TWEED SHIRE COUNCIL

Drinking Water Management System

Approved by: Manager Water

Version 6.0

Division: Engineering
Section: Water
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1 Executive Summary

1.1 Purpose

The Australian Drinking Water Guidelines (ADWG) set out a holistic approach to the management of the quality and safety of drinking water. Chapters 2 and 3 of the ADWG constitute the Framework for the Management of Drinking Water Quality. The ADWG Framework is centred on understanding how contamination of water may arise and implementing reliable, preventive controls to protect the consumer from adverse consequences. The appropriate implementation of the Framework is required to conform to the *Public Health Act 2010* which commenced operation on the 1st September 2012 when the *Public Health Regulation 2012* came into effect. The Act sets out the need for a *Quality Assurance Program* (QAP) or risk-based Drinking Water Management System (DWMS) consistent with the ADWG Framework. This document constitutes the DWMS for Council. It details how Council conforms to the Framework. The DWMS follows the structure of the Framework with 12 Elements, 32 Components and 76 Actions.

This DWMS covers the catchment and Clarrie Hall Dam and the three water supply systems including: Bray Park, Tyalgum and Uki Water Treatment Plants and their respective distribution systems.

1.2 Critical Control Points

The Critical Control Points (CCPs) and their associated monitoring and response procedures constitute the core of the DWMS. All operators are trained in the CCPs and the CCPs are displayed prominently at treatment plants. Operators retain records of system performance against the CCP requirements and record the actions taken in response to excursions outside operational and critical limit criteria.

It is important to note that the CCP tables are not exhaustive in that there are many other actions taken by Council and other stakeholders to protect and enhance drinking water quality. The CCPs are, however, those process steps that require the most attention and, wherever practicable, continuously monitored and alarms generated for urgent response by operators.

2 Introduction

2.1 Australian Drinking Water Guidelines

The Australian Drinking Water Guidelines (ADWG) set out a holistic approach to the management of the quality and safety of drinking water. Chapters 2 and 3 of the ADWG constitute the Framework for the Management of Drinking Water Quality. The ADWG Framework is centred on understanding how contamination of water may arise and implementing reliable, preventive strategies to protect the consumer from adverse consequences.

The Framework was developed to guide the design of a structured and systematic approach for the management of drinking water. The Framework is effectively a quality management system that has been developed specifically for the water industry. It incorporates a preventive risk management approach from catchment to consumer.

The Framework addresses four general areas (Figure 2.1):

- **Commitment to drinking water quality management:** This involves developing a commitment to drinking water quality management within the organisation. Adoption of the philosophy of the Framework is not sufficient in itself to ensure its effectiveness and continual improvement. Successful implementation requires the active participation of senior executive and a supportive organisational philosophy.
- **System analysis and management:** This involves understanding the entire water supply system, the hazards and events that can compromise drinking water quality, and the preventive measures and operational control necessary for assuring safe and reliable drinking water.
- **Supporting requirements:** These requirements include basic elements of good practice such as employee training, community involvement, research and development, validation of process efficacy, and systems for documentation and reporting.
- **Review:** This includes evaluation and audit processes and their review by senior executive to ensure that the management system is functioning satisfactorily. These components provide a basis for review and continual improvement.

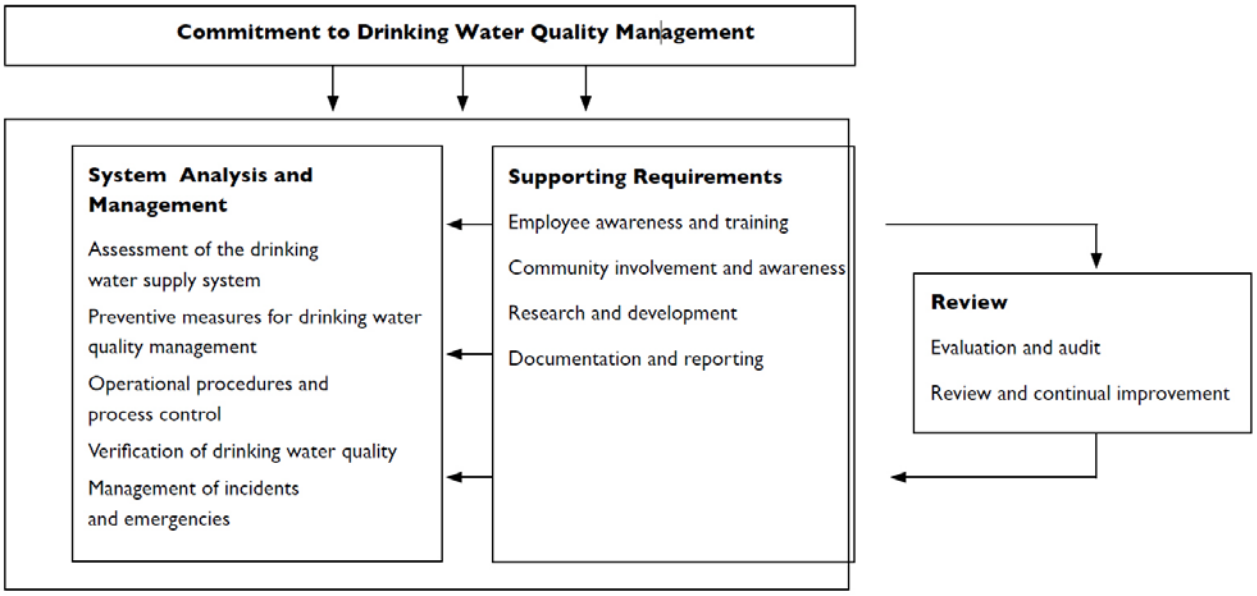


Figure 2.1 Framework for Management of Drinking Water Quality (ADWG, 2011).

2.2 Public Health Act and Regulation

The appropriate implementation of the Framework is required to conform to the *Public Health Act 2010* which commenced operation on 1 September 2012 when the *Public Health Regulation 2012* came into effect. The Act sets out the need for a Quality Assurance Program (QAP) which the Regulation refers to as a risk-based Drinking Water Management System (DWMS) that should be consistent with the ADWG Framework.

2.3 DWMS structure

This DWMS details how Council addresses and or intends to address the elements of the Framework. The DWMS follows the structure of the Framework with 12 Elements, 32 Components and 76 Actions (Table 2.1). The DWMS has also been developed in accordance with the *NSW Guidelines for Drinking Water Management Systems 2013*.

The DWMS was developed using the following steps:

- System description, water quality data analysis, risk assessment workshop, risk management workshop and water quality data review in order to address Elements 2 to 5 of the Framework. These processes were carried out separately for each water supply system: Bray Park, Uki and Tyalgum.
- An audit (termed a Gap Analysis) of the current state of conformity with the Framework and developed actions to fill those gaps.
- Documentation of how Council addresses the elements of the Framework through this DWMS, partly by referencing other existing documents and systems, and identifying actions required to further improve compliance.

Table 2.1 Summary of the ADWG Framework 12 Elements and 32 Components.

1. Commitment to Drinking Water Quality Management	***6. Management of Incidents and Emergencies***
Drinking water quality policy	Communication
Regulatory and formal requirements	Incident and emergency response protocols
Engaging stakeholders	***7. Employee Awareness and Training***
2. Assessment of the Drinking Water Supply System	Employee awareness and involvement
Water supply system analysis	Employee training
	8. Community Involvement and Awareness

Assessment of water quality data Hazard identification and risk assessment ***3. Preventive Measures for Drinking Water Quality Management*** Preventive measures and multiple barriers Critical control points ***4. Operational Procedures and Process Control*** Operational procedures Operational monitoring Corrective action Equipment capability and maintenance Materials and chemicals ***5. Verification of Drinking Water Quality*** Drinking water quality monitoring Consumer satisfaction Short-term evaluation of results Corrective action	Community consultation Communication ***9. Research and Development*** Investigative studies and research monitoring Validation of processes Design of equipment ***10. Documentation and Reporting*** Management of documentation and records Reporting ***11. Evaluation and Audit*** Long-term evaluation of results Audit of drinking water quality management ***12. Review and Continual Improvement*** Review by senior executive Drinking water quality management Improvement plan

3 ELEMENT 1 - Commitment to Drinking Water Quality Management

3.1 Drinking water quality policy

ADWG Actions

- **Formulate a drinking water quality policy endorsed by senior executives to be implemented throughout the organisation.**
- **Ensure that the policy is visible, communicated, understood and implemented by employees.**

Council has adopted a Drinking Water Policy (adopted by Council at its meeting on 20 June 2013) (Figure 3.1). The policy commits Council to implementing the requirements of the Framework through a DWMS and is the overarching policy under which this DWMS document has been created. The policy is communicated to staff and implemented by the following mechanisms:

1. Prominent display at Water Treatment Plants
2. Inclusion in Facility Working Manuals
3. Inclusion in staff induction
4. Access through Council's Intranet and Water Unit Knowledge Base (WUKB)

Drinking Water Policy

Tweed Shire Council is committed to managing its water supply effectively to provide high quality drinking water that protects public health and consistently meets the Australian Drinking Water Guidelines, and consumer and other regulatory requirements. To achieve this Council will implement a Drinking Water Management System that is based on the following principles:

- Managing water quality at all points along the delivery chain from source water to consumer
- Using a risk-based approach in which potential threats to water quality are identified and managed
- Integrating the requirements of our consumers, stakeholders, regulators and employees into our planning
- Establishing regular monitoring of the quality of drinking water and effective reporting mechanisms to provide relevant and timely information, to promote confidence in the water supply and its management
- Developing appropriate contingency planning and incident response capability
- Continually improving our practices by assessing performance against corporate commitments and stakeholder expectations
- Implementing and regularly reviewing maintenance and asset management programs

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.

Figure 3.1 Drinking Water Policy

3.2 Regulatory and formal requirements

ADWG Actions

- **Identify and document all relevant regulatory and formal requirements.**
- **Ensure responsibilities are understood and communicated to employees.**
- **Review requirements periodically to reflect any changes.**

The *Public Health Act 2010* and the *Public Health Regulation 2012* require drinking water suppliers to develop and adhere to a 'quality assurance program'. The *NSW Guidelines for Drinking Water Management Systems 2013* describe the process to develop and implement the quality assurance program.

Local water utilities must also comply with the NSW *Best-Practice Management of water Supply and Sewerage Framework* and *Best Practice Management of Water Supply and Sewerage Guidelines*. The Framework and Guidelines outline the requirements for an Integrated Water Cycle Management (IWCM) and a Strategic Business Plan (SBP). Council has adopted an IWCM and SBP to meet the requirements.

Table 3.1 Summary of the key Regulatory and Formal Requirements relating to drinking water quality management.

Regulatory or formal requirement	***Relevance to drinking water quality***
Public Health Act 2010 (NSW), Part 3, Division 1, Clause 25 and supporting *Public Health Regulation 2012* (NSW), Part 5, Clause 34.	Sets out the need for Quality Assurance Programs and notes that the Australian Drinking Water Guidelines Framework provides the point of reference for developing such a program
Australian Drinking Water Guidelines 2011	Sets out appropriate practice for drinking water quality management within Australia
NSW Guidelines for Drinking Water Management Systems 2013	Describes the process to develop and implement a management system
Fluoridation of Public Water Supplies Act 1957 (NSW)	Sets out the requirements for fluoridation of public water supplies
NSW Code of Practice for the Fluoridation of Public Water Supplies 2011	
NSW Health Drinking Water Monitoring Program 2005	Provides for independent testing by NSW Health of Council's treated water as supplied to consumers
Public Health (General) Regulation 2002 (NSW)	Requires Council to notify NSW Health if there is reason to suspect that drinking water quality might pose a risk to public health
NSW Water Supply and Sewerage Benchmarking Report 2012-2013	Attachment 2 – Appendix E documents the minimum requirements for ensuring water supplies are safe from microbial contamination
Protection of the Environment Operations Act 1997 (NSW)	Sets out the requirements for the control of water pollution from certain activities (noting that these may be in the drinking water catchment) which are registered with the Office of Environment and Heritage (OEH)

Regulatory or formal requirement	***Relevance to drinking water quality***
Local Government Act 1993 (NSW) and *Local Environment Plans*.	Catchment development control to help protect the catchment, e.g. works in the catchment and new and existing development: farms and residential and other development.
Local Government (General) Regulation 2005 (NSW)	Sets out the requirements for on site sewage management systems (noting that these may be in the drinking water catchment) to be of an accredited (by NSW Health) design, to be registered with Council and to be subject to inspection
Pesticides Act 1997 (NSW)	Helps to protect the catchment from pesticide pollution
Environmental Planning and Assessment Act 1979 (NSW)	Guides protection of the catchment from major polluting facilities such as sewage and other wastewater discharges.
Water Management Act 2000 (NSW) and related water sharing plan	Extraction and environmental flows
Dangerous Goods (Road and Rail Transport) Regulation 2009 (NSW)	Helps to prevent spills and encourages reporting of spills of hazardous substances in the catchment.
Australian Guidelines for Water Recycling 2006	Covers managing risks of potable water supply cross-connections in dual reticulation systems.
NSW Dams Safety Act 1978 and Dam Safety Committee guidelines (informed by the ANCOLD guidelines) for surveillance and reporting.	NSW Dam Safety Committee requires an operational manual for the dam which may indirectly affect water quality.
Algal Contingency Plan for Marine and Freshwater Areas – North Coast Region, by DNR for the RACC, 2006. Interim *Blue-green Algal Management Protocols*, Water Directorate 2011.	Guide Council's response to blue-green algae incidents.
Water Supply Code of Australia (WSA03) 2011, Water Services Association of Australia	Document technical best practice for design and construction of water supply networks.
Sewerage Code of Australia (WSA 02)-2002	Covers the planning, design and construction of trunk, branch and reticulation sewers as well as maintenance structures
Plumbing Code of Australia	Sets out requirements for plumbing in Council's area of operations
NSW Best-Practice Management of Water Supply and Sewerage Framework 2011	This is the practical means of implementing the Goal of the NSW Government's Country Towns Water Supply and Sewerage Program by the regional NSW local water utilities, which are expected to implement the Framework

Regulatory or formal requirement	***Relevance to drinking water quality***
NSW Best-Practice Management of Water Supply and Sewerage Guidelines 2007	Sets out the NSW Government requirements for effective and efficient delivery of water supply and sewerage services and sustainable water conservation practices and water demand management.

Table 3.2 Summary of core Council documents relating to drinking water quality.

Regulatory or formal requirement	***Relevance to drinking water quality***
Tweed Shire Council Integrated Water Cycle Management Study 2013	Influence water quality indirectly.
Strategic Business Plan	Planning document for Council's water supply and sewerage businesses. The plan identifies the levels of service which provide the best value for money for the community. The plan also documents the utility's proposed management of assets and resources required to achieve the target levels of service.
Clarrie Hall Dam Management Plan	Manage Clarrie Hall Dam water supply and catchment area
C401 Water Reticulation Development Specification	Development specs include testing of pressure and superchlorination [the latter done in house], based on the WSAA codes. This includes standard drawings that ensure installations meet a required standard.
C402 Sewerage System Development Specification	Indirectly relevant to protection of water from sewer contamination.
D11 Water Supply Design Specifications	Guides backflow, class of pipes and standard installation requirements.
D12 Sewerage System Design Specifications	Guides separation of sewer and water
Tweed Shire Council Drought Management Strategy 2009	Influence water quality indirectly.
Water Restrictions Policy	Outlines water restriction levels required to maintain essential supply
Backflow Policy	Policy to prevent backflow into the water supply
Water Connections Policy	Outlines how customers are connected to the water supply
Trade Waste Policy	Ensures wastewater treatment systems do not unnecessarily pollute waterways.

3.3 Engaging stakeholders

ADWG Actions

- **Identify all the stakeholders who could affect, or be affected by, decision or activities of the drinking water supplier.**
- **Develop appropriate mechanisms and documentation for stakeholder commitment and involvement.**
- **Regularly updated the list or relevant agencies.**

Providing quality drinking water requires Council to engage and consult with a range of stakeholders (Table 3.3 and 3.4). Council's stakeholders in relation to water supply include, but are not limited to, government agencies, businesses, cultural groups, education providers, environmental groups, media, landholders and customers (rate payers).

The State Government is a core stakeholder for Council, particularly the NSW Office of Water and NSW Health. Both were invited and participated in the risk assessment process and the development of this DWMS. These agencies will also be invited to take part in future risk assessment actions, reviews and audits.

NSW Health and Council respond together to water quality contamination events, such as the detection of *E. coli* in the distribution system. In the unlikely event of suspected or confirmed water contamination, Council will notify NSW Health immediately.

Council engages with stakeholders for specific purposes and projects to gain stakeholder commitment and involvement. Method and levels of engagement with stakeholders is guided by Council's Engagement Strategy. Communication and engagement activities vary project-to-project according to:

- The level of engagement - informing, consulting, involving or collaborating
- The intensity of impact or sensitivity towards an issue or project - high, medium or low
- The reach of the impact - Shire-wide or locality based
- Legislative requirements

Council has a range of tools to facilitate stakeholder engagement, including public exhibitions, community information sessions, community satisfaction surveys, an online feedback facility, meetings and an online engagement portal (Your Say Tweed).

Table 3.3 Summary of Core Stakeholders.

Stakeholder	***Relevance to drinking water quality***	***How Council engages with this party***
NSW Health North Coast Area Health Service	Provides expertise, advice, regulatory requirements and water quality monitoring services to Council	Annual meetings with the Local Area Health Service to discuss the DWMS and progress on the Improvement Plan Participation of NSW Health in drinking water quality risk assessments, both the initial assessment and future review and updates Annual reporting to NSW Health on the DWMS and water quality test results
NSW Office of Water	Provides expertise, advice and regulatory	Annual reporting to the Office of Water on performance of the Water Unit

Stakeholder	*Relevance to drinking water quality*	*How Council engages with this party*
	requirements to Council	Inspections by the Office of Water of treatment plants and systems

Table 3.4 Summary of Additional Stakeholders.

Stakeholder	*Relevance to drinking water quality*
NSW Office of Environment and Heritage (OEH)	Protection and management of waterways
Northern Rivers Catchment Management Authority	Sustainable management of Natural Resources and implementation of the Catchment Action Plan
NSW Environment Protection Authority (EPA)	Regulation of wastewater treatment plants
NSW National Parks and Wildlife Service	Management of park within the catchment
NSW Department of Primary Industries	Management of forestry, waterways and agricultural land within the catchment
Council Water Unit	Provide water & sewerage operational & maintenance services and strategic planning
Council Environmental Health Unit	Involved in public health and pollution control and response to water quality incidents
Council Planning and Regulatory Division	Involved strategic planning and development assessment
Council Building Unit	Involved in review and assessment of plumbing within buildings
Tweed River Committee	Council's advisory committee for natural resource management, particularly water and riparian vegetation issues.
NSW Water Directorate	Provide technical information and advice to local governments members in NSW
Water Services Association Australia	Provide a forum for debate on issues of importance to the urban water industry. WSAA provides a national focus for the provision of information on the urban water industry.
Education providers (North Coast Institute of TAFE)	Provide training to operators and water professionals
Catchment Landholders	Catchment management
Chambers of Commerce and other Industry Groups in the shire	Shire business development
Local emergency services	Fire, SES, Ambulance, Police
Commercial, industrial and residential users and consumers of the water, including tourists, workers and visitors	Set local water quality expectations

Stakeholder	***Relevance to drinking water quality***
Ratepayers	Provide funding to support water quality investments
Residents and Ratepayers Associations and Community Groups	Set local water quality expectations
Developers	Development of new infrastructure and devices
Chemical suppliers	Provide chemical for water treatment
Special medical (dialysis)	Special water quality and supply requirements
Environmental groups	Catchment management
Aboriginal Community – via Aboriginal Advisory Committee	Set water quality expectations

4 ELEMENT 2 - Assessment of the Drinking Water Supply System

4.1 Water supply system analysis

ADWG Actions

- **Assemble a team with appropriate knowledge and expertise.**
- **Construct a flow diagram of the water supply system from catchment to consumer.**
- **Assemble pertinent information and document key characteristics of the water supply to be considered.**
- **Periodically review the water supply system analysis.**

4.1.1 Assessment Team

System assessments were undertaken by teams with the appropriate knowledge and expertise. The initial system assessments were undertaken during 2009 (Table 4.1) and the Tyalgum assessment was updated during 2012 following the construction of a new plant (Table 4.2).

Table 4.1 System Assessment Team - 2009

Organisation	***Position***	***Name***
Tweed Shire Council	Manager Water Unit	Anthony Burnham
	Water & Sewerage Operations Engineer	Peter Haywood
	Treatment Plant Process Engineer	Marty Hancock
	Water Treatment & Catchment Supervisor	Wayne Watson
	Environmental & Health Coordinator	Doreen Harwood
	Laboratory Coordinator	Paul Wright
	Waterways Program Leader	Tom Alletson
NSW Health	Environmental Health Officer	Geoff Sullivan
NSW Office of Water	Principal Urban Water Manager	Chris Hennessy
Combined Tweed Rural Industries Association	President	Colin Brooks
Community	Retired Manager Water Unit	John Henley
Water Futures	Consultant	Daniel Deere
Water Futures	Consultant	Annette Davison
City Water Technology	Consultant	Bruce Murray
Hunter Water Australia Pty Ltd	Consultant; Team Leader - Membranes, Process and Operations	Matt Bloomfield

Organisation	*Position*	*Name*
Tweed Shire Council	Councillor	Katie Milne
Tweed Shire Council	Councillor	Barry Longland

Table 4.2 System Assessment Update Team - 2012

Organisation	*Name*
Tweed Shire Council	Marty Hancock
	Peter Haywood
	Wayne Watson
	Darren Lyndon
	Anthony Burnham
	Michael Wraight
NSW Health	Geoff Sullivan
NSW Office of Water	Chris Hennessy
Water Futures	Dan Deere

4.1.2 Water Supply System

Council has three water supply systems (Figure 4.1):

- Bray Park Water Supply System
- Uki Water Supply System
- Tyalgum Water Supply System

All systems draw water from the Tweed River catchment which covers an area of more than 570 square kilometres and is entirely located within the boundary of the Tweed Local Government Area (LGA). Key features of the LGA are summarised in Table 4.3.

The Bray Park system extracts water from the Tweed River at Bray Park Weir (Figure 4.2). The catchment for this area includes the Oxley and Tweed River catchments. Clarrie Hall Dam (CHD) is located on Doon Doon Creek, a tributary of the Tweed River. It was built as water storage for the Tweed water supply. When required, water is released to supplement natural flows into Bray Park Weir. The Bray Park system supplies water to all the urban areas of the Tweed Shire accept for the villages of Uki and Tyalgum.

The Uki system extracts water from the Tweed River and supplies water to the village of Uki. Uki is downstream of Doon Doon Creek and CHD. Water is treated at the Uki Water Treatment Plant. Natural water flows can be supplemented by releases from CHD as required.

The Tyalgum system extracts water from a weir pool on the Oxley River. Water is treated at the Tyalgum Water Treatment Plant supplies water to the village of Tyalgum. During dry periods the Oxley River sometimes stops flowing and severe blue-green algal blooms in the weir pool may necessitate the carting of water from the Bray Park system.

The water supply reticulation network consists of a series of pump stations, reservoirs, pressure control valves, chlorine and carbon dioxide dosing points and pipes. Figure 4.3 provides an overview of the network and details of the network are maintained on Council's GIS system.

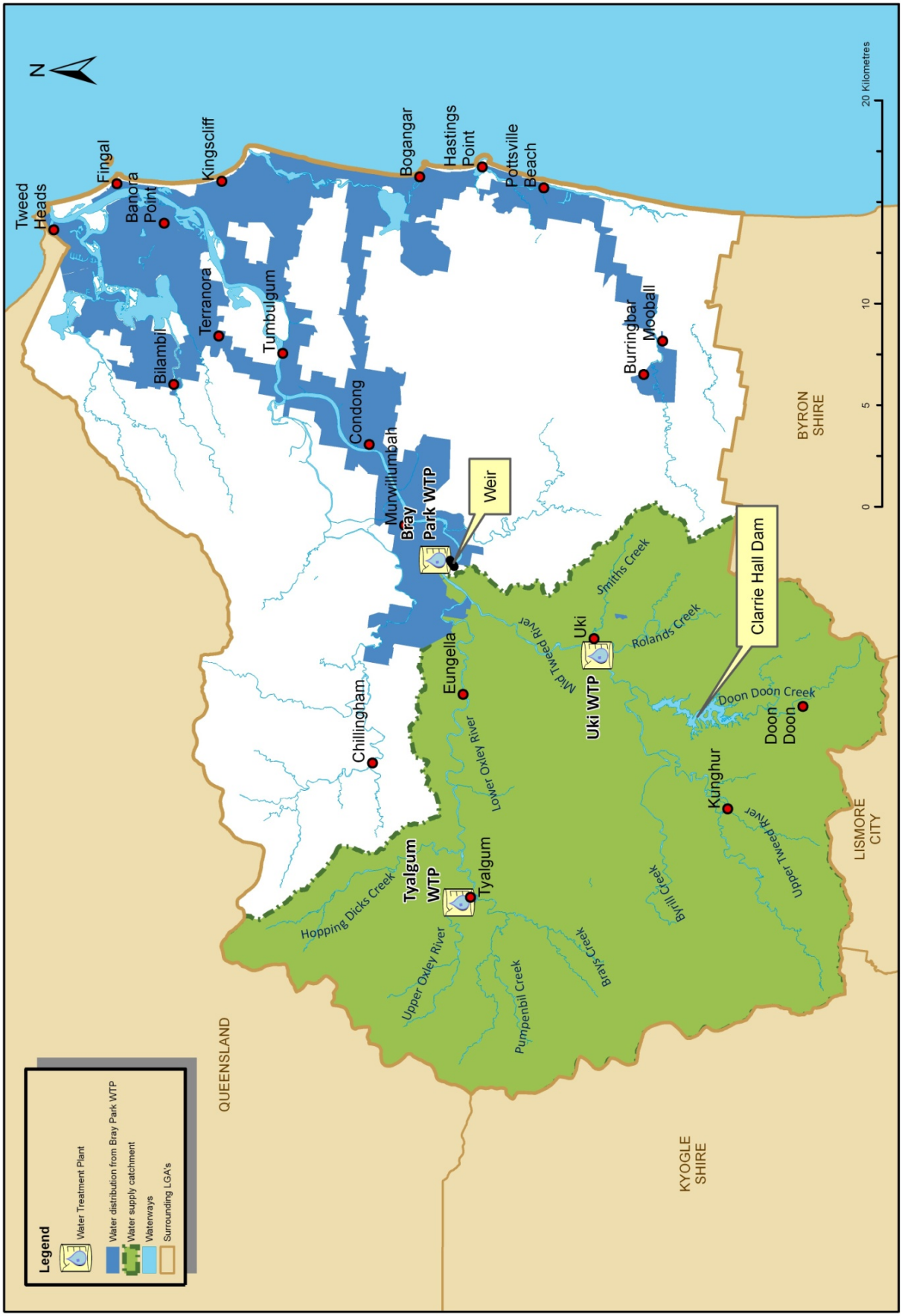


Figure 4.1 Overview of network

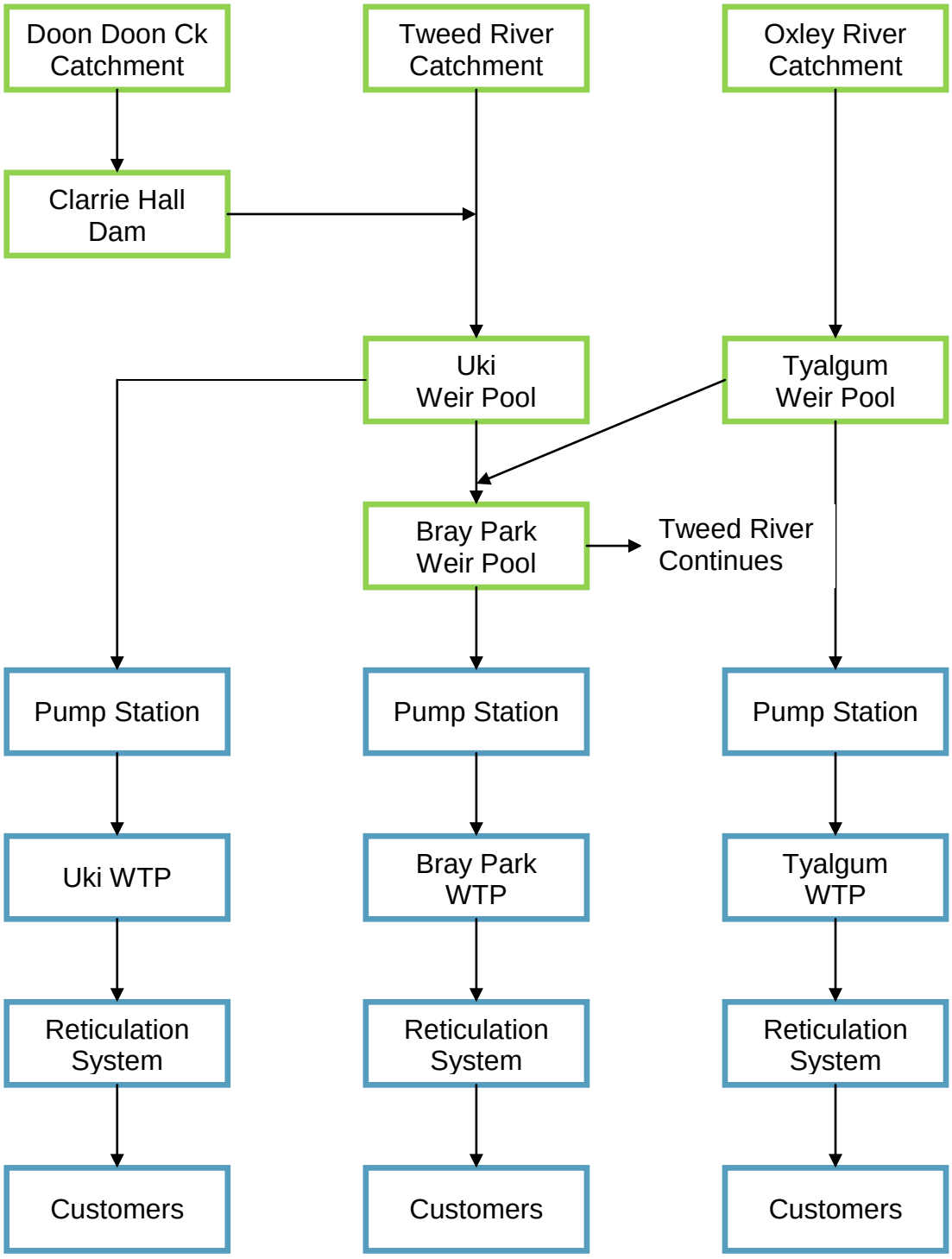


Figure 4.2 Overview Process Flow Diagram of water supply systems.

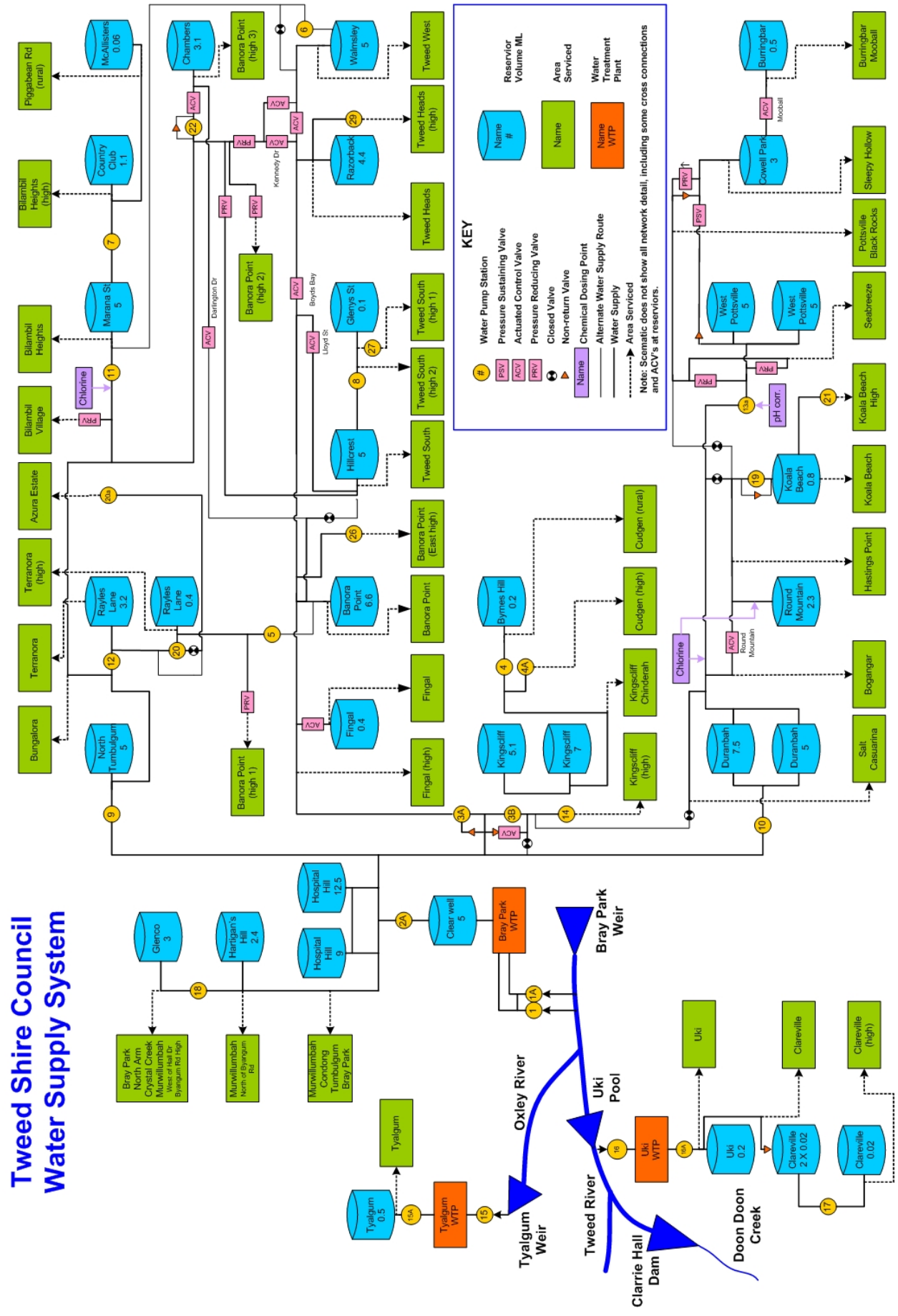


Figure 4.3 Process Flow Diagram of Distribution Network.

Table 4.3 Key characteristics of the Tweed LGA and catchment boundary

Characteristic	Details
Location	Far North Coast of NSW
Catchment area	1,340 km^2
Catchment boundary	Boundary coincides with LGA boundary and includes the catchments of the Tweed River and three coastal estuaries (Cudgen, Cudgera and Mooball Creeks)
Tweed River catchment	1,080 km^2
Population	85,000 (2011 Census)
Main coastal urban areas (and resident populations served based on 2011 Census)	Tweed Heads and surrounding suburbs (25,087), Banora Point (15,047), Kingscliff (6,392), Casuarina (1,661), Bogangar (3,099), Hastings Point (582) and Pottsville (5,735)
Main rural towns (and resident populations served based on 2011 Census)	Murwillumbah (7,406), Uki (765), Tyalgum (503), Mooball (377) and Burringbar (858)
Major catchment features	The Tweed Valley is surrounded by the McPherson Range to the north, Tweed Range to the West and Nightcap Range to the south. Mt Warning is the centre of an extinct shield volcano (1156 m). The Tweed River floodplain extends to the Cobaki and Terranora Broadwaters and coastal beaches.

4.1.3 Water Sources

The majority of the Tweed water supply catchment is made up of rural and agricultural land uses, small residential villages, sclerophyll open forest and sub-tropical rainforest (Table 4.4). The Tweed has an average rainfall of approximately 1600 mm per year. Rain that falls within the catchment travels through forests, farms, villages and stormwater drains. As this water moves over the land, it picks up sediment, impurities and pathogens. Water quality issues include:

- Cyanobacteria (blue-green algal) blooms causing taste and odour issues and potential toxins.
- Pathogens and faecal microorganisms including thermotolerant coliforms, particularly *E. coli*.
- Variable turbidity with storm or flood related events up to 1,000 NTU.
- Moderate organic content.
- Disinfection by-product formation due to moderate levels of organics in raw water.
- Low raw water alkalinity during high turbidity events.
- Soluble iron and manganese.
- Temperature variation.
- Raw water is slightly aggressive.

Of overall importance from a water quality perspective are the high average runoff rates from the catchment. These rates are due to steep ranges in the upper catchment and short stream lengths in the lower catchment. In combination, the topographical features of the catchment can give rise to peak flows which can carry high levels of runoff contaminants

such as pathogens and particles quickly into waterways and potentially overwhelm treatment barriers.

Other potential water quality risks with this water source include protozoa and bacteria generated by cattle grazing adjacent to the waterway, and potential human pathogens, including viruses, from any failing and hydraulically connected on-site sewage management systems.

Table 4.4 Water Sources Summary

Source	System	Category	Description
Clarrie Hall Dam Catchment	Bray Park and Uki	National Park	Small area of national park (Mt Jerusalem, Nightcap) mainly around the borders of the catchment, this type of land use will typically include native vegetation with potential inputs from native and feral animals
		Land uses	Agricultural, rural residential at the headwaters of the dam. Chemicals, e.g. pesticides, in rural residential and agricultural areas
		Human Sewage	Onsite treatment system with the potential for failure and input of human pathogens and nutrients
		Recreation	Some bushwalking and camping
		Natural	This type of land use will typically include native vegetation with potential inputs from native and feral animals. Geological contributions, Fe, Mn, turbidity, P. Aquatic weeds.
Tweed River	Bray Park and Uki	National Park	Large area of national park (Mt Jerusalem, Nightcap, Border Ranges), this type of land use will typically include native vegetation with potential inputs from native and feral animals
		Land uses	Agricultural, rural residential and small villages. Chemicals, e.g. pesticides, in rural residential and agricultural areas
		Human Sewage	Onsite systems with the potential for failure and input of human pathogens and nutrients
		Recreation	Bushwalking and camping
		Natural	Flying foxes, sites near Uki and Bray Park. This type of land use will typically include native vegetation with potential inputs from native and feral animals. Geological contributions, Fe, Mn, turbidity, P and aquatic weeds.
Tyalgum Creek	Tyalgum	National Park	Small area of national park (Border Ranges, Lamington) mainly around the headwaters of the Oxley River, this type of land use will typically

Source	System	Category	Description
			include native vegetation with potential inputs from native and feral animals
		Land uses	Agricultural, rural residential and small villages. Chemicals, e.g. pesticides, in rural residential and agricultural areas
		Human Sewage	On-site sewage management systems with the potential for failure and input of human pathogens and nutrients
		Recreation	Some bushwalking and camping
		Natural	Flying foxes, sites near upstream of weir. This type of landuse will typically include native vegetation with potential inputs from native and feral animals. Geological contributions, Fe, Mn, turbidity, P. Aquatic weeds.

Water Extraction

Council holds Water Access Licences for each water treatment plant (Table 4.5). Each licence has conditions which Council adheres to. There are also water sharing rules under a Water Sharing Plan 2010.

Table 4.5 Water Access Licences

	Bray Park WTP	Uki WTP	Tyalgum WTP
Licence #	WAL30306	WAL21606	WAL23834
Water storage	Bray Park Weir, Tweed River	Run of Tweed River abstraction	Tyalgum Weir, Oxley River
Annual Allocation	27500ML	67ML	45ML pa
Water sharing plan	Mid Tweed River	Mid Tweed River	Upper Oxley River

4.1.4 Water Treatment

The water treatment processes for the Bray Park, Uki and Tyalgum water treatment plants are summarised in Table 4.6. The process diagrams for each plant have been taken from the plant SCADA overview (Figures 4.7 to 4.9)

Table 4.6 Water supply system and treatment.

Bray Park WTP	Uki WTP	Tyalgum WTP
Pre-screening • In line 0.8 mm strainers Pre-Treatment • Manganese removal (Potassium permanganate) • Taste and Odour removal (Powdered activated carbon) • Calcium addition (Hydrated Lime) • Alkalinity and pH correction (Carbon dioxide) • Coagulation (Aluminium sulphate) Filtration • Membrane ultrafiltration Post-Treatment • Disinfection (Gaseous chlorine) • Fluoride • pH correction (Sodium hydroxide) Clear water storage	Pre-Treatment • Taste and Odour removal (Powdered activated carbon) • Alkalinity and pH correction (Sodium hydroxide) • Coagulation (Aluminium sulphate) Clarification • Lamella separator Filtration • Media filtration – Dynasand Post-Treatment • Disinfection (Sodium hypochlorite) • pH correction (Sodium hydroxide) Clear water storage	Pre-screening • In-creek coarse sand filtration Pre-Treatment • Coagulation (Polyaluminium chloride) Filtration • Membrane ultrafiltration Post-Treatment • Disinfection (Sodium hypochlorite) • Taste and odour removal (Biologically activated carbon) Clear water storage

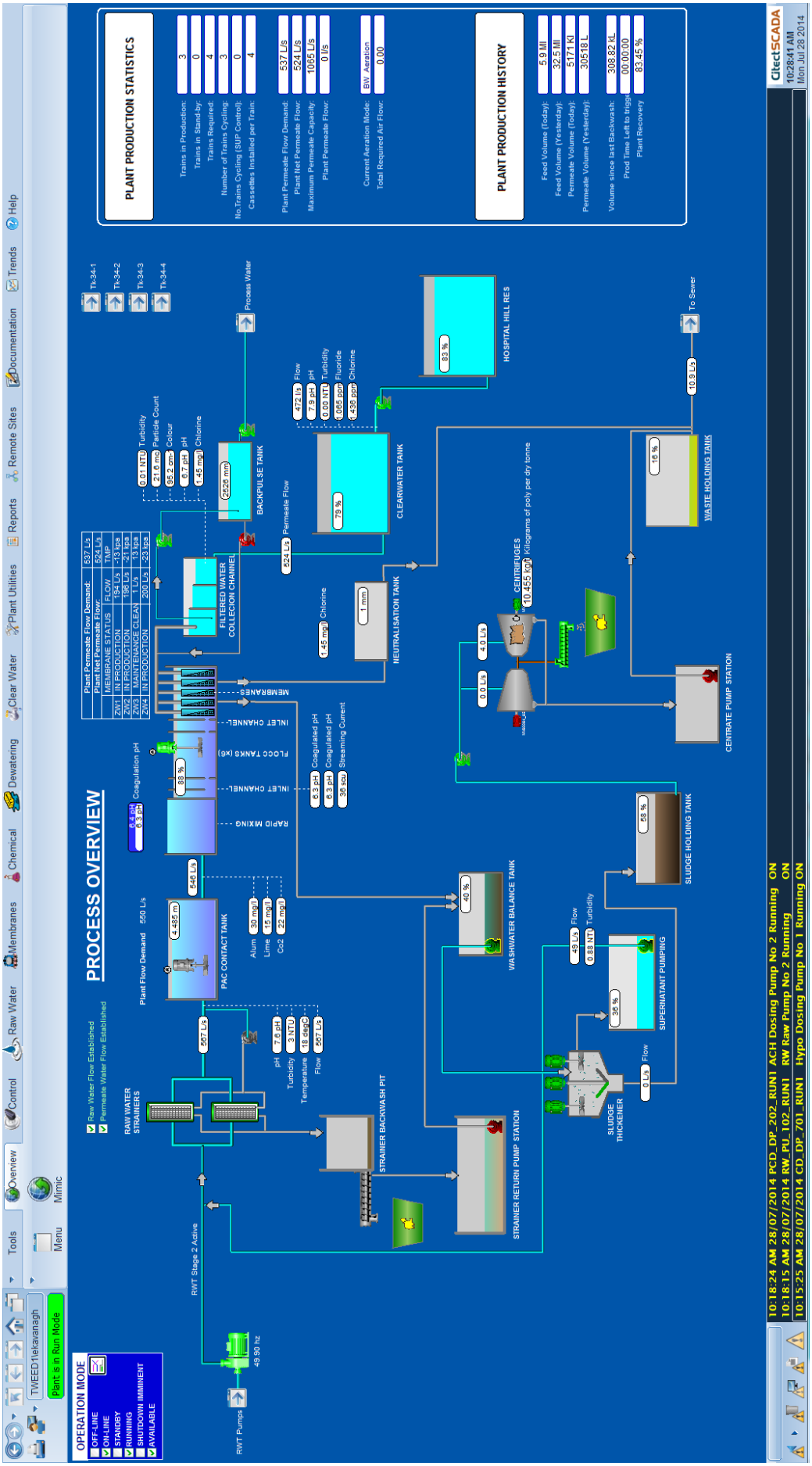


Figure 4.7 Process Flow Diagram of Bray Park WTP.

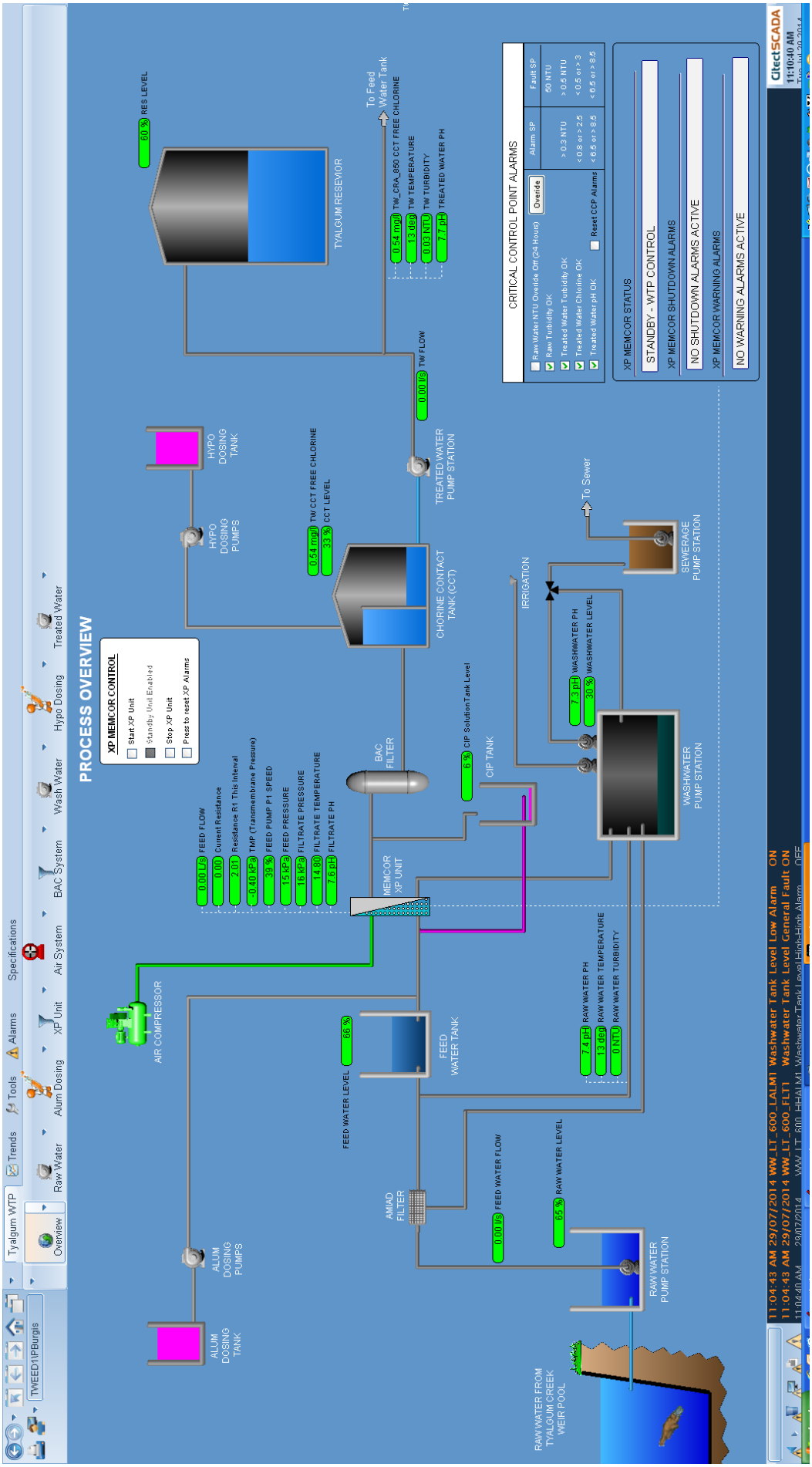


Figure 4.8 Process Flow Diagram of Tyalgum WTP.

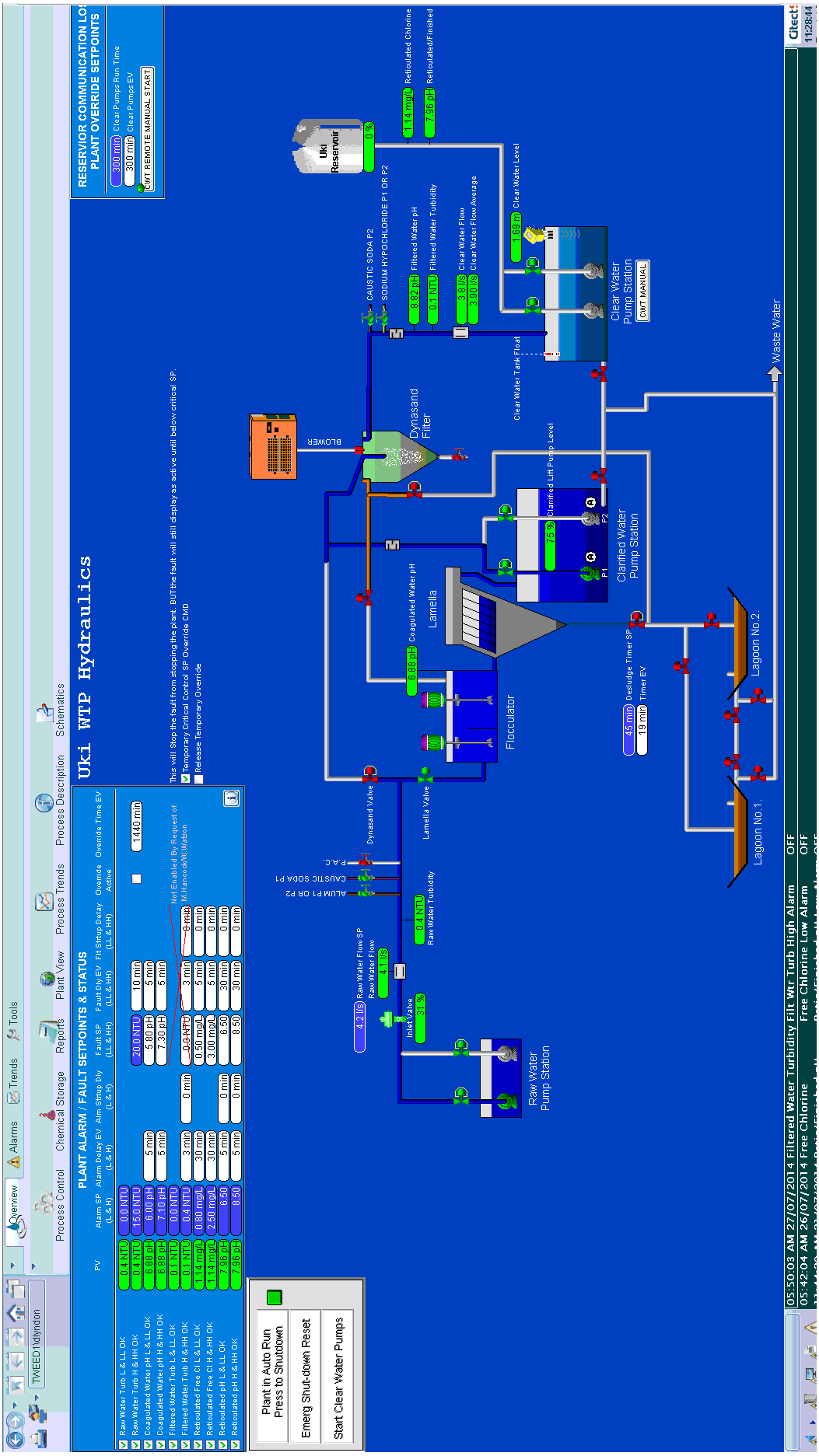


Figure 4.9 Process Flow Diagram of Uki WTP.

4.1.5 Water Distribution

The water distribution system consists of a series of pump stations, reservoirs, pressure control valves, actuated control valves, chlorine and carbon dioxide dosing points and pipes.

For the Bray Park system, water is pumped to Hospital Hill reservoirs from where it is distributed through trunk mains to four general areas. The areas are

- Murwillumbah , Bray Park, Condong and Tumbulgum serviced from Hospital Hill, Glenco and Hartigan's Hill reservoirs
- Casuarina, Bogangar, Hastings Point, Koala Beach, Pottsville and Burringbar are serviced from Duranbar, Round Mountain, Koala Beach, West Pottsville, Cowell Park and Burringbar reservoirs
- Kingscliff, Fingal, Banora Point and Tweed Heads are serviced from Fingal, Banora Point, Hillcrest Glenys St and Chambers reservoirs.
- Bungalora, Terranora, Bilambil Village and Bilambil Heights are Tweed Heads is serviced by North Tumbulgum, Rayles Lane, Marana St, Country Club and McAllisters reservoirs

There are many interconnections and control valves which allow for alternate routing of water to meet demand.

Within the distribution network there are two rechlorination points to boost free chlorine residual to the southern area at Round Mountain and to the northern area at Bilambil Village. There is also a Carbon dioxide dosing point at Pottsville at Pump Station 13A to correct pH.

The Uki system consists of three reservoirs, the main reservoir is for the village of Uki and the smaller Clareville reservoirs are for a small subdivision to the east of Uki.

The Tyalgum system has only one reservoir and a single pump station.

The network of pipes consist of various materials ranging in diameter from 25mm to 1000mm. Table 4.7 provides a break down of pipe types for all Council water pipes.

Table 4.7 Reticulation pipe types

Pipe material type	Length (km)	Length %
Ductile Iron Cement Lined	378	54
Unknown	165	23
Asbestos Cement	48	7
Cast Iron Cement Lined	35	5
UPVC	36	5
Mild Steel Cement Lined	26	4
Polyethylene	16	2
Other	2	0.3
Total	706	100

4.1.6 System review

The system description and supporting information will be reviewed annually and updated.

4.2 Assessment of water quality data

ADWG Actions

- **Assemble historical data from source waters, treatment plants and finished water supplied to consumers (over time and following specific events).**
- **List and examine exceedances.**
- **Assess data using tools such as control charts and trend analysis to identify trends and potential problems.**

Water quality data were sourced from Council and NSW Health databases. To be consistent with Council's approach, where a detection limit was recorded for data otherwise outside detection limits the recorded value was left at the detection limit. The raw water sources and treated water were analysed for a wide range of chemical, physical and biological parameters and the key water quality issues identified (Table 4.8) (Implementation of a Drinking Water Management System – Risk Workshop, 2010).

All of the raw water sources were more polluted than oligotrophic waters and would be capable of sustaining algal blooms at problematic levels with suitable environmental conditions. Toxigenic and taste and odour causing algae were identified. In addition, there was evidence of rainfall-related faecal contamination. Raw waters were also relatively high in turbidity, colour, iron and manganese. Therefore, the maximum risk without treatment scored on the high side for all systems for these hazards.

In general, the most common water quality issues in the reticulation systems were low chlorine residual, elevated pH and the occasional presence of total coliforms. These data are symptomatic of cement lined pipes in long, warm water systems leading to loss of chlorine residual, or loss of chlorine residual effectiveness due to elevated pH, with the appearance of regrowth total coliforms. For the main Bray Park system, these problems were more pronounced in some localities than others. While these issues are not exceedances, it is best practice to maintain a disinfectant residual and appropriate pH, and to seek to minimise total coliform presence.

The Tyalgum system had additional problems with elevated turbidity, iron and aluminium as well as total coliforms present in the treated water, all symptomatic of treatment performance problems. These problems are more significant from a health risk perspective.

Table 4.8 Water quality issues

System	Issue	Comments	Water Quality Significance
All systems, raw water	Algae	Algal counts, chlorophyll *a* and phosphorus levels occasionally exceed trigger values.	Although not a direct source of supply to the major urban systems, these results indicate that the raw water is subject to potentially significant blooms of problem phytoplankton. Toxigenic genera, such as *Microcystis* and *Anabaena,* have been identified as have compounds such as MIB and geosmin.
	Metals	Total iron and total manganese frequently exceed drinking water guideline values.	Although not a direct source of supply to the major urban systems, these results indicate that the raw water would yield levels of metals that require treatment.
	Aesthetics	Both turbidity and colour frequently exceed drinking water guideline values.	Although not a direct source of supply to the major urban systems, these results indicate that the raw water would yield levels of turbidity and colour that require treatment.
	Microbial pathogens	Faecal coliform levels routinely exceed drinking water guideline values.	Although not a direct source of supply to the major urban systems, these results indicate that the raw water would require reliable treatment.
Bray Park – (treated water)	Total coliforms	Total coliforms exceeded the previous guideline value at the 95th %ile and maximum.	While not indicating a breach of product safety in their own right, total coliforms in distribution systems and stored water supplies can reveal regrowth and possible biofilm formation or contamination through ingress of foreign material, including soil or plants. The presence of total coliforms in treated water suggests a problem with treatment performance.
	pH	Some data error apparent although pH also suspected of being of concern in this system.	When pH is below 6.5 or above 11, the water may corrode plumbing fittings and pipes. Chlorine disinfection efficiency is impaired above pH 8.0.
	Chlorine	Chlorine residuals were found to be low.	Low chlorine means that maintenance of product quality and safety within the reticulation system could be compromised. Low chlorine was more common at particular sites.
Uki (treated water)	Total coliforms	Total coliforms exceeded the previous guideline value at the 95th %ile and maximum.	See above
	pH	Exceeded guideline value at the 95th %ile and maximum.	See above
	Chlorine	Chlorine residuals were found to be low.	Low chlorine means that maintenance of product quality and safety within the reticulation system could be compromised.
Tyalgum (treated water)	Total coliforms	Total coliforms exceeded guideline value at the 95th %ile and maximum.	See above
	Antimony	Exceeded guideline value at the 95th %ile and maximum.	Antimony, as the trivalent (Sb(III)) or pentavalent (Sb(V)) salts, has occasionally been detected in natural source waters. Occurrences are more common in areas near lead or copper smelting operations. Antimony-tin solder is beginning to replace lead solder and hence exposure to antimony in drinking water may increase in the future.
	Aluminium	Regularly present in treated water above the guideline value with a 95th %ile only marginally below and maximum above the guideline.	Aluminium in treated water is not particularly hazardous but does indicate a problem with treatment leading to aluminium residual breakthrough.
	Iron	Exceeded guideline value at the 95th %ile and maximum.	Iron has a taste threshold of about 0.3 mg/L in water, and becomes objectionable above 3 mg/L. High iron concentrations give water an undesirable rust-brown appearance and can cause staining of laundry and plumbing fittings, fouling of ion-exchange softeners, and blockages in irrigation systems. Growths of iron bacteria, which concentrate iron, may cause taste and odour problems and lead to pipe restrictions, blockages and corrosion.
	pH	Exceeded guideline value at the 95th %ile and maximum.	See above
	Turbidity	Exceeded guideline value at the 95th %ile and maximum.	Increases in turbidity can compromise disinfection efficacy.
	Chlorine	Chlorine residuals were found to be low.	Low chlorine means that maintenance of product quality and safety within the reticulation system could be compromised.

4.3 Hazard identification and risk assessment

Actions

- **Define the approach and methodology to be used for the hazard identification and risk assessment.**
- **Identify and document hazards sources and hazardous events for each component of the water supply system.**
- **Estimate the level of risk for each identified hazard or hazardous event.**
- **Evaluate the major sources of uncertainly associated with each hazard and hazardous event and consider actions to reduce uncertainty.**
- **Determine significant risks and document priorities for risk management.**
- **Periodically review and update the hazard identification and risk assessment to incorporate any changes.**

The assessment team (Section 4.1) were provided with the results from the system analysis (Section 4.1) and system review (Section 4.2) and during a workshop the hazards and risks to the end users of the water and the critical control points were determined.

In the workshop, the following definitions[1] were used:

Hazard: A physical, chemical or biological agent in the water with the potential to cause an adverse effect. It is important to understand and associate the types of hazards with the hazardous events because it allows appropriate control measures to be put in place. Examples of hazards might be:

- Human-infectious pathogens and nutrients from failing septic tanks.
- Particles and nutrients from land clearing practices.

Hazard Identification: The process of identifying hazards at the relevant process steps.

Hazardous Event: A hazardous event is an incident or situation that can lead to the presence of a hazard e.g.:

- Failure of septic tanks causing leakage of septage into waterways leading to:
  - Public health impacts from polluted water.
  - Water quality impacts from nutrients exacerbating conditions for weed and algal/cyanobacterial growth in waterways.
- Land clearing practices in the catchment causing erosion and export of sediment leading to:
  - Public health impacts from increased turbidity in water, which can decrease the effectiveness of disinfection, increase the challenge on filtration barriers and shield pathogens from disinfection.
  - Water quality impacts from transport of nutrients, such as phosphorus, into waterways and exacerbation of weed and algal/cyanobacterial growth in waterways.

Risk Analysis: The process of collecting and evaluating information on hazards and conditions to assess likelihood and severity of consequences and hence to decide which are significant for water quality risk management.

Preventive measures: Actions, activities and processes used to prevent hazards from occurring or reduce them to acceptable levels.

Critical Control Points: An activity, procedure or process at which control can be applied and which is essential to prevent a hazard or reduce it to an acceptable level.

Quality Control Points: An activity, procedure or process at which control can be applied and which is essential to prevent a hazard or reduce it to an acceptable level.

In addressing the risks, workshop participants were invited to systematically work through what is known about the source and the associated water quality risks including identifying the control measures currently in place. Participants were then asked to assess each risk as Likelihood (Table 4.9) x Consequence (Table 4.10). A risk assessment matrix was used to assess risks to the identified end uses (Table 4.11). A tabular format was used to capture the consensus of participants.

Risk Assessment Summaries are retained and maintained by Council as an excel risk assessment register (Tweed WQ Risk Register V6, 2012).

Table 4.9 Likelihood rating criteria

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 4.10 Consequence rating criteria

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 4.11 Risk Matrix

	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

5 ELEMENT 3 - Preventive measures for drinking water quality management

5.1 Preventive measures and multiple barriers

ADWG Actions

- **Identify existing preventative measures from catchment to consumer for each significant hazard or hazardous event and estimate the residual risk.**
- **Evaluate alternative or additional preventative measures where improvement is required.**
- **Document the preventative measures and strategies into a plan addressing each significant risk.**

The preventive measures were identified by the assessment team in the hazards and risk workshop and documented in the risk assessment register (Tweed WQ Risk Register V6, 2012). Where it was assessed that alternative preventative measures were required these measures risks these were added to the Improvement Plan.

Many preventive measures were not identified as critical control points because they apply to general system management. These include controls such as:

- Development assessment and control via the Local Environmental Plan.
- Catchment management via the Catchment Management Authority – various environmental and catchment management activities to improve water quality.
- Council's program of regulating, (assessing, inspecting and enforcing) on site sewage management system compliance.
- Compliance with plumbing codes of practice both in relation to Council's activities and the regulation (assessing, inspecting and enforcing) of activities of others.
- Maintenance of the distribution system in a sanitary condition through good operating practices and disinfection of new water mains.
- Checking of all new sub-divisions using Council inspectors against Council's required standards.
- Inspecting all new buildings using Council Buildings Section inspectors against Plumbing Regulations.

An essential preventative measure is the effective disinfection of the water supply. This is ensured through treatment processes that meet the required chlorine contact time value of greater than 15mg/L/minute (0.5mg/L of free chlorine residual after 30 minutes) (Table 5.1). It is also essential to maintain a free chlorine residual in the distribution system of ≥ 0.2 mg/L.

Table 5.1 Minimum C.t values

Water Supply	Contact Time Max. flow (min)	Minimum Free Chlorine Residual (mg/L)	C.t value (mg/L/min)
Bray Park WTP	66	0.5	33
Uki WTP	42	0.5	21
Tyalgum WTP	40	0.5	20

5.2 Critical Control points

ADWG Actions

- **Assess preventative measures from catchment to consumer to identify critical control points.**
- **Establish mechanisms for operational control.**
- **Document critical control points, critical limits and target criteria.**

The Critical Control Points (CCPs) and their associated monitoring and response procedures constitute the core of the DWMS. The CCPs were defined during the risk workshop, and further fine-tuned after the workshop.

The CCPs were identified on the following basis:

- Points at which preventive measures are present that significantly reduce moderate, high or very maximum significant risks
- Points at which operational parameters can be identified that can be monitored and for which critical limits can be set
- Points at which it is possible to monitor the operational monitoring parameters frequently enough to reveal any failures in a timely manner
- Points at which procedures for corrective action can be implemented in a timely response to deviation from defined critical limits

Once the CCPs were identified the acceptable operating parameters for each point were determined. For each CCP the system process, hazard and operational monitoring parameter were recorded. Then the target alert and critical limits were determined for each point. Limits are defined as:

- **Operational targets** have been defined as the optimal operating point at the critical control point.
- **Alert limits** have been defined that occur somewhere between the target value and critical limit. Deviation outside the adjustment limit indicates a possible trend towards the critical limit and may by symptomatic of a loss of control. Therefore, some adjustment is required to bring the process back under control if the alert limit is exceeded.

- **Critical limits** are performance criteria that separate acceptability from unacceptability in terms of hazard control and drinking water safety. Deviation outside the critical limits indicates a loss of control of the process and creates a situation in which confidence in the safety of the water may be lost.

The control of each limit was then determined. It is essential that the levels at CCPs are reliably controlled without compromise. For this reason, where possible, CCPs are controlled by hard code in the PLC and exceedances initiate alarms and plant shutdown. Operational procedures must then be followed and corrective actions appropriately authorised before the plant can be operated. Possible corrective actions were also identified, however the complexity of operations prevents all possibilities being documented and suitably qualified and certified operational staff are required to problem solve exceedances and determine the appropriate corrective action.

Alert and Critical levels for each CCP are displayed prominently at each treatment plant. They are also incorporated into the plant SCADA so that they are obvious to operators. The Critical Control Points are maintained as an active document and is accessible through the Water Unit Knowledge Base.

6 ELEMENT 4 - Operational Procedures and Process Control

6.1 Operational Procedures

ADWG Actions

- **Identify procedures required from processes and activities from catchment to consumer.**
- **Document all procedures and compile into an operations manual.**

Operational procedures formalise the activities that are essential to ensure the provision of consistently good water quality. Detailed procedures are required for the operation of all processes and activities, including preventive measures, operational monitoring, CCPs and maintenance requirements.

Council operates and maintains an Asset Management System that records all asset information and schedules the servicing and maintenance of assets.

Council provides preventative and reactive maintenance to reticulation assets predominantly utilising in-house resources but also some Contract services. A defined preventative maintenance strategy exists in the Asset Management Manual and is implemented using asset management software. A comprehensive set of procedures exist for standard tasks and all staff are trained in the required standards and procedures. Standards of work and levels of service are defined and adhered to. Council operates a 24-hour customer service system for reactive work. The following key maintenance plans exist for reticulation (Table 6.1):

Table 6.1 Key reticulation maintenance plans

Plan Name	Frequency Years	Additional information
Hydrant maintenance / testing	3	Includes pressure / flow tests, non-aggressive flushing, bowl surround cleaning and line marking. Associated SOP Water Hydrant and Valves and SWMS RA 0049- Hydrant Maintenance.
6-weekly reservoir maintenance	0.125	Inspection of structure, access, drainage paths, bird proofing. Cleaning of gutters and roof. Associated SOP Reservior Inspection and Maintenance and site specific risk assessments.
6 and 12 monthly dead end flushing	0.5 / 1	Dead ends (DE) are flushed 12-monthly for ring main DE's, 6-monthly for straight DE's.
Meter Reading	0.25	Rolling weekly program to complete residential meter reading quarterly. Monthly reading for large users. Associated SOP Water Meter Reading and SWMS RA 0101- Water Meter Reading.
Meter replacement program	20	Based on age and consumption. Associated SOP Water Service Repair and Installation and SWMS RA 0095- Water Service Repairs and Installation
Reservoir Drop Tests	3	Night test done to establish if a reservoir zone is leaking. Associated leak detection completed for zones identified with unacceptable levels of leakage.

PRV Testing	1	Annual test to ensure devices are functioning and setpoints have not been lost. Associated SOP PRV maintenance.
Water mains Crossings	1	This maintenance plan is for the inspection and maintenance of above ground water pipes crossings. It is not fully developed.
Backflow testing	1	Testings and maintenance on all Council owned devices to ensure backflow protection is working. Associated SOP Backflow Testing and Repairs
Bulk combo inspections	1	Larger water meter installation checks to ensure water is passing through meters and not through unregistered bypass flowpaths.
Mains Cleaning	5	Annual contract work for air scouring of water mains to ensure manganese / iron deposits do not build up over time. Mains selected on priority and complaints.
Reservoir Cleaning program	5	5-Yearly contract for internal live cleaning of floors and third party inspection.

A comprehensive set of procedures are used for the safe and efficient operation of the water treatment plants and catchment (Table 6.2).

Table 6.2 Operational documents for treatment plants and catchment

Procedure Name	**Scope and Purpose**
Operation and Maintenance Manual	Treatment plant specific procedures that detail the equipment and manufacturers safety guidelines for each plant
Process Operations Manual	To detail the various plant processes and how to operate the system
Checklist	A record of the plant operator's routine observations that are undertaken to check that all plant operations are normal
Logsheet	A record of important operational parameters such as: flows, pump run times, chemical usage, process monitoring.
Hazard and Risk Register	A register to identify, assess and control the operational hazards and risks posed to the operation of and relevant tasks and duties undertaken by the workgroup.
Safe Work Method Statement (SWMS)	A risk assessment of a task including control measures to reduce the risk.
Standard Operating Procedures (SOP)	To provide a uniform standard guide as to the standard operating procedure of major tasks. Key SOP's include: 1. Water Treatment Plant Operation 2. Water Quality Sampling and Monitoring 3.Water Quality Complaints and Incidents 4. Dam and Weir Inspection and Maintenance 5. Blue-green Algae Management
Work Instructions	Instructions for specific minor tasks
Environmental Emergency Management Plan	Provide site specific information relating to environmental management and emergency / incident response.

Clarrie Hall Dam Catchment Management Plan	Procedures for the operation of the dam and weir waterways and procedures for dam releases and environmental flows.
Clarrie Hall Dam Operations and Maintenance Manual	Procedures for the operation of the Dam infrastructure
Clarrie Hall Dam Safety Emergency Plan	Procedures for the safe operation of the dam and responses to emergency events such as floods

6.2 Operational Monitoring

ADWG Actions

- **Develop monitoring protocols for operational performance of the water supply system, including the selection of operational parameters and criteria and the routine analysis of results.**
- **Document monitoring protocols into an operational monitoring plan.**

6.2.1 Catchment

The water quality monitoring for the catchment, including Clarrie Hall Dam and Uki, Tyalgum and Bray Park water sources, is undertaken by the operators following the Water Monitoring Program (Section 7.1). The CHD infrastructure is monitored routinely as outlined in the Operations and Maintenance Manual. This includes: daily observations (seepage and tunnel inspections), infrastructure surveillance (crack monitoring and photographic records) and annual safety audits by external dam engineers.

The waterways are monitored daily. This includes operator observation and raw water sampling. More comprehensive sampling is undertaken by the Tweed Laboratory Centre. The Catchment Management Plan outlines the procedures for aquatic weed control, buffer zone and recreational area management.

The telemetry system also monitors water levels, control valves and the dam mixer. This system can be controlled by the operators either onsite or from the Treatment Plant.

6.2.2 Water Treatment Plants

The water quality monitoring for the water produced by the treatment plants is undertaken by the operators following the Water Monitoring Program (Section 7.1). More comprehensive analysis of samples is undertaken by the Tweed Laboratory Centre.

The Treatment Plant PLC and SCADA systems are used by the operators to monitor and control the treatment plant processes. The on-call operator is required to monitor the plants after hours. The SCADA system sends an alarm to the operator and the operator can access the SCADA system remotely or attend the site if required.

The more frequent (daily or weekly) checks and monitoring of equipment are undertaken by operators. Any abnormal operation, failures and breakdowns are tasked to Council's Mechanical and Electrical Centre through the Asset Management System.

6.2.3 Reticulation

The reticulation network is monitored and maintained by the Reticulation Operators, Reticulation Assistants, Fitters, Electricians and Technicians. A telemetry system is used to

monitor field equipment such as pump stations, actuated valves and reservoirs. The telemetry is available to various groups of staff with hierarchy access rights. It can also be accessed remotely by on-call staff. It provides automatic control, monitoring and alarming.

A well developed understanding and model exists for the water reticulation network and rules have been set for operational monitoring. Reservoirs call for water from water pump station went needed. High, low and overflow levels are monitored and appropriately alarmed, hours of operation are restricted wherever possible, and historic information is held such as reservoir levels, pump status, daily hours, events and alarms. Certain staff can override the automatic control as required.

Most water meters (residential) are read quarterly on a rolling program. Large users are on a monthly program. This is completed within the reticulation workforce and part of there weekly duties.

The reticulation water quality monitoring is undertaken by the Water Treatment Plant Operators on a weekly basis. The Water Monitoring Program describes the comprehensive monitoring of the entire system.

6.2.4 Recording

Water quality monitoring undertaken by the operators is recorded in logsheets and monitoring of the plant operation and performance is recorded in checklists and logsheets. Water quality monitoring by the Tweed Laboratory Centre is directly uploaded to Council's Performance Monitoring Database. CHD depth profiling and reticulation monitoring by the operators is also recorded in the database.

Maintenance and inspections of system assets is recorded in the Asset Management System.

6.3 Corrective Action

ADWG Actions

- **Establish and document procedures for corrective actions to control excursions in operational parameters.**
- **Establish rapid communication systems to deal with unexpected results.**

Detailed procedures for operating the treatment plants are provided in the Treatment Plant and Dam Operations and maintenance Manuals. These manuals provide procedures on how to operate the plant, identify faults and take corrective action to control excursions from normal operation. Corrective actions are also documented with the CCPs (section 5.2).

Unexpected results are identified by the SCADA system of operator set points and critical control points. Excursions outside of these parameters initiate an alarm on the SCADA and send an alarm to the operator by SCADA phone and email. Operators also complete daily water quality testing and checklists to confirm normal operation. The results are compared to operational targets and limits, exceedances are recorded in the logsheets and actions taken to correct the excursion. Any breaches of CCPs are recorded in the CCP Report. This form includes the relevant staff to be notified. Customer complaints and water quality incidents are managed and communicated in accordance with the Drinking Water Complaints and Incident Standard Operating Procedure (Section 8).

6.4 Equipment capability and maintenance

ADWG Actions

- Ensure that equipment performs adequately and provides sufficient flexibility and process control.
- Establish a program for regular inspection and maintenance of all equipment, including monitoring equipment.

The catchment and treatment plant and reticulation mechanical and electrical equipment is serviced and maintained in-house by Council's Mechanical and Electrical department. The instrumentation, SCADA, telemetry and PLC's are maintained by the Electronics Technicians. Some equipment is maintained by external specialist contractors e.g. centrifuge, blowers, compressors and chlorine gas equipment.

Scheduled routine inspections, servicing and maintenance of equipment is defined and completed. Results of the work are recorded. The Operations and Maintenance Manuals are used to create service schedules and generate work orders. Council's Asset Management software contains the servicing and maintenance plans and records.

Council maintains an inventory of critical spares on site for treatment plants and runs a store for consumables and reticulation equipment.

Council uses predictive models to estimate assets useful life, condition and risk ensuring equipment is renewed or replaced before failure. Strategic planning also exists predicting growth based on typical population growth and known developments. This information is used in deciding the sizing / capacity of equipment / assets.

6.5 Materials and chemicals

ADWG Actions

- **Ensure only approved materials and chemicals are used.**
- **Establish documented procedures for evaluating chemicals, material and suppliers.**

6.5.1 Materials

Materials on customer properties

Council is the regulator of plumbing and drainage in the Tweed Shire. All plumbing and drainage work carried out in the Tweed Shire must be carried out by NSW licensed plumbers and therefore complies with the Plumbing Code of Australia AS/NZS 3500. Written approval from Council is required prior to the performing plumbing work and an inspections by Council are required.

Council inspects properties to ensure that appropriate backflow prevention is in place upon initial connection. Results are recorded on the form Backflow Prevention Device Testing Certificate and Council maintains a register of this information. Annual testing of these devices is the owners responsible but Council reminds owners, receives and audits the annual inspection details and records the information in the register.

Building Inspectors from Council inspect buildings to check compliance with Council requirements.

Trade waste agreements are required for premises discharging non-domestic waste to Council's Sewer System. Council regulates new connections, business changes or changes of use and carries out annual inspections as a minimum for these properties.

Materials within Council assets
In general, only Council operators do the live work on the system. At times third parties do work such as new developments, but third parties don't work on the live system alone and Council operators inspect the work. Systems are constructed using Council specifications which default to WSAA and the Plumbing Code of Australia.

The Council "Development Design Specification D11 Water Supply Version 1.4 (2011)" refers extensively to the Water Services Association of Australia "WSA 03-2002 - Water Supply Code of Australia" in relation to the construction of the water reticulation systems and to "AS/NZS 4020" in relation to PVC pipe.

The Council "Development Construction Specification C401 Water Reticulation Version 1.2 (2010)" refers extensively to the Water Services Association of Australia WSA 03-2002 - Water Supply Code of Australia in relation to the construction of the water reticulation systems.

6.5.2 **Chemicals**

A range of chemicals are used in the treatment of water and indirectly for wastewater and membrane cleaning (Table 6.3). Only chemicals that have been deemed in the ADWG as suitable for use in water treatment are used. The supply of chemicals for water treatment is managed under an open tender and contract with successful suppliers. Suppliers are required to provide:

1. Formal accreditation of the manufacturing facility by an independent accreditation agency (eg ISO).
2. Quality System that facilitates the tracking of product from raw material to delivery.
3. Verification testing from an independent NATA accredited laboratory.
4. Product specification which describes the product and the typical impurity analysis. The product is only accepted if the specification includes limits for all the potential impurities listed in the ADWG chemical fact sheets. The limits need also to be below the calculated Recommended Maximum Impurity Concentration (RMIC). The RMIC's have been calculated for each treatment plant, however the product specifications limits are far below the RMIC's and so the Suppliers are required to comply with their specification and not the RMIC limits.
5. Certificate of compliance at least once per month that verifies that the product meets the specification and identifies the deliveries that the certificate relates to.
6. Current SDS that, as a minimum, complies with the Safe Work Australia Code of Practice for the Preparation of SDS for Hazardous Chemicals.

Operators order chemicals as required and receive deliveries following the Chemical Supply and Delivery Standard Operating Procedure. This includes procedures to ensure safe delivery of the chemical, checking of the delivery vehicle and delivery docket. Certificates of Compliance are checked to ensure that the product meets the specification. The operators record all delivery details in a logsheet.

The ChemAlert™ system is used to help manage chemical safety from an occupational safety perspective. The system manages chemicals via the Operational Safety Management System (OMS) and hosts the relevant Safe Work Method Statements (SWMS).

Table 6.3 Chemicals used in water treatment

Treatment Plant	Chemical	Purpose
Bray Park	Aluminium Sulphate	Coagulation – organics removal
	Carbon Dioxide Gas	pH correction and increase alkalinity
	Chlorine Gas	Disinfection
	Citric Acid	Membrane cleaning
	Hydrated Lime	Increase calcium - hardness
	Hydrofluosilicic Acid	Dental health
	Sodium Bisulphite	Neutralisation of membrane cleaning water
	Polymer	Coagulation of wastewater
	Potassium Permanganate	Manganese oxidation and removal
	Powder Activated Carbon	Organics removal – taste and odour removal associated with BGA
	Sodium Hydroxide	pH correction
	Sodium Hypochlorite	Membrane cleaning
Uki	Aluminium Sulphate	Coagulation – organics removal
	Powder Activated Carbon	Organics removal – taste and odour removal associated with BGA
	Sodium Hydroxide	pH correction and increase alkalinity
	Sodium Hypochlorite	Disinfection
Tyalgum	Aluminium Chlorohydrate	Coagulation – organics removal
	Citric Acid	Membrane cleaning
	Granular Activated Carbon	Organics removal – taste and odour removal associated with BGA
	Sodium Hypochlorite	Membrane cleaning and disinfection

7 ELEMENT 5 - Verification of Drinking water quality

7.1 Drinking water quality monitoring

ADWG Actions

- **Determine the characteristic to be monitored in the distribution system and in water as supplied to the consumer.**
- **Establish and document a sampling plan for each characteristic, including the location and frequency of sampling.**
- **Ensure monitoring data is representative and reliable.**

Council has maintained a water quality monitoring program for many years. In 2010 the program was reviewed and recommendations made to meet and in many cases exceed the current ADWG and NSW Health Drinking Water Monitoring Program requirements (Drinking Water Quality Monitoring Report). These recommendations were then implemented into a Water Quality Monitoring Program (Table 7.1 and 7.2). The Water Monitoring Program is available to all Water Unit staff through the Water Unit Knowledge Base and the results are available through the Performance Monitoring Database.

The program outlines the monitoring program from catchment to tap. It details the parameters to be monitored and addresses: environmental monitoring of the catchment waterways, depth profiling and blue-green algal monitoring of Clarrie Hall Dam, raw water monitoring of treatment plant source water, treatment plant process monitoring and verification monitoring throughout the reticulation network. The parameters to be monitored and the frequency of sampling were determined by analysis of historical water quality data and the identified water quality issues. The hazards and risks from the system analysis (Section 4.3) were then considered along with the treatment processes and ADWG requirements.

The reticulation sites were selected to provide early detection of any water quality non-compliance issues, particularly microbiological failures. The reticulation network was divided into zones that are supplied from a single source and are hydraulically separated from other zones. The zones were defined as reticulation areas feed from a breakpoint such as a reservoir. In a complex network zones are connected at least at times during the pumping schedule. Depending on the size and complexity of the zone, between one and five sampling sites were selected. Sites were selected so that they represented the outer regions of the zones although in the larger zones some sites were more centrally located (Table 7.3 and Figure 7.1). A sampling rotation has been implemented so that each zone is sampled weekly but in larger zones with multiple sites the site sampled within the zone is rotated. However, for each zone there is at least a key site that is always sampled. All samples are collected by the operators from vandal proof taps that are suitable for the flame treatment that is required for Microbiological samples. At the time of sampling the operator also does on the spot analysis of temperature, pH and chlorine.

Monitoring required for daily operation is undertaken by the operators at the treatment plant laboratory. This includes a range of physical and chemical parameters. The operators conduct the dam profiling, reticulation sampling and collect most samples for the Tweed Laboratory Centre. Procedures for this work are detailed in the Water Quality Monitoring Standard Operating Procedure. Testing is undertaken consistent with the specific instrument instruction manuals.

The Tweed Laboratory Centre undertakes the verification monitoring for Council. To ensure that monitoring data is reliable, the Tweed Laboratory Centre complies with the requirements of ISO/IEC 17025:2005 and carries National Association of Testing Authorities, Australia accreditation for biological (accreditation number 13538) and chemical (accreditation number 12754) public testing services. The scope of accreditation covers all of the sampling and analysis that is routinely carried out that is of relevance to drinking water quality.

The Water Quality Monitoring Program outlines the monitoring required by the Tweed Laboratory Centre. The Centre's staff enter the requirements into the Laboratory Information Management System which is used for the routine organisation of the testing program. A Chain of Custody sheet is also produced and used to track each routine sample. This sheet includes the name of the sample and the parameters to be analyzed.

Table 7.1 Tweed Laboratory Centre Water Quality Monitoring

Catchment	Location	Type	Frequency	Parameters
Bray Park	Clarrie Hall Dam - 2 sites(X, Z)	Raw - depth profile (0, 4, 8, 12, 16, 20m)	4 weekly at same time as weekly	Algae - Count, biovolume, ID
Bray Park	Clarrie Hall Dam - 2 sites(X, Z)	Raw - depth profile (0, 4, 8, 12, 16, 20m)	Weekly	TP, TN, TFe, TMn, Fe, Mn, TOC @ 0, 8, 20m
Bray Park	Clarrie Hall Dam - 6 sites	Raw - surface	Event, if algal cell type and density indicate a risk	Algae
Bray Park, Uki, Tyalgum	Clarrie Hall Dam, Bray Park weir, BPWTP post raw water strainers, Uki Pool, Tyalgum Weir	Raw	Weekly	pH, EC, Alk,TDS TH, CaH, TC, AC, Turb, TFe, Fe, TMn, Mn, Si, ThermoColi (for one yr only), TColi, E. coli, Algae
Bray Park, Uki, Tyalgum	Clarrie Hall Dam, Bray Park weir, BPWTP post raw water strainers, Uki Pool, Tyalgum Weir	Raw	4 Weekly	Chla, F, TP, OP, TKN, NH3-N, NO3-N, NO2-N, TOC, DOC, TAl, SS, Clostridium perfringens, Somatic coliphage
Bray Park, Uki, Tyalgum	BPWTP post raw water strainers, Uki Pool, Tyalgum Weir	Raw	Event, if algal cell type and density indicate a risk	Geosmin, MIB, toxins
Bray Park	Bray Park Weir	Raw	Quarterly and following spill events (1st week Feb, May, Aug, Nov)	Pesticides OC/OP's
Bray Park	Bray Park Weir	Raw	Annual and following spill events	Organics
Bray Park	Bray Park Weir	Raw	Every 5 years	Alpha and gross beta radionuclides
Bray Park	WTP	Combined Permeate	Weekly	Absorbance, DOC
Tyalgum	TWTP post GAC and prechlorination	Permeate	Weekly	Absorbance, DOC

Bray Park, Uki, Tyalgum	WTP	Treated	Weekly	Turb, TC, pH, ALK, pALK, F, TAl, TFe, Fe, TMn, Mn, E. coli, Tcoli, TOC, DOC, TH, CaH, TDS,SO4-S, Cl
Bray Park, Uki, Tyalgum	WTP	Treated	Event, if E. coli threshold breached	Clostridium perfringens, Somatic coliphage
Bray Park, Uki, Tyalgum	Reticulation	Treated	Weekly	Turb, TColi, E. coli, pH (Stability investigation sites - RET7,10,15,18 ,19, 26 - Alk,TH,CaH,Cl,SO4,EC)
Bray Park, Uki, Tyalgum	Reticulation	Treated	Monthly	pAlk, Alk, TC, F, TAl, TSb, TCd, TCu, TFe, TPb, TMn, TNi, TZn, Na, Mg, As, Cr, Ca, TH, Cl, SO4, EC, THM
Uki	Sludge Lagoon supernatant	Waste	Fortnightly	pH, SS, TAl, Al
Bray Park	Sludge Lagoon supernatant	Waste	Only required when overflowing to drain	pH, SS, TP, TN, TCl2, Al, TAl, Fe, TFe, TMn, Mn
Bray Park	Waste to sewer	Waste	Weekly	BOD, SS, TDS,pH
Tyalgum	Waste to sewer/irrigation	Waste	Weekly	BOD, SS, TDS,pH

Table 7.2 Treatment Plant Operator Water Quality Monitoring

Catchment	Location	Type	Frequency	Parameters
Bray Park	WTP	Raw	Daily	Alk, pH, EC, T, Turb, TH, CaH, TC, AC, Al, Mn, Fe
Bray Park, Uki	Clarrie Hall Dam - 2 sites(X,Z)	Raw - depth profile (1-20m every m)	Weekly	DO, T, pH, EC, Turb
Uki	WTP	Raw	Daily	Alk, pH, EC, T, Turb, TH, AC, Al, Mn, Fe
Tyalgum	WTP	Raw	Daily	pH, Turb, T, TC
Bray Park	WTP	Coagulated	Daily	pH, TC
Bray Park	WTP	Combined permeate	Daily	Turb, TC, Mn
Bray Park	WTP	Treated	Daily	FCl, pH, F, TC, Al
Bray Park	WTP	Clear Water	Daily	Turb, pH, Alk, TH, CaH, Al, Fe, Mn, FCl, F
Uki	WTP	Coagulated	Daily	Turb, pH, Alk
Uki	WTP	Treated	Daily	Turb, pH, Alk, TH, AC, Al, Fe, Mn, FCl
Tyalgum	WTP	Treated	Daily	pH, Turb, FCl
Bray Park, Uki, Tyalgum	Reticulation	Treated	Weekly	pH, T, FCl, TCl

Table 7.3 Reticulation Monitoring Sites

Site Name	NSW Health #	Weeks Sampled	Feed Reservior
Bray Park WTP System			
Murwillumbah/Brisbane St	26	1,2,3,4	Hospital Hill
Murwillumbah/Charles St	27	1	Hospital Hill
South Murwillumbah/Lundberg Dr	28	2	Hospital Hill
South Murwillumbah/Scott St	29	3	Hospital Hill
Tumbulgum/Riverside Dr	44	4	Hospital Hill
Murwillumbah/Thompson St	30	1,3	Hartigan Hill
Murwillumbah/Tombonda St	31	2,4	Hartigan Hill
Bray Park/Elouera St	32	1,3	Glencoe
North Arm/Saddle Wy	33	2,4	Glencoe
Bogangar/Rosewood Av	15	1,2,3,4	Duranbah
Nunderi/Norths Ln	43	1,3	Duranbah
Kingscliff/Forster Av	34	2,4	Duranbah
Hastings Point/Creek St	35	1,2,3,4	Round Mountain
Koala Beach/Sugar Glider Dr	36	1,2,3,4	Koala Beach
Pottsville/Andrew Av	37	1,2,3,4	West Pottsville
Pottsville/Overall Dr	38	1,3	West Pottsville
Pottsville/Taree St	39	2,4	West Pottsville
Moobal/Pottsville Rd	17	1,2,3,4	Cowell Park
Burringbar/Greenvale Crt	18	1,2,3,4	Burringbar
Kingscliff/Marine Pd	19	1,2,3,4	Kingscliff
Cudgen/Collier St	40	1,3	Kingscliff
Chinderah/Rutile St	41	2,4	Kingscliff
Cudgen/Plantation Rd	42	1,2,3,4	Byrnes Hill
Fingal/Letitia Rd	20	1,2,3,4	Fingal
Bilambil/Bilambil Rd	45	1,2,3,4	North Tumbulgum
Terranora/Eliza Fraser Ct	46	1,2,3,4	Rayles Ln Large

Banora Point/Blue Haze Cr	12	1,2,3,4	Rayles Ln Small
Bilambil Heights/McAllisters Rd	5	1,2,3,4	Country Club
Cobaki/Cobaki Rd	47	1,2,3,4	McAllisters
Bilambil Heights/Warringa Dr	48	1,3	Marana
Bilambil Heights/Broadwater Esp	7	2,4	Marana
Tweed Heads West/Jacaranda Av	49	1,2,3,4	Walmsleys
Tweed Heads West/Piggabeen Rd	8	1,3	Walmsleys
Tweed Heads West/Gray St	50	2,4	Walmsleys
Tweed Heads/Coral St	10	1,3	Razorback
Tweed Heads/Caloola Dr	51	2,4	Razorback
Tweed Heads South/Dry Dock Rd	52	1,3	Hillcrest
Banora Point/Botanical Ct	53	2,4	Hillcrest
Tweed Heads South/Hillcrest Av	54	1,2,3,4	Glenys Street
Banora Point/Avondale Dr	55	1,2,3,4	Banora Point
Banora Point/Water St	56	1,3	Banora Point
Banora Point/Hibiscus Pde	57	2,4	Banora Point
Banora Point/Pioneer Pde	58	1,3	Chambers
Banora Point/Paperbark Crt	59	2,4	Chambers
Uki WTP System			
Uki/Mitchell St	3	2,4	Uki
Uki/Smiths Creek rd	4	1,3	Uki
Smiths Creek/Clareville Rd	5	1,2,3,4	Clareville 1
Tyalgum WTP System			
Tyalgum/Coolman St	1	1,2,3,4	Tyalgum

Figure 7.1 Reticulation Monitoring Sites

7.2 Consumer satisfaction

ADWG Actions

- **Establish a consumer complaint and response program including appropriate training of employees.**

Most enquiries and complaints are received by phone during business hours and are received by the Contact Centre. However, Council does have an after hours Contact Centre and on-call operators to respond to complaints. The Contact Centre is provided with information in the A-Z of Services and information on how to respond to various water quality complaints. This is accessed through the intranet Corporate Knowledge Base. The Contact Centre will request the relevant information from the customer and lodge a job Customer Request Module™ (CRM). The procedures for notifying the appropriate operational staff are detailed in the Water Quality Complaints and Incidents Standard Operating Procedure. The Contact Centre instructions include the direction that the following people are to be contacted immediately in the case of a customer health concern.

1. Treatment Plant Engineer
2. Operations Engineer
3. Water Treatment and Catchment Supervisor

All Treatment Plant Operators are trained in the Water Quality Complaints and Incidents Standard Operating Procedure (SOP). The SOP includes a flow chart on the communication pathway to be followed for all complaints. It also includes procedures on how to investigate a complaint, a description of common complaints, causes and corrective actions. The SOP also includes Council's procedures for handling incidents. These procedures incorporate the NSW Health Response Protocols for:

1. The management of microbiological quality of drinking water
2. Failure in water treatment or detection of *Giardia* or *Cryptosporidium*
3. The management of physical and chemical quality

An essential part of the SOP is the Water Supply Incident Report which identifies the appropriate incident control team, captures the incident details, notifications and corrective actions.

7.3 Short Term evaluation of results

ADWG Actions

- **Establish procedures for daily review of drinking water quality monitoring data and consumer satisfaction.**
- **Develop reporting mechanisms internally and externally where required.**

The daily monitoring of water quality by the operators is entered into an electronic log sheet. The logsheet has target limits and conditional formatting to alert the operator if a result exceeds the targets. The target limits are consistent with the CCPs although there are many process targets that are not CCPs. The duty operator is responsible for communicating any exceedances to the senior operator and corrective action is determined.

The Tweed Laboratory Centre is responsible for immediately alerting NSW Health and the Treatment Plant staff to any ADWG exceedances, particularly any bacteriological failures.

The database has been programmed with operational targets and aesthetic and health guidelines. When a target or guideline is exceeded a report is automatically generated and emailed to the engineer and supervisor (Figure 7.2).

Figure 7.2 Example Water Quality Report

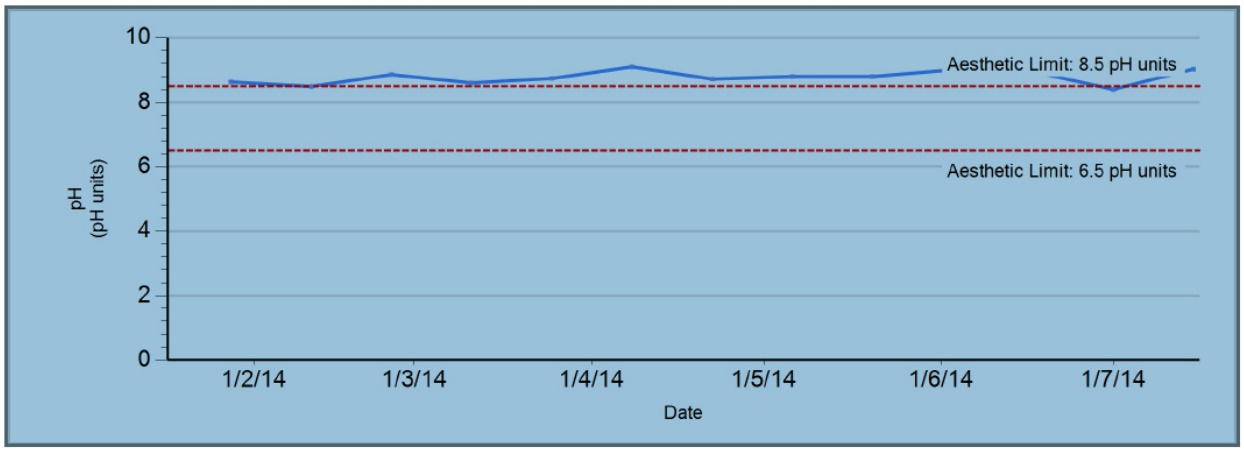
Water Supply Latest ADWG Exceedances
1/17/2014 to 7/16/2014

TWEED SHIRE COUNCIL

Note regarding handling of readings below the Pratical Quantifiable Limit (PQL):
- Where 50% or more of the readings are below the PQL, a value of zero is used for calculations and graphing.
- Where less than 50% are below the PQL, half the PQL value is used.
- Red markers on the graph indicate readings below the PQL

RET 10 Tweed Heads/Coral St (Retic Field Tests)

pH (pH units) Minimum: **8.400**, Maximum: **9.100**, Mean: **8.779**, Median: **8.800**



7.4 Corrective Action

ADWG Actions
- **Establish and document procedures for corrective action in response to non-conformance or consumer feedback.**
- **Establish rapid communication systems to deal with unexpected events.**

Operators react to daily monitoring and take corrective actions as required. Any CCP breaches are recorded and communicated according to the CCP Report. Customer complaints about water quality are directed to appropriate staff (Section 7.2).

Non-conformance that exceeds ADWG guidelines is treated as an incident and managed in accordance with the Water Quality Complaints and Incidents Standard Operating Procedure which includes the NSW Health Response Protocols. As part of the incident investigation NSW Health are consulted and re-testing is initiated.

An essential barrier against pathogens in the distribution system is the maintenance of a free chlorine residual. The Water Quality Complaints and Incidents Standard Operating Procedure includes corrective actions for free chlorine residuals < 0.2 mg/L. For extremities in the system where free residuals are consistently < 0.2 mg/L but not < 0.05 mg/L and E. coli test results are 100% compliant then the integrity of the system must be inspected on an annual basis (Section 6.2.3). If however, the free chlorine residual level is consistently below 0.05mg/L at the extremeties, with E. coli test results showing 100% compliance then integrity of the system will be inspected four monthly and flushed as needed to remove ‘stagnant’ water. Areas that are identified as consistently having residuals < 0.2 mg/L will also be reviewed for opportunities to improve water circulation and or shorten turnover rates.

Additional chlorine booster stations may also be required to maintain free chlorine residuals (Section 14.2)

8 ELEMENT 6 - Management of Incident and emergencies

8.1 Communication

ADWG Actions

- **Define communication protocols with the involvement of relevant agencies and prepare a contact list of key people, agencies and businesses.**
- **Develop a public and media communication strategy.**

Communication protocols for communication with relevant agencies are detailed in The Water Quality Complaints and Incidents Standard Operating Procedure. Communication protocols for other incidents are detailed in the Environmental Emergency Management Plans for each treatment facility. These documents detail key people and their contact details.

Council's public and media communication strategy is detailed in the Media Policy and Media Procedure. All public and media communication is coordinated by the Communication and Customer Unit in cooperation with the Water Unit manager.

The Media Policy aims to ensure Council:

- Upholds its commitment to the community by keeping it informed of Council's actions and activities.
- Provide the media with timely, accurate, consistent and reliable information.
- Manages and has knowledge of information that is conveyed to media relating to organisational operational matters.

The Media Procedure ensures Council messages to the community – particularly those through the press and electronic media – are managed in a timely, accurate and reliable way.

For notifying the public in the event of a water quality incident Council has template public notification documents to help guide media communication when water quality emergencies are encountered.

8.2 Incident and Emergency response protocols

ADWG Actions

- **Define potential incident and emergencies and document procedures and response plans with the involvement of relevant agencies.**
- **Train employees and regularly test emergency response plans.**
- **Investigate and incident or emergencies and revise protocols as necessary.**

8.2.1 Incident and emergency plans and procedures

Council has adopted the Health Safety Environment Management System (HSES) to establish an effective systematic process and framework for the overall management of Council's operational activities in relation to work health, safety and the environment.

The requirements of this system apply to all Council workers (fulltime, temporary, casual, contractors, volunteers and relevant stakeholders).

This management plan is a core element of the HSES, providing a site-specific framework for the management of health, safety and the environment at each of Council's Wastewater Treatment Plants.

Council also has a Workplace Environmental Management Policy and Chemical Management System called ChemAlert. ChemAlert is a proprietary web-based package that is used to manage chemicals on site. The system provides online access to safety data sheets, dangerous goods and hazardous substances registers, chemical storage volumes and product information.

Council's commitment to work health and safety is detailed further in the WHS Responsibility, Authority and Accountability Protocol.

Response plans to environmental incidents and emergencies at Water Treatment Plants are documented in the relevant Environmental Emergency Management Plan for each plant. The objectives of the EEMP are to:

- Provide site specific information relating to environmental management and emergency / incident response, which satisfies requirements under the relevant legislation.
- Ensure integration with Council's existing policies and procedures.
- Ensure comprehensive and timely communication about a pollution incident to employees, the EPA, other relevant authorities, and community members who may be affected by the impacts of the pollution incident.
- Minimise and control the risk of a pollution incident or emergency situation by requiring identification of risks and development of planned actions to minimise and manage those risks.
- Ensure the plan is properly implemented by trained staff, identifying persons responsible for implementing it, and is regularly tested and reviewed for accuracy, currency and suitability.

Water quality complaints and incident response plans are detailed in the Water Quality Complaints and Incidents Standard Operating Procedure. This document includes:

- Procedures for communication and recording of complaints and incidents
- Guidelines on how to investigate a complaint or incident
- Information on typical water quality complaints and their causes
- Incident response procedures that incorporate the NSW Health Response Protocols for:
  1. Management of microbiological quality of drinking water
  2. Failure in water treatment or detection of giardia or cryptosporidium in drinking water
  3. Management of physical and chemical quality
- A Water Supply Incident Report that records the details of an incident, the response team, notifications and recommendations for future improvements.

The procedure helps to guide the communication process, the agencies involved in the incident, and provides the contact details for relevant people. To help respond in general to major incidents and emergencies such as floods, Council uses its Business Continuity Plans.

For major failures of critical functions and a range of threats, Council has a suite of Business Continuity Plans. This documents act as a guide for Council to respond to these events and

have been prepared in accordance with the NSW Water Directorate guidelines and templates. Scenarios include:

- Contamination of raw water source
- Contamination of treated water supply network
- Drought
- Major flood
- Tsunami

Council has an Environmental Incident protocol for wastewater overflows, pollution events and treatment plant malfunctions. This protocol contains the notifications as required in Part 5.7 of the *Protection of the Environment Operations Act* 1997 (POEO Act).

Selected Council Water Unit staff carry “Emergency Packs” in their vehicles and are required to act as a first response. The following staff have the ability to utilise the emergency information when required:

- Director Engineering
- Manager Water
- Senior Engineer Operations & Maintenance
- Senior Engineer Capital Works
- Senior Engineer Planning & Assessment
- Engineer Treatment & Catchment
- Senior Technical Officer Treatment
- Operational Coordinator Reticulation
- Operational Coordinator Mechanical & Electrical
- Engineer Water Efficiency & Connections

The pack includes specific information from the following documents:

- Business Continuity Plan
- Dam Safety Emergency Plan
- Operational instructions for Weir, Fish Ladder and Dam
- Water Quality Incident Reporting Protocol
- Sewage Overflow Response SOP and notification template
- Trunk Main Repairs SOP
- Customer Complaint / Work Request Form (water & sewer)
- Lab testing, Licence limits and typical water quality information
- Emergency Communication and Reporting Information
- Insurance
- Ministry for Police and Emergency Services (Natural Disaster Assessment)
- Various phone lists

Boil water notices

The Water Quality Complaints and Incidents Standard Operating Procedure refers to the NSW health protocols for issuing Boil Water notices. In the event of an *E. coli* failure in the treated water, the Tweed Laboratory Centre will immediately notify NSW Health and the Treatment Engineer. A Boil water notice would only be issued following consultation with the NSW Health Officer. Council would be responsible for communicating the boil water notice and in preparing such notices Council would make use of the NSW Health templates:

- Example Boil water alert for *Cryptosporidium* and or *Giardia* contamination

- Example Boil Water Alert *E. coli* Contamination

Cyanobacteria (blue-green algae)
The Water Quality Monitoring Program includes weekly monitoring of the raw water sources for algae including Cyanophyta species identification, counts and biovolumes. Council has adopted the Water Directorate, Blue-green Algae Management Protocols, NSW 2014. Incidents are managed with reference to this protocol and in cooperation with the North Coast Algal Coordinating Committee (RACC) of the NSW Office of Water.

Council responses to a Blue-green algal bloom are outlined in the Blue-green Algae Managemnt Standard Operating Procedure. This includes:

- Increased sampling of algal levels, taste and odour compounds and toxins
- Notifications
- Operational changes including dosing of Powder Activated Carbon
- Signage and notifications required

8.2.2 Training and Improvements

The training program for operators is detailed in Section 9. This includes training in the Water Quality Complaints and Incidents Standard Operating Procedure, incident management and Environmental Emergency Management Plan. This training is updated regularly through the delivery of tool box talks and the Environmental Emergency Management Plan is tested and reviewed annually.

Following each incident the report template requires a review and improvements required.

9 ELEMENT 7 - Employee awareness and training

9.1 Employee awareness and involvement

ADWG Actions

- **Develop mechanisms and communication procedures to increase employees' awareness of and participation in drinking water quality management.**

The Water Unit Knowledge Base is the primary portal for communication of all Water Unit activities, systems, procedures and information. The WUKB is available to all Water Unit staff and keeps staff informed of water quality management.

Major new initiatives and achievements of the Water Unit are communicated to the broader Council employees through the staff newsletter – 'insideOUT'.

Meetings are held weekly/fortnightly to discuss and communicate water quality issues. The minutes and actions are available through the WUKB.

Water quality and management are standard agenda items in a range of other meetings. These include:

1. Water Treatment Plant Meeting – Operations Engineers and Operators, this is the most important meeting for water quality and includes routine review of water quality reports.
2. Safety and Operations Meeting – Manager, Engineers and Supervisors
3. Distribution System Meeting – Engineer and system supervisors
4. Treatment & Catchment Meeting – Senior Operations Engineer and Treatment Engineer
5. Senior Engineers Meeting – Manager and Senior Engineers

All incidents are communicated to relevant staff through email groups. This ensures appropriate staff are kept informed.

Outdoor staff are also communicated important information by the use of tool box talks and morning meetings to deliver specific messages and this information is recorded in Council's record keeping system.

9.2 Employee training

ADWG Actions

- **Ensure that employees, including contractors, maintain the appropriate experience and qualification.**
- **Identify training need and ensure resources are available to support training programs.**
- **Document training and maintain records of all employee training.**

9.2.1 Induction

Training is provided to Council employees as part of site inductions, specialised skills and technology (e.g. ChemAlert, Aurion), and annual workplace health and safety and

emergency response training. This includes a review of the responsibilities of staff and an update of procedural and legislative changes.

The site specific induction will include:

- Environmental Management e.g. environmental hazards of substances handled, pollution prevention (spill management and overflow management), odour control, waste and stormwater management.
- Health and Safety e.g. physical hazards of the workplace and activities, health and hygiene hazards, personal protective equipment, incident and near miss reporting.
- Emergency response (see below) and pollution incident response procedures.

Emergency response training is delivered annually and includes:

- Emergency Warden evacuation drills
- the communication procedure in the event of an emergency / incident;
- the location of emergency contact details;
- practicing a mock spill clean-up procedure including where to find emergency equipment and how to use it;
- ensuring staff are aware of their obligations in the event of an actual or potential emergency;
- ensuring staff are aware of the responsibilities and roles of other key staff members in the event of an emergency.

The Council HSE Management System states that all employees are required to undertake the following inductions prior to commencing work:

- Corporate WHS Induction
- Workgroup Activity Induction
- Site Specific Inductions

9.2.2 **Training**

A training needs analysis has been completed for each field based staff position and is used to determine what training is provided to each employee. Each staff position within the Water Unit Water Treatment Plant Operator training includes a Certificate 3 in Water Operations. Council also intends that operators are Certified under the National Certification Framework. Qualified operators are currently enrolled in the NSW Certification Trial.

The Mechanical and Electrical staff are qualified for their trade. Electricians are licensed and Electronics Technicians are licensed electricians with additional training in PLC and SCADA. Fitters are also trade qualified. Reticulation staff do not currently require a trade qualification although many are licenced plumbers. Council is developing a program for upskilling of reticulation operators to a Certificate 3 in Water Operations.

Some Reticulation staff are licenced plumbers but most commence as Assistant's in the water industry operations. Currently reticulation staff receive no certification for their role.

Overall, there is considered to be a high level of experience and expertise within Council.

9.2.3 Training records

The Human Resources Section maintains records of all employee training. All training of operators is recorded in Council's HR Orion database.

10 ELEMENT 8 - Community Involvement and Awareness

10.1 Community consultation

ADWG Actions

- **Assess requirements for effective community involvement.**
- **Develop a comprehensive strategy for community consultation.**

Council has a Community Engagement Strategy in place which outlines the requirements for involving the community in Council's strategic planning and decision-making processes. This strategy:

- Defines community engagement and identifies the methods of engagement Council uses for the key stages of engagement – inform, consult, involve, collaborate and empower.
- Identifies the broad categories of Council projects which require engagement.
- Provides an Engagement Matrix to align the methods of engagement with the category of Council projects.

Community consultation and involvement in relation to Council's provision of water and wastewater services is determined by the Community Engagement Strategy and the Engagement Matrix (Figure 10.1).

Council also has an online engagement tool, Your Say Tweed. This tool is used by the Water Unit to inform customers about current engagement activities and provides yet another avenue for customers to provide feedback relating to water and wastewater policies, strategies, projects and initiatives.

The Communication and Customer Services section supports the Water Unit to implement the Community Engagement Strategy by providing support, advice and coordination for customer service, communication, marketing and community participation and engagement activities on behalf of the Water Unit.

Engagement Matrix

	What to do?	When you are dealing with...			
	1 = every time 2 = in most circumstances 3 = on specific occasions 4 = on rare occasions	Shire-wide / High Impact	Shire-wide / Low Impact	Locality Based / High Impact	Locality Based / Low Impact
INFORM	Customer Contact Centre	1	1	1	1
	Tweed Shire Council website	1	1	1	3
	Tweed Link/Advertising/Features	1	1	2	3
	Media Release	1	1	2	3
	Publications/information material	1	2	2	4
	Councillors' community catch up	3	4	2	3
	Social Networking	2	2	3	3
	Council facilitated events	4	4	4	4
	Letterbox Drop	4	4	3	3
	Targeted Direct Mail	2	2	2	3
	Presentation/Public Speaking	2	3	3	4
	Community Notice Boards	3	3	3	3
	Site Specific Signage	3	3	3	3
CONSULT	Tweed Shire Council website (eg: On Exhibition)	2	3	3	4
	Community Conversation	3	3	2	3
	Public exhibitions/submissions	1	2	3	4
	Community displays/information sessions	2	2	3	4
	Surveys	3	4	4	4
	Site Meeting/Tour	2	3	2	4
	Personal briefing	1	1	2	2
INVOLVE / COLLABORATE	Tweed Shire Council website (moderated forums)	3	3	3	4
	Meetings by invitation	1	2	2	4
	Meetings with Council committees/advisory groups	1	3	3	4
	Large Group/Stakeholder Collaboration	2	2	3	4

Engagement tools in the involve/collaborate stage will vary depending on the nature of the project requiring engagement.

Figure 10.1 Community Engagement Matrix

10.2 Communication

ADWG Actions

- **Develop an active two way communication program to inform consumers and promote awareness of drinking water quality issues.**

Customers wishing to report a drinking water quality issue are advised to contact Council.

Once received by Council, any drinking water quality complaint is handled in accordance with the *Water Quality Complaints and Incidents Standard Operating Procedure.*

In most instances, drinking water complaints are received over the phone by Council's trained customer service professionals. However, complaints can also be received by email, post, in person or Council's Smartphone Application.

Action taken by Council to raise awareness of drinking water quality issues vary according to the severity of the issue (ie risk to public health) and the scale of the impact (ie number of households, schools etc impacted). In the event of a drinking water quality issue, Council may use the following channels to alert customers:

- Council's website, which provides information for customers on the indicators of a potential drinking water quality issue, instructions for customers who have identified a water quality issue as well as information on current water supply service problems. The website also provides information on backflow prevention and cross connection control to help to minimise the risk of contamination of water supply.
- Council's Smartphone Application provides customers with information on current water service problems and interruptions as well as enabling customers to report a problem directly to Council.
- The Water Unit alerts the customer service officers immediately of any drinking water quality issues and Council's response to rectify the issue, enabling them to accurately answer customer enquiries.
- Media releases targeting print, online and broadcast media
- The Tweed Link, which is a weekly newspaper produced by the Council.

In the event that a Boil Water Notice is required, the Tweed Laboratory Centre will immediately notify NSW Health. Council would work with NSW Health to communicate the boil water notice, using the established NSW Health templates.

Council reports on the number of drinking water quality complaints to its customers in the publicly available Council Reports, it's website and publications ie Tweed Link and/or Water Matters which is a water-specific publication mailed to customers with their quarterly water notice.

11 ELEMENT 9 - Research and Development

11.1 Investigative studies and research monitoring

ADWG Actions

- **Establish programs to increase understanding of the water supply system**
- **Use information to improve management of the water supply system**

Council engages external consultants to provide expert advise on any complex operational issues relating to water supply. When a water supply issue is identified that cannot be readily resolved, the consultant works closely with Council staff to increase understanding of the causes and develop actions and or processes to rectify the issue.

Council relies on the various industry and agency bodies to conduct research and provide guidance on new technologies and water supply improvements. Memberships include:

1. Water Directorate (Member)

Water Directorate provides focused technical information to its members. There aims include:

- providing an independent source of advice to Councils on water and sewerage operations
- promoting a more efficient operation of Local Government water and sewerage infrastructure;
- providing direction on technical issues;
- providing networking opportunities for water and sewerage engineers to share knowledge and improve communication within the industry

2. Australian Water Association (Member)

AWA is independent and not for profit. It plays an essential role in supporting the Australian water sector in the delivery of effective and sustainable water management practices. Their mission is to foster knowledge, understanding and advancement in sustainable water management – its science, practice and policy – through advocacy, collaboration and professional development.

3. Water Industry Operators Association of Australia (Member)

Key Objectives are:

- Promoting standards of education and training to ensure efficiency and competency of members
- Preservation of clean waterways and protection of Public Health and the environment
- Accumulation and distribution of information on all aspects of the Water Industry

4. Water Services Association of Australia

- WSAA is the peak industry body that supports the Australian Urban Water Industry. Its members and associate members provide water and sewerage services to approximately 16 million Australians and many of Australia's largest industrial and commercial enterprises. The Association facilitates collaboration, knowledge sharing, networking and cooperation within the urban water industry.

Council maintains key staff awareness of government industry direction and changes through attendance of conferences seminars and workshops.

11.2 Validation of processes

ADWG Actions

- **Validate processes and procedures to ensure that they are effective at controlling hazards.**
- **Revalidate process periodically or when variation in conditions occurs.**

Council utilises expert consultants to design and commission water treatment facilities and processes. Operational process manuals are also developed as part of these engagements. Council's operational staff operate and maintain treatment facilities in accordance with these manuals. Theses manuals are updated as a result of equipment or process changes and for more complex items additional consulting input is sort. Council continues to maintain an operational consulting support contract with expertise in water treatment.

Water supply quality is validated through the water quality monitoring program. Any issues are resolved through the incident management procedures and actions taken to control the hazards. Processes will be reviewed as issues arise or regulations change. Evaluation and audit processes are documented in section 13.2.

11.3 Design of equipment

ADWG Actions

- **Validate the selection and design of new equipment and infrastructure to ensure continuing reliability.**

The procurement process involves design specifications being developed by Council's project and design engineers which are supported by external consultants as required. The Contract Section is responsible for producing the commercial tender documentation. Formal processes are then used to advertise, assess and award contracts via a tender panel.

Council's Procurement policy reflects Local Government Act procurement regulations. Major water supply contracted works are typically managed with assistance from NSW Public Works, who have a body of expertise to draw from and provide contractual support to Council.

12 ELEMENT 10 - Documentation and Reporting

12.1 Management of documentation and records

ADWG Actions

- **Document information pertinent to all aspects of drinking water quality management.**
- **Develop a document control system to ensure current versions are in use.**
- **Establish a records management system and ensure that employees are trained to fill out records.**
- **Periodically review and revise as necessary.**

Council has record keeping systems and procedures in place to ensure (Table 12.1):

- Quick, easy access to information and documents via web based systems
- Accurate Version Control
- Clear, documented procedures
- Accurate collection and analysis of data

Table 12.1 Document Management Systems

System	Contents
Health Safety and Environment Corporate Intranet Page	• Standard Operating Procedures (SOPs) • Safe Work Method Statements (SWMS) • Environmental Emergency Management Plans • Hazard and Risk Register • Chemalert - Safety data sheets and chemical register
Corporate Knowledge Base/Council website	• Council Policies and strategies • Customer Communication • Public Website and Education
Water Unit Knowledge Base	• Web based information management system - centralised access to Water Unit Data, Documents, Processes and Information • Access information via keyword search • Portal to access information via other systems listed • Policies and Procedures • Links to external sites e.g. EPA licenses, ADWG
Corporate Record Keeping System (ECM)	• Incident Reports • Council and Corporate Reports • Correspondence • Orders and quotes
Customer Request Management (CRM)	• Customer complaints and requests for service
Engineering Plans and Library Register	• Operational and Maintenance Manuals • Plan register • Professional Publications
Performance Monitoring database	• Water Quality Data from Tweed Laboratory Centre

	• Clarrie Hall Dam and Reticulation Monitoring
Telemetry (SCADA)	• Telemetry data is recorded in a database called citec historian
Network Folders	• Accident and Incident register • Working Documents • Working Instructions • Log Sheets and Daily Inspection Checklists • Photos
Asset Management System (MEX)	• Asset Condition and Replacement Schedule • Maintenance schedule
Geographic Information System (GIS)	• Asset types, characteristics including locations

Document Control System
Council's web based information management system is designed to facilitate version control and regular review of content and procedures. This system also enables live links to external websites such as NSW health and Environmental Protection Agency Licences to ensure currency of information.

Council also has a version control system in place on all procedural documents to document the date of creation.

Training is provided for operators through the induction process and on the job training with supervisors on use of log sheets, spreadsheets and databases.

Key Supporting Documents
1. Implementation of a Drinking Water Management System – Risk Workshop, 2010
2. Tweed WQ Risk Register V8, 2014
3. Critical Control Points
4. Critical Control Point Report
5. Water Quality Complaints and Incidents Standard Operating Procedure
6. Water Supply Incident Report
7. Improvement Plan

12.2 Reporting

ADWG Actions
- **Establish procedures for effective internal and external reporting.**
- **Produce an annual report to be made available to consumers, regulatory authorities and stakeholders.**

The Office of Water prepares an annual Water Supply and Sewerage Benchmarking Report from data provided by Council. This report presents the full suite of performance indicators and benchmarking data for all local water utilities. This report along with their tailored Action Plan enables each local water utility to benchmark its performance against that of similar utilities to facilitate performance improvement. The Office of Water then provides data from this report to the National Water Initiative. In addition the Water Unit prepares Quarterly reports to Council. These reports are available to the general public, customers and stakeholders and can be accessed from Agency and Council websites.

The Performance Monitoring database has been programmed to generate water quality reports to meet the requirements of the Office of Water and Council reports.

13 ELEMENT 11 - Evaluation and Audit

13.1 Long-term evaluation of results

ADWG Actions

- **Collect and evaluate long term data to assess performance and identify problems.**
- **Document and report results.**

The Performance Monitoring Database not only produces short term reports for immediate corrective action (Section 7.3) but also produces long-term evaluation of results. These reports can be generated for any time period and include summary statistics and graphs. These reports will be used to internally review and update the assessment of water quality trends, hazard identification and risk assessment (Section 4). This will be completed annually (financial year).

An annual review of the system performance will be prepared based on the annual water quality report. This report will:

1. Update the assessment of water quality data trends, hazard identification and risk assessment.
2. Review performance of CCP's
3. Review Customer Complaints
4. Compare performance against levels of service
5. Review the monitoring program
6. Update any changes to the supply system (Section4)
7. Update operational procedures and processes
8. Make changes to address any new regulatory requirements

13.2 Audit of drinking water quality management

ADWG Actions
- **Establish processes for internal and external audits**
- **Document and communicate audit results**

The annual review will be used as the basis for an internal audit by the Water Unit. The Office of Water's Water Supply and Sewerage Benchmarking Report and Council's Quarterly Reports will also inform the annual review. This internal review will focus on:

1. Water quality and compliance with operational targets and ADWG
2. Implementation of CCP's
3. Incident management
4. Customer satisfaction
5. Operational record keeping particularly operator log sheets
6. Compliance with Fluoridation Act, Regulation and Code of Practice
7. Implementation of the Improvement Plan

The annual review and updated Improvement Plan will be provided to the local Public Health Unit and Office of Water officer for comment.

Following the internal review and independent external audit will be undertaken by an approved Public Health Unit auditor. The auditor will be required to produce a report that will be provided to the Public Health Unit. The first internal and external audit will occur after June 2015. Following this audit Council will consult with the local Public Health Unit on the frequency of ongoing external audits.

14 ELEMENT 12 - Review and Continual Improvement

14.1 Review by senior executive

ADWG Actions
- **Senior executive review of the effectiveness of the management system.**
- **Evaluate the need for change.**

The DWMS will be reported and tabled to Council for adoption by the Director. Following Council's adoption the DWMS will be reviewed annually via an internal review coordinated by the Unit Manger.

An external audit will conducted by an approved Public Health Unit auditor starting in 2015. The frequency of these audits will be determined via consultation with the local Public Health Unit.

The review and audit results will be reported to Council. Any actions from the review and audit will be included in the DWMS's detailed improvement plan. Actions that cannot be accommodated within normal operational activities will be incorporated into Council's future Delivery and Operational Plans on a priority basis. Additionally each update of Water Supply Strategic Business Plan will identify the need to and scope of any overall review of the DWMS.

These processes will ensure Council is working on continual improvement of water supply services from a quality and safety perspective.

14.2 Drinking water quality management improvement plan

ADWG Actions

- **Develop a drinking water quality management improvement plan.**
- **Ensure that the plan is communicated and implemented and that improvements are monitored for effectiveness.**

The Improvement Plan is to be regularly updated to ensure that the water supply system and its operation are continually improving and that all recommendations and changes are documented and planned. The Improvement Plan can be updated at any time but will at least be updated following:

1. Incident investigations
2. Annual Review
3. Any changes to water supply system
4. Changes to legislation, regulations or guidelines

The live and up to date version of the improvement plan will be available via links from the Water Unit Knowledge Base.

15 References

ADWG 2011 NHMRC/NRMMC (National Health and Medical Research Council/ Natural Resource Management Ministerial Council) *Australian Drinking Water Guidelines* (ADWG) National Water Quality Management Strategy.

Public Health Act 2010 (NSW).

Public Health Regulation 2012 (NSW).

NSW Guidelines for Drinking Water Management Systems 2013 NSW Health.

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