0.002	0.004	0
Inverloch	one/month	12	0.5	0.002	0.003	0.006	0
Koonwarra	one/month	12	0.5	0.001	0.003	0.004	0
Korumburra	one/month	12	0.5	0.001	0.009	0.024	0
Lance Creek	one/month	12	0.5	0.002	0.004	0.010	0
Leongatha	one/month	12	0.5	0.001	0.004	0.006	0
Loch	one/month	12	0.5	0.002	0.006	0.009	0
Meeniyan	one/month	12	0.5	0.001	0.002	0.004	0
Nyora	one/month	12	0.5	0.001	0.006	0.012	0
Poowong	one/month	12	0.5	0.003	0.008	0.021	0
Port Franklin	one/month	12	0.5	0.001	0.010	0.026	0
Port Welshpool	one/month	12	0.5	0.001	0.009	0.040	0
Toora	one/month	12	0.5	0.001	0.015	0.033	0
Wonthaggi	one/month	12	0.5	0.002	0.005	0.012	0
Yarram	one/month	12	0.5	0.001	0.004	0.017	0

Nitrate and Nitrite

Nitrates and nitrites are naturally-occurring oxides of nitrogen. Nitrite is rapidly oxidised to nitrate and is seldom present in well-oxygenated or chlorinated supplies. Chloramination disinfection can lead to nitrate and nitrite formation in the distribution system due to the action of nitrifying bacteria. The ADWG specify that, from a health perspective, the concentrations of nitrate and nitrite should not exceed 50 mg/L and 3 mg/L respectively. Monitoring for oxidised nitrogen (nitrate plus nitrite) was conducted in all chlorinated South Gippsland Water systems in 2018-19. The standard of 50 mg/L for nitrate was used to measure water quality performance for oxidised nitrogen given nitrite's rapid conversion to nitrate. Specific analysis for both nitrate and nitrite was conducted in the chloraminated localities. All the chloraminated localities complied with the specific guideline values for nitrate and nitrite; refer to Tables 21, 22 and 23.

Table 21: Oxidised nitrogen (nitrate + nitrite) for 2018-19 (chlorinated supplies only)

Water treatment plant / system	Localities supplied	Sampling frequency	Total number of samples	Minimum Result (mg/L)	Maximum Result mg/L	Number of samples where standard was not met
Dumbalk	**Dumbalk**	**one/quarter**	**4**	**0.47**	**1.20**	**0**
Fish Creek	**Fish Creek**	**one/quarter**	**4**	**0.24**	**0.50**	**0**
Foster	**Foster**	**one/quarter**	**4**	**0.11**	**0.39**	**0**
Korumburra	**Korumburra**	**one/quarter***	**1**	**7.90**	**7.90**	**0**
Leongatha	**Leongatha Koonwarra**	**one/quarter**	**4**	**0.29**	**1.40**	**0**
Meeniyan	**Meeniyan**	**one/quarter**	**4**	**0.09**	**0.93**	**0**
Toora	**Port Franklin Post Welshpool Toora**	**one/quarter**	**4**	**0.03**	**2.40**	**0**

**Prior to connection to Lance Creek supply system*

Table 22: Nitrate for 2018-19 (chloraminated localities only)

Water sampling locality	Minimum sampling frequency	Total number of samples	Minimum result (mg/L)	Maximum result (mg/L)	Number of samples where guideline was not met
Alberton	one per month	12	0.04	0.94	0
Cape Paterson	one per month	14	0.07	0.69	0
Inverloch	one per month	12	0.07	0.63	0
Korumburra	two per month*	14	0.06	0.27	0
Lance Creek	one per month	14	0.05	0.76	0
Loch	one per month	12	0.08	0.84	0
Nyora	one per month	12	0.07	1.30	0
Poowong	one per month	12	0.06	1.10	0
Wonthaggi	one per month	14	0.06	0.70	0
Yarram	one per month	12	0.04	0.94	0

**Post connection to Lance Creek supply system*

Table 23: Nitrite for 2018-19 (Chloraminated localities only)

Water sampling locality	Minimum sampling frequency	Total number of samples	Minimum result (mg/L)	Maximum result (mg/L)	Number of samples where guideline was not met
Alberton	one per month	12	0.002	0.016	0
Cape Paterson	one per month	14	0.003	0.020	0
Inverloch	one per month	12	0.003	0.009	0
Korumburra	two per month*	14	<0.002	0.007	0
Lance Creek	one per month	14	<0.002	0.003	0
Loch	one per month	12	0.003	0.010	0
Nyora	one per month	12	0.002	0.009	0
Poowong	one per month	12	<0.002	0.007	0
Wonthaggi	one per month	14	0.002	0.010	0
Yarram	one per month	12	0.002	0.018	0

**Post connection to Lance Creek supply system*

Nitrosodimethylamine (NDMA)

N-Nitrosodimethylamine (NDMA) is produced as a byproduct of chloramination of drinking water due to the oxidation of natural organic matter by chlorine in the presence of ammonia. The ADWG specify that, based on health considerations, the concentration of NDMA in drinking water should not exceed 0.0001 mg/L (100 ng/L).

Monitoring of chloraminated systems for NDMA was conducted quarterly, with results indicating water supplied by South Gippsland Water complied with the guideline value for NDMA; refer to Table 24.

Table 24: NDMA in chloraminated supplies for 2018-19

Water treatment plant /system	Localities supplied	Sampling frequency (samples per time period)	Total number of samples	Result (mg/L)	Number of samples where standard was not met
Devon North	**Alberton Yarram**	**one/year**	**1**	**<0.000003**	**0**
Lance Creek	**Cape Paterson Inverloch Lance Creek Wonthaggi**	**one/year**	**1**	**<0.000003**	**0**
Lance Creek	**Loch Nyora Poowong**	**one/year**	**1**	**<0.000003**	**0**
Lance Creek	**Korumburra**	**one/year**	**1**	**<0.000003**	**0**

Other inorganic chemicals

Inorganic chemicals may be present in water as a result of the natural dissolution of rocks, soils and some plants, or through contamination from industrial and agricultural sources. Materials used to coat pipes and plumbing fittings may also be sources of inorganic chemicals in drinking water. Monitoring of all water supply systems was conducted to verify compliance with ADWG health-related guidelines for chemical concentrations as specified in Table 25.

Table 25: Other inorganic chemicals for 2018-19

Parameter	Sampling frequency	Number of samples per water supply/locality*	Total Number of samples taken in 2018-19	ADWG guideline value (mg/L)	Maximum results (mg/L)	Number of samples where standard was not met
Antimony	**Annually**	**one per locality**	**19**	**0.003**	**<0.001**	**0**
Barium	**Annually**	**one per locality**	**19**	**2**	**0.033**	**0**
Beryllium	**Annually**	**one per locality**	**19**	**0.06**	**<0.001**	**0**
Boron	**Annually**	**one per locality**	**19**	**4**	**0.03**	**0**
Cadmium	**Annually**	**one per locality**	**19**	**0.002**	**<0.0002**	**0**
Chromium	**Annually**	**one per locality**	**19**	**0.05**	**<0.001**	**0**
Cyanide	**Annually**	**one per system**	**10**	**0.08**	**<0.005**	**0**
Mercury	**Annually**	**one per locality**	**19**	**0.001**	**<0.001**	**0**
Molybdenum	**Annually**	**one per locality**	**19**	**0.05**	**<0.001**	**0**
Nickel	**Annually**	**one per locality**	**19**	**0.02**	**<0.001**	**0**
Selenium	**Annually**	**one per locality**	**19**	**0.01**	**<0.001**	**0**
Silver	**Annually**	**one per locality**	**19**	**0.1**	**<0.001**	**0**
Sulphate	**Quarterly**	**one per system**	**40**	**500**	**77**	**0**
Vanadium	**Annually**	**one per locality**	**19**	**-**	**<0.001**	**0**
Zinc	**Annually**	**one per locality**	**19**	**3**	**0.015**	**0**

*Monitoring is conducted at the entry point to distribution systems or at customer tap sites in each locality dependent on likelihood of change in level of chemical as it passes through the water supply system.

Other organic chemicals

Potential sources of contamination of the drinking water supply with organic chemicals are industrial effluent, run-off from agricultural land, and the use of pesticides and herbicides. Organic disinfection byproducts, such as the chloroacetic acids, can also form as result of disinfection processes. Consistent with historical data, monitoring of raw water intakes, distribution entry point water or customer tap sites found that levels of organic chemicals were compliant with the ADWG health-related guidelines for the 2018-19 period; refer to Table 26.

Table 26: Organic chemical monitoring results for 2018-19

Parameter	Sampling frequency	Number of samples per water supply system/locality*	Total Number of samples taken in 2018-19	Maximum results mg/L	ADWG Guideline value mg/L	Number of samples where guideline was not met
1,1-dichloroethane	Annually	One per system	10	<0.001	a	-
1,2-dichloroethane	Annually	One per system	10	<0.001	0.003	0
2,4,5-T	Annually	One per system	8	<0.00001	0.1	0
2,4,5-TP	Annually	One per system	8	<0.00001	b	-
2,4,6-T	Annually	One per system	8	<0.0001	b	-
2,4,6-trichlorphenol	Annually	One per system	10	<0.001	0.02	0
2,4-D	Annually	One per system	8	0.0002	0.03	0
2,4-DB	Annually	One per system	8	<0.00001	b	-
2,4-DP	Annually	One per system	8	<0.00001	b	-
2,6-D	Annually	One per system	8	<0.0001	b	-
4-Chlorophenoxyacetic Acid	Annually	One per system	8	<0.00001	b	-
Atrazine	Annually	One per system	8	<0.002	0.02	0
Benzene	Annually	One per system	10	<0.001	0.001	0
Benzo(a)pyrene	Annually	One per system**	3	<0.000002	0.00001	0
Carbon tetrachloride	Annually	One per system	10	<0.001	0.003	0
Chloroacetic acid	Annually	One per locality	19	<0.005	0.15	0
Clopyralid	Annually	One per system	8	<0.00005	2	0
Dicamba	Annually	One per system	8	<0.00001	0.1	0
Dichloroacetic acid	Annually	One per locality	19	0.029	0.1	0
Fluoroxypyr	Annually	One per system	8	<0.00005	b	-
Glyphosate	Annually	One per system	8	<0.03	1	0
MCPA	Annually	One per system	8	0.00001	0.04	0
MCPB	Annually	One per system	8	<0.00001	b	-
Mecoprop	Annually	One per system	8	<0.00001	b	-
Metsulfuron methyl	Annually	One per system	8	<0.0001	0.04	0
Pentachlorphenol	Annually	One per system	10	<0.001	0.01	0
Picloram	Annually	One per system	8	0.00005	0.3	0
Prometryn	Annually	One per system	8	<0.002	b	-
Simazine	Annually	One per system	8	<0.002	0.02	0
Tetrachloroethene	Annually	One per system	10	<0.001	0.05	0
Trichloroacetic acid	Annually	One per locality	19	0.024	0.1	0
Trichloroethylene	Annually	One per system	10	<0.001	a	-
Triclopyr	Annually	One per system	8	0.00010	0.02	0

Table notes:

a Insufficient data to set an ADWG guideline value based on health considerations

b No ADWG information available

* Monitoring is conducted at raw water inlets to treatment plants or at clear water storage outlets to distribution systems

** Monitoring conducted at Devon North, Lance Creek and Leongatha water treatment plants only

Raw water monitoring

For the purposes of risk management, the parameters listed in Table 27 were monitored in raw water at the specified (minimum) frequencies by external laboratory analysis in raw water at all South Gippsland Water treatment plants for the 2018-19 reporting period.

Table 27: Raw water monitoring frequencies

Parameter	Sampling frequency
Escherichia coli	Weekly
Total Coliforms	Weekly
Cryptosporidium	Event-based
Giardia	Event-based
Cyanobacteria (Blue-green algae)	Weekly (external/internal)
Algae byproducts (MIB/Geosmin/Saxitoxin)	Event-based
Alkalinity	Monthly
Aluminium	Quarterly
Calcium	Quarterly
Copper	Quarterly
Dissolved Organic Carbon	Quarterly
Manganese	Quarterly
Nitrogen	Quarterly
Orthophosphorous	Quarterly
Total Organic Carbon	Quarterly
Turbidity	Weekly
Pesticides	Annually/Biannually/Event-based
Radionuclides	Every 7 years: Sampling conducted in 2016

Data obtained from all water quality monitoring programs conducted by South Gippsland Water is available on request by telephoning Customer Service on 1300 5682 0444 or emailing **sgwater@sgwater.com.au**

Aesthetics

South Gippsland Water strives to provide drinking water that is consistently clear and pleasant to drink for all customers. Actions taken to manage aesthetic characteristics include:

- Optimisation of treatment processes to minimise levels of iron, manganese and organic compounds in supplied water
- pH adjustment of treated water
- Regular flushing and air-scouring to remove sediment accumulation in mains
- Frequent sampling and analysis for aesthetic parameters
- Monitoring and management of algal blooms in raw water reservoirs
- Monitoring when required for compounds that may impart unpleasant tastes and odours to drinking water

Results of monitoring for aesthetic characteristics are provided in Tables 28 to 33 on the following pages.

Photos: Members of our friendly customer service team

Colour

Water may appear coloured due to the presence of natural organic substances including humic and fulvic acids, and dissolved inorganics, such as iron and manganese. Based on aesthetic considerations, the ADWG specifies that colour should not exceed 15 Hazen Units (HU). Water supplied by South Gippsland Water complied with the guideline value for colour; refer to Table 28.

Table 28: True Colour Results for 2018-19

Water treatment plant / system	Localities supplied	Minimum sampling frequency (samples per time period)*	Total number of samples	Average result (HU)	Maximum result (HU)	Number of samples where guideline was not met
Devon North	**Alberton Yarram**	**one/quarter**	**9**	**3**	**8**	**0**
Dumbalk	**Dumbalk**	**one/quarter**	**9**	**2**	**2**	**0**
Fish Creek	**Fish Creek**	**one/quarter**	**9**	**3**	**4**	**0**
Foster	**Foster**	**one/quarter**	**9**	**2**	**4**	**0**
Korumburra	**Korumburra**	**one/quarter**	**9**	**3**	**6**	**0**
Lance Creek	**Cape Paterson Inverloch Lance Creek Wonthaggi**	**one/quarter**	**9**	**2**	**4**	**0**
Leongatha	**Leongatha Koonwarra**	**one/quarter**	**9**	**3**	**4**	**0**
Meeniyan	**Meeniyan**	**one/quarter**	**9**	**2**	**2**	**0**
Poowong	**Loch Nyora Poowong**	**one/quarter**	**9**	**5**	**8**	**0**
Toora	**Port Franklin Port Welshpool Toora**	**one/quarter**	**9**	**2**	**4**	**0**

*Changed from monthly to quarterly during 2018-19

Iron

Iron is present in source waters due to dissolution of soil and rock. High iron concentrations in drinking water can occur through rusting of iron pipes and fittings. Based on aesthetic considerations, the ADWG specify that the concentration of iron should not exceed 0.3 mg/L. Water supplied by South Gippsland Water complied with the guideline value for iron; refer to Table 29.

Table 29: Iron results for 2018-19

Water sampling locality	Frequency of sampling (samples per time period)	Total number of samples	Minimum result mg/L	Maximum result mg/L	Number of samples where guideline was not met
Alberton	one/quarter	4	<0.01	<0.01	0
Cape Paterson	one/quarter	4	0.01	0.03	0
Dumbalk	one/quarter	4	<0.01	<0.02	0
Fish Creek	one/quarter	4	0.01	0.03	0
Foster	one/quarter	4	<0.01	<0.02	0
Inverloch	one/quarter	4	<0.01	0.02	0
Koonwarra	one/quarter	4	0.01	0.02	0
Korumburra	one/quarter	4	<0.01	0.03	0
Lance Creek	one/quarter	4	<0.01	<0.01	0
Leongatha	one/quarter	4	<0.01	<0.01	0
Loch	one/quarter	4	0.01	0.01	0
Meeniyan	one/quarter	4	<0.01	0.03	0
Nyora	one/quarter	4	<0.01	<0.01	0
Poowong	one/quarter	4	0.01	0.04	0
Port Franklin	one/quarter	4	<0.01	0.01	0
Port Welshpool	one/quarter	4	<0.01	<0.01	0
Toora	one/quarter	4	<0.01	<0.01	0
Wonthaggi	one/quarter	4	<0.01	0.02	0
Yarram	one/quarter	4	<0.01	0.01	0

Alkalinity

Alkalinity is defined as the quantitative capacity of an aqueous solution to neutralise an acid. In simpler terms, it is a measure of how easily the pH of water can be changed. Alkalinity is mainly determined by the levels of carbonate, bicarbonate and hydroxyl anions (negatively-charged ions) present. The property of alkalinity has a strong influence on what is referred to as water stability, which is the tendency of water to be corrosive, stable, or scale-forming on contact with surfaces.

Water stability is complex and influenced by a number of factors, but in general soft water of low pH and low alkalinity will tend to corrode surfaces. Highly corrosive (aggressive) water is not desirable in that it can lead to the leaching of copper and other metals from pipes and plumbing fittings.

In contrast, hard water of high pH and high alkalinity will generally tend to deposit calcium carbonate (form scale) on pipes, plumbing fittings and hot water systems. While encrustation of pipes and fittings is not desirable for obvious reasons, a thin layer of calcium carbonate can be beneficial in that it provides protection against corrosion in conditions of changing water stability.

There are no specific standards for alkalinity in drinking water but as this property provides resistance against changes in pH that can lead to either corrosion or excessive encrustation, a reasonable level should be maintained in drinking water supplies. What is reasonable for a particular type of water will depend mainly upon its other characteristics of pH and hardness, but a value in the range of 50 to 200 mg/L $CaCO_3$ is generally considered to be optimal.

Results of alkalinity monitoring are provided in Table 30.

**Explanatory note on units used to express both alkalinity and hardness properties*

Calcium carbonate equivalent (mg/L CaCO3) is the value obtained when taking into account the different characteristics in relation to reactivity (ability to combine) of various salts, such that the overall effect is the same as that produced by the expressed concentration of calcium carbonate. This allows for a convenient method of comparison in chemistry. As both alkalinity and hardness are aggregate properties created by the combined effects of different salts, the calcium carbonate equivalent unit is used in each case. This does not mean, however, that alkalinity and hardness are the same property. Alkalinity is chemically defined as the sum of all titratable bases in a solution, whereas hardness is the sum of all polyvalent cation (ions having more than one positive charge) concentrations in a solution. With respect to a solution made purely from the compound calcium carbonate, therefore, the property of alkalinity is due to the component carbonate anion (a base), while the property of hardness is due to the component calcium cation.

Table 30: Alkalinity Results for 2018-19

Water treatment plant / system	Localities supplied	Minimum sampling frequency (samples per time period)	Total number of samples	Minimum result (mg/L as $CaCO_3$)*	Maximum result (mg/L as CaCO3)*	Number of samples where guideline was not met
Devon North	Alberton Yarram	one/quarter	4	28	86	0
Dumbalk	Dumbalk	one/quarter	4	40	120	0
Fish Creek	Fish Creek	one/quarter	4	40	44	0
Foster	Foster	one/quarter	4	36	44	0
Korumburra	Korumburra	one/quarter	4	45	65	0
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	one/quarter	6	47	75	0
Leongatha	Leongatha Koonwarra	one/quarter	4	38	44	0
Meeniyan	Meeniyan	one/quarter	4	39	75	0
Poowong	Loch Nyora Poowong	one/quarter	4	49	110	0
Toora	Port Franklin Post Welshpool Toora	one/quarter	4	37	51	0

**refer to explanatory note in text above*

Hardness

Hardness is a measure of the concentration of calcium and magnesium ions in water. To minimise undesirable build-up of scale in hot water systems, the ADWG specifies that total hardness (as calcium carbonate) in drinking water should not exceed 200 mg/L. Water supplied by South Gippsland Water complied with the guideline value for hardness; refer to Table 31.

Table 31: Total Hardness in calcium carbonate ($CaCO_3$) equivalents* for 2018-19

Water treatment plant / system	Localities supplied	Sampling frequency (samples per time period)	Total number of samples	Average result (mg/L as $CaCO_3$)*	Maximum result (mg/L as $CaCO_3$)*	Number of samples where guideline was not met
Devon North	Alberton Yarram	one/quarter	4	24	31	0
Dumbalk	Dumbalk	one/quarter	4	100	130	0
Fish Creek	Fish Creek	one/quarter	4	33	41	0
Foster	Foster	one/quarter	4	28	33	0
Korumburra	Korumburra	one/quarter	4	52	65	0
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	one/quarter	4	67	78	0
Leongatha	Leongatha Koonwarra	one/quarter	4	68	74	0
Meeniyan	Meeniyan	one/quarter	4	77	93	0
Poowong	Loch Nyora Poowong	one/quarter	4	57	60	0
Toora	Port Franklin Port Welshpool Toora	one/quarter	4	28	31	0

**refer to explanatory note on units in alkalinity section on previous pages.*

pH

The property of pH relates to the hydrogen ion concentration of water. pH is measured on a logarithmic scale from 0 to 14. A pH of 7 is neutral, a pH greater than 7 is alkaline, and a pH less than 7 is acidic.

To reduce corrosion and encrustation in pipes and fittings, the ADWG specifies that the pH of drinking water should be between 6.5 and 8.5. The ADWG also states that new concrete tanks and cement-mortar lined pipes can significantly increase pH and a value up to 9.2 may be tolerated, provided monitoring indicates no deterioration in microbiological quality.

The reference to microbiological quality is made in the ADWG since the disinfecting power of chlorine in chlorinated systems is greatest at lower pH and gradually declines as pH increases. Significant impairment of chlorine disinfection occurs above pH 8.0. The results for pH in chlorinated systems are provided in Table 32. Based on mean pH values, all localities complied with the aesthetic guideline.

The chemistry (and the effect of pH) for chloramination disinfection differs from that of chlorination. A higher pH is actually beneficial in a chloraminated system as it slows the natural decay of monochloramine and prevents the formation of dichloramine and trichloramine, which can cause unpleasant tastes and odours. A consequence of maintaining a higher pH is that occasional exceedance of the ADWG guideline can occur, particularly where there are cement-lined pipes. Based on mean pH results as provided in Table 33, all chloraminated localities complied with the aesthetic guideline of 6.5 to 9.2. As shown in Table 33 there was one result which did not meet the aesthetic guideline for Alberton in 2018-19. This was addressed with water main flushing to remove aged water from the system.

Table 32: pH results for chlorinated system in 2018-19

Water sampling locality	Minimum frequency of sampling (samples per time period)	Total number of samples	Minimum result pH	Mean result pH	Maximum result pH	Number of samples not compliant with aesthetic guideline
Dumbalk	**one/week**	**52**	**7.8**	**8.1**	**8.3**	**0**
Fish Creek	**one/week**	**52**	**7.6**	**8.0**	**8.4**	**0**
Foster	**one/week**	**52**	**7.2**	**7.6**	**8.0**	**0**
Koonwarra	**one/week**	**52**	**7.2**	**7.7**	**8.0**	**0**
Korumburra*	**two/week**	**77**	**6.9**	**7.9**	**8.5**	**0**
Leongatha	**two/week**	**104**	**7.2**	**7.5**	**7.8**	**0**
Meeniyan	**one/week**	**52**	**7.2**	**7.6**	**8.0**	**0**
Port Franklin	**one/week**	**52**	**7.5**	**8.0**	**8.5**	**0**
Port Welshpool	**one/week**	**52**	**7.1**	**7.6**	**8.0**	**0**
Toora	**one/week**	**52**	**7.2**	**7.5**	**7.9**	**0**

*Prior to connection to Lance Creek system and change to chloramination disinfection

Table 33: pH results for chloraminated localities in 2018-19

Water sampling locality	Minimum frequency of sampling (samples per time period)*	Total number of samples	Minimum result pH	Mean result pH	Maximum result pH	Number of samples not compliant with aesthetic guideline
Alberton	**one to two per week**	**63**	**8.0**	**8.6**	**9.6**	**1**
Cape Paterson	**two per week**	**106**	**7.4**	**8.3**	**8.9**	**0**
Inverloch	**two to three per week**	**165**	**7.3**	**8.2**	**8.8**	**0**
Korumburra**	**Two per week**	**37**	**8.0**	**8.5**	**8.5**	**0**
Lance Creek	**one per week**	**52**	**7.0**	**8.2**	**9.0**	**0**
Loch	**one to two per week**	**61**	**7.4**	**8.3**	**8.8**	**0**
Nyora	**one to two per week**	**62**	**7.3**	**8.1**	**8.8**	**0**
Poowong	**one per week**	**58**	**7.7**	**8.1**	**8.7**	**0**
Wonthaggi	**two per week**	**104**	**7.4**	**8.3**	**8.9**	**0**
Yarram	**one to two per week**	**62**	**7.5**	**8.2**	**9.1**	**0**

* Monitoring frequency changes seasonally for some localities

** Post connection to Lance Creek system and change to chloramination disinfection

Analysis of results

Comparison of results for Schedule 2 parameters over three years

A comparison of compliance with water quality standards specified in Schedule 2 of the Safe Drinking Water Regulations 2015 in the 2018-19 period with that of the previous two financial years is presented in Figure 2. Consistent compliance across all South Gippsland Water water sampling localities is illustrated and in measure with the water quality standards listed in Schedule 2 of the Regulations for Trihalomethanes and Turbidity. An *Escherichia coli* detection in Poowong saw a decline in overall compliance with the water quality standard for *Escherichia coli* in 2018-19. Refer to Part 3 for details.

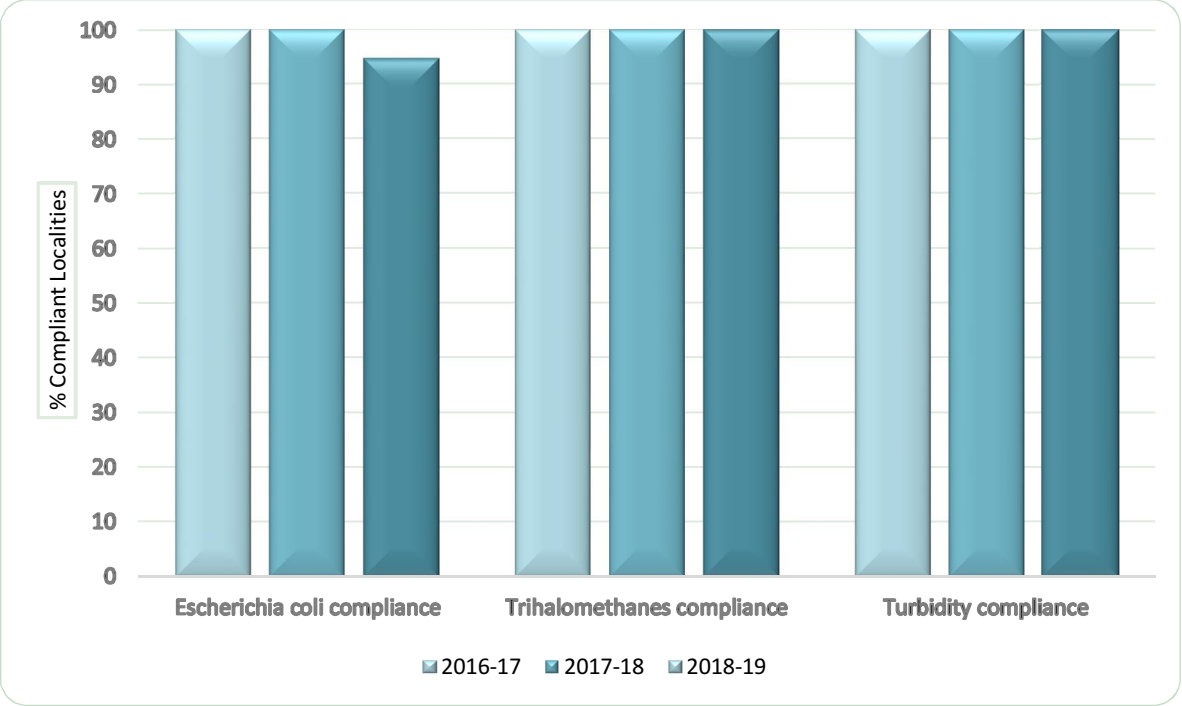

Figure 2: Percentage of localities where the drinking water complied with the water quality standards for Escherichia coli, trihalomethanes and turbidity

Comparison of results of other water quality parameters over three years

A comparison of results for the 2018-19 reporting period and the previous two financial years for water quality parameters other than those listed in Schedule 2 of the Safe Drinking Water Regulations 2015 is presented in Table 34. The comparison is based on percentage compliance with the guideline values of the *Australian Drinking Water Guidelines 2011.*

Table 34: Percentage of samples compliant with health-related guidelines from the ADWG

Water Quality Parameter	Percentage of samples compliant with health-related guidelines from the *Australian Drinking Water Guidelines 2011*		
	2016-17	2017-18	2018-19
Arsenic	100 %	100 %	100 %
Aluminum	100 %	100 %	100 %
Chlorine	100 %	100 %	100 %
Copper	100 %	100 %	100 %
Cyanogen chloride	100 %	100 %	100 %
Iron	100 %	100 %	100 %
Lead	100 %	100 %	100 %
Manganese	100 %	100 %	100 %
Nitrate	100 %	100 %	100 %
Nitrite	100 %	100 %	100 %
NDMA	100 %	100 %	100 %
Antimony	100 %	100 %	100 %
Barium	100 %	100 %	100 %
Beryllium	100 %	100 %	100 %
Boron	100 %	100 %	100 %
Cadmium	100 %	100 %	100 %
Chloroacetic acid	100 %	100 %	100 %
Chromium	100 %	100 %	100 %
Cyanide	100 %	100 %	100 %
Dichloroacetic acid	100 %	100 %	100 %
Mercury	100 %	100 %	100 %
Molybdenum	100 %	100 %	100 %
Nickel	100 %	100 %	100 %
Selenium	100 %	100 %	100 %
Silver	100 %	100 %	100 %
Sulphate	100 %	100 %	100 %
Trichloroacetic acid	100 %	100 %	100 %
Zinc	100 %	100 %	100 %
1,2-dichloroethane	100 %	100 %	100 %
2,4,5-T	100 %	100 %	100 %
2,4,6-trichlorphenol	100 %	100 %	100 %
2,4-D	100 %	100 %	100 %
Atrazine	100 %	100 %	100 %
Benzene	100 %	100 %	100 %
Benzo(a)pyrene	100 %	100 %	100 %
Carbon tetrachloride	100 %	100 %	100 %
Clopyralid	100 %	100 %	100 %
Dicamba	100 %	100 %	100 %
Glyphosate	100 %	100 %	100 %
MCPA	100 %	100 %	100 %
Metsulfuron methyl	100 %	100 %	100 %
Pentachlorphenol	100 %	100 %	100 %
Picloram	100 %	100 %	100 %
Simazine	100 %	100 %	100 %
Tetrachloroethene	100 %	100 %	100 %
Triclopyr	100 %	100 %	100 %
Gross Alpha *	100 %	Not monitored	Not monitored
Gross Beta *	100 %	Not monitored	Not monitored

*Radiological parameters monitored once every seven years as per risk-based monitoring program. No monitoring occurred in the 2018-19 reporting period.

5. Complaints relating to water quality for 2018-19

South Gippsland Water records and attends to all complaints relating to drinking water quality to ensure the highest level of customer satisfaction. Table 35 below illustrates the four complaint types and the number of complaints received for each type over the 2018-19 year. Determination of the number of complaints per 100 customers supplied is based on the number of complaints compared with the total number of connected properties. A comparison of the number complaints with that of the previous two reporting periods is provided in Table 36. Complaints for 2018-19 are broken down into complaint type per locality and supply system in Table 37.

Table 35: Customer complaints for 2018-19

Type of complaint	Number of complaints	Number of complaints per 100 customers (connected properties) supplied
Dirty/discoloured water	**41**	**0.19**
Taste and/or odour	**32**	**0.15**
Air in water	**9**	**0.04**
Alleged/suspected illness	**2**	**0.01**
Other	**3**	**0.01**
Total complaints	**87**	**0.40**

Table 36: Complaints comparison of 2018-19 with the previous two reporting periods

Type of complaint	Number of Complaints			Comparison with previous reporting period	Comments
	2016-17 reporting period	2017-18 reporting period	**2018-19 reporting period**		
Dirty/discoloured Water	96	142	**41**	Significant decrease	High number of complaints for 2017-18 addressed with air-scour cleaning of affected systems. Lance Creek connection to Korumburra also likely to have contributed to decline in complaints for 2018-19.
Taste or odour	28	62	**32**	Moderately significant decrease	Supplemental supply from Melbourne water grid has allowed for improved management of algae-related taste and odour issues in 2018-19. Majority of complaints recorded for Leongatha; refer to Part 3 for details
Air in Water	5	13	**9**	No significant change	Complaints due to air-scour water mains cleaning
Alleged illness	0	6	**2**	No significant change	Includes general queries re water quality and health concerns. No evidence provided or found that supplied drinking water was cause
Other	7	4	**3**	No significant change	Complaints include corrosion of internal household plumbing

Table 37: Customer complaints according to complaint type and locality for 2018-19

Water treatment plant / supply system	Water sampling locality	Complaint category					Total complaints per locality	Total complaints per supply system
		Dirty / discoloured water	Taste and/or odour	Air in water	Alleged illness	Other		
Devon North	Alberton	1	0	0	0	0	1	2
	Yarram	0	0	1	0	0	1	
Dumbalk	Dumbalk	0	0	0	0	0	0	0
Fish Creek	Fish Creek	0	0	0	1	0	1	1
Foster	Foster	2	2	0	0	0	4	4
Korumburra	Korumburra	6	3	1	0	1	11	11
Lance Creek	Cape Paterson	1	0	0	0	0	1	13
	Inverloch	0	1	1	0	0	2	
	Lance Creek	0	0	0	0	0	0	
	Wonthaggi	8	1	0	0	1	10	
Leongatha	Koonwarra	1	0	0	0	0	1	29
	Leongatha	6	21	0	1	0	28	
Meeniyan	Meeniyan	0	0	0	0	0	0	0
Poowong	Loch	0	0	0	0	0	0	4
	Nyora	0	2	1	0	1	4	
	Poowong	0	0	0	0	0	0	
Toora	Port Franklin	1	0	0	0	0	1	23
	Port Welshpool	9	1	3	0	0	13	
	Toora	6	1	2	0	0	9	
Total complaints per category		41	32	9	2	3	87	87

Management of complaints

Dirty/discoloured water

Dirty/discoloured water complaints relate to problems with the clarity of water. Tap water that contains sediments or particles and is coloured yellow, brown or blackish hues is often reported as "dirty water" by the customer. The particles and colour are produced by manganese and other mineral oxides rather than what might commonly be referred to as "dirt" (i.e. soil, mud, sewerage), but the overall effect is that water appears dirty and is unacceptable to the customer. Complaints in this category include reports of stained laundry items which may result from oxidation of minerals in contact with laundry detergents in a washing machine.

Dirty/discoloured water complaints primarily result from:

- High manganese levels in source waters. The soil in the South Gippsland region is naturally high in manganese, and run-off into reservoirs and rivers is unavoidable. Not all manganese can be removed during the water treatment process so accumulation in the distribution system can occur;
- Accumulation of sediment within water mains over time; and/or
- Unintended scouring of water mains following high flows or recharging of the system.

Corrective actions to address dirty/discoloured water include:

- Use of aeration and potassium permanganate dosing systems at water treatment plants to oxidise manganese and maximise physical removal through filtration;
- Implementation of scheduled air-scouring and flushing programs within all water sampling localities to remove manganese and other accumulated sediments;
- Additional flushing when required in response to individual complaints, and increased frequency of flushing regimes for problem areas.
- Provision of a commercial cleaning product which removes discolouration marks from laundry items in response to individual customer complaints.

There were 41 complaints received in relation to dirty/discoloured water in the 2018-19 financial year.

Taste and odour

What is considered acceptable in terms of the flavour and smell of water has some level of individual subjectivity. For instance, some customers object to the taste and odour of chlorine, while others receiving water with the same chlorine concentration do not. This may be because the objecting customers sense the chlorine taste and odour more acutely than others, or because they perceive chlorine as something they don't want to drink. While tastes and odours in drinking water do not generally denote that the water is unsafe to drink, South Gippsland Water always endeavours to minimise unpleasant flavours. This is important not only for the customer's satisfaction and enjoyment but also so that they will choose supplied tap water over other potentially less-safe options (e.g. from a poorly-managed tank water system) or options having adverse environmental impacts (i.e., purchased bottled water).

Taste and odour complaints result primarily from:

- Algae-related compounds in the water;
- Manganese and/or iron sediment in the water;
- Changes in pH, dissolved oxygen and other factors in relation to ageing of water within a water main due to low flows.
- Chlorine in water.

Corrective actions to prevent or address taste and odour issues include:

- Routine monitoring of supplied water for taste and odour, manganese, iron, turbidity, pH and chlorine;
- Specific analysis for taste and odour related parameters (as above) when required in response to individual complaints;
- Use of powdered activated carbon (PAC) at treatment plants to remove algae-related and other taste and odour compounds from water;
- Use of aeration and potassium permanganate dosing systems at water treatment plants to oxidise manganese and maximise removal from source waters.
- Water main flushing and air-scouring programs

There were 32 complaints relating to taste and odour issues received from customers in 2018-19. The majority of these were for Leongatha; refer to Part 3 for more information.

Air in water

Air in water complaints are generally received following the implementation of air-scour mains cleaning programs. While notification is given to residents prior to air-scouring, customers may become concerned at the 'milky' appearance of water. Customers are advised that the white colour of the water is due to the presence of tiny air-bubbles and that flushing through a tap for a few minutes should correct the problem. If the problem cannot be resolved by the customer, mains flushing is carried out.

There were nine complaints involving air in water from South Gippsland Water customers in the 2018-19 reporting period. The majority of these related to air-scouring in the Toora water supply system.

Alleged illness

Customers may make an alleged illness complaint if they suspect that supplied tap water is the cause of illness or other conditions, such as skin or eye irritation. Generally a customer will call to seek reassurance with regards to water quality rather than alleging that the water is the cause of their health problem. Customers with health concerns are encouraged to consult a medical professional for diagnosis and treatment. Depending on the nature of the complaint, additional monitoring to verify quality of drinking water supplied to the customer's residence and through the domestic plumbing system may be carried out. Details of the complaint and results of both monitoring and diagnostic testing (if provided) are recorded via an Illness Complaint Record Form. In the unlikely event of

supplied drinking water being found to be a causative factor of illness, the Department of Health and Human Services would be immediately notified. Further actions, which might include issuing of a boil water advisory, would be implemented as a matter of the highest priority.

There were two calls received in relation to health concerns for 2018-19. Investigation of these found no evidence that the drinking water supply was the cause of the issue.

Other complaints

Other complaints generally relate to concerns that are beyond the control and responsibility of South Gippsland Water, such as problems with aquarium fish or garden plants, and issues with domestic plumbing or appliances. In response to such complaints, results of monitoring programs that may be relevant are reviewed, and additional investigation and monitoring is carried out where appropriate. Customers are informed of the likelihood of supplied water being the cause of the problem and given advice on where to seek additional assistance if required.

There were a total of three calls in this category for 2018-19.

6. Findings of the most recent risk management plan audit

Under section 7 of the Safe Drinking Water Act 2003 (the Act), a water supplier is required to prepare, implement and review a risk management plan for the supply of drinking water to the public. The most recent risk management plan audit carried out by a Department of Health and Human Services approved auditor occurred in April 2018. South Gippsland Water was found to be compliant in all auditable elements for the period 8th June 2016 to 27th April 2018. The Risk Management Plan Audit Certificate is provided in Appendix 2 of this report.

While no non-compliances were recorded, the auditor made a number of observations and identified some opportunities for improvement. Specific findings, including opportunities for improvement, were also reported by the auditor; these can be found in Appendix 3 of the 2017-18 Annual Drinking Water Quality Report. South Gippsland Water has considered and prioritised all opportunities for improvement for actioning or further review as deemed appropriate.

7. Regulated water

Regulation 16 of the Safe Drinking Water Regulations 2015 requires details of regulated water supplied be included in this annual report. Regulated water is defined as "water that is not intended for drinking but could reasonably be mistaken as drinking water". South Gippsland Water did not supply any regulated water in the 2018-19 period.

Appendices

Appendix 1: South Gippsland Water's Drinking Water Quality Policy

Drinking Water Quality Policy

South Gippsland Water

"Committed to high-quality drinking water"

South Gippsland Water is committed to the management of its water supply systems to ensure the provision of safe, high-quality drinking water that consistently meets customer expectations, the National Health and Medical Research Council's Australian Drinking Water Guidelines, and relevant legislation and regulatory requirements. In order to achieve this objective, in partnership with stakeholders and relevant agencies, the Corporation will:

- Implement and maintain a Drinking Water Quality Management System to identify and minimise risks to drinking water quality at all points from catchment to consumer.
- Develop and implement an appropriate drinking water quality monitoring program and reporting system to provide relevant and timely information, and ensure confidence in the water supply and its management.
- Implement appropriate contingency and incident response systems to effectively manage incidents that may adversely affect drinking water quality.
- Review and assess the performance of the Drinking Water Quality Management System with respect to this Policy to ensure continual improvement and best practice management.
- Integrate into the Corporation's planning, the needs and expectations of its consumers, stakeholders, regulators and employees to ensure both effective and economical solutions for managing drinking water supplies.
- Ensure compliance with all Acts, regulations, guidelines and standards relevant to drinking water quality.

This Policy requires all managers and employees at South Gippsland Water involved in the supply of drinking water to be responsible for understanding, implementing, maintaining and continually improving the Drinking Water Quality Management System.

This Drinking Water Quality Policy is proudly displayed at South Gippsland Water facilities and is communicated to all persons working for or on the Corporations behalf during induction or contract proceedings. The Policy is available to the public upon request or via the South Gippsland Water website. Contact details are:–

South Gippsland Water
14-18 Pioneer Street
PO Box 102
Foster, Victoria 3960
(03) 5682 0444

or: www.sgwater.com.au

Appendix 2: Drinking water risk management plan audit certificate

Schedule 1

Safe Drinking Water Regulations 2015 – Regulation 10

RISK MANAGEMENT PLAN AUDIT CERTIFICATE

Certificate Number: 156

Audit period: 08th June 2016 to 27th April 2018

To: Mr Philippe du Plessis
Managing Director
South Gippsland Water Corporation
PO Box 102
Foster, Vic 3960

Australian Business Number (ABN): 40 349 066 713

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

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

Signature of approved auditor: _____

Dr.P. (Dharma) Dharmabalan

Date: 27th April 2018

Exemplar Global Certified Auditor
Drinking Water QMS Scheme
Certificate Number 14555

Glossary of acronyms and terms used in report

ADWG	*Australian Drinking Water Guidelines* 2011; published by the National Health and Medical Research Council
Coliforms	A general term for certain types of rod-shaped bacteria that share identifying characteristics.
Cyanobacteria	Photosynthetic aquatic bacteria commonly referred to as 'blue-green algae' (though not actually algae).
DWMS	Drinking Water Management System
'the Department'	Department of Health and Human Services (State Government of Victoria)
E. coli	*Escherichia coli*: thermotolerant bacteria used as an indicator of faecal contamination
HACCP	Hazard Analysis and Critical Control Point
<	'Less than' (mathematical term)
>	'Greater than' (mathematical term)
L	Litre: a unit of volume (equal to 1000 cubic centimetres)
mg/L	Milligrams per litre: a unit of concentration (one milligram is equal to 0.001 grams)
ML	Megalitres: a unit of volume (one megalitre is equal to one million litres)
NATA	National Association of Testing Authorities
ng/L	Nanograms per Litre: a unit of concentration (one ng is equal to 0.000000001 grams)
NHMRC	National Health and Medical Research Council
Orgs/100 mL	Organisms/per 100 millilitre of water: a unit of measurement used in microbiology
Pathogen	Disease-causing microorganism
PAC	Powdered activated carbon
PLC	Programmable logic controller: a digital computer used for automation of electromechanical processes
Quarter	Time period referring to one quarter of a year, *i.e.* three months.
RMP	Risk Management Plan
'the Act'	*Safe Drinking Water Act 2003*
'the Regulations'	Safe Drinking Water Regulations 2015
SGW	South Gippsland Water (South Gippsland Region Water Corporation, 'the Corporation')

Glossary of water treatment agents and processes

Aluminium chlorohydrate	Aluminium salt used as a coagulant in water treatment
Aluminium sulphate	Aluminium salt used as a coagulant in water treatment
Chloramine	A compound of chlorine and ammonia used for disinfection
Chlorine	An element used as a disinfectant in water treatment. May be applied in gaseous, elemental form, or via aqueous solution of sodium hypochlorite.
Coagulation	A chemical water treatment process that involves neutralisation of charge on particles (impurities) in water. This destabilisation of charge allows for particles to clump together rather than repel each other electrostatically.
Dewatering of waste water	Method of post water treatment water conservation. Removes excess water from sludge so it can be returned to a reservoir and reused.
Disinfection	Use of chemical, other agent (e.g. ultraviolet light) or process to kill or inactivate microorganisms which may be harmful to human health.
Dissolved air floatation (DAF) clarification	Water treatment process involving use of pressurised air for clarification. Microscopic air bubbles attach to floc and cause floc to float and make a sludge layer. This allows for separation of impurities (as floc) from water.
Filtration	Final water treatment process prior to disinfection; clarified water passes through large filters where impurities are entrapped.
Flocculation	A physical water treatment process that causes clumps formed through coagulation processes to come together into larger masses known as floc. Formation of floc allows for purification of water via sedimentation and filtration processes.
Fluoridation	Addition of fluoride to water for public dental health purposes.
Granular medium	Layers of sand, gravel and crushed anthracite that make up a water treatment plant filter.
Hydrochloric acid	An acid used to lower the pH of water which enables optimisation of coagulation processes
Manganese oxidation	Water treatment process important for minimising dirty/discoloured water complaints. Oxidation of dissolved manganese in raw (source) water causes it to precipitate out of solution as a solid. This is in turn allows for the solid oxidised manganese particles to be removed via coagulation, flocculation and filtration processes.
Manganese sequestration	Process that may be used to mitigate post treatment manganese oxidation and resulting discolouration of water. Manganese that has not been removed in treatment may oxidise on contact with chlorine disinfectants or air. Sequestration (or chelation) causes manganese to form soluble complexes that do not cause discolouration of water.
pH correction (pre/post treatment)	Raw water pH can vary due to environmental factors. Pre pH correction is needed to optimise treatment processes. Post pH treatment may be required to ensure pH is suitable for disinfection, and for distribution to customers in terms of aesthetics and water stability.
Polyacrylamide	Chemical polymer which may be used to facilitate flocculation or dewatering processes. Acts by binding particles/floc together.
Potassium permanganate	Compound used to oxidise manganese
Powdered activated carbon (PAC)	Primarily used to adsorb taste and odour compounds produced by algae from raw water
Sedimentation clarification	A physical water treatment process using gravity to remove suspended solids from water
Sodium hydroxide	Base used to raise the pH of water and optimise coagulation pH levels.
Ultraviolet disinfection	Use of ultraviolet light to kill/inactivate water-borne microorganisms that may be harmful to human health.