Greater Hume Council

Annual Report 2017-18

Drinking Water Management System

August 2018

VIRIDIS CONSULTANTS

Annual Report 2017-18

Drinking Water Management System

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Executive Summary

Water suppliers in New South Wales (NSW) are required to have a 'quality assurance program', referred to as a Drinking Water Management System (DWMS). An annual review of the DWMS is recommended to ensure that it is valid and being implemented effectively. Furthermore, an annual report is required to be prepared and submitted to the local Public Health Unit (PHU), NSW Health.

Viridis Consultants P/L (Viridis) was engaged by Greater Hume Council to prepare the DWMS Annual Report for the 2017-18 reporting period.

Council is responsible for two water supply schemes - Culcairn and Villages supplies. For the Villages, bulk treated water is obtained from Albury City Council (ACC) and reticulated to customers. There were no material changes to the two water supply schemes including source, treatment processes and distribution network during the reporting period that could negatively impact the risk assessment.

There have been discussions with ACC and Riverina Water on taking over the operations and management of water services. Council has motioned and approved to retain operation and management of water services.

There were no issues noted against the ADWG health-based guidelines for the schemes. One breach of the ADWG health-based guidelines was recorded for nickel for the Culcairn scheme, although this was most likely related to a sample contamination issue or testing error.

Council maintained a high level of consumer satisfaction, with eleven water quality complaints received over the reporting period. Council followed appropriate processes when these complaints were received to ensure health of consumers was not jeopardised.

Further, there were no non-compliances for critical control point monitoring that required reporting to NSW Health.

The Improvement Plan, which forms an integral part of the DWMS, demonstrates the practice of continual improvement. There were 12 action items open (to start or underway) from the last review of the Improvement Plan which had timeframes due during this reporting period. During the reporting period, only two actions were progressed due to discussions around the divestment of water services, most actions were on hold or delayed until the outcome of this was more certain. The actions on hold do not compromise the ability to provide safe drinking water to customers. With Council's decision that divestment will not proceed, implementation of the Improvement Plan will progress as normal. New timeframes have been assigned to the improvement actions.

As part of continual improvement and preparation of this Annual Report, three new improvement actions have been identified and added to the Improvement Plan, related to the repair or replacement of reservoirs and undertaking a comprehensive review of risk registers for both schemes. Council's ongoing commitment is required to enable the improvements/recommendations identified to be successfully implemented.

The DWMS was also reviewed during the preparation of this Annual Report. Overall, the review found that the risk profile had not changed negatively for the schemes and Council is undertaking continual improvements. The DWMS remains current, based on the review discussions undertaken. Minor updates to the documents are required, which will be undertaken when the risk registers are comprehensively reviewed in 2019.

1. Introduction

Water suppliers in New South Wales (NSW) were required to establish and adhere to a 'quality assurance program', referred to as a Drinking Water Management System (DWMS). The DWMS is a risk based approach to managing drinking water quality.

An annual review of the DWMS is recommended to ensure that it is valid and is being implemented effectively. In addition, an annual report is required to be prepared and submitted to the local Public Health Unit (PHU), NSW Health.

Greater Hume Council has engaged Viridis Consultants P/L (Viridis) to prepare the DWMS Annual Report for the 2017-18 reporting period, which covers a 12-month period from 1 July 2017 to 30 June 2018.

This report summarises Council's drinking water quality performance for the reporting period, outcomes of the DWMS annual review and progress on the implementation of the improvement plan.

2. Supply Schemes

Council is responsible for two water supply schemes:

- Culcairn supply - urban area only. Raw water is sourced from a bore and treated at the Culcairn water treatment plant (WTP) through aeration and disinfection prior to distribution to customers.
- Villages supply (Jindera, Burrumbuttock, Brocklesby, Gerogery, Gerogery West and some connected rural areas). Bulk treated water is obtained from Albury City Council (ACC) and reticulated to villages. Council undertakes re-chlorination at the service reservoirs to provide a barrier against potential recontamination.

Water supply for the townships of Henty, Holbrook, Morven, Walla Walla, Walbundrie and Woomargama is provided by Riverina Water.

3. Scheme Changes

3.1. General

Council has had a name change to Greater Hume Council and has a new logo.

There have been discussions with ACC and Riverina Water for taking over the operations and management of Council's water services. In Council's April 2018 meeting, it was motioned and approved for the retention of the operational and management of water services by Greater Hume Council.

3.2. Culcairn Supply

There were no significant changes to the Culcairn water supply scheme including source, treatment processes and distribution network. The Culcairn WTP completed a renewal of chlorination equipment during the reporting period. This did not result in a material change to the operation process to trigger an urgent review of the risk register.

3.3. Villages Supply

There were no significant changes to the Villages supply in relation to the distribution of the bulk treated water from ACC.

4. Critical Control Points

The Critical Control Point (CCP) for the scheme was reviewed as part of the preparation of this report. The CCP remained the same.

The CCP for the Culcairn scheme is disinfection. There is no CCP identified for the Village scheme as it receives bulk treated water from ACC. The other important operational monitoring is captured in the operational monitoring plan and being implemented, including reservoir integrity (refer to section 5).

There was no CCP critical limit breach for the reporting period which required notification to the Public Health Unit (PHU), see Figure 1. On instances when the result was outside the target range, adjustments were undertaken to ensure the process maintained its effectiveness.

In addition, the turbidity of the bore water was consistently <1 NTU, as required to ensure effective disinfection (see Figure 2). pH, another parameter important to ensure the effectiveness of chlorination, was consistent over the reporting period within the range of 6.5 and 8.5 (see Figure 3).

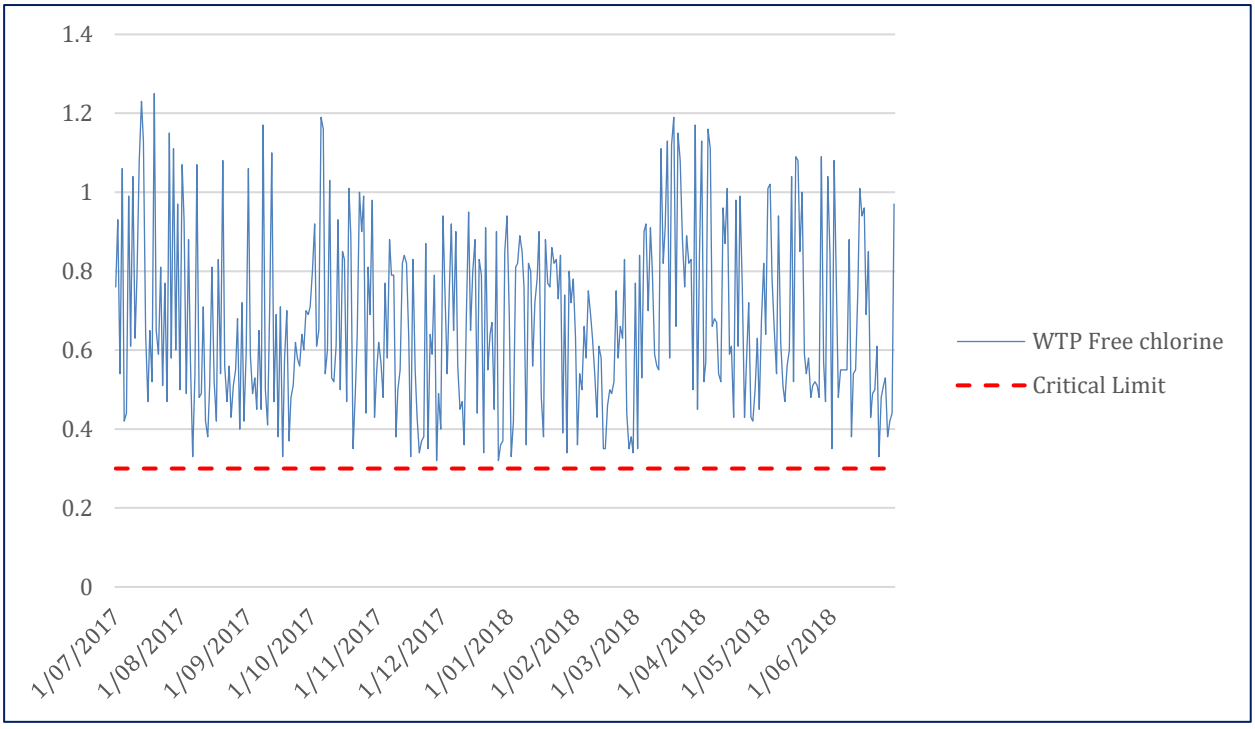

Figure 1 Disinfection CCP monitoring trend for the Culcairn WTP

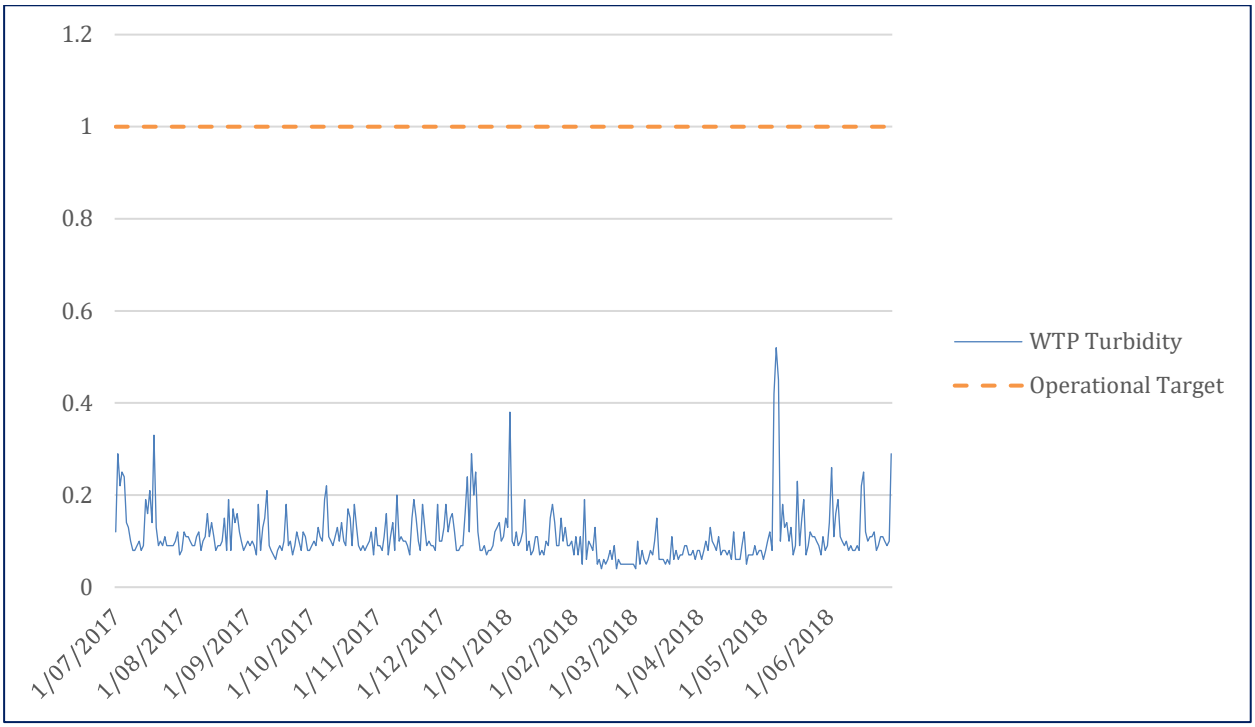

Figure 2 Turbidity trend for the Culcairn WTP

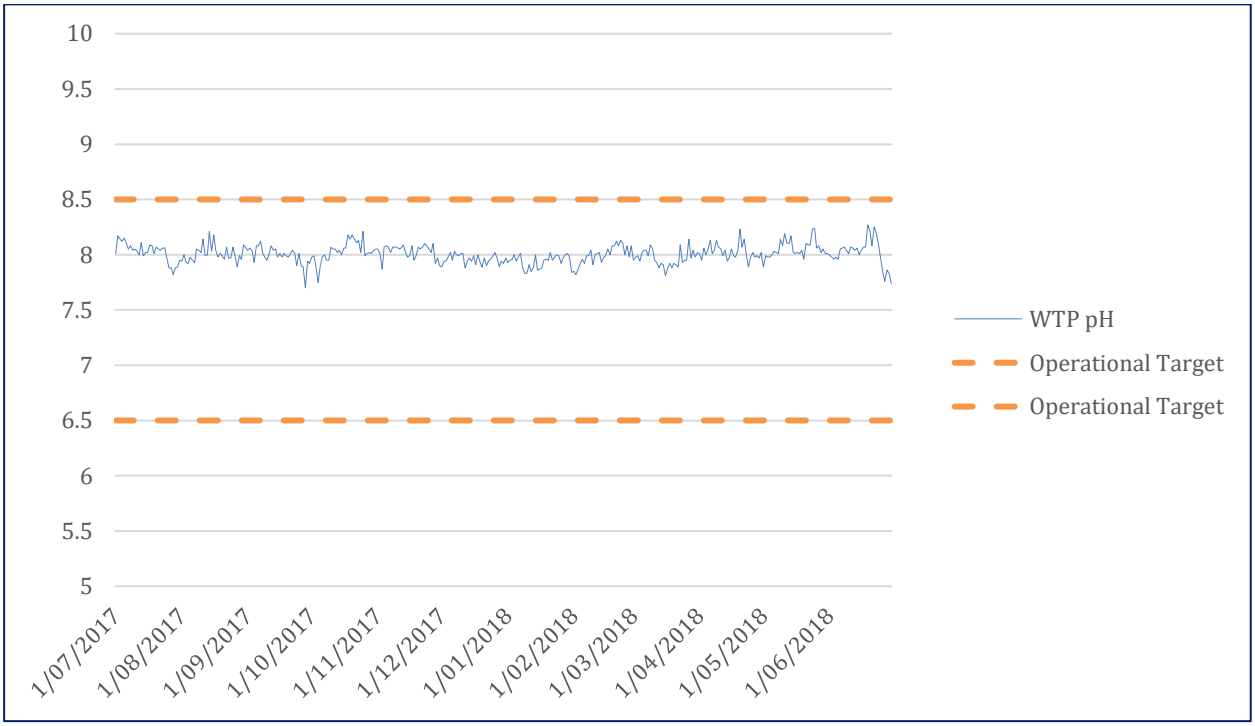

Figure 3 pH trend for the Culcairn WTP

5. Reservoir Integrity

Maintaining the integrity of the distribution system is an important barrier in keeping the supply safe from potential recontamination. This includes ensuring that the service reservoirs are closed and not vulnerable to contamination, for example, by vermins, birds or rainwater runoff ingress.

The operators do a general check and observation of the reservoirs weekly during their monitoring rounds and a detailed inspection using the reservoir inspection checklist is undertaken every 6 months. In addition, Council engages external contractors to clean and thoroughly inspect its service reservoirs, and undertakes actions on items brought to attention. The external engagement is undertaken every 4 years, with the most recent one undertaken in 2017. The next external cleaning is scheduled for 2021.

Table 1 provides a summary of the in-house and external contractor reservoir inspections undertaken during the reporting period.

Table 1 Summary of reservoir inspections undertaken

Inspection period/ date and type	Reservoir	Findings / issues	Comments
Aug 17 – in-house and external contractor	Big Brock Reservoir	No issues noted.	Not water quality related. This will be monitored and action taken as required.
	Black St Reservoir	Delamination of outer reinforcement cover noted, detailed inspection performed by Brearly & Hansen.	The reservoir will be repaired and upgraded. Replacement works have been budgeted 2019/2020. Reservoir undergoes structural inspection monthly to provide early warning for further degradation. No adverse impact on water quality.
	Burrumbuttock Reservoir	Minor leak found at reservoir base construction joint.	Leak is monitored weekly to determine degradation. Noted as seasonal (winter only).
	Culcairn WTP Tank	No issues noted.	None.
Aug 17 – in-house and external contractor	Gerogery Reservoir	No issues noted.	None.
	Gordon St Reservoir	No issues noted.	None.
	Jindera Gap Reservoir	No issues noted.	None
	Little Brock Reservoir	No issues noted.	None.
11/04/18 – in-house	Big Brock Reservoir	No issues noted.	None.
	Gerogery Reservoir	No issues noted.	None.
	Jindera Gap Reservoir	Reservoir cleaning was conducted late (due 05/17, completed 10/17).	None.
	Little Brock Reservoir	No issues noted.	None.

Inspection period/ date and type	Reservoir	Findings / issues	Comments
12/04/18 – in-house	Black St Reservoir	Delamination of outer reinforcement cover noted, detailed inspection performed by Brearly & Hansen.	Same as noted for Aug 17 above.
	Burrumbuttock Reservoir	Minor leak found at reservoir base construction joint.	Same as noted for Aug 17 above.
	Culcairn WTP Tank	Reservoir cleaning was conducted late (due 05/17, completed 10/17).	None.
	Gordon St Reservoir	No issues noted.	None.

6. Incidents Reported to NSW Health

There was one water quality incident that required reporting to NSW Health, with a high nickel level detected in a sample collected on 05/12/2017 for the Culcairn scheme. The nickel level was found to be 0.03 mg/L, above the ADWG health guidelines of 0.02 mg/L.

A repeat sample was collected on 02/01/2018 and was found to have a nickel content lower than the limit of detection (0.01 mg/L). This indicated that it was most likely a sample contamination issue or testing error. The PHU was kept informed during the incident and confirmation testing.

There were no other ADWG health-based guideline compliance issues for either the Culcairn or Villages schemes. For further detail, refer to section 7.

7. Drinking Water Quality Performance

Verification of drinking water quality provides an assessment of the overall performance of the system and the ultimate quality of drinking water being supplied to consumers. This incorporates monitoring drinking water quality as well as assessment of consumer satisfaction.

7.1. Verification Monitoring

Drinking water quality monitoring is a wide-ranging assessment of the quality of water in the distribution system and importantly, as supplied to the consumer. It includes regular sampling and testing to assess whether water quality is complying with ADWG guideline values. Monitoring of drinking water is regarded as the final check that, overall, the barriers and preventive measures implemented to protect public health are working effectively.

The drinking water quality performance of the schemes is presented in Appendix A (extracted from the NSW Health water quality database). There were no issues noted against the ADWG health-based guidelines for the schemes. One breach of the ADWG health-based guidelines was recorded for the Culcairn scheme, although this was most likely related to a sample contamination issue or testing error (refer to section 6).

ADWG aesthetic guideline exceedance was noted for pH for the Village supply scheme (outside the range of 6.5-8.5), with 31 of 51 samples above pH 8.5 as shown in

Table 4. Aesthetic exceedences **do not** pose any threat to the health of consumers but may cause scaling and customer complaints and reduce the efficacy of chlorine residual as a barrier against recontamination.

Free chlorine residual levels for both schemes were maintained at >0.2 mg/L, as seen from the verification monitoring results, refer to Figures 4 and 5. Having the chlorine as <0.2 mg/L is not a hazard in itself, however, it is recommended to maintain a free chlorine level >0.2 mg/L as it will provide adequate barrier against potential recontamination. Council undertakes corrective actions, for example, increase of chlorine dose when the operational limit is breached.

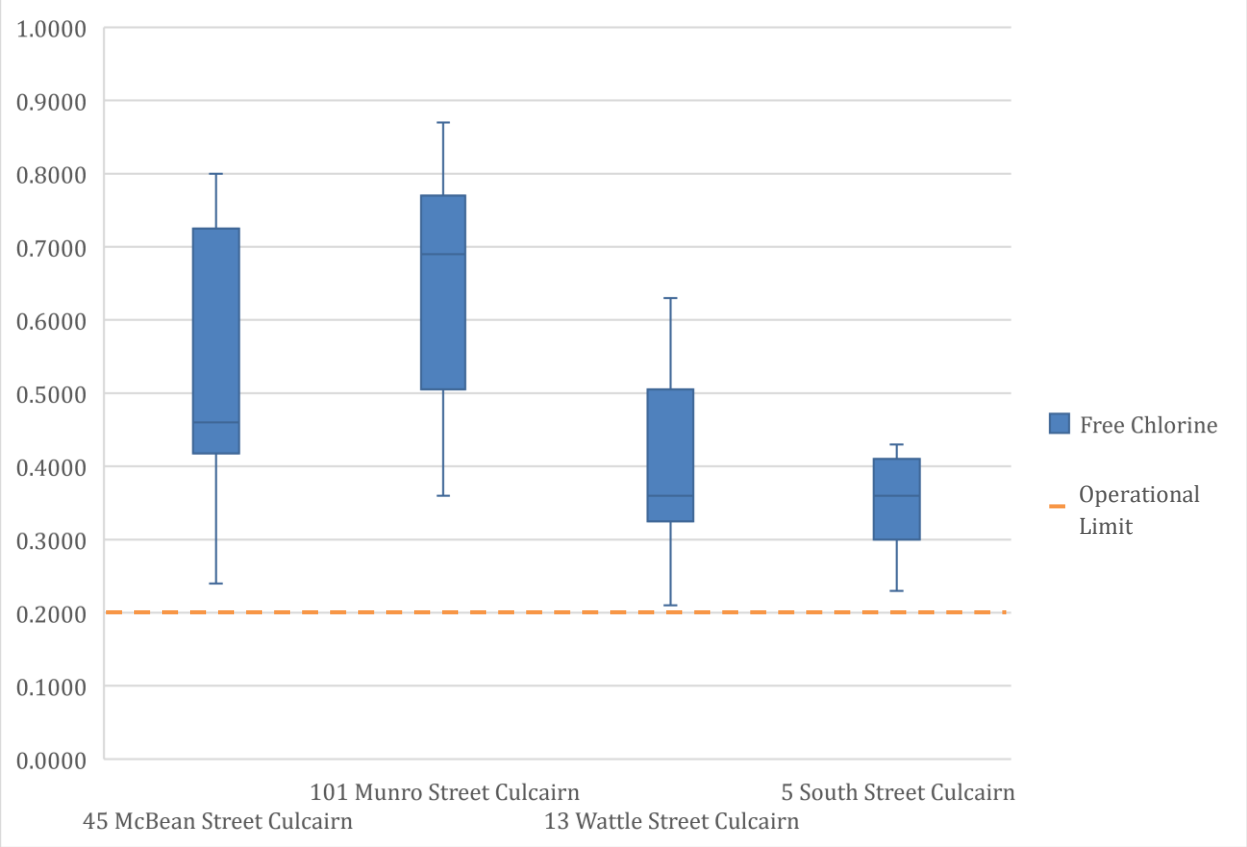

Figure 4 Free chlorine verification sampling within the Culcairn supply reticulation network.

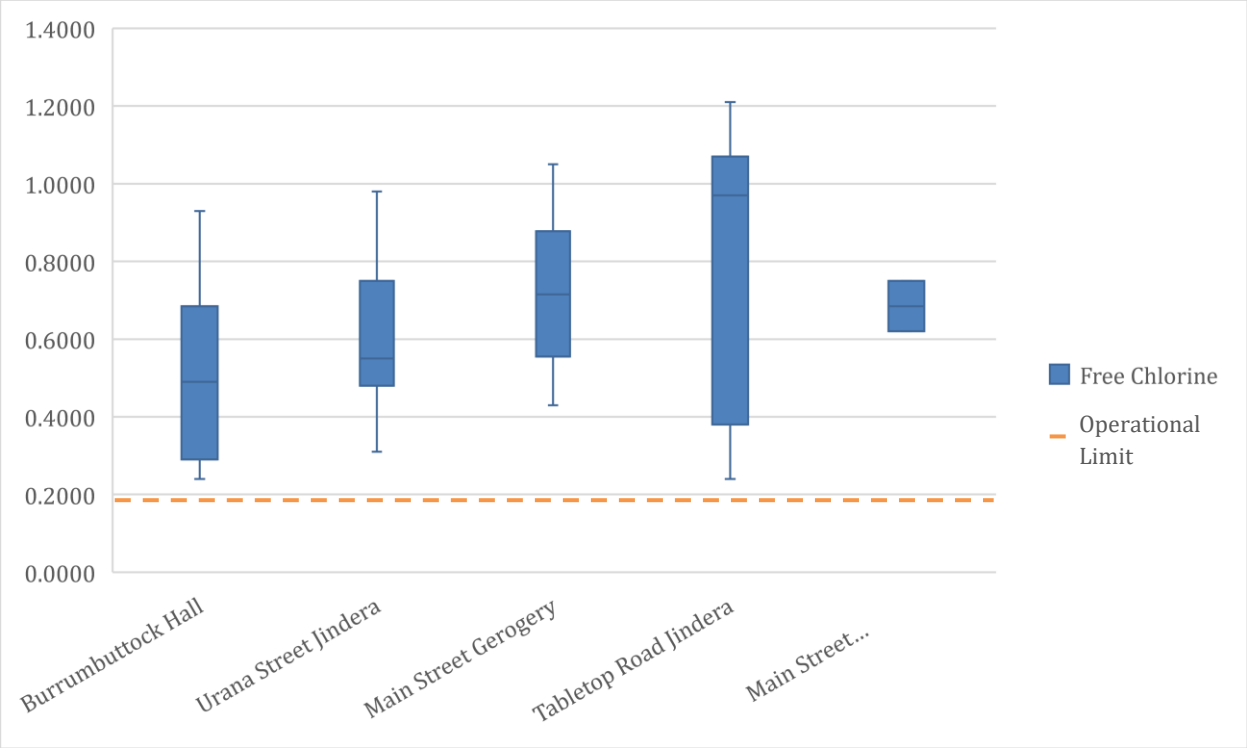

Figure 5 Free chlorine verification sampling within the Village supply reticulation network.

7.2. Water Quality Customer Complaints

Monitoring of consumer complaints can provide valuable information on potential problems that may not have been identified by performance monitoring of the water supply system. Consumer satisfaction with drinking water quality is largely based on a judgment that the aesthetic quality of tap water is 'good', which usually means that it is colourless, free from suspended solids and has no unpleasant taste or odour.

There were eleven water quality complaints over the reporting period as shown in Table 2.

Table 2 Water quality complaints.

Complaint	Number of Incidents
Dirty Water	7
Dirty Water and Poor Taste	2
Poor Taste and Feeling Unwell	2

Two complaints noted that consumers were feeling unwell, but these were isolated incidents. They were addressed by flushing the mains. Prior to flushing, a sample of the water for each incident was sent to the Greater Murray Water Testing Laboratory for analysis. The results and subsequent investigation did not identify any secondary issues or issues with the quality of the water.

Two complaints for dirty water and poor taste were noted. The root cause was found to be old internal plumbing corroding, and a flushing service was conducted. The investigations did not uncover any secondary issues.

Seven complaints for dirty water (without taste concern) were noted during the reporting period. In three cases, the mains were flushed, while for the remainder of complaints the individual service was flushed. The investigations did not uncover any secondary issues.

8. Improvement Plan Implementation

An Improvement Plan is part of a management system and demonstrates the continual improvement process in place for an organisation. Council has an Improvement Plan, which is part of their DWMS.

8.1. Status

The Improvement Plan was reviewed and updated during the preparation of this annual report. Refer to Appendix B for detailed progress of the Improvement Plan, including commentary.

There were 12 action items open (to start or underway) from the last review of the Improvement Plan which had timeframes due during this reporting period.

During the reporting period, two actions were progressed. Due to discussions around the handing over of water services to either ACC or Riverina Water, most actions were on hold or delayed until the outcome of this was more certain. Note, the actions on hold do not compromise the ability to provide safe drinking water to customers. With Council's decision that divestment will not proceed (refer also to section 3.1), implementation of the Improvement Plan will progress. New timeframes have been assigned to the improvement actions.

8.2. New Additions

As part of the DWMS annual review (section 9), three new actions were included in the Improvement Plan. The new action numbers are 71, 72 and 73 and can be seen in Appendix B. The new improvement actions were added to the Improvement Plan following the annual review.

9. DWMS Review Outcomes

The annual review of the DWMS was undertaken as part of preparing this annual report. Appendix C includes the review discussions, actions and timeframe.

The review discussions were undertaken through a teleconference between Tom Plunkett (Manager Water and Wastewater), Tasleem Hasan (Viridis – review facilitator) and Glen Luscombe (Viridis – review support) on 14 August 2018.

Overall, the review found that the risk profile had not changed negatively for the schemes and Council is undertaking continual improvements. The monitoring programs are being followed and resulted in the detection of one high nickel sample. Council followed the incident protocol and kept the PHU informed. The most likely cause of this out-of-specification result was sample contamination or testing error. Aside from this incident, results showed compliance with the ADWG health-based guidelines.

The incident response protocol for managing pathogen risks has been recently updated by NSW Health. Appendix A of Council's drinking water quality incident response plan will be updated accordingly. In general, the DWMS remains current, based on the review discussions undertaken. Minor updates to the documents are required, which will be undertaken when the risk registers are comprehensively reviewed in 2019.

Council intends on following up on correspondence received from NSW Health for further funding opportunity related to DWMS projects. The PHU will be contacted to follow up on the request submitted earlier on possible support for a chlorination strategy/study for the Village scheme and DBPs testing in the Village scheme.

10. DWMS Audit Outcomes

There was no formal audit undertaken for DWMS implementation over the reporting period.

The external audit frequency will be followed and implemented, upon advice and confirmation from NSW Health.

Glossary

Word	Description
ADWG	Australian Drinking Water Guidelines
CCP	Critical Control Point
DWMS	Drinking Water Management System
NSW	New South Wales
NTU	Nephelometric Turbidity Units
pH	An expression of the intensity of the basic or acid condition of a liquid. Natural waters usually have a pH between 6.5 and 8.5.
PHU	Public Health Unit
SCADA	Supervisory Control and Data Acquisition
WTP	Water Treatment Plant

Appendix A

Drinking Water Quality Performance

Table 3 Culcairn Scheme Water Quality Data

Parameter (Units)	N	Mean	Med	SD	Min	Max	5 %tile	95 %tile	Guide	OoS	Compliance %
Aluminium (mg/L)	3	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.2 (A)	0	100.00
Antimony (mg/L)	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.003 (H)	0	100.00
Arsenic (mg/L)	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01 (H)	0	100.00
Barium (mg/L)	3	0.04	0.05	0.00	0.04	0.05	0.04	0.05	2 (H)	0	100.00
Boron (mg/L)	3	0.07	0.05	0.03	0.05	0.10	0.05	0.10	4 (H)	0	100.00
Cadmium (mg/L)	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.002 (H)	0	100.00
Calcium (mg/L)	3	13.07	13.30	1.07	11.90	14.00	11.90	14.00	10000*	0	100.00
Chloride (mg/L)	3	70.33	65.00	9.24	65.00	81.00	65.00	81.00	250 (A)	0	100.00
Chromium (mg/L)	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05 (H)	0	100.00
Copper (mg/L)	3	0.02	0.00	0.02	0.00	0.05	0.00	0.05	2 (H)	0	100.00
E. coli (mpn/100 mL)	50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0 (H)	0	100.00
Fluoride (mg/L)	3	0.62	0.62	0.07	0.55	0.69	0.55	0.69	1.5 (H)	0	100.00
Free chlorine (mg/L)	51	0.49	0.44	0.18	0.21	0.87	0.24	0.80	0.2* – 5 (H)	0	100.00
Iodine (mg/L)	3	0.09	0.09	0.00	0.09	0.09	0.09	0.09	0.5 (H)	0	100.00
Iron (mg/L)	3	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.3 (A)	0	100.00
Lead (mg/L)	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01 (H)	0	100.00
Magnesium (mg/L)	3	11.63	11.63	0.45	11.18	12.08	11.18	12.08	10000*	0	100.00
Manganese (mg/L)	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5 (H)	0	100.00
Mercury (mg/L)	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.001 (H)	0	100.00
Molybdenum (mg/L)	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05 (H)	0	100.00
Nickel (mg/L)	3	0.01	0.01	0.01	0.01	0.03	0.01	0.03	0.02 (H)	1	66.67
Nitrate (mg/L)	3	0.50	0.50	0.00	0.50	0.50	0.50	0.50	50 (H)	0	100.00
Nitrite (mg/L)	3	0.05	0.05	0.00	0.05	0.05	0.05	0.05	3 (H)	0	100.00
pH	3	8.13	8.10	0.25	7.90	8.40	7.90	8.40	6.5 - 8.5 (A)	0	100.00
Selenium (mg/L)	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01 (H)	0	100.00
Silver (mg/L)	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1 (H)	0	100.00

Parameter (Units)	N	Mean	Med	SD	Min	Max	5 %tile	95 %tile	Guide	OoS	Compliance %
Sodium (mg/L)	3	67.67	70.00	4.93	62.00	71.00	62.00	71.00	180 (A)	0	100.00
Sulfate (mg/L)	3	19.67	18.00	2.89	18.00	23.00	18.00	23.00	500 (H)	0	100.00
Total Chlorine (mg/L)	51	0.54	0.49	0.21	0.22	1.21	0.29	0.88	5 (H)	0	100.00
Total Coliforms (mpn/100 mL)	51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0*	0	100.00
Total Dissolved Solids (TDS) (mg/L)	3	233.33	234.00	2.08	231.00	235.00	231.00	235.00	600 (A)	0	100.00
Total Hardness as CaCO3 (mg/L)	3	80.57	82.90	4.13	75.80	83.00	75.80	83.00	200 (A)	0	100.00
True Colour (Hazen Units (HU))	3	0.67	0.50	0.29	0.50	1.00	0.50	1.00	15 (A)	0	100.00
Turbidity (NTU)[1]	50	0.36	0.12	1.43	0.05	10.20	0.07	0.47	5 (A)	1[1]	98.00
Uranium	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02 (H)	0	100.00
Zinc (mg/L)	3	0.02	0.01	0.02	0.01	0.04	0.01	0.04	3 (A)	0	100.00

*OoS - out of specification, (H) – Health based guideline value, (A) – Aesthetic guideline value, *As per NSW Health Water Quality Database*

[1] Two turbidity samples were entered into the NSW Health Monitoring database incorrectly. The two incorrect entries were 10.2 NTU on 04/12/17 (should be 0.12 NTU) and 4.14 NTU on 05/02/18 (should be 0.14 NTU). This has resulted in the Culcairn scheme incorrectly showing one out of specification reading.

Table 4 Village Scheme Water Quality Data

Parameter (Units)	N	Mean	Med	SD	Min	Max	5 %tile	95 %tile	Guide	OoS	Compliance %
Aluminium (mg/L)	2	0.105	0.105	0.02	0.09	0.12	0.09	0.12	0.2 (A)	0	100.00
Antimony (mg/L)	2	0.0005	0.0005	0	0.0005	0.0005	0.0005	0.0005	0.003 (H)	0	100.00
Arsenic (mg/L)	2	0.0008	0.0008	0.0004	0.0005	0.001	0.0005	0.001	0.01 (H)	0	100.00
Barium (mg/L)	2	0.009	0.009	0	0.009	0.009	0.009	0.009	2 (H)	0	100.00
Boron (mg/L)	2	0.05	0.05	0	0.05	0.05	0.05	0.05	4 (H)	0	100.00
Cadmium (mg/L)	2	0.0003	0.0003	0	0.0003	0.0003	0.0003	0.0003	0.002 (H)	0	100.00
Calcium (mg/L)	2	8.5	8.5	0.71	8	9	8	9	10000*	0	100.00
Chloride (mg/L)	2	6.5	6.5	0.71	6	7	6	7	250 (A)	0	100.00
Chromium (mg/L)	2	0.0025	0.0025	0	0.0025	0.0025	0.0025	0.0025	0.05 (H)	0	100.00
Copper (mg/L)	2	0.0038	0.0038	0.0018	0.0025	0.005	0.0025	0.005	2 (H)	0	100.00
E. coli (mpn/100 mL)	51	0	0	0	0	0	0	0	0 (H)	0	100.00
Fluoride (mg/L)	2	1.04	1.04	0	1.04	1.04	1.04	1.04	1.5 (H)	0	100.00
Free chlorine (mg/L)	51	0.65	0.62	0.26	0.24	1.21	0.27	1.07	0.2* – 5 (H)	0	100.00
Iodine (mg/L)	2	0.01	0.01	0	0.01	0.01	0.01	0.01	0.5 (H)	0	100.00
Iron (mg/L)	2	0.01	0.01	0	0.01	0.01	0.01	0.01	0.3 (A)	0	100.00
Lead (mg/L)	2	0.0015	0.0015	0.0007	0.001	0.002	0.001	0.002	0.01 (H)	0	100.00
Magnesium (mg/L)	2	1.52	1.52	0.014	1.51	1.53	1.51	1.53	10000*	0	100.00
Manganese (mg/L)	2	0.008	0.008	0.0014	0.007	0.009	0.007	0.009	0.5 (H)	0	100.00
Mercury (mg/L)	2	0.0001	0.0001	0	0.0001	0.0001	0.0001	0.0001	0.001 (H)	0	100.00
Molybdenum (mg/L)	2	0.0025	0.0025	0	0.0025	0.0025	0.0025	0.0025	0.05 (H)	0	100.00
Nickel (mg/L)	2	0.005	0.005	0	0.005	0.005	0.005	0.005	0.02 (H)	0	100.00
Nitrate (mg/L)	2	0.75	0.75	0.35	0.5	1	0.5	1	50 (H)	0	100.00
Nitrite (mg/L)	2	0.05	0.05	0	0.05	0.05	0.05	0.05	3 (H)	0	100.00
pH	51	8.61	8.89	0.75	7.19	9.57	7.34	9.49	6.5 - 8.5 (A)	31	39.22
Selenium (mg/L)	2	0.001	0.001	0	0.001	0.001	0.001	0.001	0.01 (H)	0	100.00
Silver (mg/L)	2	0.001	0.001	0	0.001	0.001	0.001	0.001	0.1 (H)	0	100.00

Parameter (Units)	N	Mean	Med	SD	Min	Max	5 %tile	95 %tile	Guide	OoS	Compliance %
Sodium (mg/L)	2	5.5	5.5	0.71	5	6	5	6	180 (A)	0	100.00
Sulfate (mg/L)	2	8.5	8.5	2.12	7	10	7	10	500 (H)	0	100.00
Total Chlorine (mg/L)	51	0.8	0.8	0.29	0.28	1.5	0.33	1.32	5 (H)	0	100.00
Total Coliforms (mpn/100 mL)	51	0	0	0	0	0	0	0	0*	0	100.00
Total Dissolved Solids (TDS) (mg/L)	2	41.5	41.5	0.71	41	42	41	42	600 (A)	0	100.00
Total Hardness as CaCO3 (mg/L)	2	27.5	27.5	1.84	26.2	28.8	26.2	28.8	200 (A)	0	100.00
True Colour (Hazen Units (HU))	2	0.5	0.5	0	0.5	0.5	0.5	0.5	15 (A)	0	100.00
Turbidity (NTU)	50	0.42	0.37	0.18	0.17	0.86	0.22	0.84	5 (A)	0	100.00
Uranium	2	0.0025	0.0025	0	0.0025	0.0025	0.0025	0.0025	0.02 (H)	0	100.00
Zinc (mg/L)	2	0.025	0.025	0.021	0.01	0.04	0.01	0.04	3 (A)	0	100.00

*OoS - out of specification, (H) – Health based guideline value, (A) – Aesthetic guideline value, *As per NSW Health Water Quality Database*

Appendix B

Improvement Plan Status

Improvement Plan

Date Reviewed: 16 August 2018

No.	Source	Improvement Actions	Action Rating	Responsibility	Due Date	Status	Comments/Outcomes
1	DWMS development 2014	Council to develop a Drinking Water Quality Policy. Once prepared, the Policy should be printed and displayed in a visible location, and discussed at toolbox meetings.	-	DE & M - W&WW	Mid 2016	Complete	Developed by Viridis. Will be endorsed by council, new action item added for council endorsement.
2	DWMS development 2014	The Stakeholder Register to include position of contacts and include contact details.	-	M - W&WW	Mid 2016	Complete	Developed by Viridis.
3	DWMS development 2014	Council to develop a documented Stakeholder Communication Protocol.	-	M - W&WW	Mid 2016	Complete	Part of the IERP
4	DWMS development 2014	The Stakeholder Register should also have version control information, including version number, date revised and date due for revision.	-	M - W&WW	Mid 2016	Complete	Developed as excel spreadsheet, which will be maintained.
5	DWMS development 2014	Council to develop Water Quality Monitoring Plan (from catchment to tap).	High	M - W&WW	N/A	Complete	Done, included in the DWMS document.
6	DWMS development 2014	Council to document a procedure to review water quality data in the short term.	-	M - W&WW	Mid 2016	Complete	Process discussed as monthly meetings which will be minuted.
7	DWMS development 2014	Council to develop a Communication Protocol/System for immediately identifying and notifying when samples have breached limits. Protocol is a flowchart of Council staff, including names, role and contact numbers, which shows who rings who and when.	-	M - W&WW	Mid 2016	Complete	Part of the IERP
8	DWMS development 2014	Council to document automatic notification of alarms through Council employee's mobile phones in the Communications Protocol.	-	M - W&WW	Mid 2016	Complete	Mentioned in the system characteristics as a more relevant place of inclusion.
9	DWMS development 2014	All maintenance actions and their frequency should be documented.	-	Overseer	Ongoing	Complete	12 monthly preventive maintenance program (mechanical and electrical). Asset Management Plan. Ongoing task.
10	DWMS development 2014	Council to develop documented Work Method Statements for water sampling and a sampling plan, which includes the location and frequency of sampling.	-	M - W&WW	Mid 2016	Complete	SOP developed. Location and freq in monitoring tables.
11	DWMS development 2014	Council is to develop documented incident and emergency protocols. Council should also consult with NSW Health, NSW Office of Water and external stakeholders in the preparation of the protocols. The NSW Health protocols listed below should be incorporated into the emergency and response plan. They describe the appropriate responses where there is evidence of contamination of the drinking water supply: • NSW Health Response Protocol: for the management of physical and chemical quality: http://www.health.nsw.gov.au/environment/water/Pages/nswhrp-chemical.aspx • NSW Health Response Protocol: for the management of microbiological quality of drinking water	-	M - W&WW	Mid 2016	Complete	Part of the IERP

No.	Source	Improvement Actions	Action Rating	Responsibility	Due Date	Status	Comments/Outcomes
12	DWMS development 2014	Council to document Emergency Response Plans and train employees in their use. The frequency of training is to be determined. Council should determine frequency at which the response plans are tested for their effectiveness and reviewed and make improvements as necessary.	-	M - W&WW	Mid 2016	Complete	Part of the IERP.
13	DWMS development 2014	Council to continue to update corrective action procedures, which were documented in the Risk Assessment Workshop. Council's Manager Water & Sewer will be responsible for updating these.	Medium	M - W&WW	Jun-17	Complete	SOPs have been developed, including for CCPs. These will be updated as required on an ongoing basis.
14	DWMS development 2014	Council's Manager Water & Sewer to review sampling locations to ensure monitoring data is representative and reliable.	-	M - W&WW	Ongoing	Complete	Culcairn - increase operational monitoring to all sites weekly. Verification - sites okay, weekly from one site.
15	DWMS development 2014	Council's Manager Water & Sewer to review water quality data daily and to document the review process.	-	M - W&WW	Ongoing	Complete	Process documented in DWMS, operators to review data daily, monthly meeting to do review by M-W&WW.
16	DWMS development 2014	The findings and recommendations from the DWMS study are to be included in the SBP.	-	DE & M - W&WW	Dec-19	Underway	SBP is under review now, consultants engaged.
17	DWMS development 2014	Council is to undertake a bore water analysis for its new bore (being drilled as of February 2014) and for the currently used bore.	High	M - W&WW	N/A	Complete	No issues. Selenium was within acceptable value.
18	DWMS development 2014	Council to undertake an inspection of its currently used bore (as of February 2014) to determine cause for turbidity at startup.	Medium	M - W&WW	Dec-19	Underway	New bore is being used as primary source. Old bore has dummy valve to dump first draw water until it becomes clearer. Discussions with contractors to do this work, cameras may be deployed to see what is happening. This task was on hold as discussions were happening on whether water services would be taken over by ACC or Riverina Water, and was retimed to December 2019 following resolution of ownership by GHC.
19	DWMS development 2014	Council to develop a Service Level Agreement with Albury City Council regarding the supply of water for the Villages Water Supply.	High	M-W&WW & DE	Jun-19	To Start	This task was on hold as discussions were happening on whether water services would be taken over by ACC or Riverina Water, and was retimed to December 2019 following resolution of ownership by GHC.
20	DWMS development 2014	Council to document communications system for emergencies and unexpected events.	-	M - W&WW	End 2016	Complete	Part of the IERP
21	DWMS development 2014	Once Incident and Emergency Response Protocols are developed, Council is to document a process for investigating emergencies and incidents, evaluating emergency response plans in that incident and implementing improvements if necessary.	-	M - W&WW	End 2016	Complete	Part of the IERP
22	DWMS development 2014	Council is to develop and document a complete set of SOPs for all water quality related activities.	Very High	M - W&WW	End 2016	Complete	Discussed above, same as item 13.
23	DWMS development 2014	Council is to provide the final SOPs, and incident and emergency procedures to operators.	Very High	M - W&WW	End 2016	Complete	Shared with staff. Close.
24	DWMS development 2014	Council to develop emergency response plans and train employees in their use.	-	M - W&WW	End 2016	Complete	Part of the IERP
25	DWMS development 2014	Ongoing training plan for Council's staff needs to be developed. Training undertaken should be recorded.	-	M - W&WW	End 2016	Complete	Training needs identified at annual appraisal and followed up on.

No.	Source	Improvement Actions	Action Rating	Responsibility	Due Date	Status	Comments/Outcomes
26	DWMS development 2014	Staff review procedures should be documented to ensure they are adequately trained.	-	M - W&WW	End 2016	Complete	Part of annual appraisal process. Training needs is a specific agenda item
27	DWMS development 2014	Council should consider providing water quality and performance data on their website.	-	DE	End 2016	Complete	Discussed, not needed on website at the moment.
28	DWMS development 2014	Assessment process for the selection and design of new equipment to be documented.	-	DE	End 2016	Complete	Council has its procurement process, section 60 approval.
29	DWMS development 2014	Council to specify and document a frequency for review of records on InfoXpert.	-	DE	End 2016	Complete	Covered elsewhere such as review of water quality data etc.
30	DWMS development 2014	Council to ensure the Drinking Water Quality Management Improvement Plan is communicated, implemented and monitored. Council's Director of Operations will be responsible.	-	DE	End 2016	Complete	This document is the Improvement Plan, it was discussed with staff in Oct 16.
31	DWMS development 2014	Council to complete inspection of septic tanks and record findings in OSMS Inspection Register.	-	E & P	Mid 2017	Complete	Ongoing process so not an improvement item per se.
32	DWMS development 2014	Council to consider implementing online water quality measurement at the two points where water is received from Albury City Council: at Jindera Gap WSPS and from the ACC Trunk Main from ACC's Table Top Reservoir.	High	M - W&WW	Dec-19	Underway	Verbal discussions with ACC underway. This task was on hold as discussions were happening on whether water services would be taken over by ACC or Riverina Water, and was retimed to December 2019 following resolution of ownership by GHC.
33	DWMS development 2014	Council to record or obtain from Albury City Council (ACC), water quality delivered to Villages Water Supply.	Medium	M - W&WW	Dec-19	Underway	This is also related to the task above, item 32. This task was on hold as discussions were happening on whether water services would be taken over by ACC or Riverina Water, and was retimed to December 2019 following resolution of ownership by GHC.
34	DWMS development 2014	Council to provide information on water quality and performance to external stakeholders. Council should consider publishing such information on their website.	-	M - W&WW	Mid 2017	Complete	This was not seen as necessary at the moment.
35	DWMS development 2014	Council to undertake revalidation periodically or when conditions change. An external consultant or NSW Office of Water can be used for this purpose. Council can also contact other councils to discuss the performance of similar processes.	-	M - W&WW	Mid 2017	Complete	Discussed above with design of equipment. CCPs revisited in Oct 2016. CCP performance will be validated annually when the DWMS Annual Report is compiled.
36	DWMS development 2014	Council to develop a documented procedure for review of the water supply process and performance results, with the required frequency, to be undertaken by Council's Manager Water & Sewer. The results of the review should be documented and reported. The following frequencies are suggested: • After the results of each microbiological sample; • Monthly for trends and water quality implications; and • Yearly where the suitability of sampling locations is studied to ensure the best representative picture.	-	M - W&WW	Mid 2017	Complete	Mentioned in the DWMS, part of IERP, monthly operational meetings, yearly when the DWMS Annual report is compiled.
37	DWMS development 2014	Determine frequency of and criteria to be assessed in internal and external audits of the Drinking Water Management System.	Medium	M - W&WW	Mid 2017	Complete	Internal review - yearly. When DWMS Annual Report is prepared. External audit frequency will be followed as directed by NSW Health.
38	DWMS development 2014	Council should record the results of the audits of the Drinking Water Management System and communicate them within Council.	-	DE	Mid 2017	Complete	When audits are done these will be included in the DWMS Annual Report. This has been discussed and agreed.

No.	Source	Improvement Actions	Action Rating	Responsibility	Due Date	Status	Comments/Outcomes
39	DWMS development 2014	Council should nominate the Council staff member to review the results of the audits, both internal and external.	-	M - W&WW	Mid 2017	Complete	MWWW to review, discuss further with DE on support/changes required as relevant.
40	DWMS development 2014	Senior executives are to review, at least annually, the effectiveness and implementation of the DWMS, results of drinking water quality performance, validation of process from catchment to consumer, audit reviews, and previous management reviews. The review should also consider: • concerns of consumers, regulators and other stakeholders, • evaluate the suitability of the drinking water quality policy, • objectives and preventive strategies in relation to changing internal and external conditions such as changes in legislation and Council's activities, advances in science and technology, outcomes from previous incidents and emergencies and external reporting and communication. The results of the review are to be recorded.	-	DE	Mid 2017	Complete	Discussed - review will be undertaken annually when the DWMS Annual Report is compiled, the report will then be shared with senior executives.
41	DWMS development 2014	Council should add water quality data into its Annual Report.	-	DE	Mid 2018	Complete	There is now requirement for a DWMS annual report, which will address this.
42	DWMS development 2014	Council should make the water supply performance data, water quality data and Annual Report available to consumers, stakeholders and regulatory authorities.	-	DE	Mid 2018	Complete	Reports are provided to council, and is seen as sufficent.
43	DWMS development 2014	Information on long-term evaluations of the water supplies, including water quality data, should be available to the public.	-	DE	Mid 2018	Complete	As per above.
44	DWMS development 2014	Council to develop a system for audits by an external party. The external audits are to be undertaken by an independent auditor approved by NSW Health. Council to document a system for internal audits. Also, results are to be recorded and communicated within Council. The following table is provided as a sample audit schedule.	-	DE	Mid 2018	Complete	Discussed in item 37 above so closed out here.
45	DWMS development 2014	Culcairn - Council to investigate presence of disinfection by-products in reticulation by undertaking a testing program through NSW Health.	-	-	-	Complete	Oct 2016 review suggested that bore supply is at very low risk from DBPs hence this is not required at the moment.
46	DWMS development 2014	Culcairn - Council to inspect currently used bore after new bore is commissioned and brought online.	-	-	-	Complete	Discussed earlier so closed out here.
47	DWMS development 2014	Culcairn - Council to analyse bore water for pH, turbidity, iron, manganese and colour.	-	-	-	Complete	New bore is being used as primary source. Old bore has dummy valve to dump first draw water until it becomes clearer. Analysis of new bore was done, no issues found.
48	DWMS development 2014	Culcairn - Consider options for mixing in reservoir. Test for chlorine residual from the scour line.	Medium	DE	Jun-20	Complete	Closed here, refer to item 72. Black Street reservoir has common in and common out, may be some dead water on top. Difficult to make modifications like inlet extended at an angle, due to safety issues. All water supply assets were inspected externally in 2017. This reservoir will be replaced in 2019-20 year. Already in capital works program.
49	DWMS development 2014	Culcairn - Council to carryout testing for selenium in the new bore.	-	-		Complete	Was done, no issues.

No.	Source	Improvement Actions	Action Rating	Responsibility	Due Date	Status	Comments/Outcomes
50	DWMS development 2014	Culcairn - Council to consider online monitoring of chlorine residual and alarm.	High	M-W&WW	Dec-19	To Start	It will be useful to have the online monitoring with alarms and SCADA for the CCP at the Culcairn WTP. This task was on hold as discussions were happening on whether water services will be taken over by ACC or Riverina Water.
51	DWMS development 2014	Culcairn - Council to consider preparing a backflow prevention policy for existing properties.	Medium	Health and Building Department	Dec-19	Underway	Discussions have happened with Health and Building dept to get this moving. Responsible person at Health and Building has been on long-term sick leave, will be resolved before Dec 2019.
52	DWMS development 2014	Culcairn - Confirm that backflow prevention is provided on the fire trucks.	-	-	-	Complete	Council trucks fill in from standpipe, which has air break. Trucks have air gaps device.
53	DWMS development 2014	Culcairn - Council to document mains flushing SOP.	-	-	-	Complete	Done.
54	DWMS development 2014	Culcairn - Council to consider preparing SOPs for mains breaks repairs.	-	-	-	Complete	Done
55	DWMS development 2014	Culcairn - Council to develop SOPs to prevent cross-contamination due to tools used on both water and wastewater assets. Council to disinfect tools used on wastewater assets with hypochlorite sprays.	Medium	M - W&WW	Dec-19	Complete	Viridis engaged to develop the SOP.
56	DWMS development 2014	Village supply - Council to implement DBP testing in the reticulation system through NSW Health.	Medium	M - W&WW	Jun-19	To Start	Tom to discuss with PHU
57	DWMS development 2014	Village supply - Inlet of the reservoir to be modified to enable mixing.	-	-	-	Complete	Has been done for Jindera.
58	DWMS development 2014	Village supply - Council to negotiate a Service Level Agreement with Albury City Council.	-	-	-	Complete	Discussed in item 19 above so closed out from here.
59	DWMS development 2014	Village supply - Council to implement online monitoring for pH and turbidity at the interface with Albury City Council.	-	-	-	Complete	Discussed earlier so closed out here.
60	DWMS development 2014	Village supply - Council to consider making a backflow prevention policy for existing properties.	-	-	-	Complete	Discussed earlier so closed out here.
61	DWMS development 2014	Village supply - Council to check if fire trucks have backflow prevention.	-	-	-	Complete	Discussed earlier so closed out here.
62	DWMS development 2014	Village supply - Install air gaps on standpipes.	-	-	-	Complete	Has been done.
63	DWMS development 2014	Village supply - Council to document mains flushing SOP.	-	-	-	Complete	Has been done.
64	DWMS development 2014	Village supply - Council to discuss issue of unstable water during negotiations with ACC for water supply.	High	M - W&WW	Dec-19	To Start	Should be done with item 19, which is discussion about the supply agreement. ACC is also upgrading its WTP, which will help with the issue.
65	DWMS development 2014	Village supply - Council to consider preparing SOPs for mains breaks repairs.	-	-	-	Complete	Has been done.

No.	Source	Improvement Actions	Action Rating	Responsibility	Due Date	Status	Comments/Outcomes
66	DWMS development 2014	Village supply - Council to develop SOPs to prevent cross-contamination due to tools used on both water and wastewater assets. Council to disinfect tools used on wastewater assets with hypochlorite sprays.	-	-	-	Complete	Discussed earlier so closed out here.
67	DWMS Review 2016	Develop a calibration schedule for monitoring equipment, and ensure records of calibration undertaken are maintained.	Medium	M - W&WW and Overseer	Dec-19	To Start	Equipment are calibrated but schedule needs to be developed. Timeframe moved from 2017 to Dec 19.
68	DWMS Review 2016	Obtain formal endorsement of the DWQ Policy from council and upload on council's website.	Medium	M - W&WW and Overseer	Feb-17	Complete	Done, on Council website.
69	DWMS Review 2016	Investigate Authority software to use asset module to schedule the 4 yearly reservoirs clean and thorough inspections by divers.	Low	M - W&WW and Overseer	Dec-19	To Start	Reservoirs were externally inspected and cleaned in 2017. The next round of reservoir clean will be in 2021. The contractor (Aqualift) currently has a reminder system to ensure that reservoir cleaning is performed.
70	DWMS Review 2017	When possible before the next external contractor inspection in 2021, repair/replace internal roof support for Culcairn WTP and internal ladder for Big Brock reservoir.	Low	M - W&WW and Overseer	Dec-20	Complete	Black St Reservoir to be replaced see item 72.
71	DWMS Review 2018	Burrumbuttock reservoir minor leak repair.	Medium	M - W&WW and Overseer	Dec-19	To Start	Tom to discuss underwater repair with Aqualift when they are next in the area.
72	DWMS Review 2018	Black Street Reservoir Replacement.	High	M - W&WW and Overseer	Jun-20	Underway	Replacement of the reservoir is budgeted for FY19/20. Also consider options for reservoir mixing e.g. separate inlet and outlet (refer to item 48).
73	DWMS Review 2018	Undertake a comprehensive review of the risk registers for the Culcairn and Villages scheme (Element 2 of the DWMS).	High	M - W&WW	Jun-19	To Start	PHU can be approached to see if NSW Health can fund it.

Appendix C

DWMS Review Details

DWMS Review Summary

Item	Review Findings	Actions	Timeframe
Any change required to legal and formal requirements?	Table 1 in the DWMS was reviewed. It is recommended to update the requirements to include Circular LWU 18 requirements.	Update the legal and formal requirements during the next DWMS update.	Sep 19
Any change required to the stakeholders and emergency contacts list?	One operator to be added to the list of contacts. DPI Water is now DoI Water.	List of contacts to be updated.	Nov 18
Is there a need to update the process flow diagram in the DWMS? See also section 3 of this report.	The infrastructure details have not changed, and the schematic remains current.	n/a	n/a
CCP performance – any issues? Re-validated?	CCP performance is discussed in section 4 of this report. No issues were noted.	n/a	n/a
Review of incident management process.	The incident response plan was developed in Nov 16. Appendix A on pathogen response protocol needs to be changed with the recent update to this protocol by NSW Health.	IERP Appendix A to be updated.	Nov 18
Were there any investigative studies or research undertaken that may impact drinking water management practices?	No major investigative project work was undertaken. GHC is currently reviewing online handover monitoring. There is possible support from NSW Health on water quality improvement projects regarding disinfection.	Tom to discuss with PHU possible support for a chlorination strategy and DBPs testing for the Village scheme.	Dec 18
Reservoir inspections and/or cleaning (internal/external) – any issues?	Discussed in section 5.	Renew Black St reservoir. Repair Burrumbuttock Reservoir leak.	2019/20
Verification monitoring	Discussed in section 7. The monitoring was undertaken as required. However, two samples were uploaded incorrectly, giving a false-positive reading for turbidity. Council has adhered to the verification monitoring program, and this issue will be notified to the PHU.	Tom to advise PHU of incorrectly entered turbidity values for the Culcairn scheme.	Nov 18
Operational monitoring	Results were analysed from the operational monitoring spreadsheets. Although the verification sampling results for free chlorine in the Village reticulation were >0.2 mg/L, the operational monitoring results showed that the limit of 0.2 mg/L was breached on 25 instances for the Village	Tom to discuss with PHU possible support for a chlorination strategy and DBPs testing for the Village scheme.	Dec 18

Item	Review Findings	Actions	Timeframe
	scheme. However, most results were >0.2 mg/L (refer Figure 6). There was no breach of the lower free chlorine operational limit for the Culcairn scheme (refer Figure 7). It is noted that free chlorine incoming from to the Jindera Gap reservoir was below the lower operational limit of 0.2 mg/L on four occasions, and that significant variability is noted in this parameter (refer Figure 8). Note, all values were significantly lower than the health-based guideline value of 5 mg/L. A chlorination strategy study for the Village supply will be useful.		
Does the risk register need to be reviewed and updated?	The risk assessment was undertaken in 2014. Improvement actions have been delivered and some are progressing. A comprehensive review of the risk register in 2018-19 period is recommended (if not earlier).	Undertake comprehensive review of the risk assessment. Tom to discuss with PHU for possible support.	Jun 19
Does the DWMS need to be updated?	The DWMS is largely current with only minor updates as noted above e.g. Council name change, logo change, DPI Water to DoI Water.	Update the DWMS documents when the risk registers are comprehensively reviewed (as per above).	Sep 19

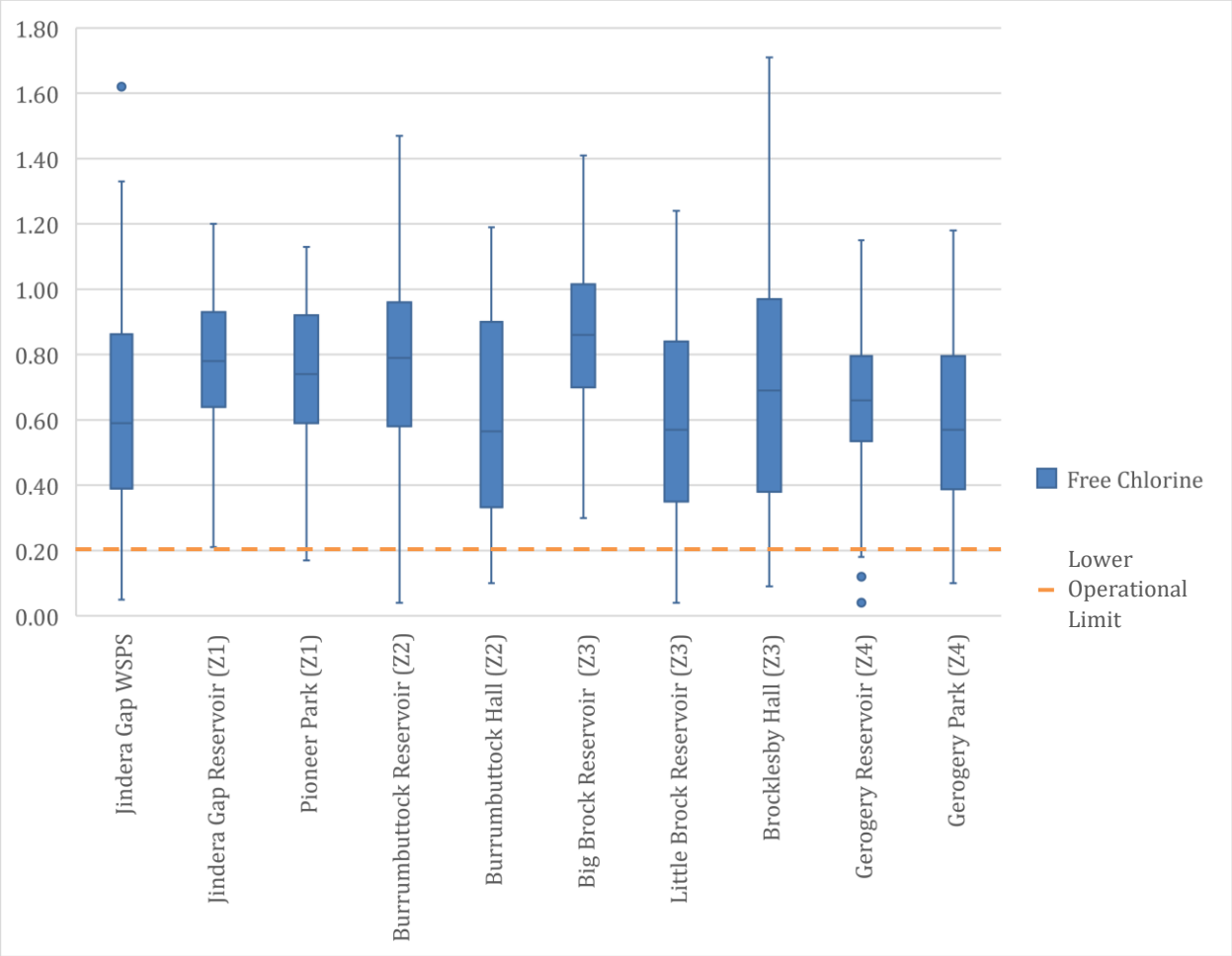

Figure 6 Operational monitoring free chlorine at transfer point and reticulation network - Villages scheme.

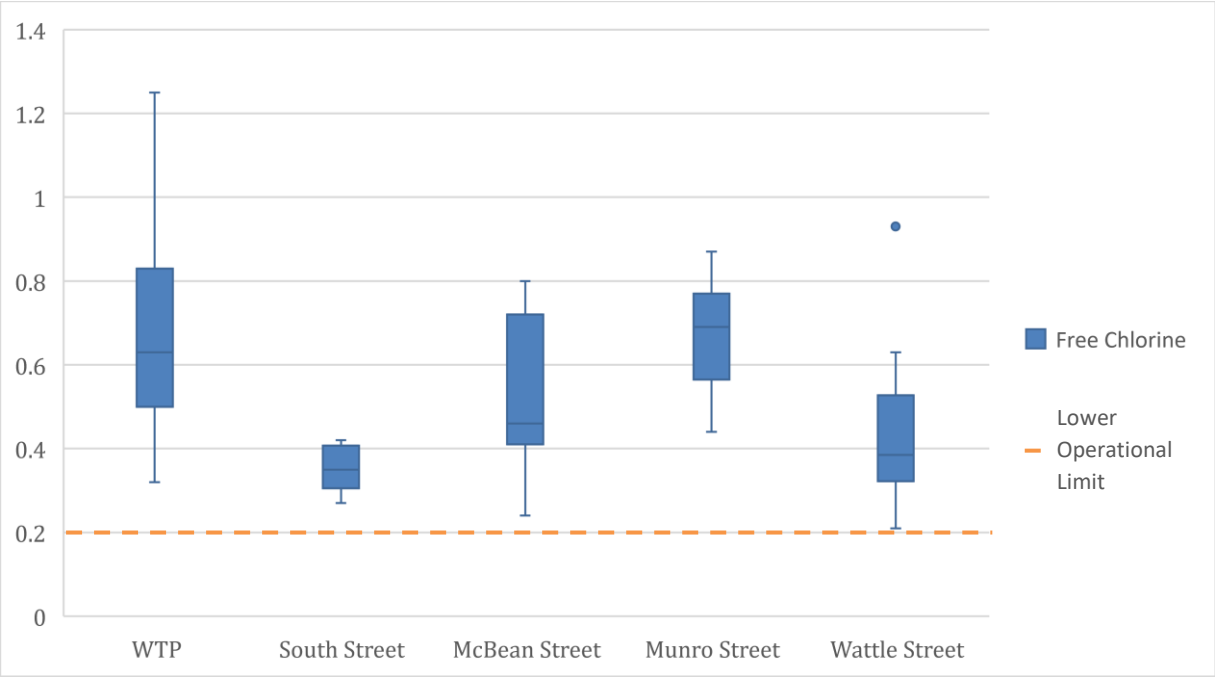

Figure 7 Operational monitoring free chlorine at WTP and reticulation network - Culcairn scheme.

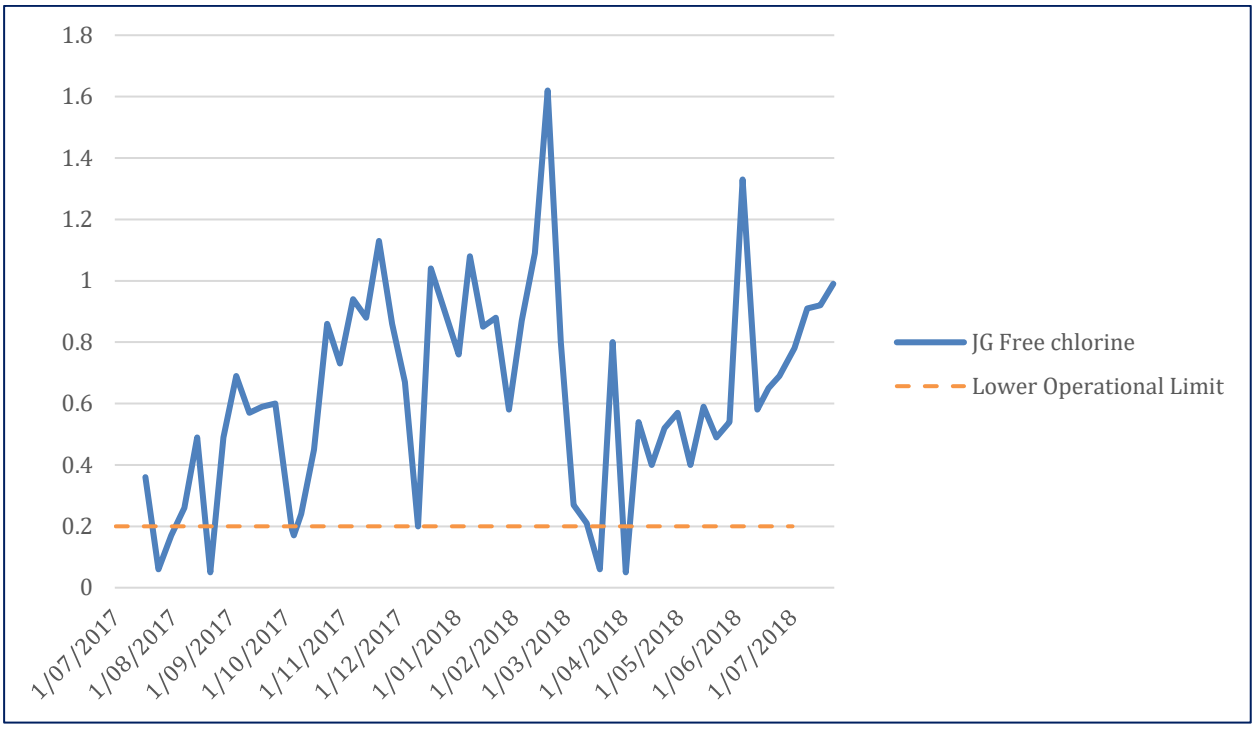

Figure 8 Operational monitoring of incoming free chlorine at Jindera Gap Reservoir

www.viridis.net.au