Cowra Council

Drinking Water Management System

Cowra Council

Date: 2 May 2025

DOCUMENT	Drinking Water Management System		
WATER UTILITY	Cowra Council		
DOCUMENT OWNER	Manager Cowra Works		
VERSION	**AUTHOR**	**REVIEW**	**DATE**
3.0	S. Hinton	Cowra Council NSW Health DPE Water	11/12/2023
3.1	S. Hinton	Cowra Council NSW Health DPE Water	25/10/2024
3.2	G Williams	Cowra Council	02/05/2025

EXECUTIVE SUMMARY

Plan Purpose

The NSW *Public Health Act 2010* (the 'Act') was passed by Parliament at the end of 2010. The Act (and its supporting Regulation) includes the requirement for water suppliers to produce a Quality Assurance Program (QAP), which is based on the *Framework for Management of Drinking Water Quality* (the 'Framework') in the *Australian Drinking Water Guidelines* (NHMRC/NRMMC, 2011). For the purposes of implementation, this QAP is termed a Risk-Based Drinking Water Management System (DWMS). Water utilities in NSW were required to develop and adhere to a DWMS by 1 September 2014. The Regulation requires a water supplier to provide its most recent DWMS to NSW Health.

This document forms Cowra Shire Council's response to the development of a DWMS and is based on the 12 Elements of the ADWG Framework. This DWMS is supported by a range of procedures, registers, data management systems, flow diagrams, process and instrumentation diagrams, etc., which are referenced at the appropriate points in this document.

Critical Control Points

Cowra Shire Council has the following CCPs:

Cowra WTP

Critical Control Point	Controls	Monitoring Parameter	How Measured	Operating Target	Alert Range	Critical Limit
Conventional Filtration	Pathogens	Turbidity	Continuous online (individual filters)	<0.2 NTU	0.2 - 0.5 NTU	>0.5 NTU (for 15 minutes)
Primary Disinfection	Chlorine-sensitive pathogens; chlorine	Free chlorine	Continuous online (R1); grab samples	1.8-3.0 mg/L	1.5 - 1.8mg/L	<1.5mg/L, >5.0mg/L
Fluoridation	Fluoride	Fluoride	Continuous online (R1); grab samples	0.95-1.05 mg/L	<0.95mg/L, >1.05mg/L	>1.5mg/L and >4.0mg/L

Darbys Falls WTP

Critical Control Point	Controls	Monitoring Parameter	How Measured	Operating Target	Alert Range	Critical Limit
Membrane Filtration	Pathogens	Turbidity	Continuous online	≤0.1 NTU	0.1–0.14 NTU	>0.15 NTU
	Pathogens	Membrane Integrity	Pressure decay test (each day WTP attended)	PDT pass	N/A	PDT fail
Primary Disinfection	Chlorine-sensitive pathogens; chlorine	Free chlorine	Continuous online (filtered water tank); grab samples	2.0mg/L	<1.8mg/L, >3.0mg/L	<1.4mg/L, >5.0mg/L (>20 mins)

Wyangala WTP

Critical Control Point	Controls	Monitoring Parameter	How Measured	Operating Target	Alert Range	Critical Limit
Membrane Filtration	Pathogens	Turbidity	Continuous online	≤0.1 NTU	0.1 - 0.14 NTU	>0.15 NTU
	Pathogens	Membrane Integrity	Pressure decay test (daily)	PDT pass	N/A	PDT fail
UV Disinfection	Pathogens	UV Dose	Calculated on SCADA via intensity, flow and UV Transmittance	TBC	TBC	<22mJ/cm^2 (TBC – may be 40)
Chlorine Disinfection	Chlorine-sensitive pathogens; chlorine	Free chlorine	Continuous online (filtered water tank); grab samples	TBC	TBC	TBC

All Schemes

Critical Control Point	Controls	Monitoring Parameter	How Measured	Operating Target	Alert Limit	Critical Limit
Reservoir Integrity	Pathogens	Integrity	Inspection	No evidence of breach or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of contaminant in reservoir / significant breach of integrity that cannot be resolved in normal timeframes

Incidents and Emergencies

Incidents and emergencies are managed as follows:

+ Recognised and reported internally (through staff training)
+ Classified based on severity/risk
+ Managed and reported externally in accordance with the incident classification
+ Through following the relevant NSW Health incident response protocol or other applicable guidance

CCP exceedances or other incidents with potential to impact public health must be reported to the Bathurst Public Health Unit immediately on 02 6330 5880.

Improvement Plan

An improvement plan is presented in Table 37.

CONTENTS

APPENDICES

1.INTRODUCTION AND BACKGROUND

The *Public Health Act 2010* (NSW) ('the Act') requires drinking water suppliers to establish, and adhere to, a 'quality assurance program' (QAP) that complies with the Public Health Regulation 2012 (NSW) ('the Regulation'). The Regulation requires water suppliers to implement a QAP consistent with the Framework for Management of Drinking Water Quality ('the Framework') in the Australian Drinking Water Guidelines (ADWG) 2011 (NHMRC/NRMMC 2011). The QAP will be referred to as a Drinking Water Management System ('DWMS') and water utilities in NSW were required to have a DWMS in place by 1 September 2014. The Regulation requires a water supplier to provide its most recent DWMS to NSW Health.

As stated in the ADWG:

> *"The most effective means of assuring drinking water quality and the protection of public health is through adoption of a preventive management approach that encompasses all steps in water production from catchment to consumer."*

The NSW Government has encompassed this philosophy within the legislation. The Act includes the following requirement:

> *Section 25 Quality assurance programs*
> *(1) A supplier of drinking water must establish, and adhere to, a quality assurance program that complies with the requirements prescribed by the regulations.*

The Regulation states the following:

> Part 5 Safety measures for drinking water
>
> *Clause 34 Quality assurance programs*
> *(1) For the purposes of section 25 (1) of the Act, a quality assurance program must address the elements of the Framework for Management of Drinking Water Quality (as set out in the Australian Drinking Water Guidelines published by the National Health and Medical Research Council) that are relevant to the operations of the supplier of drinking water concerned.*
> *(2) A supplier of drinking water must provide the Director-General with a copy of its most recent quality assurance program.*
> *(3) The Director-General may arrange for the review of a quality assurance program of a supplier of drinking water at any time.*

In developing a management system, water suppliers should undertake a risk assessment from catchment to consumer and develop critical control points to ensure that unsafe water is not released into the distribution system and also, that treated water is protected from contamination during distribution.

This DWMS forms Cowra Shire Council's (CSC) response to the requirement for a QAP. This DWMS is a risk-based system which has been developed based on the 12 Elements, 32 Components and 76 Actions of the Framework and the *NSW Guidelines for Drinking Water Management Systems 2013* (NSW Health/ NSW Office of Water 2013). The DWMS is supported by a range of procedures, registers, drawings, etc., which are referenced at appropriate points in this document.

1.1 Overview of the Framework

The ADWG set out a holistic approach to drinking water management including understanding where sources of contamination may arise and how contamination may find its way to the consumer. The approach is termed the *Framework for Management of Drinking Water Quality* ('the Framework'; Figure 1).

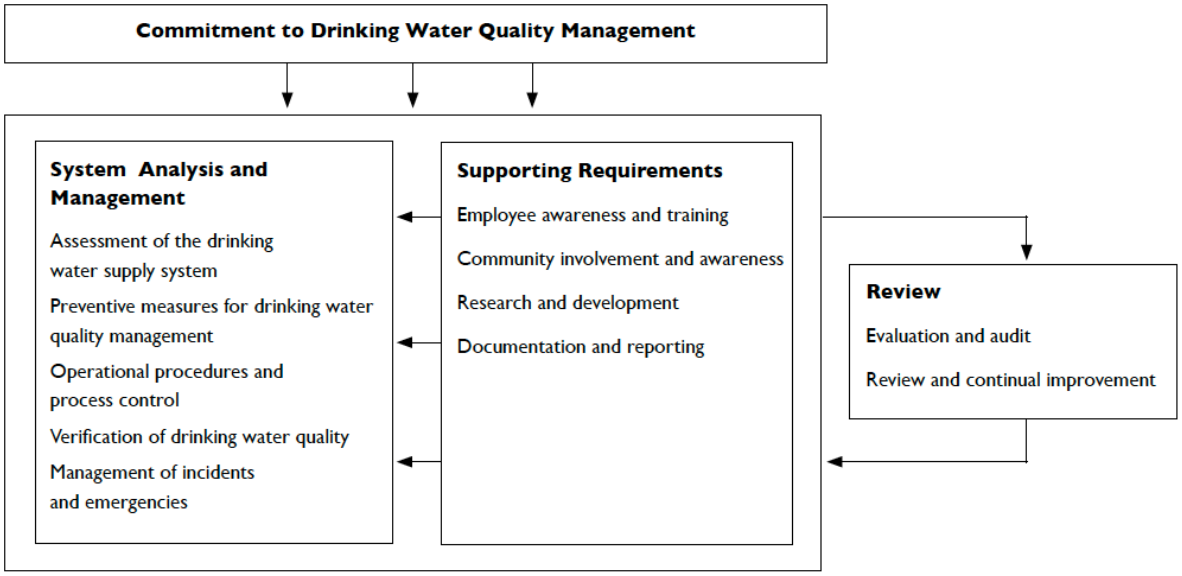

Figure 1: Framework for Management of Drinking Water Quality (NHMRC/NRMMC 2011)

ADWG (2011) sets out six guiding principles for drinking water management as follows:

1. The greatest risks to consumers of drinking water are pathogenic microorganisms. Protection of water sources and treatment are of paramount importance and must never be compromised.
2. The drinking water system must have, and continuously maintain, robust multiple barriers appropriate to the level of potential contamination facing the raw water supply.
3. Any sudden or extreme change in water quality, flow or environmental conditions (e.g. extreme rainfall or flooding) should arouse suspicion that drinking water might become contaminated.
4. System operators must be able to respond quickly and effectively to adverse monitoring signals.
5. System operators must maintain a personal sense of responsibility and dedication to providing consumers with safe water, and should never ignore a consumer complaint about water quality.
6. Ensuring drinking water safety and quality requires the application of a considered risk management approach.

1.2 Scope

This DWMS applies to the operation and maintenance of the following drinking water supply systems (described in detail in 3.1):

+ Cowra
+ Darbys Falls
+ Central Tablelands Water (Gooloogong, TMH and Pearce's Scheme)
+ Wyangala

Water from the Central Tablelands Supply System is treated by infrastructure owned, operated, and maintained by Central Tablelands Water (CTW) and therefore it does not receive detailed attention in this DWMS, other than its potential impact on Cowra Shire Council's water supply systems.

The non-potable water distribution systems operated in Billimari are not intended for drinking, and therefore, other than its potential effect on the drinking water systems, it does not receive detailed attention in this DWMS.

1.3 Document Control

This DWMS document is owned by the Manager Cowra Works and approved by the Director – Infrastructure and Operations. The Manager Cowra Works is responsible for ensuring that the DWMS is reviewed annually and on system change.

1.4 DWMS Responsibilities and Authorities

CSC employees are encouraged to participate in decisions that affect their jobs and areas of responsibility. This participation fosters a sense of ownership for decisions and their consequences. Specific drinking water management responsibilities and authorities are described in position descriptions, which are maintained by CSC's Human Resources department. The main responsibilities and authorities related to the DWMS are listed below.

1.4.1 All Managers and Employees

All managers and employees involved in the supply of drinking water are responsible for understanding, implementing, maintaining and continuously improving the DWMS, as well as:

+ Being aware of:
  - The Drinking Water Quality Policy
  - Characteristics of the water supply system and preventive strategies in place throughout the system
  - Regulatory and legislative requirements
  - Roles and responsibilities of employees and departments
  - How their actions can impact on water quality and public health.

1.4.2 Councillors

Councillors are responsible for, and are authorised to review and approve the Drinking Water Quality Policy annually. Councillors also have overall responsibility for the management of drinking water quality, but the day-to-day requirements of this are delegated to the relevant managers.

1.4.3 General Manager

The General Manager has the authority to approve annual budgets, including those for water services.

1.4.4 Director – Infrastructure and Operations

The Director – Infrastructure and Operations has the authority to approve annual budgets and individual purchase orders.

1.4.5 Manager Cowra Works

The Manager Cowra Works is responsible for overseeing engineering works and approving annual budgets, including those for water services. This position is also responsible for:

+ Supporting and promoting the Drinking Water Quality Policy and the establishment and continual improvement of the CSC DWMS
+ Maintaining oversight of the effectiveness of the DWMS
+ Evaluating the need for change
+ Ensuring the following key elements of the DWMS are developed and implemented:
  - Processes for the assessment of the drinking water supply system and preventive measures for drinking water quality management, with a focus on critical control points
  - Operational procedures, process control and verification of drinking water quality
  - Management of incidents and emergencies
  - Processes to ensure that employees, including contractors, maintain the appropriate experience and qualifications
  - Processes and communication procedures to increase employees' and contractors' awareness of and participation in drinking water quality management
  - Processes to identify, communicate and review compliance requirements
  - Processes for identifying all stakeholders who could affect, or be affected by, council decisions or activities on the water supply systems
  - Processes (internal and external audits) for the systematic evaluation of activities and programs to confirm that objectives are met
  - Processes to identify and act on drinking water quality improvements, including communication and monitoring of effectiveness of improvements
+ Management review of the DWMS and in particular:
  - Reviewing reports from audits, drinking water quality performance and previous management review and authorising implementation of improvements where relevant
  - Considering concerns of consumers, regulatory and other stakeholders
  - Evaluating the suitability of the Drinking Water Quality Policy, objectives and preventive strategies in relation to changing internal and external conditions.

In practice, the Manager Cowra Works would likely delegate a number of responsibilities to the Water & Wastewater Engineer.

1.4.6 Water & Wastewater Engineer

The Water & Wastewater Engineer supports the Manager Cowra Works in implementing the DWMS as described above. Among other responsibilities, this position is authorised to:

+ Approve changes to standard operating procedures
+ Approve process modifications to water treatment and supply works.

1.4.7 Water Treatment Supervisor

The Water Treatment Supervisor is responsible for:

+ Maintenance of preventive measures as identified in the water quality risk assessments
+ Implementation of operational procedures, process control and verification of drinking water quality
+ Asset management/maintenance plans
+ SCADA response (interpreting and responding to SCADA alarms)
+ Management of SCADA
+ Management of laboratory equipment/functions

+ Work planning, prioritisation and scheduling (both proactive and reactive)
+ Primary response to significant incidents
+ Field support and customer liaison.

The Water Treatment Supervisor is authorised to:

+ Instruct operators on approved procedures.

1.4.8 Water Operators

Water Operators are responsible for:

+ Operation and minor maintenance of the water treatment facilities with a focus on the correct operation of the identified CCPs and their supporting programs
+ Operation and maintenance of laboratory functions to meet operational and reporting needs
+ Primary response to incidents
+ Bringing water quality issues to management's attention when they become aware of those issues
+ Awareness of their actions in protecting drinking water quality.

2.COMMITMENT TO DRINKING WATER QUALITY MANAGEMENT

2.1 Drinking Water Quality Policy

CSC has developed a Drinking Water Quality Policy, as outlined below:

Cowra Shire Council is committed to managing its water supply effectively to provide a safe, high-quality drinking water that consistently meets the current version of NHMRC/NRMMC Australian Drinking Water Guidelines, and consumer and other regulatory requirements.

To achieve this, in partnerships with stakeholders and relevant agencies, Cowra Shire Council will:

+ Manage water quality at all points along the delivery chain from source water to the consumer;
+ Use a risk-based approach in which potential threats to water quality are identified and balanced;
+ Integrate the needs and expectations of our consumers, stakeholders, regulators and employees into our planning where possible and appropriate;
+ Establish regular monitoring of the quality of drinking water and effective reporting mechanisms to provide relevant and timely information, and promote confidence in the water supply and its management;
+ Develop appropriate contingency planning and incident response capability;
+ Participate in appropriate research and development activities to ensure continued understanding of drinking water quality issues and performance;
+ Contribute to the debate on setting industry regulations and guidelines, and other standards relevant to public health and the water cycle;
+ Continually improve our practices by assessing performance against corporate commitments and stakeholder expectations.

Cowra Shire Council will implement and maintain a drinking water quality management system consistent with the Australian Drinking Water Guidelines to manage effectively the risks to drinking water quality.

All managers and employees involved in the supply of drinking water are responsible for understanding, implementing, maintaining and continuously improving the drinking water management system.

At a corporate level, CSC indicates their commitment to water quality via infrastructure delivery programs and Operational Plans, which are regularly reviewed and available for public consultation. Final documents are made available on CSC's website:

T2.1 Maintain and improve shire's water supply network to meet consumer demand and satisfy health requirements at the lowest life-cycle cost

CSC's corporate mission statement as stated in their Strategic Business Plan for Water Supply and Sewerage Services 2014 is:

Provide water supply and sewerage services to meet the current and future community needs in an environmentally and financially sustainable manner

This document also outlines CSC's adopted levels of service for water supply.

At a WTP level, CSC indicates their commitment to water quality via a Charter of Responsibilities, which is displayed at Cowra WTP. The Charter of Responsibilities includes the following commitments:

+ Water Treatment Plant
  - Produce safe drinking water at all times
  - Produce the best quality water from the existing system
+ Operators
  - Their actions do not compromise the production of safe drinking water at any time
  - They actively provide feedback to supervisor/management when they become aware of shortcomings in the treatment sequence that may contribute to the production of unsafe drinking water
  - They are alert to changes in the system that they operate
  - They act to produce water that is aesthetically pleasing
  - Operators must ensure that each step in the process of the WTP is monitored effectively and optimised

Table 1: Summary of Cowra Shire Council Levels of Service

Description	Unit	Level of Service	
		Current Target	Future Target
SUPPLY INTERRUPTIONS TO CUSTOMERS			
Planned			
- Notice given to domestic customers*	Days	1	1
- Notice given to commercial customers*	Days	8	8
- Notice given to industrial customers*	Days	8	8
- Maximum duration	Hours/event	8	8
- Frequency	No./year/customer	1	1
Unplanned			
- Water man breaks	No./100km/year	15	10
- Average duration	Hours/event	8	8
- Frequency	No. interruptions/ year/ system	28	28
Response Times for Service Interruptions*			
Time to have staff on-site commence work after notification			
Priority 1 (Failure to maintain continuity or quality of supply to a large number of customers or to a critical user at a critical time)			
All Customers			
- 90% of times	Minutes	60	60
- 100% of times	Minutes	120	120
Priority 2 (Failure to maintain continuity or quality of supply to a small number of customers or to a non-critical user at a non-critical time)			
All Customers			
- 90% of times	Minutes	120	120
- 100% of times	Minutes	240	240
Priority 3 (Failure to maintain continuity or quality of supply to a single customer)			
All Customers			
- 90% of times	Minutes	180	180
- 100% of times	Minutes	240	240
CUSTOMER FEEDBACK/ COMPLAINTS@ (identified in the CRM system)			
Complaints Received	No./ 1000 connections		
- Water quality complaints		5	5
- Service complaints		10	10
- Billing and account complaints		2	1
Response Times for Feedback/ Complaints			
% calls answered by an operator within 30 seconds@*	%	100	100
General complaints and inquiries			
- Written complaints*	Working days	2	7
- Email	Working days	-	7
- Personal/ oral complaints*	Working days	9	7

Description	Unit	Level of Service	
		Current Target	Future Target
ENVIRONMENT			
Net greenhouse gas emissions@	Tonnes CO_2 equivalent/year	310	310
WATER QUALITY (POTABLE WATER) Compliance with ADWG, NHMRC & NRMMC, 2011)			
Microbial Parameters			
- Total coliforms	CFU/100mL	0	0
- *E. coli*	CFU/100mL	0	0
- Sampling frequency	Samples/month	12	12
Physical-chemical Parameters*			
- pH	Unit	6.5-8.5	6.5-8.5
- Colour	HU	15	15
- Turbidity	NTU	5	5
- Fluoride	mg/L	1.5	1.5
- Free available chlorine (WTP)	mg/L	1	1
- Free available chlorine (Retic.)	mg/L	0.2	0.2
- Iron	mg/L	0.3	0.3
- Manganese	mg/L	0.5	0.5
- Sampling and analysis frequency	No./ year	12	12
Percentage Compliance			
Zones achieving compliance with	% compliance		
- Physical parameters		100	100
- Chemical parameters@		100	100
- Microbiological parameters@		100	100

@ - NWI Performance Indicators; * - Times apply for 95% of incidents

2.2 Regulatory and Formal Requirements

Regulatory and formal requirements have been compiled into Table 2. The register will be reviewed at least annually as part of the overall DWMS review.

CSC staff are trained in their formal responsibilities through internal and external training, including courses run by the DPE Water, and documented toolbox meetings. CSC has also committed to running annual refresher training in drinking water responsibilities.

Table 2: Regulatory and formal requirements for supply of drinking water

Regulatory or Formal Requirement	Relevance to Drinking Water Quality	Agency
Commonwealth Legislation		
Water Act 2007	Provides for the management of the ground and surface water resources of the Murray-Darling Basin, with particular focus on managing extractions to "protect, restore and provide for the ecological values and ecosystem services of the Murray-Darling Basin".	Murray Darling Basin Authority
Competition and Consumer Act 2010	Replaces the Trade Practices Act 1974 and incorporates Schedule 2 - The Australian Consumer Law. As a "seller" of water, the local council is subject to provisions of Consumer transactions and Consumer guarantees, which guarantees that the goods supplied are reasonably fit for purpose.	Australian Competition and Consumer Commission
NSW Legislation		
Catchment Management Authorities Act 2003	Natural resource management, from planning to operations, is to be undertaken at the catchment level. State-wide standards are to be applied. Catchment Action Plans are used to define key themes for each catchment, each with specific catchment and management targets.	Lachlan Environmental Water Advisory Group (EWAG). Natural Resources Commission
Environmental Planning & Assessment Act 1979	Requires that the environmental impacts of projects be studied at all stages on the basis of scale, location and performance. Under Part 3 of the Act, Local Environmental Plans (LEPs) are developed to establish what forms of development and land use are permissible and/or prohibited.	NSW Department of Planning and Environment (Water)
Local Government Act 1993	Local councils have the responsibility for the provision of water supply to consumers, in accordance with the NSW Best-Practice Management of Water Supply and Sewerage Guidelines.	NSW Office of Local Government
NSW Groundwater Quality Protection Policy 1998	Manages groundwater resources for sustainable economic, social and environmental uses, with a specific principle to protect town water supplies against contamination. A key recommendation is to develop wellhead protection plans.	NSW Department of Planning and Environment (Water)
Protection of the Environment (Operations) Act 1997	Requires licences for activities with potentially significant environmental impacts. Prosecution may be carried out under this act for any chemical leakage, spill, and disposal of wastes or similar.	NSW EPA
Public Health Act 2010 *Public Health Regulation 2022*	Requires all water authorities to develop Drinking Water Management Systems. Bestows certain powers on NSW Health with respect to provision of safe drinking water, including ability to enter treatment facilities, order mandatory testing or obtain information about the drinking water and powers to close a water supply. Council is required to issue public advice regarding the water supply when directed by the Chief Health Officer of NSW Health.	NSW Health
Water Management Act 2000	Provides the basis for water planning, the allocation of water resources and water access entitlements. Licences for extraction for the three systems are governed by the provisions of this Act.	NSW Department of Planning and Environment (Water)
Work, Health & Safety Act 2011	Specifies conditions for storage and handling of chemicals on-site at water treatment plants.	SafeWork NSW
Plumbing and Drainage Act 2011 *Plumbing and Drainage Regulation 2012*	Largely for management of the distribution system including legislative requirements for plumbing and drainage works	Local governments
Guidelines and Programs		
Australian Drinking Water Guidelines 2011 (Updated Sep. 2022)	Ensures the accountability of drinking water managers and operators and health authorities and auditors for the supply of safe, good quality drinking water to consumers.	NSW Health

Regulatory or Formal Requirement	Relevance to Drinking Water Quality	Agency
NSW Best-Practice Management of Water Supply and Sewerage Guidelines 2007	Provides for appropriate, affordable and cost- effective services to meet community needs while protecting public health and the environment and making best use of regional resources. Requires a Strategic Business Plan (SBP), including a Financial Plan and associated asset management plans, reviewed and updated every four years; a 30-year Integrated Water Cycle Management (IWCM) plan. Council has an IWCM, but not yet an SBP for their water business.	NSW Department of Planning and Environment (Water)
NSW Health Drinking Water Monitoring Program 2005	NSW Health provides analysis of drinking water samples for water utilities, providing an independent analysis of water at point of supply.	NSW Health
NSW Health Response Protocol for management of microbial quality of drinking water	Guides Public Health Units and water utilities in their joint response to rapidly changing source water quality, treatment failure or microbial contamination. https://www.health.nsw.gov.au/environment/water/Pages/nswhrp-microbiological.aspx	NSW Health
NSW Health Response Protocol for management of physical and chemical quality	Guides Public Health Units and water utilities in their joint response following the detection of physical and chemical water characteristics that exceed the Guidelines. Aesthetic and health related guideline values are considered. https://www.health.nsw.gov.au/environment/water/Pages/nswhrp-chemical.aspx	NSW Health
National Partnership Agreement on Water for the Future	The COAG Strategy on Water and Wastewater Services in Remote Communities in New South Wales aims to provide water infrastructure and build the capacity of the Council to improve the management and overall security of water in remote communities.	Australian Government NSW Department of Planning and Environment (Water)
AS/NZS 3500 Plumbing and Drainage Set	Largely for management of the distribution system including standards for plumbing and drainage issues	NSW Fair Trading
Plumbing Code of Australia	Specifications for plumbing in drinking water systems, to be complied with by administrators, plumbing Licensees, developers and property owners/occupiers.	NSW Fair Trading
Water Sharing Plan for the Great Artesian Basin (2020)	Governs the licensing of groundwater extraction in the Great Artesian Basin	NSW Department of Planning and Environment (Water) NSW Department of Natural Resources Access Regulator (NRAR) WaterNSW

2.3 Engaging Stakeholders

A list of drinking water stakeholders, along with their relevance to drinking water and primary contact details, has been compiled into a register, included below in Table 3. Council also distributes water to the Aboriginal community of Erambie under a service agreement with the Department of Planning and Environment (DPE). The roles and responsibilities of the Aboriginal community of Erambie, the Local Aboriginal Land Council Chief Executive Officer, Cowra Shire Council, the DPE and NSW Health are listed in Appendix 1.

The stakeholder table shall be reviewed at least annually as part of the overall DWMS review.

Table 3: DWMS Stakeholders

Stakeholder	Role in Drinking Water Quality Management	Areas of Communication
NSW Health (PHU)	Local advice on drinking water management and retrospective powers under the Public Health Act 2010 (NSW)	Local advice sought on drinking water management and liaison on disease outbreaks (if possible link to drinking water borne route)
NSW Health (Water Unit)	General advice on drinking water management and retrospective powers under the Public Health Act 2010 (NSW)	General advice sought on drinking water management
Department of Planning and Environment (Water)	Regulator for provisions under the Local Government Act 1993	Advice on drinking water management and water treatment in particular
Erambie Community	Refer to Appendix 1	Refer to Appendix 1
NSW Office of Environment and Heritage	Polluting activities regulator, advice on spills in catchment, environmental flows advice	Referral of concerns relating to pollution in source waters and environmental flows
WaterNSW and Department Planning and Environment (Water)	Utility activities regulator, water allocation and access issues	Licence, inspection reports, liaison over resource issues
Independent Pricing and Regulatory Tribunal (IPART)	Pricing of water	Representations on specific aspects of water management
Local Government and Shires Association	Provision of information relevant to drinking water production and management such as conferences and regulatory changes	Maintain professional relationship. Share knowledge
Council staff	Carriage and ownership of essential activities of the Drinking Water Management System	Communication on operations, maintenance
Central Tablelands Water	Supply reticulated water to Central Tablelands water supply system (Gooloogong, Pearce's Scheme and TMH)	Maintain professional relationships
National Health and Medical Research Council and National Resource Managers Ministerial Council	National drinking water guideline authors	Review and comment on revisions to guidelines
Water Services Association of Australia (WSAA)	Professional body	Use of, and contribution to the development of, standards and codes of practice
Water Directorate	Professional body	
Research and technical organisations (CRCs, universities, technical experts)	Sources of technical expertise and services	Maintain professional relationships Procure services
Industry peers (e.g. utilities of similar size)	Sources of technical expertise, peer review and benchmarking	Maintain professional relationships Procure services
Police/NSW Fire and Rescue	Control of emergency spills and site security issues	Support in control of site security Response to spills and bursts

Stakeholder	Role in Drinking Water Quality Management	Areas of Communication
Rural Fire Service/NSW Fire and Rescue	Response to emergencies (in particular bushfires)	Response to spills and bursts Response to emergencies such as bushfires
State Emergency Services	Response to emergencies	Response to spills and bursts & co-ordinate evacuations
Standards Australia	Professional body	Use of, and contribution to the development of, standards and codes of practice
Residents/ businesses within Catchment areas	Notify Council of changes in catchment. Potential to impact of source water quality.	Information sharing and education
Commercial and industrial customers	Those to whom safe, quality water is to be provided but whose operations may contaminate WSC water	Backflow prevention requirements including annual site inspections and check of test certificates
Drinking water customers	Those to whom safe, quality water is to be provided	Customer complaint follow up Customer contract Water Bills Internet (Council website and social media)
NSW Fair Trading	Water fitness for purpose and related trading issues	Liaison over water product issues
Local Emergency Management Committee	Coordinates response to local emergency, including public health emergencies	As described in Local Emergency Management Plan
Central NSW Joint Organisation (formerly CENTROC)	Advocates for and improves operational efficiencies of member councils	Publications and GMAC meetings

CSC's mechanisms for stakeholder engagement vary according to the type of stakeholder, but include:

+ Community consultation methods as listed in 9.1.
+ Liaison with regional DPE Water officer
+ Liaison with local Public Health Unit (PHU)
+ Attending various training, conferences and seminars with industry bodies
+ Coordinated response to emergency situations
+ Use of various water quality-related publications (e.g. ADWG, standards, codes)

3.ASSESSMENT OF THE DRINKING WATER SUPPLY SYSTEM

3.1 Water Supply System Analysis

3.1.1 Water Safety Team

The Water Safety Team responsible for development of the most recent version of this DWMS comprised of the personnel shown in Table 4.

Table 4: Water Safety Team

Organisation	Role
Cowra Shire Council	Director Infrastructure & Operations
	Manager Cowra Works
	Water Treatment Supervisor
	Water & Wastewater Engineer
	Water Operators (as required & subject to availability)
NSW Health	Water Unit Representative
	Public Health Unit Representative
DPE Water	Water & Sewer Inspector
DWMS Expert Consultant	Workshop Facilitator

The core Water Safety Team for ongoing implementation and maintenance of the DWMS consists of:

+ Manager Cowra Works
+ Water & Wastewater Engineer
+ Water Treatment Supervisor
+ Water Treatment Operators

The core Water Safety Team is supported by the local NSW Public Health Unit and local DPE Water & Sewerage Officer.

3.1.2 Water Supply Systems

Process flow diagrams (PFDs) of CSC's water supply systems were developed for the risk assessment workshops and are reviewed regularly as part of the DWMS review process. PFDs for each water treatment plant (WTP) were also developed, and are shown in the following sections.

The PFDs are supported by a number of diagrams and drawings, including:

+ General arrangement drawings of WTPs
+ Hydraulic profile drawings of WTPs
+ Piping and instrumentation diagrams of WTP equipment
+ GIS records of reticulation assets

PFDs are shown overleaf in

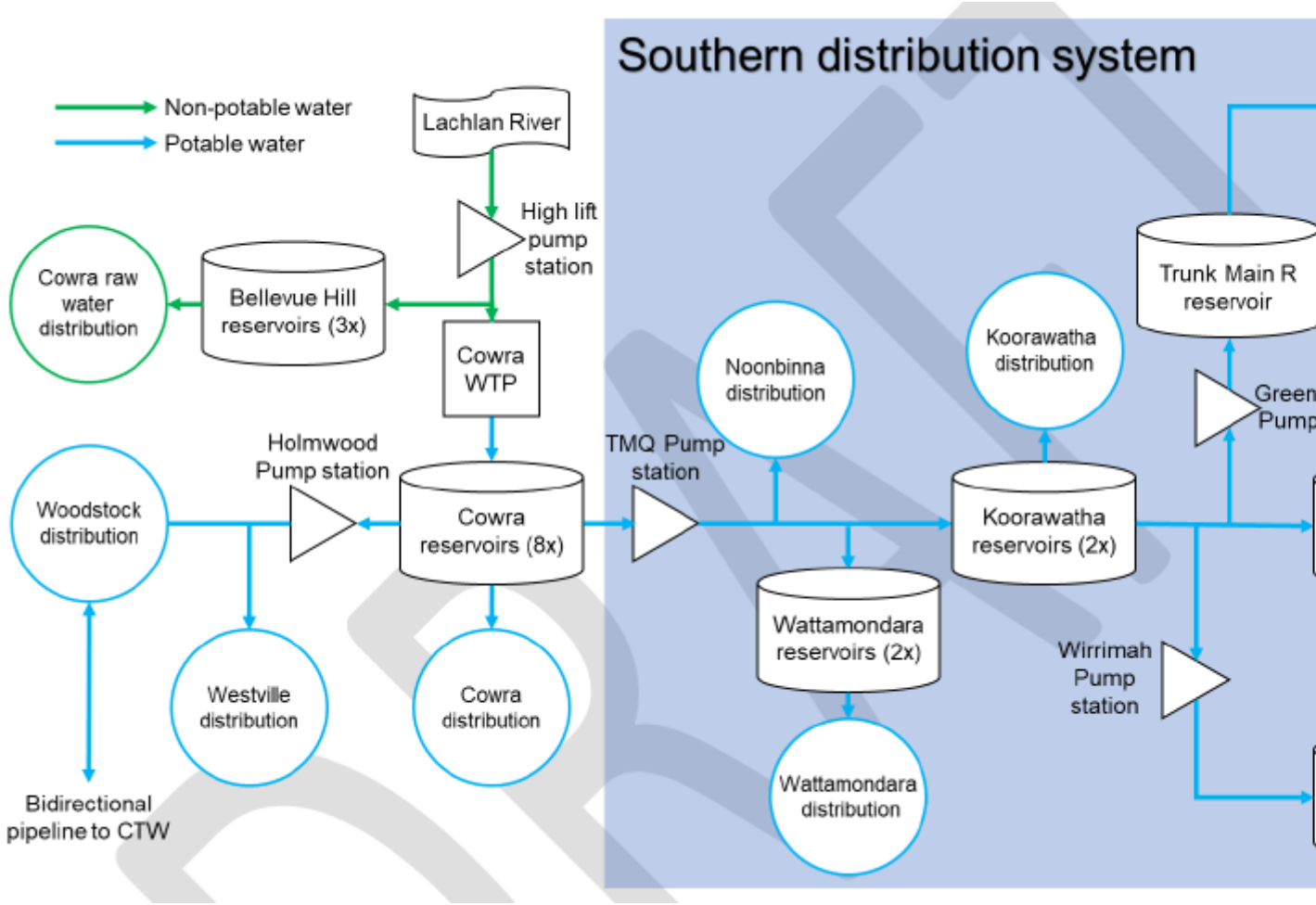

Figure 2 to Figure 8 and are accompanied by system description summaries in

Table 5 to Table 9.

Cowra Water Supply System

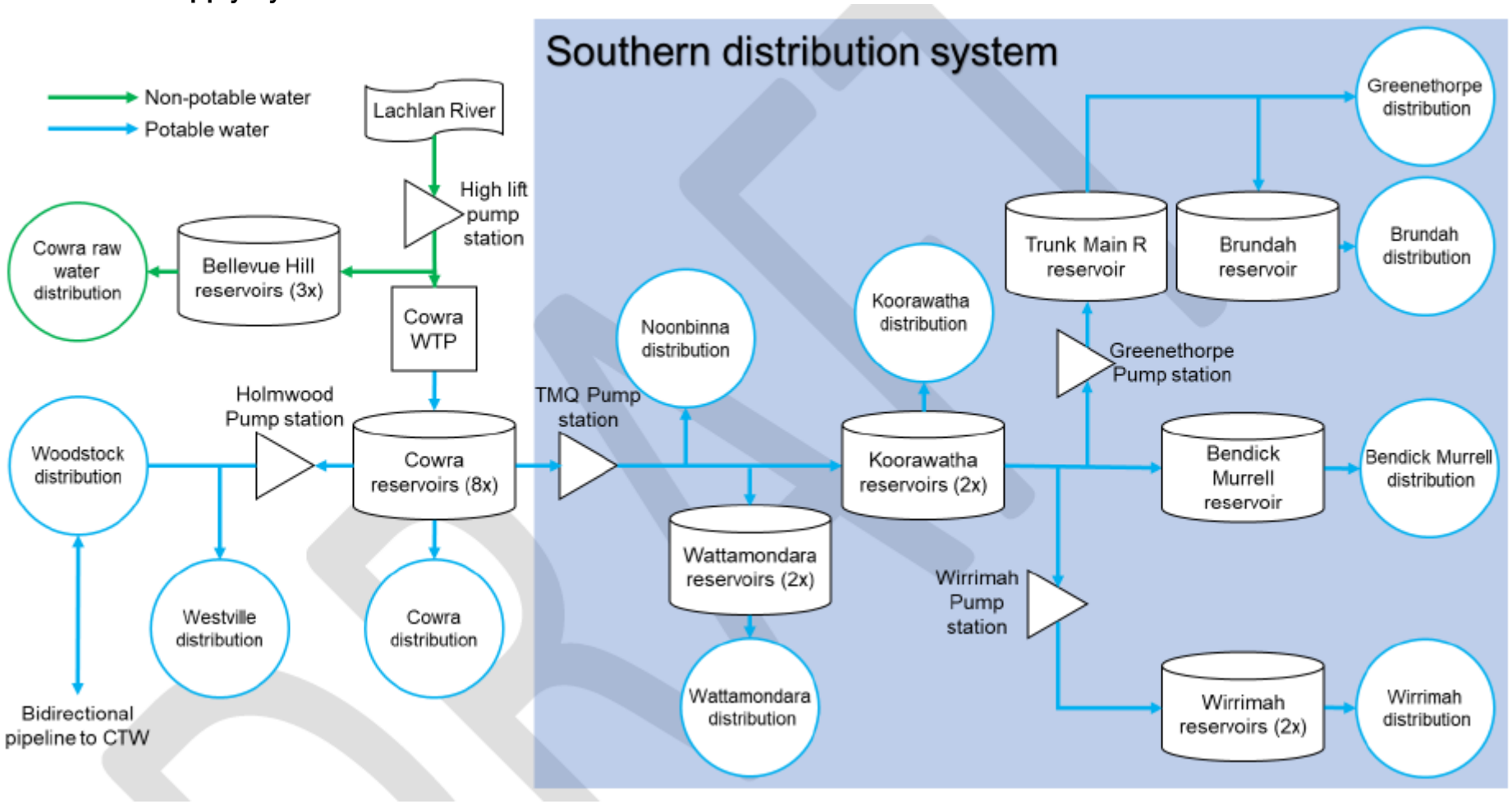

Figure 2: Conceptual Flow Diagram of Cowra Water Supply System

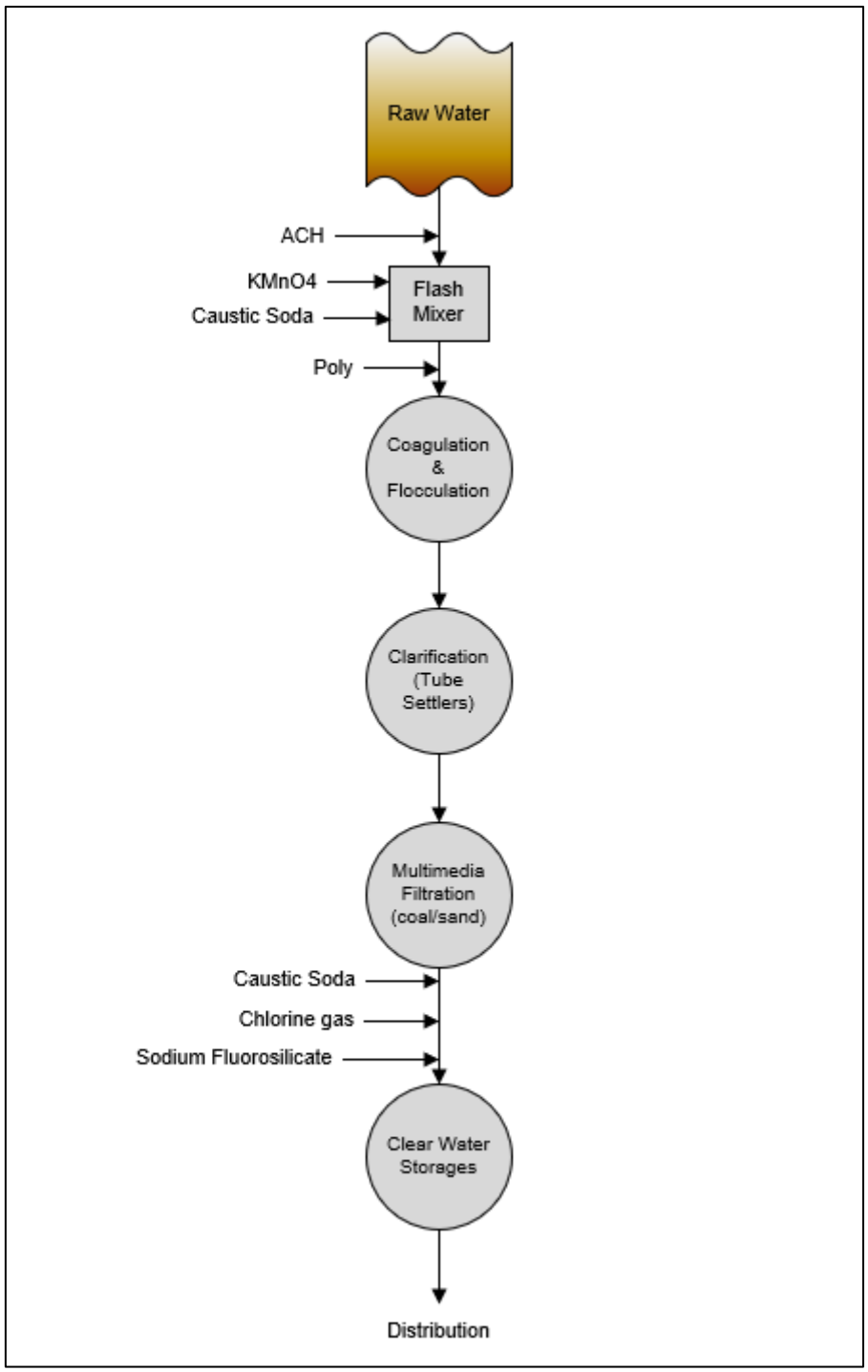

Figure 3: Conceptual Flow Diagram of Cowra WTP

Table 5: Cowra Water Supply Systems Summary

System Component	Description
Population supplied	9,750
Water source and catchment	Location: ▪ Lachlan River Land uses: ▪ Livestock grazing ▪ Cereal and feed crops ▪ Population centres Water quality: ▪ Moderate salinity (≈170-300 mg/L) Response to algal events coordinated by Central West Regional Algal Coordinating Committee (RACC), but note no history of algal blooms affecting Cowra WTP.
Water treatment	Raw water from the Lachlan River is treated at Cowra WTP as follows: ▪ Aluminium Chlorohydrate (ACH) dosing for coagulation ▪ Potassium permanganate (KMnO4) dosing for metals oxidation (Flash Mixer) ▪ Pre-coagulation caustic soda dosing for pH correction (Flash Mixer) ▪ Poly dosing ▪ Flocculation ▪ Clarification (tube settlers) ▪ Multi-media (coal/sand) filtration ▪ Post-filtration caustic soda dosing for pH correction and stabilisation ▪ Chlorination (chlorine gas) for disinfection ▪ Sodium fluorosilicate dosing for fluoridation
Storage after treatment	Treated water from the WTP is collected in the Cowra Reservoirs (11x).
Distribution of product	Flow by gravity from Cowra Reservoirs to Cowra reticulation. Pumped from Cowra Reservoirs to: ▪ Noonbinna reticulation ▪ Wattamondara Reservoir ▪ Koorawatha Reservoirs (2x) ▪ Woodstock Reservoir Flow by gravity from Woodstock Reservoir to Woodstock reticulation and Westville Reservoirs (4x) Flow by gravity from Wattamondara Reservoir to Wattamondara reticulation. Flow by gravity from Koorawatha Reservoir (High) to Koorawatha reticulation. Pumped from Koorawatha Reservoir (Low) to: ▪ Brundah ▪ Greenethorpe Reservoir ▪ Wirrimah Reservoirs ▪ Bendick Murrell Reservoir Flow by gravity from Bendick Murrell Reservoir to Bendick Murrell reticulation.
Year of construction or augmentation	1985

System Component	Description
Distribution of product	Cowra Reservoirs: ▪ R1: 1.36 ML ▪ R2: 3.6 ML ▪ R3: 1.36 ML ▪ R4a: 2.25 ML ▪ R4b: 2.25 ML ▪ Intermediate Reservoir: 4.5 ML ▪ High Level Reservoir 08: 4.4 ML ▪ High Level Reservoir 07: 9 ML ▪ Soil Con: 0.073 ML Wattamondara Reservoir: 0.53 ML Koorawatha Reservoirs: ▪ High Level: 0.23 ML, ▪ Low Level: 0.53 ML Bendick Murrell Reservoir: 0.23 ML Wirrimah Reservoirs: ▪ High Level: 0.16 ML ▪ Low Level: 0.23 ML Trunk Main R (Greenethorpe) Reservoir: 0.23 ML Brundah Reservoir: 0.80 ML Westville Reservoirs (4x): 0.18 ML each Woodstock Reservoir: 0.66 ML
Capacity	Raw water: 32 ML/day Treatment: 14.3ML/day
Special controls required	▪ Quality of chemicals, materials, etc. used in the production and delivery of the product. ▪ Manual verification sampling of water from the distribution network. ▪ Backflow prevention and trade waste management. ▪ Operation and maintenance of all infrastructure to prevent recontamination.

Darbys Falls Water Supply System

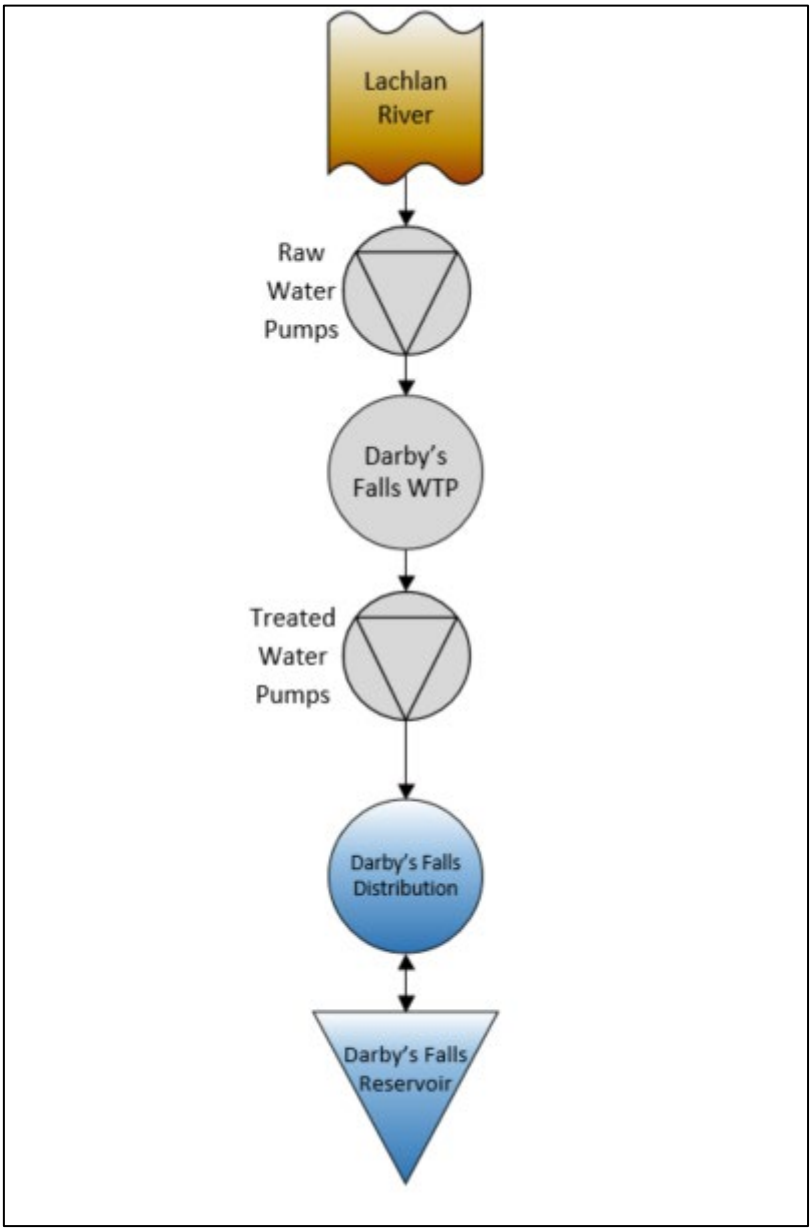

Figure 4: Conceptual Flow Diagram of Darby's Falls Water Supply System

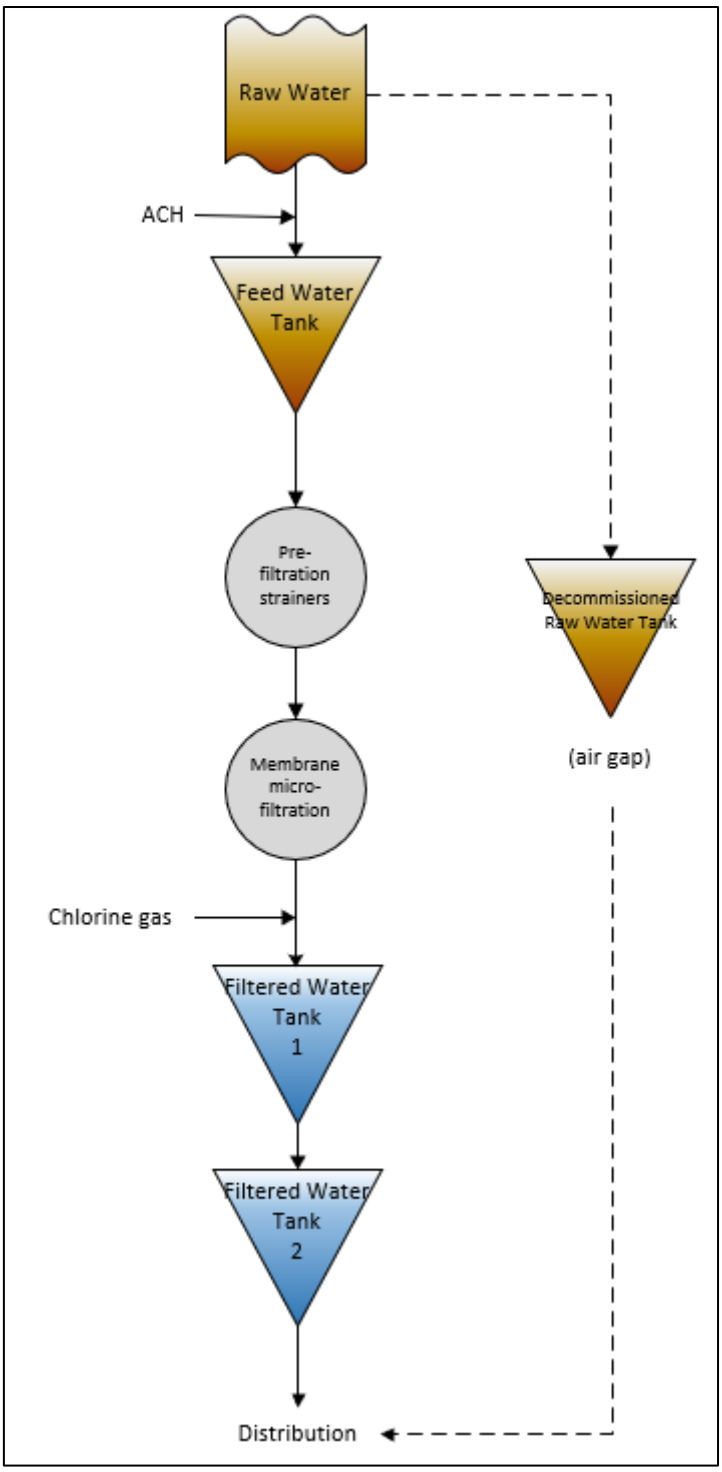

Figure 5: Conceptual Flow Diagram of Darby's Falls WTP

Table 6: Darby's Falls Water Supply System Summary

System Component	Description
Population supplied	316
Water source and catchment	Location: ▪ Lachlan River Land uses: ▪ Livestock grazing ▪ Cereal and feed crops ▪ Population centres Water quality: ▪ Moderate salinity (≈170-300 mg/L) Routine monitoring of algal events is coordinated by the Central West Regional Algal Coordinating Committee, although water sourced from the system by CSC has, historically, not been affected by algal blooms..
Water treatment	Raw water from the Lachlan River is treated at Darbys Falls WTP as follows: ▪ Aluminium Chlorohydrate (ACH) dosing for coagulation ▪ 0.5 µm strainers for pre-filtration ▪ Membrane micro-filtration ▪ Chlorination (chlorine gas) for disinfection
Storage after treatment	Treated water is pumped to the reticulation and to the roofed Village Reservoir (0.27 ML). When the WTP is not pumping, water flows by gravity from Village Reservoir to the reticulation.
Distribution of product	Via pressurised pipes, 1 pumping station and 1 reservoir.
Year of construction or augmentation	2014
Reservoirs	Village Reservoir: 0.27 ML
Capacity	250kL/d (modelled Peak Day Demand is 91.7kL/d)
Special controls required	▪ Quality of chemicals, materials, etc. used in the production and delivery of the product. ▪ Manual verification sampling of water from the distribution network. ▪ Backflow prevention and trade waste management. ▪ Operation and maintenance of all infrastructure to prevent recontamination.

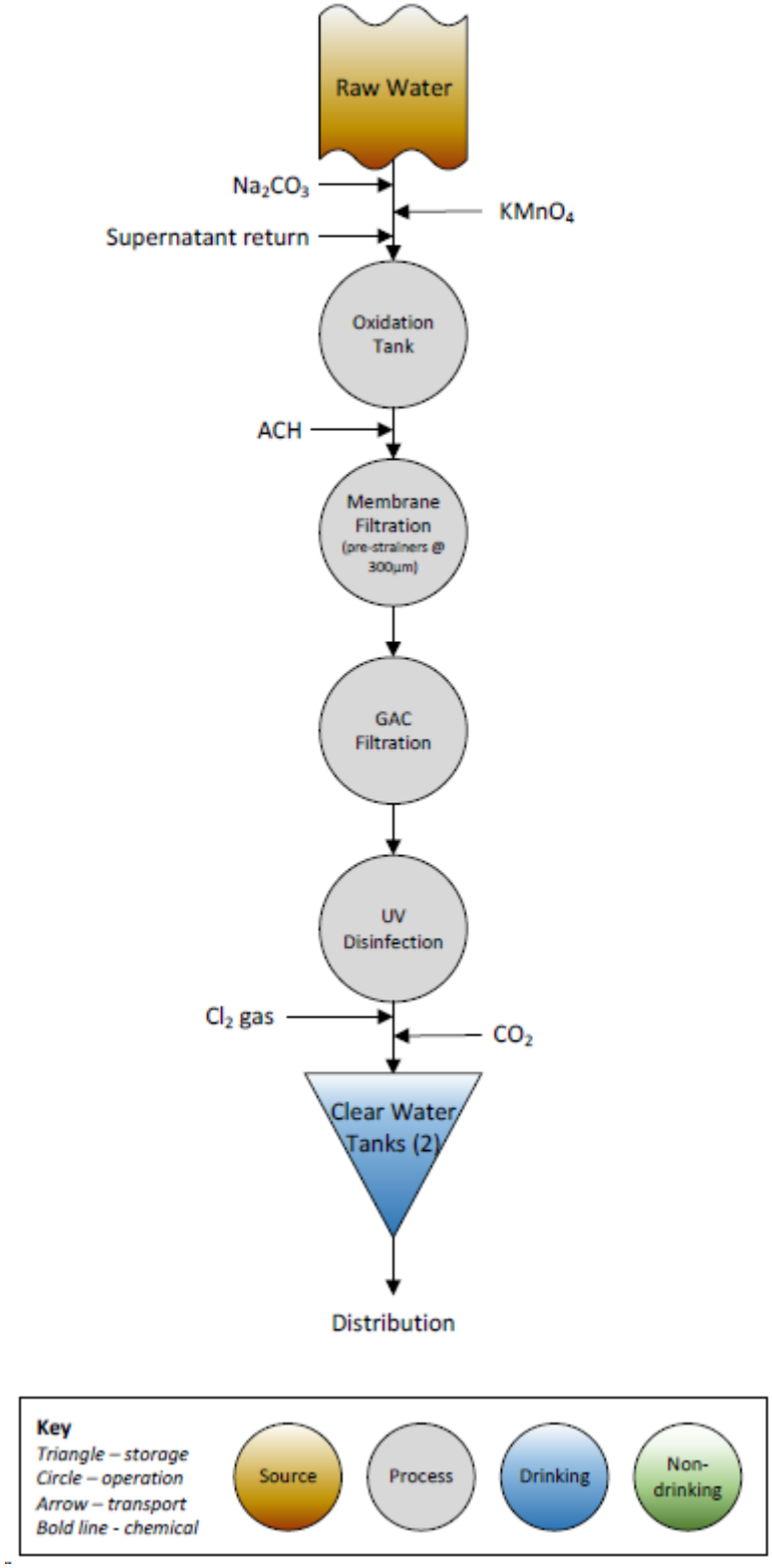

Figure 6: Conceptual Flow Diagram of Wyangala WTP

Table 7: Wyangala Water Supply Systems Summary

System Component	Description
Population supplied	200, with significant seasonal increase
Water source and catchment	Location: ▪ Wyangala Dam (Lachlan River) Land uses: ▪ Livestock grazing ▪ Cereal and feed crops ▪ Population centres Water quality: ▪ Moderate salinity (≈170-300 mg/L) ▪ Response to algal events coordinated by WaterNSW.
Water storage	Wyangala Dam (1,220 GL, managed by WaterNSW)
Water treatment	Raw water from Wyangala Dam is treated at Wyangala WTP as follows: ▪ Sodium carbonate dosing for pH correction ▪ Potassium permanganate dosing for oxidation ▪ Return of wastewater supernatant into incoming raw water flow ▪ Membrane filtration (UF) ▪ Granular Activated Carbon (GAC) filtration for adsorption of algal toxins and taste/odour compounds ▪ UV Disinfection ▪ Chlorination (chlorine gas) ▪ Carbon dioxide for pH correction
Storage after treatment	Treated water is stored in the Clear Water Tanks (x2), where chlorine contact time is provided.
Distribution of product	Flow by gravity to Wyangala reticulation. High water pressure due to elevation of WTP is managed by a pressure reducing valve.
Year of construction or augmentation	2024
Reservoirs	Wyangala Clear Water Tanks (2x): 0.130 ML and 0.90 ML
Capacity	0.8 ML/d
Special controls required	▪ Quality of chemicals, materials, etc. used in the production and delivery of the product. ▪ Manual verification sampling of water from the distribution network. ▪ Backflow prevention and trade waste management. ▪ Operation and maintenance of all infrastructure to prevent recontamination.

Central Tablelands Water Supply System

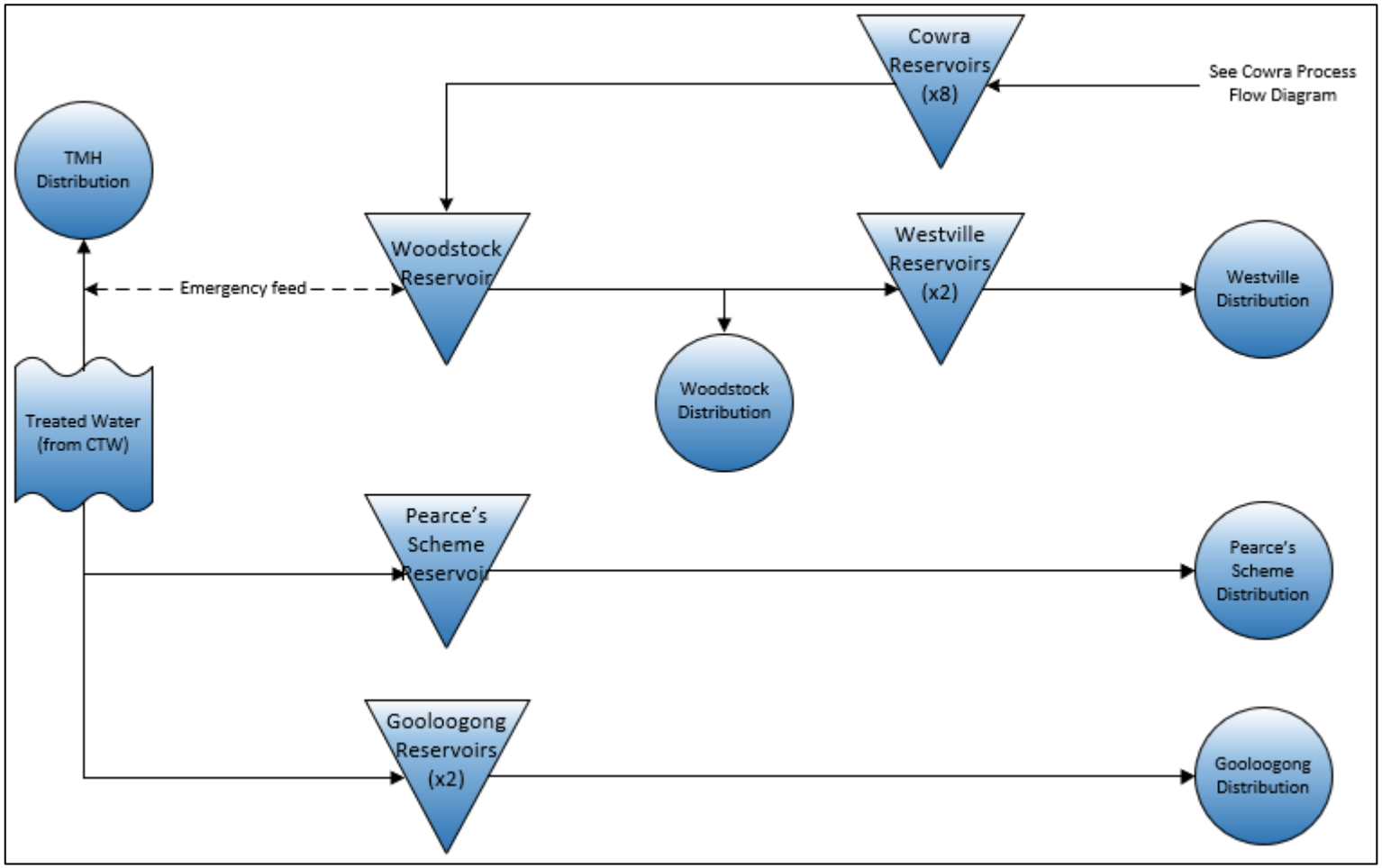

Figure 7: Conceptual Flow Diagram of Central Tablelands Bulk Water Supply System

Table 8: Central Tablelands Water Supply System Summary

System Component	Description
Population supplied	902
Water source	Bulk treated water is received from Central Tablelands Water (CTW) and supplied under agreement
Water treatment	**Note:** The water treatment infrastructure is owned, operated and maintained by CTW. More detailed information about their systems can be found in CTW's DWMS upon request. Raw water in Lake Rowlands is de-stratified in situ using compressed air. De-stratified raw water is then treated at Carcoar WTP as follows: ▪ Aluminium sulphate (alum) dosing for coagulation ▪ Flocculation ▪ Clarification ▪ Sand filtration ▪ Post-filtration soda ash dosing for pH correction and stabilisation ▪ Chlorine dosing for disinfection ▪ Fluoridation
Storage after treatment	Treated water supplied by CTW is collected in the following reservoirs: ▪ Pearce's Scheme ▪ Gooloogong (2x) Woodstock Reservoir is connected to Central Tablelands such that bi-directional flow is possible for emergency supply between the LWUs.
Distribution of product	▪ Flow by gravity from the handover point with CTW to the TMH reticulation. ▪ Flow by gravity from Pearce's Scheme Reservoir to Pearce's Scheme reticulation. ▪ Flow by gravity from Gooloogong Reservoirs to Gooloogong reticulation.
Reservoirs	Pearce's Scheme Reservoir: 0.12 ML Gooloogong Reservoirs: ▪ R16 (North): 0.22 ML ▪ R15 (South): 0.23 ML
Special controls required	▪ Quality of chemicals, materials, etc. used in the production and delivery of the product. ▪ Manual verification sampling of water from the distribution network. ▪ Backflow prevention and trade waste management. ▪ Operation and maintenance of all infrastructure to prevent recontamination.

Billimari Non-Drinking Water Supply System

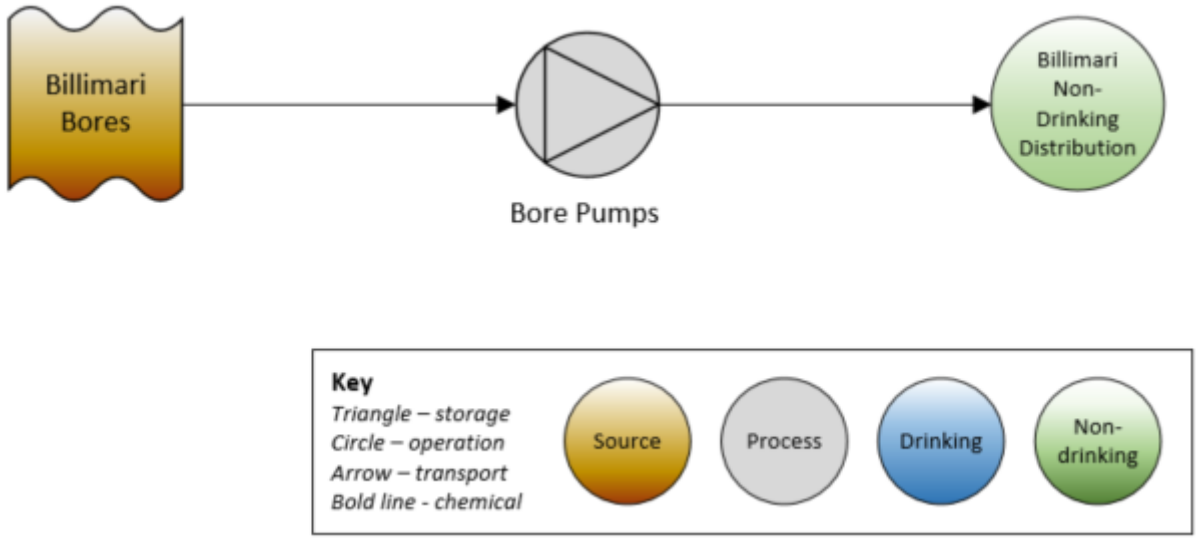

Figure 8: Conceptual Flow Diagram of Billimari Non-Drinking Water Supply System

Table 9: Billimari Non-Drinking Water Supply System Summary

System Component	Description
Population supplied	200
Water source	Billimari bores
Water treatment	Nil
Storage	13 Reservoirs ▪ R17 (Tank 1A): 0.1 ML ▪ R18 (Tank 1B): 0.1ML ▪ R20 (Tank 2): 0.15 ML ▪ R21 (Tank 3): 0.15 ML ▪ R22 (Tank 4): 0.08 ML ▪ R23 (Tank 5): 0.15 ML ▪ R24 (Tank 6): 0.02 ML ▪ R25 (Tank 7): 0.13 ML ▪ R26 (Tank 8): 0.13 ML ▪ R27 (Tank 9): 0.020 ML ▪ R27B (Tank 9B): 0.0225 ML ▪ R28 (Tank 10): 0.12 ML ▪ R40 (Tank 11): 0.0285 ML
Distribution of product	The Billimari Water System works on a combination of gravity and pumped flows. In summary: ▪ Pumped from Billimari Bores to Tank 1B; ▪ Tank 1B gravity feeds to Tank 1A (interconnected); ▪ Tank 1A is then pumped to Tanks 2 and 5; ▪ Tank 1B gravity feeds the village of Billimari; ▪ Tank 2 pumped to Tank 3 (Tank 3 back feeds Tank 2 via gravity when pumps are not in operation); ▪ Tank 2 gravity feeds Tank 6; ▪ Tank 3 pumped to Tank 4 (Tank 4 back feeds Tank 3 via gravity when pumps are not in operation); ▪ Tank 4 gravity feeds portion of retic; ▪ Tank 5 back feeds Tank 1A via gravity when pumps are not in operation); ▪ Tank 5 gravity feeds Tank 11; ▪ Tank 6 pumped to Tank 7 (Tank 7 back feeds Tank 6 via gravity when pumps are not in operation); ▪ Tank 7 pumped to Tank 8 (Tank 8 back feeds to Tank 7 via gravity when pumps are not in operation); ▪ Tank 8 gravity feeds Tanks 9 and 9B; ▪ Tank 9s 9-9B pumped to Tank 10 and gravity feeds portion of retic; ▪ Tank 10 gravity feeds retic.
Special controls required	▪ Signage at Billimari Village entrances ▪ Communication of non-drinking status. ▪ Operation and maintenance to prevent decrease in non-drinking water quality and contamination of drinking water supply.

3.2 Assessment of Water Quality Data

Water quality data were analysed for the original 2013-14 risk assessment workshops; and the summary from this review is contained in the historical risk assessment summary papers on Council's server. Another data review was undertaken in preparation for the 2020 risk assessment review, with the key findings summarised in the following sections. The full report containing the review of water quality information is provided in Appendix 2. A standalone risk assessment for the new Wyangala WTP was undertaken in late 2023. Raw water quality data was compiled and reviewed for this assessment, and this has been included in Appendix 2 also.

Water quality data have not been analysed for the non-drinking water systems.

3.2.1 Cowra

+ Aluminium in settled and treated water was generally below 0.1mg/L but there were occasional results up to 0.9mg/L, indicating potential issues with flocculation. Verification monitoring data contained 7 exceedances of the ADWG aesthetic guideline: all from the WTP Reservoir 1 sample point between 2012 and 2016.
+ Treated water turbidity was frequently above the critical limit of 0.5NTU. Reticulation turbidity results of >1NTU have been recorded at most Cowra sample sites, and the average of 0.68NTU is in Bligh Tanner's opinion relatively high for a dataset of >1000 results.
+ Treated water free and total chlorine was generally maintained in the 1-3mg/L band. The trend was very consistent, despite the relatively wide band. Bligh Tanner would be interested to discuss the summer vs. winter chlorine dosing points and any consequent impacts on disinfection during the risk workshops.
+ Treated water fluoride did not exceed 1.3mg/L (benchtop instrument) however only 32% of results were within the desired range of 0.95-1.05mg/L. A verification monitoring result of 82mg/L is assumed to be a typographical error. However there were several results approaching 1.5mg/L from Koorawatha.
+ Reticulation *E. coli* detections: 3 in 2010, 2 in 2012, 1 in 2014 and 1 in 2017. No detections in 2018 or 2019.
+ In the reticulation data, there were 3 x total chlorine results greater than 7mg/L. Free chlorine in all 3 samples was measured at below 2mg/L. Two of the results were from Chapple Street, Greenethorpe in 2014 and 2015 – 14 months apart. This may indicate a test method issue.
+ In the central region of Cowra, many sites do not meet the desirable free chlorine levels outlined in DPE Water's Circular LWU 18, i.e. >0.2mg/L throughout the distribution system. In the southern region of Cowra, performance across sites was slightly better compared to the central region.
+ Treated water manganese results occasionally exceeded the ADWG aesthetic guideline of 0.1mg/L

3.2.2 Darbys Falls

+ Treated water turbidity is rarely within the target range and is not indicative of a functioning membrane filtration process (would typically expect <0.1NTU). Treated water turbidity regularly approaches the critical limit of 1NTU and has exceeded it on multiple occasions. Unless there is another explanation (e.g. continuing oxidation of manganese) then this may indicate significant breaches to the membranes.
+ Treated water colour has often exceeded the ADWG aesthetic limit of 15HU. This may represent manganese post-oxidation.
+ Treated water chlorine has only recently begun to be measured within the target range. Prior to September 2018, the majority of chlorine results were below the low critical limit.
+ Reticulation chlorine results show significant spiking in results (at 74 Main Street) but overall a high percentage of results were <0.2mg/L. The average free chlorine concentration at Darby's Falls Reservoir was 0.18mg/L
+ No detection of *E. coli*, nor exceedances of ADWG health or aesthetic guidelines
+ Total coliforms were detected in 16 of 45 samples, with a maximum result of 170mpn/100mL. However the trend of positive detections as a % of total samples has been decreasing.
+ Average of turbidity results was 0.65NTU with a maximum of 2.3NTU

3.2.3 Central Tablelands

+ Average free chlorine across the CTW supply area was 0.73mg/L, with a maximum of 7.6mg/L (measured at Gooloogong Reservoir outlet).
+ pH was highest in Westville, where all sites had an average of greater than 8.
+ Temperature cycles between 10°C and 30°C, with temperatures above 25°C typically for 2 months over the summer.
+ 10 detections of *E. coli* out of 432 samples. Maximum result of 12mpn/100mL. The percentage of sample results in which *E. coli* was detected has dropped over time, and no *E. coli* detections have occurred since 2016.
+ Total coliforms were detected in 80 of 432 samples (19%). The detection rate has been dropping, and there were no detections in 2019.

3.3 Hazard Identification and Risk Assessments

The risk assessment methodology adopted was as follows:

Events and hazards were identified for each process step. Risks posed by each of the events were assessed. Key terms are defined in Table 10:

Table 10: Risk assessment terminology

Term	Definition
Hazardous event	A hazardous event is one that introduces contaminants (hazards) to the water. For this risk assessment the hazardous event was for the level of contamination to be unacceptable for treatment through the downstream processes. Examples of a hazardous event might be: ▪ Cyanobacterial bloom resulting in toxins that cannot be removed by downstream processes ▪ Distribution reservoir contamination by vermin resulting in pathogens in the distribution system
Hazard	A hazard is a physical, chemical or biological agent in the water with the potential to cause an adverse effect. Examples of hazards might be: ▪ Human-infectious pathogens and nutrients from failing septic tanks ▪ Particles and nutrients from land clearing practices
Maximum risk	Likelihood and consequence of the hazardous event occurring if the controls were to fail or considered inadequate.
Controls in place	Controls are practices and equipment that reduce the hazard or the hazardous event. Examples of controls include: ▪ Catchment management programs to reduce nutrients in the river, thereby reducing cyanobacterial blooms ▪ A water treatment plant ▪ A backflow prevention program
Controlled risk	Controlled or 'residual' risk was assessed by identifying the likelihood and consequence of the hazardous event occurring with the control in place. The risks were assessed as Likelihood (Table 8) x Consequence (Table 9). A risk assessment matrix (ADWG, 2011) was used to assess risks to the identified end uses (Table 10).

The results were captured in Microsoft Excel® spreadsheets, which were combined to become the controlled Risk Register. The Risk Register is reviewed regularly as part of the DWMS review process.

Table 11: Likelihood Table (NHMRC/NRMMC, 2011)

Level	Descriptor	Example Description
A	Almost certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur or should occur at some time
D	Unlikely	Could occur at some time
E	Rare	May occur only in exceptional circumstances

Table 12: Consequence Table (NHMRC/NRMMC, 2011)

Level	Descriptor	Example Description
1	Insignificant	Insignificant impact, little disruption to normal operation, low increase in normal operation costs
2	Minor	Minor impact for small population, some manageable operation disruption, some increase in operating costs
3	Moderate	Minor impact for large population, significant modification to normal operation but manageable, operation costs increase, increased monitoring
4	Major	Major impact for small population, systems significantly compromised and abnormal operation if at all, high level of monitoring required
5	Catastrophic	Major impact for large population, complete failure of systems

Table 13: Risk Matrix (NHMRC/NRMMC, 2011)

Likelihood	Consequence				
	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
A (almost certain)	Moderate	High	Very high	Very high	Very high
B (likely)	Moderate	High	High	Very high	Very high
C (possible)	Low	Moderate	High	Very high	Very high
D (unlikely)	Low	Low	Moderate	High	Very high
E (rare)	Low	Low	Moderate	High	High

The outcomes of the risk assessments are discussed in Appendix 3. In summary, a number of risks remained 'very high' and 'high' after controls were assessed (i.e. at the 'residual risk' level). Specifically these risks were:

Risks remaining 'Very High':

+ Backflow/cross connection from high-risk consumers leading to water contamination events
+ Seasonal conditions affecting water temperature in the raw and treated water and longevity of chlorine residual in the distribution system
+ Non-drinking water being consumed as if it were drinking water
+ Contamination of Cowra filtered water via the open filtered water well
+ Reservoir ingress leading to contamination of treated water
+ Loss of water supply due to membrane fouling at the new Wyangala WTP

Many risks remain High after consideration of control measures, as the nature of the ADWG risk methodology means that a hazard with a 'Major' or 'Catastrophic' consequence cannot be any less likely than 'Rare', thereby leaving a High risk. In these cases the goal is for each of these risks to be determined 'As Low As Reasonably Practical' (ALARP).

High risks that could be improved through further lowering of the residual likelihood include:

+ Poor quality water supplied from CTW, and no awareness by CSC
+ Trihalomethane formation in the Cowra supply system

4.PREVENTIVE MEASURES FOR DRINKING WATER QUALITY MANAGEMENT

4.1 Preventive Measures and Multiple Barriers

CSC's preventive measures were identified and assessed during the Risk Workshops, and have been documented alongside the significant risks that they address in the Risk Register. A number of preventive measures that are managed by external parties but relied upon by CSC (examples include Australian Standards and Codes of Practice) were also identified, and have been documented in the Risk Register. Gaps identified in the workshops were noted as actions in the Risk Register and are included in Table 37.

4.2 Critical Control Points

Key risks were reviewed during the Risk Workshops and critical control points (CCPs) identified. For a point to satisfy the requirements of a CCP it must:

+ Control hazards that represent a significant risk and require elimination or reduction to assure supply of safe drinking water
+ Have a parameter (actual hazard or surrogate) that can be measured in a timely manner for the hazardous event
+ Be able to have a correction applied in a timely manner in response to a deviation in the process

CCPs were identified during the Risk Workshops held in October 2013 and July 2014 and then revised and updated in the 2020 risk review. Wyangala CCPs were drafted in December 2023 and will be reviewed following full commissioning of the WTP.

CCPs and OCPs are summarised in Table 14 to Table 16, as well as documented with the corresponding targets, limits and key procedures in the CCP procedures, which are included in Appendix 4.

Table 14: Cowra Critical & Operational Control Point Summary

Critical Control Point	Controls	Monitoring Parameter	How Measured	Operating Target	Alert Range	Critical Limit
CCP1: Filtration	Pathogens	Turbidity	Continuous online (individual filters)	<0.2 NTU	≥0.3 NTU	>0.5 NTU (for 15 minutes)
CCP2: Primary Disinfection	Chlorine-sensitive pathogens; chlorine	Free chlorine	Continuous online (R1); grab samples	1.8-3.0 mg/L	<1.8mg/L	<1.5mg/L, >5.0mg/L
CCP3: Fluoridation	Fluoride	Fluoride	Continuous online (R1); grab samples	0.95-1.05 mg/L	<0.95mg/L, >1.05mg/L	>1.5mg/L and >4.0mg/L
CCP4: Reservoir Integrity	Pathogens	Integrity	Inspection	No evidence of breach or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of contaminant in reservoir / significant breach of integrity that cannot be resolved in normal timeframes
Operational Control Point	**Controls**	**Monitoring Parameter**	**How Measured**	**Operating Target**	**Adjustment Limit**	**Alert Limit**
OCP1: Plant Inlet	Pathogens, turbidity, pH, alkalinity	Turbidity Alkalinity pH	Continuous online (raw water turbidity & pH); Daily grab sample (turbidity, pH, alkalinity)	20-200NTU >70mg/L as $CaCO_3$ >7.6 and <8.0	Variation of >30NTU <60mg/L as $CaCO_3$ <7.6 or >8.0	>1000NTU <40 or >150mg/L as $CaCO_3$ <7.5 or >8.1
OCP2: Oxidation	Manganese	Manganese	Continuous online & grab sample (settled water)	<0.05mg/L	>0.05mg/L	>0.1mg/L
OCP3: Clarification	Pathogens, turbidity	Turbidity	Continuous online & grab sample (settled water)	<1 NTU	>1 NTU	>5 NTU

Table 15: Darbys Falls Critical Control Point Summary

Critical Control Point	Controls	Monitoring Parameter	How Measured	Operating Target	Alert Range	Critical Limit
Filtration	Pathogens	Turbidity	Continuous online	≤0.1 NTU	>0.1 NTU	>0.15 NTU
	Pathogens	Membrane Integrity	Pressure decay test (each day WTP attended)	PDT pass	N/A	PDT fail
Primary Disinfection	Chlorine-sensitive pathogens; chlorine	Free chlorine	Continuous online (filtered water tank); grab samples	2.0mg/L	<1.8mg/L, >3.0mg/L	<1.4mg/L, >5.0mg/L (>20 mins)
Reservoir Integrity	Pathogens	Integrity	Inspection	No evidence of breach or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of contaminant in reservoir / significant breach of integrity that cannot be resolved in normal timeframes
Operational Control Point	**Controls**	**Monitoring Parameter**	**How Measured**	**Operating Target**	**Adjustment Limit**	**Alert Limit**
Plant Inlet	Pathogens, turbidity	Turbidity	Continuous online	<30NTU	N/A	>120NTU

Table 16: Wyangala Critical Control Point Summary

Critical Control Point	Controls	Monitoring Parameter	How Measured	Operating Target	Alert Range	Critical Limit
Filtration	Pathogens	Turbidity	Continuous online	≤0.1 NTU	0.1 – 0.14 NTU	>0.15 NTU
	Pathogens	Membrane Integrity	Pressure decay test (each day WTP attended)	PDT pass	N/A	PDT fail
UV Disinfection	Pathogens (protozoa and bacteria)	UV Dose	SCADA calculation (UV intensity, UVT and flow rate)	TBC	TBC	<22mJ/cm^2 (TBC, may be 40)
Chlorine Disinfection	Chlorine-sensitive pathogens; chlorine	Free chlorine	Continuous online (filtered water tank); grab samples	TBC	TBC	TBC
Reservoir Integrity	Pathogens	Integrity	Inspection	No evidence of breach or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of contaminant in reservoir / significant breach of integrity that cannot be resolved in normal timeframes
Operational Control Point	**Controls**	**Monitoring Parameter**	**How Measured**	**Operating Target**	**Adjustment Limit**	**Alert Limit**
Plant Inlet	Pathogens, turbidity, loss of supply	Turbidity	Continuous online	<30NTU	30-100 NTU	>100NTU
Oxidation	Manganese	Manganese	Grab sample (& dosing system status on SCADA)	<0.05mg/L	0.05 - 0.1mg/L	>0.1mg/L
Supernatant return	Pathogens	Turbidity Flow rate	Continuous online	<5NTU <5% of raw water flow rate	5 – 15NTU 5-10% of raw water flow rate	>15NTU >10% of raw water flow rate

5.OPERATIONAL PROCEDURES AND PROCESS CONTROL

5.1 Operational Procedures

Operations and Maintenance (O&M) Manuals are in place for Darby's Falls WTP and Wyangala WTP. Hard copies of these are kept on site and at Cowra WTP. An electronic copy of the Darby's Falls O&M Manual is also stored on the shared network I:\ drive. A new O&M Manual is in development for Cowra WTP, following extensive upgrades.

CCP procedures and some supporting operational procedures were developed as part of the preparation of this DWMS, and are attached in Appendix 4.

Additional operational procedures have been developed by Cowra Shire Council, and are summarised in Table 17. Procedures developed by Enviropacific for the Wyangala WTP will be included in this table once complete.

Table 17: Operational Documentation

Doc No.	Procedure Title	Last Reviewed
SOP-WTP-00	General SCADA Usage	02/12/2024
SOP-WTP-01	Backwash River Screens	02/12/2024
SOP-WTP-02	Change Chlorine Drum	13/01/2025
SOP-WTP-03	Filter Backwash	02/12/2024
SOP-WTP-04	Refill Fluoride Hopper	02/12/2024
SOP-WTP-05	Plant Startup	02/12/2024
SOP-WTP-06	Plant Shutdown	02/12/2024
SOP-WTP-10	Perform Chemical Drop Test	02/12/2024
SOP-WTP-11	Bell Hill Res Filter Operation	02/12/2024
SOP-WTP-12	Response to Power/Air Failure	02/12/2024
SOP-WTP-13	Pump Station Checks	02/12/2024
SOP-WTP-14	Jar Test	02/12/2024
SOP-WTP-15	Chlorine Optimisation	02/12/2024
SOP-WTP-16	Optimisation of Clear Water pH	02/12/2024
SOP-WTP-17	Fluoride Optimisation	02/12/2024
SOP-WTP-18	ERP – Evacuation	02/12/2024
SOP-WTP-50	Filter Control Panel Operation	02/12/2024
SOP-WTP-51	Pot Perm Batching Plant Operation	02/12/2024
SOP-WTP-52	Poly Batching Plant Operation	02/12/2024
SOP-WTP-53	Coagulant ACH Dosing Skid Operation	02/12/2024
SOP-WTP-54	Caustic Tanker Unloading System Operation	02/12/2024
SOP-WTP-61	Pot Perm Dosing Skid Operation	02/12/2024

Doc No.	Procedure Title	Last Reviewed
SOP-WTP-62	Poly Dosing Skid Operation	02/12/2024
SOP-WTP-63	Coagulant ACH Dosing Skid Operation	02/12/2024
SOP-WTP-64	Caustic Dosing Skid Operation	02/12/2024
SOP-WTP-65	Chlorine Dosing Operation	02/12/2024
SOP-WTP-70	Field Testing	02/12/2024
SOP-WTP-71	Calibration of Water Quality Instruments	02/12/2024
SOP-WTP-72	Laboratory Testing	02/12/2024

5.2 Operational Monitoring

CSC conducts operational monitoring daily at Cowra WTP, as detailed in Table 18, with results recorded in monthly spreadsheets stored on the shared network I:\ drive. As part of operational monitoring, CSC monitors fluoride dosing at Cowra WTP in accordance with the *NSW Code of Practice for Fluoridation of Public Water Supplies* (whenever fluoride dosing is operational).

CSC conducts operational monitoring weekly at Darbys Falls WTP, as detailed in Table 19, and Wyangala WTP, as detailed in Table 20. Results for these WTPs are recorded in Council's dedicated water/sewer data system (WaterOutlook).

Procedures for how to collect and test samples are to be developed, as listed under 5.1; a formalised Water Quality Monitoring Program is also to be developed.

CSC also relies on the Guide for Submitting Water Samples to FASS (NSW Forensic and Analytical Science Service) for Analysis, which is publicly available on the NSW Health website
http://www.health.nsw.gov.au/environment/water/documents/dal_analysis.pdf

Table 18: Cowra WTP Log Sheet Monitoring

Process Location	Parameter	Test Frequency
Raw water	Alkalinity	Daily
	Apparent colour	Daily
	Fluoride	Daily
	Iron	Daily
	Manganese	Daily
	pH	Daily
	Turbidity	Daily
	Temperature	Daily
	TOC's (UVA, UVT and TOC)	Daily
	Total Suspended Solids	Daily
Settled water	Turbidity	Daily
	pH	Daily
	Temperature	Daily
	Chlorine	Daily
	Manganese	Daily
	TOC's (UVA, UVT and TOC)	Daily
	Alkalinity	Daily
	Apparent colour	Daily
Treated water	Apparent colour	Daily
	Fluoride	Daily
	Free chlorine peak	Daily
	Free chlorine residual	Daily
	Hardness	Daily
	Iron	Weekly
	Manganese	Daily
	pH	Daily
	TOC's (UVA, UVT and TOC)	Daily

Process Location	Parameter	Test Frequency
	Total chlorine peak	Daily
	Total chlorine residual	Daily
	Temperature	Daily
	Turbidity	Daily

Table 19: Darbys Falls WTP Log Sheet Monitoring

Process Location	Parameter	Test Frequency
Raw water	Alkalinity	Weekly
	Temperature	Twice Weekly
	TOCs (UVA/UVT/TOC)	Weekly
	Apparent colour	Weekly
	Iron	Weekly
	Manganese	Weekly
	pH	Twice Weekly
	Suspended solids	Weekly
	Turbidity	Twice Weekly
Treated Water	Alkalinity	Weekly
	Apparent colour	Weekly
	Free chlorine	Twice Weekly
	Hardness	Weekly
	Iron	Weekly
	Manganese	Weekly
	pH	Twice Weekly
	Temperature	Twice Weekly
	TOCs (UVA/UVT/TOC)	Weekly
	Suspended solids	Weekly
	Total chlorine	Twice Weekly
	Turbidity	Twice Weekly
	Pressure Decay	Twice Weekly
	Filter Fouling Index	Twice Weekly

Table 20: Wyangala WTP Log Sheet Monitoring

Process Location	Parameter	Test Frequency
Raw water	Alkalinity	Weekly
	Apparent colour	Weekly
	Iron	Weekly
	Manganese	Weekly
	pH	Twice Weekly
	Suspended Solids	Weekly
	TOCs (UVA/UVT/TOC)	Weekly
	Temperature	Twice Weekly
	Turbidity	Twice Weekly
Treated water	Apparent colour	Weekly
	Free chlorine	Twice Weekly
	Hardness	Weekly
	Iron	Weekly
	Manganese	Weekly
	Weekly	TOCs (UVA/UVT/TOC)
	pH	Twice Weekly
	Temperature	Twice Weekly
	Total chlorine	Twice Weekly
	Turbidity	Twice Weekly

5.3 Corrective Action

CSC has a number of corrective actions associated with CCPs, which are summarised in the CCP procedures themselves.

CSC also relies on guidance documents from external parties for appropriate corrective actions, including the following:

+ NSW Health Response Protocols, publicly available via the NSW Health website:
  - http://www.health.nsw.gov.au/environment/water/pages/drinking-water.aspx
  - Response protocol flow charts have been included in this DWMS in Appendix 5.
+ NSW Water Supply and Sewerage Benchmarking Report Appendix E: Effective disinfection of a potable water supply and assuring integrity of the distribution system to prevent contamination of the supply, publicly available via the DPE Water website

CSC communicates operational issues internally via documented Toolbox meetings. Communication systems for water quality issues also include:

+ Formal reports from DPE Water on water treatment works, outlining corrective actions or required works
+ Informal liaison with local NSW Health PHU
+ Informal liaison with local DPE Water Officer
+ Informal liaison with local water authorities to share knowledge

5.4 Equipment capability and maintenance

The water quality testing equipment used by CSC is listed in Table 21. This table also outlines the calibration requirements for instruments. Formal instrument calibration procedures are to be developed, as listed under 5.1. Instruments are calibrated regularly, but formal logs are to be developed.

Reliability of CSC's water quality testing equipment is also informally verified against monitoring equipment used by the local DPE Water Officer.

CSC's asset management consists of inspections and reactionary maintenance and a proactive asset management program is to be developed. This has been included as an action in the Improvement Plan.

Table 21: CSC Online Water Quality Testing Equipment List and Calibration Details

Instrument	Brand/Model	Location	Calibration Frequency	Comments
Turbidimeter (raw)	ProDetec AquaScat	Online	Weekly	
Turbidimeter (settled & treated)	ProDetec AquaScat	Online	Weekly	
Chlorine Residual Analyser	E+H CCS142D	Online	Weekly	
pH Meter	E+H CPS11D	Online	Weekly	
Fluoride Analyser	diaLog DACb	Online	Automatic	
Manganese Analyser	Chemscan	Online	Automatic	
Conductivity Analyser	E+H CLS21D	Online	N/A	

Table 22: CSC Benchtop/Field Water Quality Testing Equipment List and Calibration Details

Instrument	Brand/Model	Location	Calibration Frequency	Comments
Turbidimeter	Orion AQ4500 Lovibond TB350	Laboratory and field	Weekly Verify daily	
Chlorine Residual Analyser	Chlorosense HACH SL1000	Laboratory and field	Verify weekly Daily	
pH Meter/ ISE Fluoride Analyser	Hach/ HQ440d	Laboratory	Daily	pH also used for alkalinity and hardness testing
pH Meter	HACH SL1000	Field	Daily	
Spectrophotometer	Hach/ DR3900	Laboratory	N/A	Used for aluminium, colour, iron, manganese)
Digester	Hach/ DRB200	Laboratory	N/A	For metals analysis
Coliform and *E. coli* presence/ absence and MPN test kit	CPI International/ Colitag	Laboratory	N/A	
Conductivity Analyser	Hach HQ40d	Field	N/A	
Thermometer	Unbranded	Laboratory and field	N/A	

5.5 Materials and chemicals

CSC orders WTP treatment chemicals and materials from reputable suppliers. Chemicals and materials used at CSC's WTPs include:

+ ACH supplied by WaterFloc or IXOM
+ Multifloc A1400 polymer supplied by Hardman Chemicals
+ Chlorine gas supplied by IXOM
+ Calcium hypochlorite supplied by Segure Water
+ Sodium hypochlorite supplied by Lachlan Fertilizers
+ Caustic soda supplied by Redox
+ Potassium permanganate supplied by Redox
+ Sodium fluorosilicate supplied by Redox
+ Laboratory reagents supplied by Hach
+ Citric acid supplied by Redox

CSC assures the quality of chemicals used in water treatment by obtaining NATA certificates for all chemical deliveries, and by testing the specific gravity (SG) of all liquid chemicals.

CSC also relies on guidance documents from external parties for material and chemical quality specifications, including:

+ ADWG Chapter 8 Drinking Water Treatment Chemicals
+ AS/NZS 4020 Testing of products for use in contact with drinking water
+ Plumbing Code of Australia
+ NSW Local Government Procurement

6.VERIFICATION OF DRINKING WATER QUALITY

6.1 Drinking Water Quality Monitoring

CSC conducts weekly verification monitoring throughout the distribution systems of the Cowra, Darbys Falls, Wyangala, and Central Tablelands drinking water supply systems. Results are stored within WaterOutlook, CSC's dedicated water data management and collation system.

WaterOutlook is supplemented by the NSW Drinking Water Database as appropriate.

Sample point locations are listed in Table 23. Parameters monitored include:

- *E. coli*
- Free chlorine residual
- pH
- Total chlorine
- Total coliforms
- Turbidity

Table 23: CSC Verification Monitoring Sample Sites

System	Sample Site Location
Cowra	Saburo Nagakura Park
	High Level Reservoir
	Mulyan Oval
	Apex Park
	Airport
	Erambie
	Harry Chapman Park
	Reg Grocott Park
	Intermediate Reservoir
	Noonbinna Valve Shed
	Wirrimah Pump Station
	Bendick Murrell Pub
	Greenethorpe Park
	Greenethorpe Church
	Brundah Farm House
Darbys Falls	26 Main Street
	74 Main Street
Wyangala	Country Club
	Not defined
Central Tablelands	Gooloogong Park
	Gooloogong Pub

CSC participates in the NSW Health Drinking Water Monitoring Program. Sample point locations and sample frequencies are listed for each supply system in Table 24 to Table 29. Sample point locations and frequencies for the new Darby's Falls drinking water system are to be developed, in consultation with NSW Health.

All samples are sent to FASS, NSW Health's NATA accredited laboratory and both NSW Health and CSC are provided with results from the analyses. Fluoride analysis results carried out by CSC are also transmitted to NSW Health, in line with the *NSW Code of Practice for Fluoridation of Public Water Supplies* (NSW Health, 2011). Under the NSW Health Drinking Water Monitoring Program, local water utilities are notified of results that exceed a guideline value.

CSC also relies on standards and guidance documents from external parties, including Disinfection of Drinking Water Information Sheet 1.1 in ADWG (2011), which includes information on disinfection residual maintenance and monitoring.

Parameters monitored as part of the 'microbiology' analysis suite include:

- *E. coli*
- Free chlorine residual
- pH
- Total chlorine
- Total coliforms
- Turbidity

Parameters monitored as part of the 'chemistry' analysis suite include:

- Aluminium
- Antimony
- Arsenic
- Barium
- Boron
- Cadmium
- Calcium
- Chloride
- Chromium
- Copper
- Cyanide
- Fluoride
- Fluoride Ratio
- Iodide
- Iodine
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Molybdenum
- Nickel
- Nitrate
- Nitrite
- pH
- Selenium
- Silver
- Sodium
- Sulphate
- Total Dissolved Solids (TDS)
- Total Hardness as CaCO3
- True Colour
- Turbidity
- Zinc

Note: includes only sample sites that have had results recorded in the last five years

Table 24: Cowra Supply System Sample Sites for NSW Health Program

Sample Site Location	Site Code	Monthly FASS Sample
Saburo Nagakura Park, Cowra	111	Yes
Cowra Water Treatment Plant (Reservoir #1)	132	No
0 Darling Street, Cowra	139	Yes
41 Comerford Street, Cowra	171	Yes
Not Defined, Cowra	999	No
Erambie Yalbillinga Boori Daycare	170	Yes
Edward Square Park, Greenethorpe	127	Yes
Noonbinna Pump Station, Noonbinna	122	Yes
Waddell Street, Wattamondara	123	Yes
Koorawatha Pump Station 9 Boorowa Street, Koorawatha	124	Yes
138 Bendick Murrell Road, Bendick Murrell	821	Yes
Wirrimah Pump Station	154	Yes
142 Lachlan Street, Cowra	160	Yes
0 Lyall Street, Cowra	157	Yes

Table 25: Wyangala Supply System Sample Sites for NSW Health Program

Sample Site Location	Site Code	Monthly FASS Sample
Wyangala Country Club	119	Yes
Waugoola Road, Wyangala	155	No
4 Waugoola Road, Wyangala	190	Yes
Not Defined, Wyangala	999	No

Table 26: Darbys Falls Supply System Sample Sites for NSW Health Program

Sample Site Location	Site Code	Monthly FASS Sample
Darbys Falls Rural Fire Service Station	120	Yes
Darbys Falls Playground	801	No

Table 27: Central Tablelands Supply System Sample Sites for NSW Health Program

Sample Site Location	Site Code	Monthly FASS Sample
Gooloogong Public School King Street, Gooloogong	128	No
Gooloogong Caravan Park	173	Yes
Not Defined, Gooloogong	999	No
Westville Southern Reservoirs Westville Road, Cowra	156	Yes

Sample Site Location	Site Code	Monthly FASS Sample
Westville Road, Westville	182	No
Dorset Lane, Westville	183	No
Woodstock Bowling Club Waugoola Street, Woodstock Parkes Street, Woodstock	121	Yes
Woodstock Showground Robinson Street, Woodstock	180	Yes
Rankin Street, Woodstock	181	No

Table 28: Non-Drinking Water Supply Systems Sample Sites for NSW Health Program

Sample Site Location	Site Code	Monthly FASS Sample
Sloan Street, Billimari	130	No
Sloan Street, Billimari	158	No
Not Defined, Billimari	999	No

Table 29: Sampling Frequencies

Analysis Suite	Supply System	Frequency
Microbiological	Cowra	Monthly
	Wyangala	Monthly
	Central Tablelands	Monthly
	Darby's Falls	Monthly
	Billimari	Infrequent
Chemical	Cowra	Monthly
	Wyangala	Twice-Yearly
	Central Tablelands	Twice-Yearly
	Darby's Falls	Twice-Yearly
	Billimari	Infrequent

CSC, in conjunction with NSW Health, will review sample site locations regularly as part of the implementation and ongoing review of this DWMS.

6.2 Consumer Satisfaction

CSC's water quality complaints protocol occurs as follows:

+ Administration assistants receive complaints by telephone
+ Details are recorded in the Discoloured Water Complaints Spreadsheet stored on the shared network I:\ drive
+ Administration assistants notify the Works Engineer, or if they cannot be reached, the Water Treatment Supervisor
+ Works Engineer and Water Treatment Supervisor liaise and coordinate a response, which would typically include:
  - Investigation, sampling and testing, coordinated by the Water Treatment Supervisor. Parameters tested include turbidity, colour, pH, chlorine, coliforms and *E. coli*
  - Flushing of the affected area, coordinated by the Works Engineer

A Consumer Complaints procedure is to be developed.

6.3 Short-Term Evaluation of Results

CSC records WTP monitoring results, daily at Cowra WTP, weekly at Darby's Falls WTP and Wyangala WTP in plant log sheets stored on the shared network I:\ drive. Operators review results daily, weekly and monthly as part of their operations. Operators discuss water quality results at documented Toolbox talks meetings.

Review and analysis of the results in the NSW Health Drinking Water Database is undertaken weekly by the Water Treatment Supervisor.

Where non-compliant water quality is identified through short-term evaluation of results, the type of response is determined by the framework described in the following section.

6.4 Corrective Action

CSC responses to water quality non-compliance include:

+ Manual dosing of sodium hypochlorite in response to positive detections of total coliforms or *E. coli*
+ Investigation and/or reactive flushing following customer complaint, as detailed in section 6.2 above.

CSC also relies on guidance documents from external parties for appropriate corrective actions, including the following, which are publicly available via the NSW Health website:

+ NSW Health Drinking Water Monitoring Program Handbook:
  - http://www.health.nsw.gov.au/environment/water/documents/dwmp-booklet05.pdf
+ NSW Health Response Protocols:
  - http://www.health.nsw.gov.au/environment/water/pages/drinking-water.aspx
  - Response protocol flow charts have been included in this DWMS in Appendix 5

CSC communicates issues internally via documented Toolbox meetings. Communication systems for water quality issues also include:

+ Formal notifications from NSW Health regarding water quality exceedances
+ Formal reports from DPE Water outlining corrective actions or required works for infrastructure
+ Informal liaison with local NSW Health PHU
+ Informal liaison with local DPE Water Officer
+ Informal liaison with local water authorities to share knowledge

7.MANAGEMENT OF INCIDENTS AND EMERGENCIES

This plan clearly describes the actions and accountabilities of key operational, managerial and executive staff, and is intended to show the communication pathways and key actions at each level.

Each incident or emergency will require a considered individual response.

7.1 Emergency Response Levels

CSC uses 3 different emergency response levels. The lower 2 levels align to the critical control points at each water scheme (adjustment actions and critical actions) whilst the highest level triggers a wider emergency response through activation of the Emergency Management Plan.

Table 30 Emergency response levels

Level	Description
3	Activation of the Emergency Management and Community Disaster Resilience Plans
2	Critical Control Point or ADWG health guideline value exceedance
1	Operator adjustments to processes

7.1.1 Linkages to Critical Control Point Procedures

The colours of the Critical Control Points align to the above levels – a parameter outside of the Adjustment limit is a Level 1 operator intervention. Where a process goes outside of the CCP critical limit, this is a Level 2 incident that requires immediate reporting to the Public Health Unit. This is the same process that would occur for the detection of *E. coli.*

If there is a declared disaster or emergency and the Emergency Management Plan is activated, actions will be taken in accordance with those plans (noting the importance of maintaining the actions within this DWMS as these actions are intended to protect public health).

Table 31 Key management responses for each level

Level	Description	Management response(s)	Positions responsible
Level 3 Disaster or Emergency	▪ Emergency Management Plan activated, or natural disaster declared. ▪ Examples include flood, drought, bushfire, and terrorism	▪ External assistance requested to manage emergency or disaster. ▪ Effective communication with community	▪ General Manager ▪ Director – Infrastructure & Operations

Level	Description	Management response(s)	Positions responsible
Level 2 Incidents	▪ Exceedance of ADWG health guideline value ▪ Exceedance of CCP critical limit ▪ Outbreak of waterborne disease ▪ Unable to provide treated water. ▪ Loss of water supply for >6 hours	▪ Ensure all control measures are functioning effectively. ▪ Ensure effective communication between CSC, PHU and DPE as appropriate.	▪ Manager Cowra Works ▪ Water Treatment Supervisor
Level 1 Operator Adjustments	▪ Exceed Alert Limit for CCPs (or OCPs) ▪ Effectively managed by the water treatment operators undertaking actions in CCP document.	▪ Implement CCP or OCP actions to return to operational target. ▪ Check and act upon operations and maintenance records and procedures. ▪ Take appropriate actions to rectify situation	▪ Water Treatment Supervisor ▪ Water Operators

7.1.2 Level 1 - Operator Adjustment

At Level 1 operational actions are required to manage the issue and prevent escalation. Issues at this level are normally identified by the operators through operational monitoring or visual inspections.

Corrective actions will be taken to ensure processes are brought back to target levels, a note made in WTP diary (WTP exceedances), and the Water Treatment Supervisor informed as required or escalated immediately if the problem cannot be rectified.

Routine reporting ensures that repeated breaches of adjustment limits are not systemic and overlooked.

7.1.3 Level 2 - Incident

At this level, there is a potential for an adverse public health impact.

All critical limit exceedances and detections of parameters above ADWG health guideline levels are Level 2 incidents.

These issues are identified through either operational or verification monitoring of the processes and water quality, or where there has been a significant supply issue resulting in the loss (or likely loss) of water supply for a period >6 hours.

When identified, these issues are immediately communicated to the Manager Cowra Works as required.

Level 2 incidents are reported immediately to the local PHU.

Appropriate corrective actions will be identified and implemented as soon as practicable to minimise the effect of the incident.

7.1.4 Level 3 – Emergency or Declared Natural Disaster

This level emergency or disaster requires coordination across departments and may require external resourcing and support from agencies, such as Department of Emergency Services, Department of Health, DPE and emergency responders.

Level 3 emergencies are generally dealt with at the General Manager level with mobilisation of significant resources.

In these cases, relevant Emergency/Disaster Management Plans will be activated.

A list of emergency contacts has been included in the following section.

7.2 Communication

In a water quality incident or emergency scenario, CSC follows the internal chain of command from whomever has identified the concern, to the Manager Cowra Works.

The Manager Cowra Works is responsible for alerting external parties. If the Manager Cowra Works is unavailable then this would be undertaken by the Director – Infrastructure and Operations. If both are unavailable, then any members of the Water Safety Team can report the incident, with priority being to the Public Health Unit.

Table 32: Incident and Emergency contacts

Stakeholder	Contact	Number
NSW Health (Western NSW Local Health District PHU)	Senior Environmental Health Officer	02 6330 5880
DPE (Water)	Regional Water & Sewerage Inspector	0428 443 790
WaterNSW		1300 662 077
NSW SES		132500
Cowra Fire Station		000 (Emergencies) 02 9493 1270
Cowra Police Station		000 (Emergencies) 02 6341 5099
NSW Rural Fire Service (Cowra)		02 6340 2065
Cowra Hospital		02 5338 5500
Wyangala Holiday Park		02 6345 0877

Key contacts for Erambie are included in Appendix 1.

7.2.1 Reporting to NSW Health

There is no mandatory reporting format when advising the Public Health Unit that a water incident has occurred. In these instances, speed of reporting is the priority so that the Environmental Health department can rapidly begin to assess the potential impacts on public health.

Contact should be made by phone immediately after being made aware of the incident, and the number listed in Table 32 should always be answered. If for some reason the phone is not answered, an attempt should be made again within 5-10 minutes.

While the Manager Cowra Works (or delegate) is making the phone call, other team members should be gathering as much information as possible about the nature and extent of the incident. This may include, but should not be limited to:

+ Time and date that any relevant samples were collected (if relevant), and whether repeat samples have been arranged or collected (and ETA of results)
+ Performance of water treatment plant in the period leading up to the sample collection (if relevant)
+ Other water quality results with relevance to the incident (e.g. if *E. coli* is detected, the microbiological results, free chlorine, turbidity and pH results from other sample sites in the system will be relevant)
+ Raw water quality
+ Operational factors that may have contributed to the incident (e.g. mains break)

7.3 Incident and Emergency Response Protocols

7.3.1 Information sources

Depending on the type of incident/emergency, there may be different information sources relevant to management of the incident. Table 33 summarises some of the key resources available to CSC based on the incident type.

Table 33: Incident and emergency – information sources

Incident type	Document reference
Microbiological failure or threat	NSW Health Response Protocol – Management of Microbiological Quality
Physical and chemical contamination	NSW Health Response Protocol - Management of Physical and Chemical Quality
Cyanobacterial (Blue-green algae) bloom/ toxins	WaterNSW and/or Regional Algal Coordination Committee Alerts NSW Water Directorate Blue Green Algae Management Protocols https://www.waterdirectorate.asn.au/Bookshop/Blue-GreenAlgaeManagementProtocols-2014.aspx
Fluoride incident	New South Wales Code of Practice for Fluoridation of Public Water Supplies (Appendix C) https://www.health.nsw.gov.au/environment/water/Documents/code-of-practice.pdf
Business interruption	NSW Water Directorate Business Continuity Management Guidelines Section 10.3 https://www.waterdirectorate.asn.au/Bookshop/BusinessContinuityManagementGuidelines-2012.aspx
CCP Exceedance	CSC CCP Procedure(s) – see Appendix 4 Standard Operating Procedures
Shire-wide Emergency	Central West Regional Emergency Management Plan https://www.nsw.gov.au/sites/default/files/2021-03/emergency-management-plan-central-west.pdf
Pollution incidents	Pollution Incident Response Management Plan (outside of this DWMS)

7.3.2 NSW Health Response Protocols

Water quality incidents are managed according to the NSW Health Response Protocols, including:

+ a critical limit has been exceeded at a critical control point (CCP) for pathogen risk
+ there is a raw water quality problem likely to affect water treatment
+ there is evidence of vermin (birds, possums or other animals) found in a reservoir
+ Escherichia coli (*E. coli*) is detected in drinking water
+ Exceedance of physical or chemical guideline values

The protocols are available on the NSW Health website at:
https://www.health.nsw.gov.au/environment/water/Pages/drinking-water-quality-and-incidents.aspx

The latest version of the protocols as of December 2023 have been included in Appendix 5.

8.EMPLOYEE AWARENESS AND TRAINING

8.1 Employee Awareness and Involvement

CSC communicates water quality issues with employees and contractors via documented Toolbox meetings, to which all employees present must sign on. Employees are also encouraged to discuss water quality via:

+ Informal liaison with local NSW Health PHU
+ Informal liaison with local DPE Water Officer
+ Informal liaison with local water authorities to share knowledge

Furthermore, key CSC water personnel are involved in the development, ownership and maintenance of the DWMS.

A Charter of Responsibilities, developed by the WTP Supervisor, is currently being revised and is to be approved by CSC senior management.

8.2 Employee Training

The *NSW Code of Practice for Fluoridation of Public Water Supplies* (NSW Health, 2011) requires fluoride plant operators to hold a NSW Health fluoride plant operators certificate. All CSC operators hold a Certificate III in Water Operations. Additional training needs are identified and managed through performance appraisals and budgeted for in the CSC Operational Plan.

CSC assures the quality of employee training by only engaging registered training organisations. CSC operators also attend various conferences and workshops. Contractor competency is managed by keeping a list of CSC's preferred contractors which is monitored using Council's project management protocols and tender requirements.

9.COMMUNITY INVOLVEMENT AND AWARENESS

9.1 Community Consultation

CSC informs the community about water issues via a range of discussion and media types.

Community consultation is achieved through:

+ Council meetings
+ Letter drops
+ Door knocks
+ Council notice board, published in paper
+ Website – to be developed
+ With regards to the Aboriginal community of Erambie the CEO of the Local Aboriginal Land Council will, in consultation with Council, be responsible for all community consultation and communication and be the 'First Point of Contact" for the community. Upon receipt of an issue, the CEO will notify Council which will record and respond to the issues within its area of responsibility.
+ The Local Aboriginal Land Council - CEO will obtain a list of recent issues from Council and present the list for review at the 4–monthly meetings. A list of contacts for the Aboriginal community is located in Appendix 1.

9.2 Communication

CSC receives community feedback about water quality via complaints, as detailed in 6.2.

CSC uses the following mechanisms to inform the community about water quality issues:

+ Community consultation methods as detailed in 9.1;
+ Tags on non-drinking water meters declaring "Do not drink";
+ Awareness campaigns during National Water Week, including school programs; and
+ drumMuster program.

10.RESEARCH AND DEVELOPMENT

10.1 Investigative Studies and Research Monitoring

CSC's investigative programs include:

+ Weekly testing of total coliforms and *E. coli* in the raw water, with extra monitoring during storm events
+ Aluminium methodology for the analysis of aluminium concentrations and residuals – including conferring with NSW Health
+ Optimising filter operation and outlet control to even flow over all filters
+ Investigating possible improvements in energy efficiencies by using VSDs
+ Formal reports from NOW, including corrective actions arising from those reports
+ One-off samples taken in response to customer requests when considered necessary
+ Jar testing in response to changes in raw water quality

10.2 Validation of Processes

CSC relies on guidance from NSW Health and/or published scientific literature to informally validate the effectiveness of its treatment systems.

Minimum, Typical, and Best effective C.t values of disinfection were calculated as part of the development of this DWMS, following the methodology detailed in the WIOA publication 'Guide to the measurement and use of Ct'. All effective C.t values with disinfection parameters for each WTP are listed in the following tables.

Values for Cowra were updated in 2023 following initial results of a tracer study however this work is not yet complete and values need to be confirmed. Values for Wyangala have been included however much of this data is 'placeholder' pending confirmation and/or commissioning.

Table 34: Summary of Cowra WTP Effective C.t and Disinfection Parameters

Parameter	Units	Value			Data Source
		Worst Case	Typical Case	Best Case	
Effective C.t	min.mg/L	**10.8**	65	381	Calculated
Free Cl_2 residual	mg/L	1.5	1.8	3.0	CCP critical limit and target range
WTP outflow rate	L/s	110	57	25	CSC flow data 2019-2022. Conservatively assumes all flow is through R1 – to be updated when data available.
Baffling factor (T10/T)		0.14	0.14	0.14	Initial Hunter H2O study results (August 2022) – to be confirmed
Contact tank capacity	m^3	1360	1360	1360	CSC – R1 only
Minimum tank operating level	%	25	65	100	CSC operating levels (R1)
Effective contact time	mins	7.2	36.2	126.9	Calculated

Table 35: Summary of Darbys Falls WTP Effective C.t and Disinfection Parameters

Parameter	Units	Value			Data Source
		Worst Case*	Typical Case	Best Case	
Effective C.t	min.mg/L	15.7	38.1	96.2	Calculated
Free Cl_2 residual	mg/L	1.4	2.0	3.0	Darbys Falls CCPs
WTP outflow rate	L/s	7	7	7	WTP flow rate *2 – estimate of peak flow rate to town in the absence of flow data
Baffling factor (T10/T)		1 (pipe) 0.3 (tank)	1 (pipe) 0.3 (tank)	1 (pipe) 0.3 (tank)	Estimated
Contact tank capacity	m^3	10	10	10	CSC – assumes 2 5kL tanks online
Minimum tank operating level	%	25	50	100	CSC
Effective contact time (tanks plus pipe)	mins	11.2	17.6	29.5	Calculated

Table 36: Summary of Wyangala WTP Effective C.t and Disinfection Parameters

Parameter	Units	Value			Data Source
		Worst Case	Typical Case	Best Case	
Effective C.t	min.mg/L	16	45	120	Calculated
Free Cl_2 residual	mg/L	0.8	1.5	3.0	Draft CCPs
WTP outflow rate	L/s	10	10	10	Placeholder data - TBC
Baffling factor (T10/T)		0.1	0.1	0.1	Conservative assumption
Contact tank capacity	m^3	240	240	240	CSC
Minimum tank operating level	%	50	75	100	Placeholder data - TBC
Effective contact time	mins	20	30	40	Calculated

CSC operators perform regular jar tests to ensure that the treatment processes at the WTPs are appropriate for current source water quality. The Water Operators follow the jar testing procedure formally taught in the DPE Water, Water Treatment Operations course, cross referenced with the procedure in the WIOA *Optimisation of Coagulation and Flocculation* handbook.

CSC will need to review system changes such as the future possible extension of the drinking water reticulation networks.

10.3 Design of Equipment

CSC relies on consultants and contractors to validate the selection and design of new equipment required for upgrades and process improvements, with input from water quality team. All new infrastructure must also be approved by the DPE Water, in accordance with Section 60 of the *Local Government Act 1993*, prior to construction.

11.DOCUMENTATION AND REPORTING

11.1 Management of Documentations and Records

CSC uses the software system Content Manager (CM9) to manage Council-wide documents, including those pertinent to water quality. A dedicated data collation and reporting system (WaterOutlook) has been implemented for the performance monitoring and compliance of Council's potable water systems (Cowra, Wyangala and Darbys Falls only).

The NSW Health Drinking Water Database is used as a supplementary records management system for CSC's water quality results that are collected as a part of the Drinking Water and Operational Monitoring Program(s).

CSC's website is also used as a vehicle for the storage and communication of information.

11.2 Reporting

CSC contributes to the annual performance data collection and reporting required by DPE Water.

As a water utility that fluoridates, CSC is required to report fluoride monitoring results and any fluoride dosing incidents to NSW Health in accordance with the *NSW Code of Practice for Fluoridation of Public Water Supplies* (NSW Health, 2011).

Reports on water quality can be generated through the NSW Health Drinking Water Database.

Other internal and external reporting includes:

+ Weekly routine report to from operators to WTP Supervisor
+ WTP Supervisor weekly data summary to Water & Wastewater Engineer
+ Historic data summaries as part of SCADA upgrade
+ EPA Licence Performance Data (waste water discharge)
+ Flow meter readings to WaterNSW
+ DPE inspections reported to WTP Supervisor and Manager Water and Wastewater
+ Operational/compliance updates to Councillors (via Council meetings)
+ CSC Operational Plan
+ CSC Annual Report

12.EVALUATION AND AUDIT

12.1 Long-Term Evaluation of Results

Long term trending of data is carried out for risk assessment workshops and is captured within the Risk Assessment Briefing Documents. CSC also uses the NSW Drinking Water Database for long-term evaluation of distribution water quality results.

CSC will review performance of CCPs, water quality data and levels of service against ADWG, NSW Water Supply and Sewerage Performance Monitoring reports and other regulatory requirements prior to annual review of the Improvement Plan, the annual budgeting process and the strategic planning process. Operational performance by way of water quality data will be reviewed daily, weekly, and yearly.

12.2 Audit of Drinking Water Quality Management

Informal inspections of the system are carried out by Operators, but there is currently no program of formal internal audits in place.

External inspections of the system are carried out by the local DPE Water Officer at a risk-based frequency determined by the Department. The Officer's findings are used to help direct works.

It is understood that external DWMS audits will soon be rolled out across NSW Local Water Utilities in accordance with the *NSW Guidelines for Drinking Water Management Systems.*

13.REVIEW AND CONTINUAL IMPROVEMENT

13.1 Review by Senior Executive

CSC's Annual Report includes information regarding:

+ Works on the water supply system, including related expenditure
+ Progress on water-related goals (e.g. compliance with Best Practice Guidelines for Water and Sewerage)

This DWMS and its implementation is reviewed annually to ensure that it maintains currency with the water supply and its management practices. A DWMS Review Report is prepared annually and must be provided to NSW Health.

13.2 Drinking Water Quality Management Improvement Plan

Actions to improve risk management in the water supply system were identified in the risk and CCP workshops in 2020 and 2023.

All actions are captured within Table 37. Tasks in the Improvement Plan are prioritised and responsibilities will be delegated/assigned as part of the ongoing implementation of this DWMS.

Table 37: Drinking Water Quality Improvement Plan

Scheme	No.	Action	Timeframe
Risk Level: Very High			
All schemes	1	Model distribution systems (chlorine and temperature); using operational chlorine & temperature data and reservoir temperature profiles (sample at different depths). Investigate reservoir mixing if required, and review risk assessment based on outcomes	
All schemes	2	Progression of rechlorination projects	
All schemes	3	Conduct sanitary survey - already in planning as part of IWCM work	
All schemes	4	Review register of high risk customers with a view to identifying any additional high risk customers	
All schemes	5	Alert Environmental Department around backflow requirements with new DAs; particularly change of business	
All schemes	6	Check rainwater tanks (possibly under Policy 17)	
All schemes	7	Audit presence and condition of reservoir vermin proofing, particularly in corrugation gaps	
Bilimari	8	Consider including warnings in every rates notice Ensure all taps are labelled "Not suitable for drinking" Advise/remind real estate agents that water is non-drinking Include non-drinking details on council website	
Cowra	9	Cover the filtered water well	

Scheme	No.	Action	Timeframe
Wyangala	10	Verify minimum ACH dose rate required - undertake jar tests (dose, take sample, filter through 0.45 µm, test UVA/UVT). May be some "trial and error" with initial operation balancing membrane fouling with organics removal. Close attention to TMP.	
Wyangala	11	Method for back-pressurising to be confirmed	
Wyangala	12	Calculate CT for chlorine disinfection under reasonable worst-case conditions	
Wyangala	13	Confirm no-flow alarm through rotameter	
Wyangala	14	Add in Wyangala CWS into WaterOutlook for scheduling	
Wyangala	15	Confirm Enviropacific will rectify vermin proofing around top of reservoir walls where they meet the roof (currently plugged with foam pieces)	
Wyangala	16	Consider CWS ladder lock out mechanism	
Risk Level: High			
All	17	Undertake a security review (site security, contractor management, SCADA security)	Not started (2025/26)
All	18	Review procurement procedure for chemical quality considerations	Not started (2024/25)
All	19	Review how mains breaks are managed [SWMSs could cover water quality (positive pressure where possible, flushing, super chlorination if possible, water quality check before return to service)]	Not started (2025/26)
CTW	20	Update Bulk Water Supply Agreement to ensure water quality criteria and communications triggers are well described, and routine sharing of water quality data	Underway
CTW	21	Develop incident response procedure for receipt of out of specification bulk water	Underway
CTW	22	Formalise process of water quality data collation, review and trend analysis	Underway
CTW	23	Install online monitoring at priority water handover points	Underway (completed at Gooloogong)
Cowra	24	Consider doing THM monitoring (PHU can likely fund this)	Not started
Cowra	25	Review CT recommendations from Hunter H2O report, implement solutions to ensure >15mg.min/L CT	Underway – ongoing
Cowra	26	Implement recommendations from Hunter H2O filter optimisation work Assess options for filter-to-waste during ripening	Ongoing
Cowra	27	Develop/formalise WTP O&M program	Underway
Cowra	28	Consider need for UV treatment	Underway
Cowra	29	Conduct intensive monitoring program upstream and downstream of Boorowa River confluence with Lachlan River, to determine water quality effects of Boorowa River. Review risk to the Cowra supply system (after intensive monitoring program)	Not started.
Darby's Falls	30	Lock/tag out/remove valve to Darby's Falls winter dosing point to prevent accidental operation	Completed
Darby's Falls	31	Ensure Darby's Falls Reservoir is secure (locked)	Completed

Scheme	No.	Action	Timeframe
Darby's Falls	32	Darby's Falls TMP to be visible and alarmed on SCADA	Completed
Darby's Falls	33	Operators to be trained in membrane plant diagnostics (in progress) - implement longer term monitoring of TMP trends	Completed Ongoing training
Darby's Falls	34	Darby's Falls - Pump sample water back to chlorine analyser continuously to provide visibility of chlorine residual even when plant offline (also requires code change to inhibit chlorine dosing if plant not operating)	Completed
Darby's Falls	35	Check how OSSMSs are inspected, and how inspections are prioritised	Completed Ongoing action by Council's Environmental Services Department.
Darby's Falls	36	Check how developments are approved when they're close to water intakes	Completed Ongoing action by Council's Environmental Services Department.
Wyangala	37	Cross connections with raw - WaterNSW workshop to be checked	Completed
Wyangala	38	Verify whether UV can achieve virus removal at the operating dose.	2024/25
Wyangala	39	Ensure SOPs and training provided	2024/25
Wyangala	40	Monitor pH changes caused by cement tank - particularly in low alkalinity source water periods	2024/25 Ongoing
Wyangala	41	Consider options for approaching WaterNSW to improve communications (possibly through Consultation Advisory Group)	Ongoing
Wyangala	42	Confirm timing on Pressure Decay Tests - FDS indicates PDTs are at 7 day frequencies. Reduce this to daily.	2024/25
Wyangala	43	Confirm return rate & operation of supernatant return. Set a critical limit	2024/25
Wyangala	44	Check handover documentation covers management of GAC media	2024/25
Risk Level: Medium			
All	45	Formalise records for reservoir inspections	Completed
All	46	Ensure that new mains commissioning procedure includes requirements from Aus. standards and WSAA requirements	Ongoing
All	47	Continue liaison with State Water to establish pre-warning notifications (dam releases)	Completed
Darby's Falls	48	Darby's Falls: Investigate reservoir mixing and rechlorination to keep residuals up (in progress)	Ongoing
Wyangala	49	Need to confirm with Enviropacific what issues may arise at low alkalinities with the ACH / UF process, as well as chlorine?	2024/25

Scheme	No.	Action	Timeframe
Wyangala	50	Consider doing THM monitoring - PHU will fund this	2024/25
Wyangala	51	Confirm online pH and Cl2 monitoring on inlet to CWS - SCADA mimic shows this	2024/25
Other (Incident Debrief Report)			
All	52	Train staff in the implementation of the DWMS, with a focus on Critical Control Points and Incident Reporting	Ongoing – Annual

14.REFERENCES

- Cowra Shire Council (2013). Annual Report 2012-2013, downloaded from CSC's website on 26/03/2014.
- Cowra Shire Council (2014). Cowra Shire Council Integrated Water Cycle Management Evaluation Study, supplied via email by Ken Keliher on 21/08/2014
- Cowra Shire Council (2013). Operational Plan 2013-2014/ Delivery Program 2013-2017, downloaded from CSC's website on 26/03/2014.
- Cowra Shire Council (2013). Strategic Business Plan for Water Supply and Sewerage Levels 2014, supplied via email by Ken Keliher on 15/08/2014
- NHMRC, NRMMC (2011). Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.
- NSW Health Drinking Water Database. Viewed on 12 August 2013. <http://www.drinkingwaterdb.nsw.gov.au/>.
- NSW Health, NSW Health Drinking Water Monitoring Program (2005). <http://www.health.nsw.gov.au/environment/water/documents/dwmp-booklet05.pdf>
- NSW Health, NSW Health Response Protocols. Viewed on 8 April 2014. <http://www.health.nsw.gov.au/environment/water/Pages/nswhrp-microbiological.aspx>
- NSW Health, Guidelines for Water Carters. <http://www.health.nsw.gov.au/publichealth/environment/water/drinkwater_watercarters.asp>
- NSW Health, Division of Analytical Laboratories. Guide for Submitting Water Samples to the Division of Analytical Laboratories for Analysis 2010. Division of Analytical Laboratories, New South Wales, Lidcombe, <http://www.health.nsw.gov.au/environment/water/documents/dal_analysis.pdf>
- NSW Health, NSW Office of Water (2013). NSW Guidelines for Drinking Water Management Systems 2013. NSW Health, NSW Department of Primary Industries – Office of Water, New South Wales, North Sydney.
- NSW Office of Water (2013). 2011-12 Water Supply and Sewerage – NSW Benchmarking Report. NSW Office of Water Online, viewed 10 October 2013, <http://www.water.nsw.gov.au/Urban-water/Country-Towns-Program/Best-practice-management/Performance-monitoring/Performance-monitoring/default.aspx>.

A1. ERAMBIE ABORIGINAL COMMUNITY – CONTACTS, ROLES AND RESPONSIBILITIES

A2. RISK BRIEFING DOCUMENTS (2020 & 2023)

A3. DWMS RISK REGISTERS

A4. CCP AND OCP PROCEDURES

A5. NSW HEALTH INCIDENT RESPONSE PROTOCOLS