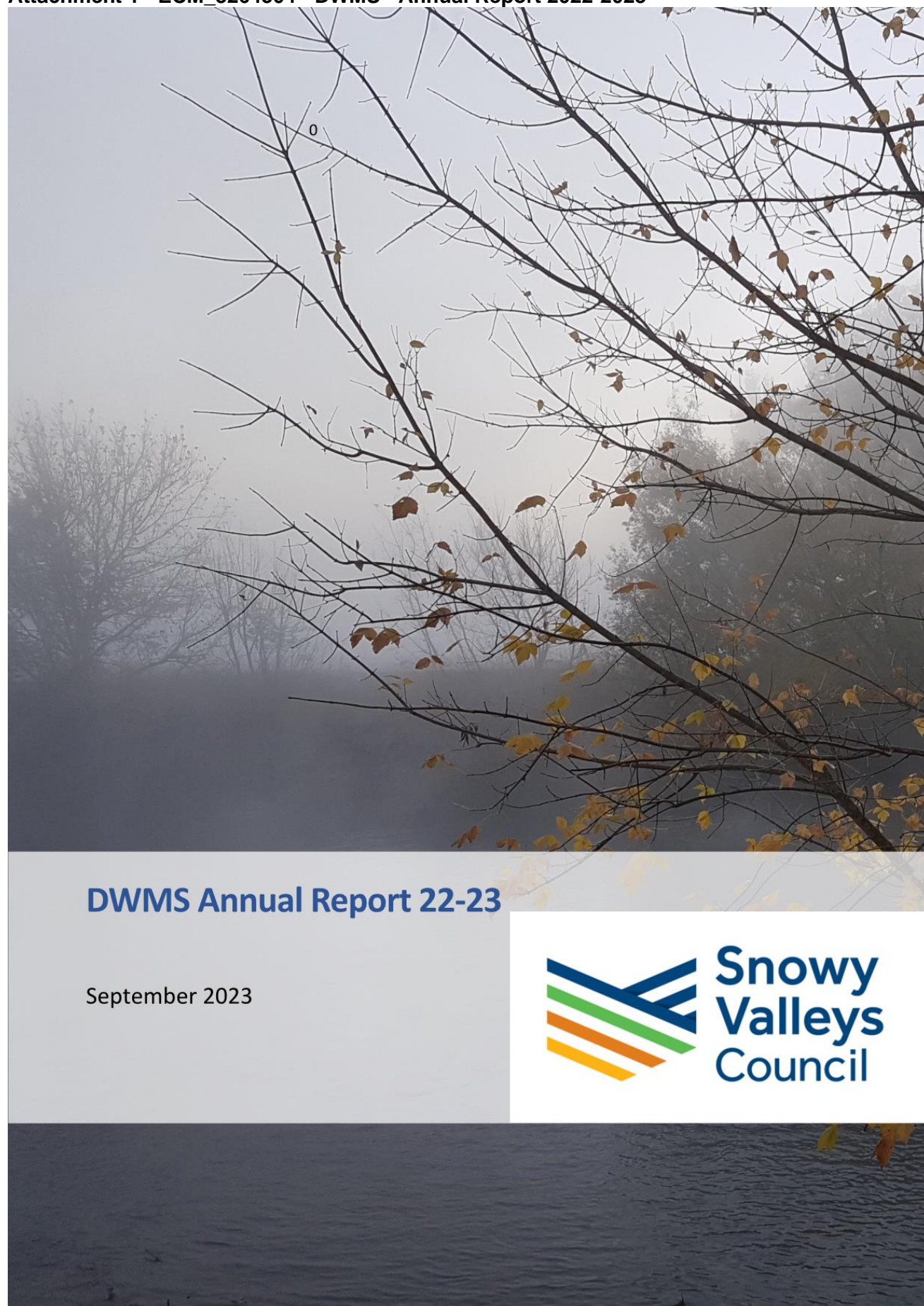


## **11.4 DRINKING WATER MANAGEMENT SYSTEM ANNUAL REPORT FOR 2022-2023 - ATTACHMENTS**

Attachment Titles:

1. Drinking Water Management System - Annual Report 22-2023

**Attachment 1 - ECM\_3264504 - DWMS - Annual Report 2022-2023**





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## Appendices

### A. Verification Monitoring



## EXECUTIVE SUMMARY

Water suppliers in New South Wales (NSW) are required to establish and adhere to a 'quality assurance program', referred to as a Drinking Water Management System (DWMS). 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 Snowy Valleys Council (SVC) to prepare the DWMS Annual Report for the 2022-2023 reporting period from 1 January 2022 to 30 June 2023. Historically, SVC have reported on a calendar year, but in order to align with other reporting this will switch to a financial year. This is the transition report and reports on 18 months of operation.

SVC is responsible for treating and distributing water to:

- Batlow Township
- Brungle Township
- Khancoban Township
- Talbingo Township
- Tumbarumba Township
- Tumut Township
- Morgans Reserve- Cloverdale
- Adelong Township.

Verification monitoring results for all schemes 100% conformed with the *Australian Drinking Water Guidelines* (ADWG) health-based guidelines. All schemes noted a small number of results that were excursions of the ADWG aesthetic guideline values but had no impact on public health.

There were occasional critical limit breaches during the reporting period, particularly for fluoride (failure to meet the minimum concentration). It was identified that the CCPs need a detailed review and update, which will be undertaken in the second half of 2023.

SVC maintained overall good customer satisfaction, with only twenty-three water quality customer complaints across all schemes.





## 1. INTRODUCTION

Water suppliers in New South Wales (NSW) are 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 report is required to be prepared and submitted to the local Public Health Unit (PHU), NSW Health.

Snowy Valleys Council (SVC) has engaged Viridis Consultants P/L (Viridis) to prepare the DWMS Annual Report for 2022-2023. This DWMS Report covers a reporting period from 1 January 2022 to 30 June 2023. It summarises SVC's drinking water quality performance for the reporting period and progress on the implementation of the improvement plan. Historically, SVC have reported on a calendar year, but in order to align with other reporting this will switch to a financial year. This is the transition report and reports on 18 months of operation.



## 2. SUPPLY SCHEME

SVC operates and manages the following drinking water supply schemes, as outlined in Table 1 below.

Table 1 Snowy Valleys Council's Drinking Water Supply Schemes

Scheme Name	Primary Source	Secondary Source	Emergency Supply	Treatment Processes	Served Areas
<b>Batlow</b>	Kunama Dam (via Little Gilmore Creek)	-	-	<ul style="list-style-type: none"> <li>Flocculation</li> <li>Ultrafiltration</li> <li>Disinfection (chlorine gas)</li> <li>Fluoridation (sodium fluoride)</li> <li>Storage (Batlow Reservoir)</li> </ul>	Batlow Township
<b>Brungle</b>	Nimbo Creek	-	Tumut River	<ul style="list-style-type: none"> <li>Limestone Contact Tank (optional)</li> <li>Microfiltration</li> <li>Disinfection (sodium hypochlorite)</li> <li>Storage (Brungle Reservoir)</li> </ul>	Brungle Township
<b>Khancoban</b>	Khancoban Creek	-	-	<ul style="list-style-type: none"> <li>Course filtration (offline)</li> <li>Disinfection (chlorine gas)</li> <li>Storage</li> </ul>	Khancoban Township
<b>Talbingo</b>	Jounama Creek	-	Jounama Pondage	<ul style="list-style-type: none"> <li>Flocculation</li> <li>Sand Filtration</li> <li>Disinfection (chlorine gas)</li> <li>Storage (high level and low-level reservoir)</li> </ul>	Talbingo Township
<b>Tumbarumba</b>	Burra Creek	Tumbarumba Creek	McKeenin Street and Common Bore	<ul style="list-style-type: none"> <li>Flocculation</li> <li>Sand Filtration</li> <li>Fluoridation (sodium fluoride)</li> <li>Disinfection (chlorine gas)</li> </ul>	Tumbarumba Township
<b>Tumut</b>	Tumut River	-	-	<ul style="list-style-type: none"> <li>Powdered activated carbon (optional)</li> <li>Flocculation</li> <li>Fluoridation (sodium fluorosilicate)</li> <li>Sand Filtration</li> <li>Disinfection (chlorine gas)</li> <li>Adelong Re-chlorination (chlorine gas)</li> </ul>	Tumut Township Morgans Reserve-Cloverdale Adelong Township



### **3. SCHEME CHANGES**

The scheme changes are discussed in this section.

#### **3.1. Batlow Scheme**

There were no significant permanent changes to the scheme, including catchment characteristics, treatment processes, chemicals used and the distribution network.

#### **3.2. Brungle Scheme**

There were no significant permanent changes to the scheme, including catchment characteristics, treatment processes, chemicals used and the distribution network.

#### **3.3. Khancoban Scheme**

There were no significant permanent changes to the scheme, including catchment characteristics, treatment processes, chemicals used and the distribution network.

#### **3.4. Talbingo Scheme**

There were no significant permanent changes to the scheme, including catchment characteristics, treatment processes, chemicals used and the distribution network.

#### **3.5. Tumbarumba Scheme**

There were no significant permanent changes to the scheme, including catchment characteristics, treatment processes, chemicals used and the distribution network.

#### **3.6. Tumut Scheme**

There were no significant permanent changes to the scheme, including catchment characteristics, treatment processes, chemicals used and the distribution network.





#### **4. CRITICAL CONTROL POINTS**

Critical control points (CCP) are selected as points that control hazards that represent a significant risk and require elimination or reduction to assure supply of safe drinking water. These points are applied to important treatment processes and must have a timely measurable parameter and corrective actions that are able to be applied in response to a deviation. Alert and critical limits applied to the parameter are used to assess process performance rather than final water quality (which is discussed in the Verification Monitoring Performance section). A critical limit excursion may indicate that a treatment process is no longer operating properly whereas an ADWG non-conformance indicates that water delivered to customers did not meet required specifications. Both should be managed in accordance with the IERP, and CCP procedures where applicable.

This annual review has identified the need for a formal CCP review which will be undertaken in the second half of 2023.

##### **4.1. Batlow**

A detailed data analysis of the CCP performance for Batlow from Jan 2022 to Jun 2023 is presented in Figure 1.

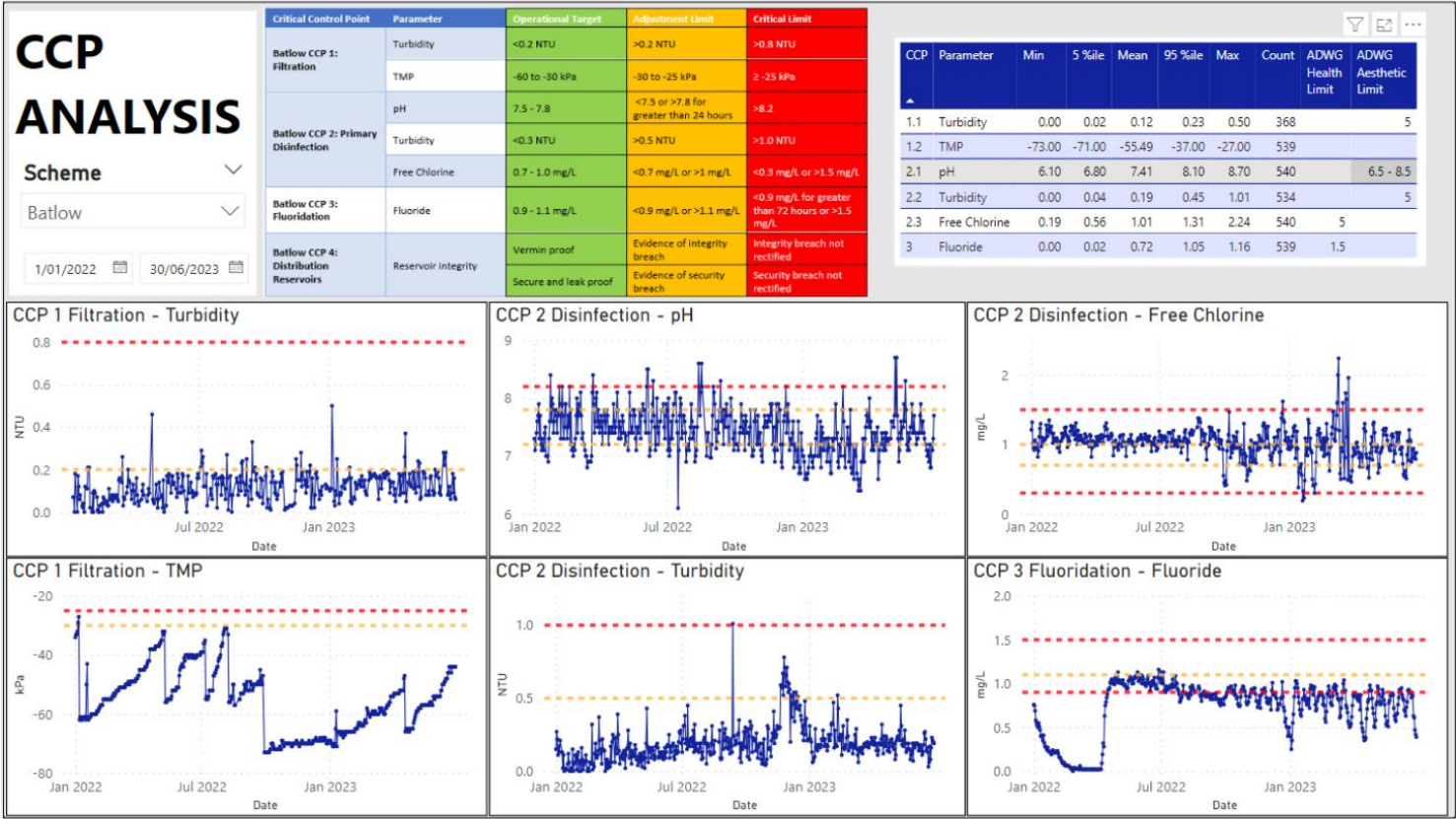


Figure 1 Batlow CCP Analysis Dashboard



The turbidity trend of the filtered water shows good conformance (mostly <0.2 NTU). There were several values that exceeded the alert limit and most of these came straight down. There were no breaches of the 0.8 NTU critical limit.

The TMP trend of filtered water demonstrates very good conformance (mostly <-30 kPa). The alert limit of -30 kPa was only exceeded in January 2022. There were no instances where the critical limit was exceeded.

There were many pH values that lay outside the upper and lower alert limits. The pH exceeded the upper critical limit several times, with 5 excursions from the ADWG aesthetic limit of 6.5 – 8.5. When the pH limits were triggered, operators made adjustments to resolve the issues, and the pH returned to target levels following the excursions.

The turbidity trend of the treated water shows good conformance (mostly <0.5 NTU), except for an event at the end of November 2022 where the alert limit of 0.5 NTU was exceeded. There was also a result of 1.01 NTU on the 13/09/2022 that exceeded the critical limit.

Free chlorine in the treated water shows a consistent trend between 1-1.5 mg/L for the first half of 2022, although slightly higher than the alert limit. From October 2022 to June 2023, there was significant variance in the free chlorine residual due to an issue with the chlorine rotameter. This was resolved after the chlorinator's servicing. Also, there were two breaches of the low critical limit in January 2023 and seven instances of the high critical limit being breached in March 2023. However, there were no times when the free chlorine residual approached the ADWG health limit of 5 mg/L.

The fluoride trend shows that there were no times when the fluoride exceeded the upper critical limit. However, there have been some issues with the fluoride dosing, at the start of the reporting period there was a failure and fluoridation stopped. This was rectified but the dose has not been consistent, especially in 2023 and there have been a number of instances where the dose has been less than 0.9 mg/L.

#### **4.2. Brungle**

A detailed data analysis of the CCP performance for Brungle from Jan 2022 to Jun 2023 is presented in Figure 2.



Figure 2 Brungle CCP Analysis Dashboard



The turbidity trend of filtered water shows very good conformance (mostly <0.5 NTU). There were no instances where the critical limit was exceeded.

TMP trend of the filtered water displays 100% conformance with the CCP limits.

pH of the treated water displays a trend of mostly 7.0 – 7.5, which falls below the lower alert limit. However, there were no breaches of the critical limit and all values remained consistent between the ADWG aesthetic guidelines.

The turbidity trend of treated water shows very good conformance (mostly <0.5 NTU). There were only two instances where the result was above the alert limit, and no breaches of the critical limit were recorded.

The free chlorine trend of the treated water shows that most values exceeded the upper alert and critical limits. There were no times when the free chlorine residual approached the ADWG health limit of 5 mg/L and there were no breaches of the lower critical limit. This limit will be reviewed to ensure that it has been set appropriately.



4.3. Khancoban

A detailed data analysis of the CCP performance for Khancoban from Jan 2022 to Jun 2023 is presented in Figure 3.

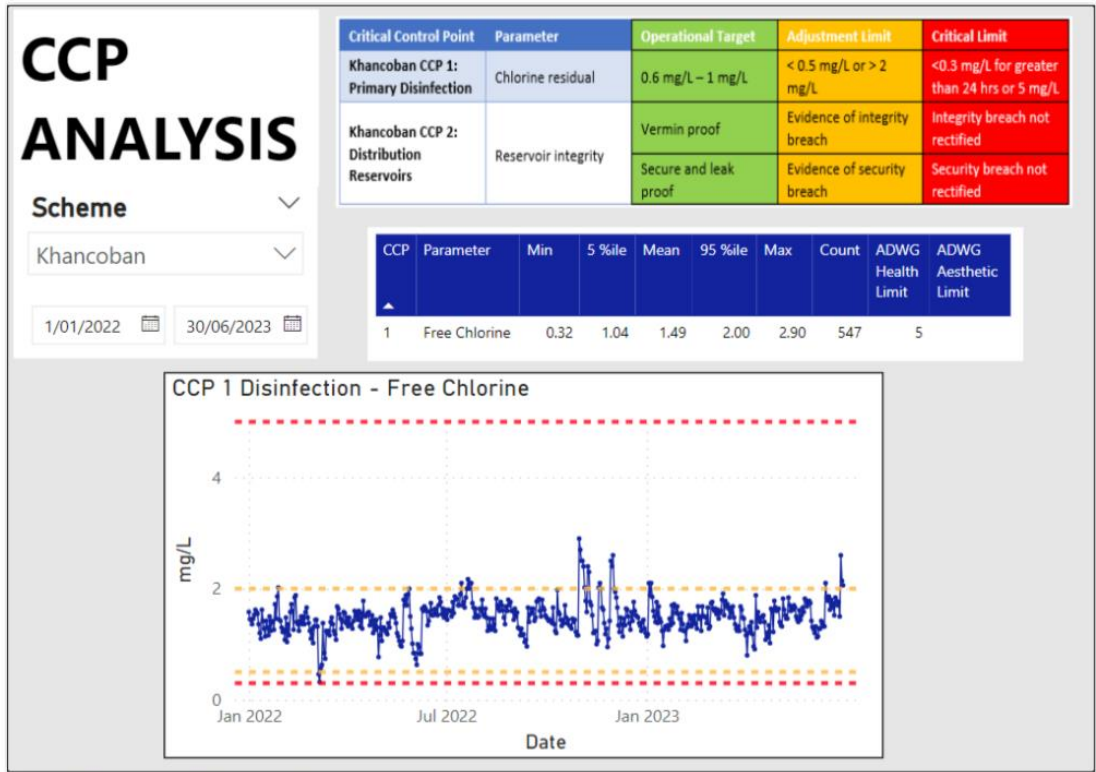


Figure 3 Khancoban CCP Analysis Dashboard

The free chlorine trend of the treated water shows there was very good conformance, and few values fell below the lower alert limit of 0.5 mg/L. There were a few times where free chlorine residual exceeded the upper alert limit, however there were no times where the free chlorine residual breached the critical limits.

4.4. Talbingo

A detailed data analysis of the CCP performance for Talbingo from Jan 2022 to Jun 2023 is presented in Figure 4.



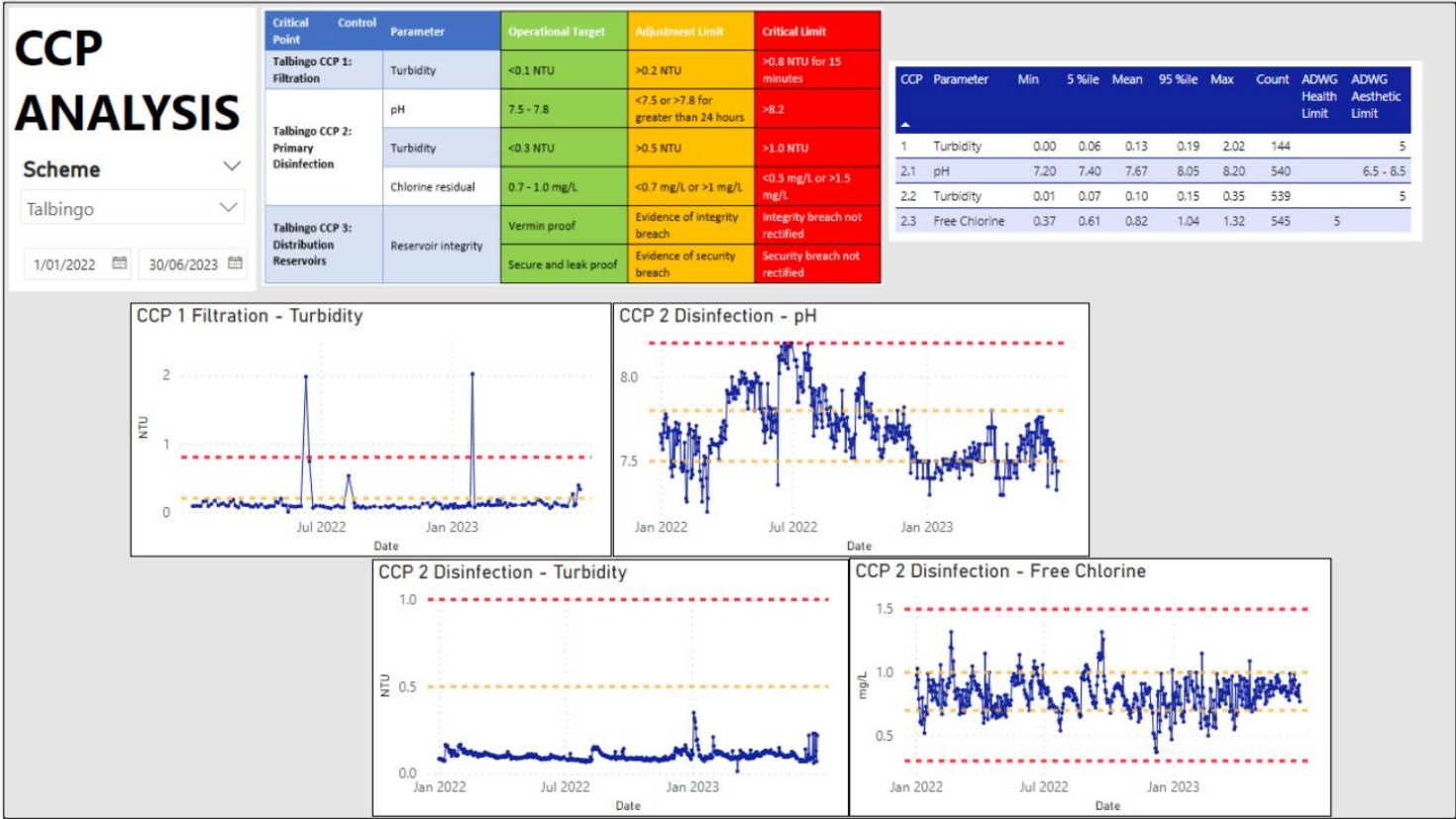


Figure 4 Talbingo CCP Analysis Dashboard



The turbidity trend of filtered water shows that it is mostly <0.2 NTU. There were two breaches of the critical limit on the 10/06/22 and 30/01/23, on both instances it was 2 NTU. This could be due to raw water and pre-filter turbidity also being high on these occasions.

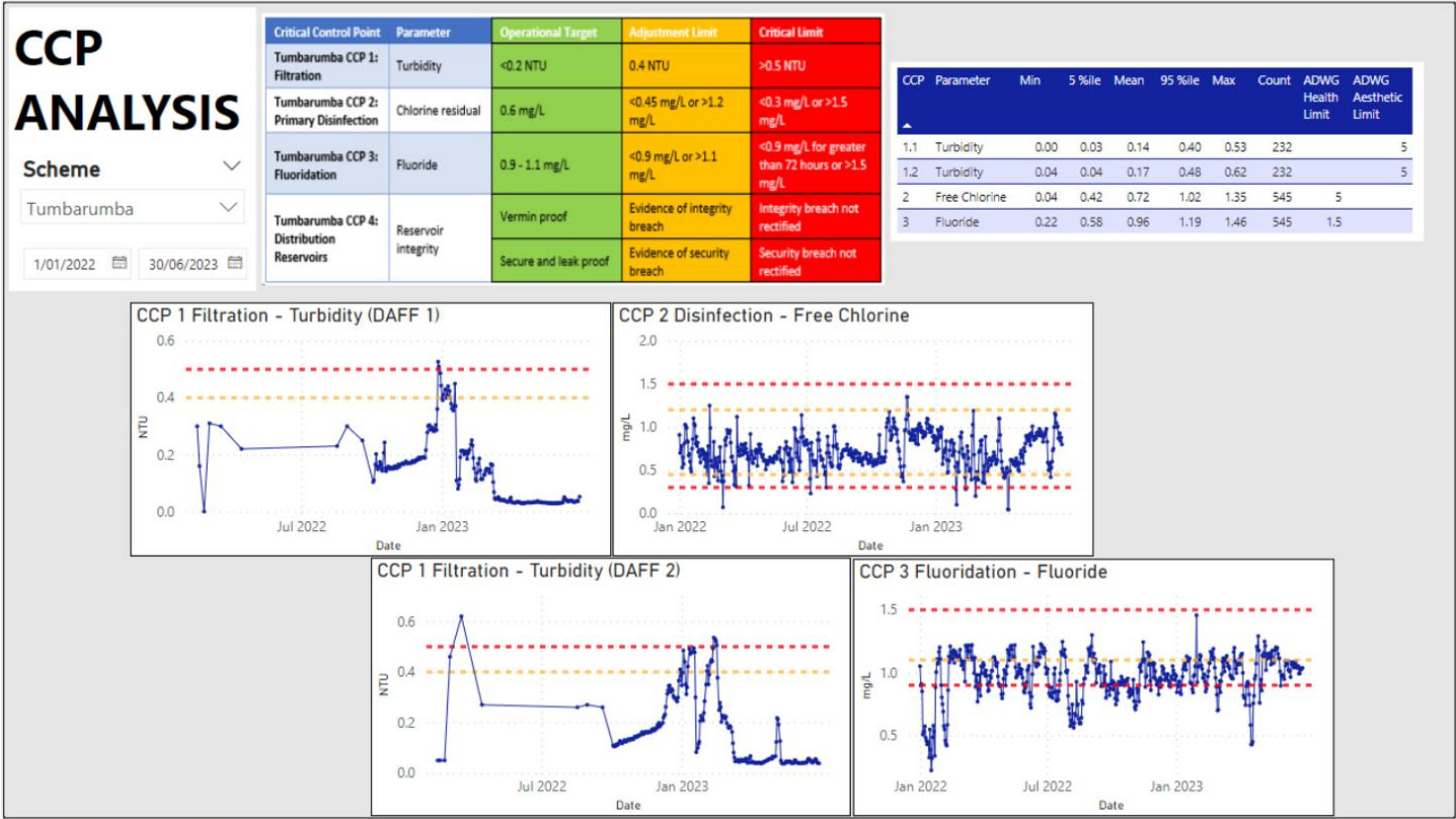
The pH of the treated water shows quite a variable trend with a range of 7.2 – 8.2. From early April 2022 to late October 2022, pH was generally above the upper alert limit, but the critical limit was never breached. Also, the results 100% conformed with the ADWG aesthetic guideline.

Turbidity of the treated water shows 100% conformance with the CCP limits.

The free chlorine trend of the treated water displays good conformance (mostly between 0.5 mg/L and 1.0 mg/L). There were some excursions of the upper and lower alert limit, but there were no instances where the critical limits were breached.

#### **4.5. Tumbarumba**

A detailed data analysis of the CCP performance for Tumbarumba from Jan 2022 to Jun 2023 is presented in Figure 5.





The DAFF turbidity trend shows it was mostly <0.4 NTU across both filters. In late 2022 to early 2023, there was a spike of values that exceeded the alert limit and a couple of instances where the critical limit was breached. During this time the soda ash pre dosing flow meter intermittently faulted and rectifying the issue caused unstable turbidity levels. Additionally, backwashing was occurring irregularly due to CCP setpoints in the automatic backwash settings.

The free chlorine trend of the treated water displays very good conformance (mostly between 0.45 mg/L and 1.20 mg/L). There were several excursions of the alert limits, and there were seven scattered instances of free chlorine falling below the low critical limit. Issues were addressed, and free chlorine returned to target levels following the excursions.

The fluoride trend of the treated water shows that many values fell below the lower critical limit of 0.9 mg/L throughout the reporting period. There were several incidents notified to NSW health regarding this. No values exceeded the ADWG health limit of 1.5 mg/L.

#### **4.6. Tumut**

A detailed data analysis of the CCP performance for Tumut from Jan 2022 to Jun 2023 is presented in Figure 6.

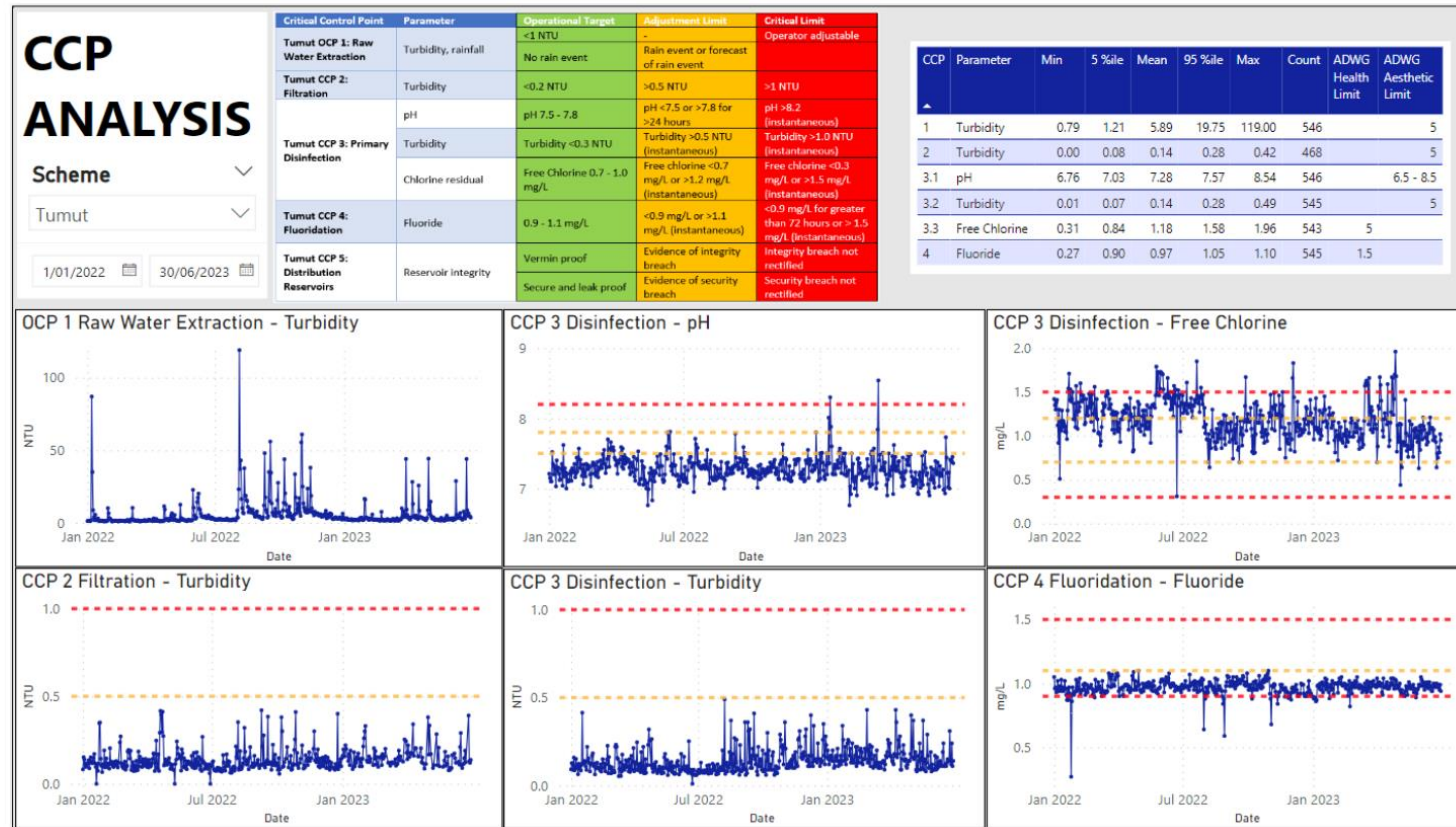


Figure 6 Tumut CCP Analysis Dashboard



The turbidity trend of the raw water shows variability over the reporting period. From early August 2022 to late November 2022, there was a phase of high turbidity with many values recording >10 NTU and maximum value of 119 NTU.

Turbidity of the filtered and treated water shows 100% conformance with the CCP limits.

pH of the treated water displays a trend of mostly 7.0 – 7.5, which falls below the lower alert limit. There were two instances of the upper critical limit being exceeded but all values remained consistent between the ADWG aesthetic guidelines.

The free chlorine of the treated water shows variance in the trend but generally fell between 0.7 – 1.5 mg/L. The upper and lower alert limits were triggered numerous times, however, the free chlorine residual did not fall below the lower critical limit. There were multiple breaches of the upper critical limit 1.5 mg/L throughout the reporting period, however the ADWG limit of 5 mg/L was not exceeded.

The fluoride trend of treated water displays very good conformance (mostly between 0.9 mg/L and 1.1 mg/L). There were several instances where the lower alert limit of 0.9 mg/L was triggered but there were no exceedances of the upper alert or critical limits.





#### 4.7. Reservoir Integrity

SVC has a CCP for reservoir integrity for all schemes. 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 not vulnerable to contamination, for example, by vermin, birds, or rainwater runoff ingress. Security of the facilities is also examined to deter contamination by human agency. A program should be kept for reservoir and clear water tank inspections including consistent record keeping as required for CCPs.

SVC has a planned schedule of detailed reservoir inspections for each facility at either two-yearly or four-yearly intervals. A summary of the SVC ASAM RT database, which stores the records of detailed reservoir inspections and cleans, is summarised in Table 2.

Table 2 Reservoir Inspections and Cleans

Reservoir	Last inspection date in ASAM RT	WQ related findings	Next inspection date scheduled
Adelong	16/02/2020	External and internal areas appear to be OK.	16/02/2024
Adelong Break Tank	16/02/2020	Entry hatch requires a lock to prevent unauthorised access. There is light corrosion on the underwater section of the roof support post.	16/02/2024
Batlow WTP CWT	15/02/2020	There are osmotic blisters in the lower wall coating.	15/02/2024
Batlow WTP RWT	7/05/2022	The hatches are not sealed. The internal ladder is heavily corroded.	7/05/2024
Brungle	12/02/2020	The entry hatch is not well secured and can be opened when locked.	12/02/2024
Cherry Lane Concrete (Offline)	14/11/2013	NA	NA
Cherry Lane Steel	8/05/2022	The entry hatch and roof hatch are both unlocked. There are osmotic blisters in the lower wall coating. Bolts are corroded on the ladder, inlet riser and overflow base areas indicating poor coating application.	8/05/2023
Cloverdale 1 (Offline)	17/11/2013	NA	NA
Cloverdale 2 (Offline)	17/11/2013	NA	NA
Godfrey	15/02/2020	All steels components inside the tank are corroded.	15/02/2024
Golf Club	7/05/2022	The roof sheet edges are not secured. There is a hole around the level pulley where contaminated water can drain into the tank. The bitumen wall floor seals are badly deteriorated. The ladder system is heavily corroded.	7/05/2026
Khancoban No1	17/02/2020	The three hatches on the roof area are all unlocked and unsealed on the upstream side. There were two birds' nests in the roof framing, close to the entry hatch area. Small amounts of corrosion are beginning to develop on the lower wall areas and also on the internal ladder rungs.	17/02/2024
Khancoban No2	17/02/2020	The entry hatch cover is not locked. The roof edge flashings are collecting debris and preventing the roof water from draining off.	17/02/2024



Reservoir	Last inspection date in ASAM RT	WQ related findings	Next inspection date scheduled
Lambie	14/02/2020	A large dead bird was found inside the tank. All metallic components inside the tank are heavily corroded.	14/02/2024
Southern	12/02/2020	The roof edge screws are loose on the eastern side. There is a layer of sediment slough on the internal walls.	12/02/2024
Talbingo HL	13/02/2020	The entry hatch is not sealed or secured. The overflow diffuser is heavily corroded and dropping corrosion material into the water.	13/02/2024
Talbingo LL	7/05/2022	The lightweight entry hatch cover is not secured. The vent mesh panels in the side walls are too coarse and not effective against fine debris. The inlet downpipe should have a 120° elbow fitted to the base to reduce sediment stirring during the filling cycle.	7/05/2026
Tumbarumba	17/02/2020	The roof sheets do not overlap the edges of the walls. The existing guttering will overflow back into the tank when either blocked or becoming unsealed. The safety mesh fitted under the roof sheets is corroding and dropping onto the floor.	17/02/2024
Withers 1	14/02/2020	External and internal areas appear to be OK.	14/02/2024
Withers 2	14/02/2020	External and internal areas appear to be OK.	14/02/2024

There were 3 reservoirs that were identified to have overdue inspections and cleans, Cloverdale 1 & 2 and Cherry Lane Concrete, which were all offline.



## 5. INCIDENTS REPORTED TO NSW HEALTH

Table 3 includes the notifications made to the Regulator (NSW Health PHU) for the Jan 2022 to Jun 2023 reporting period.

Table 3 Notifications made to NSW Health PHU

Date notified	Scheme	Issue	Actions taken	Comments
31/05/22	Tumbarumba	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.875 mg/L after 72 hours.	It was identified the dose rate needed to be increased. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
14/06/22	Tumbarumba	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.719 mg/L after 72 hours.	It was identified the dose rate needed to be increased. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
6/07/22	Tumbarumba	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.817 mg/L after 72 hours.	It was identified the dose rate needed to be increased. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
30/07/22	Tumbarumba	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.774 mg/L after 72 hours.	There was a lab test probe failure and would not calibrate. The test probe was replaced, and the tank was dosed with fluoride. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
2/08/22	Tumbarumba	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.696 mg/L after 72 hours.	Drop test on pump showed variation in dosing rate. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
25/08/22	Tumbarumba	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.632 mg/L after 72 hours.	Inspection of saturator tank observed a low spot had occurred in powder level above tank outlet. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
28/08/22	Tumut	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.59 mg/L after 72 hours.	There was an issue with the dose feed cone which continues to block. The issue looks like the water feed could be the cause. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
1/11/22	Tumbarumba	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.871 mg/L after 72 hours.	Inspection of saturator tank exposed a rat hole in powder and a small amount of cracking noticed in fluoride in tank. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
11/11/22	Tumbarumba	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.706 mg/L after 72 hours.	It was identified the fluoride dose and powder level needed to be increased. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.



Date notified	Scheme	Issue	Actions taken	Comments
3/01/23	Batlow	CCP Fluoride – critical limit of 0.9 mg/L breached for greater than 72 hours.	There was an issue with the dose feed system. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
3/01/23	Tumut	CCP Fluoride – critical limit of 0.9 mg/L breached for greater than 72 hours.	There was an issue with the dose feed system. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
22/02/23	Batlow	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.68 mg/L after 72 hours.	There was an issue with the dose feed system. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.
1/03/23	Tumbarumba	CCP Fluoride – critical limit of 0.9 mg/L breached with a reading of 0.698 mg/L after 72 hours.	It was identified the dose rate needed to be increased and the powder/water mix in saturator was very fluffy. The PHU was notified, and relevant corrective actions were undertaken to rectify the issue.	No impact on public health due to the incident.

Council engaged NSW Public Works to conduct a Condition Assessment on the three fluoride dosing plants: Batlow, Tumbarumba and Tumut. The report (P-FY20231536) finalised on the 26/07/2023 summarised that the fluoride plants are still functional but require several issues to be addressed to be able to provide a reliable and accurate service.



## 6. VERIFICATION MONITORING 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.

### 6.1. Reticulation Water Quality Monitoring

Drinking water quality monitoring is a wide-ranging assessment of the quality of water in the reticulation or 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 reticulation drinking water quality data for the schemes for the reporting period is presented in Appendix A. ADWG conformance for each scheme is summarized in Table 4 below.

Table 4 Verification Monitoring ADWG Conformance Jan 2022 to Jun 2023 Period

Scheme	ADWD Health-based guidelines	ADWD Aesthetic-based guidelines
Batlow	100% conformance	4 out of 77 samples had free chlorine out-of-spec. 1 out of 75 samples had pH out-of-spec.
Brungle	100% conformance	1 out of 56 samples had free chlorine out-of-spec. 3 out of 53 samples had pH out-of-spec.
Khancoban	100% conformance	1 out of 35 samples had pH out-of-spec.
Morgans Reserve	100% conformance	1 out of 17 samples had pH out-of-spec.
Talbingo	100% conformance	1 out of 40 samples had free chlorine out-of-spec. 9 out of 37 samples had pH out-of-spec.
Tumbarumba	100% conformance	2 out of 3 samples had aluminium out-of-spec. 3 out of 17 samples had the fluoride ratio out-of-spec. 3 out of 73 samples had free chlorine out-of-spec. 1 out of 73 samples had pH out-of-spec. 1 out of 73 samples had detected total coliforms. 1 out of 73 samples had turbidity out-of-spec.
Tumut	100% conformance	2 out of 111 samples had free chlorine out-of-spec. 3 out of 111 samples had detected total coliforms.



## 6.2. Sampling Frequency Conformance

Sampling frequency in accordance with the monitoring program is summarised in Table 5.

The following supply systems did not achieve the sampling frequency requirement:

- Batlow (microbiology)
- Khancoban (microbiology)
- Tumbarumba (microbiology)
- Tumut (microbiology)

Table 5 Verification Monitoring Sampling Frequency Jan 2022 to June 2023 Period

Supply System	Analysis Type	Allocation (any part) in Period	Samples Expected in Period	Samples Collected in Period				Collected as % of Expected Samples
				Allocated	Additional	Repeat	Total	
Batlow SN03	Chemistry	4	3	4	0	0	4	133.33%
Batlow SN03	Microbiology	104	78	77	0	0	77	98.72%
Brungle SN04	Chemistry	4	3	3	0	0	3	100.00%
Brungle SN04	Microbiology	72	54	56	0	0	56	103.70%
Khancoban SN07	Chemistry	4	3	3	0	0	3	100.00%
Khancoban SN07	Microbiology	52	39	36	0	0	36	92.31%
Morgans Reserve SN06	Chemistry	4	3	2	1	0	3	100.00%
Morgans Reserve SN06	Microbiology	24	18	18	0	0	18	100.00%
Talbingo SN05	Chemistry	4	3	3	0	0	3	100.00%
Talbingo SN05	Microbiology	52	39	40	0	0	40	102.56%
Tumbarumba SN08	Chemistry	4	3	3	0	0	3	100.00%
Tumbarumba SN08	Microbiology	104	78	73	0	0	73	93.59%
Tumut SN01	Chemistry	24	18	18	0	0	18	100.00%
Tumut SN01	Microbiology	152	114	111	0	0	111	97.37%

The reason for the shortfall in microbiological samples is due to missed samples over the Christmas/New Year laboratory shutdown period.





### 6.3. 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.

Figure 7, Figure 8 and Figure 9 include the water quality complaints received for the reporting period.

There were 23 water quality complaints in the Jan 2022 to Jun 2023 reporting period. 17 complaints were from Tumut, 4 were from Tumbarumba and 2 were from Batlow. Most complaints were about dirty water and were actioned by flushing near the property until cleared and water quality testing returned acceptable results. Notably, Tumut has older AC pipes, and this results in a number of mains breaks.

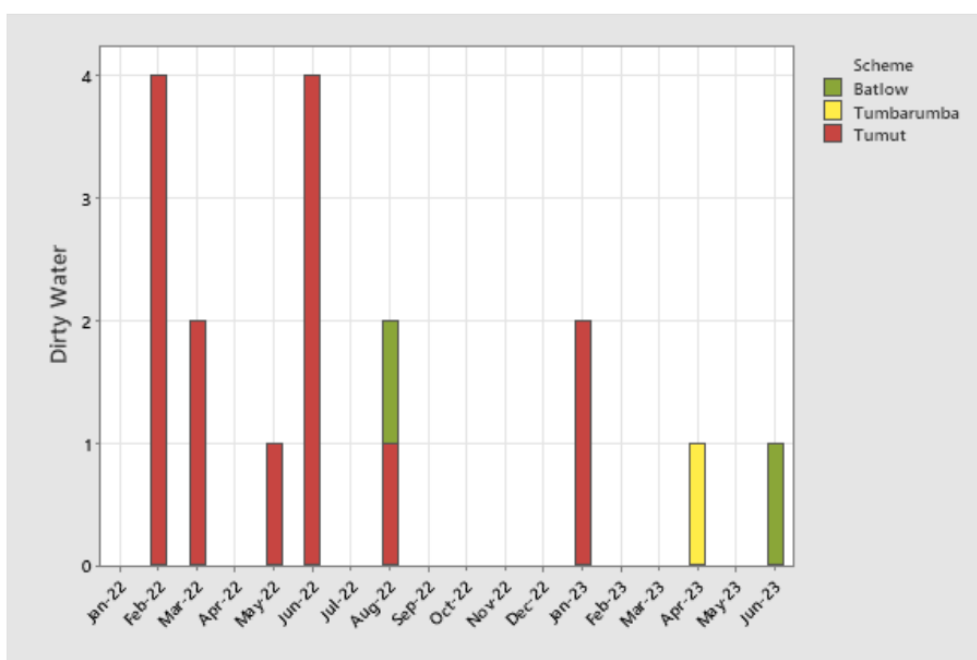


Figure 7 Water Quality Complaints – Dirty Water

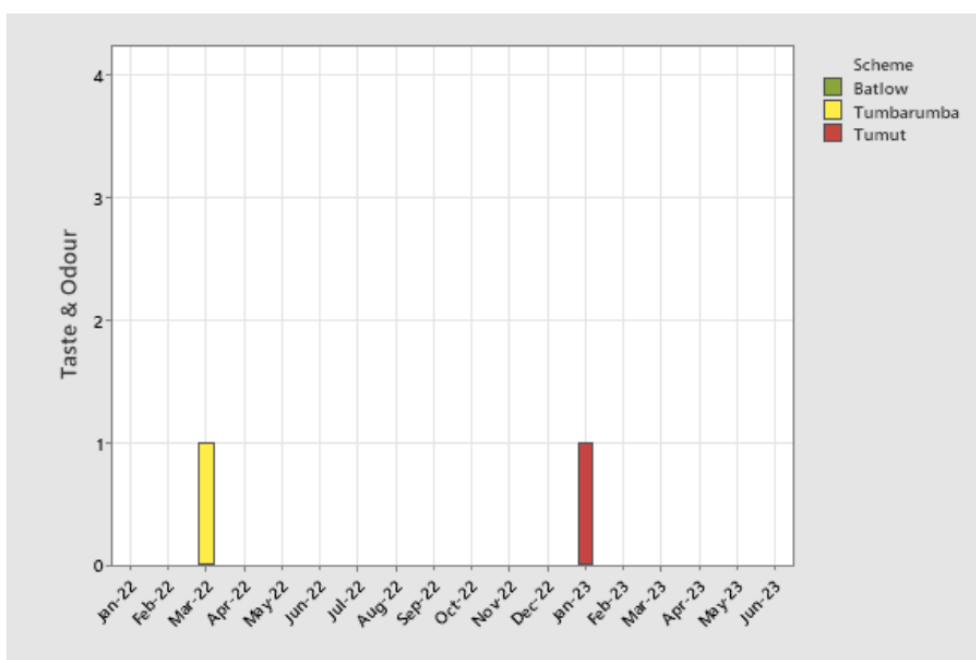


Figure 8 Water Quality Complaints – Taste &amp; Odour

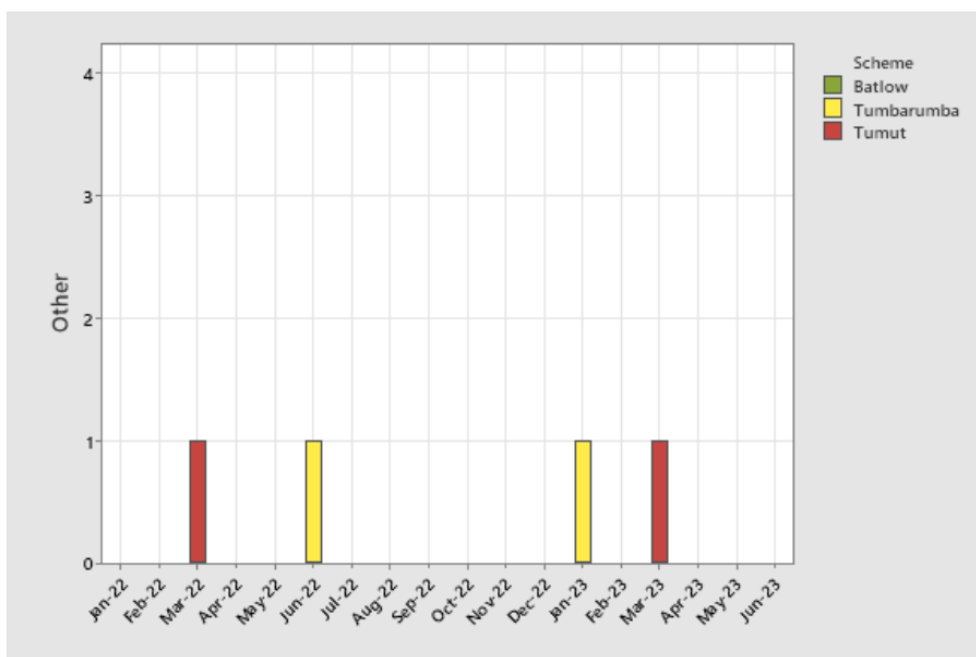


Figure 9 Water Quality Complaints – Other



## 7. IMPROVEMENT PLAN IMPLEMENTATION

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

### 7.1. Status

The Improvement Plan was reviewed and updated during the preparation of this Annual Report. A summary of the status of all improvement actions, including priority, can be seen in Figure 10.

During the review of the improvement plan for this report:

- 10 actions were completed or closed out
- 5 actions are now in progress
- 6 actions were updated to on-going.

For detailed progress and commentary, refer to the Improvement Plan.

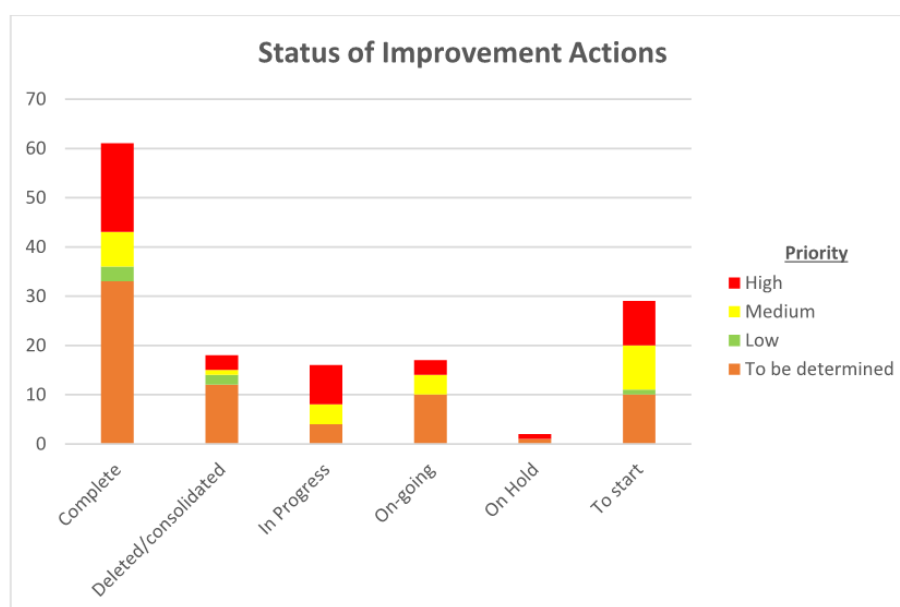


Figure 10 Status of Improvement Actions

### 7.2. New Additions

During the review and update of the Improvement Plan, it was observed that the ability to track the improvement action progress by time wasn't possible. To account for this, "Date Created", "Target Date" and "Date Completed" columns have been added to the plan.

A new Improvement Plan will be developed when the next formal risk workshop is undertaken. This will include any new improvement actions which have been identified and discussed.



## 8. DWMS REVIEW OUTCOMES

The annual review of the DWMS was undertaken as part of the preparation of this Report. A teleconference was facilitated by Viridis on 27 July 2023 via MS Teams to discuss key DWMS areas, as captured in Table 6.

The teleconference participants included:

- James Howey, Director – Viridis
- Kristy Sharvell, Graduate Scientist – Viridis
- Laxmi Pandey, Water & Wastewater Engineer – Council
- David Sam, Coordinator Utilities & Works – Council
- Quentin Adams, Manager Utilities & Waste Business - Council
- Casey Clothier, Water & Wastewater Technician – Council

The outcome of the review, as per Table 6, is that there is a need to comprehensively review and update the CCPs.

*Table 6 Review Details*

Review area	Discussions	Related action/s, as relevant
Supply system details, including schematics.	Refer to Section 3. There have been no significant changes to the scheme.	NA
CCP performance	Discussed in Section 4. Turbidity CCP breaches were reported to the PHU. There is a need to review the CCPs in detail, including input from PHU and DPE.	A full review and update of the CCPs with input from PHU and DPE.
Outcomes of drinking water quality incidents and emergencies	Discussed in Section 6. The fluoride plants at Tumbarumba and Batlow have had issues, especially with supply quality.	NA
Drinking water quality performance	Discussed in Section 7. The conformance with ADWG health-based guidelines has been good. However, there seems to be a shortfall in the microbiological sampling frequency.	NA
Concerns of consumers (customer complaints)	Discussed in Section 7.3. Generally, dirty water results from main breaks or the fire brigade have fiddled with mains to do training.	NA
Improvement plan progress	Discussed in Section 8. The status of 21 improvement actions were updated.	NA
Audit outcomes	Discussed in Section 10. Not applicable at this stage.	NA

## 9. DWMS AUDIT OUTCOMES

There was no formal DWMS audit undertaken in Jan 2022 – Jun 2023.



## GLOSSARY

Word	Description
ADWG	Australian Drinking Water Guidelines
CCP	Critical Control Point
DWMS	Drinking Water Management System
mg/L	Milligrams per litre
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
SVC	Snowy Valleys Council
WQ	Water Quality
WTP	Water Treatment Plant



## DOCUMENT HISTORY AND TRACKING

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Viridis Consultants Pty Ltd  
PO Box 131  
Bulimba Qld 4171  
Australia

1300 799 310

www.viridis.net.au  
ABN: 49 129 185 271

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**A. VERIFICATION MONITORING**



Table 7 Batlow Verification Monitoring

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
Chemistry	Aluminium	0.2	mg/L	0.0100	0.0100	0.0000	0.01	0.01	4	0	0.01	0.01	100.00
	Antimony	0.003	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	4	0	0.00005	0.00005	100.00
	Arsenic	0.01	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	4	0	0.0005	0.0005	100.00
	Barium	2	mg/L	0.0062	0.0062	0.0005	0.0056	0.0068	4	0	0.0068	0.0056	100.00
	Boron	4	mg/L	0.0028	0.0023	0.0016	0.0016	0.0051	4	0	0.0051	0.0016	100.00
	Cadmium	0.002	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	4	0	0.00005	0.00005	100.00
	Calcium	10000	mg/L	4.5000	4.5500	0.3742	4	4.9	4	0	4.9	4	100.00
	Chloride	250	mg/L	5.0000	5.0000	0.0000	5	5	4	0	5	5	100.00
	Chromium	0.05	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	4	0	0.0005	0.0005	100.00
	Copper	2	mg/L	0.0095	0.0055	0.0098	0.003	0.024	4	0	0.024	0.003	100.00
	Fluoride	1.5	mg/L	0.7250	0.9100	0.4595	0.05	1.03	4	0	1.03	0.05	100.00
	Iodine	NA	mg/L	0.0100	0.0100	0.0000	0.01	0.01	4	0	0.01	0.01	100.00
	Iron	0.3	mg/L	0.0425	0.0350	0.0359	0.01	0.09	4	0	0.09	0.01	100.00
	Lead	0.01	mg/L	0.0002	0.0002	0.0001	0.0001	0.0003	4	0	0.0003	0.0001	100.00
	Magnesium	10000	mg/L	0.7875	0.7600	0.1150	0.68	0.95	4	0	0.95	0.68	100.00
	Manganese	0.5	mg/L	0.0047	0.0018	0.0064	0.001	0.0142	4	0	0.0142	0.001	100.00
	Mercury	0.001	mg/L	0.0004	0.0004	0.0000	0.0004	0.0004	4	0	0.0004	0.0004	100.00
	Molybdenum	0.05	mg/L	0.0001	0.0001	0.0000	0.00005	0.0001	4	0	0.0001	0.00005	100.00
	Nickel	0.02	mg/L	0.0004	0.0004	0.0001	0.0002	0.0005	4	0	0.0005	0.0002	100.00
	Nitrate	50	mg/L	1.0000	1.0000	0.0000	1	1	4	0	1	1	100.00
	Nitrite	3	mg/L	0.0500	0.0500	0.0000	0.05	0.05	4	0	0.05	0.05	100.00
	pH	6.5 - 8.5		7.2000	7.2000	0.0816	7.1	7.3	4	0	7.3	7.1	100.00
	Selenium	0.01	mg/L	0.0035	0.0035	0.0000	0.0035	0.0035	4	0	0.0035	0.0035	100.00
	Silver	0.1	mg/L	0.0001	0.0001	0.0000	0.0001	0.0001	4	0	0.0001	0.0001	100.00
	Sodium	180	mg/L	3.5000	4.0000	1.0000	2	4	4	0	4	2	100.00
	Sulfate	250	mg/L	1.0000	1.0000	0.0000	1	1	4	0	1	1	100.00
	Total Dissolved Solids (TDS)	10000	mg/L	18.5000	18.5000	1.2910	17	20	4	0	20	17	100.00
	Total Hardness as CaCO3	10000	mg/L	14.4750	14.8500	1.2038	12.8	15.4	4	0	15.4	12.8	100.00
	True Colour	15	Hazen Units (HU)	2.1250	2.0000	1.6520	0.5	4	4	0	4	0.5	100.00
	Turbidity	5	NTU	0.4000	0.1750	0.5462	0.05	1.2	4	0	1.2	0.05	100.00
	Uranium	0.017	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	4	0	0.00005	0.00005	100.00
	Zinc	3	mg/L	0.0075	0.0075	0.0029	0.005	0.01	4	0	0.01	0.005	100.00
Fluoride Barcode	Fluoride	1.5	mg/L	0.7760	0.9100	0.3008	0.05	0.99	15	0	0.99	0.05	100.00
Microbiology	E. coli	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	77	0	0	0	100.00
	Free Chlorine	0.2 - 5	mg/L	0.7836	0.8700	0.3209	0.11	1.32	77	4	1.23	0.19	94.81
	pH	6.5 - 8.5		7.6023	7.6300	0.3682	6.85	8.58	75	1	8.34	7.09	98.67
	Total Chlorine	5	mg/L	0.8969	0.9900	0.3316	0.14	1.48	77	0	1.32	0.24	100.00
	Total Coliforms	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	77	0	0	0	100.00
	Turbidity	5	NTU	0.1946	0.1550	0.2104	0	1.27	76	0	0.42	0	100.00



Table 8 Brungle Verification Monitoring

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
Chemistry	Aluminium	0.2	mg/L	0.0067	0.0050	0.0029	0.005	0.01	3	0	0.01	0.005	100.00
	Antimony	0.003	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Arsenic	0.01	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	3	0	0.0005	0.0005	100.00
	Barium	2	mg/L	0.0059	0.0057	0.0010	0.005	0.0069	3	0	0.0069	0.005	100.00
	Boron	4	mg/L	0.0025	0.0026	0.0003	0.0022	0.0027	3	0	0.0027	0.0022	100.00
	Cadmium	0.002	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Calcium	10000	mg/L	4.8333	4.8000	0.9504	3.9	5.8	3	0	5.8	3.9	100.00
	Chloride	250	mg/L	7.3333	7.0000	0.5774	7	8	3	0	8	7	100.00
	Chromium	0.05	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	3	0	0.0005	0.0005	100.00
	Copper	2	mg/L	0.0153	0.0110	0.0159	0.002	0.033	3	0	0.033	0.002	100.00
	Fluoride	1.5	mg/L	0.0500	0.0500	0.0000	0.05	0.05	3	0	0.05	0.05	100.00
	Iodine	NA	mg/L	0.0100	0.0100	0.0000	0.01	0.01	3	0	0.01	0.01	100.00
	Iron	0.3	mg/L	0.0133	0.0100	0.0058	0.01	0.02	3	0	0.02	0.01	100.00
	Lead	0.01	mg/L	0.0002	0.0002	0.0001	0.0001	0.0002	3	0	0.0002	0.0001	100.00
	Magnesium	10000	mg/L	1.5567	1.3300	0.4100	1.31	2.03	3	0	2.03	1.31	100.00
	Manganese	0.5	mg/L	0.0013	0.0015	0.0004	0.0009	0.0016	3	0	0.0016	0.0009	100.00
	Mercury	0.001	mg/L	0.0004	0.0004	0.0000	0.0004	0.0004	3	0	0.0004	0.0004	100.00
	Molybdenum	0.05	mg/L	0.0001	0.0001	0.0001	0.0001	0.0002	3	0	0.0002	0.0001	100.00
	Nickel	0.02	mg/L	0.0004	0.0002	0.0003	0.0002	0.0007	3	0	0.0007	0.0002	100.00
	Nitrate	50	mg/L	1.0000	1.0000	0.0000	1	1	3	0	1	1	100.00
	Nitrite	3	mg/L	0.0500	0.0500	0.0000	0.05	0.05	3	0	0.05	0.05	100.00
	pH	6.5 - 8.5		7.4667	7.5000	0.0577	7.4	7.5	3	0	7.5	7.4	100.00
	Selenium	0.01	mg/L	0.0035	0.0035	0.0000	0.0035	0.0035	3	0	0.0035	0.0035	100.00
	Silver	0.1	mg/L	0.0001	0.0001	0.0000	0.0001	0.0001	3	0	0.0001	0.0001	100.00
	Sodium	180	mg/L	8.0000	8.0000	1.0000	7	9	3	0	9	7	100.00
	Sulfate	250	mg/L	1.0000	1.0000	0.0000	1	1	3	0	1	1	100.00
	Total Dissolved Solids (TDS)	10000	mg/L	28.3333	28.0000	3.5119	25	32	3	0	32	25	100.00
	Total Hardness as CaCO3	10000	mg/L	18.5000	18.1000	1.2490	17.5	19.9	3	0	19.9	17.5	100.00
	True Colour	15	Hazen Units (HU)	1.0000	1.0000	0.0000	1	1	3	0	1	1	100.00
	Turbidity	5	NTU	0.6667	0.6000	0.4041	0.3	1.1	3	0	1.1	0.3	100.00
	Uranium	0.017	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Zinc	3	mg/L	0.0133	0.0100	0.0058	0.01	0.02	3	0	0.02	0.01	100.00
Microbiology	E. coli	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	56	0	0	0	100.00
	Free Chlorine	0.2 - 5	mg/L	0.8057	0.8250	0.2930	0.14	1.51	56	1	1.3	0.31	98.21
	pH	6.5 - 8.5		7.7721	7.7100	0.3529	7	8.88	53	3	8.53	7.3	94.34
	Temperature	30	C	0.2700	0.2700	0.0000	0.27	0.27	1	0	0.27	0.27	100.00
	Total Chlorine	5	mg/L	0.9515	0.9650	0.3364	0.113	1.79	56	0	1.51	0.33	100.00
	Total Coliforms	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	56	0	0	0	100.00
	Turbidity	5	NTU	0.2062	0.1400	0.3048	0	2.09	55	0	0.6	0	100.00



Table 9 Khancoban Verification Monitoring

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
Chemistry	Aluminium	0.2	mg/L	0.0300	0.0200	0.0173	0.02	0.05	3	0	0.05	0.02	100.00
	Antimony	0.003	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Arsenic	0.01	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	3	0	0.0005	0.0005	100.00
	Barium	2	mg/L	0.0040	0.0041	0.0008	0.0032	0.0048	3	0	0.0048	0.0032	100.00
	Boron	4	mg/L	0.0031	0.0032	0.0012	0.0018	0.0042	3	0	0.0042	0.0018	100.00
	Cadmium	0.002	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Calcium	10000	mg/L	3.8667	3.3000	1.1590	3.1	5.2	3	0	5.2	3.1	100.00
	Chloride	250	mg/L	4.3333	4.0000	0.5774	4	5	3	0	5	4	100.00
	Chromium	0.05	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	3	0	0.0005	0.0005	100.00
	Copper	2	mg/L	0.1330	0.1420	0.1198	0.009	0.248	3	0	0.248	0.009	100.00
	Fluoride	1.5	mg/L	0.0667	0.0500	0.0289	0.05	0.1	3	0	0.1	0.05	100.00
	Iodine	NA	mg/L	0.0100	0.0100	0.0000	0.01	0.01	3	0	0.01	0.01	100.00
	Iron	0.3	mg/L	0.0367	0.0400	0.0058	0.03	0.04	3	0	0.04	0.03	100.00
	Lead	0.01	mg/L	0.0004	0.0004	0.0003	0.0001	0.0006	3	0	0.0006	0.0001	100.00
	Magnesium	10000	mg/L	1.3800	1.3500	0.4158	0.98	1.81	3	0	1.81	0.98	100.00
	Manganese	0.5	mg/L	0.0007	0.0007	0.0001	0.0006	0.0007	3	0	0.0007	0.0006	100.00
	Mercury	0.001	mg/L	0.0004	0.0004	0.0000	0.0004	0.0004	3	0	0.0004	0.0004	100.00
	Molybdenum	0.05	mg/L	0.0002	0.0002	0.0001	0.0001	0.0002	3	0	0.0002	0.0001	100.00
	Nickel	0.02	mg/L	0.0002	0.0002	0.0000	0.0002	0.0002	3	0	0.0002	0.0002	100.00
	Nitrate	50	mg/L	0.5000	0.5000	0.0000	0.5	0.5	3	0	0.5	0.5	100.00
	Nitrite	3	mg/L	0.0500	0.0500	0.0000	0.05	0.05	3	0	0.05	0.05	100.00
	pH	6.5 - 8.5		7.1000	7.0000	0.2646	6.9	7.4	3	0	7.4	6.9	100.00
	Selenium	0.01	mg/L	0.0035	0.0035	0.0000	0.0035	0.0035	3	0	0.0035	0.0035	100.00
	Silver	0.1	mg/L	0.0001	0.0001	0.0000	0.0001	0.0001	3	0	0.0001	0.0001	100.00
	Sodium	180	mg/L	3.3333	3.0000	0.5774	3	4	3	0	4	3	100.00
	Sulfate	250	mg/L	1.0000	1.0000	0.0000	1	1	3	0	1	1	100.00
	Total Dissolved Solids (TDS)	10000	mg/L	22.0000	23.0000	2.6458	19	24	3	0	24	19	100.00
	Total Hardness as CaCO3	10000	mg/L	15.3333	13.8000	4.5004	11.8	20.4	3	0	20.4	11.8	100.00
	True Colour	15	Hazen Units (HU)	1.1667	1.0000	0.7638	0.5	2	3	0	2	0.5	100.00
	Turbidity	5	NTU	0.3500	0.4000	0.2784	0.05	0.6	3	0	0.6	0.05	100.00
	Uranium	0.017	mg/L	0.0001	0.0001	0.0000	0.00005	0.0001	3	0	0.0001	0.00005	100.00
	Zinc	3	mg/L	0.0133	0.0100	0.0058	0.01	0.02	3	0	0.02	0.01	100.00
Microbiology	E. coli	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	36	0	0	0	100.00
	Free Chlorine	0.2 - 5	mg/L	1.0886	1.1300	0.3052	0.24	1.6	36	0	1.58	0.63	100.00
	pH	6.5 - 8.5		6.8129	6.7500	0.5267	6.5	9.7	35	1	7.1	6.5	97.14
	Temperature	30	C	0.3000	0.3000	0.0000	0.3	0.3	1	0	0.3	0.3	100.00
	Total Chlorine	5	mg/L	1.1814	1.2000	0.2972	0.67	1.68	35	0	1.64	0.75	100.00
	Total Coliforms	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	36	0	0	0	100.00
	Turbidity	5	NTU	0.8040	0.7000	0.3854	0.41	1.91	35	0	1.78	0.42	100.00



Table 10 Morgans Reserve Verification Monitoring

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
Chemistry	Aluminium	0.2	mg/L	0.0233	0.0200	0.0153	0.01	0.04	3	0	0.04	0.01	100.00
	Antimony	0.003	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Arsenic	0.01	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	3	0	0.0005	0.0005	100.00
	Barium	2	mg/L	0.0061	0.0060	0.0010	0.0051	0.0071	3	0	0.0071	0.0051	100.00
	Boron	4	mg/L	0.0023	0.0021	0.0005	0.0019	0.0029	3	0	0.0029	0.0019	100.00
	Cadmium	0.002	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Calcium	10000	mg/L	5.7667	5.0000	1.4154	4.9	7.4	3	0	7.4	4.9	100.00
	Chloride	250	mg/L	3.6667	4.0000	0.5774	3	4	3	0	4	3	100.00
	Chromium	0.05	mg/L	0.0007	0.0005	0.0003	0.0005	0.001	3	0	0.001	0.0005	100.00
	Copper	2	mg/L	0.0053	0.0040	0.0051	0.001	0.011	3	0	0.011	0.001	100.00
	Fluoride	1.5	mg/L	0.6733	0.9000	0.4727	0.13	0.99	3	0	0.99	0.13	100.00
	Iodine	NA	mg/L	0.2200	0.0100	0.3637	0.01	0.64	3	0	0.64	0.01	100.00
	Iron	0.3	mg/L	0.0183	0.0200	0.0126	0.005	0.03	3	0	0.03	0.005	100.00
	Lead	0.01	mg/L	0.0003	0.0002	0.0002	0.0002	0.0005	3	0	0.0005	0.0002	100.00
	Magnesium	10000	mg/L	1.0333	1.2400	0.4936	0.47	1.39	3	0	1.39	0.47	100.00
	Manganese	0.5	mg/L	0.0010	0.0013	0.0006	0.0003	0.0015	3	0	0.0015	0.0003	100.00
	Mercury	0.001	mg/L	0.0004	0.0004	0.0000	0.0004	0.0004	3	0	0.0004	0.0004	100.00
	Molybdenum	0.05	mg/L	0.0003	0.0004	0.0002	0.0001	0.0005	3	0	0.0005	0.0001	100.00
	Nickel	0.02	mg/L	0.0012	0.0014	0.0008	0.0004	0.0019	3	0	0.0019	0.0004	100.00
	Nitrate	50	mg/L	0.6667	0.5000	0.2887	0.5	1	3	0	1	0.5	100.00
	Nitrite	3	mg/L	0.0500	0.0500	0.0000	0.05	0.05	3	0	0.05	0.05	100.00
	pH	6.5 - 8.5		7.4333	7.4000	0.1528	7.3	7.6	3	0	7.6	7.3	100.00
	Selenium	0.01	mg/L	0.0035	0.0035	0.0000	0.0035	0.0035	3	0	0.0035	0.0035	100.00
	Silver	0.1	mg/L	0.0001	0.0001	0.0000	0.0001	0.0001	3	0	0.0001	0.0001	100.00
	Sodium	180	mg/L	7.6667	6.0000	3.7859	5	12	3	0	12	5	100.00
	Sulfate	250	mg/L	3.3333	1.0000	4.0415	1	8	3	0	8	1	100.00
	Total Dissolved Solids (TDS)	10000	mg/L	31.6667	30.0000	5.6862	27	38	3	0	38	27	100.00
	Total Hardness as CaCO3	10000	mg/L	18.6333	18.2000	1.5948	17.3	20.4	3	0	20.4	17.3	100.00
	True Colour	15	Hazen Units (HU)	1.3333	1.0000	0.5774	1	2	3	0	2	1	100.00
	Turbidity	5	NTU	0.6667	0.8000	0.3215	0.3	0.9	3	0	0.9	0.3	100.00
	Uranium	0.017	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Zinc	3	mg/L	0.0167	0.0200	0.0058	0.01	0.02	3	0	0.02	0.01	100.00
Microbiology	E. coli	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	18	0	0	0	100.00
	Free Chlorine	0.2 - 5	mg/L	0.7873	0.7550	0.2913	0.36	1.6	18	0	1.6	0.36	100.00
	pH	6.5 - 8.5		7.8835	7.8900	0.2555	7.38	8.6	17	1	8.6	7.38	94.12
	Total Chlorine	5	mg/L	0.9111	0.8500	0.3367	0.48	1.9	18	0	1.9	0.48	100.00
	Total Coliforms	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	18	0	0	0	100.00
	Turbidity	5	NTU	0.1247	0.1200	0.1012	0	0.35	17	0	0.35	0	100.00



Table 11 Talbingo Verification Monitoring

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
Chemistry	Aluminium	0.2	mg/L	0.0150	0.0100	0.0132	0.005	0.03	3	0	0.03	0.005	100.00
	Antimony	0.003	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Arsenic	0.01	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	3	0	0.0005	0.0005	100.00
	Barium	2	mg/L	0.0078	0.0073	0.0015	0.0066	0.0094	3	0	0.0094	0.0066	100.00
	Boron	4	mg/L	0.0022	0.0020	0.0006	0.0017	0.0029	3	0	0.0029	0.0017	100.00
	Cadmium	0.002	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Calcium	10000	mg/L	5.5000	5.6000	1.1533	4.3	6.6	3	0	6.6	4.3	100.00
	Chloride	250	mg/L	6.0000	2.0000	6.9282	2	14	3	0	14	2	100.00
	Chromium	0.05	mg/L	0.0007	0.0005	0.0003	0.0005	0.001	3	0	0.001	0.0005	100.00
	Copper	2	mg/L	0.0115	0.0020	0.0178	0.0005	0.032	3	0	0.032	0.0005	100.00
	Fluoride	1.5	mg/L	0.0500	0.0500	0.0000	0.05	0.05	3	0	0.05	0.05	100.00
	Iodine	NA	mg/L	0.0100	0.0100	0.0000	0.01	0.01	3	0	0.01	0.01	100.00
	Iron	0.3	mg/L	0.0083	0.0100	0.0029	0.005	0.01	3	0	0.01	0.005	100.00
	Lead	0.01	mg/L	0.0002	0.0002	0.0001	0.0001	0.0003	3	0	0.0003	0.0001	100.00
	Magnesium	10000	mg/L	1.6600	0.7100	1.7504	0.59	3.68	3	0	3.68	0.59	100.00
	Manganese	0.5	mg/L	0.0009	0.0009	0.0005	0.0004	0.0013	3	0	0.0013	0.0004	100.00
	Mercury	0.001	mg/L	0.0004	0.0004	0.0000	0.0004	0.0004	3	0	0.0004	0.0004	100.00
	Molybdenum	0.05	mg/L	0.0003	0.0003	0.0002	0.0001	0.0005	3	0	0.0005	0.0001	100.00
	Nickel	0.02	mg/L	0.0011	0.0011	0.0008	0.0004	0.0019	3	0	0.0019	0.0004	100.00
	Nitrate	50	mg/L	0.6667	0.5000	0.2887	0.5	1	3	0	1	0.5	100.00
	Nitrite	3	mg/L	0.0500	0.0500	0.0000	0.05	0.05	3	0	0.05	0.05	100.00
	pH	6.5 - 8.5		7.5667	7.6000	0.2517	7.3	7.8	3	0	7.8	7.3	100.00
	Selenium	0.01	mg/L	0.0035	0.0035	0.0000	0.0035	0.0035	3	0	0.0035	0.0035	100.00
	Silver	0	mg/L	0.0001	0.0001	0.0000	0.0001	0.0001	3	0	0.0001	0.0001	100.00
	Sodium	180	mg/L	10.6667	10.0000	2.0817	9	13	3	0	13	9	100.00
	Sulfate	250	mg/L	4.3333	5.0000	2.0817	2	6	3	0	6	2	100.00
	Total Dissolved Solids (TDS)	10000	mg/L	37.6667	41.0000	10.4083	26	46	3	0	46	26	100.00
	Total Hardness as CaCO3	10000	mg/L	20.5667	19.4000	8.0139	13.2	29.1	3	0	29.1	13.2	100.00
	True Colour	15	Hazen Units (HU)	0.6667	0.5000	0.2887	0.5	1	3	0	1	0.5	100.00
	Turbidity	5	NTU	0.5000	0.3000	0.4359	0.2	1	3	0	1	0.2	100.00
	Uranium	0.017	mg/L	0.0001	0.0001	0.0000	0.00005	0.0001	3	0	0.0001	0.00005	100.00
	Zinc	3	mg/L	0.0083	0.0100	0.0029	0.005	0.01	3	0	0.01	0.005	100.00
Microbiology	E. coli	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	40	0	0	0	100.00
	Free Chlorine	0.2 - 5	mg/L	0.4940	0.4850	0.2172	0.08	0.95	40	1	0.86	0.23	97.50
	pH	6.5 - 8.5		8.2008	8.2600	0.4724	7.49	9.36	37	9	9.08	7.5	75.68
	Total Chlorine	5	mg/L	0.5728	0.5650	0.2337	0.13	1.04	40	0	1.02	0.24	100.00
	Total Coliforms	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	40	0	0	0	100.00
	Turbidity	5	NTU	0.1077	0.1000	0.0804	0	0.28	39	0	0.24	0	100.00





Table 12 Tumbarumba Verification Monitoring

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
Chemistry	Aluminium	0.2	mg/L	0.5000	0.4400	0.4629	0.07	0.99	3	2	0.99	0.07	33.33
	Antimony	0.003	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Arsenic	0.01	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	3	0	0.0005	0.0005	100.00
	Barium	2	mg/L	0.0046	0.0050	0.0007	0.0038	0.0051	3	0	0.0051	0.0038	100.00
	Boron	4	mg/L	0.0020	0.0021	0.0003	0.0017	0.0023	3	0	0.0023	0.0017	100.00
	Cadmium	0.002	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Calcium	10000	mg/L	1.4667	1.5000	0.0577	1.4	1.5	3	0	1.5	1.4	100.00
	Chloride	250	mg/L	3.0000	3.0000	0.0000	3	3	3	0	3	3	100.00
	Chromium	0.05	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	3	0	0.0005	0.0005	100.00
	Copper	2	mg/L	0.0015	0.0010	0.0013	0.0005	0.003	3	0	0.003	0.0005	100.00
	Fluoride	1	mg/L	1.0633	1.0500	0.1106	0.96	1.18	3	0	1.18	0.96	100.00
	Iodine	NA	mg/L	0.0100	0.0100	0.0000	0.01	0.01	3	0	0.01	0.01	100.00
	Iron	0.3	mg/L	0.0067	0.0050	0.0029	0.005	0.01	3	0	0.01	0.005	100.00
	Lead	0.01	mg/L	0.0001	0.0001	0.0000	0.0001	0.0001	3	0	0.0001	0.0001	100.00
	Magnesium	10000	mg/L	0.6967	0.6800	0.1258	0.58	0.83	3	0	0.83	0.58	100.00
	Manganese	0.5	mg/L	0.0005	0.0004	0.0002	0.0003	0.0007	3	0	0.0007	0.0003	100.00
	Mercury	0.001	mg/L	0.0004	0.0004	0.0000	0.0004	0.0004	3	0	0.0004	0.0004	100.00
	Molybdenum	0.05	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Nickel	0.02	mg/L	0.0002	0.0002	0.0000	0.0002	0.0002	3	0	0.0002	0.0002	100.00
	Nitrate	50	mg/L	0.5000	0.5000	0.0000	0.5	0.5	3	0	0.5	0.5	100.00
	Nitrite	3	mg/L	0.0500	0.0500	0.0000	0.05	0.05	3	0	0.05	0.05	100.00
	pH	6.5 - 8.5		7.8333	7.6000	0.4933	7.5	8.4	3	0	8.4	7.5	100.00
	Selenium	0.01	mg/L	0.0035	0.0035	0.0000	0.0035	0.0035	3	0	0.0035	0.0035	100.00
	Silver	0.1	mg/L	0.0001	0.0001	0.0000	0.0001	0.0001	3	0	0.0001	0.0001	100.00
	Sodium	180	mg/L	18.6667	18.0000	5.0332	14	24	3	0	24	14	100.00
	Sulfate	250	mg/L	17.6667	18.0000	1.5275	16	19	3	0	19	16	100.00
	Total Dissolved Solids (TDS)	10000	mg/L	47.0000	48.0000	2.6458	44	49	3	0	49	44	100.00
	Total Hardness as CaCO <sub>3</sub>	10000	mg/L	6.5333	6.3000	0.5859	6.1	7.2	3	0	7.2	6.1	100.00
	True Colour	15	Hazen Units (HU)	0.8333	1.0000	0.2887	0.5	1	3	0	1	0.5	100.00
	Turbidity	5	NTU	0.2500	0.3000	0.1803	0.05	0.4	3	0	0.4	0.05	100.00
	Uranium	0.017	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	3	0	0.00005	0.00005	100.00
	Zinc	3	mg/L	0.0067	0.0050	0.0029	0.005	0.01	3	0	0.01	0.005	100.00
Fluoride Barcode	Fluoride	1.5	mg/L	0.9306	0.8900	0.1595	0.56	1.17	17	0	1.17	0.56	100.00
	Fluoride (WU result)	1.5	mg/L	1.0129	1.0000	0.1317	0.75	1.27	17	0	1.27	0.75	100.00
	Fluoride Ratio	0.8 - 1.2		1.1041	1.1200	0.1297	0.87	1.34	17	3	1.34	0.87	82.35
Microbiology	E. coli	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	73	0	0	0	100.00
	Free Chlorine	0.2 - 5	mg/L	0.5845	0.5600	0.2065	0.11	1.22	73	3	0.93	0.2	95.89
	pH	6.5 - 8.5		7.3626	7.3000	0.4467	6.48	8.32	73	1	8.28	6.61	98.63
	Temperature	30	C	16.4147	16.5000	4.0385	0.86	23.8	72	0	22.2	11.2	100.00
	Total Chlorine	5	mg/L	0.6850	0.6800	0.2142	0.18	1.32	73	0	1.02	0.29	100.00
	Total Coliforms	0	mpn/100 mL	0.7671	0.0000	6.5543	0	56	73	1	0	0	98.63
	Turbidity	5	NTU	0.3137	0.1700	0.8881	0.02	7.46	73	1	0.63	0.03	98.63



Table 13 Tumut Verification Monitoring

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
Chemistry	Aluminium	0.2	mg/L	0.0150	0.0100	0.0084	0.005	0.04	18	0	0.04	0.005	100.00
	Antimony	0.003	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	18	0	0.00005	0.00005	100.00
	Arsenic	0.01	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	18	0	0.0005	0.0005	100.00
	Barium	2	mg/L	0.0074	0.0072	0.0008	0.0064	0.0093	18	0	0.0093	0.0064	100.00
	Boron	4	mg/L	0.0024	0.0024	0.0006	0.0013	0.0046	18	0	0.0046	0.0013	100.00
	Cadmium	0.002	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	18	0	0.00005	0.00005	100.00
	Calcium	10000	mg/L	4.0222	4.1500	0.6404	2.8	4.9	18	0	4.9	2.8	100.00
	Chloride	250.	mg/L	3.6667	4.0000	0.6860	3	5	18	0	5	3	100.00
	Chromium	0.05	mg/L	0.0006	0.0005	0.0002	0.0005	0.001	18	0	0.001	0.0005	100.00
	Copper	2	mg/L	0.0136	0.0090	0.0179	0.002	0.079	18	0	0.079	0.002	100.00
	Fluoride	1.5	mg/L	0.9467	0.9550	0.0696	0.82	1.07	18	0	1.07	0.82	100.00
	Iodine	NA	mg/L	0.0106	0.0100	0.0024	0.01	0.02	18	0	0.02	0.01	100.00
	Iron	0.3	mg/L	0.0064	0.0050	0.0023	0.005	0.01	18	0	0.01	0.005	100.00
	Lead	0.01	mg/L	0.0002	0.0001	0.0002	0.0001	0.0008	18	0	0.0008	0.0001	100.00
	Magnesium	10000	mg/L	1.3533	1.2600	0.2416	1.04	1.89	18	0	1.89	1.04	100.00
	Manganese	0.5	mg/L	0.0019	0.0013	0.0014	0.00015	0.005	18	0	0.005	0.00015	100.00
	Mercury	0.001	mg/L	0.0004	0.0004	0.0000	0.0004	0.0004	18	0	0.0004	0.0004	100.00
	Molybdenum	0.05	mg/L	0.0004	0.0002	0.0004	0.0001	0.0017	18	0	0.0017	0.0001	100.00
	Nickel	0.02	mg/L	0.0013	0.0006	0.0014	0.0002	0.0053	18	0	0.0053	0.0002	100.00
	Nitrate	50	mg/L	0.6944	0.5000	0.2508	0.5	1	18	0	1	0.5	100.00
	Nitrite	3	mg/L	0.0500	0.0500	0.0000	0.05	0.05	18	0	0.05	0.05	100.00
	pH	6.5 - 8.5		7.4222	7.4000	0.1215	7.2	7.6	18	0	7.6	7.2	100.00
	Selenium	0.01	mg/L	0.0035	0.0035	0.0000	0.0035	0.0035	18	0	0.0035	0.0035	100.00
	Silver	0.1	mg/L	0.0001	0.0001	0.0000	0.0001	0.0001	18	0	0.0001	0.0001	100.00
	Sodium	180	mg/L	5.3333	5.0000	0.8402	4	7	18	0	7	4	100.00
	Sulfate	250	mg/L	1.0000	1.0000	0.0000	1	1	18	0	1	1	100.00
	Total Dissolved Solids (TDS)	10000	mg/L	25.1667	25.0000	3.2222	20	31	18	0	31	20	100.00
	Total Hardness as CaCO <sub>3</sub>	10000	mg/L	15.6222	15.3000	2.1518	11.7	19.4	18	0	19.4	11.7	100.00
	True Colour	15	Hazen Units (HU)	0.7500	0.5000	0.3930	0.5	2	18	0	2	0.5	100.00
	Turbidity	5	NTU	0.3889	0.2000	0.3935	0.05	1.2	18	0	1.2	0.05	100.00
	Uranium	0.017	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	18	0	0.00005	0.00005	100.00
	Zinc	3	mg/L	0.0083	0.0100	0.0038	0.005	0.02	18	0	0.02	0.005	100.00
Microbiology	E. coli	0	mpn/100 mL	0.0000	0.0000	0.0000	0	0	111	0	0	0	100.00
	Free Chlorine	0.2 - 5	mg/L	0.7721	0.7600	0.2316	0.11	1.35	111	2	1.25	0.35	98.20
	pH	6.5 - 8.5		7.6092	7.6000	0.2451	7.05	8.45	108	0	8	7.22	100.00
	Total Chlorine	5	mg/L	0.8932	0.8700	0.2440	0.17	1.59	111	0	1.33	0.51	100.00
	Total Coliforms	0	mpn/100 mL	0.0631	0.0000	0.4914	0	5	111	3	0	0	97.30
	Turbidity	5	NTU	0.1309	0.1000	0.1087	0	0.48	106	0	0.36	0	100.00