



Service Provider # 473

Drinking Water Quality Management Plan (DWQMP) Report

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GLOSSARY OF TERMS

ADWG	Australian Drinking Water Guidelines (2011). Published by the National Health and Medical Research Council of Australia
E. coli	<i>Escherichia coli</i> , a bacterium which is considered to indicate the presence of faecal contamination and therefore potential health risk
BRC	Barcaldine Shire Council
mg/L	Milligrams per litre
DWQMP	Drinking Water Quality Management Plan
CFU/100mL	Colony forming units per 100 millilitres
ORWA	Outback Regional Water Alliance

INTRODUCTION

Pursuant to sections 99(2) (b) and 106 of the Act, regular reviews of the approved Drinking Water Quality Management Plan must be undertaken at specific intervals, this report documents the performance of Barcaldine Regional Council (BRC) drinking water service with respect to water quality and performance in implementing the actions detailed in the drinking water quality management plan (DWQMP) as required under the *Water Supply (Safety and Reliability) Act 2008* (the Act).

The report assists the Regulator to determine whether the approved DWQMP and any approval conditions have been complied with and provides a mechanism for providers to report publicly on their performance in managing drinking water quality.

1. OVERVIEW OF OPERATIONS

Barcaldine regional Council (BRC) is a medium Drinking Water Service Provider (DWSP) as defined in the *Water Supply (Safety and Reliability) Act 2008*. BRC covers an area of 54,000sq km with an overall population of approximately 2,869 people which swells significantly in the cooler months with travelling tourists. There are five operational water schemes in the shire in the towns of Alpha, Aramac, Barcaldine, Jericho and Muttaborra. The administration centre of the shire is in Barcaldine.

The systems are source their water from bores. Aramac, Barcaldine and Muttaborra are situated within the Great Artesian Basin and their water is sourced from the high yielding aquifers within the basin between the depths of 362 and 825m. Alpha and Jericho located on the eastern side of the region source their water from shallower sub-artesian aquifers located at depths between 70 and 120m.

In mid-2018 BRC submitted an amended DWQMP to the department, demonstrating the commitment of council to managing its drinking water quality and complying with requirements of the *Water Supply (Safety and Reliability) Act 2008*, to protect public health by ensuring the provision of a safe water supply. The development of the DWQMP has documented potential risks associated with the operation of the water schemes and management strategies to safeguard drinking water quality for the public.

2. ACTIONS TAKEN TO IMPLEMENT THE DWQMP

BRC has implemented a number of actions set out in the DWQMP to provide greater surety for the supply of safe drinking water for the supply schemes within the Region. The application of a range of improvement items and management strategies that are set out in the DWQMP are identified below in section 2.1.

2.1. Progress in Implementing the Risk Management Improvement Program

The information below presents the risks identified in the DWQMP Risk Management Improvement Program and the strategies that have been implemented or are to be actioned to reduce ensure the provision of drinking water quality in the BRC's water schemes.

Table 1 RMIP Status

	Scheme	Improvement Item	Actions	Status at June 2018
2.1.1	<u>Alpha</u> <u>Aramac</u> <u>Barcaldine</u> <u>Jericho</u> <u>Muttaburra</u>	Operational & Maintenance Procedures -Identify new procedures needed, develop and obtain approval and implement.	BRC water supply schemes operational and maintenance procedures at the time of the DWQMP amendment in 2081 were outdated and non-existent. BRC is in the process of developing these procedures, which will provide the operators in the various schemes with procedures for sampling and testing water, maintenance procedures for operators fixing infrastructure and	Ongoing
2.1.2	<u>Alpha</u> <u>Aramac</u> <u>Barcaldine</u> <u>Jericho</u> <u>Muttaburra</u>	Commence Operational Monitoring of raw water quality - monitor individual bores to determine if individual bores have lower water quality.	The monitoring of bore source water quality from individual bores to identify if specific bores have low quality water characteristics has been addressed in the amended DWQMP which was approved in August 2018. The monitoring of bore water quality is to be adopted by operators on an annual basis to track the water quality from specific bores. This will allow council to identify the preferred sources of water and use them preferentially. This will be advantageous in Alpha where 5 bores are connected to the supply system and there is a higher risk of contamination in the shallow water source in comparison to the Artesian water sources.	Ongoing
2.1.3	<u>Alpha</u> <u>Aramac</u> <u>Barcaldine</u> <u>Jericho</u> <u>Muttaburra</u>	Catchment Characterisation: Identify the effect of flooding on bore water quality considering private bores which may not be capped or correctly constructed.	Due to the persistent dry weather in the region it has been difficult to assess the effect of flooding on the bore water quality in alpha and Jericho. At the next opportunity when a significant flooding event occurs in the Alpha Creek and Jordan River Catchment bore water testing will be conducted for each of the source water bores to assess if flood waters are impacting on the quality of the water supply.	Ongoing
2.1.4	<u>Alpha</u> <u>Aramac</u> <u>Barcaldine</u> <u>Jericho</u> <u>Muttaburra</u>	On-line monitoring for plant filtered water: Install analytical metering for the plant filtered water for chlorine residual, pH and turbidity.	The Alpha and Jericho water treatment plants have automated monitoring systems installed, these systems were originally installed in 2013 and have undergone upgrades in 2016, the system has sensors connected to the treatment plant outlet and the reservoir storage outlet. These sensors provide readings at the HMI screen where real time readings of the water quality can be identified, automated alarms are also triggered when concentration values exceed critical levels. The automated sensors are able to provide values for Chlorine, pH and Turbidity.	Complete

2.1.5	<u>Alpha</u> <u>Jericho</u>	Operator Training and handover process: Allow for peer training approximately 5 days, source operator from other DWSP to train operator	Currently in Alpha and Jericho there are two employees capable of operating the plants and associated water infrastructure. A water services technician has been employed by council in 2017 who has been trained to operate the schemes. The town supervisor who has experience in managing water operations is a backup staff member who has managed the system in the past.	Ongoing
2.1.6	<u>Alpha</u> <u>Jericho</u>	Provide new turbidity test equipment: Provide new turbidity test equipment with a resolution of 0.1 NTU	The Alpha and Jericho schemes have automated monitoring systems installed at the Water treatment plant which can be accessed remotely. The automated monitoring system are able to provide values for Chlorine, pH and Turbidity. Turbidity readings are provided to .01 units of accuracy.	Complete
2.1.7	<u>Alpha</u> <u>Jericho</u>	Eliminating disinfection by-products: Minimise holding of sodium hypo Discontinue pre-chlorination and commence post chlorination	Issues associated with chlorine disinfection products in the water distribution system, largely due to the degradation of the sodium hypochlorite whilst in storage, requiring increased dosage rates resulting in increased disinfection by-products have been alleviated. This issue has been addressed by installing a new calcium hypochlorite system in 2016 which does not degrade at the same rate as sodium hypochlorite and produces less disinfection by-products as the product maintains its strength in storage and is not degraded in hot weather to the same degree.	Complete
2.1.8	<u>Aramac</u> <u>Muttaburra</u>	Provide restricted access to bore sites	Restricted access has been provided for the Aramac and Muttaburra bores. The bores have been fenced off with in steel mesh facility with covered protection. Fencing was completed in 2017.	Complete
2.1.9	<u>Aramac</u>	Installation of pumps in Aramac to increase pressure	Water pressure issues in Aramac were associated with the supply bores being unable to maintain pressure during high usage. Low water pressure issues have been addressed in Aramac by installing inline pump systems to boost the bore water pressure.	Complete

3. COMPLIANCE WITH WATER QUALITY CRITERIA FOR DRINKING WATER

A summary of verification monitoring results are provided below. Verification monitoring data indicates that there are limited issues with water quality. Exceedances of ADWG guideline values are limited to aesthetic guideline values where iron and colour values have been exceeded in Muttaborra, these exceedances are due to the underlying geology of the Muttaborra bore, where iron values are elevated. The discolouration of the water in Muttaborra is due to iron precipitates in the water supply.

3.1. Alpha Drinking Water Scheme Water Quality Results 2017 – 2018

Table 2 Alpha Verification Monitoring Results

Analyte	Scheme Component	Sampling Frequency	No. of Samples	Minimum Value	Maximum Value	Average Value	Exceedance
E-Coli (Present)	Distribution	Weekly	70	0	0	0	0
Aluminium	Distribution	Monthly	12	0.05	0.05	0.05	0
Free Chlorine	Distribution	Weekly	60	0.49	1.65	1.03	0
Chlorate	Distribution	Monthly	12	0.34	0.59	0.43	0
pH	Distribution	Monthly	12	6.99	7.63	7.27	0
True colour	Distribution	Monthly	12	1.00	2.00	1.08	0
Turbidity	Distribution	Monthly	12	1.00	1.00	1.00	0
Iron	Distribution	Monthly	12	0.01	0.01	0.01	0
Manganese	Distribution	Monthly	12	0.01	0.01	0.01	0

3.2. Aramac Drinking Water Scheme Water Quality Results 2017 – 2018

4. Table 3 Aramac Verification Monitoring Results

Analyte	Scheme Component	Sampling Frequency	No. of Samples	Minimum Value	Maximum Value	Average Value	Exceedance
E-Coli (Present)	Source	Monthly	24	0	0	0	0
pH	Source	Monthly	24	7.8	8.34	8.0	0
Turbidity	Source	Monthly	24	<1	<1	<1	0
Fluoride	Source	Monthly	24	0.23	0.55	0.472	0
Iron	Source	Monthly	24	0.02	0.14	0.089	0
Manganese	Source	Monthly	24	0.01	0.07	0.031	0
True colour	Source	Monthly	24	1.0	7.0	2.364	0

4.1. Barcaldine Drinking Water Scheme Water Quality Results 2017 – 2018

5. Table 4 Barcaldine Verification Monitoring Results

Analyte	Scheme Component	Sampling Frequency	No. of Samples	Minimum Value	Maximum Value	Average Value	Exceedance
E-Coli Present)	Source/ Distribution	Weekly	134	0	0	0	0
pH	Source/ Distribution	Monthly	44	8.15	8.48	8.323	0
Turbidity	Source/ Distribution	Monthly	44	<1	<1	<1	0
Fluoride	Source/ Distribution	Monthly	44	0.08	0.28	0.217	0
Iron	Source/ Distribution	Monthly	44	0.01	0.12	0.037	0

Manganese	Source/ Distribution	Monthly	44	0.01	0.03	0.02	0
True colour	Source/ Distribution	Monthly	44	1.0	9.0	1.477	0

5.1. Jericho Drinking Water Scheme Water Quality Results 2017 – 2018

6. Table 5 Jericho Verification Monitoring Results

Anolyte	Scheme Component	Sampling Frequency	No. of Samples	Minimum Value	Maximum Value	Average Value	Exceedance
E-Coli Present)	Distribution system	Weekly	70	0	0	0	0
Aluminium	Distribution system	Monthly	12	0.05	0.08	0.05	0
Free Chlorine	Distribution system	Weekly	60	0.45	2.20	1.04	0
Chlorate	Distribution system	Monthly	12	0.08	0.58	0.29	0
pH	Distribution system	Monthly	60	6.7.	7.62	7.02	0
True colour	Distribution system	Monthly	12	1.00	2.00	1.08	0
Turbidity	Distribution system	Monthly	12	0.0	0.52	0.18	0
Iron	Distribution system	Monthly	12	0.01	0.01	0.01	0
Manganese	Distribution system	Monthly	12	0.01	0.01	0.01	0

6.1. Muttaborra Drinking Water Scheme Water Quality Results 2017 – 2018

7. Table 6 Aramac Verification Monitoring Results

Anolyte	Scheme Component	Sampling Frequency	No. of Samples	Minimum Value	Maximum Value	Average Value	Exceedance
E-Coli Present)	Source	Monthly	35	0	0	0	0
pH	Source	Monthly	24	7.74	8.36	7.916	0
Turbidity	Source	Monthly	24	<1	<1	<1	0
Fluoride	Source	Monthly	24	0.17	0.46	0.247	0
Iron	Source	Monthly	24	0.07	0.75	0.36	11
Manganese	Source	Monthly	24	0.03	0.09	0.078	0
True colour	Source	Monthly	24	1.0	26.0	10.773	8

7.1. Summary of Results

Bacteriological sampling for all of the schemes has recorded no positive results.

For the Muttaborra drinking water scheme there was an exceedance of ADWG aesthetic values with elevated levels of iron detected, these values are due to the underlying geology in the area. The Muttaborra verification monitoring data has also identified true colour values in exceedance of the aesthetic guideline values. These colour values are associated with the elevated iron values, where iron is precipitated in the drinking water supply causing discolouration.

8. NOTIFICATIONS TO THE REGULATOR UNDER SECTIONS 102 AND 102A OF THE ACT

No notifications were required to the regulator over the 2017/18 reporting period.

9. CUSTOMER COMPLAINTS RELATED TO WATER QUALITY

Over the 2017/18 reporting period there were a total of 82 complaints. Most of these complaints were received in Barcaldine, these complaints are usually associated with service issues when callouts occur where a customer has made a complaint in regards to low pressure or line breaks. A total of 7 water quality complaints were registered with Council, these quality complaints are generally regarding the discolouration of water. The discolouration of the water is associated with sediment build up in the water, a symptom of aging water lines. A summary of water complaints is provided in table 7 below.

Table 7 Aramac Verification Monitoring Results

Service Complaints	Water Quality Complaints
Sum of Service Complaints Alpha	Sum of Quality Complaints Alpha
1	0
Sum of Service Complaints Aramac	Sum of Quality Complaints Aramac
0	2
Sum of Service Complaints Barcaldine	Sum of Quality Complaints Barcaldine
74	5
Sum of Service Complaints Jericho	Sum of Quality Complaints Jericho
0	0
Sum of Service Complaints Muttaborra	Sum of Quality Complaints Muttaborra
0	0
Total service Complaints	Total Water Quality Complaints
75	7
	Total all complaints
	82

10. FINDINGS AND RECOMMENDATIONS OF THE DWQMP AUDITOR

The DWQMP third party Audit was completed in October 2017 by Bligh Tanner. A summary of the audit findings is provided below in table 8. Where items were identified to be compliant with the DWQMP these items have been omitted, the findings below present the deficiencies in meeting the DWQMP. Therefore the items below are a breakdown of the non-conformance and improvement items identified in the audit.

10.1. Commitment to Drinking Water Quality

Table 8 DWQMP Audit Findings

Criteria	Outcome	Evidence and Reasoning
Drinking Water Quality Policy		
Regulatory and Formal Requirements		
Identify and document all relevant regulatory and formal requirements.	OFI	Regulatory requirements are not stated within the approved plan; however it would be beneficial at a minimum to state the basic regulatory requirements, e.g. - Water Supply (Safety & Reliability) Act 2008 - Public Health Act 2005 & Public Health Regulation 2005 As well as provide reference to the Australian Drinking Water Guidelines. This may be beneficial for new staff, or those who have not worked in the water industry for long.
Engaging Stakeholders		
Identify all stakeholders who could affect, or be affected by, decisions or activities of the drinking water supplier.	OFI	Table 2.6 of the approved plan lists the only stakeholders as being two employees of Barcaldine Regional Council. In most DWQMPs, and ideally in practice, key stakeholders for water supply operations will include sensitive customers, regulatory agencies, important equipment & chemical suppliers etc. Consider identifying all key stakeholder groups at the time of DWQMP review.
Develop appropriate mechanisms and documentation for stakeholder commitment and involvement.	OFI	As above. If and when other stakeholders are identified, consideration should be given to appropriate mechanisms for stakeholder involvement.
Regularly update the list of relevant agencies.	OFI	As above.

10.2. Assessment of the Drinking Water Supply System

Criteria	Outcome	Evidence and Reasoning
Water supply system analysis		
Is Alpha Water Supply Scheme as described in the DWQMP?	NC	<p>The Alpha scheme has 5 bores providing raw water to the WTP; after the commissioning of the new aerodrome bore which is located approximately 5km out of town towards Jericho.</p> <p>The plan states that sodium hypochlorite is used for disinfection, however a new calcium hypochlorite disinfection system had recently been installed and commissioned (in response to issues with chlorate).</p> <p>At the time of the site visit, the plant was not operating; with the exception of the disinfection system (it was noted that the raw water turbidity was below 0.2NTU; and the operator advised this was typical unless the town was in flood). The reason given for this was that WTP refurbishment had recently been undertaken, which could not be done unless the plant was bypassed.</p> <p>The plan requires updating to reflect the current scheme circumstances. Clarity should be provided around the decision making process for taking the WTP offline, and the risk assessment reflective of this mode of operation.</p>
Is Jericho Water Supply Scheme as described in the DWQMP?	OFI	<p>The scheme remains largely as described in the DWQMP, however the sodium hypochlorite dosing system was replaced with a calcium hypochlorite system (similarly to Alpha). Pre-chlorination no longer occurs, though the dosing point remains if this is required in future. The DWQMP should be updated to reflect the current circumstances.</p>
Is Muttaborra Water Supply Scheme as described in the DWQMP?	OFI	<p>Though it has been stated in the 2015 DWQMP Report, the commissioning of the second bore is not reflected in the DWQMP. This will be simple to rectify at the time of DWQMP Review.</p>
Periodically review the water supply system analysis.	OFI	<p>As noted above, there have been changes to supply configurations since the original plan development. The risk assessment should be revisited at the time of DWQMP review in light of these changes, and the water quality data collected in that time.</p>

Assessment of water quality data		
Assemble historical data from source waters, treatment plants and finished water supplied to consumers (over time and following specific events).	OFI	A minimum of two years water quality data has been summarised in the plan. It would be beneficial to collate and analyse the data collected since 2012, to assess whether there are any emerging trends.
Periodically review and update the hazard identification and risk assessment to incorporate any changes.	OFI	The risk assessments were undertaken in 2011 in preparation for the first submission of the DWQMP. As such, they are now 6 years old and should be reviewed with reference to all the information that has become available since that time.

10.3. Preventive Measures for Drinking Water Quality Management

Criteria	Outcome	Evidence and Reasoning
Preventive measures and multiple barriers		
ALPHA - Review of preventive measures: Capped Bores	NC	There are a number of open uncapped bores in the immediate vicinity of the raw water supply bores. Contamination of the open bores could allow transmission of contaminants into the town water supply, particularly if the bores are at similar depth.
JERICOHO - Review of preventive measures: (Confirm relevance of the Plan)	OFI	In the auditor's opinion, vermin proofing of the elevated reservoir could be listed as a control measure against the "low chlorine in reservoir" risk (bacterial hazard). If ingress is prevented, then chlorine decay is less likely to result in a bacterial hazard being present.
MUTTABURRA - No preventive measures: (Confirm relevance of the Plan)	OFI	In the auditor's opinion, restriction of access to the bores could be stated as a preventive measure.
ALL SCHEMES - Review of preventive measures: Mains repair procedure	NC	This procedure was unable to be produced during the audit.
Critical control points		
Assess preventive measures from catchment to consumer to identify critical control points.	OFI	Although CCPs have not been identified within the approved plan, the installation of online monitoring at Alpha and Jericho may now allow for the identification and implementation of suitable, relevant CCPs. Consideration could be given to implementing CCPs as part of the next DWQMP review.

10.4. Operational Procedures and Process Control

Criteria	Outcome	Evidence and Reasoning
Operational procedures		
Document all procedures and compile into an operations manual.	OFI	There was minimal evidence of operational procedures sighted during the audit; and the reservoir inspection checklist (Image 104) was not in active use. This has been identified as an area for improvement (refer to the audit section covering RMIP actions).
Operational monitoring		
Operational monitoring program implementation: Alpha	NC	<p>The Alpha Operational Monitoring program was not implemented as stated in the DWQMP; this was verified by reviewing the data collected in SWIMLocal.</p> <p>Differences included but are not limited to:</p> <ul style="list-style-type: none"> No raw water <i>E. coli</i> or Coliform results No raw water turbidity results Infrequent (less than monthly) raw water pH results No raw or treated water colour results No raw water chemical analysis results <p>It was noted that treated water chlorine, turbidity and pH results were being recorded daily, which is better than the 3 times per week frequency stated in the DWQMP.</p> <p>The general system inspections are also not reported formally at a set frequency as indicated in the DWQMP.</p>
Operational monitoring program implementation: Aramac	OFI	Operational monitoring for this scheme is not supported by formal records. Operators inspect the scheme daily and report issues only as they are picked up. This should be clarified in the DWQMP at the next review.
Operational monitoring program implementation: Barcaldine	OFI	Operational monitoring for this scheme is not supported by formal records. Operators inspect the scheme daily and report issues only as they are picked up. This should be clarified in the DWQMP at the next review.

Operational monitoring program implementation: Jericho	NC	<p>The Jericho Operational Monitoring program was not implemented as stated in the DWQMP; this was verified by reviewing the data collected in SWIMLocal.</p> <p>Differences included but are not limited to:</p> <ul style="list-style-type: none"> No raw water <i>E. coli</i> or Coliform results Infrequent (less than monthly) raw water turbidity results Infrequent (less than monthly) raw water pH results No raw or treated water colour results No raw water chemical analysis results <p>It was noted that treated water chlorine, turbidity and pH results were being recorded daily, which is better than the 3 times per week frequency stated in the DWQMP.</p> <p>The general system inspections are also not reported formally at a set frequency as indicated in the DWQMP.</p>
Operational monitoring program implementation: Muttaborra	OFI	Operational monitoring for this scheme is not supported by formal records. Operators inspect the scheme daily and report issues only as they are picked up. This should be clarified in the DWQMP at the next review.
Corrective action		
Establish and document procedures for corrective action to control excursions in operational parameters.	OFI	<p>It was not clear to the auditor whether all excursions (i.e. deviations from the target criteria) would be recognised and reported to the Manager of Engineering Services in accordance with Table 6.1 of the DWQMP. The Town Foreman (responsible for Alpha and Jericho WTPs) was aware of the importance of reporting <i>E. coli</i> detections, ADWG health exceedances for chlorine, and absence of chlorine. The operational monitoring data can not necessarily be checked as it cannot be determined whether the WTPs were operating at the time.</p> <p>The DWQMP should be reviewed and consideration given to whether the new process of data collection and highlighting of cells in SWIMLocal provides enough visibility and awareness to management for excursions that are of a lower priority.</p>
Equipment capability and maintenance		
Establish a program for regular inspection and maintenance of all equipment, including monitoring equipment.	OFI	Calibration procedures exist for the test instruments at the WTPs, however the schedule is informal with calibrations undertaken as needed. Generally, instruments from one plant are transported to another and samples read side by side to confirm instruments are providing the same reading. There is no formal third party external calibration process in place. Consideration should be given to implementing a regular third party calibration schedule.

10.5. Verification of Drinking Water Quality

Criteria	Outcome	Evidence and Reasoning
Drinking water quality monitoring		
Verification monitoring program implementation: Aramac	NC	The verification monitoring program is not implemented as per the DWQMP. Specific examples include: <ul style="list-style-type: none"> - no results for dissolved oxygen and temperature (DWQMP states both are measured monthly at 2 sites) - gap in data (all parameters): April 2015. - gap in data (specific site): Aramac Bore 1 for July 2015.
Verification monitoring program implementation: Barcaldine	NC	Although there are some differences in the DWQMP verification monitoring program versus the program implemented in practice, the differences are relatively minor. <i>E. coli</i> monitoring is being undertaken weekly at both bores and the Barcaldine hospital, which is above the monthly frequency stated in the plan. Similarly to other schemes, there is no data for temperature and dissolved oxygen. There are also no chemical results for the Barcaldine Hospital however both supply bores are tested monthly and the dataset is continuous back to September 2014. An opportunity for improvement exists to amend the plan to reflect the current implemented verification monitoring program.
Verification monitoring program implementation: Jericho	NC	The verification monitoring program is not implemented as per the DWQMP. Specific examples include: <ul style="list-style-type: none"> - no chlorine monitoring data (DWQMP states it is measured monthly at the WTP outlet) - no chemical results for samples other than the Jericho WTP (DWQMP states that samples are collected monthly at the Bush Nursing building and the Swimming Pool) - no results for dissolved oxygen and temperature (DWQMP states both are measured monthly at 3 sites) - gaps in data (all parameters): no results are recorded for the month of May 2015, December 2015, September 2016, October 2016 - gaps in data (chlorate): December 2014; March, May, August and December 2015; June, September, October and December 2016.

Verification monitoring program implementation: Muttaborra	NC	The verification monitoring program is not implemented as stated in the DWQMP. Specific examples include: - no results for dissolved oxygen and temperature (DWQMP states both are measured monthly at Bore 1) - gap in data (all parameters): April 2015. - no <i>E. coli</i> results for March, July and August 2017 It should be noted that for months when <i>E. coli</i> testing is being performed, generally 3 samples are tested which is more than the number stated in the plan.
Ensure monitoring data are representative and reliable	OFI	Use of a NATA accredited laboratory for the chemical analyses ensures that these data are reliable. Consideration should be given to sending some <i>E. coli</i> verification samples to an external laboratory as an external verification of the internal Colilert method.
Corrective action		
Establish and document procedures for corrective action in response to non-conformance or consumer feedback.	OFI	Between Tables 6.3 and 6.4, and the incident management plan (section 5.3), corrective actions related to verification monitoring are outlined in the plan. The DWQMP identifies procedures (Appendix F) that would assist with responding to water contamination and customer complaints, however these have not been developed to date.

10.6. Management of Incidents and Emergencies

Criteria	Outcome	Evidence and Reasoning
Communication		
Define communication protocols with the involvement of relevant agencies and prepare a contact list of key people, agencies and businesses.	OFI	Council maintains an email distribution list for Barcaldine that includes all customers who have registered their email address. It is believed that most/all of the key customers would receive communications by this method. Generally, the other towns are small enough that door to door communication is practical.
Incident and emergency response protocols		
Train employees and regularly test emergency response plans.	OFI	Given that some time has passed since the last water quality incident, consideration could be given to testing the process for a water quality incident.

Investigate any incidents or emergencies and revise protocols as necessary.	OFI	The incident response plan states that an internal non-compliance must be raised and require sign off by the Manager Engineering Services and CEO after corrective actions have taken place. It was unable to be determined whether this occurred after the <i>E. coli</i> incident of 2014 (reported in 2016).
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10.7. Employee Awareness and Training

Criteria	Outcome	Evidence and Reasoning
Employee awareness and involvement		
Employee training		
Ensure that employees, including contractors, maintain the appropriate experience and qualifications.	OFI	Operators are not formally qualified yet, however training to Cert IV level has commenced. Generally, staff with relevant trade backgrounds are employed, for example the Alpha and Jericho Town Foreman is a qualified electrician, and others are qualified plumbers.

10.8. Research and Development

Criteria	Outcome	Evidence and Reasoning
Validation of processes		
Validate processes and procedures to ensure that they are effective in controlling hazards.	OFI	Chlorine is dosed prior to the clear water reservoirs at Alpha and Jericho, and it would appear based on the size of the tanks and the size of the towns that more than enough disinfection contact time would be provided. Nevertheless, it would be worthwhile to calculate disinfection contact time and state this in the DWQMP.

10.9. Documentation and Reporting

Criteria	Outcome	Evidence and Reasoning
Management of documentation and records		
Periodically review documentation and revise as necessary.	OFI	As outlined elsewhere, documented procedures have not been developed. The DWQMP was partially reviewed approximately 2 years ago however it was not finalised.
Reporting		
Establish procedures for effective internal and external reporting.	OFI	Internal reporting around water quality management is informal. External reporting such as the annual reports and ongoing chlorate incident reporting is formalised and appears well managed.

10.10. Review and Continual Improvement

Criteria	Outcome	Evidence and Reasoning
Review by senior executive		
Evaluate the need for change.	OFI	Though it was identified that significant changes to the DWQMP were required as early as 2015, to date the plan has not been amended.
Drinking water quality management improvement plan		
Ensure that the plan is communicated and implemented, and that improvements are monitored for effectiveness.	OFI	Although some actions were completed, there has been some slipping of dates with a number of other actions. Individual RMIP actions were audited for progress with the findings summarised below.
ALPHA - AL2 - Reinstatement of filtration	In Progress	The filters were recently refurbished due to sand carryover into the reservoir. The WTP was offline at the time of the site visit but the Town Foreman advised the full WTP process had been operational prior to the refurbishment.
ALPHA - AL3 - Monitoring of all 5 bores for <i>E. coli</i> after flooding	In Progress	A flood event has not occurred in Alpha since 2011. SWIM has been configured to allow data entry of <i>E. coli</i> results for individual bores.
JERICHO - J2 - Operational monitoring of raw water	In Progress	There is some minimal raw water operational monitoring occurring however the frequency does not appear to be regular.
ARAMAC, BARCALDINE, MUTTABURRA - ABM3 - Operational monitoring of raw water quality	No Evidence	This appears to be of limited relevance as there is no treatment; the existing verification monitoring will essentially reflect the raw water quality in these three schemes. The RMIP states that this action is a medium priority, "to assess the effectiveness of the treatment process & determine certainty of the risk level associated with bypassing the treatment plant". This statement is irrelevant to the three schemes it refers to, and the RMIP should be revisited at the next DWQMP review to ensure the actions are relevant to the specific schemes.
ALL SCHEMES - AL1, J1, ABM2 - Operational procedures in development	In Progress	Some limited procedures, however there does not appear to be evidence of a concerted effort to systematically progress with the development of procedures as suggested/outlined in Appendix F of the DWQMP.

11. OUTCOME OF THE DWQMP REVIEW AND HOW ISSUES RAISED HAVE BEEN ADDRESSED

A review of BRC DWQMP was undertaken in late 2017 and submitted to the regulator in December 2017. This review was undertaken in association with the third party audit which was completed in October 2017, whereby findings of the audit were taken into consideration for the DWQMP Review. The Review identified that the DWQMP required updating in a number of areas. Some of the outdated information included infrastructure upgrades such as the disinfection system upgrades at the Alpha and Jericho water treatment plants, the addition of a new source water bore at Muttaborra and security fencing around bores in Aramac and Muttaborra.

A major change that was implemented as a result of the review process was updating the operational and verification monitoring programs. Changes to the monitoring programs were based on an ORWA initiative, where a third party assessments of monitoring programs in the region was conducted, based on this assessment by a water quality specialist significant changes were implemented into the DWQMP monitoring programs. The changes were primarily aimed at reducing testing where historical results had repeatedly shown non detectable or low values. Also where the specialist review identified that parameters with potential health impacts had not been monitored, these parameters were included in the monitoring program.

The review also identified that outdated information was required to be updated, such information included population statistics and the number of connections within the schemes. The risk assessment was also updated based on actions implemented since the implementation of the DWQMP, including the adoption of a new chlorination product (calcium hypochlorite) and the security fencing of bores. The findings of the DWQMP review have been implemented into an amended DWQMP which was approved in August 2018.