BUSSELTON WATER

2016-17

ANNUAL WATER QUALITY REPORT

busseltonwater.wa.gov.au

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MESSAGE FROM THE CEO

I am pleased to present the 2016-17 Water Quality Report on behalf of Busselton Water.

Our commitment to achieving 100 per cent compliance with health related and non-health related water quality criteria in the Australian Drinking Water Guidelines (ADWG) is firmly established and is ensured through our Memorandum of Understanding (MoU) with the Department of Health.

Busselton Water continued to achieve exceptional water quality results in 2016-17 as detailed in this report and summarised in the following table:

2016-17 WATER QUALITY RESULTS AT A GLANCE	
Health related characteristics	**% compliance with MoU**
Escherichia coli	100
Naegleria	100
Chemical	100
Pesticides	100
Radiological	100

In addition to presenting water quality results and performance against the MoU, this report also describes the processes Busselton Water uses to collect, treat and distribute drinking water to our customers.

I wish to thank everyone who has made a contribution to these excellent results, particularly staff and representatives from the Department of Health, GHD and Rockwater.

Chris Elliott
Chief Executive Officer

OUR COMMITMENT

We are committed to achieving 100 per cent compliance with health related and non-health related water quality criteria in the ADWG.

To enable us to achieve this, we will:

- systematically monitor and report water quality performance;
- be prepared for incidents including regular testing of our response plans;
- fulfil all the requirements of our Operating Licence and MoU[1] with the Department of Health; and
- implement the Drinking Water Quality Management Plan.

Drinking Water Quality Policy

Busselton Water is committed to achieving compliance with water quality criteria in the ADWG[2].

In pursuit of our commitments, we will:

- systematically monitor and report water quality performance;
- be prepared for incidents including regular testing of our response plans.
- fulfil all the requirements of our Operating Licence and MoU with the Department of Health; and
- implement our new Water Safety Plan.

Drinking Water Quality Management Framework

Busselton Water bases its Drinking Water Quality Management System on the ADWG Framework for Management of Drinking Water Quality, endorsed by the National Health and Medical Research Council. The Framework provides benchmark water quality guidelines and values for designing a structured system for drinking water quality management.

There are 12 elements within the Framework which are considered best practice. These elements are divided into four sections:

1. Commitment to drinking water quality management.
2. System analysis and management.
3. Supporting requirements.
4. Review.

Busselton Water regularly assesses its performance against the 12 elements of the ADWG Framework.

In addition, the Operating Licence issued by the Economic Regulation Authority (ERA), recognises our MoU with the Department of Health. The MoU describes the Department of Health requirements for compliance with the microbiological, health, chemical and radiological criteria.

Busselton Water provides the Department of Health with a quarterly water quality report, outlining how the organisation has performed against agreed requirements specified in the MoU.

Busselton Water is a member of the Advisory Committee for the Purity of Water[3].

Busselton Water provides raw water information to the Department of Water and Environmental Regulation (DWER) to ensure the long-term sustainability of the water supply for the Busselton region.

1 A copy of the Memorandum of Understanding with the Department of Health is available on the Busselton Water website.

2 The "Australian Drinking Water Guidelines" published by the National Health and Medical Research Council, Australia's peak health research body, provides an authoritative reference on what defines safe, good quality drinking water; how it can be achieved; and how it can be assured. It is available for download from www.nhmrc.gov.au/guidelines/publications.

3 More information on the ACPOW can be found at http://ww2.health.wa.gov.au/Articles/A_E/Advisory-Committee-for-the-Purity-of-Water

OUR COMMITMENT

Our licence area

Busselton Water has been a successful water service provider for more than 110 years. We currently supply drinking water to almost 33,000 people within the City of Busselton, as well as transferring bulk water to the Water Corporation in Dunsborough.

In high seasons – weekends, holidays and Christmas times – Busselton Water supplies a bigger population of approximately 65,000 people.

Busselton Water expanded its operating licence area from 81,200ha to 688,700ha in August 2014. The greater operating licence area was granted by the ERA to facilitate Busselton Water's desire to grow and expand its water services operations. The official map of the expanded operating licence area can be viewed on the ERA's website[1]

1 https://www.erawa.com.au/cproot/12840/2/Operating%20area%20map%20-%20WL3%20-%20Busselton%20Water.PDF

SYSTEM ANALYSIS AND MANAGEMENT

Our water source

Busselton Water sources the bulk of its raw water from the deep, confined, Yarragadee aquifer. There is also some draw from the base of the shallower Leederville aquifer which extends from about 10 to 275 metres in depth and, below this, the Yarragadee aquifer extends to over 800 metres in depth.

Busselton Water extracts raw water under licences (GWLs 110850 and 110851), issued by the DWER, from the Yarragadee and Leederville aquifers. There are eight production bores pumping raw water to treatment plants for filtration and disinfection before the treated water is stored in tanks and reticulated to customers.

Source Protection

Busselton Water, in conjunction with DWER, developed the *Busselton Water Reserves Drinking Water Source Protection Plan* (Report WRP 139) released by the Department of Water, predecessor of DWER, in August 2013. The Plan defines the boundaries of Busselton Water's Water Reserve and assigns a Priority 1 to these reserves. This identifies that, due to the confined nature of this drinking water source, there is no risk of contamination from overlying land uses. The purpose of proclaiming the water reserves was to ensure their locations are under legislative protection.

Busselton Water is also bound by the DWER's Groundwater Licence Operating Strategy (GLOS), issued in March 2014, which stipulates annual extraction entitlement limits, licence conditions and compliance requirements. Busselton Water's consultant hydrogeologist (Rockwater Pty Ltd) reviews this document along with the implementation of the borefield construction and maintenance plan, monitoring and reporting requirements to ensure future operational strategies are sustainable in the long term.

Extraction of water in accordance with the operating strategy is shown as follows:

Financial Year	Extraction (gigalitres)
2008-2009	4.49
2009-2010	4.23
2010-2011	4.30
2011-2012	4.30
2012-2013	4.59
2013-2014	5.05
2014-2015	5.18
2015-2016	5.38
2016-2017	5.15

SYSTEM ANALYSIS AND MANAGEMENT

Understanding water quality

Turbidity	Turbidity is the cloudy appearance of water caused by the presence of suspended matter.	The ADWG specify an aesthetic guideline of 5 NTU. If disinfection is required, the turbidity of less than 1 NTU is desirable at the point of disinfection.
Colour	Colour in water originates mainly from natural drainage through soil and vegetation in a catchment.	The ADWG value for colour is based on the colour that is noticeable in a glass. This is generally accepted as 15 HU.
Iron	Iron occurs naturally in water as a result of contact with soil or rock in the catchment. Iron in the water does not present a health hazard.	The ADWG recommend that, based on aesthetic consideration, the concentration of iron should not exceed 0.3mg/L.
Manganese	Manganese in water can come from contact with soil or rock in the catchment. Manganese is not considered a health concern unless the concentration exceeds 0.5mg/L.	The ADWG recommend that based on aesthetic considerations, the levels of manganese should not exceed 0.1mg/L.
Total dissolved solids (TDS)	TDS consist of inorganic (natural) salts and small amounts of organic matter dissolved in water. TDS comprise sodium, potassium, calcium, magnesium, chloride, sulphate, bicarbonate, carbonate, silicon, organic matter, fluoride, iron, manganese, nitrate and phosphate.	Treated water quality containing TDS levels of below 500mg/L is classified as good.
Microbiological pathogens and disinfection	Thermophilic *Naegleria* refers to a group of amoeba which includes *Naegleria fowleri*, the organism that causes the waterborne disease primary amoebic meningoencephalitis. *Naegleria fowleri* is an environmental pathogen which naturally lives in fresh warm water. The most common and widespread health risk associated with drinking water is contamination by microorganisms. Organisms associated with the gut of humans and mammals cause the usual waterborne diseases. Tests are undertaken for *Escherichia coli* (*E.coli*).	The Western Australian Department of Health has notification protocols in place regarding *Naegleria*. The ADWG state that thermotolerant coliforms/*E.coli* should not be present in a minimum 100mL sample.
Radiological	There are natural levels of radiation within the environment, and groundwater sources such as that sourced from the Yarragadee aquifer can have higher background levels than that of surface water systems.	Testing is undertaken for gross alpha and gross beta radioactivity, where levels of Radium 226 and Radium 228 can be determined. The ADWG (2004) recommend that levels should not exceed 0.5Bq/L.
pH	pH is a measure of how acidic/basic water is. The range goes from 0 - 14, with 7 being neutral. pH is the measure of free hydrogen ion concentrations in the water.	The suggested aesthetic pH target from the ADWG is 6.5 to 8.5.

NTU – Nephelometric turbidity units; HU – Hazen Units; mg/L – milligrams per litre; Bq/L – Becquerel per litre

Water treatment

Busselton Water uses a three-step process to treat raw water from the deep groundwater aquifers to produce safe drinking water for customers.

Pre-treatment and aeration

Raw water is dosed with a small amount of chlorine then aerated via spray aerators, this oxidises naturally occurring iron and manganese, turning it from its soluble form into small solids.

Filtration

The pre-chlorinated and aerated water is then filtered through sand filters to remove the iron, manganese, turbidity and other impurities. The filtered water is then collected in a clear-water well.

Disinfection

A further dose of chlorine is then added to water pumped from the clear-water well. This dose maintains the disinfection level required to preserve microbiological safety before the water is stored in tanks and pumped into the distribution system. Chlorine is approved for use in drinking water supplies and Busselton Water sources chlorine gas from an ISO9001 accredited manufacturer.

The process is shown schematically overleaf.

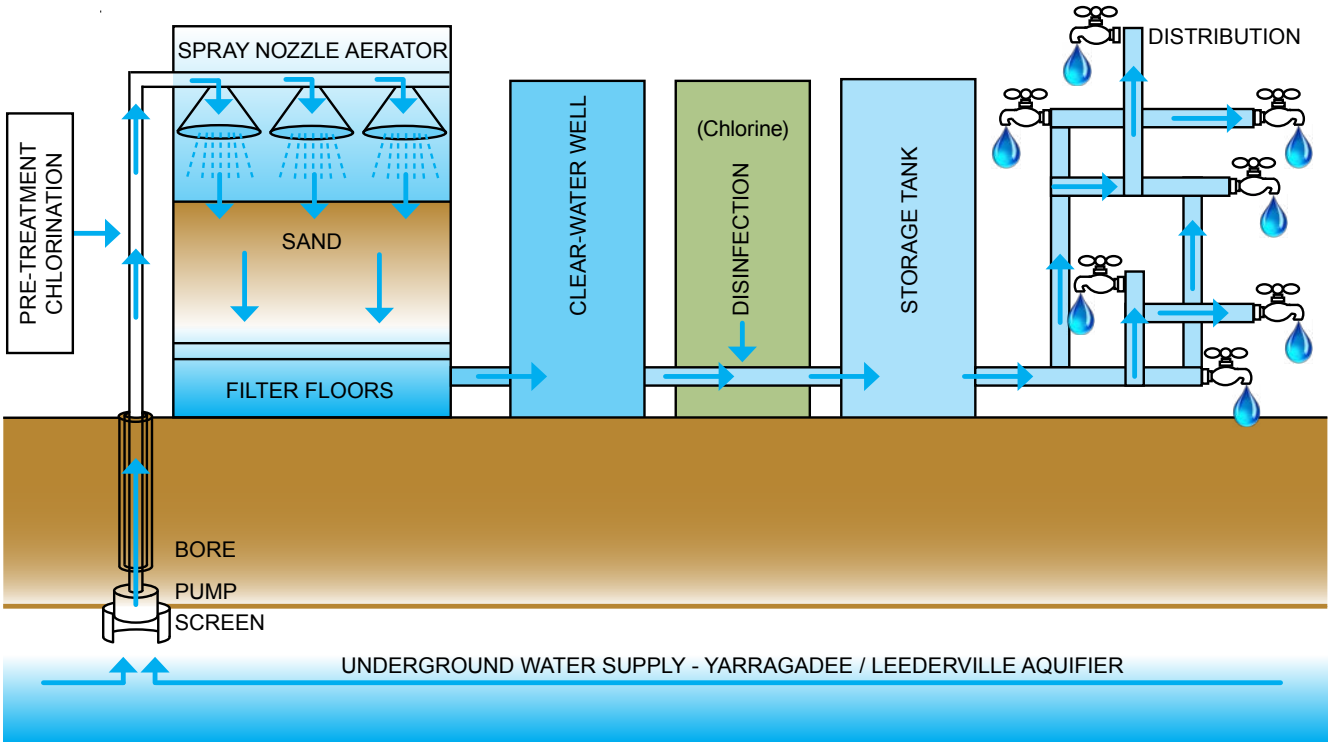
SYSTEM ANALYSIS AND MANAGEMENT

Our water treatment plants

Busselton Water has three treatment plants:

- Plant 1 – Kent Street, Busselton;
- Plant 2 – Queen Elizabeth Avenue, Busselton; and
- Plant 3 – Hobson Street, East Busselton.

WATER TREATMENT AND SUPPLY PROCESS



Distribution network

Busselton Water's distribution network delivers drinking water to customers within the City of Busselton and transfers bulk water to the Water Corporation in Dunsborough. The network operates as one large, interconnected system. Materials used in the reticulation network have been approved either under Australian Standard AS/NZS 4020:2005 (testing of procedures for use in contact with drinking water) or as scheduled in the MoU with the Department of Health.

Strict protocols established by Busselton Water in conjunction with the Department of Health assure the:

- safety and integrity of water distributed to customers; and
- safe handling of chlorine at the water treatment plants.

The distribution network has the following components:

Estimated population	32,933
Total number of connections	13,174
Total length of pipes	325km
Number of storage tanks	5
Chlorine residual target	0.4mg/L
Number of distribution water quality zones	1

Multi barrier approach

Preventing contamination and minimising potential hazards is an essential part of providing our customers with safe drinking water. The ADWG require the implementation of a multi barrier approach as the most effective way of ensuring the safety of drinking water.

Busselton Water's barriers include:

- protection of Groundwater;
- treatment;
- chlorine disinfection; and
- backflow prevention.

Busselton Water maintains and operates these multiple barriers, ensuring they are robust and that high quality water is delivered to its customers.

Incident responses

While every effort is made to prevent water quality incidents from occurring, there will inevitably be times when our systems fail due to equipment malfunction, human error, extreme weather conditions or unforeseen events. Busselton Water has incident response plans to manage such events, with the minimum possible impact on water quality.

In the event of a water quality incident, Busselton Water activates its Water Quality Incident Response Plan. This comprehensive plan is applied to manage water quality incidents and is consistent with the MoU between Busselton Water and the Department of Health.

In order to maintain our preparedness to deal with any water quality incidents, as part of our compliance with the MoU with the Department of Health, a mock event simulating a failure of our systems was held in May 2017. It tested the effectiveness of Busselton Water's Business Continuity and Emergency Response Plans.

SYSTEM ANALYSIS AND MANAGEMENT

Development, training and innovation

Water quality monitoring and testing

Busselton Water has a comprehensive water monitoring program which has been reviewed and endorsed by the Department of Health.

The key parameters monitored by Busselton Water are:

- microbiological – including Thermophilic *Naegleria* and *Escherichia coli*;
- chemical health – including a large range of parameters with health related guideline values defined by the ADWG;
- chemical non-health (aesthetic) – including a large range of parameters with non-health guideline values defined by the ADWG; and
- radiological health – monitored and tested on an annual basis.

Development, training and innovation

Busselton Water utilises training in accordance with the National Water Industry Training package. Water quality operational staff progress towards a Certificate III in Water Industry Operations.

Busselton Water adopts a best practice 70/20/10 development approach. This approach allocates more time to experiential learning and delivers better employee development and business outcomes. It consists of 70 per cent experiential learning, 20 per cent mentorship of employee learning (including development planning), and 10 per cent approved class-based training.

Personnel regularly attend relevant training courses and/or conferences.

More recently, Busselton Water has deployed innovation in the area of backflow detection systems for residential customers with radio frequency meters.

Our customers

We strive to deliver excellence in customer service and continue to improve our existing levels of customer satisfaction.

We monitor customer feedback through a water quality complaints process with results for the last five years shown on the following graph. Busselton Water received 15 water quality complaints during 2016-17, with 12 relating to taste and odour, and three relating to discoloured water.

WATER QUALITY COMPLAINTS – JULY 2012 TO JUNE 2017

REVIEW

Busselton Water monitors water quality by taking weekly water samples. We took more than 3,500 water quality samples during the year.

Microbiological and disinfection health results

Busselton Water achieved 100 per cent compliance. Busselton Water collected 364 samples from the reticulation system during the reporting period and results from 100 per cent of these samples were compliant, with no detections of the pathogens *Escherichia coli* or Thermophilic *Naegleria*. A further 1,170 samples were taken for chlorine levels.

Chemical health results

Busselton Water achieved 100 per cent compliance with all health-related requirements set out in the ADWG (2004) for chemical parameters. There is a large number of chemical parameters that have health-related guideline values in the ADWG (2004). The next section of this report gives more detail on the individual parameters.

Radiological health results

Busselton Water achieved 100 per cent compliance. Groundwater radiological testing is carried out in accordance with parameters and frequencies based on the ADWG (2004) and in consultation with the Department of Health.

Groundwater radiological testing is only required periodically. Radium 228 and Radium 226 are tested annually in April and results from these samples were 100 per cent compliant.

Non-health (aesthetic) results

Except for chlorine as described below, Busselton Water achieved 100 per cent compliance.

Busselton Water uses Chlorine to provide a disinfectant residual in the water distribution system. Disinfection is designed to kill pathogenic microorganisms, thereby preventing waterborne diseases. Chlorination is the most commonly used process for disinfection, and was endorsed by the

National Health and Medical Research Council for use as a drinking water treatment chemical in 1983. The ADWG Aesthetic Guideline value for Chlorine is 0.6 mg/L. The ADWG states that “In some supplies it may be necessary to exceed the aesthetic guideline in order to maintain an effective disinfectant residual throughout the system.” Busselton Water closely manages Chlorine dosing levels so as to maintain a minimum residual Chlorine level of 0.4 mg/L throughout the distribution system at all times. During the year, Busselton Water collected 1170 chlorine samples in the distribution network. The minimum Total Chlorine level was 0.44 mg/L, and the maximum was 0.91 mg/L. There is a large number of parameters with aesthetic guideline value in the ADWG parameters. Results of the individual parameters are outlined in the next section of this report.

WATER QUALITY RESULTS

In the period 1 July 2016 to 30 June 2017, there were no reportable water quality events requiring notification to the Department of Health.

CHEMICAL HEALTH – 1 JULY 2016 TO 30 JUNE 2017

CHARACTERISTIC mg/L	UNIT	ADWG LIMIT (Health)	Laboratory Limit of Reporting (LOR)	Number of samples		Total no. of samples (raw + distribution)	Maximum value		Number of non-compliance		Compliance % distribution water
				Raw water	Distribution water		Raw water	Distribution water	Raw water	Distribution water	
Bromodichloromethane	mg/L	0.25*	0.5	NR	12	12	-	ND	-	0	100%
Bromoform	mg/L	0.25*	0.5	NR	12	12	-	0.0041	-	0	100%
Chlorine (Total)	mg/L	5		NR	580	580	-	0.91	-	0	100%
Chloroform	mg/L	0.25*	0.5	NR	12	12	-	ND	-	0	100%
Dibromochloromethane	mg/L	0.25*	0.5	NR	12	12	-	0.0017	-	0	100%
Fluoride	mg/L	1.5	0.1	NR	84	84	-	0.6	-	0	100%
Manganese (Soluble)	mg/L	0.5	0.005	68	84	152	0.33	ND	0	0	100%
Manganese (Total)	mg/L	0.5	0.005	92	84	176	0.099	0.006	0	0	100%
Nitrate	mg/L	50	0.05	46	NR	46	0.13	-	0	-	
Nitrite	mg/L	3	0.005	46	NR	46	0.03	-	0	-	
Total Trihalomethanes	mg/L	0.25	0.0005	NR	12	12	-	0.006	-	0	100%
TOTAL				**252**	**892**	**1144**			**0**	**0**	

Note 1: ND = Not Detected
Note 2: NR = Not required to be sampled
Note 3: Chlorine Total is a Busselton Water in-house test. All others are accredited test results.
Note 4: *The concentration of trihalomethanes, either individually or in total, in drinking water should not exceed 0.25 mg/L
Note 5: Busselton Water does not add fluoride to the water. The naturally occurring fluoride levels vary from bore to bore. The maximum value shown is not indicative of the level throughout the Busselton water supply. Fluoride levels in the drinking water vary with location and time and can be between 0.03 and 0.6 mg/L

mg/L = milligrams per litre
NTU = Nephelometric turbidity units
ND = Not Detected
NA = Not Applicable

RADIOLOGICAL HEALTH – 1 JULY 2016 TO 30 JUNE 2017

CHARACTERISTIC	UNIT	ADWG (Health)	Raw Water (Bores)				Treated Water (Storage Tanks)			
			Non-Compliance (Health)	No. of Samples	% Compliance (Health)	Maximum Detected Bq/L	Non-Compliance (Health)	No. of Samples	% Compliance (Health)	Maximum Detected Bq/L
Gross Alpha	Bq/L	0.5	0	8	100%	0.265	0	5	100%	0.224
Gross Beta	Bq/L	0.5	0	8	100%	0.223	0	5	100%	0.130

Note 1: Bq/L = Becquerel per litre.

MICROBIOLOGICAL HEALTH – 1 JULY 2016 TO 30 JUNE 2017

CHARACTERISTIC	UNIT	ADWG limit	Number of samples		Total no. of samples (treated + distribution)	Maximum value		Number of non-compliance with ADWG limit		Compliance % distribution water
			Treated water (non-assessable)	Distribution water (assessable)		Treated water (non-assessable)	Distribution water (assessable)	Treated water (non-assessable)	Distribution water (assessable)	
Escherichia coli	CFU/ 100mL	0	260	364	624	0	0	0	0	100%
Thermophilic *Naegleria*	org/ 250mL	ND	260	364	624	ND	ND	0	0	100%
Naegleria fowleri	org/ 250mL	ND	0	0	0	NA	NA	0	0	100%

mg/L = milligrams per litre
NTU = Nephelometric turbidity units
ND = Not Detected
NA = Not Applicable

Note: Tests for *Naegleria fowleri* are only required if Thermophilic *Naegleria* (TN) is detected.

WATER QUALITY RESULTS

CHEMICAL NON-HEALTH (AESTHETIC) SAMPLES – 1 JULY 2016 TO 30 JUNE 2017

CHARACTERISTIC	UNIT	ADWG LIMIT	Lab Limit of Reporting (LOR)	Number of samples		Total no. of samples (raw + distribution)	Maximum value		Number of non-compliance with ADWG limit		Compliance % distribution water
				Raw water	Distribution water		Raw water	Distribution water	Raw water	Distribution water	
Alkalinity (Bicarbonate)	mg/L	-	5	30	4	34	200	180	0	0	100%
Alkalinity (Carbonate)	mg/L	-	5	30	4	34	<1	ND	0	0	100%
Alkalinity (Hydroxide)	mg/L	-	5	30	4	34	<5	ND	0	0	100%
Alkalinity (Total)	mg/L	-	5	30	4	34	180	150	0	0	100%
Aluminium (Soluble)	mg/L	0.2	0.02	30	4	34	ND	ND	0	0	100%
Aluminium (Total)	mg/L	0.2	0.02	30	4	34	ND	ND	0	0	100%
Ammonia	mg/L	0.5	0.005	NR	4	4	-	0.055	-	0	100%
Calcium	mg/L	-	0.2	NR	4	4	-	23	-	0	100%
Chloride	mg/L	250	1	30	NR	30	120	-	0	-	
Colour True	HU	15 HU	1	92	84	176	6 HU	ND	0	0	100%
Electrical Conductivity	uS/cm	-	2 uS/cm	92	84	176	750 uS/cm	740 uS/cm	0	0	100%
Filterable Reactive Phosphorus	mg/L	-	0.005	30	NR	30	0.02	-	0	-	
Filterable Reactive Phosphorus as P04	mg/L	-	0.01	30	NR	30	0.02	-	0	-	
Hardness	mg/L	200	5	30	4	34	160	110	0	0	100%
Iron (Soluble)	mg/L	0.3	0.005	92	84	176	25	0.021	80	0	100%
Iron (Total)	mg/L	0.3	0.005	92	84	176	13	0.096	80	0	100%
Magnesium		-	0.1	NR	4	4	-	13	-	0	100%
pH	pH	pH 6.5-8.5		91	570	661	pH 7.9	pH 8.5	0	0	100%
Salinity (as Total Dissolved Solids)	mg/L	500		91	NR	91	460	-	0	-	
Silica	mg/L	80	10	30	NR	30	19	-	0	-	
Sodium	mg/L	180	0.05	30	NR	30	99	-	0	-	
Sulphate	mg/L	250	0.5	29	NR	29	18	-	0	-	
Total Hardness by Calculation	mg/L	200	1	30	4	34	120	110	0	0	100%
Turbidity	NTU	5 NTU		90	580	670	2.47 NTU	0.60 NTU	0	0	100%
TOTAL				**1059**	**1530**	**2589**			**160**	**0**	**100%**

Note 1: HU = Hazen Units
NTU = Nephelometric Turbidity Units
ND = Not Detected
uS/cm = Micro siemens per centimetre
mg/L = milligrams per litre
NA = Not Applicable

Note 2: pH and Turbidity are Busselton Water in-house tests. All others are accredited test results.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