South Gippsland Water

Annual Drinking Water Quality Report 2014-15

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1.1 INTRODUCTION

At South Gippsland Water we are committed to the management of our water supply systems for the provision of safe, high-quality drinking water to all customers.

Welcome to South Gippsland Water's annual water quality report for the period 1st July 2014 to 30th June 2015. 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.

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*[*]. 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 2005 (the Regulations). More information on water treatment, quality management systems and operational improvements for 2014-15 can be found in part 2 of this report.

For the 2014-15 financial year, we are pleased to advise that drinking water supplied in all South Gippsland Water localities complied with the prescribed standards of the Regulations for *Escherichia coli* (*E. coli*), chloroacetic acids, aluminium and turbidity. With the exception of one, all localities have complied with the water quality standard for trihalomethanes. Part 3 of this report provides a summary of results from our comprehensive monitoring program, while part 4 outlines corrective actions taken to resolve water quality issues.

Customers are very important to us at South Gippsland Water and we strive to meet expectations in terms of supplying water that is not only safe to drink but also aesthetically-pleasing. We also aim to provide prompt and helpful service in response to water quality concerns. For details on the number of customer calls received in relation to water quality in 2014-15, as well as general information on how complaints are addressed, please refer to part 5.

With regard to achievements for the 2014-15 year, and as testament to our dedication to customer satisfaction, we are proud to report that a sample from the Ruby Creek water supply system (incorporating the localities of Leongatha and Koonwarra) was voted the "Best Tasting Water" in Victoria at the 2014 Water Industry Operators Association conference. We are also very proud of two of our water treatment plant operators who received awards at the same event: Jacob Bright was recognised as the "Young Operator of the Year"; while Michael Fawcett won the "Kwatye Water Prize" to assist with the implementation of an innovative mobile device application he has developed. As well as rewarding the efforts of these worthy individuals, the prizes reflect the commitment of the entire South Gippsland Water team to quality and continual improvement.

We hope that you find this report informative and invite you to contact our customer service department by telephoning 03 5662 0444 or emailing sgwater@sgwater.com.au if you require additional information on anything presented within.

[*] National Health and Medical Research Council and National Resource Management Ministerial Council *Australian Drinking Water Guidelines 2011*

1.2 CHARACTERISATION OF THE SYSTEM

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. Drinking water is supplied to 22 rural centres via ten separate supply systems; refer to Figure 1 (map).

The total water supply operation for 2014-15 comprised:

- 1,234 square kilometres of total catchment area
- 13 reservoirs and 4 raw water storage basins or tanks
- 10 water treatment plants
- 25 treated water distribution storages
- 15 water pump stations
- 699 kilometres of water mains
- 4,642 megalitres (million litres) of metered water supplied to customers

Separate water sampling localities in South Gippsland Water have been formally gazetted by the Department of Human Services in a notice in the Victoria Government Gazette Special Edition No. S193 on 3rd August 2006. Information on localities and water supply systems is provided in Table 1. There have been no major changes in arrangements with respect to water supply since the previous reporting period.

Table 1: SGW water sampling localities and supply sources

Water treatment plant	Localities supplied	Population serviced*	Principal raw water supply sources	Supplementary raw water supply sources	Raw water storage
Devon North	Alberton Yarram	510 2,240	Tarra River	Gippsland Basin groundwater aquifer (via bore, Devon North)	Devon North Raw Water Basin
Dumbalk	Dumbalk	260	Tarwin River (east branch)		Dumbalk Raw Water Tank
Fish Creek	Fish Creek	510	Battery Creek		Battery Creek Reservoir
Foster	Foster	1,110	Deep Creek		Deep Creek Reservoir; Foster Dam; Foster Raw Water Basin.
Korumburra	Korumburra	3,410	Coalition Creek; Bellview Creek; Ness Creek.	Tarwin River (west branch)	Coalition Creek Reservoir; Bellview Reservoir; Ness Gully Reservoir.
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	760 4,620 120 7,560	Lance Creek		Lance Creek Reservoir
Leongatha	Koonwarra Leongatha	190 4,990	Ruby Creek		No. 1 Reservoir; No. 2 Reservoir; Hyland Reservoir (No. 3); Western Reservoir (No. 4).
Meeniyan	Meeniyan	460	Tarwin River		Meeniyan Raw Water Basin
Poowong	Loch Nyora Poowong	280 710 320	Little Bass River		Little Bass Reservoir
Toora	Port Franklin Port Welshpool Toora	450 630 450	Agnes River		Cooks Dam

* Population estimates based on Australian bureau of Statistics (ABS) 2011 census updated with Department of Environment, Land, Water and Planning (DELWP) local government area growth factors for period 2011-16 of 2.1% for Bass Coast Shire, 0.4% for South Gippsland Shire, and 0.2% for Wellington Shire. Where no specific ABS data available for serviced locality, population has been estimated from number of connected properties and ABS statistics for average number of people per household.

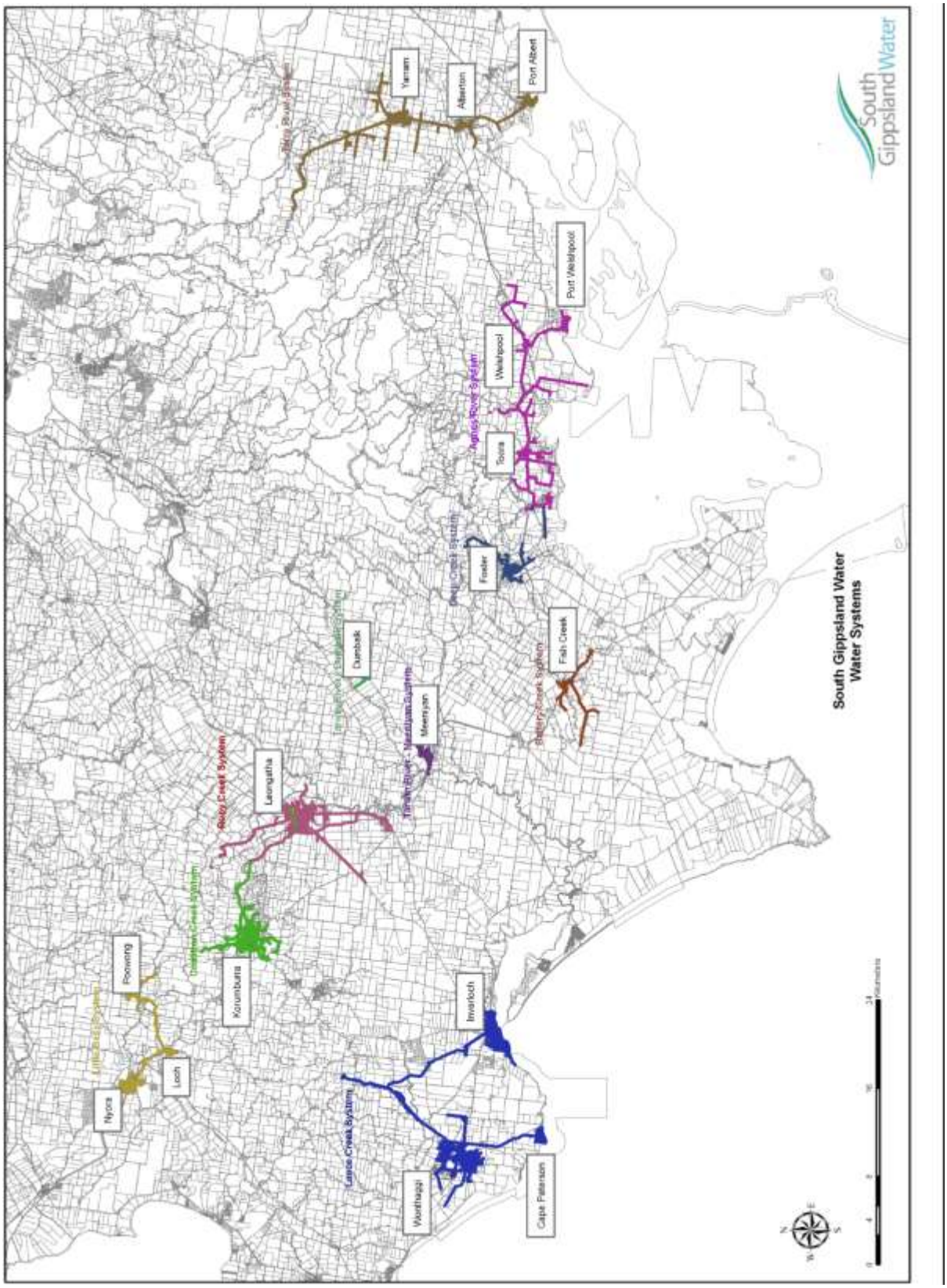


Figure 1: South Gippsland Water supply area and systems

2. WATER TREATMENT AND QUALITY MANAGEMENT SYSTEMS

2.1 WATER TREATMENT

Conventional water treatment is a process whereby water is purified to a level suitable for human consumption prior to being disinfected. In general, raw water is either collected in a reservoir or pumped from a river to a settling basin, where natural sedimentation of large particulate matter occurs. As smaller particles and dissolved substances will not settle out of the water within a practical timeframe, chemical agents must be added to precipitate and coagulate them into larger insoluble masses known as floc. The water can then be clarified by gravity settling or flotation of the floc, followed by filtration through a granular medium. Chemical disinfectants are added to the treated water product to destroy any microorganisms that may remain.

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. There have been no major changes in water treatment processes since the 2013-14 reporting period.

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

Water Treatment Plant	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 - - 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 As required Regular Regular Regular Regular Regular Regular Regular	Sodium carbonate Potassium permanganate Polyaluminium chloride - - - 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 - - Sodium carbonate Chlorine (gas) Sodium hypochlorite -

Water Treatment Plant	Localities supplied	Treatment process	Treatment frequency	Added substances
Korumburra	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) -
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 Chloramination disinfection Fluoridation Dewatering of waste water	As required As required As required Regular Regular Regular Regular Regular Regular Regular	Powdered activated carbon Sodium hydroxide / hydrochloric acid Potassium permanganate Aluminium sulphate - - Sodium hydroxide Chlorine (gas) and ammonia Hexafluorosilicic acid 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) Anionic polyacrylamide
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 Polyaluminium chloride Anionic polyacrylamide* - Sodium hypochlorite - - Anionic polyacrylamide
Poowong	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) -

*Polyacrylamide used as a floc aid, filter aid or sludge-thickening agent when required.

2.2 WATER TREATMENT ISSUES

Occasionally water quality issues can arise out of the application of treatment processes. One such issue relates to the chlorination disinfection process and resultant development of the chemical compounds known as trihalomethanes (THMs). THMs form when chlorine (or other halogen) atoms chemically combine with organic molecules in the water. The chemical reaction is favoured by increasing water temperature and contact time between chlorine and organic pre-cursor molecules. This means that THM levels will always tend to be higher in the summer-autumn period and where water can age as a result of a long distribution system (where a number of towns are supplied from the one treatment plant, for example) or low overall demand from customers (in a small town, for instance).

Lowering chlorine dosage would lead to fewer THM compounds being formed, but as disinfection is critical in preventing water-borne illness, this is not an appropriate course of action. Reducing levels of organic pre-cursor molecules prior to disinfection would also limit THM formation, but the specialised water treatment required for this is financially costly.

As a relatively low-cost remedy to the problem, air-stripping is used to remove THMs at three of South Gippsland Water's treatment plants. Pumps in the clear water storages at the Dumbalk, Fish Creek, and Meeniyan water treatment plants serve to aerate chlorinated water. This allows the volatile THM compounds to simply evaporate out of the water into the atmosphere. An issue with elevated THM levels arose for the Fish Creek locality as a result of an electrical fault with the aeration pumps in the clear water storage; refer to part 4 for further information.

2.3 QUALITY MANAGEMENT SYSTEMS AND CONTINUAL IMPROVEMENT

The risk management approach adopted by South Gippsland Water for the provision of safe drinking water is based on the twelve elements of the 'Framework for Management of Drinking Water Quality', as described in the *Australian Drinking Water Guidelines 2011.* Incorporated into the risk management system are a number of on-going programs and practices designed to ensure treatment plants are operating optimally at all times, and treated water within distribution systems is both protected from external contamination and remains aesthetically pleasing to customers; 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 kept abreast of drinking water related research, and advances in technologies and practices.

Suggestions for improvement are documented in the Drinking Water Management System (DWMS) improvement plan register. The register is reviewed at regular DWMS committee meetings with items being prioritised, actioned, and included in capital works plans where appropriate. Major improvements achieved in 2014-15 are outlined below.

2.3.1 Leongatha water treatment plant - caustic soda dosing system

The soda ash (sodium carbonate) dosing system at the Leongatha water treatment plant was replaced with a caustic soda (sodium hydroxide) dosing system in 2014-15. Achieving the same water quality outcomes, the change to caustic soda has reduced chemical costs allowing savings to be passed on to customers.

2.3.2 Implementation of a new data management system

The 2014-15 year has also seen the gradual implementation of an advanced water information management system for South Gippsland Water. The new software package allows for efficient collection and secure storage of water quality and operational data. It includes a large array of features and tools to facilitate treatment plant control, analysis of information, and preparation of reports. Once fully implemented, improvements in terms of efficiencies and whole water system management will be the result.

2.3.3 Fish Creek water treatment plant – remote monitoring of aeration pumps

As a long-term corrective action following a trihalomethane (THM) exceedance for the Fish Creek locality (refer to 3.3.1.4) electrical sensors to enable remote monitoring of the aeration pumps in the clear water storage at the treatment plant were installed in March 2015. The system generates an alarm on pump failure and allows the problem to be rectified quickly before THM concentrations can increase to unacceptable levels. Refer to section 4.2.1.1 (pages 44-45) for further information.

2.3.4 Operational improvements for Meeniyan

The cumulative effect of a number of small operational changes made at the Meeniyan water treatment plant has been an overall improvement in compliance with the aluminium water quality standard for 2014-15 (refer to section 3.10 of this report). The operational changes included:

- Optimisation of coagulant dosing
- Adjustments to filtration system leading to greater control of the process
- Use of unchlorinated (rather than chlorinated) water for polymer batching
- Optimisation of polymer dose leading to improved sludge thickening and quality of supernatant return water to raw water basin
- Reconfiguration of the clarifier desludge process

Additionally, community engagement has led to recycled water being used at the Meeniyan recreation reserve. The resultant decrease in overall demand for treated water in Meeniyan has allowed the treatment plant to be run more consistently at its optimal rate rather than at the upper limit of its design capacity. See also the 2013-14 annual drinking water quality report (available on South Gippsland Water's website) for further information.

3. QUALITY OF DRINKING WATER FOR 2014-15

3.1 WATER QUALITY MONITORING

During the 2014-15 reporting period, South Gippsland Water implemented water quality monitoring programs consistent with requirements of the *Safe Drinking Water Act 2003* (the Act). As specified in the Safe Drinking Water Regulations 2005, samples must be collected from the drinking water supply at relevant frequencies and analysed for performance against water quality standards as shown in Table 3.

Table 3: Drinking water quality standards and required sampling frequencies

Parameter	Relevant sampling frequency for each water sampling locality	Quality standard for each water sampling locality
Microbiological organisms:		
• *Escherichia coli*	One sample per week	At least 98% of all samples of drinking water collected in any 12-month period contain no *Escherichia coli* per 100 millilitres of drinking water
Chlorine-based chemicals:		
• Chloroacetic acid	One sample per month	0.15 milligrams per litre of drinking water
• Dichloroacetic acid	One sample per month	0.1 milligrams per litre of drinking water
• Trichloracetic acid	One sample per month	0.1 milligrams per litre of drinking water
• Trihalomethanes (total)	One sample per month	0.25 milligrams per litre of drinking water
Chemicals derived from treatment with ozone:		
• Bromate*	One sample per month	0.02 milligrams per litre of drinking water
• Formaldehyde*	One sample per month	0.5 milligrams per litre of drinking water
Aluminium-based chemicals:		
• Aluminium (acid-soluble)	One sample per month	0.2 milligrams per litre of drinking water
Other parameters:		
• Turbidity	One sample per week	95% upper confidence limit of the mean of samples of drinking water collected in any 12 month period must be less than or equal to 5.0 Nephelometric Turbidity Units

*As South Gippsland Water does not use ozone for treatment or disinfection, analysis for the ozone-derived chemicals of bromate and formaldehyde is not required and has not been conducted in the 2014-15 reporting period.

3.1.1 Disinfection by-product sampling frequency changes

In accordance with regulation 11 of the Safe Drinking Water Regulations 2005, a water supplier may apply to vary the frequency at which samples of drinking water are collected within a water sampling locality for a specified parameter as listed in Table 3 (above).

Based on long-term (ten years) recorded low levels from monthly monitoring, and risk review of the water treatment and supply systems, South Gippsland Water determined that future non-compliance with the regulatory standards for chloroacetic acid, dichloroacetic acid and trichloroacetic acid for any of its supply systems is extremely unlikely. Similarly, historical data and risk assessment indicated that the probability of non-compliance with the standard for the chlorine-based trihalomethanes is also very low in water supply systems where chloramine (rather than chlorine) is used as the disinfectant in water treatment.

With a view to reducing analysis costs so that savings could ultimately be passed on to customers by way of water rate reductions, South Gippsland Water applied to the Secretary to the Department of Health and Human Services for variations to sampling frequencies as follows:

- Reduction in monitoring for chloroacetic acid, dichloroacetic acid and trichloroacetic acid from monthly to quarterly (every three months) for all South Gippsland Water localities, commencing August 2014
- Reduction in monitoring of trihalomethanes (total) from monthly to quarterly for all chloraminated supply systems; namely: Alberton, Cape Paterson, Inverloch, Lance Creek, Loch, Nyora, Poowong, Wonthaggi and Yarram, commencing August 2014

The applications were assessed and approved by the Secretary, and variation notices were published in the Victoria Government Gazettes S 260 (dated 1st Aug, 2014) and S 266 (dated 8th Aug, 2014).

3.1.2 *E. coli* and turbidity sampling changes

Additionally, prior to September 2014, South Gippsland Water collected samples for *E. coli* and turbidity monitoring in excess of the one per week per locality as specified in the Regulations (refer to table 3) for the localities of Inverloch, Korumburra, Leongatha, Port Franklin, Toora and Wonthaggi. This monitoring was part of a pro-active risk management strategy based on population size and water supply distribution system characteristics. Following risk review and long-term overall compliance with the relevant water quality standards for Korumburra, Leongatha, Port Franklin, Toora and Wonthaggi, it was determined that monitoring in addition to the amount specified in the standard for these localities could be reduced. Refer to Tables 4 and 10 on following pages for details of sampling frequency changes.

3.1.3 Other Monitoring

In addition to regulatory compliance monitoring, South Gippsland Water also conducted water quality monitoring for specific parameters based on the health and aesthetic considerations detailed in the *Australian Drinking Water Guidelines 2011*. All water samples collected as part of South Gippsland Water's monitoring programs were independently analysed by a National Association of Testing Authorities (NATA) certified laboratory.

3.1.4 Analysis Results

Results of analysis for 2014-15 are summarised in Tables 4 to 28 on the following pages.

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 **(03) 5662 0444**, or by emailing sgwater@sgwater.com.au

3.2 *ESCHERICHIA COLI*

Escherichia coli (*E. coli*) is used as a specific indicator of faecal contamination to determine the safety of water for drinking. The Safe Drinking Water Regulations 2005 specify that at least 98% of all samples of drinking water collected in a 12-month period contain no *E. coli* per 100 mL of drinking water.

3.2.1 Results: Escherichia coli

Monitoring for compliance with the water quality standard for *E. coli* was conducted in accordance with the Regulations.* Results are presented in Table 4.

Table 4: *Escherichia coli* results for 2014-15 financial year

Locality	Sampling frequency 1/7/14 to 31/8/15 (samples per time period)	Sampling frequency 1/9/14 to 30/6/15 (samples per time period)*	Total No. of samples	No. of samples containing *E. coli*	Maximum result (Orgs/100mL)	Percentage of samples with no *E. coli*	Complying with regulation (Yes/No)
Alberton	1/week	1/week	52	0	0	100%	Yes
Cape Paterson	1/week	1/week	52	0	0	100%	Yes
Dumbalk	1/week	1/week	53	0	0	100%	Yes
Fish Creek	1/week	1/week	53	0	0	100%	Yes
Foster	1/week	1/week	53	0	0	100%	Yes
Inverloch	2/week	2/week	104	0	0	100%	Yes
Koonwarra	1/week	1/week	52	0	0	100%	Yes
Korumburra	2/week	1/week*	60	0	0	100%	Yes
Lance Creek	1/week	1/week	52	0	0	100%	Yes
Leongatha	3/week	2/week*	112	0	0	100%	Yes
Loch	1/week	1/week	52	0	0	100%	Yes
Meeniyan	1/week	1/week	52	0	0	100%	Yes
Nyora	1/week	1/week	52	1	1	98%	Yes
Poowong	1/week	1/week	52	0	0	100%	Yes
Port Franklin	2/week	1/week*	62	0	0	100%	Yes
Port Welshpool	1/week	1/week	53	0	0	100%	Yes
Toora	2/week	1/week*	62	0	0	100%	Yes
Wonthaggi	4/week	2/week*	120	0	0	100%	Yes
Yarram	1/week	1/week	52	0	0	100%	Yes

*Refer to 3.1.2 for information on changes to sampling frequencies for *E. coli* monitoring

3.2.2 Actions undertaken in relation to non-compliance for *E. coli*

Drinking water supplied in all localities complied with the water quality standard for *E. coli*. In response to an instance of *E. coli* detection for the Nyora locality in November 2014, investigative and corrective actions in accordance with procedures of South Gippsland Water's risk management plan were implemented. These included sampling site and distribution system clear water storage inspection, extensive follow-up sampling and water mains flushing. For specific details refer to part 4 (pages 43-44) of this report.

3.3 CHLORINE-BASED DISINFECTION BYPRODUCT CHEMICALS

Chlorine-based disinfection byproduct chemicals may be present in drinking water as a result of reactions between chlorine and naturally-occurring organic materials, such as humic and fulvic acids.

3.3.1 Results: Chlorine-based disinfection byproducts

Monitoring for compliance with the water quality standards for chlorine-based disinfection byproduct chemicals was conducted in accordance with the Safe Drinking Water Regulations 2005. A summary of results for the regulated chlorine disinfection byproducts of chloroacetic acid, dichloroacetic acid, trichloroacetic acid and trihalomethanes (total) are provided in table 5, 6, 7 and 8 respectively.

3.3.1.1 Chloroacetic acid

The Safe Drinking Water Regulations 2005 specify that chloroacetic acid in drinking water should not exceed 0.15 mg/L.

Table 5: Chloroacetic acid results for 2014-15 financial year

Locality	Sampling frequency 1/7/14 to 31/7/14 (samples per time period)	Sampling frequency 1/8/14 to 30/6/15 (samples per time period)*	Total No. of samples	No. of non-complying samples	Minimum result mg/L	Maximum result mg/L	Complying with regulation (Yes/No)
Alberton	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Cape Paterson	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Dumbalk	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Fish Creek	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Foster	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Inverloch	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Koonwarra	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Korumburra	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Lance Creek	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Leongatha	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Loch	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Meeniyan	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Nyora	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Poowong	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Port Franklin	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Port Welshpool	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Toora	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Wonthaggi	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Yarram	1/month	1/quarter	5	0	<0.005	<0.005	Yes

*Refer to 3.1.1 for information on changes to sampling frequencies

3.3.1.2 Dichloroacetic acid

The Safe Drinking Water Regulations 2005 specify that dichloroacetic acid in drinking water should not exceed 0.1 mg/L.

Table 6: Dichloroacetic acid results for 2014-15 financial year

Locality	Sampling frequency 1/7/14 to 31/7/14 (samples per time period)	Sampling frequency 1/8/14 to 30/6/15 (samples per time period)*	Total No. of samples	No. of non-complying samples	Minimum result mg/L	Maximum result mg/L	Complying with regulation (Yes/No)
Alberton	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Cape Paterson	1/month	1/quarter	5	0	<0.005	0.011	Yes
Dumbalk	1/month	1/quarter	5	0	<0.005	0.014	Yes
Fish Creek	1/month	1/quarter	5	0	<0.005	0.021	Yes
Foster	1/month	1/quarter	5	0	<0.005	0.011	Yes
Inverloch	1/month	1/quarter	5	0	0.006	0.008	Yes
Koonwarra	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Korumburra	1/month	1/quarter	5	0	0.007	0.021	Yes
Lance Creek	1/month	1/quarter	5	0	<0.005	0.007	Yes
Leongatha	1/month	1/quarter	5	0	0.007	0.017	Yes
Loch	1/month	1/quarter	5	0	0.014	0.018	Yes
Meeniyan	1/month	1/quarter	5	0	<0.005	0.021	Yes
Nyora	1/month	1/quarter	5	0	0.009	0.021	Yes
Poowong	1/month	1/quarter	5	0	<0.005	0.015	Yes
Port Franklin	1/month	1/quarter	5	0	0.015	0.028	Yes
Port Welshpool	1/month	1/quarter	5	0	0.008	0.018	Yes
Toora	1/month	1/quarter	5	0	0.012	0.022	Yes
Wonthaggi	1/month	1/quarter	5	0	<0.005	0.011	Yes
Yarram	1/month	1/quarter	5	0	<0.005	<0.005	Yes

*Refer to 3.1.1 for information on changes to sampling frequencies

3.3.1.3 Trichloroacetic acid

The Safe Drinking Water Regulations 2005 specify that trichloroacetic acid in drinking water should not exceed 0.1 mg/L.

Table 7: Trichloroacetic acid results for 2014-15 financial year

Locality	**Sampling frequency 1/7/14 to 31/7/14 (samples per time period)**	**Sampling frequency 1/8/14 to 30/6/15 (samples per time period)***	Total No. of samples	No. of non-complying samples	Minimum result mg/L	Maximum result mg/L	Complying with regulation (Yes/No)
Alberton	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Cape Paterson	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Dumbalk	1/month	1/quarter	5	0	<0.005	0.010	Yes
Fish Creek	1/month	1/quarter	5	0	0.012	0.027	Yes
Foster	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Inverloch	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Koonwarra	1/month	1/quarter	5	0	<0.005	0.006	Yes
Korumburra	1/month	1/quarter	5	0	0.008	0.014	Yes
Lance Creek	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Leongatha	1/month	1/quarter	5	0	0.009	0.016	Yes
Loch	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Meeniyan	1/month	1/quarter	5	0	0.007	0.017	Yes
Nyora	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Poowong	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Port Franklin	1/month	1/quarter	5	0	0.010	0.018	Yes
Port Welshpool	1/month	1/quarter	5	0	0.007	0.013	Yes
Toora	1/month	1/quarter	5	0	0.009	0.016	Yes
Wonthaggi	1/month	1/quarter	5	0	<0.005	<0.005	Yes
Yarram	1/month	1/quarter	5	0	<0.005	<0.005	Yes

*Refer to 3.1.1 for information on changes to sampling frequencies

3.3.1.4 Trihalomethanes (total)

The Safe Drinking Water Regulations 2005 specify that trihalomethanes in drinking water should not exceed 0.25 mg/L.

Table 8: Trihalomethanes (total) results for 2014-15

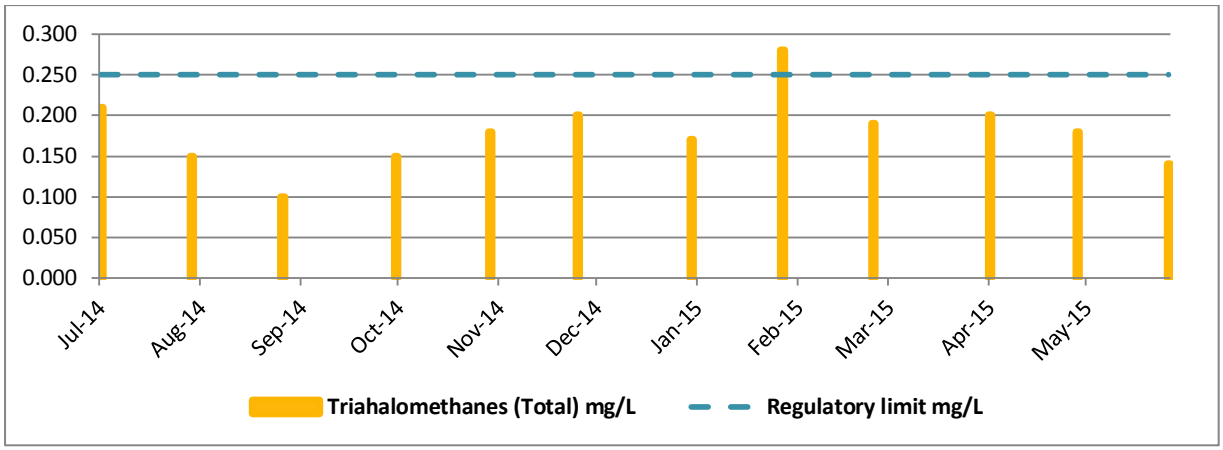
Locality	**Sampling frequency 1/7/14 to 31/7/14 (samples per time period)**	**Sampling frequency 1/8/14 to 30/6/15 (samples per time period)***	Total No. of samples	No. of non-complying samples	Minimum result mg/L	Maximum result mg/L	Complying with regulation (Yes/No)
Alberton	1/month	1/quarter*	5	0	<0.001	0.005	Yes
Cape Paterson	1/month	1/quarter*	5	0	0.008	0.013	Yes
Dumbalk	1/month	1/month	12	0	0.054	0.140	Yes
Fish Creek	1/month	1/month	12	1	0.100	0.280	No
Foster	1/month	1/month	12	0	0.063	0.110	Yes
Inverloch	1/month	1/quarter*	5	0	0.009	0.012	Yes
Koonwarra	1/month	1/month	12	0	0.098	0.140	Yes
Korumburra	1/month	1/month	12	0	0.084	0.160	Yes
Lance Creek	1/month	1/quarter*	5	0	0.008	0.013	Yes
Leongatha	1/month	1/month	12	0	0.085	0.160	Yes
Loch	1/month	1/quarter*	5	0	0.004	0.007	Yes
Meeniyan	1/month	1/month	12	0	0.084	0.140	Yes
Nyora	1/month	1/quarter*	5	0	0.002	0.010	Yes
Poowong	1/month	1/quarter*	5	0	0.002	0.008	Yes
Port Franklin	1/month	1/month	12	0	0.060	0.150	Yes
Port Welshpool	1/month	1/month	12	0	0.036	0.120	Yes
Toora	1/month	1/month	12	0	0.043	0.110	Yes
Wonthaggi	1/month	1/quarter*	5	0	0.009	0.012	Yes
Yarram	1/month	1/quarter*	5	0	<0.001	0.008	Yes

*Refer to 3.1.1 for information on changes to sampling frequencies for chloraminated supplies

3.3.2 Actions undertaken in relation to non compliance for chlorine-based disinfection byproduct chemicals

There was an exceedance of the regulatory standard for trihalomethanes (total) for the locality of Fish Creek in February 2015. In response to this exceedance, investigative and corrective actions were implemented in accordance with procedures of South Gippsland Water's risk management plan. These included additional monitoring for triahlomethanes, inspection of relevant operational set-ups, and water mains flushing. Refer to Figure 2 (on following page) and part 4 (pages 44-45) of this report for detailed information.

Figure 2: **2014-15 Trihalomethane results for non-complying locality of Fish Creek**



3.4 OZONE-BASED DISINFECTION BYPRODUCT CHEMICALS

Water supplied by South Gippsland Water is not treated with ozone and therefore byproducts derived from ozone are not a significant risk to drinking water supplied and are not required to be measured.

3.5 ALUMINIUM

Aluminium may be present in drinking water where aluminium salts are used as coagulants in water treatment processes to destabilise particles in water. The Safe Drinking Water Regulations 2005 specify that acid-soluble aluminium in drinking water should not exceed 0.2 mg/L.

3.5.1 Results: Aluminium

Monitoring for compliance with the water quality standard for aluminium was conducted in accordance with the Regulations. A summary of aluminium results for all localities is provided in Table 9.

Table 9: Acid-soluble aluminium results for 2014-15 financial year

Locality	Sampling frequency (No. of samples per time period)	Total No. of samples	No. of non-complying samples	Minimum result mg/L	Maximum result mg/L	Complying with regulation (Yes/No)
Alberton	1/month	12	0	<0.01	0.02	Yes
Cape Paterson	1/month	12	0	<0.01	0.04	Yes
Dumbalk	1/month	12	0	<0.01	0.06	Yes
Fish Creek	1/month	12	0	<0.01	0.04	Yes
Foster	1/month	12	0	<0.01	0.02	Yes
Inverloch	1/month	12	0	<0.01	0.03	Yes
Koonwarra	1/month	12	0	<0.01	0.02	Yes
Korumburra	1/month	12	0	<0.01	0.18	Yes
Lance Creek	1/month	12	0	<0.01	0.03	Yes
Leongatha	1/month	12	0	<0.01	0.02	Yes
Loch	1/month	12	0	0.02	0.04	Yes
Meeniyan	1/month	12	0	<0.01	0.08	Yes
Nyora	1/month	12	0	<0.01	0.04	Yes
Poowong	1/month	12	0	<0.01	0.04	Yes
Port Franklin	1/month	12	0	<0.01	0.02	Yes
Port Welshpool	1/month	12	0	<0.01	0.02	Yes
Toora	1/month	12	0	<0.01	0.02	Yes
Wonthaggi	1/month	12	0	<0.01	0.03	Yes
Yarram	1/month	12	0	<0.01	0.03	Yes

3.5.2 Actions undertaken in relation to non-compliance for aluminium

Drinking water supplied in all localities complied with the water quality standard for aluminium and no actions were required in relation to non-compliance.

3.6 TURBIDITY

Turbidity is a 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 2005 specify that the calculated 95% upper confidence limit (UCL) of the mean of samples of drinking water collected in any 12-month period should be less than or equal to 5.0 Nephelometric Units (NTU).

3.6.1 Results: Turbidity

Monitoring for compliance with the water quality standard for turbidity was conducted in accordance with the Regulations. A summary of turbidity monitoring results is presented in table 10.

Table 10: Turbidity Results for the 2014-15 financial year

Locality	Sampling frequency 1/7/14 to 31/8/15 (samples per time period)	Sampling frequency 1/9/14 to 30/6/15 (samples per time period)*	Total No. of samples	Maximum result NTU	95% UCL of mean	Complying with regulation (Yes/No)
Alberton	1/week	1/week	52	1.1	0.3	Yes
Cape Paterson	1/week	1/week	52	0.6	0.3	Yes
Dumbalk	1/week	1/week	53	0.9	0.3	Yes
Fish Creek	1/week	1/week	53	1.4	0.4	Yes
Foster	1/week	1/week	53	0.8	0.3	Yes
Inverloch	2/week	2/week	104	0.7	0.3	Yes
Koonwarra	1/week	1/week	52	0.4	0.2	Yes
Korumburra	2/week	1/week*	60	0.6	0.3	Yes
Lance Creek	1/week	1/week	52	0.6	0.3	Yes
Leongatha	3/week	2/week*	112	0.6	0.3	Yes
Loch	1/week	1/week	52	0.4	0.2	Yes
Meeniyan	1/week	1/week	52	0.6	0.3	Yes
Nyora	1/week	1/week	52	0.6	0.2	Yes
Poowong	1/week	1/week	52	0.6	0.3	Yes
Port Franklin	2/week	1/week*	62	1.2	0.3	Yes
Port Welshpool	1/week	1/week	53	0.6	0.3	Yes
Toora	2/week	1/week*	62	1.1	0.3	Yes
Wonthaggi	4/week	2/week*	120	0.5	0.2	Yes
Yarram	1/week	1/week	52	0.6	0.2	Yes

*Refer to 3.1.2 for information on changes to turbidity sampling frequency

3.6.2 Actions undertaken in relation to non-compliance for turbidity

Based on the calculated UCL of the mean, drinking water supplied in all localities complied with the water quality standard for turbidity and no actions were required in relation to non-compliance.

3.7 FLUORIDE

Naturally-occurring fluoride concentrations in drinking water are largely dependent on the type of 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* (2009) states that the annual average concentration for fluoride in drinking water must not exceed a level of 1 mg/L.

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 shown 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 this optimal concentration in operating a fluoride dosing facility, 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.

3.7.1 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 11.

Table 11: Fluoride results for non-fluoridated supplies in the 2014-15 financial year

Water Treatment Plant	Localities Supplied	Sampling Frequency (Samples per time period)	Total No. of Samples	Result mg/L	Complying with regulation Yes/No
Devon North	Alberton Yarram	1/year	1	0.05	Yes
Dumbalk	Dumbalk	1/year	1	0.12	Yes
Fish Creek	Fish Creek	1/year	1	<0.05	Yes
Foster	Foster	1/year	1	<0.05	Yes
Korumburra	Korumburra	1/year	1	0.09	Yes
Leongatha	Leongatha Koonwarra	1/year	1	0.08	Yes
Meeniyan	Meeniyan	1/year	1	0.09	Yes
Poowong	Loch Nyora Poowong	1/year	1	0.12	Yes
Toora	Port Franklin Port Welshpool Toora	1/year	1	0.06	Yes

3.7.2 Actions undertaken in relation to non-compliance in non-fluoridated supplies

Drinking water monitored at distribution entry point sites at all water treatment plants for non-fluoridated supplies complied with the ADWG guideline value for fluoride, and there were no actions required in relation to non-compliance.

3.7.3 Results: fluoride in fluoridated supply

For the fluoridated supply of Lance Creek, monitoring is conducted in accordance with the *Code of practice for fluoridation of drinking water supplies* (2009; refer to Table 12 for results.

Table 12: Fluoride results for fluoridated (Lance Creek) supply system in the 2014-15 financial year

Locality	Sampling frequency (Samples per time period)	Total No. 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	1/week	52	0.9±0.1	0.59	0.91	0.80	Yes	Yes
Inverloch	1/week	52	0.9±0.1	0.61	0.92	0.80	Yes	Yes
Lance Creek	1/week	52	0.9±0.1	0.13	0.91	0.81	Yes	Yes
Wonthaggi	1/week	52	0.9±0.1	0.56	0.91	0.81	Yes	Yes

3.7.4 Actions undertaken in relation to non-compliance for fluoride in fluoridated supplies

No actions were required in relation to non-compliance; drinking water in all fluoridated localities complied with both the *Health (fluoridation) Act 1973* and the ADWG guideline for maximum 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.

3.8 OTHER ALGAE, 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.

3.8.1 Arsenic

Arsenic is a naturally-occurring element which can be introduced to water through the 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 13.

Table 13: Arsenic results for 2014-15 financial year

Water Treatment Plant	Localities supplied	Sampling frequency (samples per time period)	Total No. of samples	Result mg/L	Complying with ADWG guideline value Yes/No
Devon North	Alberton Yarram	1/year	1	<0.001	Yes
Dumbalk	Dumbalk	1/year	1	<0.001	Yes
Fish Creek	Fish Creek	1/year	1	<0.001	Yes
Foster	Foster	1/year	1	<0.001	Yes
Korumburra	Korumburra	1/year	1	<0.001	Yes
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	1/year	1	<0.001	Yes
Leongatha	Leongatha Koonwarra	1/year	1	<0.001	Yes
Meeniyan	Meeniyan	1/year	1	<0.001	Yes
Poowong	Loch Nyora Poowong	1/year	1	<0.001	Yes
Toora	Port Franklin Port Welshpool Toora	1/year	1	<0.001	Yes

3.8.2 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 14.

Table 14: Copper results for 2014-15 financial year

Locality	Sampling Frequency (samples per time period)	Total No. of samples	Minimum result mg/L	Maximum result mg/L	Complying with ADWG guideline value (Yes/No)
Alberton	1/quarter	4	0.001	0.017	Yes
Cape Paterson	1/quarter	4	0.015	0.016	Yes
Dumbalk	1/quarter	4	0.006	0.015	Yes
Fish Creek	1/quarter	4	0.002	0.013	Yes
Foster	1/quarter	4	0.005	0.008	Yes
Inverloch	1/quarter	4	0.009	0.017	Yes
Koonwarra	1/quarter	4	0.005	0.022	Yes
Korumburra	1/quarter	4	0.010	0.033	Yes
Lance Creek	1/quarter	4	0.008	0.036	Yes
Leongatha	1/quarter	4	0.004	0.006	Yes
Loch	1/quarter	4	0.003	0.021	Yes
Meeniyan	1/quarter	4	0.002	0.016	Yes
Nyora	1/quarter	4	0.003	0.012	Yes
Poowong	1/quarter	4	0.003	0.008	Yes
Port Franklin	1/quarter	4	0.001	0.007	Yes
Port Welshpool	1/quarter	4	0.002	0.007	Yes
Toora	1/quarter	4	0.005	0.006	Yes
Wonthaggi	1/quarter	4	0.008	0.014	Yes
Yarram	1/quarter	4	0.001	0.005	Yes

Note: Samples are taken for analysis from the reticulation system. Copper levels may be higher at 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 03 5682 0444.

3.8.3 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 15.

Table 15: Cyanogen chloride for 2014-15 financial year: chloraminated systems only.

Water Treatment Plant	Localities supplied	Sampling frequency (samples per time period)	Total No. of samples	Maximum result mg/L	Complying with ADWG Guideline value Yes/No
Devon North	Alberton Yarram	One per year	1	<0.05	Yes
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	One per year	1	<0.05	Yes
Poowong	Loch Nyora Poowong	One per year	1	<0.05	Yes

3.8.4 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 16.

Table 16: Lead results for 2014-15 financial year

Locality	Sampling frequency (samples per time period)	Total No. of samples	Minimum result mg/L	Maximum result mg/L	Complying with ADWG guideline value (Yes/No)
Alberton	1/quarter	4	<0.001	<0.001	Yes
Cape Paterson	1/quarter	4	<0.001	<0.001	Yes
Dumbalk	1/quarter	4	<0.001	<0.001	Yes
Fish Creek	1/quarter	4	<0.001	<0.001	Yes
Foster	1/quarter	4	<0.001	<0.001	Yes
Inverloch	1/quarter	4	<0.001	<0.001	Yes
Koonwarra	1/quarter	4	<0.001	<0.001	Yes
Korumburra	1/quarter	4	<0.001	<0.001	Yes
Lance Creek	1/quarter	4	<0.001	<0.001	Yes
Leongatha	1/quarter	4	<0.001	<0.001	Yes
Loch	1/quarter	4	<0.001	<0.001	Yes
Meeniyan	1/quarter	4	<0.001	<0.001	Yes
Nyora	1/quarter	4	<0.001	<0.001	Yes
Poowong	1/quarter	4	<0.001	<0.001	Yes
Port Franklin	1/quarter	4	<0.001	<0.001	Yes
Port Welshpool	1/quarter	4	<0.001	<0.001	Yes
Toora	1/quarter	4	<0.001	<0.001	Yes
Wonthaggi	1/quarter	4	<0.001	<0.001	Yes
Yarram	1/quarter	4	<0.001	<0.001	Yes

3.8.5 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 aesthetic-based and health-based guideline values for manganese; refer to Table 17.

Table 17: Manganese result for 2014-15 financial year

Locality	Sampling frequency (samples per time period)	Total No. of samples	Minimum result mg/L	Maximum result mg/L	Complying with ADWG guideline value (Yes/No)
Alberton	1/month	12	<0.001	0.017	Yes
Cape Paterson	1/month	12	0.002	0.017	Yes
Dumbalk	1/month	12	<0.001	0.001	Yes
Fish Creek	1/month	12	0.001	0.035	Yes
Foster	1/month	12	0.006	0.030	Yes
Inverloch	1/month	12	0.003	0.037	Yes
Koonwarra	1/month	12	0.001	0.008	Yes
Korumburra	1/month	12	0.002	0.028	Yes
Lance Creek	1/month	12	0.003	0.023	Yes
Leongatha	1/month	12	0.002	0.026	Yes
Loch	1/month	12	0.002	0.010	Yes
Meeniyan	1/month	12	<0.001	0.001	Yes
Nyora	1/month	12	0.002	0.006	Yes
Poowong	1/month	12	0.002	0.006	Yes
Port Franklin	1/month	12	0.002	0.005	Yes
Port Welshpool	1/month	12	<0.001	0.016	Yes
Toora	1/month	12	0.003	0.020	Yes
Wonthaggi	1/month	12	0.003	0.021	Yes
Yarram	1/month	12	<0.001	0.031	Yes

3.8.6 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 was conducted in all chloraminated South Gippsland Water localities in 2014-15. All localities complied with the guideline values for nitrate and nitrite; refer to Tables 18 and 19.

Table 18: Nitrate results for 2014-15 financial year: chloraminated systems

Locality	Sampling frequency Winter & Spring (samples per time period)	Sampling frequency Summer & Autumn (samples per time period	Total No. of samples	Minimum result mg/L	Maximum result mg/L	Complying with ADWG guideline value (Yes/No)
Alberton	1/month	2/month	20	0.190	0.830	Yes
Cape Paterson	1/month	2/month	20	0.390	1.800	Yes
Inverloch	1/month	2/month	20	0.220	1.300	Yes
Lance Creek	1/month	2/month	20	0.091	1.200	Yes
Loch	1/month	2/month	20	0.074	1.600	Yes
Nyora	1/month	2/month	20	0.120	1.600	Yes
Poowong	1/month	2/month	20	0.160	1.700	Yes
Wonthaggi	1/month	2/month	20	0.120	1.300	Yes
Yarram	1/month	2/month	20	0.160	0.860	Yes

Table 19: Nitrite results for 2014-15 financial year: chloraminated systems

Locality	Sampling frequency Winter & Spring (samples per time period)	Sampling frequency Summer & Autumn (samples per time period	Total No. of samples	Minimum result mg/L	Maximum result mg/L	Complying with ADWG guideline value (Yes/No)
Alberton	1/month	2/month	20	0.006	0.029	Yes
Cape Paterson	1/month	2/month	20	0.060	0.940	Yes
Inverloch	1/month	2/month	20	0.068	1.200	Yes
Lance Creek	1/month	2/month	20	0.003	0.021	Yes
Loch	1/month	2/month	20	0.002	0.019	Yes
Nyora	1/month	2/month	20	0.002	0.016	Yes
Poowong	1/month	2/month	20	0.014	0.420	Yes
Wonthaggi	1/month	2/month	20	0.006	0.044	Yes
Yarram	1/month	2/month	20	0.019	0.770	Yes

3.8.7 N-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 20.

Table 20: NDMA for 2014-15 financial year: chloraminated systems

Water Treatment Plant	Localities Supplied	Sampling frequency (samples per time period)	Total No. of Samples	Maximum result mg/L	Complying with ADWG guideline value Yes/No
Devon North	Alberton Yarram	2/quarter	8	0.000037	Yes
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	2/quarter	8	0.000020	Yes
Poowong	Loch Nyora Poowong	2/quarter	8	0.000016	Yes

3.8.8 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 21.

Table 21: Results of inorganic chemical monitoring in 2014-15 financial year

Parameter	Sampling frequency	No. of Samples per water supply system/locality*	Total No. of samples taken in 2014-15	Maximum result mg/L	ADWG guideline value mg/L	Compliance with ADWG guideline value (Yes/No)
Antimony	Annually	One per locality	19	<0.001	0.003	Yes
Barium	Annually	One per system	10	0.032	2	Yes
Beryllium	Annually	One per system	10	<0.001	0.06	Yes
Boron	Annually	One per system	10	0.03	4	Yes
Cadmium	Annually	One per locality	19	<0.0002	0.002	Yes
Chromium	Annually	One per locality	19	<0.001	0.05	Yes
Cyanide	Annually	One per system	10	<0.005	0.08	Yes
Mercury	Annually	One per system	10	<0.0001	0.001	Yes
Molybdenum	Annually	One per system	10	<0.001	0.05	Yes
Nickel	Annually	One per locality	19	0.001	0.02	Yes
Selenium	Annually	One per system	10	<0.001	0.01	Yes
Silver	Annually	One per system	10	<0.001	0.1	Yes
Sulphate	Quarterly	One per system	40	58	500	Yes
Zinc	Annually	One per locality	19	0.018	3	Yes

*****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.

3.8.9 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. Consistent with historical data, monitoring of raw water intake or distribution entry point water at all South Gippsland Water treatment plants found that levels of industrial and agricultural chemicals were compliant with the ADWG health-related guidelines for the 2014-15 period; refer to Table 22.

Table 22: Results of organic chemical monitoring in 2014-15 financial year

Parameter	Sampling Frequency	No. of Samples per water supply system*	Total No. of samples taken in 2014-15	Maximum result mg/L	ADWG guideline value mg/L	Compliance with ADWG guideline value Yes/no
1,1-dichloroethane	Annually	One per system	10	<0.001	a	-
1,2-dichloroethane	Annually	One per system	10	<0.001	0.003	Yes
2,4,5-T	Biannually	Two per system	20	<0.00001	0.1	Yes
2,4,5-TP	Biannually	Two per system	20	<0.00001	b	-
2,4,6-T	Biannually	Two per system	20	0.0001	b	-
2,4,6-trichlorphenol	Annually	One per system	10	<0.001	0.02	Yes
2,4-D	Biannually	Two per system	20	0.00002	0.03	Yes
2,4-DB	Biannually	Two per system	20	<0.00001	b	-
2,4-DP	Biannually	Two per system	20	<0.00001	b	-
2,6-D	Biannually	Two per system	20	<0.0001	b	-
4-Chlorophenoxyacetic Acid	Biannually	Two per system	20	<0.00001	b	-
Atrazine	Biannually	Two per system	20	<0.002	0.02	Yes
Benzene	Annually	One per system	10	<0.001	0.001	Yes
Benzo(a)pyrene	Annually	One per system†	4	<0.000002	0.00001	Yes
Carbon tetrachloride	Annually	One per system	10	<0.001	0.003	Yes
Clopyralid	Biannually	Two per system	20	<0.00005	2	Yes
Dicamba	Biannually	Two per system	20	<0.00001	0.1	Yes
Fluoroxypyr	Biannually	Two per system	20	<0.00005	b	-
Glyphosate	Biannually	Two per system	20	<0.03	1	Yes
MCPA	Biannually	Two per system	20	<0.00001	0.04	Yes
MCPB	Biannually	Two per system	20	<0.00001	b	-
Mecoprop	Biannually	Two per system	20	<0.00001	b	-
Methoxychlor	Biannually	Two per system	20	<0.0002	0.3	Yes
Metsulfuron methyl	Annually	One per system	10	<0.0001	0.04	Yes
Pentachlorphenol	Annually	One per system	10	<0.001	0.01	Yes
Picloram	Biannually	Two per system	20	0.00027	0.3	Yes
Prometryn	Biannually	Two per system	20	<0.002	b	-
Simazine	Biannually	Two per system	20	<0.002	0.02	Yes
Tetrachloroethene	Annually	One per system	10	<0.001	0.05	Yes
Trichloroethylene	Annually	One per system	10	<0.001	a	-
Triclopyr	Biannually	Two per system	20	0.00026	0.02	Yes

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, Korumburra, Lance Creek and Leongatha water treatment plants only

3.8.10 Raw water monitoring

For the purposes of risk management, the parameters listed in Table 23 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 2014-15 reporting period.

Table 23: Raw water monitoring

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
Phosphorous	Quarterly
Total Organic Carbon	Quarterly
Turbidity	Weekly
Pesticides	Annually/Biannually/Event-based
Radionuclides	Every 7 years: Sampling conducted in 2009

Data obtained from all water quality monitoring programs conducted by South Gippsland Water is available on request by telephoning Customer Service on 03 5662 0444 or emailing **sgwater@sgwater.com.au**

3.9 AESTHETICS

South Gippsland water aims to provide aesthetically-pleasing drinking water for all customers. Actions taken to manage aesthetic characteristics include:

- Monitoring and management of algae blooms in raw water reservoirs;
- 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; and,
- 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 24, 25, 26 and 27. For manganese results, refer to Table 17.

3.9.1 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, and it has a strong influence on water stability; that is, the tendency of water to be either corrosive, stable, or scale-forming with regard to the surfaces it comes in to contact with.

While water stability is complex and influenced by a number of factors, soft water of low pH and low alkalinity will generally 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, a *thin* layer of calcium carbonate on surfaces can be beneficial in that it provides protection against corrosion.

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 24.

Table 24: Total Alkalinity measured in calcium carbonate ($CaCO_3$) equivalents* for the 2014-15 financial year

Water treatment plant	Localities supplied	Sampling frequency (samples per time period)	Total No. of samples	Minimum result mg/L as $CaCO_3$	Maximum Result mg/L as $CaCO_3$
Devon North	Alberton Yarram	One per quarter	4	22	40
Dumbalk	Dumbalk	One per quarter	4	42	96
Fish Creek	Fish Creek	One per quarter	4	28	43
Foster	Foster	One per quarter	4	37	46
Korumburra	Korumburra	One per quarter	4	56	78
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	One per quarter	4	59	68
Leongatha	Leongatha Koonwarra	One per quarter	4	37	65
Meeniyan	Meeniyan	One per quarter	4	36	67
Poowong	Loch Nyora Poowong	One per quarter	4	78	100
Toora	Port Franklin Port Welshpool Toora	One per quarter	4	31	56

* Calcium carbonate equivalent (unit) is used as a convenient method of comparison in chemistry. It 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. 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, however, mean that alkalinity and hardness are the same. 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.

3.9.2 Colour

Colour may be imparted to water 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 25.

Table 25: Colour (true) results for the 2014-15 financial year

Water treatment plant	Localities supplied	Sampling frequency (samples per time period)	Total No. of samples	Mean result HU	Maximum result HU
Devon North	Alberton Yarram	One per month	4	<3	14
Dumbalk	Dumbalk	One per month	4	2	2
Fish Creek	Fish Creek	One per month	4	3	6
Foster	Foster	One per month	4	2	2
Korumburra	Korumburra	One per month	4	3	6
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	One per month	4	3	6
Leongatha	Leongatha Koonwarra	One per month	4	<2	<2
Meeniyan	Meeniyan	One per month	4	<2	<2
Poowong	Loch Nyora Poowong	One per month	4	5	8
Toora	Port Franklin Port Welshpool Toora	One per month	4	<2	4

3.9.3 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 26.

Table 26: Total Hardness in calcium carbonate ($CaCO_3$) equivalents* for the 2014-15 financial year

Water treatment plant	Localities supplied	Sampling frequency (samples per quarter)	Total No. of samples	Mean result mg/L as $CaCO_3$	Maximum Result mg/L as $CaCO_3$	Complying with ADWG guideline value Yes/No
Devon North	Alberton Yarram	One per quarter	4	26	28	Yes
Dumbalk	Dumbalk	One per quarter	4	102	130	Yes
Fish Creek	Fish Creek	One per quarter	4	42	49	Yes
Foster	Foster	One per quarter	4	35	36	Yes
Korumburra	Korumburra	One per quarter	4	41	60	Yes
Lance Creek	Cape Paterson Inverloch Lance Creek Wonthaggi	One per quarter	4	73	77	Yes
Leongatha	Leongatha Koonwarra	One per quarter	4	65	72	Yes
Meeniyan	Meeniyan	One per quarter	4	92	110	Yes
Poowong	Loch Nyora Poowong	One per quarter	4	70	86	Yes
Toora	Port Franklin Port Welshpool Toora	One per quarter	4	37	40	Yes

* Calcium carbonate equivalent (unit) is used as a convenient method of comparison in chemistry. It 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. 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, however, mean that alkalinity and hardness are the same. 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.

3.9.4 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 27.

Table 27: Iron results for the 2014-15 financial year

Locality	Sampling Frequency (samples per time period	Total No. of samples	Minimum result mg/L	Maximum result mg/L	Complying with ADWG guideline value (Yes/No)
Alberton	1/quarter	4	<0.01	<0.01	Yes
Cape Paterson	1/quarter	4	<0.01	0.02	Yes
Dumbalk	1/quarter	4	<0.01	0.02	Yes
Fish Creek	1/quarter	4	<0.01	0.05	Yes
Foster	1/quarter	4	<0.01	<0.01	Yes
Inverloch	1/quarter	4	<0.01	<0.02	Yes
Koonwarra	1/quarter	4	<0.01	<0.01	Yes
Korumburra	1/quarter	4	<0.01	<0.01	Yes
Lance Creek	1/quarter	4	<0.01	<0.01	Yes
Leongatha	1/quarter	4	<0.01	<0.01	Yes
Loch	1/quarter	4	<0.01	0.02	Yes
Meeniyan	1/quarter	4	<0.01	0.02	Yes
Nyora	1/quarter	4	<0.01	<0.01	Yes
Poowong	1/quarter	4	<0.01	0.03	Yes
Port Franklin	1/quarter	4	<0.01	<0.01	Yes
Port Welshpool	1/quarter	4	<0.01	0.02	Yes
Toora	1/quarter	4	<0.01	<0.01	Yes
Wonthaggi	1/quarter	4	<0.01	0.01	Yes
Yarram	1/quarter	4	<0.01	<0.01	Yes

3.9.5 pH

pH is a measure of the hydrogen ion concentration of water. It 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. Based on mean pH values, drinking water supplied by South Gippsland Water in chlorinated systems complied with the guideline range for pH; refer to Table 28.

The chemistry of disinfection (and the effects of pH) where chloramine is used instead of chlorine is different. A higher pH is actually beneficial in chloraminated systems as this slows the natural decay of monochloramine and prevents the formation of dichloramine and trichloramine, which can cause unpleasant taste and odours. A consequence of maintaining a higher pH is that occasional exceedance of the ADWG guideline can occur. Such instances are addressed with watermain flushing to remove aged water from the system. Based on mean pH values, pH in chloraminated systems complied with the ADWG guideline range; refer to Table 29.

Table 28: pH results for chlorinated system in 2014-15 financial year

Locality	Sampling frequency (samples per time period)	Total No. of samples	Minimum result pH	Maximum result pH	Mean result pH	Complying with ADWG guideline (Yes/No)
Dumbalk	One per week	53	7.8	8.3	8.1	Yes
Fish Creek	One per week	53	7.4	8.8	8.2	Yes
Foster	One per week	53	7.5	8.0	7.6	Yes
Koonwarra	One per week	52	7.6	8.1	7.9	Yes
Korumburra	Two per week	52	7.6	8.2	7.9	Yes
Leongatha	Two per week	104	7.3	8.4	7.6	Yes
Meeniyan	One per week	52	7.2	8.2	7.6	Yes
Port Franklin	One per week	52	7.5	8.7	8.0	Yes
Port Welshpool	One per week	53	7.0	8.1	7.5	Yes
Toora	One per week	52	7.0	8.0	7.4	Yes

Table 29: pH result for chloraminated systems in 2014-15 financial year

Locality	Sampling frequency (samples per time period)	Total No. of samples	Minimum result pH	Maximum result pH	Mean result pH	Complying with ADWG guideline (Yes/No)
Alberton	One per week	52	8.2	9.5	9.0	Yes
Cape Paterson	One per week	52	7.3	8.2	7.6	Yes
Inverloch	Two per week	104	7.4	8.6	7.8	Yes
Lance Creek	One per week	52	7.4	8.8	8.2	Yes
Loch	One per week	52	8.3	8.9	8.5	Yes
Nyora	One per week	52	8.1	9.0	8.4	Yes
Poowong	One per week	52	7.9	9.0	8.4	Yes
Wonthaggi	Two per week	104	7.3	8.6	8.0	Yes
Yarram	One per week	52	7.3	9.4	8.4	Yes

3.10 ANALYSIS OF RESULTS

A comparison of analysis results over the past three financial years (refer to Table 30, and Figures 3 and 4) demonstrates consistent compliance with the water quality standards listed in Schedule 2 of the Safe Drinking Water Regulations 2005 for *E. coli*, the chloroacetic acids, and turbidity.

A decline in compliance with the trihalomethane water quality standard can be observed for the 2014-15 period. This is due to one exceedance of the compliance limit for Fish Creek that occurred as a result of an aeration pump failure at the water treatment plant; refer to part 4 of this report for further details.

An improvement with regard to aluminium compliance for 2014-15 compared to 2013-14 occurred as a result of operational improvements at the Meeniyan water treatment plant; refer to section 2.3.4 of this report, as well as the 2013-14 annual drinking water quality report (available on South Gippsland Water's website) for further details.

Table 30: Comparison of percentage compliance with water quality standards over three years

WATER QUALITY PARAMETER	COMPLIANCE WITH WATER QUALITY STANDARDS					
	PERCENTAGE OF LOCALITIES			PERCENTAGE OF CUSTOMERS		
	2012-13	2013-14	2014-15	2012-13	2013-14	2014-15
Escherichia coli	100	100	100	100	100	100
Chloroacetic Acid	100	100	100	100	100	100
Dichloroacetic Acid	100	100	100	100	100	100
Trichloroacetic Acid	100	100	100	100	100	100
Trihalomethane	100	100	94.7	100	100	98.3
Aluminium	100	94.7	100	100	98.4	100
Turbidity	100	100	100	100	100	100

Figure 3:Percentage of water sampling localities where the drinking water complied with the water quality standards

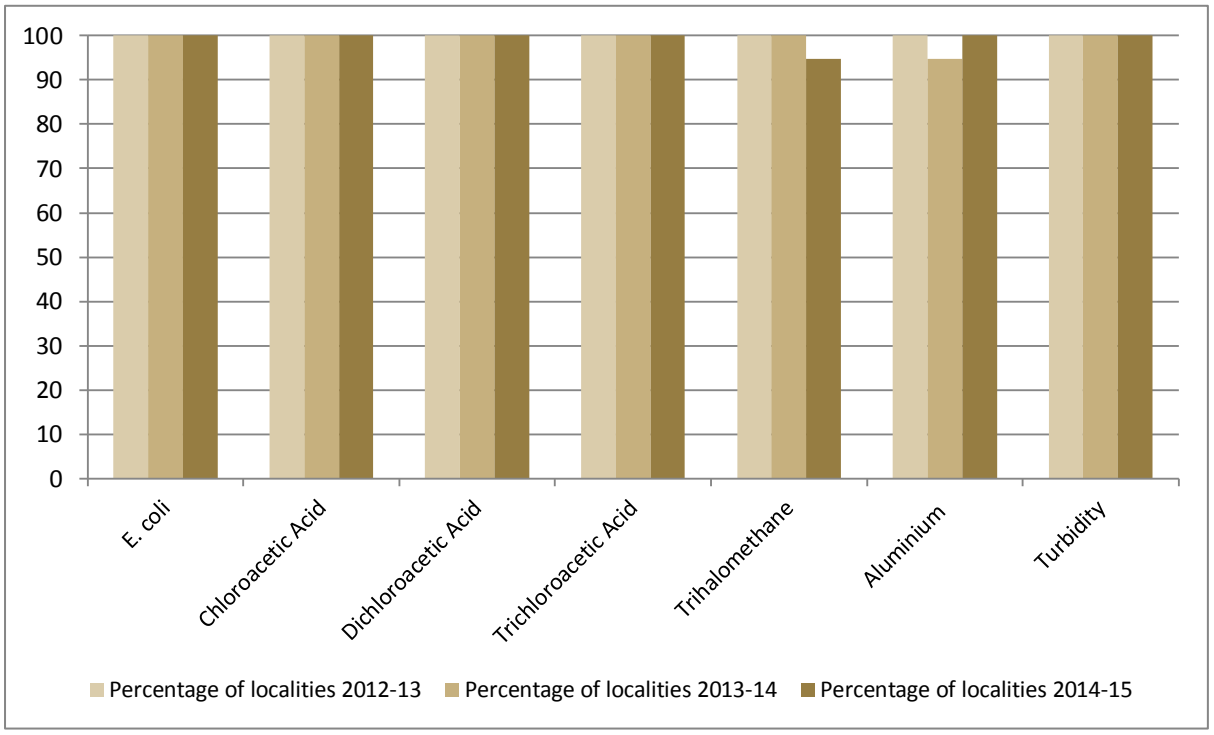
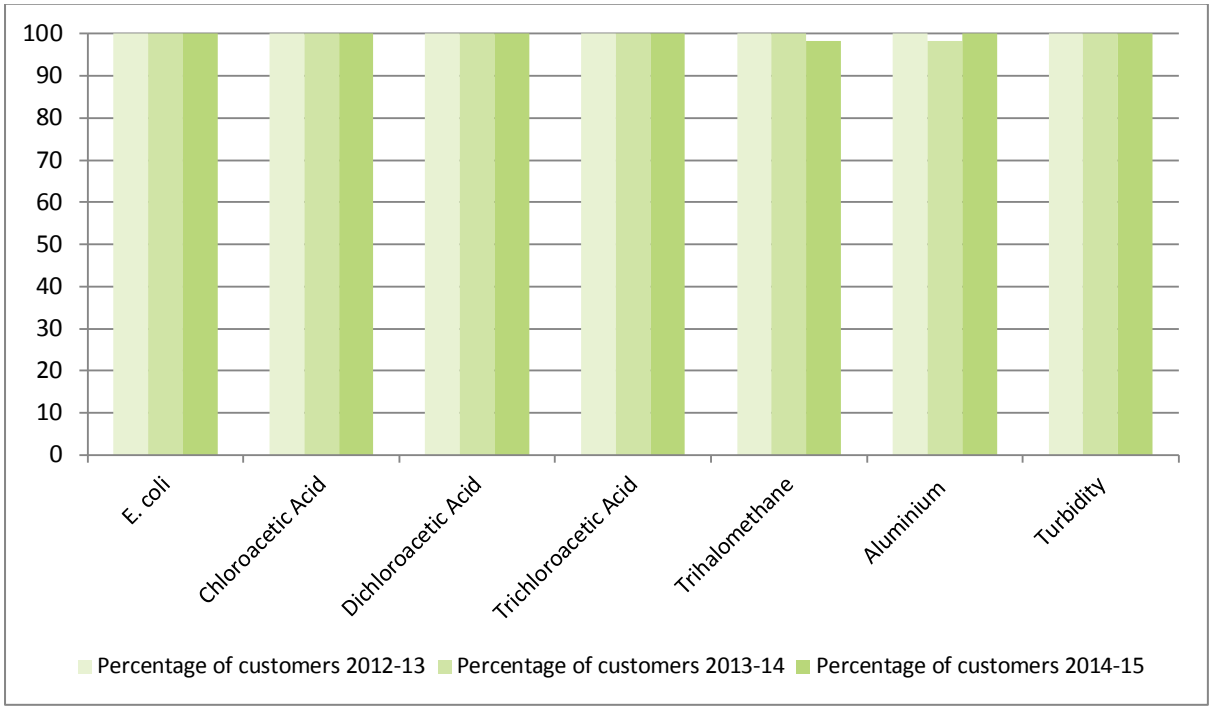


Figure 4: **Percentage of customers supplied with drinking water that complied with the water quality standards**



4. EMERGENCY AND INCIDENT MANAGMENT

4.1 INCIDENTS REPORTED UNDER SECTION 22 OF THE ACT

Section 22 of the *Safe Drinking Water Act 2003* (the Act) requires water suppliers 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. Based on this requirement, the incidents described in this section have been reported to the Department in the 2014-15 reporting period. Table 31 provides a summary of events reported under section 22 of the Act.

Table 31: Summary of events reported to the Department under Section 22 of the Act in 2014-15

Water sampling locality affected	Date of Incident	Location of Incident	Nature of Incident	Nature of known or suspected contamination/cause of incident	Ref.
Poowong	14/07/14 to 14/7/14	Poowong Water Tower Internal Site (upper section of tank site)	Microbiological non-conformance	*E. coli*: 4 orgs/100mL	4.1.1.1
Nyora	17/11/14 to 19/11/14	Nyora customer tap site	Microbiological non-conformance	*E. coli*: 3 orgs/100mL	4.1.1.2

4.1.1 *Escherichia coli* detections

Escherichia coli (*E. coli*) is a species of bacteria that inhabits the intestinal tracts of humans, other mammals and some birds. *E. coli* can also be carried by reptiles and amphibians. While most strains of *E. coli* are not harmful, their presence in water indicates possible contamination with faecal material; hence *E. coli* are used as an indicator in quality monitoring for other potentially pathogenic (and more difficult to detect) microorganisms that may be associated with faeces. Other types of bacteria with similar characteristics as *E. coli* (collectively known as 'coliforms') but not necessarily associated with faecal contamination are also routinely monitored to provide a general gauge on the cleanliness of the water supply system.

Routine weekly microbiological monitoring is performed at water sampling locations as per requirements of the Safe Drinking Water Regulations 2005. For the 2014-15 reporting period, there was one instance of *E. coli* detection for a regulated customer tap sample collected from the locality of Nyora. In addition, there was one instance of *E. coli* detection for a sample collected from the Poowong water tower.

The incident response for microbiological detections as documented in South Gippsland Water's Drinking Water Management System involves the following actions being implemented within 24 hours of positive *E. coli* results being received from the contracted laboratory:

- Notification and reporting to the Department of Health and Human Services in accordance with section 22 of the Act;
- Review of treatment plant and disinfection system operations to assess possibility of malfunction or disinfection failure.
- Review of distribution systems work (such as mains break repair) and investigation of any other potential sources of contamination;
- Security checks and monitoring of distribution water storages;
- Confirmation of flushing programs conducted prior to the notification;
- Flushing of the water mains at potentially affected locations;

- Retesting of chlorine residuals, pH and turbidity;
- Adjustment of chlorine dosing rates to obtain minimum residual of 0.2 mg/L or an approved level required at a particular sample location; and,
- Follow-up sampling and analysis for the non-conforming sample site and other sites across the relevant sampling locality.

All *E. coli* detections are treated seriously and acted on promptly. If cell numbers are low, and there are no further *E. coli* detections in samples collected subsequent to implementation of corrective actions, then, consistent with safe drinking water legislation, the incident is deemed isolated and not regarded as a cause for concern with respect to public health.

For most instances of *E. coli* detection, obvious sources of contamination cannot be found and a positive result for a drinking water sample may be speculatively attributed to one or more of the following:

- Human error, involving contamination of the sample during the sampling or testing processes;
- Insufficient residual chlorine or chloramine to prevent re-growth of bacteria within the mains and protect treated water throughout the distribution system;
- Release of bacteria from biofilm material that coats the internal walls of pipes and storage tanks. (The slimy biofilm layer can protect organisms from the disinfecting action of chlorine or chloramine; if bacteria become liberated from the film in regions of the distribution system where the concentration of disinfectant is low, then these organisms may survive long enough to be detected in a sample);
- Ingress of groundwater through small undetectable cracks in pipes during transitory low pressure events within the mains. (Again, if chlorine or chloramine is at a level insufficient for rapid disinfection within the mains, then bacteria may survive and be detected in a sample).

For the two detection events in the 2014-15 reporting period, low *E. coli* numbers were recorded. The events are described below.

4.1.1.1 *E. coli* detection for Poowong Water Tower internal (upper section of tank) site

A notification under section 22 of the Act was sent to the Department on the 15th July 2014 in relation to *E. coli* detection for the Poowong water tower (internal site). Despite having a total chlorine concentration of 2.7 mg/L, a sample taken on the 14th July 2014 was found to contain coliforms at a level of 10 orgs/100 mL, with 4 orgs/100 mL being *E. coli*.

In response to the detection, the tower was partially drained and refilled with freshly treated water. Investigation confirmed that the Poowong water treatment plant was operating within specifications and there were no treatment or disinfection issues. Follow-up samples collected at the tower and five customer tap sites in Poowong on the 15th July were found to contain no *E. coli* or coliforms.

4.1.1.2 *E. coli* detection for a customer tap site in Nyora

A notification in accordance with section 22 of the Safe Drinking Water Act was forwarded to the Department following a low-level *E. coli* detection of 1 orgs/100mL for a site in Follet Drive, Nyora on the 17th November, 2014. Investigation found no evidence of related treatment or disinfection issues at the supplying Poowong water treatment plant, and total chlorine for the non-conforming site found to be a fairly typical 2.8 mg/L at the time of sampling. Additionally, there were no microbial detections recorded for other routine samples collected in connected localities of Poowong and Loch on the same day.

In response to the detection, the Follet Drive main was flushed and follow-up samples were collected from four customer tap sites in Nyora on the 18th November. While there were no microbial detections for the Follet Drive site resample, an *E. coli* detection of 3 orgs/100mL was recorded for a follow-up sample collected in Hewson Street. In response to this second detection, the entire Nyora reticulation system was flushed and the Nyora water tower was inspected. There were no breaches of structural integrity observed for the tower, and no *E. coli* detections for samples collected subsequent to flushing from seven sites in in the township on the 19th November.

While the source of the detected *E. coli* is unknown, the fact that a higher than usual volume of water was being withdrawn from the Nyora system for the purposes of pressure testing newly installed sewerage mains is noteworthy. It is possible that this change in the velocity of water flow caused dislodgement of biofilms from the walls of the water-mains.

4.2 OTHER REPORTED EVENTS

4.2.1 Section 18 reported events

Section 18 of the *Safe Drinking Water Act 2003* (the Act) requires a water supplier to notify the Department of Health and Human Services where it becomes aware that supplied drinking water does not comply, or is not likely to comply, with any relevant water quality standard. The purpose of section 18 is to ensure the Department is alerted to potential water quality issues that may require further investigation or actions. A section 18 notification in relation to Total Trihalomethanes for the Fish Creek system was forwarded to the Department in the 2014-15 reporting period; refer to discussion below.

4.2.1.1 Total Triahalomethanes levels above regulatory limit for Fish Creek

Note: see also part 2.2 *Water Treatment Issues* for background information on trihalomethanes

A Total Trihalomethanes (THMs) result of 0.28 mg/L was recorded for the Fish Creek locality on the 3rd February, 2015. This level is 0.03 mg/L above the regulatory limit of 0.25 mg/L. Following receipt of the result on the 5th February, mains flushing to remove aged water from the distribution system and Fish Creek clear water storage basin was implemented. Analysis of samples taken from three customer taps sites following flushing indicated that while total THM levels across town had dropped below the regulatory limit, they were still quite high, with a result of 0.24 mg/L being recorded for the original non-complying site on the 10th February.

Further investigation at the Fish Creek water treatment plant revealed that the aeration pumps in the elevated clear water storage tanks had both ceased to operate. During normal operation the pumps serve to air-strip THMs formed in the clear water storage. It appeared that one of the pumps was faulty and this caused the relevant electrical circuit breaker to trip out both pumps. The faulty pump was replaced on the 24th February, and a subsequent decline in total THM levels was observed. A regulatory sample collected from a customer tap site on the 3rd March recorded a more satisfactory result of 0.19 mg/L.

To ensure a pump fault is attended to more quickly, electrical sensors were installed in March 2015. These allow monitoring and control of the aeration pumps via the Supervisory Control and Data Acquisition (SCADA) system of the water treatment plant.

Important note: The *Australian Drinking Water Guidelines* (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"

4.2.2 Blue-green algae (cyanobacteria) blooms reported to DELWP

Notification of an algal bloom to the Department of Health and Human Services is only required if drinking water supplied from the water source affected by the bloom has the potential to pose a threat to human health or may result in widespread public complaint, as stipulated in section 22 of the Safe Drinking Water Act. For the purposes of regional monitoring and management, however, the Department of Environment, Land, Water and Planning (DELWP) is advised when local algal blooms occur and cell volumes exceed specified limits.

Algal blooms are managed according to the potential toxicity of the identified species, cell numbers and densities, and efficacy of existing treatment processes in removing algae and algae-related compounds from raw water. As part of South Gippsland Water's incident response procedures, which are documented in its drinking water management system, the following actions may be implemented in response to algal detections:

- Increased monitoring for algae and algae-related toxins (when potentially toxic species are identified) and other compounds that may cause taste and odour issues;
- Initiation of powdered activated carbon (PAC) dosing to remove algae-related toxins and other compounds;
- Isolation and containment of the affected reservoir where applicable;
- Selective use of offtakes (where available) at reservoirs to minimise volume of algae cells entering the treatment plant;
- Destratification of reservoir;
- Application of algicide where appropriate; and,
- Notification to major customers advising of potential for taste and odour issues.

With respect to the algae events reported in Table 32, implementation of appropriate incident response procedures resulted in controlled events that had no real potential to affect public health.

Table 32: Blue-green algae (cyanobacteria) blooms reported to DELWP in 2014-15

Location	Date of bloom	Nature of bloom
Lance Creek Reservoir	29/12/14 to 02/03/15	Total cyanobacterial biovolume >0.2 mm^3/L
Lance Creek Reservoir	09/04/15 to 25/05/15	Total cyanobacterial biovolume >0.2 mm^3/L
Korumburra Reservoir No. 1	25/08/14 to 30/09/14	Total cyanobacterial biovolume >0.2 mm^3/L
Korumburra Reservoir No. 1	21/10/14 to 16/02/15	Total cyanobacterial biovolume >0.2 mm^3/
Korumburra Reservoir No. 3	09/02/15 to 16/02/15	Total cyanobacterial biovolume >0.2 mm^3/L

5. COMPLAINTS RELATING TO WATER QUALITY

5.1 COMPLAINTS FOR 2014-15

South Gippsland Water records and attends to all complaints relating to drinking water quality to ensure the highest level of customer satisfaction. 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. No localities supplied by South Gippsland Water recorded a total number of complaints greater than 10 per 100 customers supplied during the 2014-15 reporting period; refer to Table 33. A comparison of the number of complaints with that of the previous two reporting periods is provided in Figure 4.

Table 33: Customer complaints summary for 2014-15

Type of complaint	Number of complaints	Number of complaints per 100 customers (connected properties) supplied
Discoloured Water	36	0.18
Taste/Odour	32	0.16
Blue Water	0	0.00
Air in Water	2	0.01
Other	8	0.04

5.2 MANAGEMENT OF COMPLAINTS

Customer complaints relating to water quality are managed in accordance with procedures documented in South Gippsland Water's quality document system. Upon receipt of a complaint, a customer service officer classifies the information and records it in a computer database. An activity sheet is then created for investigation of the complaint within a specified time period. The objective of the investigation is to determine the cause of the complaint and the actions required to rectify the problem. All investigative and corrective actions are recorded in the computer database once complete. The causes of the different types of complaints received and the relevant preventive and corrective actions are described below.

5.2.1 Discoloured water

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 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 flushing regimes for 'problem-spot' areas.

- Provision of a commercial cleaning product which removes discolouration marks from laundry items in response to individual customer complaints.

There were 36 complaints received in relation to discoloured water in the 2014-15 financial year.

5.2.2 Taste and odour

Taste and odour complaints result primarily from:

- Algae-related compounds in the water;
- Manganese and/or iron sediment in the water;
- Chlorine in water.

Corrective actions to address taste and odour 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.

There were 32 calls relating to taste and odour issues received from customers in 2014-15.

5.2.3 Blue water

Blue water is caused by corrosion of domestic copper pipes. When taps are not operated frequently (overnight, for example), copper may dissolve and concentrate in the stationary water within the pipes. In response to complaints, the corrosive potential of supplied water is reviewed and customers are advised to flush taps until clear. There were no reports of blue water from South Gippsland Water customers in the 2014-15 reporting period.

5.2.4 Air in water

Air in water complaints are generally received following the implementation of air-scour 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 will correct the problem. There were two complaints involving air in water from South Gippsland Water customers in the 2014-15 reporting period.

5.2.5 Other complaints

Other complaints generally relate to concerns that are beyond the control and responsibility of South Gippsland Water, such as death of aquarium fish or garden plants, and problems with domestic plumbing or appliances. Results of monitoring programs that may be relevant are reviewed, and additional investigation may be 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 was a total of eight complaints/enquiries in this category for 2014-15.

Complaints in this category may also include general queries from customers experiencing illness or dermatological conditions. Customers expressing concern that a health issue relates to tap water are encouraged to consult a medical professional for diagnosis and treatment. Additional monitoring to verify quality of supplied drinking water to the customer's residence is carried out. Details of the complaint and results of both monitoring and diagnostic testing (if provided) are recorded. Generally, customers are seeking reassurance with regards to water quality rather than alleging that drinking water is the cause of their health problem. In the unlikely event that investigation of reported illness did produce evidence that water quality might be a factor, 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.

Five of the 'Other' complaints/queries received from customers were in relation to health concerns for 2014-15. Four of these were queries with regard to skin irritations and one was a query relating to general feelings of being unwell. There were no complaints of gastrointestinal illness.

6. FINDING 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 occurred in May 2014. South Gippsland Water was found to be compliant in all auditable elements for the period 27th April 2012 to 26th May 2014. Refer to the South Gippsland Water Annual Drinking Water Quality Report 2013-14 for further details

South Gippsland Water was not required to be audited in the 2014-15 financial year. The next audit is likely to be conducted in the first half of 2016.

7. UNDERTAKINGS UNDER SECTION 30 OF THE ACT

Section 30 of the *Safe Drinking Water Act 2003* allows for the Secretary to the Department of Health and Human Services to accept a written undertaking from a water supplier that certain actions will be performed. Water suppliers can apply to the Secretary for an undertaking in the event that they are, or are likely to be, in contravention of the Act or its associated regulations.

There were no undertakings for South Gippsland Water in the 2014-15 reporting period.

8. GLOSSARY OF TERMS AND FURTHER INFORMATION

ADWG	*Australian Drinking Water Guidelines* 2011; published by the National Health and Medial Research Council and the National Resource Management Ministerial Council
Chlorine	An element commonly used as a disinfectant in water treatment
Chloramine	A compound of chlorine and ammonia commonly used for disinfection in water treatment
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).
DELWP	Department of Environment, Land, Water and Planning, Victoria
DWMS	Drinking Water Management System
'the Department'	Department of Health and Human Services, Victoria. (Formerly the Department of Health)
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
RMP	Risk Management Plan
'the Act'	*Safe Drinking Water Act 2003*
'the Regulations'	Safe Drinking Water Regulations 2005
SGW	South Gippsland Water (South Gippsland Region Water Corporation, 'the Corporation')

Customers and members of the public may obtain further information on the results of water quality monitoring programs or any matters related to this report by contacting South Gippsland Water's Customer Service Department on **03 5682 0444** or by emailing sgwater@sgwater.com.au

SOUTH GIPPSLAND WATER

DRINKING WATER QUALITY POLICY

“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 the NHMRC/NRMMC Australian Drinking Water Guidelines, relevant regulatory requirements and customer expectations. 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 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;
- Annually 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 planning the needs and expectations of its consumers, stakeholders, regulators and employees to ensure both effective and economical solutions for managing safe drinking water supplies;
- Ensure compliance with all 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 Water Quality Policy is proudly displayed at South Gippsland Water facilities and is communicated to all persons working for or on our behalf during induction or contract proceedings. The Policy is available to the public upon request or via the South Gippsland Water website. Our contact details are –

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