ANNUAL WATER QUALITY REPORT 2021-22

mucheawater.com.au

Contents

Tables

Figures

1. Overview

Aqua Ferre (Muchea) Pty Ltd (trading as Muchea Water) operates under Water Services Licence number WL51, issued by the Economic Regulation Authority, Western Australia.

Muchea Water's operating area is within the Shire of Chittering, approximately 50 kilometres north-east of Perth, Western Australia.

1.1 Our Commitment

Our commitment to compliance with health related and non-health related water quality criteria of the Australian Drinking Water Guidelines (ADWG) is firmly established and reinforced through our Memorandum of Understanding (MoU) with the Department of Health WA. This document, in accordance with Section 11 of the MoU, reports the water quality performance for the period 1 July 2021 to 30 June 2022.

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

Table 1: Drinking Water Quality Results 2021/22

Water Quality Incidents	
Incidents reportable to Department of Health	1
Health Related Characteristics	**Compliance**
Escherichia coli	100%
Naegleria	100%
Chemical	99%
Pesticides	100%
Radiological	100%
Chlorine Disinfection	100%
Non-Health Related Characteristics	
Aesthetic characteristics (excluding chlorine)	84%

1.2 Drinking Water Policy

Muchea Water is committed to ensuring that drinking water supplied to our customers is safe, provided sustainably and meets or exceeds our customer expectations.

Our water is regularly monitored to ensure it meets the health-related criteria set out in the ADWG.

In pursuit of our commitments, we will:

- endorse and follow ADWG guidelines
- fulfil all the requirements of our MoU with the Department of Health
- safely manage water quality throughout the treatment process, from our water source through to the end supply to consumers
- undertake regular water quality monitoring and provide timely public reporting of results

- adopt a risk-based approach in our operations to identify and manage potential threats to water quality
- plan for contingencies and develop incident response capabilities
- continue investment in our water treatment and distribution infrastructure for the present and the future
- maintain communications with stakeholders and regulators
- welcome consumer feedback on our service and water quality.

1.3 Drinking Water Quality Management Framework

Muchea Water bases its Drinking Water Quality Management System on the Framework for Management of Drinking Water Quality, within the ADWG endorsed by the National Health and Medical Research Council. This framework:

- defines benchmark water quality guidelines and values for drinking water quality management
- defines a preventative approach to the management and operation of a drinking water system, encompassing all steps in water production from source to consumer.

The Department of Health WA and Muchea Water signed a Memorandum of Understanding (MoU) in May 2021, which runs for five years and describes the requirements for compliance with microbiological, chemical and radiological drinking water quality criteria. The MoU is publicly available from the Muchea Water website at: www.muchea.water.com.au/forms

Muchea Water's MoU incorporates the preventative water management strategy, from source to consumer, outlined in the ADWG Framework for Management of Drinking Water Quality. The MoU is structured to reflect the 12 guiding elements of the framework and thereby integrates all facets of the drinking water quality management and assurance system. The MoU covers items such as the agreed monitoring program, management practices and procedures, approved chemicals and material to be used within the drinking water system, data management and reporting mechanisms and the type of incident and emergency responses required.

We report our performance quarterly to the Department of Health. Until replaced with the Annual Water Quality report, quarterly Water Quality reports are publicly available on the Muchea Water website at: www.mucheawater.com.au/forms

Muchea Water recognises and supports the ongoing work of the Advisory Committee for the Purity of Water.[1]

[1] More information on the Advisory Committee for the Purity of Water can be found at: Advisory Committee for the Purity of Water (health.wa.gov.au)

1.4 Contact Details

Muchea Water's contact details are:

Table 2: Muchea Water Contact Details

Water Provider Contact Details	
Trading Name	Muchea Water
Company Name	Aqua Ferre (Muchea) Pty Ltd
Company Address (HO)	Level 1, 5 Ord Street, West Perth
Company Phone	08 9551 1620
Company Email	admin@mucheawater.com.au

1.5 Useful Links

- Muchea Water
- Department of Health – Water Unit
- NHMRC Australian Drinking Water Guidelines
- Economic Regulation Authority WA – Water
- Department of Water and Environmental Regulation – Water

2. Understanding Water Quality

Table 3: Water Quality Parameters

Parameter	Description	ADWG Recommendations
Iron & Manganese	Iron and Manganese in water can come from contact with containing soil or rock in the catchment. Iron and Manganese can both accumulate in pipe sediments and be re-suspended during periods of rapid changes to water flow patterns.	The ADWG recommend that based on aesthetic consideration, the concentration of Iron should not exceed 0.3 milligrams per Litre (mg/L). The ADWG recommend that based on aesthetic considerations, the levels of Manganese should not exceed 0.1 mg/L. Manganese is not considered a health concern unless the concentration exceeds 0.5 mg/L.
pH	pH is a measure of water acidity (pH 7 is 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.
Turbidity (NTU)	Turbidity is the cloudy appearance of water caused by the presence of suspended particulate matter. Turbidity of 5 NTU would appear slightly muddy or milky in a glass. Crystal clear water usually has a turbidity of less than 1 NTU.	The ADWG specify an aesthetic guideline of <5 Nephelometric Turbidity Units (NTU). If disinfection is required, then a turbidity of less than 1 NTU is desirable at the point of disinfection.
True Colour	True colour in water originates mainly from natural water drainage through soil and vegetation in a catchment. As a guide, tea has a colour of about 2500 HU, and a colour of 15 HU can be noticed in a glass of water.	The aesthetic value for colour is based on the colour that is noticeable in a glass. This is generally accepted as <15 HU.
Total Dissolved Solids (mg/L)	Total Dissolved Solids (TDS) consist of inorganic (natural) salts and small amounts of organic matter dissolved in water. TDSs comprise sodium, potassium, calcium, magnesium, chloride, sulphate, bicarbonate, carbonate, silica, organic matter, fluoride, iron, manganese, nitrate and phosphate. Water with low TDS can taste flat, while water with high TDS tastes salty and causes scaling in pipes, fittings and household appliances.	The ADWG provide guidance in the palatability of drinking water according to TDS concentration: 0 to 600 mg/L – Good quality 600 to 900 mg/L – Fair quality 900 to 1200 mg/L – Poor quality >1200 mg/L – Unpalatable
Microbial pathogens	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*) as an indicator of microbial contamination.	The ADWG state that thermotolerant coliforms/*E.coli* should not be present in a minimum 100mL sample of drinking water. DoH has notification protocols in place regarding exception events for pathogens. Muchea Water will immediately notify the DoH of any confirmed detection of thermotolerant coliforms, *E.coli* or

Parameter	Description	ADWG Recommendations
	Thermophilic *Naegleria* refers to a group of amoebae which includes *Naegleria fowler*i, the organism that causes the waterborne disease primary amoebic meningoencephalitis. *Naegleria fowleri* is an environmental pathogen which naturally lives in fresh warm water.	thermophilic *Naegleria* species in any sample for microbiological analysis.
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 screening levels can be determined. The ADWG recommend a screening level of 0.5 Becquerel per litre (Bq/L).
THMs	Trihalomethanes (THMs) may be present in drinking water as a by-product of disinfection using chlorination. Muchea Water regularly monitor the drinking water to ensure that THM remains below guideline levels	The ADWG health guideline for total THM is 0.25 mg/L, expressed as an average long-term exposure. .
Pesticides	Muchea Water regularly monitor the drinking water to ensure that no pesticide or other synthetic organic compound exceeds the respective guideline level.	The ADWG provides health related guidelines for an extensive range of pesticides and industrial chemicals.

Note: 1. Milligram per litre (mg/L) is the commonly used unit for concentration, the mass of a constituent dissolved in 1 litre of water, generally synonymous with “parts per million” (ppm).

3. Our Water System

3.1 Location

Muchea Water operates within the Shire of Chittering, approximately 50 kilometres north-east of Perth, Western Australia.

3.2 Licence area

Muchea Water is a licenced water services provider to an approved operating area, supplying potable water services to two developments:

- the Wildflower Estate, a residential subdivision located at Reserve Road, Chittering; and
- the Muchea Employment Node (MEN), an industrial development located east of the Muchea townsite.

The Wildflower Ridge subdivision is located approximately 7km north of the Muchea town centre and will comprise over 300 residential lots, each approximately 5,000 sqm or more in size.

The MEN, also referred to more recently as the Muchea Industrial Park (MIP), comprises an area of 1,167ha and is located approximately 2km east of the Muchea town centre. The first stage comprises approximately 30 industrial lots over 20ha. Further stages will be developed, and industrial lots sold, in the future. Lots range in size from 10,000 sqm to 30ha. The MIP sits at the junction of the NorthLink extension of Tonkin Highway, the Brand Highway and the Great Northern Highway.

Both areas are indicated on the map in Figure 1.

Muchea Water operates under Water Services Licence number WL51, issued by the State's regulator, the Economic Regulation Authority, Western Australia (ERA). We report annually to the ERA and are regularly audited against the Water Services Code of Conduct (Customer Service Standards).

Our Water Services Licence is available at the ERA website at: Licence Holders – Economic Regulation Authority Western Australia (erawa.com.au)

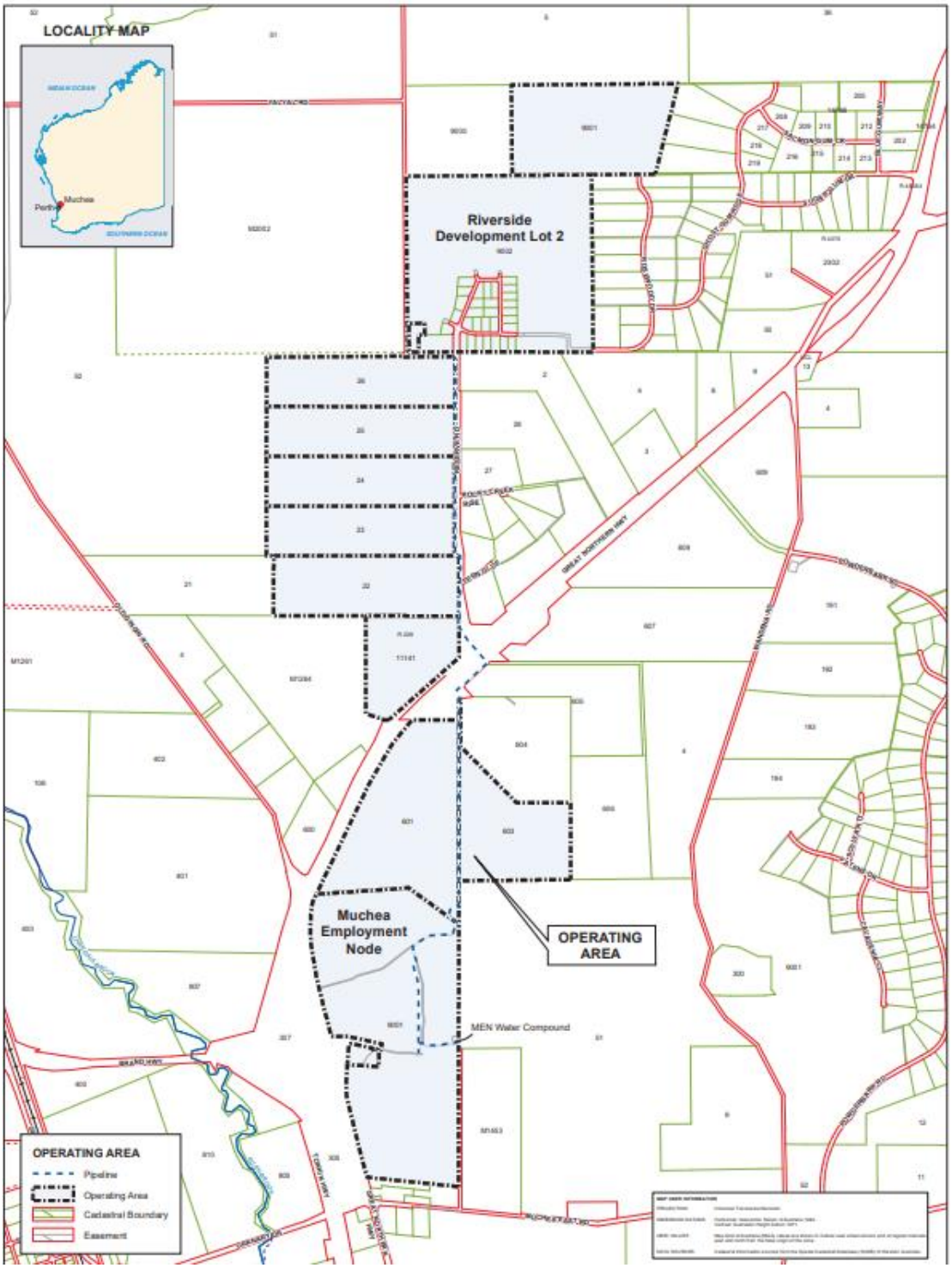

Figure 1: Muchea Water Operating Area

3.3 Infrastructure

Table 4: System Information

Summary	
Number of connections (1)	48
Number of customers (2)	75
Average water supplied in June quarter (L/day)	43,910
Sources of water	100% groundwater
Treatment systems	2 stage filtration, UV disinfection, chlorination
Length of mains	Approximately 5 km
Number of water quality localities (zones)	1
Number of sample points	4

Notes:

(1) The number of connections refers to properties (including vacant lots and lots under construction) that have been connected to Muchea Water's reticulation network and are having regular meter readings taken.
(2) The number of customers refers to customer account holders registered with Muchea Water, including vacant lots, even where they have not yet been connected to Muchea Water's network.

3.4 Water source

Muchea Water operates one water supply system with water sourced from the Leederville–Parmelia Aquifer, a large underground fresh water supply.

Muchea Water holds a Licence to Take Water (GWL59907(8)), issued by DWER, under the *Rights in Water and Irrigation Act 1914*.

Water is abstracted from Muchea Water's production bore and pumped directly to our adjacent water treatment plant (WTP), located on Reserve Road, Chittering.

3.5 Source protection

Muchea Water's Drinking Water Source Protection Plan was developed to identify and assess risks to groundwater quality and to develop management practices to mitigate those risks. This aligns with the requirements of DWER to protect the safety of the drinking water supply.

Muchea Water routinely samples the ground water to monitor quality and works cooperatively with DWER and the Department of Health to ensure the ongoing safety of the water source.

The production bore is secured within our locked, chain mesh fenced WTP compound on the south-west corner of the Wildflower Ridge Estate, on Reserve Road, Chittering.

3.6 Abstraction amounts

Muchea Water's Licence to Take Water (GWL59907(8)), allows annual extraction up to 651,700kL (651.7 million litres) from the Leederville Aquifer using the production bore. Reflecting the recent commencement of operations, Muchea Water typically abstracts less than 25,000kL/year of groundwater.

Table 5: Abstraction volumes

Reporting Period	Volume kL
1 July 2020 to 30 June 2021	9,644
1 July 2021 to 30 June 2022	21,818

3.7 Water treatment

The water extracted from the aquifer is treated at Muchea Water's WTP to remove metals and solids and disinfect and dose the treated water to comply with ADWG quality requirements. The treated water is then stored in tanks at the treatment plant for delivery by a reticulation network to the Wildflower Estate customers and a mains network pipe to the MEN where there is a further back up storage tank and a local reticulation network.

The water is treated with the addition of sodium hypochlorite solution (chlorination) which is an accepted form of drinking water disinfection across Australia. The water treatment is monitored constantly and regularly tested by a NATA accredited laboratory to ensure it meets the requirements of the Department of Health and the ADWG.

3.8 Distribution network

Treated water is stored in tanks at the treatment plant for delivery by a reticulation network to customers in the adjacent Estate and a mains network pipe to the MEN. Muchea Water does not add fluoride to drinking water supplied to consumers.

Materials used within the distribution network are approved under Australian Standard AS/NZS 4020 (Testing of Products for Use in Contact with Drinking Water) or complying with Department of Health document Materials and Substances in Contact with Drinking Water requirements or as scheduled in the MOU with the Department of Health.

3.9 Team

Employees and contractors involved with the Muchea Water drinking water system have appropriate training and experience to be demonstrably competent with the treatment, supply and monitoring of drinking water.

3.10 Incident response

Whilst Muchea Water makes all effort to prevent incidents from occurring, there will inevitably be equipment malfunctions, human errors, extreme weather conditions or unforeseen events that adversely affect our operations. Muchea Water has plans in place to respond to and manage such events such that water quality impacts are minimised.

Joint incident response exercises are conducted annually as required by the Department of Health as part of the MoU.

In 2022, Muchea Water conducted a mock incident workshop, attended by representatives from the Department of Health and the Shire of Chittering, which considered the impacts of a major bush fire in the area and what is required to mitigate water supply interruption and potential contamination of drinking water. Observations arising from this workshop have been further reviewed and actions implemented.

4. System Operation

4.1 Customer service

Muchea Water is committed to ensuring our customers are satisfied with the quality of water they receive.

Table 6: Customer Complaints Log

Period	Number of Customer Complaints Regarding Water Quality
1 July 2021 – 30 June 2022	2

During the period, Muchea Water received two (2) customer complaints involving water quality, both regarding discolouration of water supplied.

In the first instance it was identified that the customer's water discolouration was due to suspended iron. It was discussed with the customer that whilst the level was within the ADWG aesthetic guidelines, Muchea Water was investigating means to improve the water quality. Muchea Water constantly monitors iron levels in bore and treated water and has an ongoing process improvement program in an effort to lower the level of iron in water through the WTP. Muchea Water also has a regular program of pipe flushing to lower residual iron that may gather in the reticulation system.

On a separate occasion, a customer reported a slightly cloudy discolouration. Muchea Water attended the customers residence, additional sampling was performed, and a pipe flushing regime was undertaken. Across these two events, the average resolution time was 1.5 days.

4.2 Notifiable incidents

During the period 1 July 2021 to 30 June 2022 there was one (1) water quality incident that was reportable to the Department of Health.

One of two samples collected from the Consumer Sample points in May 2022 was reported with a value of carbon tetrachloride of <0.005 mg/L which may be above the ADWG health related criterion value of 0.003 mg/L.

This exceedance was not reported to the Department of Health at the time due to simple oversight. Muchea Water is working to improve screening of laboratory results and arranged for resampling of source and drinking water for analysis for carbon tetrachloride. The resampling confirmed results below 0.001mg/L, which will be reported in forthcoming water quality reports.

4.3 Improvements

Muchea Water is committed to carrying out regular servicing and maintenance of equipment and infrastructure to ensure that drinking water quality is not compromised at any time. We implement system and management improvements as required to maintain reliability of service and minimise risk to quality of water supplied to customers.

Muchea Water has an ongoing process improvement program to improve outcomes from the WTP. As part of this improvement program Muchea Water engages suitably qualified service providers and engineering firms as necessary to review our processes and advise us on improvement recommendations.

4.4 Water monitoring

Muchea Water's monitoring of water quality occurs at three levels:

- continuous monitoring by on-line instrumentation with out-of-specification values raising an alarm, relayed automatically to service personnel
- frequent periodic monitoring by personnel in the field using handheld analytical equipment
- regular sampling with analysis by a NATA registered laboratory.

Sampling and field monitoring are performed in accordance with industry standards. All microbial, detailed chemical and radiological analysis is carried out by a laboratory accredited by NATA for the required analyses.

5. Drinking Water Quality Results

5.1 Drinking water compliance – microbiology

There were no recorded microbiological non-conformances recorded during the 1 July 2021 to 30 June 2022 reporting period.

Results for the period (from the Treated Water, Wildflower Estate and MEN sample points) are included in Table 7 below.

Table 7: Microbiological Samples 2021/22

Characteristic	No of Samples Analysed	Units	ADWG Limit	Number of Samples NOT meeting ADWG Limit	% Compliance
Escherichia coli	69	CFU/100 mL	0	0	100
Thermophilic *Naegleria*	29	organisms / 250 mL	ND (1)	0	100
Naegleria Fowleri (2)	0	organisms / 250 mL	ND (1)	0	100

Notes:

(1) ND = Not detected

(2) Analysis for *Naegleria Fowleri* is usually only performed when a test for thermophilic *Naegleria* returns a positive result.

5.2 Drinking Water Compliance – Chemical – Health Related

5.2.1 Inorganic chemical constituents

During the 1 July 2021 to 30 June 2022 reporting period, one (1) sample of a total of two (2) samples collected (50%) had concentrations of carbon tetrachloride above the ADWG Health related guideline of 0.003 mg/L.

From the remaining (222) samples collected from the Consumer Sample Points during the 1 July 2021 to 30 June 2022 reporting period, all were compliant with ADWG health-related guideline.

The results for the period (from the Treated Water, Wildflower Estate and MEN sample points) are included in Table 8 below.

Table 8: Inorganic Chemical – Health Related – Compliance Summary 2021/22

Characteristic	Number of Samples Analysed	Unit	ADWG Health Limit	Maximum Value	Number of Samples NOT Meeting ADWG limit	% Compliance
Free Chlorine	88	mg/L	5	1.1	0	100
Nitrite Nitrogen	2	mg/L as N	0.9	<0.01	0	100
Nitrate Nitrogen	2	mg/L as N	11.3	<0.01	0	100
Total Cyanide	2	mg/L	0.08	<0.004	0	100
Total Antimony	2	mg/L	0.003	<0.001	0	100
Total Cadmium	2	mg/L	0.002	<0.0001	0	100
Chromium (V)	2	mg/L	0.05	<0.01	0	100
Total Copper	2	mg/L	2	0.022	0	100
Total Lead	2	mg/L	0.01	0.002	0	100
Total Manganese	4	mg/L	0.5	0.015	0	100
Total Nickel	2	mg/L	0.02	<0.001	0	100

5.2.2 Pesticides

All samples collected (45) at the Consumer Sample Points during the 1 July 2021 to 30 June 2022 reporting period were compliant with ADWG health-related guidelines. Additional analyses (3) with no current ADWG health limits have been included for completeness.

The results for the period (from the Treated Water, Wildflower Estate and MEN sample points) are included in Table 9 below.

Table 9: Pesticide Chemicals – Health Related – Compliance Summary 2021/22

Characteristic	Number of Samples Analysed	Unit	ADWG Health Limit	Maximum Value	Number of Samples NOT Meeting ADWG limit	% Compliance
Aldrin	2	mg/L	0.0003	<0.00001	0	100
Amitrole	2	mg/L	0.009	<0.0001	0	100
Atrazine	2	mg/L	0.02	<0.00002	0	100
gamma BHC	2	mg/L	No Limit	<0.00001	0	N/A
Chlordane	2	mg/L	0.002	<0.00001	0	100
Chlorfenvinphos	2	mg/L	0.002	<0.00002	0	100
Clopyralid	2	mg/L	2	<0.01	0	100
2,4-D	2	mg/L	0.03	<0.01	0	100
4,4-DDT	2	mg/L	0.009	<0.00001	0	100
Dieldrin	2	mg/L	0.0003	<0.00001	0	100
Diquat	2	mg/L	0.007	<0.00005	0	100
Diuron	2	mg/L	0.02	<0.00002	0	100
Endosulfan I	2	mg/L	0.02	<0.00001	0	100
Glyphosate	2	mg/L	No Limit	0.01	0	N/A
Heptachlor	2	mg/L	0.0003	<0.000005	0	100
Heptachlor Epoxide	2	mg/L	No Limit	<0.00001	0	N/A
Hexazinone	2	mg/L	0.4	<0.00002	0	100
MCPA	2	mg/L	0.04	<0.01	0	100
Paraquat	2	mg/L	0.02	<0.0001	0	100
Picloram	2	mg/L	0.3	<0.01	0	100
Propiconazole	2	mg/L	0.1	<0.00005	0	100
Simazine	2	mg/L	0.02	<0.00002	0	100
Temephos	2	mg/L	0.4	<0.00002	0	100
Triclopyr	2	mg/L	0.02	<0.01	0	100

5.2.3 Non-pesticide hydrocarbons

All samples from the Consumer Sample Points collected during the 1 July 2021 to 30 June 2022 reporting period were compliant with ADWG Health related guidelines, except one (1) sample returning an analysis for carbon tetrachloride of <0.005 mg/L which may exceed the 0.003 mg/L criterion. A second sample for carbon tetrachloride was reported as being <0.001 mg/L. Additional samples (40) with no current ADWG health limits have been included for completeness.

The results for the period (from the Treated Water, Wildflower Estate and MEN sample points) are included in Table 10 below.

Table 10: Non-Pesticide Hydrocarbon Chemicals – Health Related – Compliance Summary 2021/22

Characteristic	Number of Samples Analysed	Unit	ADWG Health Limit	Maximum Value	Number of Samples NOT Meeting ADWG limit	% Compliance
Disinfection By-products						
Bromate	6	mg/L	0.02	<0.005	0	100
Chloral Hydrate	6	mg/L	0.1	<0.001	0	100
Chloroacetic acid	6	mg/L	0.15	<0.005	0	100
Dichloroacetic acid	6	mg/L	0.1	<0.001	0	100
Trichloroacetic acid	6	mg/L	0.1	<0.001	0	100
2-Chlorophenol	6	mg/L	0.3	<0.0001	0	100
2,4-Dichlorophenol	6	mg/L	0.2	<0.0002	0	100
2,4,6-Trichlorophenol	6	mg/L	0.02	<0.0002	0	100
Total THM's	6	mg/L	0.25	0.034	0	100
Monocyclic aromatic hydrocarbons						
bis (2-ethylhexyl)phthalate	2	mg/L	No Limit	<0.01	0	N/A
Benzene	2	mg/L	0.001	<0.001	0	100
Toluene	2	mg/L	0.8	<0.002	0	100
Ethyl Benzene	2	mg/L	0.3	<0.002	0	100
Meta & Para Xylene	2	mg/L	0.6	<0.002	0	100
Ortho Xylene	2	mg/L	0.6	<0.002	0	100
Total Xylenes	2	mg/L	0.6	<0.002	0	100
Sum of BTEX	2	mg/L	No Limit	<0.001	0	N/A
Polycyclic aromatic hydrocarbons						
Naphthalene	2	mg/L	No Limit	<0.005	0	N/A
Acenaphthylene	2	mg/L	No Limit	0.00002	0	N/A
Acenaphthene	2	mg/L	No Limit	0.00002	0	N/A
Fluorene	2	mg/L	No Limit	0.00002	0	N/A
Phenanthrene	2	mg/L	No Limit	0.00002	0	N/A

Characteristic	Number of Samples Analysed	Unit	ADWG Health Limit	Maximum Value	Number of Samples NOT Meeting ADWG limit	% Compliance
Anthracene	2	mg/L	No Limit	0.00002	0	N/A
Fluoranthene	2	mg/L	No Limit	0.00002	0	N/A
Pyrene	2	mg/L	No Limit	0.00002	0	N/A
Benz(a)athracene	2	mg/L	No Limit	0.00002	0	N/A
Chrysene	2	mg/L	No Limit	0.00002	0	N/A
Benzo(b+j)fluoranthene	2	mg/L	No Limit	0.00002	0	N/A
Benzo(k)fluoranthene	2	mg/L	No Limit	0.00002	0	N/A
Benzo(a)pyrene	2	mg/L	No Limit	0.00002	0	N/A
Indeno(1,2,3cd)pyrene	2	mg/L	No Limit	0.00002	0	N/A
Dibenz(a,h)anthracene	2	mg/L	No Limit	0.00002	0	N/A
Benzo(g,h,i)perylene	2	mg/L	No Limit	0.00002	0	N/A
Total PAH	2	mg/L	No Limit	0.000005	0	N/A
Benzo(a)pyrene TEQ (zero)	2	mg/L	No Limit	0.000005	0	N/A
Other						
Carbon Tetrachloride	2	mg/L	0.003	<0.005	1 (1)	50
Acrylamide	2	mg/L	0.0002	<0.0002	0	100

Note:

(1) Carbon tetrachloride – Sometimes occurs as an impurity in sodium hypochlorite used for disinfection (it is not a disinfectant by-product). One of two samples of drinking water returned a result of <0.005 which may be above the health-related criterion. Additional sampling has been arranged to confirm levels below the ADWG criterion.

5.3 Drinking Water Compliance – Chemical – Aesthetic

5.3.1 Inorganic chemical constituents

During the 1 July 2021 to 30 June 2022 reporting period:

- one (1) samples of a total of twenty-nine (86) samples (2%) indicated pH levels above the ADWG Aesthetic related guideline of 8.5.
- nine (9) samples of a total of eighty-eight (88) samples (10%) indicated Free Chlorine concentrations above the ADWG Aesthetic related guideline of 0.6 mg/L
- fifty-one (51) samples of a total of eighty-six (86) samples (59%) indicated Total Iron concentrations above the ADWG Aesthetic related guideline of 0.3 mg/L.

To ensure effective disinfection and maintain microbial safety of drinking water within the drinking water reticulation system, Muchea Water has made an operating decision to target a residual free chlorine concentration slightly above the ADWG aesthetic guideline.

Muchea Water constantly monitors iron levels in bore and treated water and has an ongoing process improvement program to lower the level of iron in water through the WTP. As part of this improvement program Muchea Water has engaged the services of a leading engineering firm to advise on potential remediation measures. Muchea Water also has a regular program of pipe flushing to lower residual iron that may gather in the reticulation system.

The results for the period (from the Treated Water, Wildflower Estate and MEN sample points) are included in Table 11 below.

Table 11: Inorganic Chemical – Aesthetic Related – Compliance Summary 2021/22

Characteristic	Number of Samples Analysed	Unit	ADWG Aesthetic Limit	Maximum Value	Number of Samples NOT Meeting ADWG limit	% Compliance
pH	86	pH Units	6.5-8.5	8.6	1	98
Total Dissolved Solids Dried at 175-185°C	4	mg/L	600	328	0	100
Turbidity	4	NTU	5	1	0	100
Colour (True)	4	HU	15	5	0	100
Free Chlorine	88	mg/L	0.6	1.1	9	90
Ammonia Nitrogen	4	mg/L as NH_3	0.5	<0.01	0	100
Total Hardness by Calculation	4	mg $CaCO_3$/L	200	38	0	100
Total Aluminium	4	mg/L	0.2	<0.01	0	100
Total Iron	86	mg/L	0.3	1.02	51	41
Total Zinc	2	mg/L	3	0.026	0	100

5.3.2 Non-pesticide hydrocarbons

All samples collected (28) at the Consumer Sample Points during the 1 July 2021 to 30 June 2022 reporting period were compliant with ADWG Aesthetic related guidelines.

The results for the period (from the Treated Water, Wildflower Estate and MEN sample points) are included in Table 12 below.

Table 12: Non-Pesticide Chemicals – Aesthetic Related – Compliance Summary 2021/22

Characteristic	Number of Samples Analysed	Unit	ADWG Aesthetic Limit	Maximum Value	Number of Samples NOT meeting ADWG limit	% Compliance
2-Chlorophenol	6	mg/L	0.0001	<0.0001	0	100
2,4-Dichlorophenol	6	mg/L	0.0003	<0.0002	0	100
2,4,6-Trichlorophenol	6	mg/L	0.002	<0.0002	0	100
Toluene	2	mg/L	0.025	<0.002	0	100
Ethyl Benzene	2	mg/L	0.003	<0.002	0	100
Meta & Para Xylene	2	mg/L	0.02	<0.002	0	100
Ortho Xylene	2	mg/L	0.02	<0.002	0	100
Total Xylenes	2	mg/L	0.02	<0.002	0	100

5.4 Drinking water compliance – radiological

No radiological sampling from the Consumer sample points was carried out over the compliance period 1 July 2021 to 30 June 2022.

Radiological samples were collected for the source water in the period 1 July 2021 to 30 June 2022 with all samples compliant with the ADWG radiological related guidelines. Results are detailed in Section 6.5.

5.5 Drinking water compliance – other

No sampling for PFAS from the Consumer sample points was carried out over the compliance period 1 July 2021 to 30 June 2022. Groundwater is drawn from the confined Leederville aquifer through a well-constructed and sealed bore, providing a high level of protection from contaminants in the surface and superficial aquifers. The closest known source of PFAS to the Muchea Water facility is the RAAF Base Pearce, approximately 15 kilometres south of the WTP. The risk of PFAS contamination of the drinking water is assessed as insignificant.

6. Source Water Quality Results

The source water is not required to meet ADWG. However, where the source water does not meet the ADWG, treatment is applied to make the water suitable for drinking.

6.1 Source water quality – chemical – health related

All samples collected (40) at the Source Sample Point during the 1 July 2021 to 30 June 2022 reporting period were compliant with ADWG Health related guidelines. Additional samples (3) with no current ADWG health limits have been included for completeness.

The results for the period are included in Table 13 below.

Table 13: Chemical – Health Related – Analysis Summary 2021/22

Characteristic	Number of Samples Analysed	Unit	ADWG Health Limit	Maximum Value	Number of Samples NOT meeting ADWG limit
Total Arsenic	1	mg/L	0.01	<0.001	0
Total Barium	1	mg/L	2	0.043	0
Total Beryllium	1	mg/L	0.06	<0.001	0
Total Boron	1	mg/L	4	0.06	0
Fluoride	1	mg/L	1.5	0.3	0
Total Manganese	2	mg/L	0.5	0.08	0
Total Mercury	1	mg/L	0.001	<0.0001	0
Total Molybdenum	1	mg/L	0.05	<0.001	0
Total Nickel	1	mg/L	0.02	<0.001	0
Nitrate Nitrogen	2	mg/L as N	11	<0.01	0
Nitrite Nitrogen	1	mg/L as N	0.9	<0.01	0
Total Selenium	1	mg/L	0.01	<0.01	0
Total Silver	1	mg/L	0.1	<0.001	0
Total Uranium	1	mg/L	0.017	<0.001	0

6.2 Source water quality – pesticides – health related

All samples collected (4) at the Source Sample Points during the 1 July 2021 to 30 June 2022 reporting period were compliant with ADWG Health related guidelines. Additional samples (3) with no current ADWG health limits have been included for completeness.

The results for the period are included in Table 14 below.

Table 14: Pesticide – Health Related – Analysis Summary 2021/22

Characteristic	Number of Samples Analysed	Unit	ADWG Health Limit	Maximum Value	Number of Samples NOT meeting ADWG limit
1,2-Dibromoethane (EDB)	1	mg/L	0.001	<0.001	0
Epichlorohydrin	1	mg/L	0.0005	<0.0002	0
EDTA	1	mg/L	0.25	<0.01	0
Nitriloacetic Acid (NTA)	1	mg/L	0.2	<0.05	0
2,2-Dichloropropane	1	mg/L	No Limit	<0.001	N/A
1,2-Dichloropropane	1	mg/L	No Limit	<0.001	N/A
1,3-Dichloropropylene	1	mg/L	No Limit	<0.002	N/A

6.3 Source water quality – non-pesticides hydrocarbons – health related

All samples collected (20) at the Source Sample Points during the 1 July 2021 to 30 June 2022 reporting period were compliant with ADWG Health related guidelines. Additional samples (2) with no current ADWG health limits have been included for completeness.

The results for the period are included in Table 15 below.

Table 15: Non-Pesticide Hydrocarbons – Health Related – Analysis Summary 2021/22

Characteristic	Number of Samples Analysed	Unit	ADWG Health Limit	Maximum Value	Number of Samples NOT Meeting ADWG Limit
Monocyclic aromatic hydrocarbons					
Benzene	1	mg/L	0.001	<0.001	0
Toluene	1	mg/L	0.8	<0.001	0
Ethyl Benzene	1	mg/L	0.3	<0.001	0
Meta & Para Xylene	1	mg/L	0.6	<0.001	0
Styrene	1	mg/L	0.03	<0.001	0
Ortho Xylene	1	mg/L	0.6	<0.001	0
Total Xylenes	1	mg/L	0.6	<0.001	0
Chlorobenzene	1	mg/L	0.3	<0.001	0
1,4-Dichlorobenzene	1	mg/L	0.04	<0.0001	0
1,2-Dichlorobenzene	1	mg/L	1.5	<0.001	0
Sum of Trichlorobenzene	1	mg/L	0.03	<0.001	0
Chlorinated aliphatic hydrocarbons					
Methylene chloride	1	mg/L	0.004	<0.002	0
1,1-Dichloroethane	1	mg/L	No Limit	<0.001	N/A
1,2-Dichloroethane	1	mg/L	0.003	<0.001	0
1,1,1-Trichloroethane	1	mg/L	No Limit	<0.001	N/A
1,1-Dichloroethene	1	mg/L	0.03	<0.001	0
cis-1,2-Dichloroethene	1	mg/L	0.06	<0.001	0
trans-1,2-Dichloroethene	1	mg/L	0.06	<0.001	0
Hexachlorobutadiene	1	mg/L	0.0007	<0.0005	0
Vinyl chloride	1	mg/L	0.0003	<0.0002	0
Other					
Carbon Tetrachloride	1	mg/L	0.003	<0.001	0

6.4 Source water quality – chemical – aesthetic related

During the 1 July 2021 to 30 June 2022 reporting period fifteen (15) samples indicated total iron concentration above the ADWG aesthetic related guideline of 0.3 mg/L.

Whilst informative, it is noted that it is not this initial source water that is required to meet ADWG guidelines, but rather the final treated water after it has passed through the WTP and all the treatment processes.

Nevertheless, the sampling indicates that the source water does contain levels of total iron that requires attention during the treatment process to bring treated water within ADWG guidelines. Muchea Water constantly monitors iron levels in bore and treated water and has an ongoing process improvement program to lower the level of iron in water through the WTP. Further information on Muchea Water's efforts to address iron is also included in section 5.3.1.

The results for the period are included in Table 16 below.

Table 16: Chemical – Aesthetic Related – Analysis Summary 2021/22

Characteristic	Number of Samples Analysed	Unit	ADWG Health Limit	Maximum Value	Number of Samples NOT Meeting ADWG Limit
pH	14	pH Units	6.5-8.5	7.02	0
Total Dissolved Solids Dried at 175-185°C	2	mg/L	600	275	0
Colour (True)	2	HU	15	1	0
Chloride	1	mg/L	250	124	0
Sulfate	1	mg/L as SO_4	250	13	0
Sodium	1	mg/L	180	65.2	0
Total Hardness by Calculation	2	mg $CaCO_3$/L	200	38	0
Reactive Silica	1	mg/L as SiO_2	80	50.2	0
Reactive Silica as Silicon	1	mg/L as Si	80	23.5	0
Total Aluminium	1	mg/L	0.2	<0.01	0
Total Iron	15	mg/L	0.3	10.4	15
Total Manganese	2	mg/L	0.1	0.08	0

6.5 Source water quality – radiological

All samples collected from the Source Water Sample Point during the 1 July 2021 to 30 June 2022 reporting period were compliant with the ADWG radiological related guidelines.

Radioactivity is reported in units of Becquerels per Litre (Bq/L).

The results for the period are included in Table 17 below.

Table 17: Radiological – Compliance Summary 2021/22

Aesthetic Characteristic	Number of Samples Analysed	Unit	ADWG Radiological Screening Level	Maximum Value	Number of Samples NOT Meeting ADWG Limit	% Compliance
Gross Alpha	2	Bq/L	0.5	0.05	0	100
Gross Beta activity - 40K	2	Bq/L	0.5	<0.10	0	100

6.6 Source water quality – other

As set out in section 5.5, no sampling for PFAS was carried out over the period 1 July 2021 to 30 June 2022. Groundwater is drawn from the confined Leederville aquifer through a well-constructed and sealed bore, providing a high level of protection from contaminants in the surface and superficial aquifers. The closest known source of PFAS to the Muchea Water facility is the RAAF Base Pearce, approximately 15 kilometres south of the WTP. The risk of PFAS contamination of the drinking water is assessed as insignificant.

7. Glossary

Word	Meaning
ADWG	Australian Drinking Water Guidelines
Bg/L	Becquerels per Litre
CFU	Colony forming units
DoH	Department of Health, Western Australia
DWER	Department of Water & Environmental Regulation, Western Australia
DWSPP	Drinking Water Source Protection Plan
ERA	Economic Regulation Authority, Western Australia
HU	Hazen Units
MEN	Muchea Employment Node, an industrial development in Muchea, WA
mg/L	Milligrams per Litre
MIP	Muchea Industrial Park (also known as MEN)
MoU	Memorandum of Understanding
Muchea Water	Aqua Ferre (Muchea) Pty Ltd, ACN 630 936 319, trading as Muchea Water
NATA	National Association of Testing Authorities
ND	Not detected
NTU	Nephelometric Turbidity Units
TDS	Total Dissolved Solids
Wildflower Estate	Wildflower Ridge Estate, a residential subdivision in Chittering, WA
WA	Western Australia
WTP	Water treatment plant