DRINKING WATER MANAGEMENT SYSTEM

Byron Shire Council
August 2021

DOCUMENT CONTROL SHEET

DOCUMENT

Drinking Water Management System

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2.0	J Huxley	MTR		01/07/2014
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GLOSSARY

Term	Definition
ADWG	Australian Drinking Water Guidelines
BSC	Byron Shire Council
CCP	Critical Control Point
DPIE	Department of Planning, Industry and Environment - Water
DWMS	Drinking Water Management System – also known in other documents as the Drinking Water Quality Assurance Management Plan
GIS	Geographic Information System
OCP	Operational Control Point
PHU	Public Health Unit
SOP	Standard Operating Procedure
SWMS	Safe Work Method Statement
SWP	Safe Work Procedure
WTP	Water Treatment Plant

1 INTRODUCTION

1.1 Overview

Byron Shire Council (BSC), in partnership with NSW Health, has developed a risk based Drinking Water Management System (DWMS) consistent with the *Australian Drinking Water Quality Guidelines* (ADWG) (NHMRC, NRMMC, 2011).

The drinking water management system meets the requirements of Section 25 of the *Public Health Act 2010* (NSW) and Part 5 Section 34 of the Public Health Regulation 2012.

The ADWG provides the framework for the good management of drinking water supplies. The framework was developed to guide a structured and systematic approach for the management of drinking water quality from catchment to tap. It incorporates a quality assurance program developed specifically for the water industry and includes elements of Hazard Analysis Critical Control Point (HACCP), ISO 9001 (Quality Management) and AS/NZS ISO31000:2009 (Risk Management).

1.1.1 Context

All urban areas of Byron shire with the exception of Mullumbimby are provided with treated water that is sourced from the Regional Water Supply from Rous County Council. This water supply is treated at the Nightcap Water Treatment Plant and provided by Rous County Council to eight reservoirs within Byron Shire Council. There is a water supply agreement in place between Rous County Council and Byron Shire Council under which it is made clear that Byron Shire Council is responsible for the Reservoirs and reticulation network.

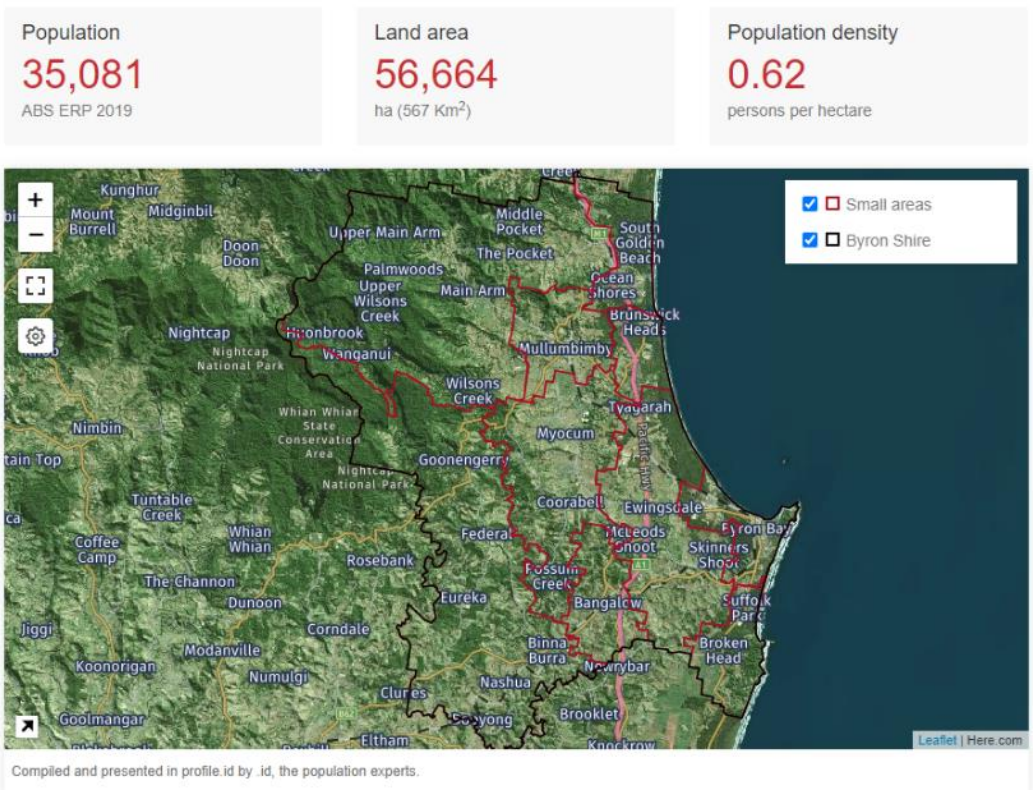

Figure 1 Byron Region

The Mullumbimby supply is sourced from Wilsons Creek via Lavertys Gap Weir. Byron Shire Council treats and reticulates drinking water to Mullumbimby from the Mullumbimby Water Treatment Plant as described in this management plan.

As such, this DWMS is Catchment to tap for the Mullumbimby Scheme, but Supply Reservoir to tap for the Byron supplies as Rous County Council manages water quality from catchment to point of supply to Byron Shire under their own DWMS to the Byron Shire Reservoirs.

2 COMMITMENT TO DRINKING WATER MANAGEMENT

2.1 Objective

The *Public Health Act 2010* and *Public Health Regulation 2012* include provisions regarding drinking water. These regulatory instruments require that a supplier of drinking water develop and implement a quality assurance program. The program is required to be in accordance with the Australian Drinking Water Guidelines.

This document aims to support Byron Shire Council to deliver safe drinking water. Access to safe water is a basic need and is one of the most important contributors to public health.

The overall approach is to provide drinking water supply system staff (i.e. operators and managers) with a user-friendly document that supports Council in its management of a safe drinking water supply. It provides an overview of the system and a summary of all relevant documentation and supporting requirements as required.

This DWMS is a living document. The system will be reviewed and updated in line with Council's monitoring and reporting procedures and when new processes or changes are introduced.

2.2 Commitment

Byron Shire Council is committed to managing its drinking water supply systems to provide a safe, quality drinking water that consistently meets the ADWG, consumer expectations and regulatory requirements. Council demonstrates commitment to drinking water quality management throughout the organisation by:

- Implementing a Drinking Water Policy

  Reticulated/Town Drinking Water Quality Policy (Policy 12/017)
  https://www.byron.nsw.gov.au/Council/Your-right-to-Council-information/Policies-publications/ReticulatedTown-Drinking-Water-Quality-Policy

- Implemented a policy to protect the Mullumbimby raw water source

  Laverty's Gap Weir Catchment Management Policy (Policy 07/105)

  https://www.byron.nsw.gov.au/Council/Your-right-to-Council-information/Policies-publications/Lavertys-Gap-Weir-Catchment-Management-Policy

- Defining the roles and responsibilities to provide safe drinking water
- Identifying and assessing risks, controls and preventative measures to protect drinking water quality and public health
- Adopting a continuous improvement approach including an improvement plan

2.3 Regulatory and Formal Requirements

Council is required to adhere to many regulatory and formal requirements. There is commonwealth legislation (i.e. the *Water Act 2007)*, state legislation (i.e. *Public Health Act 2010,*

Fluoridation of Public Water Supplies Act 1957) and National and State Guidelines and Programs (i.e. Australian Drinking Water Guidelines 2011). The regulatory and formal requirements relating to drinking water quality in Byron Shire Council have been identified and detailed in Table 1.

Table 1 Regulatory and Formal Requirements

Regulatory or Formal Requirement	Relevance to Drinking Water Quality	Agency
Commonwealth Legislation		
Competition and Consumer Act 2010	Replaces the Trade Practices Act 1974 and incorporates Schedule 2 – The Australian Consumer Law. As a "seller" of water, the local council is subject to provisions of Consumer transactions and Consumer guarantees, which guarantees that the goods supplied are reasonably fit for purpose	Australian Competition and Consumer Commission
Water Act 2007	Provides for the management of the ground and surface water resources of the Murray-Darling Basin, with particular focus on managing extractions to 'protect, restore and provide for the ecological values and ecosystem services of the Murray-Darling Basin'.	Murray Darling Basin Authority
NSW Legislation		
Environmental Planning and Assessment Act 1979	Requires that the environmental impacts of projects be studied at all stages based on scale, location and performance. Under Part 3 of the Act, Local Environmental Plans (LEPs) are developed to establish what forms of development and land use are permissible and/or prohibited. LEPs ensure that drinking water quality is considered when assessing development applications. .	NSW Department of Planning Infrastructure and Environment (Planning)
Fluoridation of Public Water Supplies Act 1957	Requirements for testing and reporting where water supplies are fluoridated.	NSW Health
Local Government Act 1993	Local councils have the responsibility for the provision of water supply to consumers, in accordance to the NSW Best-Practice Management of Water Supply and Sewerage Guidelines.	NSW Government - Division of Local Government
Protection of the Environment (Operations) Act 1997	Requires licences for activities with potentially significant environmental impacts. Prosecution may be carried out under this act for any chemical leakage, spill, and disposal of wastes or similar.	NSW EPA
Public Health Act 2010 and Public Health Regulation 2012	Requires all water authorities to develop Drinking Water Management Systems. Bestows certain powers on NSW Health with respect to provision of safe drinking water, including ability to enter treatment facilities, order mandatory testing or obtain information about the drinking water and powers to close a water supply. Council is required to follow the NSW Health Response Protocols and take action if directed by the Director of the Public Health Unit as the delegate of the Chief Health Officer.	NSW Health
Water Management Act 2000 Water Management Amendment Act(s) 2010, 2014, 2018	Provides the basis for water planning, the allocation of water resources and water access entitlements. Licences for extraction for the three systems are governed by the provisions of this Act.	NSW Department of Planning, Industry and Environment
Work, Health & Safety Act 2011	Specifies conditions for storage and handling of chemicals on-site at water treatment plants.	WorkCover Authority of NSW
Guidelines and Programs		
Water supply agreement Rous Water and Byron Shire Council	This agreement defines the roles and responsibilities for the management of water supply within the area of operations for both parties. The agreement also formalises the levels of service and working relationship between Rous Water and Byron Shire Council.	Rous Water

Regulatory or Formal Requirement	Relevance to Drinking Water Quality	Agency
Australian Drinking Water Guidelines 2011	Ensures the accountability of drinking water managers and operators and health authorities and auditors for the supply of safe, good quality drinking water to consumers.	National Guideline, required to be implemented by the Public Health Regulations.
NSW Best-Practice Management of Water Supply and Sewerage Guidelines 2007	Provides for appropriate, affordable and cost-effective services to meet community needs while protecting public health and the environment and making best use of regional resources. Requires a Strategic Business Plan (SBP), including a Financial Plan and associated asset management plans, reviewed and updated every four years; a 30-year Integrated Water Cycle Management (IWCM) plan.	NSW Department of Planning, Industry and Environment - Water
NSW Groundwater Quality Protection Policy 1998	Manages groundwater resources for sustainable economic, social and environmental uses, with a specific principle to protect town water supplies against contamination. A key recommendation is to develop wellhead protection plans.	NSW Office of Water
NSW Health Drinking Water Monitoring Program 2005	NSW Health provides analysis of drinking water samples for water utilities, providing an independent analysis of water at point of supply.	NSW Health
NSW Health Response Protocols	Protocols for reporting – see Emergency Response Section of this document for applicable links.	NSW Health
National Partnership Agreement on Water for the Future	The COAG Strategy on Water and Wastewater Services in Remote Communities in New South Wales aims to provide water infrastructure and build the capacity of the Council to improve the management and overall security of water in remote communities.	Australian Government NSW Department of Planning, Industry and Environment
National Construction Code	Specifications for plumbing in drinking water systems, to be complied with by administrators, plumbing Licensees, developers and property owners/occupiers.	Office of Fair Trading
Licences		
Water Access License Certificates	Extraction licences for water supplies. All licences are for quantity only, whether for ground or surface water supplies.	NSW Department of Planning, Industry and Environment - State Water
Standards and Codes (this list is not intended to be exhaustive)		
AS/NZ 3500.0 to 4:2018 Plumbing and Drainage	Describes the standards for plumbing and drainage. Relevant to the management of the distribution network	National Standard
AS/NZ 4020:2018 Testing of products in contact with drinking water	All products used in the drinking water system should be checked for compliance with this standard	National Standard
AS/NZ 2845:2010 Backflow Prevention Devices	Defines the requirements for backflow prevention devices	National Standard
AS/NZS 2927:2019 The storage and handling of liquified chlorine gas	Describes the design and storage and operation of chlorine gas facilities	National Standard

2.4 Stakeholders

There are numerous stakeholders that are relevant to the provision of safe drinking water. The stakeholders involved in the management of drinking water quality in Byron Shire are listed below. Both NSW Health (both state and regional) and Department of Planning Industry and Environment (DPIE) participated in the development of this DWMS.

Table 2 Stakeholders for drinking water management

Stakeholder	Role	Participation
NSW Health	Provides expert advice and support to Council in achieving their regulatory requirements	Provides water analysis through the NSW Health Drinking Water Monitoring Program.
		NSW Health response protocols; e.g. for microbial and physical and chemical exceedances.
		Representatives from the Local Public Health Unit and NSW Health Water Unit participated in the Risk Assessment Workshop as part of the development of the DWMS.
NSW Department of Planning, Industry and Environment - Water	Technical support on investigations, design, construction, operation, maintenance and management	Inspector visits and assesses WTPs compliance every three months. Technical support on investigations, design, construction, operation, maintenance, and management.
		Annual Reporting on Water Supply performance.
		Participated in Risk Assessment Workshops as part of the DWMS.
North Coast Local Land Services	Natural resource management and emergency management	Liaise with Local Land Services regarding the management of water quality in the drinking water catchment.
Rous Water	Water Supply Authority	Supplies Byron Shire Council with bulk water. The water supplied by Rous is distributed via Council managed reservoirs to the Byron drinking water supply system. Rous water and constituent Councils operate under a Water Supply Agreement, July 2018 (Ref: S2018/9758 L/DOC 2488 - Signed Service Level Agreement Between Byron Shire Council and Rous County Council)

3 ASSESSMENT OF THE DRINKING WATER SUPPLY SYSTEMS

Byron Shire Council provides drinking water services to the communities of Bangalow, Billinudgel, Brunswick Heads, Byron Bay, Mullumbimby, New Brighton, Ocean Shores, South Golden Beach and Suffolk Park.

Table 3 Details of the supply systems

Community	Mullumbimby Water Supply	Byron Water Supply
Catchment	Richmond River	Richmond River
Treatment Plant	Mullumbimby WTP	Nightcap WTP
Population	3100 (NSW Health WQ Database) 3596 (ABS 2016)	**Total** **18958** Bangalow 1100 Billinudgel (218, ABS) Brunswick Heads 1200 Byron Bay 8103 New Brighton (293, ABS) Ocean Shores 4700 South Golden Beach 1327 Suffolk Park 2528
Treatment	Coagulation, direct sand filtration, chlorine disinfection.	Coagulation, flocculation, dissolved air floatation, filtration, ozone, biological activated carbon, chlorine disinfection
Reservoirs (Capacity)	Left Bank Rd (1.5 ML) Azalea St (4.5) (second 0.9ML offline)	Bangalow Granuaille Rd 0.9 ML Byron Bay Wategos 0.45 ML Paterson St 2.67 ML Suffolk Park and Broken Head Coopers Shoot 2.5 ML Coopers Shoot 10 ML (?) Brunswick Heads Saddle Road 2.3 ML Ocean Shores Tongarra Dr 0.135 ML South Golden Beach Warrambool 0.9 ML New Brighton and Billinudgel Yamble Dr 6 ML

Community	Mullumbimby Water Supply	Byron Water Supply	
Length of Mains (m)	57 960	Bangalow Billinudgel Brunswick Heads Byron Bay New Brighton Ocean Shores South Golden Beach Suffolk Park	15 480 2 400 15 550 56 560 4 480 44 680 3810 2528
Pump Stations	Wilsons Creek – Lavertys Gap Weir Gardenia Tristran	North Ocean Shores – North Ocean Shores – Ocean Shores – Ocean Shores – Ocean Shores – Suffolk Park – Bangalow –	Flinders Palmer Warrambool Tongarra Yamble Corkwood Granuaille

3.1 Mullumbimby

3.1.1 Overview

The Mullumbimby water supply is sourced from the upper regions of the Wilsons River sub-catchment which forms part of the upper reaches of the Richmond Catchment. Raw water is extracted from Wilsons Creek at Laverty's Gap Weir. Water flows by gravity through a heritage listed 'race', via a mountain tunnel, to the Mullumbimby Water Treatment Plant.

The Mullumbimby Water Treatment Plant consists of coagulation and flocculation using aluminium sulphate. The water is then passed through sand filters and chlorine is added as it leaves the clear well and prior to the chlorine contact tanks on site.

Raw water is dosed with soda ash and alum prior to flow splitting allowing flocculation to occur in twin flocculation chambers. When the raw water supply is clean, the flocculated water can increase in turbidity, as the flocs increase turbidity. Flocculation performance is best managed by ensuring that the pH is maintained at 6.8 with actions undertaken if the pH drops below 6.4 or raises above 7. Flocculated water then flows by gravity to sand filters.

The filters are operated with a target turbidity below 0.2 NTU and the filters are backwashed if the turbidity increases above 0.3 NTU for more than 15 minutes. The WTP shuts down if the turbidity increases above 0.5 NTU for more than 5 minutes.

Backwash water is captured in backwash sedimentation tanks, and the supernatant is returned to the head of the plant in the "Race". There is no control over pumping rates nor turbidity of the supernatant return.

Filtered water from both sets of filters recombines where it is dosed with chlorine and soda ash for pH control.

Treated water gravitates to the Left Bank and Azalea St Reservoirs, although there are customers serviced directly off the trunk mains.

Figure 2 Raw water

Figure 3 Chemical dosing and flocculation chambers

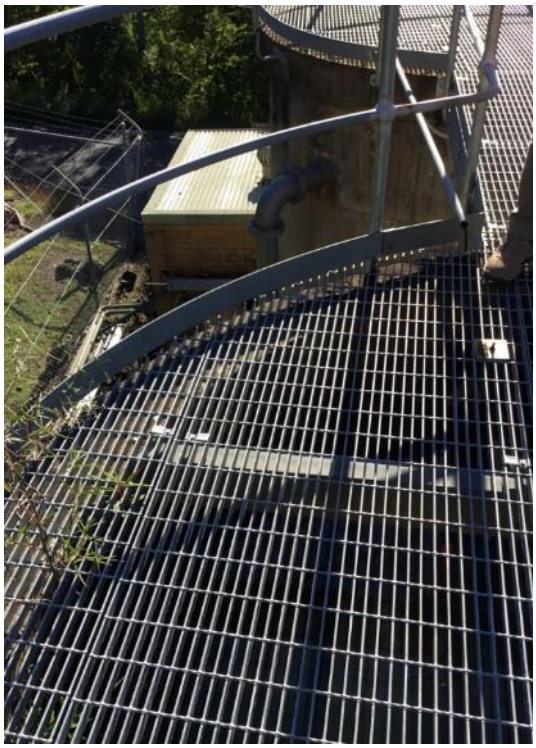

Figure 4 Top of flocculation chambers

Figure 5 Pressure Sand Filters

Figure 6 Chemical dosing pumps

Figure 7 Clear water tanks

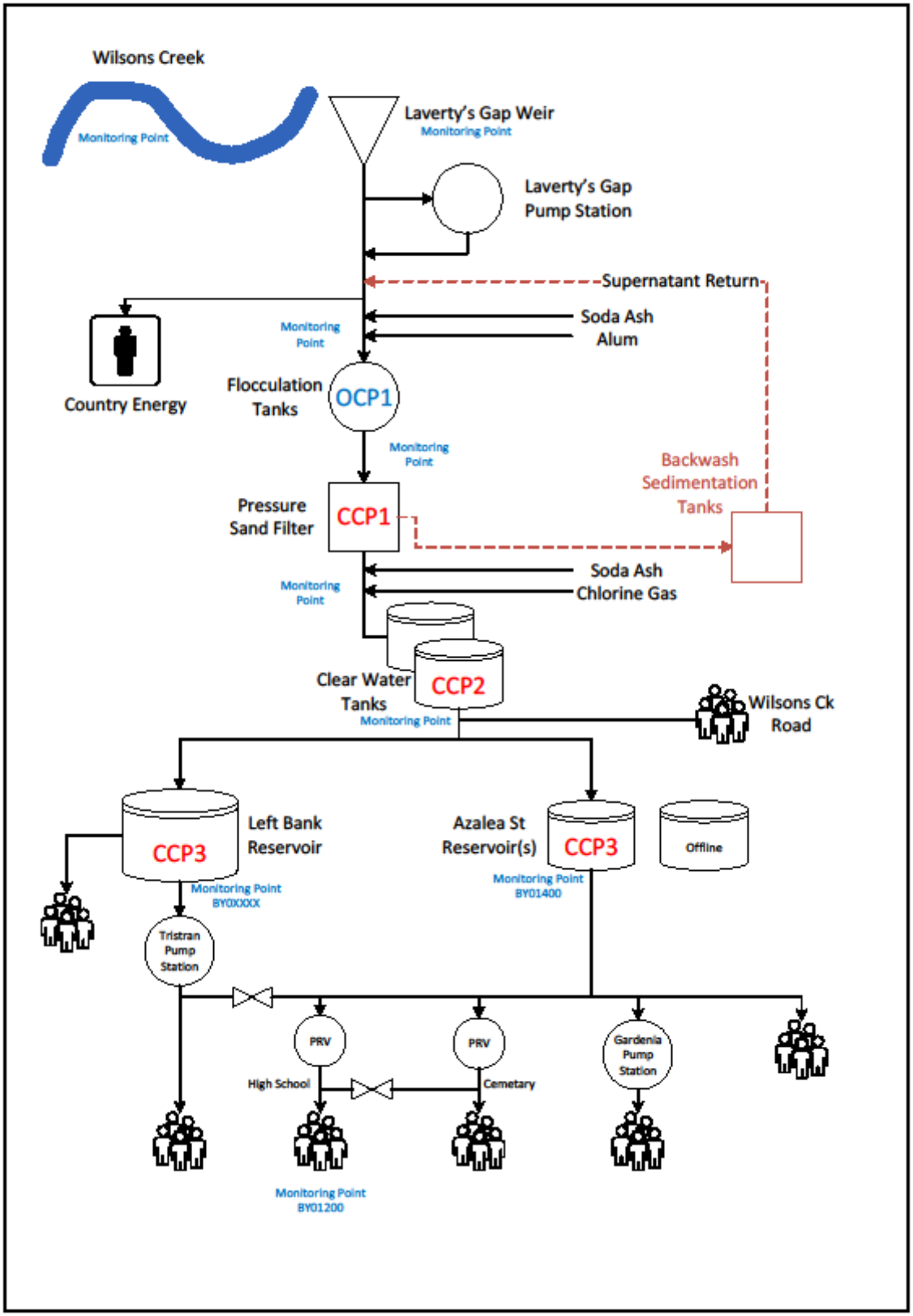

Figure 8 Mullumbimby Treatment and Reticulation Flow Chart

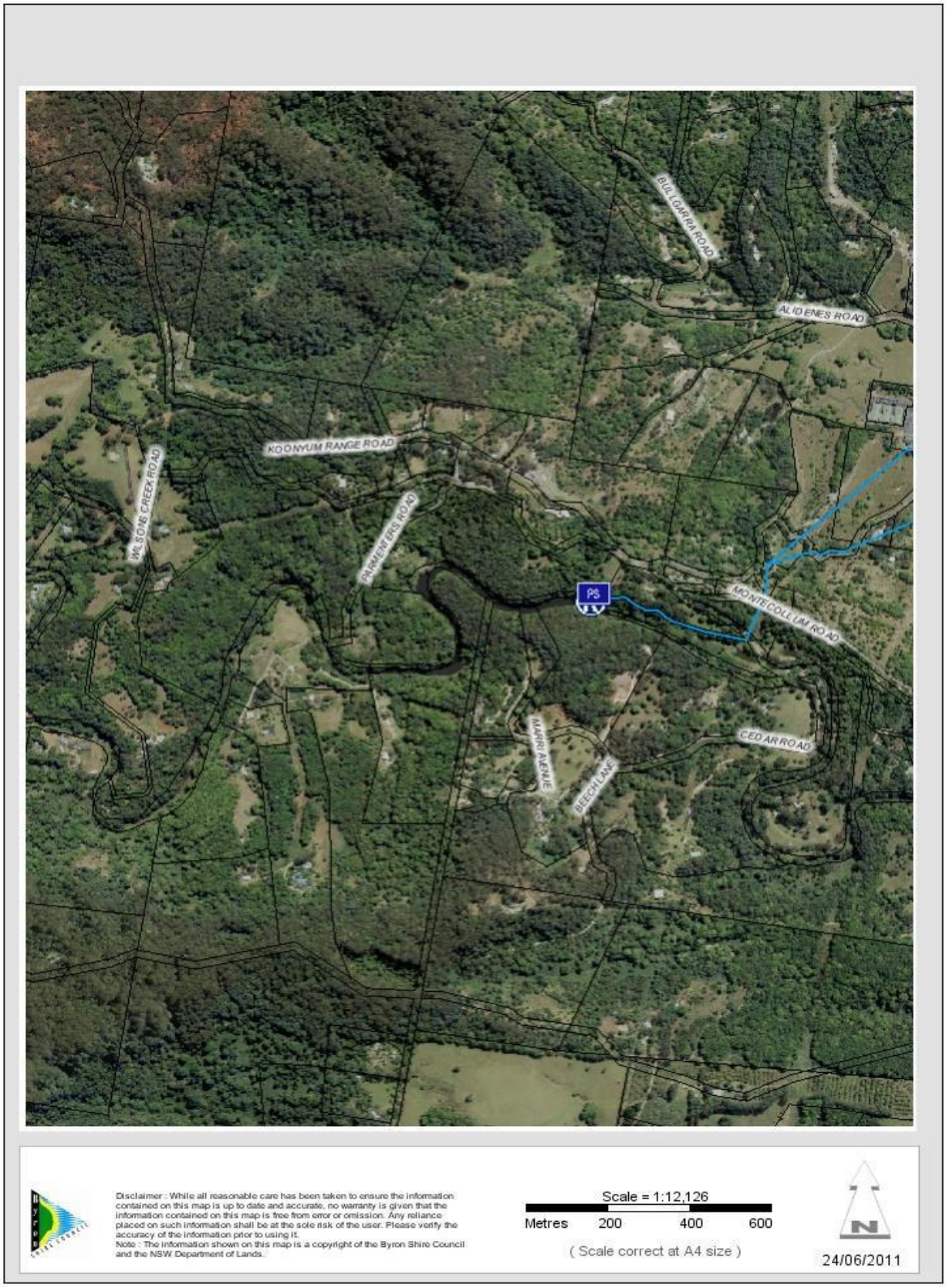

Figure 9 Laverty's Gap Weir

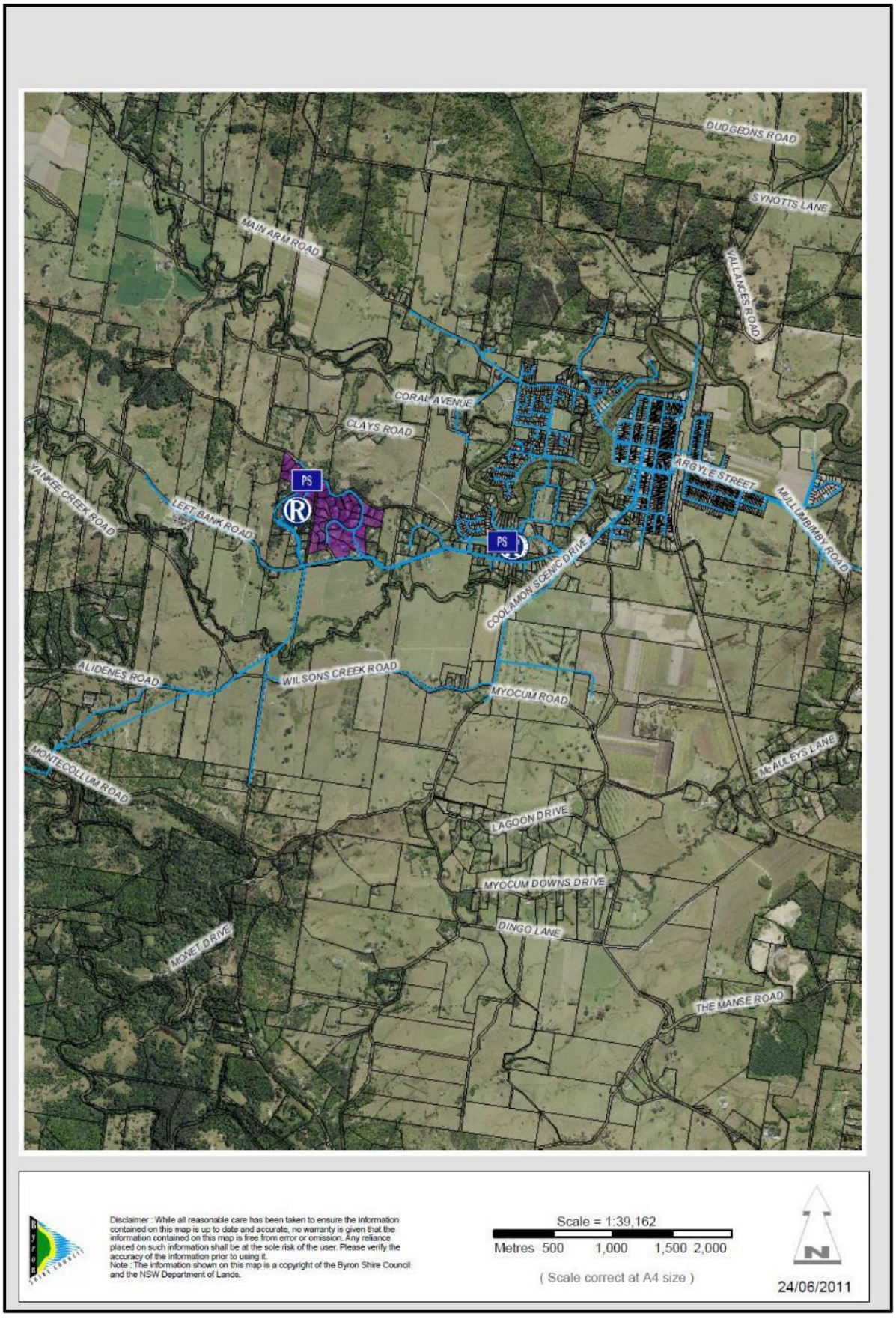

Figure 10 Mullumbimby Reticulation

3.2 Byron water supply

3.2.1 Overview

The Byron drinking water supply is purchased from Rous Water. Rous Water is the regional water supply authority providing potable bulk water to constituent Councils. The raw water supply is extracted from Rocky Creek Dam and treated at the Nightcap Water Treatment Plant (WTP). The Nightcap WTP provides drinking water that undergoes full treatment, including coagulation, flocculation, dissolved air floatation and filtration, ozonation, biologically activated carbon and disinfection to the residents of Byron Shire. The water supply to Byron Shire is not fluoridated.

Rous County Council is responsible for the management of the catchment, treatment systems and supply to the inlet of the Byron Reservoirs. Rous distributes the supply water from a Rous County Council Reservoir at St Helena, where it flows into eight regional reservoirs owned and operated by Byron Shire Council.

Byron Shire Council is responsible for the reticulation of this water from the reservoirs to the consumers.

The Water Supply Agreement January 2014 (#769411) between Byron Shire Council and Rous Water defines the roles and responsibilities for the management of water supply. In relation to water quality, the responsibility of BSC begins at the downstream end of the Rous County Council meter on the inlet pipe of the Reservoir.

Rous County Council will:

- Supply water to BSC of a quality that meets the Rous Water Drinking Water Management System and Australian Drinking Water Guidelines 2011
- Supply water which will maintain reasonable disinfection residuals
- Make available any water quality test upon request
- Produce a monthly water quality report for Council
- Manage the drinking water supply system in accordance with NSW Health approved DWMS

Byron Shire Council will:

- Manage its infrastructure to best preserve disinfection residual downstream of the supply points
- Manage the drinking water supply system in accordance with NSW Health approved DWMS

The provision of residual disinfection is a joint responsibility of Rous County Council and Byron Shire Council. All Byron Shire Council reservoirs are concrete and roofed; although work is required to ensure that telecommunications equipment is either relocated or installed without compromising access or integrity.

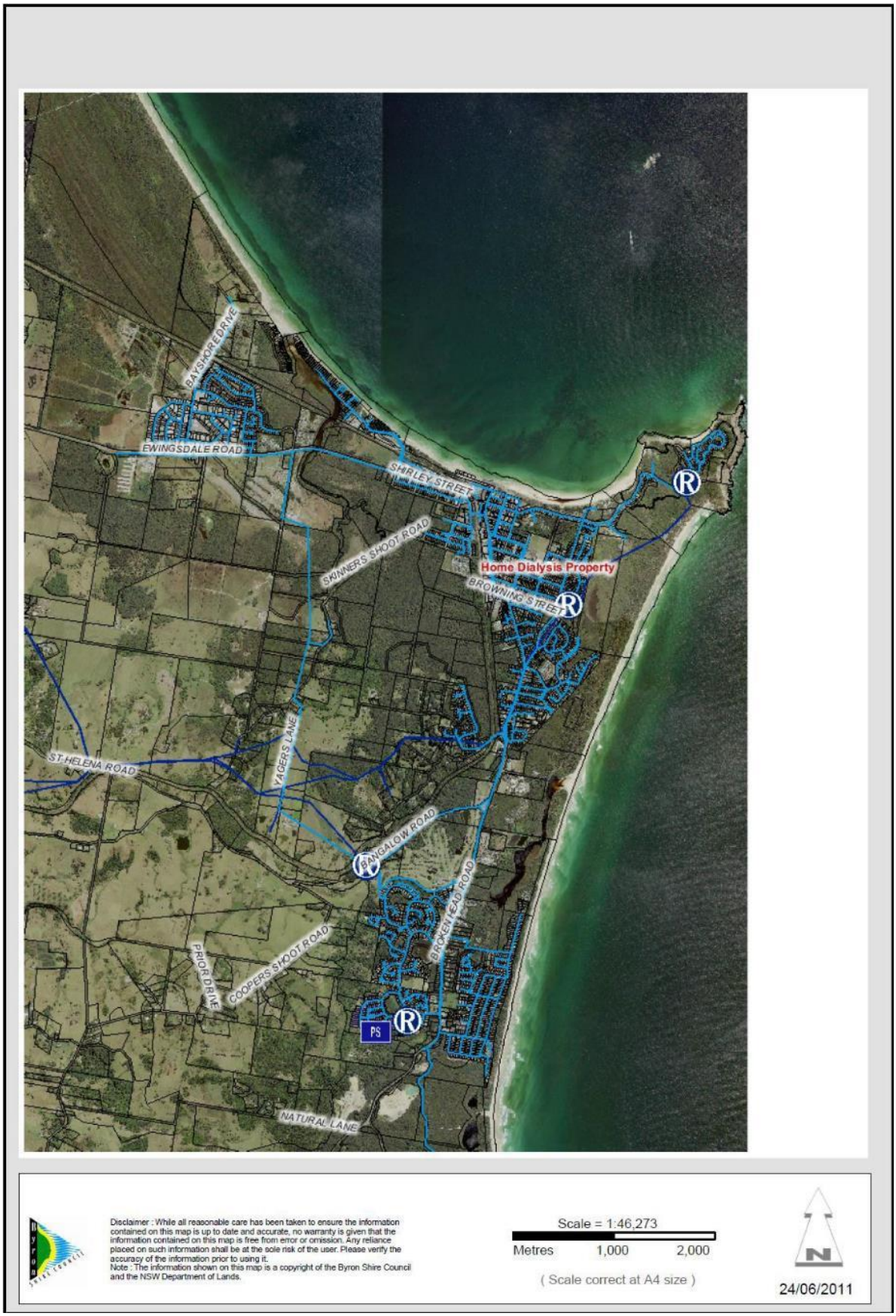

Figure 11 Byron Bay Reticulation

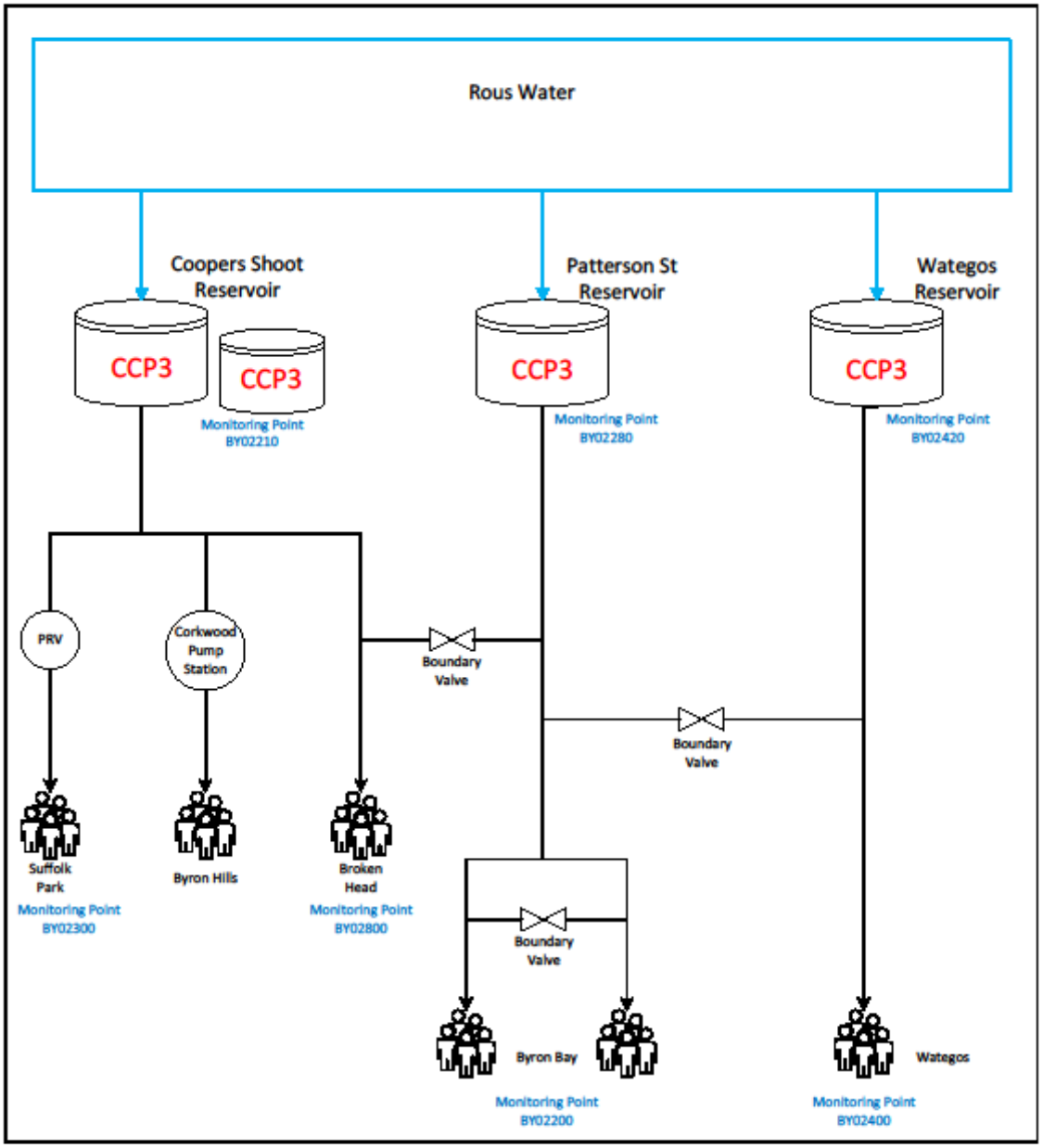

Figure 12 Byron Bay Reticulation Flow Diagram

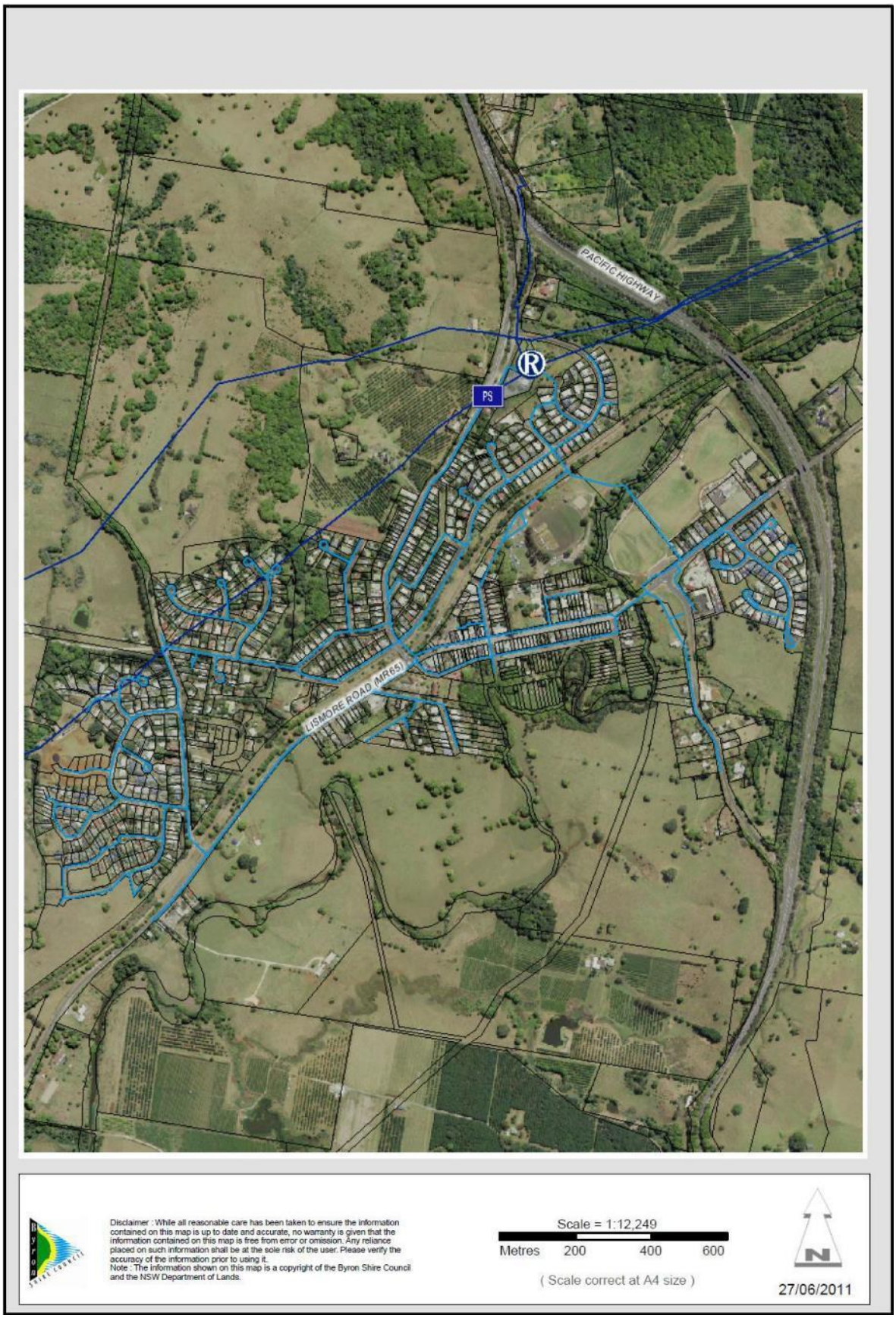

Figure 13 Bangalow Reticulation

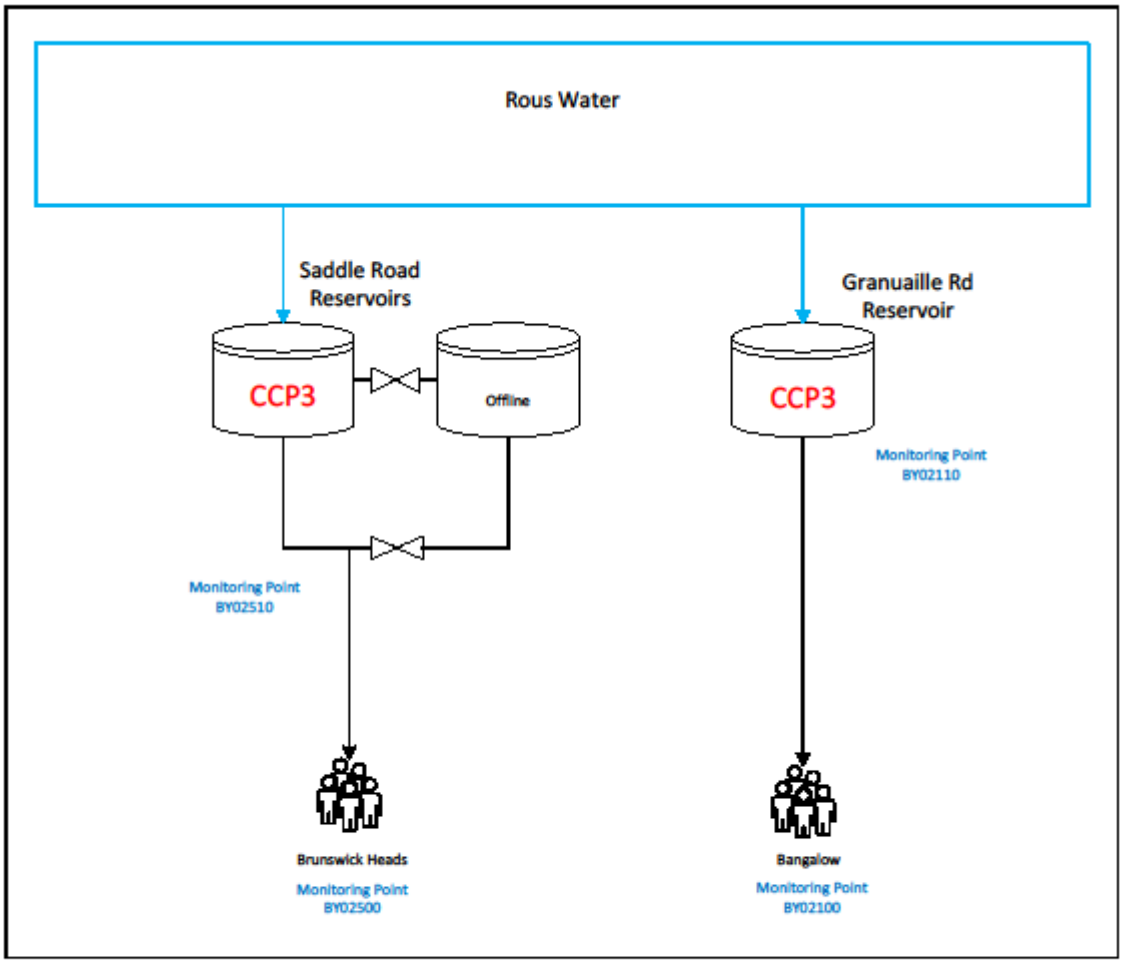

Figure 14 Bangalow and Brunswick Heads Reticulation Flow Diagram

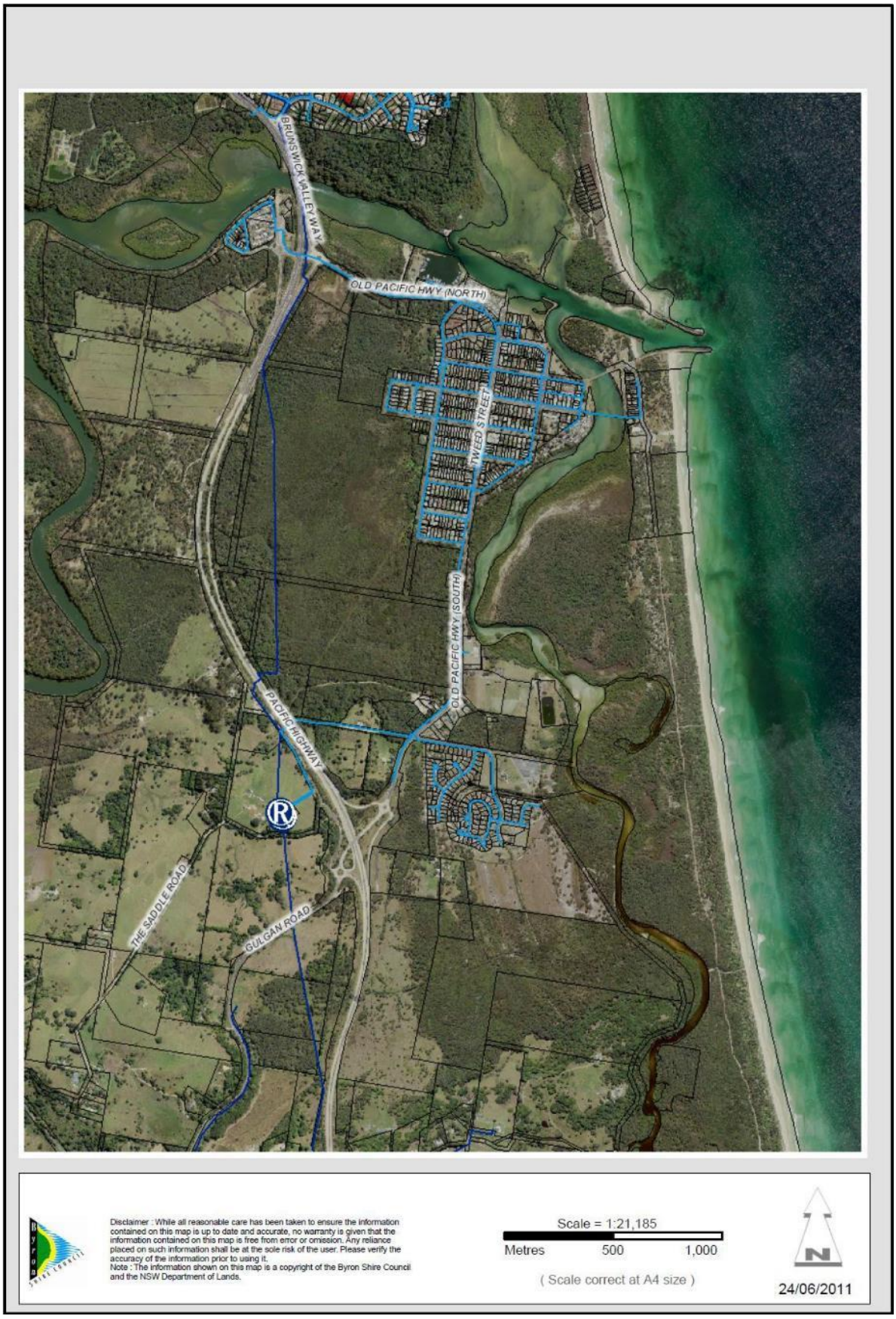

Figure 15 Brunswick Heads Reticulation

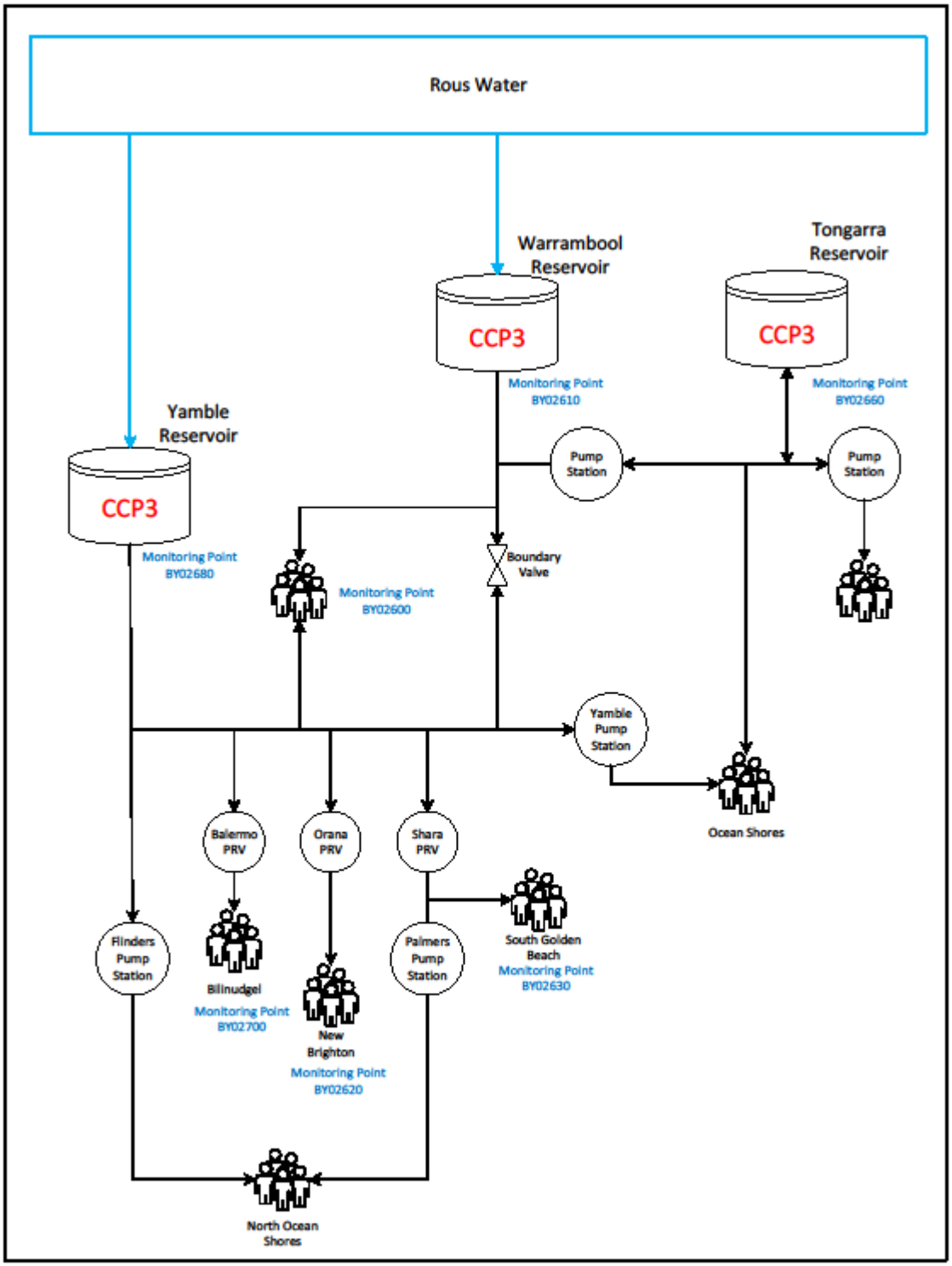

Figure 16 Ocean Shores Reticulation Flow Diagram

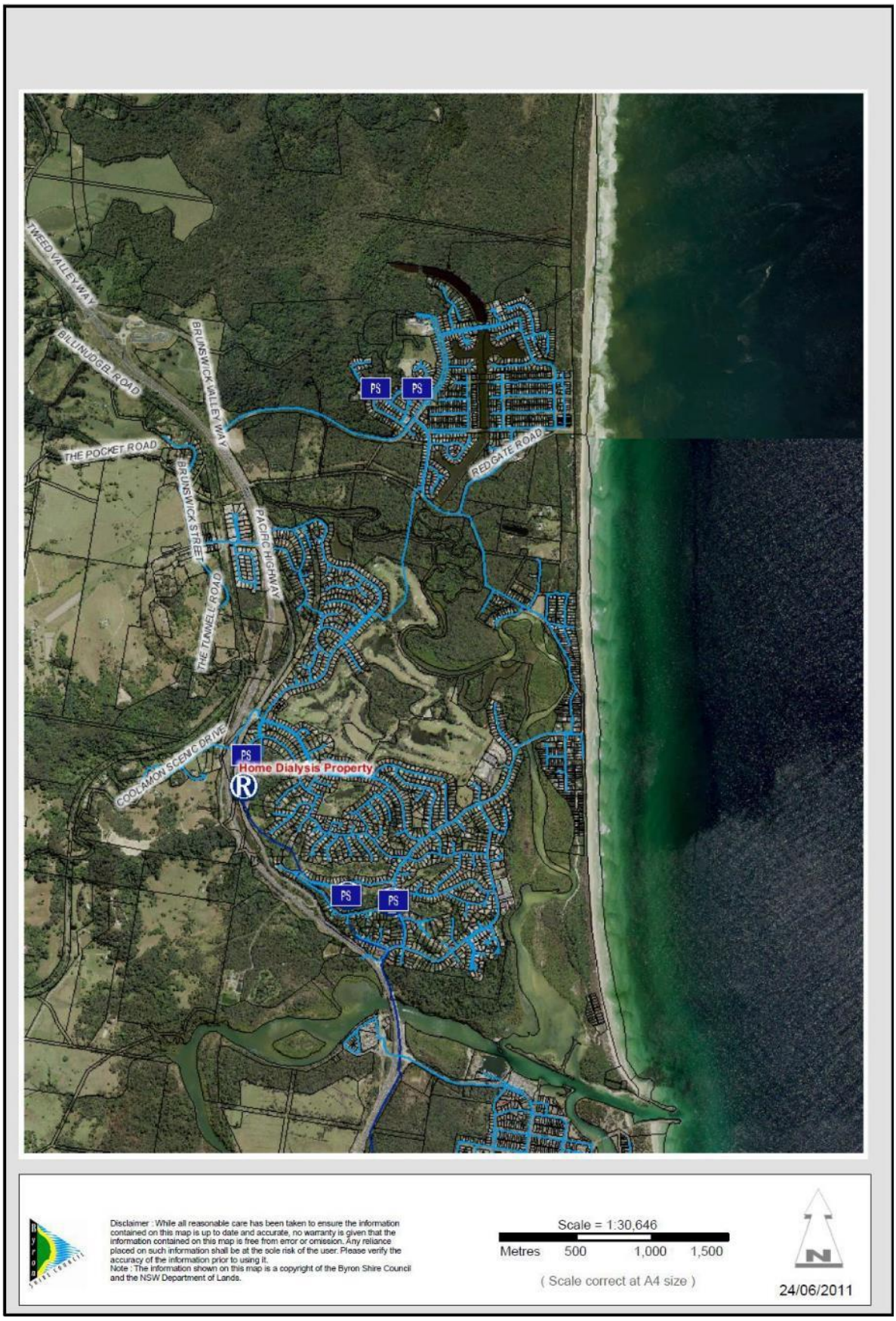

Figure 17 Ocean Shores Reticulation

3.3 Water Quality Assessment

3.3.1 Raw water (Mullumbimby only)

Water for the Mullumbimby water treatment plant is sourced from the upper Wilsons River Catchment which forms tributary of the Richmond River.

Figure 18 Wilsons Creek Catchment and Mullumbimby

This catchment has low levels of development but does include farmland and rural residential areas. It is expected that there is direct access of cattle to waterways, and potential for septic systems to fail. As such the conservative assessment of the catchment is unprotected.

This was confirmed during the development of the Weir Catchment Management Plan Laverty's Gap Catchment (Water Futures 2007).

Byron Shire Council undertakes regular monitoring of the raw and treated water. The table overleaf summarises the water quality data from 2015 to 2019. In addition, there is weekly cyanobacterial monitoring. There are no values in the dataset where total cyanobacteria exceed 10000 cells/mL, and furthermore the potentially toxic species have not been detected (at all) over the entire 5-year period.

Table 4 Raw water quality - Mullumbimby

	Count	Minimum	Maximum	95%ile	Median
Alkalinity as $CaCO_3$	217	7	34	24.02	15.72
Conductivity	193	46.1	104.3	96	77.8
TDS by Calculation	193	28.6	64.7	59.7	48
Colour True	216	8	62.5	37.25	16.5
Chloride	218	8	56	16	12
Hardness Total $CaCO_3$	215	5.5	20	16.24	10.9
Calcium	215	1.03	3.60	3.00	1.96
Magnesium	215	0.70	2.60	2.11	1.44
Sulfur as Sulfate	215	1.57	14.00	4.90	2.45
Iron (Total)	215	0.2	2.4	0.9	0.5
Manganese (Total)	211	0.01	0.16	0.05	0.02

As can be seen from the data above, the water is low alkalinity. Iron levels average 0.5 mg/L and manganese levels are rarely above the aesthetic guidelines.

Raw water turbidity has been monitored routinely and the below figure shows a typical raw water turbidity graph. That is, the turbidity can increase with rain events, but in drier times is consistently below 5 NTU. Over the 2016-2019 time period, the median raw water turbidity was 3.8 NTU. The plant ceases to produce water if the turbidity exceeds 60 NTU, but this is almost never reached.

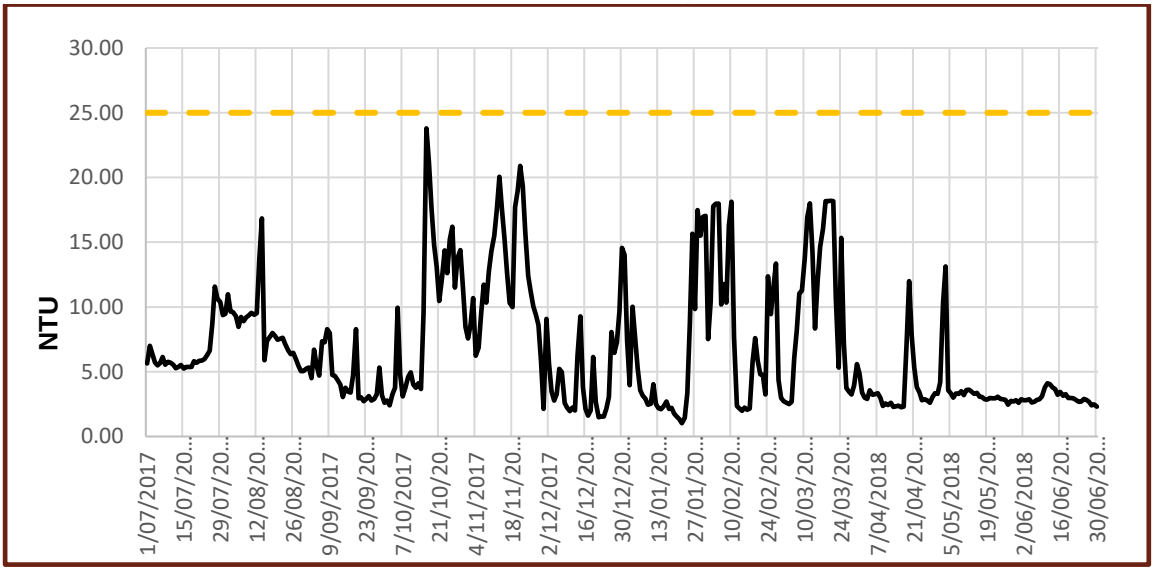

Figure 19 Typical raw water turbidity profile 2017/2018. Yellow line indicates the operational action limit.

3.3.2 Treated water quality

Filtered water turbidity is typically very good, with average turbidity typically below 0.05 NTU. However as can be seen below, there are irregular spikes in turbidity. These are often related to changes in raw water quality. The yellow and red lines are the action and critical limits that were in place at the time. These limits have now been adjusted such that the plant shut down is now at 0.5 NTU to better manage the protozoan risk.

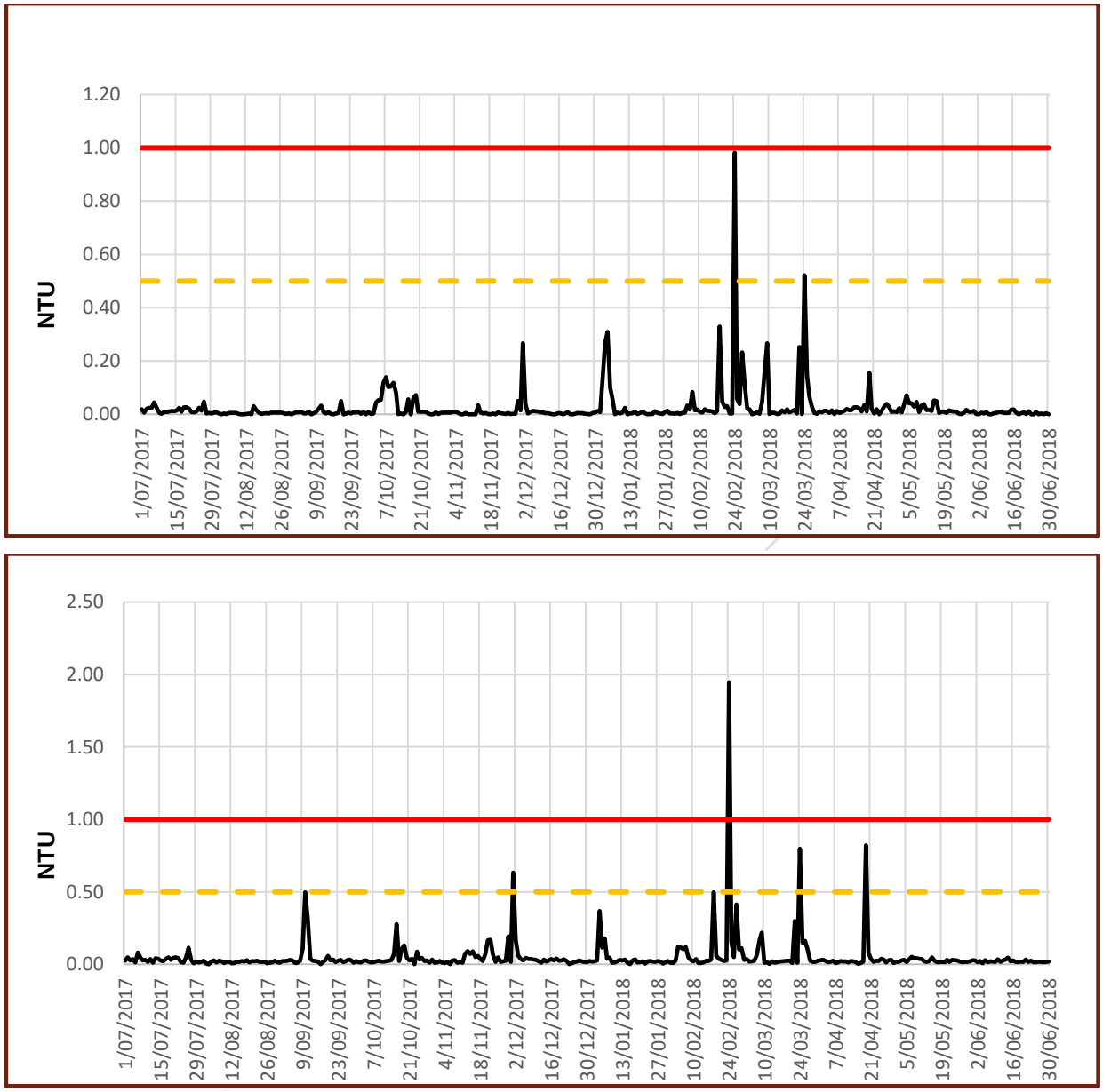

Figure 20 Filter 1 (top) and 2 (bottom) performance for 2017/18

3.3.3 Disinfection

Disinfection is achieved by chlorination. Chlorine is generally managed well, although as shown below there have been failures. The yellow lines represent action limits at the time, and the red lines indicate critical limits for managing the bacterial and viral risk (lower limit), or chemical risk (higher limit).

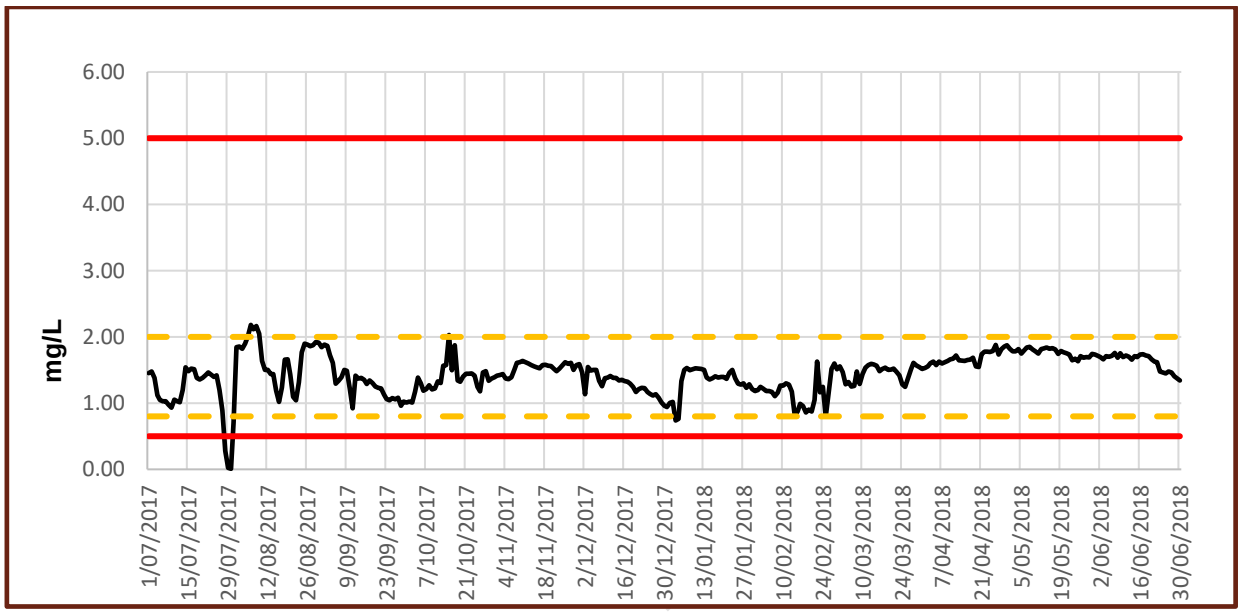

Figure 21 Disinfection performance 2017 and 2018 at Mullumbimby WTP

3.3.4 Chlorine CCP critical limit validation

Disinfection is generally considered effective for the bulk of the Mullumbimby community, with an average chlorine level of 1.37 mg/L from Jan 2014 to Dec 2018. However, there is a concern regarding the chlorine contact time to the first residents prior to the Reservoirs (Azalea St and Left Bank) given the configuration and mode of operation of the clear water tanks at the low chlorine critical limit. The view taken for the DWMS is that the low chlorine critical limit should achieve 15mg.min/L as a minimum under all operational circumstances. However, where there is an identified risk of *Naegleria fowleri* Ct should be at least 30mg.min/L.

Any water supply that seasonally exceeds 30°C or continually exceeds 25°C can support the growth of Naegleria. It can be seen in Figure 22 that the temperature profile of the reticulation network in Mullumbimby is below 25°C and only in exceedance of 30°C on three occasions in the last 3 years (3 instances at McGoughans lane between August 2018 and August 2021). It is therefore considered the risk of *aegleria fowleri* is low and therefor a low chlorine critical limit of 15mg.min/L is acceptable for the Mullumbimby system.

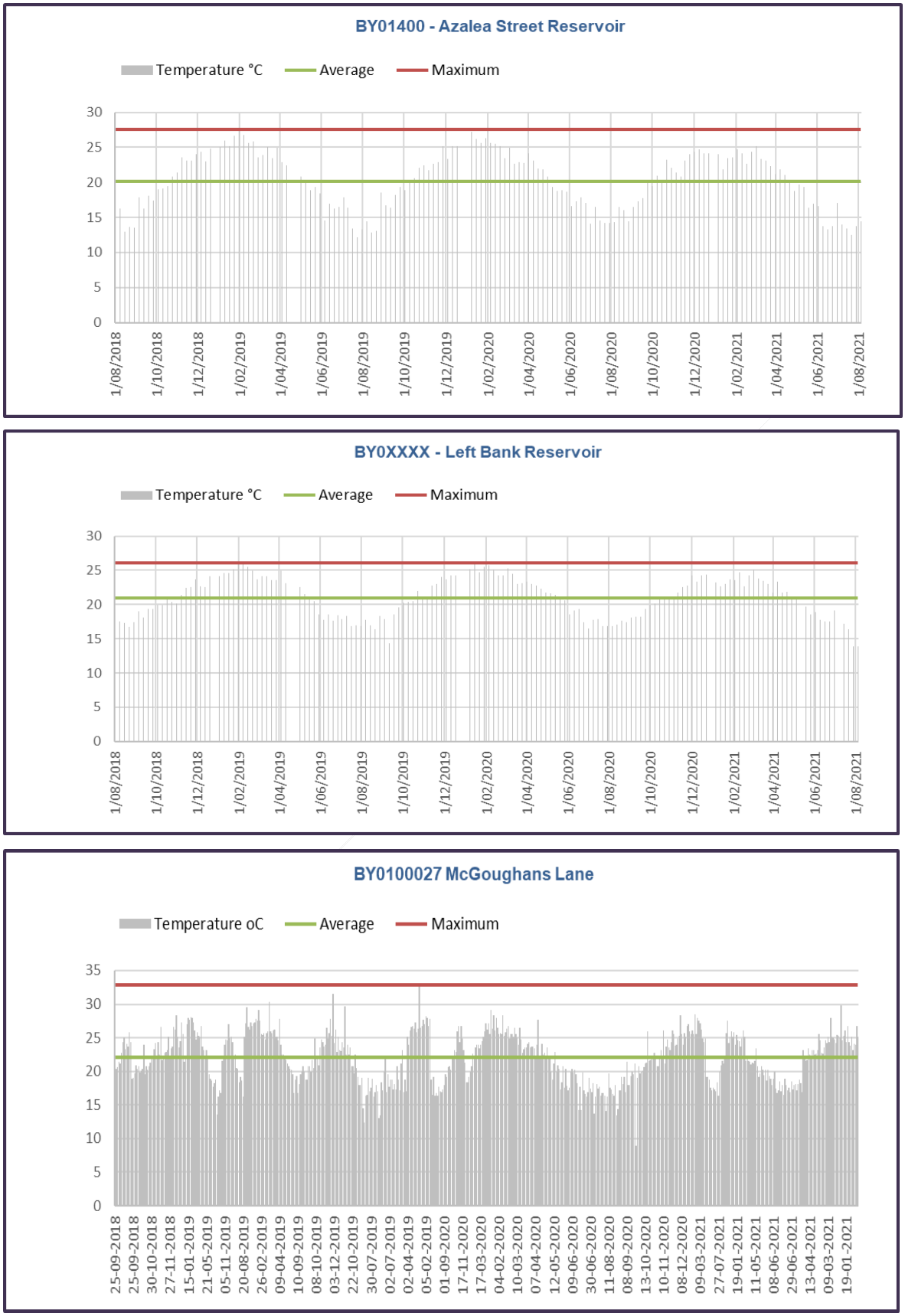

Figure 22 Temperature Profile in Reticulation and Reservoirs

There are shortfalls in sufficient chlorine concentration contact time provided to residents provided water prior to the Left Bank and Azalea St Reservoirs at peak times (12 properties). Under normal operational conditions (not peak demand), and > 30% in CWT2, sufficient contact time of 15mg.min/L is achieved.

All other customers (downstream of Left Bank and Azalea St Reservoirs) sufficient contact time of 15mg.min/L is achieved under all conditions. The information in the table overleaf documents the operational conditions in 2019.

The need for an options assessment has been identified to address the issue of low chlorine contact time for the bulk line customers prior to the reservoirs. Options that are being investigated include (but are not limited to):

a) Disconnection of rural customers from Mullumbimby trunk water supply main; and
b) Rural customers on Mullumbimby trunk water main be placed on permanent boil water alert.

The completed options assessment will be reviewed and endorsed by Council's Executive Team. In the interim, boil water alerts will be issued to rural customers when measures have failed to mitigate the lower critical limit breach of 0.5 mg/L at CCP2 and the legal ramifications of adopting either of the above options is being investigated.

Table 5 Chlorine contact time scenarios for validation of low chlorine critical limit

Parameter	CWT1	CWT2
Low critical chlorine limit	0.5 mg/L (from 2019 CCP)	
Maximum Volume	63 kL at 100%	241 kL at 100%
Minimum operating level	0* (*SCADA low low limit is 10%, however if CWT2 is <30%, CWT1 is empty)	15% (SCADA low low limit)
Baffle Factor	0.1 worst case to 0.3 best case	
Flow rate	Not precisely known as it is not measured – maximum plant production rate is 40L/s but discharge rate from the reservoirs is the defining factor. Peak day was 2.446 ML or 28L/s. With a peaking factor of 2, the potential maximum flow rate is likely to be 56L/s.	
Potential worst case Ct	Not normally applicable, but if Valve 4 is open, 0.4 mg.min/L at 40L/s baffle factor of 0.3 and 10% operating level.	if flow 40L/s, baffle factor 0.3 and operating level of 15% =2.26 mg.min/L
Minimum Ct (ADWG)	15 mg.min/L	
Typical Ct achieved	Average chlorine 1.4, flow rate 26L/s (daily average production 1.1 ML, with peaking factor of 2), minimum CWT 2 level of 30%, 0.3 baffle factor, 19 mg.min/L	

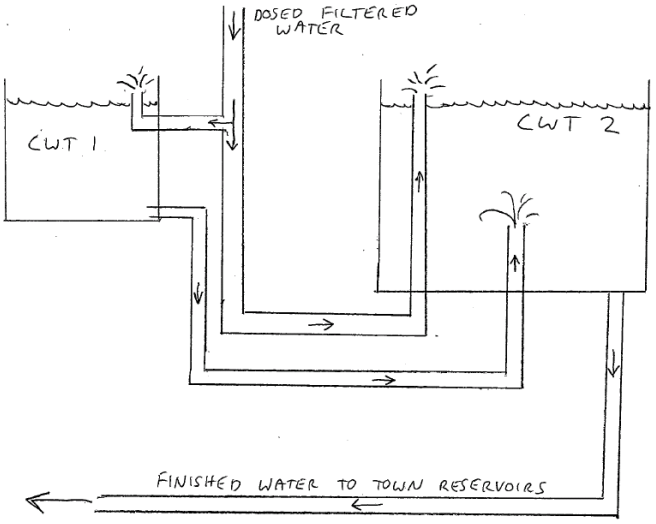

Figure 23 Configuration of clear water tanks demonstrating that contact time should only consider CWT2 under normal operation

Table 6 Mullumbimby verification monitoring data

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% compliant
Chemistry													
	Aluminium	0.2000	mg/L	0.0292	0.0300	0.0138	0.01	0.05	12	0	0.05	0.01	100.00
	Antimony	0.0030	mg/L	0.0004	0.0005	0.0002	0.00005	0.0005	12	0	0.0005	0.00005	100.00
	Arsenic	0.0100	mg/L	0.0005	0.0005	0.0001	0.0005	0.001	12	0	0.001	0.0005	100.00
	Barium	2.0000	mg/L	0.0114	0.0088	0.0123	0.0025	0.05	12	0	0.05	0.0025	100.00
	Boron	4.0000	mg/L	0.0440	0.0500	0.0141	0.0121	0.05	12	0	0.05	0.0121	100.00
	Cadmium	0.0020	mg/L	0.0002	0.0003	0.0001	0.00005	0.0005	12	0	0.0005	0.00005	100.00
	Calcium	10000	mg/L	4.0833	2.5500	4.4574	1.9	17.7	12	0	17.7	1.9	100.00
	Chloride	250.0000	mg/L	14.6667	14.0000	2.4246	13	22	12	0	22	13	100.00
	Chromium	0.0500	mg/L	0.0024	0.0025	0.0011	0.0005	0.005	12	0	0.005	0.0005	100.00
	Copper	2.0000	mg/L	0.0132	0.0065	0.0153	0.0025	0.05	12	0	0.05	0.0025	100.00
	Fluoride	1.5000	mg/L	0.0500	0.0500	0.0000	0.05	0.05	12	0	0.05	0.05	100.00
	Iodine	0.5000	mg/L	0.0100	0.0100	0.0000	0.01	0.01	12	0	0.01	0.01	100.00
	Iron	0.3000	mg/L	0.0079	0.0050	0.0045	0.005	0.02	12	0	0.02	0.005	100.00
	Lead	0.0100	mg/L	0.0014	0.0010	0.0010	0.0002	0.0035	12	0	0.0035	0.0002	100.00
	Magnesium	10000	mg/L	1.4467	1.4100	0.6650	0.66	3.35	12	0	3.35	0.66	100.00
	Manganese	0.5000	mg/L	0.0030	0.0025	0.0018	0.0005	0.0078	12	0	0.0078	0.0005	100.00
	Mercury	0.0010	mg/L	0.0001	0.0001	0.0001	0.00005	0.0004	12	0	0.0004	0.00005	100.00
	Molybdenum	0.0500	mg/L	0.0023	0.0025	0.0012	0.0001	0.005	12	0	0.005	0.0001	100.00
	Nickel	0.0200	mg/L	0.0042	0.0050	0.0019	0.0002	0.005	12	0	0.005	0.0002	100.00
	Nitrate	50.0000	mg/L	0.5833	0.5000	0.1946	0.5	1	12	0	1	0.5	100.00
	Nitrite	3.0000	mg/L	0.0500	0.0500	0.0000	0.05	0.05	12	0	0.05	0.05	100.00
	pH	6.5 - 8.5		8.0000	8.0000	0.1859	7.8	8.4	12	0	8.4	7.8	100.00
	Selenium	0.0100	mg/L	0.0015	0.0010	0.0010	0.001	0.0035	12	0	0.0035	0.001	100.00
	Silver	0.1000	mg/L	0.0012	0.0010	0.0013	0.0001	0.005	12	0	0.005	0.0001	100.00

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% compliant
	Sodium	180.0000	mg/L	25.0000	25.5000	7.8509	6	41	12	0	41	6	100.00
	Sulfate	500.0000	mg/L	13.0833	12.5000	1.7299	11	17	12	0	17	11	100.00
	Total Dissolved Solids (TDS)	600.0000	mg/L	73.4167	73.0000	14.0419	61	114	12	0	114	61	100.00
	Total Hardness as CaCO3	200.0000	mg/L	16.1417	12.1500	11.1708	9	46.9	12	0	46.9	9	100.00
	True Colour	15.0000	Hazen Units (HU)	0.9167	0.7500	0.5573	0.5	2	12	0	2	0.5	100.00
	Turbidity	5.0000	NTU	0.4542	0.2000	0.7238	0.05	2.6	12	0	2.6	0.05	100.00
	Uranium	0.0170	mg/L	0.0017	0.0025	0.0013	0.00005	0.0025	6	0	0.0025	0.00005	100.00
	Zinc	3.0000	mg/L	0.0129	0.0100	0.0099	0.005	0.04	12	0	0.04	0.005	100.00
Microbiology													
	E. coli	0.0000	mpn/100 mL	0.0000	0.0000	0.0000	0	0	262	0	0	0	100.00
	Free Chlorine	0.2 - 5	mg/L	0.9521	0.9700	0.2663	0.07	1.75	265	1	1.34	0.48	99.62
	pH	6.5 - 8.5		7.6433	7.6000	0.3009	7.1	8.5	254	0	8.2	7.3	100.00
	Temperature	30.0000	C	22.6202	23.2500	3.5207	13.6	29.2	84	0	27.8	16.7	100.00
	Total Chlorine	5.0000	mg/L	1.0742	1.1100	0.2673	0.18	1.8	265	0	1.45	0.57	100.00
	Total Coliforms	0.0000	mpn/100 mL	0.2808	0.0000	3.6805	0	59	260	7	0	0	97.31
	Turbidity	5.0000	NTU	0.2931	0.2000	1.1015	0.01	17	235	1	0.42	0.09	99.57

As indicated in the table above, other than a single turbidity of 17 NTU, and 7 detections of total coliforms all samples comply with both health and aesthetic parameters.

Table 7 Rocky Creek Scheme (Byron) verification monitoring data

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% compliant
Chemistry													
	Aluminium	0.2000	mg/L	0.0176	0.0100	0.0213	0.005	0.15	64	0	0.04	0.005	100.00
	Antimony	0.0030	mg/L	0.0005	0.0005	0.0001	0.00005	0.0005	64	0	0.0005	0.00005	100.00
	Arsenic	0.0100	mg/L	0.0006	0.0005	0.0002	0.0005	0.001	64	0	0.001	0.0005	100.00
	Barium	2.0000	mg/L	0.0041	0.0025	0.0083	0.0021	0.05	64	0	0.005	0.0025	100.00
	Boron	4.0000	mg/L	0.0467	0.0500	0.0103	0.0115	0.05	64	0	0.05	0.0154	100.00
	Cadmium	0.0020	mg/L	0.0002	0.0003	0.0001	0.00005	0.0005	64	0	0.00025	0.00005	100.00
	Calcium	10000	mg/L	19.2594	20.0000	4.7347	2	32.1	64	0	26.1	12.6	100.00
	Chloride	250.0000	mg/L	14.0859	14.0000	2.5473	0.5	21	64	0	17	11	100.00
	Chromium	0.0500	mg/L	0.0025	0.0025	0.0009	0.0005	0.007	64	0	0.0025	0.0005	100.00
	Copper	2.0000	mg/L	0.0104	0.0080	0.0088	0.0025	0.05	64	0	0.023	0.0025	100.00
	Fluoride	1.5000	mg/L	0.0500	0.0500	0.0000	0.05	0.05	64	0	0.05	0.05	100.00
	Iodine	0.5000	mg/L	0.0119	0.0100	0.0059	0.01	0.05	64	0	0.02	0.01	100.00
	Iron	0.3000	mg/L	0.0070	0.0050	0.0036	0.005	0.02	64	0	0.01	0.005	100.00
	Lead	0.0100	mg/L	0.0011	0.0010	0.0005	0.0003	0.004	64	0	0.0011	0.0007	100.00
	Magnesium	10000	mg/L	1.3525	0.9000	3.2892	0.53	27.18	64	0	1.47	0.7	100.00
	Manganese	0.5000	mg/L	0.0024	0.0025	0.0008	0.00015	0.005	64	0	0.0025	0.0005	100.00
	Mercury	0.0010	mg/L	0.0001	0.0001	0.0001	0.00005	0.0004	64	0	0.0004	0.00005	100.00
	Molybdenum	0.0500	mg/L	0.0024	0.0025	0.0010	0.00005	0.007	64	0	0.0025	0.0001	100.00
	Nickel	0.0200	mg/L	0.0049	0.0050	0.0035	0.0002	0.03	64	1	0.005	0.0002	98.44
	Nitrate	50.0000	mg/L	0.5516	0.5000	0.2462	0.5	2.3	64	0	1	0.5	100.00
	Nitrite	3.0000	mg/L	0.0500	0.0500	0.0000	0.05	0.05	64	0	0.05	0.05	100.00
	pH	6.5 - 8.5		7.7094	7.7000	0.2231	6.8	8.1	64	0	8	7.4	100.00
	Selenium	0.0100	mg/L	0.0013	0.0010	0.0008	0.001	0.0035	64	0	0.0035	0.001	100.00
	Silver	0.1000	mg/L	0.0010	0.0010	0.0008	0.0001	0.005	64	0	0.001	0.0001	100.00

Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% compliant
	Sodium	180.0000	mg/L	11.0156	11.0000	3.4892	6	26	64	0	17	7	100.00
	Sulfate	500.0000	mg/L	1.6563	1.0000	2.5211	1	21	64	0	3	1	100.00
	Total Dissolved Solids (TDS)	600.0000	mg/L	77.2656	77.5000	8.7709	45	100	64	0	90	65	100.00
	Total Hardness as CaCO3	200.0000	mg/L	53.6656	53.4000	20.6851	9.6	190.1	64	0	69.1	34.4	100.00
	True Colour	15.0000	Hazen Units (HU)	0.7097	0.5000	0.3661	0.42	2	64	0	1	0.5	100.00
	Turbidity	5.0000	NTU	0.3313	0.1000	0.6479	0.05	3.5	64	0	1.3	0.05	100.00
	Uranium	0.0170	mg/L	0.0021	0.0025	0.0009	0.00005	0.0025	35	0	0.0025	0.00005	100.00
	Zinc	3.0000	mg/L	0.0168	0.0100	0.0120	0.005	0.06	64	0	0.04	0.005	100.00
Microbiology													
	E. coli	0.0000	mpn/100 mL	0.0690	0.0000	1.8340	0	53	840	3	0	0	99.64
	Free Chlorine	0.2 - 5	mg/L	0.7717	0.7900	0.2278	0.01	1.52	848	9	1.12	0.37	98.94
	pH	6.5 - 8.5		7.5399	7.5000	0.2233	7	8.4	812	0	7.9	7.2	100.00
	Temperature	30.0000	C	23.6164	22.9500	14.6241	12.4	252	262	4	28	17	98.47
	Total Chlorine	5.0000	mg/L	0.8891	0.9100	0.2370	0.03	1.8	848	0	1.22	0.47	100.00
	Total Coliforms	0.0000	mpn/100 mL	0.4430	0.0000	6.4513	0	165	833	16	0	0	98.08
	Turbidity	5.0000	NTU	0.2262	0.1900	0.1998	0.01	2.81	751	0	0.41	0.08	100.00

The water quality in the Byron schemes is similarly of high quality, there have been 16 total coliform detections, 9 occasions where chlorine was below 0.2 mg/L and just 3 detections of *E. coli* out of 840 total samples. This demonstrates that water quality is generally well managed.

4 HAZARD IDENTIFICATION AND RISK ASSESSMENT

The risk assessment was undertaken on the 8th and 9th October 2019 for the Mullumbimby and Byron schemes. The previous risk assessment was undertaken in 2013.

The objectives of the risk assessment were to:

- Identify drinking water hazards that may impact water quality in all schemes
- Identify if there are any additional hazards that should be risk assessed
- Assess any drinking water hazardous events that are considered relevant
- Reassess risks based on current understanding of the schemes
- Capture comments that contextualise the risk assessment
- Review the target limits, alarm limits and critical limits for Critical Control Points (CCPs)
- Identify if there is a need for further mitigation measures
- Identify the risk management improvement items that are required to reduce mitigated risks to an acceptable level

4.1 Risk assessment team

The risk assessment team is listed below:

Table 8 Risk assessment team

Name	Organisation	Position
Cam Clarke	Byron Shire	Manager Utilities
Dominic Taylor	Byron Shire	Operator Mullumbimby Water Treatment Plant
Geoff Snell	DPIE	Senior Project Officer
Dean Baulch	Byron Shire	Principal Systems Engineer
Ray Collins	Byron Shire	Water Treatment Coordinator
Paul Williamson	North Coast PHU NSW Health	Environmental Health Officer
Zenah Bradford-Hartke	Water Unit - NSW Health	Project officer and Policy advisor
Andrew Logan	Rous Water	Planning Manager
Michael Lawrence	Bligh Tanner	Facilitator

4.2 Risk methodology

For the 2019 risk assessment Council used the following risk methodology which is an adaption of the ADWG risk framework.

The consequence descriptors use terminology such as “acute” which includes all pathogens, and “chronic”, which generally are the chemical health parameters where negative health outcomes would only be expected after a lifetime of exposure.

Similarly, the likelihood timeframes are altered, with more explicit quantifying statements to put the number of expected occurrences into perspective.

Lastly, the actual risks are altered in the matrix to ensure that a catastrophic consequence can be reduced to a medium “acceptable” risk if the likelihood can be reduced to rare. The choice of this

matrix reduces the variability between reviews and eliminates the need to consider risks ‘as low as possible” or the need to alter consequences of a hazard to achieve an acceptable risk.

Where a mitigated risk is rated as "High" or "Extreme", risk improvement items were identified, that when complete should lower the risk to an acceptable level.

4.2.1 Hazard identification

The hazards identified in the previous risk assessment, and any additional relevant hazards, were identified. The type of hazards that were assessed include biological, chemical, physical, and radiological, followed by identifying the sources for each of the hazards within the specific catchments.

4.2.2 Unmitigated risk assessment

Unmitigated risk is determined by considering the consequence and likelihood of a hazard in the absence of any other controls.

Consequence is the impact that the hazard would have if it were to occur

Likelihood is an assessment of the frequency at which the hazardous event is likely to occur, resulting in the potential consequence.

The consequence and likelihood descriptors are included overleaf.

Once the consequence and likelihood are determined, the risk is read from the risk matrix.

For example, for most hazards, the unmitigated risk represents the risk of drinking raw water with no treatment. For chemicals that are added in the water treatment process (e.g. chlorine) the unmitigated risk assumes that chlorine has been added, but without any monitoring or control of the dose rate.

Comments that place the unmitigated risks in context are included in the table.

4.2.3 Mitigated risk assessment

The mitigated risk assessment is undertaken by considering the hazardous events that could lead to the hazard being present. The unmitigated risk is brought forward from the unmitigated risk assessment, and the barriers that prevent or minimise the risk of that hazard are identified.

Barriers include the current treatment barriers (disinfection etc), but also include any actions that may minimise the hazard in the catchment (e.g. ensuring reservoir integrity). The effectiveness of these measures is then considered in the context of any recent incidents, and with water quality data where available.

This allows an assessment of the mitigated risk by again assessing the consequence (which normally will not change – i.e. bacteria make you sick if they are present), and the new likelihood. An uncertainty rating is included in the mitigated risk assessment.

4.2.4 Risk Management Improvement Items

Where a mitigated risk was rated as High or Extreme, the risk assessment team discussed the issues and determined an appropriate mitigation action to lower that risk in the future.

These were identified in the mitigated risk matrices. These items are collated in the risk improvement program later in the DWMS.

Table 9 Risk matrix

Public Health Risk Matrix Likelihood	Consequence	Insignificant	Minor	Moderate	Major	Catastrophic
		Isolated aesthetic exceedance – little operational disruption	Local aesthetic exceedance, potential isolated breach of chemical health parameter	Widespread aesthetic exceedances, or repeated breaches of chronic health guidelines	Potential acute health impact, no outbreak expected	Potential acute health impact, declared outbreak likely
Almost Certain	Occurs daily to weekly	Medium	High	High	Extreme	Extreme
Likely	1-4 occurrences per month	Medium	Medium	High	High	Extreme
Possible	1-11 occurrences per year	Low	Medium	Medium	High	High
Unlikely	1 occurrence every 1-5 years	Low	Low	Medium	Medium	High
Rare	<1 occurrence every 5 years	Low	Low	Low	Medium	Medium

Table 10 Unmitigated Risk Assessment

Hazard	Sources of Hazard	Unmitigated Risk			Comment
		Consequence	Likelihood	Risk	
Bacteria/ Virus (Source Water)	Unprotected catchment, grazing, primary and secondary contact, onsite sewage	Catastrophic	Almost Certain	Extreme	
Bacteria/ Virus (Reticulation)	Faecal contamination into reservoirs or mains ingress	Catastrophic	Likely	Extreme	
Protozoa (Crypto/ Giardia) (Source Water)	grazing, primary and secondary recreational activities, onsite sewage, wild animals, waste dumping	Catastrophic	Almost Certain	Extreme	
Protozoa (Crypto/ Giardia) (Retic)	reservoir contamination, mains contamination	Catastrophic	Possible	High	
Protozoa (Naeglaria) (Reticulation)	reservoir contamination, mains contamination, elevated temperatures, food source in unfiltered supplies.	Catastrophic	Possible	High	
Cyanobacteria	Algal bloom in Laverty's Gap Weir	Moderate	Possible	Medium	
Chlorine	chemical overdose	Moderate	Almost Certain	High	
Chlorate	Breakdown of sodium hypochlorite (or formation with electrolytic)	Moderate	Possible	Medium	Should consider chlorate if electro chlorination to be implemented.
Copper	corrosion of pipework	Moderate	Rare	Low	
Cyanobacterial toxins	Toxic algal bloom	Major	Possible	High	
Disinfection byproducts	elevated organics and long detention times	Moderate	Likely	High	
Heavy metals	natural geology, chemical impurities, corrosion of assets	Moderate	Unlikely	Medium	
Lead	lead containing brass fittings, lead joins in pipes	Moderate	Unlikely	Medium	
Hydrocarbons	spills in catchment	Moderate	Rare	Low	
Hydrocarbons (retic)	mains contamination	Minor	Unlikely	Low	Polyethylene service lines are permeable to hydrocarbons
Manganese (Source)	natural geology, black water event in river	Moderate	Possible	Medium	rain events bring elevated iron and manganese
Manganese (reticulation)	Solubilise in reticulation/ historical coatings on mains	Moderate	Unlikely	Medium	
Nitrate (surface water)	Agriculture, horticulture, onsite sewage	Moderate	Unlikely	Medium	
Pesticides	Agriculture, horticulture, illegal disposal, spill	Moderate	Possible	Medium	
Radioactivity	Natural geology	Moderate	Rare	Low	
Aluminium	natural sources, alum	Moderate	Almost Certain	High	
Colour	naturally occurring	Insignificant	Rare	Low	Water does not normally have any significant colour
Iron	natural geology, sediment	Minor	Unlikely	Low	
Taste and odour	stagnating water in reticulation, old mains, chlorine dosing	Minor	Unlikely	Low	Not a normal issue
Softness	local geology, cement lined pipes	Minor	Unlikely	Low	
pH	source water changes, overdose/ underdose pH correction chemicals, degradation of concrete in mains	Moderate	Almost Certain	High	
Turbidity (Surface Water)	Storm events, land clearing, farming practices	Moderate	Almost Certain	High	

Hazard	Sources of Hazard	Unmitigated Risk			Comment
		Consequence	Likelihood	Risk	
Turbidity (Retic)	sloughing of biofilm, accumulation when dry, resuspension of sediment in reservoirs/mains, main break	Minor	Almost Certain	**High**	
Loss of Supply	Raw water supply compromised/ infrastructure (race) failure/telemetry failure/power supply/ fire	Catastrophic	Unlikely	**High**	Race is old and leaking. Structural assessment may be required? Heritage listed. Loss of power supply. Some areas of Byron and Mullumbimby where pressure pumps are required.
Malicious action	Sabotage/Terrorism	Catastrophic	Likely	Extreme	Critical infrastructure stolen twice, political issues, high level of community activism.
Operator Error	Mistake/ lack of training / overworked	Catastrophic	Almost Certain	Extreme	Simulation mode can result in operators not being aware of issues.
Chemical Supply	Unable to get supply from providers	Catastrophic	Possible	**High**	Link to potential contaminants in chemicals. AS4020.

Table 11 Mitigated Risk Register – Mullumbimby

Process Step	Risk ID	Primary Hazard	Source of Hazard/ Hazardous event	Maximum Risk	Primary preventive measure	Other preventive measures	Comments	Residual Risk				Improvement Items		
								Consequence	Likelihood	Risk	Uncertainty	This year	1-2 years	~5 years
Water abstraction	M1	Turbidity (Surface Water)	Rainfall event, agricultural activity, logging, pigs, camping, fires	High	flocculation/ filtration	Shut down when raw water is high	plant shuts down on filtered water turbidity. Can flush race (manually). Turbidity meter on raw water.	Moderate	Rare	Low	Confident			
	M2	Protozoa (Crypto/ Giardia) (Source Water)	Agriculture, recreational activities, septics, upstream STPs	Extreme	flocculation/ filtration		Current shutdown is 0.8 NTU - recycle of supernatant.	Catastrophic	Possible	High	Reliable	Reduce critical limit to 0.5 NTU		
	M3	Bacteria/ Virus (Source Water)	Agriculture, recreational activities, septics, upstream STPs	Extreme	disinfection	filtration	one point where chlorine dosing may have been impacted, but believe this was an online meter issue. CT is potentially an issue	Catastrophic	Possible	High	Estimate	CWT levels, chlorine levels, flow rate to be confirmed (and confirm that the CW tanks operate in series).		
	M4	Cyanobacteria	Bloom in River	Medium	filtration		Weekly testing	Moderate	Unlikely	Medium	Confident			
	M5	Cyanobacterial toxins	Toxic bloom	High	chlorination		Has not been a detected bloom in 15 years	Major	Unlikely	Medium	Reliable			
	M6	Pesticides	Agriculture, spill	Medium	flocculation		Would need to visually identify a fish kill, or have knowledge of a spill	Moderate	Unlikely	Medium	Estimate			
	M7	Bacteria/ Virus (Source Water)	Raw water bypass	Extreme	Valved off, may have been removed.		Operator believes there is a raw water bypass to town	Catastrophic	Possible	High	Estimate	Investigate if bypass still exists and if so, air gap or remove from service.		
pH control	M8	pH	Underdose soda ash	High	Pre and post dose Soda ash	duty standby pumps/ auto changeover, electrical failure alarm	Impacts floc	Moderate	Unlikely	Medium	Reliable			
Flocculation	M9	Aluminium	Overdose/ carryover	High	flocculation/ filtration	duty standby pumps/ auto changeover	Difficult to implement automatic OCP - reliant on operator intervention	Moderate	Unlikely	Medium	Reliable	Investigate if there can be a flow alarm and failure alarm		
	M10	Protozoa (Crypto/ Giardia) (Source Water)	poor coagulation	Extreme	Jar tests on change, flocculation/ filtration	duty standby pumps/ auto changeover		Catastrophic	Unlikely	High	Reliable		Investigate whether UV is a feasible option for this WTP.	
	M11	Turbidity (Surface Water)		High	flocculation/ filtration			Moderate	Unlikely	Medium	Confident			
Recycle Supernatant	M12	Protozoa (Crypto/ Giardia) (Source Water)		Extreme	flocculation/ filtration		Pumps to the race when the overflow tank reaches a float level - most likely during backwash. Filter performance is generally good, but requires tightening CCP	Catastrophic	Possible	High	Reliable	Consider if supernatant should be treated to lower Crypto risk	Investigate whether UV is a feasible option for this WTP.	
Filtration	M13	Protozoa (Crypto/ Giardia) (Source Water)	Filter breakthrough	Extreme	flocculation/ filtration	Backwash on head loss	Current shutdown is 0.8 NTU - recycle of supernatant. Combined turbidity measurement of compartments of Filters 1 and 2. (multiple grades - 12-15 different grades)	Catastrophic	Possible	High	Confident	Implement lower critical limit for turbidity.		
	M14	Turbidity (Surface Water)	Filter breakthrough	High	flocculation/ filtration		Difficult to inspect during operation	Moderate	Unlikely	Medium		Implement lower critical limit for turbidity		
	M15	Bacteria/ Virus (Source Water)	Filter breakthrough	Extreme	disinfection	flocculation/ filtration		Catastrophic	Rare	Medium		Implement lower critical limit for turbidity		

Process Step	Risk ID	Primary Hazard	Source of Hazard/ Hazardous event	Maximum Risk	Primary preventive measure	Other preventive measures	Comments	Residual Risk				Improvement Items		
								Consequence	Likelihood	Risk	Uncertainty	This year	1-2 years	~5 years
Chlorination	M16	Bacteria/ Virus (Source Water)	Underdose chlorine	Extreme	disinfection	flocculation/ filtration	CT not believed to be met at all times (especially when backwashing and both reservoirs calling for water). Under normal operation, Ct is believed to be met (average, not peak flow, and target, not critical low chlorine). Drum - order cylinder when drum is running low. Use scale to determine remaining chlorine.	Catastrophic	Possible	High	Estimate	Confirm operating levels to calculate CT. Update CCP to new limits. Check that the scale is alarmed to ensure continuity of chlorine supply.		
	M17	Bacteria/ Virus (Source Water)	Turbidity	Extreme	disinfection	flocculation/ filtration		Catastrophic	Rare	Medium	Reliable			
	M18	Chlorine	Overdose chlorine	High	Disinfection CCP		Control of system has been good - no values > 2.5mg/L. Daily testing manually, and online meters with shutdown	Moderate	Rare	Low	Confident			
	M19	Disinfection byproducts	Reaction with organics	High	Disinfection CCP	flocculation/ filtration		Moderate	Possible	Medium	Estimate		consider project for THM monitoring when high risks addressed.	
Reticulation	M20	Heavy metals	Leaching out of pipes/ fittings	Medium	Stabilise water with soda ash	Lead from old piping removed from service	Plumbing standards, AS 4020	Moderate	Unlikely	Medium	Confident			
	M21	Bacteria/ Virus (Reticulation)	Vermin contamination of reservoirs	Extreme	Reservoir design. Inspection program. Residual chlorine maintained.	Drone inspections every 3 months. Divers every 5 years	Some holes in Azalea St	Catastrophic	Unlikely	High	Estimate	Review inspection program to ensure inspections occur and identified maintenance activities are undertaken. Increase Staffing. Consider developing iAuditor inspection checklist.		
	M22	Protozoa (Crypto/ Giardia) (Retic)	contamination following mains breaks	High	Separate crews and trucks for water mains repairs	SOPs		Catastrophic	Rare	Medium	Estimate	Consider Hy5 Water main repair hygiene program		
	M23	Bacteria/ Virus (Reticulation)	contamination following mains breaks	Extreme	Separate crews and trucks for water mains repairs	SOPs		Catastrophic	Rare	Medium	Estimate			
	M24	Bacteria/ Virus (Reticulation)	Backflow	Extreme	Council may have backflow devices. Policy. Meters with check valves.	Register of testable backflow meters, testing not current	Craft Brewery proposed	Catastrophic	Possible	High	Estimate	Resource for plumbing inspections/ audits for all backflow prevention devices		
	M25	Bacteria/ Virus (Reticulation)	Illegal accessing of hydrants	Extreme			Contractors are accessing hydrants without authorisation	Catastrophic	Possible	High	Estimate	Internal awareness and training for internal council staff.	Consider fining contractors accessing without authorisation	
	M26	Protozoa (Crypto/ Giardia) (Retic)	Backflow	High	Council may have backflow devices. Policy.	Register of testable backflow meters, testing not current	Not believed to be likely sources for Crypto	Catastrophic	Rare	Medium	Estimate			
Whole of system	M27	Malicious action	Terrorism/ Vandalism	Extreme	Some reservoirs fenced, treatment plant fenced, security patrols (WTP), inspections	Offboarding process	3 times in 7 months.	Catastrophic	Possible	High	Estimate	Significant security upgrades in process. Fix lock on Azalea St Res Inspection process reviewed Water Outlook		Consider removing access ladders to reservoirs, and use EWPs to access.
	M28	Operator Error	e.g. from an accidental oversight, an untrained or overworked operator	Extreme	All operators have minimum competency (Cert 3 for operators).	CCPs SOPs for key operations Trainee operator Calibration of equipment	Left hand and right hand valves (known in reticulation, not believed at plant)	Catastrophic	Unlikely	High	Reliable	Check if Valve 4 is left or right handed. Mark if different. Increase Staffing. Dedicated WTP operators and team leader Review contractor skills/training. Corporate Safety system will develop training needs	Ongoing training as per needs analysis. VOC process to confirm competency.	

Process Step	Risk ID	Primary Hazard	Source of Hazard/ Hazardous event	Maximum Risk	Primary preventive measure	Other preventive measures	Comments	Residual Risk				Improvement Items		
								Consequence	Likelihood	Risk	Uncertainty	This year	1-2 years	~5 years
												analysis.		
	M29	Loss of Supply	Drought / pump failure / mains breaking	High	0.5 ML supply line from Rous water. Preventive maintenance as per asset management plan.	Drought Management Plan	Business continuity plan being developed. Secure yield assessment and Mullumbimby water supply strategy	Catastrophic	Rare	Medium	Reliable	Review to determine appropriateness of 0.5 ML pipeline to mitigate loss of supply.		

Table 12 Mitigated Risk Assessment – Byron - Rous Schemes (Reticulation only)

Risk ID	Primary Hazard	Source of Hazard/ Hazardous event	Maximum Risk	Primary preventive measure	Other preventive measures	Comments	Residual Risk				Improvement Items		
							Consequence	Likelihood	Risk	Uncertainty	This year	1-2 years	~5 years
B1	Disinfection byproducts	Reaction with organics	High	Rous has Ozone BAC process		Rous has 6 monthly THM testing - no elevated results	Moderate	Possible	Medium	Estimate			
B2	Heavy metals	Leaching out of pipes/ fittings	Medium			Plumbing standards, AS 4020	Moderate	Unlikely	Medium	Confident			
B3	Bacteria/ Virus (Reticulation)	Vermin contamination of reservoirs	Extreme	Reservoir design. Inspection program. Residual chlorine maintained.	Drone inspections every 3 months. Divers every 5 years	Some holes in Azalea St. Other reservoirs show signs that current inspections are ineffective.	Catastrophic	Unlikely	High	Estimate	Review inspection program to ensure inspections occur and identified maintenance activities are undertaken. Increase Staffing. Consider developing iAuditor inspection checklist.		
B4	Protozoa (Naeglaria) (Reticulation)	Opportunistic Ingress	High	Residual chlorine generally >0.5 mg/L			Catastrophic	Rare	Medium	Confident			
B5	Bacteria/ Virus (Reticulation)	Telco impacts reservoir integrity - Especially Wategos and Patterson's	Extreme	Temporary works have improved integrity of roof	Increased visual inspections and ongoing program of work.	Project report from Aqualift	Catastrophic	Unlikely	High	Estimate		Roof replacements required - need to remove telecommunications infrastructure first.	Consider provision of alternate locations for telecommunications infrastructure
B6	Bacteria/ Virus (Reticulation)	Contamination from roof runoff via Box gutters - Warrambool, Left Bank, Granuille Rd, Yamble Drive, Saddle Road	Extreme	5 yearly inspection.			Catastrophic	Unlikely	High	Estimate	Clear out centre box gutter (Warrambool vegetation is close to reservoir), Inspection of roof integrity especially with gutters under the roof.	Identify roofs for replacement. Consider ROV/ diver inspection.	
B7	Bacteria/ Virus (Reticulation)	Loss of chlorine residual in Reservoir/ Reticulation	Extreme	Service Level Agreement (July 2018) for minimum 0.8 mg/L at all 5 transfer points	Notification protocols for parameters outside service level agreement		Catastrophic	Rare	Medium	Estimate	Confirm Sampling plan to ensure appropriateness of reticulation samples (ensure extremities monitored)		
B8	Malicious action	Vandalism - Especially Wategos	Extreme	Regular inspections		Most at risk given location and accessibility.	Catastrophic	Unlikely	High	Estimate	Security Review		
B9	Protozoa (Crypto/ Giardia) (Retic)	contamination following mains breaks	High	Separate crews and trucks for water mains repairs	SOPs		Catastrophic	Rare	Medium	Estimate	Consider Hy5 Water main repair hygiene program		
B10	Bacteria/ Virus (Reticulation)	contamination following mains breaks	Extreme	Rous has dedicated water crews. Trained on main break repair.	SOPs	Flushing after repairs, good chlorine maintained.	Catastrophic	Rare	Medium	Estimate			
B11	Bacteria/ Virus (Reticulation)	Backflow	Extreme	Council may have backflow devices. Policy. Meters with check valves.	Register of testable backflow meters, testing not current		Catastrophic	Possible	High	Estimate	Resource for plumbing inspections/ audits for all backflow prevention devices		
B12	Bacteria/ Virus (Reticulation)	Illegal accessing of hydrants	Extreme			Contractors are accessing hydrants without authorisation	Catastrophic	Possible	High	Estimate	Internal awareness and training for internal council staff.	Consider fining contractors accessing without authorisation	
B13	Protozoa (Crypto/ Giardia)	Backflow	High	Council may have backflow devices. Policy.	Register of testable backflow meters, testing	Not believed to be high risk sources for Crypto	Catastrophic	Rare	Medium	Estimate			

Risk ID	Primary Hazard	Source of Hazard/ Hazardous event	Maximum Risk	Primary preventive measure	Other preventive measures	Comments	Residual Risk				Improvement Items		
							Consequence	Likelihood	Risk	Uncertainty	This year	1-2 years	~5 years
	(Retic)				not current								
B14	Malicious action	Terrorism/ Vandalism	Extreme	Some reservoirs fenced, treatment plant fenced, security patrols (WTP), inspections	Offboarding process	3 times in 7 months.	Catastrophic	Possible	High	Estimate	Significant security upgrades in process. Fix lock on Azalea St Reservoir Inspection process reviewed Water Outlook		Consider removing access ladders to reservoirs and use EWPs to access.
B15	Operator Error	e.g. from an accidental oversight, an untrained or overworked operator	Extreme	All operators have minimum competency (Cert 3 for operators).	CCPs SOPs for key operations Trainee operator	Left hand and right hand valves (known to be present in reticulation, not believed to be present at WT plant)	Catastrophic	Unlikely	High	Reliable	Increase Staffing. Dedicated WTP operators and team leader Review contractor skills/training. Corporate Safety system will develop training needs analysis.	Ongoing training as per needs analysis. VOC process to confirm competency.	
B16	Loss of Supply	Trees over/ near assets	High	Maintenance of easements		Rous water has concerns about vegetation management in easements	Catastrophic	Unlikely	High	Confident	Identify Trees over or near assets on easements and gain approvals to remove trees	Ongoing maintenance to remove trees on easements	

5 PREVENTIVE MEASURES FOR DRINKING WATER QUALITY MANAGEMENT

As indicated, the primary preventive measures are assessed and recorded as part of the risk assessment process.

5.1 Critical Control Points

Critical Control Points (CCPs) are activities, procedures or processes where the operator can apply control, and are essential processes in reducing risks to an acceptable level. In order to distinguish acceptable from unacceptable performance at each CCP, target levels, adjustment limits and critical limits have been identified for the Byron, Collarenebri, Lightning Ridge, Rowena, Carinda and Cumborah drinking water supply system.

Three different limits have been set for the Byron Shire Council drinking water supply system:

1. **Target Level:** Representing day-to-day operational limits and procedures. This is what the WTP aims to achieve
2. **Adjustment Limit:** Deviation from the Adjustment Limit indicates a trend towards loss of control and corrective actions should be immediately taken to resolve the problem and restore control to the Drinking Water Supply System
3. **Critical Limit:** Deviation from the Critical Limit indicates loss of control and the potential of unacceptable health risks. If the critical limit is exceeded, incident and emergency plans should be immediately activated

5.1.1 CCPs

- Filtered water turbidity
- Chlorine disinfection at WTP
- Reservoir Integrity

CCPs are in a traffic light format.

5.1.2 OCPs

- Coagulation pH at Mullumbimby WTP

As OCPs do not have a critical limit, they are a variant of the traffic light format.

5.1.3 Maintaining Key Barriers

DPIE issued Circular LWU 18 '*Assuring the safety of drinking water supplies*', (4 June 2014) with corresponding protocols that are to be implemented by all local water utilities providing a drinking water supply. The Circular is available in Appendix A. Council must meet the minimum requirements in order to achieve the key barriers outlined below (NSW Office of Water, 2014):

- Effective disinfection to kill or remove pathogens in the raw water
- Ensure distribution system integrity to prevent contamination
- Maintenance of free chlorine residual in the reticulation system

Council is required to ensure the SOPs meet the minimum requirement for each key barrier as outlined by DPIE

Mullumbimby Water Treatment Plant
CCP1: Filtration Critical Control Point Procedure

What is measured	How is it measured	When is it measured	What is the control point	What are the hazards	Record Keeping
Turbidity	Inline and daily grab	Continuously	Filter outlet	Protozoa, Turbidity	SCADA, plant log sheet

Critical Limit
>0.5 NTU
(for >15 minutes)

- Initiate a backwash if sufficient water in Reservoir
- Cease production if unable to backwash
- If backwash fails to reduce NTU to below critical limit. Team Leader Water Operations / On-call Coordinator (out of hours) performs an investigation.
- Inform Utilities Manager in accordance with Council's Incident Management Procedure
- Utilities Manager to contact Public Health Unit in the event of a critical failure or risk to Water Supply quality.
  - Call Mid North Coast and Northern NSW LLHD on 6620 7585 (business hours) or 0428 882 805 (AH)

If required contact DPIE Inspector on 0412 283 768

Adjustment Limit
>0.3 NTU
(for >60 minutes)

- Check turbidity using hand-held meter to confirm result
- Recalibrate online instrument if necessary
- Backwash if not yet done today, or consider need for additional backwash
- Manually check turbidity and pH in supernatant
- Check chemical dosing systems - Alum and Soda Ash
- Troubleshoot problem and implement corrective actions as appropriate
- Increase monitoring until system conforms

Target
< 0.2 NTU

Daily

- Check SCADA and alarms - rectify as necessary
- visual plant check
- check floc and colour in sed lagoon
- check chemical dosing systems
- perform daily lab tests (see App 1)
- initiate filter backwash

Weekly

- Calibrate manual turbidity meter
- Calibrate online turbidity meters as per operation manual

Mullumbimby Water Treatment Plant
CCP2: Disinfection Critical Control Point Procedure

What is measured	How is it measured	When is it measured	What is the control point	What are the hazards	Record Keeping
Free and Total Chlorine	Inline (free) and daily grab	Continuously and daily	Post chlorine dosing	Bacteria and viruses	SCADA, plant log sheet

Critical Limit
< 1 mg/L or
> 5 mg/L
(for >15 minutes)

- If >5 mg/L immediately shut off chlorine dosing
- If < 1 mg/L increase chlorine dose rate and confirm Ct
- If action frails to bring Chlorine level within critical limits. Team Leader Water Operations / On-call Coordinator (out of hours) performs an investigation.
- Inform Utilities Manager in accordance with Council's Incident Management Procedure
- Utilities Manager to contact Public Health Unit in the event of a critical failure or risk to Water Supply quality.
  - Call Mid North Coast and Northern NSW LLHD on 6620 7585 (business hours) or 0428 882 805 (AH)
- If required contact DPIE Inspector on 0412 283 768

Adjustment Limit
< 1.5 mg/L or
> 2.5 mg/L

- Take a grab sample to confirm hand-held reading is the same as online reading.
  - Recalibrate if required
- Check chlorine dosing system
  - Cylinders have chlorine
  - Auto changeover has worked correctly
  - No gas leaks
  - Check calibration of online instrumentation
- Adjust chlorine dose rate (up or down) as necessary to bring dose back to target level
- Troubleshoot system and implement corrective actions as appropriate
- Increase monitoring until chlorine dose is within adjustment limits

Target
1.5 to 2.5 mg/L
Free Chlorine

Daily

- Perform routine daily lab tests – react as required
- Visual plant check
  - Head unit
  - Regulator
  - Auto changeover
  - Number of chlorine cylinders
- Re-order chlorine cylinders as necessary

Weekly

- Sample pH, turbidity and free chlorine in reticulation
- Check calibration of inline meter (cross check with hand-held and adjust calibration if required).

Byron Shire Council Reservoir Integrity
CCP3: Critical Control Point Procedure

What is measured	How is it measured	When is it measured	What is the control point	What are the hazards	Record Keeping
Reservoir Integrity	Inspections of ladders, hatches, and roof integrity	Routine visual when on site Quarterly detailed external inspection 5 yearly internal inspections	Reservoir Integrity	Pathogens	Operator Diary External inspection reports

Critical Limit

Evidence of contamination, unauthorised access or vermin identified

- Team Leader Water Operations / On-call Coordinator (out of hours) performs an investigation.
  - Provide detail of the issue and take relevant water samples for testing
- Inform Utilities Manager in accordance with Council's Incident Management Procedure
- Utilities Manager to contact Public Health Unit in the event of a critical failure or risk to Water Supply quality.
  - Call Mid North Coast and Northern NSW LLHD on 6620 7585 (business hours) or 0428 882 805 (AH)
- Follow the advice of the PHU and provide free chlorine level
- If required contact DPIE Inspector on 0412 283 768

Adjustment Limit

Possible points of ingress identified

- Seal the reservoir as soon as possible (replace vermin proofing, seal small holes, replace and missing bolts etc.)
- Conduct thorough inspection of the reservoir looking for evidence of contamination (includes a visual inspection of the water within the reservoir)
- Contact Utilities Manager to report breaches that cannot be immediately fixed
- Rectification works to be programmed with priority based on severity of issue
- Measure free chlorine and consider manual dosing if low

Target

Secure and vermin proof

- Ensure hatches are sealed and locked
- Check vermin proofing is intact
- Check for water leaks/ signs of deterioration/ build-up of leaf litter (especially in box gutters)
- Look for evidence of animals/ birds nesting
- Inspect ladders and fencing for security
- Routine reservoir and grounds maintenance
- Ensure no overhanging vegetation where ever possible

Mullumbimby Water Treatment Plant
OCP1: Flocculation Operational Control Point Procedure

What is measured	How is it measured	When is it measured	What is the control point	What are the hazards	Record Keeping
pH	Grab sample	Daily	Soda Ash Dosing	Protozoa and turbidity	plant log sheet

Adjustment Limit
pH > 7.2

- Repeat sample
- If confirmed, shut down plant until issue is resolved.
- Team Leader Water Operations / On-call Coordinator (out of hours) performs an investigation.
- Inform Utilities Manager in accordance with Council's Incident Management Procedure

Alert Limit
pH < 6.4 or > 7

- Repeat sample
  - Recalibrate pH meter if required
- Check Alum and soda ash dosing
  - overdose of Alum or underdose of soda ash drives pH down
  - underdose of alum or overdose of soda ash drives pH up
  - Do a drop test on chemical dose to confirm appropriate dosing.
- Adjust chlorine dose rate (up or down) as necessary to bring dose back to target level
- Troubleshoot system and implement corrective actions as appropriate
- Increase monitoring until pH is within adjustment limits

Target
pH 6.8

Daily

- Perform routine daily lab tests – react as required
- Visual plant check
  - Weir
  - Raw water
  - Alum and Soda Ash dosing
  - Floc formation in flocculation chamber
- Re-order soda ash and alum as required

5.2 Preventive maintenance and calibration

5.2.1 Planned maintenance

Preventive maintenance ensures assets are kept in good working order and therefore contamination incidences should not result from malfunctions of important processes. Calibration of instruments especially used to measure critical limits is required to ensure data is reliable.

Water and Sewer planned maintenance tasks are listed and managed using the schedules in the spread sheets in Documents #448000, #468000 and #464600. The Customer Request Management (CRM) database is used to manage the task workflows.

Tasks are automatically flagged in the schedule spreadsheets when they become due. CRMs (or Requests) are then raised for these due tasks and the CRM numbers recorded in the schedule. All of the Water and Sewer Assets are identified in spreadsheets which are included in the GIS system; relevant financial schedules and the planned maintenance spreadsheets. Each asset (or group of assets) is provided with check sheets. These include maintenance instructions with check boxes to confirm completion and record readings.

The maintenance spreadsheets identify:

- Asset or group of assets
- Officers responsibility for undertaking the maintenance
- Frequency
- Last completed
- Next due

The check sheet documents are printed, marked with the CRM numbers and issued. The assigned field staff complete the work outlined on the check sheets and mark them up to provide job reports. The checklists are then returned, the CRMs closed and the schedules updated. The spreadsheets then recalculate the next due dates for each task. Any identified work is recorded in a planned repair backlog by raising additional CRMs.

Customer reports of breakdowns and other issues are also recorded using CRMs. These sheets are printed and assigned to field staff that address the problems and return the sheets so the CRMs can be completed.

Planned maintenance completion for each asset class is reviewed weekly by the Water and Sewer Coordinators to identify progress and priorities.

The Water Treatment Plant has a specific instrumentation maintenance task and instructions. Similarly, all flow meters and instrumentation in the reticulation system.

5.2.2 Unplanned Maintenance

Unplanned maintenance is identified through various sources. These are:

WTP SCADA system

The Water Treatment Plant has an SCX based SCADA system operating the plant. The details of the system are contained in the WTP Operations Manual. This system is monitored at the site; the Operations office at the BSC Depot; and on the Coordinator’s notebook computers

Telemetry system

The reservoirs and water booster pump stations around the Shire are all monitored by a telemetry system. The main parameters monitored are reservoir levels and pump stations pump operations.

This system is monitored at the Operations office at the BSC Depot; and on all the operational computers

Phone calls from the public

Notification from the Public are documented in the Customer Request Management system. Members of the public can phone, fax or email any issues they may have or see with the water system. In particular this mechanism is essential for identifying service line breaks; main breaks; meter repairs; water quality and low flow issues. During business hours CRMs are raised immediately the information is received. CRMs are available on all BSC computers

Operational observations

The Water Treatment Plant has a qualified Water Operator attend the plant on a daily basis. Daily duties include inspections of all components for correct operation. Any observed malfunctions are either dealt with immediately or are subject of a CRM for actioning by others

Out of specification reports from monitoring data (via the WaterOutlook database)

This is an SQL database system that records data collected by the site operators and all parameter data analysed by external sources (most commonly external Laboratory). The data is input both manually and automatically depending on the source. All key parameters have control limits set. If a result is outside these control limits an email is sent to the Coordinator Reticulation and Treatment Systems and the Manager System Operations Water for action as required.

During business hours calls from the public are received by Water and Sewerage staff that take details of the caller and the problem; and raise a Customer Request in the CRM system. This CRM system will send an email to the Coordinator Reticulation and Treatment Systems for actioning in the field. If the problem is of an urgent nature, the receiving officer will also telephone the Coordinator to ensure the issue is responded to in a timely manner.

After hours, calls from the public are received by a contracted monitoring service. They have instructions that any calls received regarding water and sewerage assets/problems are immediately referred to the Water and Sewerage On-Call Coordinator for assessment and resourcing as required.

During business hours the Coordinator Reticulation and Treatment Systems has specific responsibility for ensuring any alarms from the Water System and telephone calls from the public are appropriately resourced. After hours the Water and Sewerage On-Call Coordinator has specific responsibility for ensuring all calls from the public and alarms are monitored and appropriately resourced.

The Manager System Operations Water has overall responsibility to ensure that there is a responsible person at all times monitoring and resourcing alarms generated by the SCADA and Telemetry systems or phoned in by the public. This is managed through an on-call system.

5.3 Materials and chemicals

Council’s objective is to ensure all equipment purchased performs adequately and provides sufficient flexibility and process control. All work carried out in the drinking water supply systems is done in accordance with the National Construction Code v3, and relevant standards including AS4020.

Chemicals used on site at Mullumbimby include Soda Ash for pH adjustment, Alum for coagulation, and chlorine gas for disinfection. These are purchased from reputable suppliers and stored on site in appropriate facilities. A certificate of analysis is provided with each batch.

6 OVERVIEW OF MONITORING

6.1 Operational Monitoring

BSC have a Drinking Water Quality Monitoring Plan (#1121196) documenting monitoring points, parameters, trigger levels, frequency, actions and responsibilities from catchment to consumer. The purpose of the BSC operational monitoring regime is to assess the operational performance of the water supply systems. The parameters and points monitored are used to reflect the effectiveness of each process and indicate treatment performance.

Monitoring consists of online monitoring of key parameters, supported by manual grab sampling.

Table 13 Operational Monitoring

Monitoring Parameter	Raw water	WTP	Reservoirs	Reticulation
Free and Total Chlorine		Daily	Weekly	Weekly
pH	Daily	Continuous	Weekly	Weekly
Turbidity	Daily	Continuous		Weekly
Colour	Weekly	Weekly		
TDS	Weekly	Weekly		
Alkalinity	Weekly	Weekly		Weekly
Fe and Mn	Weekly	Weekly		Weekly
Al				Weekly
Dose rates		Weekly		
E. coli	Monthly and event	Weekly	Weekly	Weekly
Cyanobacteria	Weekly or Monthly			
Rainfall	Daily			
Weir level	Daily			
Flow rate	Daily and event			
Number of backwashes		Daily		

Table 14 Key Processes and Corrective Actions

Process /Step	Potential Hazard	Trigger points	Monitoring	Corrective action
BGA in raw water	Chemical toxins, taste and odour	BGA cells > 500 cells/mL	Nutrient levels (monthly) Visual inspection of Weir pool and coarse screen (daily) Routine sampling	BGA management protocols (Doc #659568)
Raw water turbidity	Reduced treatment capacity, potential indicator or contamination	Plant shutdown > 60 NTU	Continuous	Adjust Alum dose, backwash as necessary, shut down WTP if required
Alum Dosing	Protozoan pathogens, aluminium	pH <6 or > 7, Al residual > 0.2 mg/L	Filtered and finished water pH (continuous) Finished water Al (daily)	Jar tests as required, dosing equipment checked regularly
Filtration	Protozoan pathogens, turbidity	>0.3 NTU > 0.5 NTU See CCP 1	CCP1 continuous online for each filter set	Backwash if > 0.3 NTU, shutdown if > 0.5 NTU. Incident if plant does not shut down.
Free Chlorine	Bacteria and viruses	See CCP2	Online continuous	Adjust dose as necessary, if insufficient chlorine or > 5 mg/L call PHU.
Reservoir integrity	Pathogens	See CCP 3 Points of ingress identified, Vermin in reservoirs	Monthly inspections internally, routine external inspections	Repair reservoirs, consider need to isolate/ empty. Contact PHU as required under CCP3
Free chlorine in reservoirs and reticulation	Bacteria and viruses	Target >0.5 mg/L <0.2 mg/L	Weekly monitoring	Consider need to flush, consider increasing dose rate at WTP, consider need to manually dose reservoirs with chlorine.

6.2 Verification Monitoring

The verification of drinking water quality supplied to the consumer assesses the overall performance of the system. Verification provides an important link back to the operation of the water supply system and additional assurance that the preventive measures and treatment barriers have worked and are supplying safe quality water.

Council monitors water quality at various points of supply as part of the *NSW Health Drinking Water Monitoring Program* which provides ongoing independent verification of the treatment process. The locations and frequency of sampling are based on population, and are detailed in each scheme sub-section. The program assesses the microbial, physical and chemical properties of the water as detailed in Table 33. The results are accessed at: www.drinkingwaterdb.nsw.gov.au

Byron Shire Council staff is responsible for the collection of samples for the *NSW Health Drinking Water Monitoring Program*.

Samples are submitted in accordance with the *"Guide for Submitting Water Samples to FASS for Analysis"* (Sydney West Area Health Service, 2010) and Council procedures for samples.

In addition, samples are also collected and run in house, these are not accessible through the NSW Health database, but provide further information. Typically reservoirs are sampled on a weekly basis, except when staff are on leave (e.g. over Christmas etc.). The parameters for in house monitoring include chlorine, pH, temperature, *E. coli,* HPC and TPC. Within reticulation, at least one sample per reticulation zone is sampled weekly, with the lowest frequency for specific sites monthly.

Sample locations are included in the table below. These are matched in the NSW Health monitoring program.

Table 15 Reservoir and reticulation monitoring sites

Bangalow		
BY02110 - Granuaille Reservoir	BY02100 - Bangalow Primary School - Market Street	
Brunswick Heads		
BY02510 - Saddle Road Reservoir	BY02500 - Pilgrim Park - Tweed Street	
Byron Bay		
BY02420 - Wategos Reservoir	BY02280 - Paterson Street Res	BY02210 - Coopers Shoot 2.5ML Res
BY0XXX- Coopers Shoot 10ML Res	BY02400 - Wategos SPS Tap - Marine Parade	BY02200 - Byron Bay - Middleton St Sample Tap
BY02300 - Suffolk Park - Beech Drive	BY02800 - Broken Head Road	
Mullumbimby		
BY0XXXX - Left Bank Reservoir	BY01400 - Azalea Street Reservoir	BY01200 - McGougans Lane
Ocean Shores		
BY02610 - Warrambool Reservoir	BY02660 - Tongarra Reservoir	BY02680 - Yamble Reservoir
BY02600 - Ocean Shores - Jarrah Crescent	BY02700 - Billinudgel Firestation - Wilfred Street	BY02620 - New Brighton Sports Oval - Byron St
BY02630 - South Golden Beach - Jack Lane		

The analytes monitored for the NSW Health Monitoring Program include:

Table 16 NSW Health Drinking Water Monitoring Program Analytes

Parameters		
Microbial		
E. coli		
Disinfection		
Free chlorine	Total chlorine	
Physical		
pH	Total Dissolved Solids	True Colour
Temperature	Total Hardness	Turbidity
Chemical		
Aluminium	Copper	Nickel
Antimony	Fluoride	Nitrate
Arsenic	Iodine	Nitrite
Barium	Iron	Selenium
Boron	Lead	Silver
Cadmium	Magnesium	Sodium
Calcium	Manganese	Sulphate
Chloride	Mercury	Uranium
Chromium	Molybdenum	Zinc

6.3 Corrective Actions

Council evaluates water quality data on receipt of monitoring results. Water quality results from NSW Health are reported to Council's Water Quality Officer.

Drinking water quality results are assessed against the ADWG. Any exceedances are immediately reported to the Council's personnel Director of Engineering/Technical Services and Director of Environmental Services. and responded to according to NSW Health response protocols (refer section 7.2).

Drinking water quality exceedances from NSW Health drinking water monitoring triggers a notification by the laboratory to Council's Director of Engineering/Technical Services.

Immediately the exceedances are reported to the Director of Engineering/Technical Services and appropriate operators.

Any exceedances are recorded and acted upon immediately with the appropriate regulatory authorities notified. All test results are recorded in the NSW Health Drinking Water Database which is completely independent of Byron Shire Council.

6.4 Equipment Capability and Maintenance

Byron Shire Council has an existing Asset Management Policy (Feb 2010) and an Asset Management Strategy (Jun 2012). The policy states that an inspection regime will be used as part of asset management to ensure that agreed levels of service are maintained and to identify

asset renewal priorities based on the condition assessment model. Council uses *Confirm* Asset Management Information System to manage the integrity of asset data.

Council is currently investigating service contracts for equipment calibration and maintenance.

6.5 Materials and Chemicals

Council conforms to the *National Construction Code v3,* the *AUS-SPEC 0071 water supply – Reticulation and pump stations* (Design) (NATSPEC, year unknown) and the Australian Standards (AS/NZ4020 – Testing of products for use in contact with drinking water) in the purchasing of materials and chemicals.

The use, including transport and storage, of chemicals listed as “Dangerous Goods” under the Work Health and Safety Regulation 2012 (NSW), including chlorine and fluoride, is dictated by the provisions of the Work, Health and Safety Regulation and Work Cover. Storages and trucks are licensed according to the Work, Health and Safety Regulation 2012.

Chemical suppliers should be evaluated and selected on their ability to supply product in accordance with required specifications. Documented procedures for the control of chemicals, including purchasing, verification, handling, storage and maintenance, should be established to assure the quality of the chemicals at the point of application. Responsibilities for testing and quality assurance of chemicals should therefore be clearly defined in purchase contracts by Council.

NSW Health recommends that all chemical deliveries are attended by a trained water treatment plant operator, and that the following procedures are followed:

- A certificate of analysis is provided by the supplier at the time of delivery for each batch of chemical supplied and that the chemical satisfies the criteria specified in Chapter 8 of the Australian Drinking Water Guidelines, prior to the commencement of unloading
- The correct chemical is being delivered into the appropriate storage
- If relevant, check that the correct concentration has been supplied

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7 MANAGEMENT OF INCIDENTS AND EMERGENCIES

Byron Sire Council Water and Sewerage Operations have an Incident Management Protocol that details how emergency situations will be managed and resolved. It also contains a list of key internal and external contacts. It is updated annually or as required.

The BSC Incident Management Protocol (June 2021) includes contact list of key people, agencies and businesses; procedures for internal and external notification; responsibilities and authorities both internal and external communication. Maintaining consumer confidence and trust during and after an incident helps alley community concerns and restores community confidence in the water supply.

The clearly defined BSC protocol for both internal and external communication enables Council to act effectively in remediating the situation.

Table 17 Key Contacts

	Byron Shire Internal Contacts	Person	Phone
1	Principal Engineering Systems Planning	Dean Baulch	6626 7085 0418 463 885
2	Utilities Manager	Cameron Clark	0417 464 716
3	Director Infrastructure Services	Phil Holloway	0407 299 926
	Rous County Council Contacts	**Person**	**Phone**
1	Distribution Services Manager	Michael McKenzie	6623 3813 0407 351 731
2	Technical Services Director	Wayne Franklin	6623 3811 0427 261 823

7.1.1 Linkages to Critical Control Point Procedures

Filtration, disinfection and reservoir integrity are managed as critical control points.

The CCP wall charts are present at Mullumbimby water treatment plant so that operators are able to implement the appropriate corrective actions as soon as possible.

The actions identified in the coloured boxes next to the traffic lights are the actions that the operators are required to take when the adjustment or critical limits are exceeded. This includes reference to the required escalation and communication pathway.

Escalation of a critical limit to the Utilities Manager triggers the Incident Management Protocol at Byron Shire Council. This includes adherence to the response protocols described below.

7.2 NSW Health Response Protocols

Water quality incidents are managed in accordance with the NSW Health Protocols. These protocols are updated periodically on the NSW Health Website.

As such, the NSW Health website is the primary reference.

The web pages have links to the appropriate information depending on the particular scenario and should always be consulted in an incident.

7.2.1 NSW Health Response Protocol for the Management of Physical and Chemical Quality

https://www.health.nsw.gov.au/environment/water/Pages/nswhrp-chemical.aspx

The key first step of this protocol is to immediately contact the Public Health Unit on becoming aware of the exceedance of an ADWG Health Guideline Value.

7.2.2 Managing pathogen risks in drinking water: Response Protocol for Water Utilities and Public Health Units

https://www.health.nsw.gov.au/environment/water/Pages/nswhrp-microbiological.aspx

Water utilities must immediately notify the local Public Health Unit of any incident affecting the ability to provide safe drinking water.

The response protocol outlines the actions that should be taken by Byron Shire Council in responding to critical limit exceedances, raw water quality problems, reservoir contamination and test results indicating possible contamination.

Byron Shire Council has responsibility to investigate and carry out corrective actions to restore control of treatment processes.

7.2.3 Template for Boil Water Alerts

Appendix C include draft templates for boil water alerts and do not drink alerts.

The boil water alert template only requires editing to identify the location where customers need to boil their water, and a decision as to who is the appropriate contact.

The do not drink alert will require further information and input from NSW Health. This template may be used, for example, if there has been a significant contamination event in the catchment that has resulted in a contaminant being present at levels that present an immediate (acute) health risk.

Examples include pesticides, fuel, fire fighting foam etc.

As the public health impacts for each contaminant will vary, the advice in the do not drink template needs to be tailored to the specific incident.

8 SUPPORTING REQUIREMENTS

8.1 Employee Awareness and Training

Council has a training programme for all employees which is reviewed annually. This training programme is a part of council's overall Human Resources management and is documented in the Human Resources Management Manual (document #254796).

The water operations team has monthly toolbox meetings to discuss operational issues. These meetings are minuted and reported to senior management The entire water and sewer operations team has quarterly production meetings with senior management to discuss performance; operational and wider Council issues. These meetings are also minuted.

8.2 Community Involvement and Awareness

Council recognises the importance of community consultation through the Community Strategic Plan (BSC, 2012). Council has a range of mechanisms to encourage community involvement through the following mechanisms and initiatives:

1. Council's Ordinary meetings: ordinary meetings of Council are held in the Council Chambers at Station Street in Mullumbimby, with all meetings open to the public

2. Council's website: Council maintains a "Water" section on Council's website, which provides information to the community in regards to plumbing, rainwater tanks, water education, water interruptions and the water supply system.

3. The Lavertys Gap Catchment Management Plan (document #673411): has identified 6 actions to implement to improve community involvement and awareness

4. Byron Shire Council partners Rous Water with various demand management programmes which encompass

- Rebates for water efficient devices
- Rainwater tank rebates
- Community education workshops
- Business Blue and Green programme to reduce water consumption

5. The Water and Recycling Advisory Committee: this committee comprises staff and volunteers from the community who meet every 3 months and reviews data, policies and programmes and makes recommendations to Council

6. Complaints Management Policy (document #1154370): details the procedures for handling complaints submitted by the community. According to the policy, complaints monitoring will be used to identify areas for improvement in Council's service delivery

7. Customer Request Management System: every customer request received form the community is formally responded to with a letter advising the customer of the outcome and also providing some water saving information.

8.1 Consumer Satisfaction

Council has customer service staff to handle complaints and requests. The call centre records all requests, which are forwarded to the appropriate staff.

Council uses EnviroCAR for all customer complaints. Written complaints are assigned to the relevant person and actioned. Emergencies and health related water quality complaints are responded to as soon as possible. For all non-urgent complaints: personal complaints are responded within two working days; written complaints are responded to within five working days.

9 RESEARCH AND DEVELOPMENT

9.1 Investigative studies and research monitoring

BSC undertakes investigative studies and research monitoring on a project basis as required.

Examples of research and development include:

- Mullumbimby WTP Upgrade – extensive research and studies were undertaken on plant performance and structures to determine future water requirements.
- Mullumbimby WTP Concept Design
- In partnership with Rous – chloramination – chlorine / analysis of rainwater tanks in area
- Development of a hydraulic model of the whole Rous system

9.2 Validation of processes and equipment

Validation requires the evaluation of system processes and equipment to prove the performance under all conditions expected to be encountered during operations.

During the development of the current DWMS, the filtration performance was evaluated, and CCP limits were tightened in accordance with ADWG recommendations for protozoan removal.

Similarly, as indicated in Section 3.3.4, the chlorine low critical limit was challenged and is subject to further external review to determine an appropriate pathway forward.

The need for an options assessment has been identified to address the issue of low chlorine contact time for the bulk line customers prior to the reservoirs. Options that are being investigated include (but are not limited to):

a) Disconnection of rural customers from Mullumbimby trunk water supply main; and
b) Rural customers on Mullumbimby trunk water main be placed on permanent boil water alert.

The completed options assessment will be reviewed and endorsed by Council's Executive Team. In the interim, boil water alerts will be issued to rural customers when measures have failed to mitigate the lower critical limit breach of 0.5 mg/L at CCP2 and the legal ramifications of adopting either of the above options is being investigated.

Validation of new or upgraded processes and equipment is undertaken by qualified, experienced engineers and operators through:

- System design according to industry guidelines and standards
- Individual process and equipment specification against CCP target limits
- Procurement of equipment/chemicals from approved suppliers

Market pre-validation by suppliers, particularly associated with water treatment chemicals

Ct has not been validated at Mullumbimby

10 DOCUMENTATION AND REPORTING

10.1 Management of Documentation and Records

Council maintains all documents in the TRIM document management system. All documents are maintained in accordance with the state government guidelines.

The DWMS documents information pertinent to all aspects of drinking water quality management for the Byron and Mullumbimby drinking water supply systems. The DWMS is a living document and should be maintained in-line with actual operations and management. Any changes to the drinking water supply systems should be updated and documented within this DWMS.

10.2 Reporting

Water quality monitoring results are recorded both manually and electronically on the Council server at the Byron STP. These results are reported to the Utilities Manager monthly, or more frequently if requested.

As required by the Water Supply Agreement with Rous County Council:

- BSC will provide quarterly Reports to Rous Water – to be submitted two weeks prior to the Rous Water Regional Water Supply Agreement Committee meeting for inclusion in the business paper

Rous County Council provides monthly and annual Reports to BSC

Council undertakes reporting as required by NSW Health and NSW Office of Water including:

NSW Health compliance reporting for drinking water quality monitoring:

- drinking water quality within BSC is monitored and the results are recorded in the NSW Health Drinking Water Database.
- Water quality reports can be produced from the database, which is located at the following web page: http://www.drinkingwaterdb.nsw.gov.au

Water Supply and Sewerage NSW Performance Reporting:

- Council's water supply service performance is detailed in the NSW Water Supply and Sewerage Performance Monitoring Report annually. This report is available for public access from DPIE
- Data is supplied annually to DPIE and through them, reported federally as part of the National Water Initiative. As part of this process, there is an external audit of the data collection and reporting systems every 3 years.

In line with Council's responsibilities the following reports are maintained:

- Council Annual Report: available electronically on Council's website
- Byron Shire Council Integrated Water Cycle Management Plan

In addition to the above reports, Byron Shire Council Water Operations prepare monthly reports on the status of the water operations. These reports are reviewed by BSC Manager Utilities and issued to staff for information.

The following items are reviewed:

- Financial position
- Water Quality Issues
- Water Main Breaks
- Water Service Breaks
- Low pressure/no pressure water issues
- Quantity of water supplied
- Water system losses
- Number of Customer Requests received
- Safety Incidents

11 REVIEW AND AUDIT

11.1 Evaluation and Audit

Water quality results within the Byron and Mullumbimby drinking water supply systems are recorded and stored in the electronic database on the server at the Byron STP.

Council reviews this data regularly to observe, identify and analyse trends. The Water and Sewer Coordinator reviews data on a daily basis. The Manger Utilities reviews the data on a monthly basis or if they receive an alarm.

External audit of the DWMS is not yet required by NSW Health, but is expected to commence as DWMSs across the state become more mature.

The NSW DPIE Inspector carries out external assessment of the WTP on quarterly basis. NSW DPIE and the NSW Health Public Health Unit may check key elements of the DWMS such as whether CCPs are implemented correctly and whether the improvement plan is being implemented.

The NSW Health Public Health Act allows NSW Health to review a DWMS at any time.

11.2 Review by Senior Management

As part of the requirements of Council's reporting procedures, the Manager Utilities reviews the effectiveness of the management system and the underlying policies. This review considers the effectiveness and implementation of the DWMS.

11.3 Improvement Plan

The risk assessment identified a number of improvements that are directly linked to the items in the risk registers.

The improvement actions are reproduced overleaf.

Table 18 Risk Management Improvements

Risk ID	Primary Hazard	Residual Risk	Improvement Items		
			This year 2021	1-2 years	~5 years
M2	Protozoa (Crypto/ Giardia) (Source Water)	High	Reduce critical limit to 0.5 NTU		
M3	Bacteria/ Virus (Source Water)	High	CWT levels, chlorine levels, flow rate to be confirmed (and confirm that the CW tanks operate in series).		
M7	Bacteria/ Virus (Source Water)	High	Investigate if bypass still exists and if so, air gap or remove from service.		
M9	Aluminium	Medium	Investigate if there can be a flow alarm and failure alarm		
M10	Protozoa (Crypto/ Giardia) (Source Water)	High		Investigate whether UV is a feasible option for this WTP.	
M12	Protozoa (Crypto/ Giardia) (Source Water)	High	Consider if supernatant should be treated to lower Crypto risk and determine if % of supernatant return is within best practice	Investigate whether UV is a feasible option for this WTP.	
M13	Protozoa (Crypto/ Giardia) (Source Water)	High	Implement lower critical limit for turbidity.		
M14	Turbidity (Surface Water)	Medium	Implement lower critical limit for turbidity		
M15	Bacteria/ Virus (Source Water)	Medium	Implement lower critical limit for turbidity		
M16	Bacteria/ Virus (Source Water)	High	Confirm operating levels to calculate CT. Update CCP to new limits. Check that the scale is alarmed to ensure continuity of chlorine supply.		
M19	Disinfection byproducts	Medium		consider project for THM monitoring when high risks addressed.	
M21	Bacteria/ Virus (Reticulation)	High	Review inspection program to ensure inspections occur and identified maintenance activities are undertaken. Increase Staffing. Consider developing iAuditor inspection checklist.		
M22	Protozoa (Crypto/ Giardia) (Retic)	Medium	Consider Hy5 Water main repair hygiene program		
M24	Bacteria/ Virus (Reticulation)	High	Resource for plumbing inspections/ audits for all backflow prevention devices		
M25	Bacteria/ Virus (Reticulation)	High	Internal awareness and training for internal council staff.	Consider fining contractors accessing without authorisation	

Risk ID	Primary Hazard	Residual Risk	Improvement Items		
			This year 2021	1-2 years	~5 years
M27	Malicious action	High	Significant security upgrades in process. Fix lock on Azalea St Res Inspection process reviewed Water Outlook		Consider removing access ladders to reservoirs, and use EWPs to access.
M28	Operator Error	High	Check if Valve 4 is left or right handed. Mark if different. Increase Staffing. Dedicated WTP operators and team leader Review contractor skills/training. Corporate Safety system will develop training needs analysis.	Ongoing training as per needs analysis. VOC process to confirm competency.	
M29	Loss of Supply	Medium	Review to determine appropriateness of 0.5 ML pipeline to mitigate loss of supply.		
Byron Schemes					
B3	Bacteria/ Virus (Reticulation/reservoirs)	High	Review inspection program to ensure reservoir inspections occur and identified maintenance activities are undertaken. Consider developing iAuditor inspection checklist.		
B5	Bacteria/ Virus (Reticulation/reservoirs)	High		Roof replacements required - need to remove telecommunications infrastructure first.	Consider provision of alternate locations for telecommunications infrastructure
B6	Bacteria/ Virus (Reticulation/reservoirs)	High	Clear out centre box gutter (Warrambool vegetation is close to reservoir), Inspection of roof integrity especially with gutters under the roof.	Identify roofs for replacement. Consider ROV/ diver inspection.	
B7	Bacteria/ Virus (Reservoirs/Reticulation)	Medium	Confirm Sampling plan to ensure appropriateness of reticulation samples (ensure extremities monitored)		
B8	Malicious action	High	Security Review		
B9	Protozoa (Crypto/ Giardia) (Retic)	Medium	Consider Hy5 Water main repair hygiene program		
B11	Bacteria/ Virus (Reticulation)	High	Resource for plumbing inspections/ audits for all backflow prevention devices		
B12	Bacteria/ Virus (Reticulation)	High	Internal awareness and training for internal council staff.	Consider fining contractors accessing without authorisation	

Risk ID	Primary Hazard	Residual Risk	Improvement Items		
			This year 2021	1-2 years	~5 years
B14	Malicious action	High	Significant security upgrades in process. Fix lock on Azalea St Reservoir Inspection process reviewed Water Outlook		Consider removing access ladders to reservoirs and use EWPs to access.
B15	Operator Error	High	Increase Staffing. Dedicated WTP operators and team leader Review contractor skills/training. Corporate Safety system will develop training needs analysis.	Ongoing training as per needs analysis. VOC process to confirm competency.	
B16	Loss of Supply	High	Identify trees over or near assets on easements and gain approvals to remove trees	Ongoing maintenance to remove trees on easements	

It is the responsibility of the Utilities Manager to implement and track the improvement program actions.

As indicated previously, the actions taken to implement these actions are reported in the annual report.

12 SUPPORTING DOCUMENTS

Australian Drinking Water Guidelines 6 2011

https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines

Incident Response Protocols:

Managing pathogen risks in drinking water: response protocol

https://www.health.nsw.gov.au/environment/water/Pages/nswhrp-microbiological.aspx

Chemical Exceedance response protocol
https://www.health.nsw.gov.au/environment/water/Pages/nswhrp-chemical.aspx

Other NSW Health websites:

Water quality database

https://www.health.nsw.gov.au/environment/water/Pages/drinking-water-database.aspx

Other NSW Health information about drinking water

http://www.health.nsw.gov.au/environment/water/Pages/drinking-water.aspx

NSW Guidelines for Water Carters

https://www.health.nsw.gov.au/environment/water/Publications/nsw-guidelines-for-water-carters.pdf

APPENDIX A
CIRCULAR 18

APPENDIX B
BOIL WATER ALERT TEMPLATES

Boil Water Alert

DD/MMM/YEAR

E. coli bacteria contamination

Byron Shire Council regularly monitors drinking water to ensure its safety.

Regular monitoring has detected *E. coli* bacteria in the <<INSERT AFFECTED COMMUNITY>> water supply. *E. coli* itself is generally not harmful but its presence in drinking water is associated with sewage and animal wastes. These bacteria indicate that the water may be contaminated with organisms that may cause gastrointestinal disease.

As a precaution you are advised that water used for consumption should be brought to a rolling boil. Water should then be allowed to cool and stored in a clean container with a lid and refrigerated.

Boiled or bottled water should be used for:

Drinking, cooking, washing uncooked foods (such as seafood or salads), making ice, personal hygiene, pet's drinking water, washing hands, cleaning teeth, gargling, face washing of young children, washing toys and children's utensils.

Dishes should be washed in hot soapy water or in a dishwasher. Children should take boiled or bottled water to school.

Byron Shire Council is working to alleviate the problem.

For further information contact:

<<Council Contact Details>>

Boil Water Alert

Precautions for schools and child care centres

DD/MMM/YEAR

A “Boil Water Alert” has been issued for
<<INSERT AFFECTED COMMUNITY>>.
Until further notice, children and employees should not consume water, ice or drinks made with water, or raw foods rinsed with water that has not been boiled or filtered.

When possible, parents and caregivers should provide their children with boiled or bottled water, bottled juices or juices prepared with boiled water from home.

Access to drinking fountains should be restricted or turned off where possible, so that students do not drink unboiled water by mistake.

Water should flow unrestricted to toilets and washrooms. Signs should be placed in the washrooms indicating that the water is not for drinking.

Students and staff are advised to thoroughly wash their hands with soap and running warm tap water after using the toilet and handling food. Hands should then be dried thoroughly.

Byron Shire Council is working to alleviate the problem.
For further information contact:
<<Council Contact Details>>

Boil Water Alert

DD/MMM/YEAR

Cryptosporidium (and or Giardia) contamination

Byron Shire Council has detected *Cryptosporidium* *(and or Giardia)* in the <<INSERT AFFECTED COMMUNITY>> water supply. These organisms may cause gastrointestinal disease.

Anyone in the identified area with symptoms such as diarrhoea, abdominal pain, slight fever or vomiting should contact their doctor. As a precaution you are advised that water used for consumption should be brought to a rolling boil. Water should then be allowed to cool and stored in a clean container with a lid and refrigerated.

Boiled or bottled water should be used for:

Drinking, cooking, washing uncooked foods (such as seafood or salads), making ice, personal hygiene, pet's drinking water, washing hands, cleaning teeth, gargling, face washing of young children, washing toys and children's utensils.

Dishes should be washed in hot soapy water or in a dishwasher. Children should take boiled or bottled water to school.

Special care is advisable for certain consumers at this time, these include; people with severely weakened immune systems (the immunosuppressed), individuals receiving dialysis treatment, and aged individuals. Please contact your doctor or local Public Health Unit for more information.

Byron Shire Council is working to alleviate the problem.

For further information contact:

<<Council Contact Details>>

Lifting of Boil Water Alert

DD/MMM/YEAR

Residents in <<INSERT AFFECTED COMMUNITY>> no longer need to boil their drinking water.

Byron Shire Council advises that any residents that restricted their water usage run their kitchen and bathroom taps for 5 minutes to flush any stagnant water from their household plumbing.

Byron Shire Council apologies for the inconvenience and thanks you for your cooperation.