Integrated Water Cycle Management Strategy

Issues Paper

MidCoast Council

10 November 2022

→ **The Power of Commitment**

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Executive summary

The MidCoast is a Local Government Area (LGA) in the New England, Hunter and Mid-North Coast regions of New South Wales. MidCoast Council (Council) was formed in 2016 from the merger of Gloucester Shire, Great Lakes and Greater Taree LGAs.

The LGA covers 10,060 square kilometres with a 2020 estimated regional population of 94,395 people.

Council commissioned the preparation of an IWCM Strategy to comply with the NSW Government's Best-Practice Management of Water Supply and Sewerage Framework. This report provides a summary of the issues and all the outcomes from Items 2 to 7 of Department of Planning and Environment (DPE) February 2019, IWCM Strategy Check List.

Water supply and sewerage schemes

Council provides water supply and sewerage servicing to the major towns and villages located within the LGA. Table E.1 lists the towns and villages serviced by both water supply and sewerage schemes as well as by water schemes only.

Table E.1 Serviced communities

Towns/villages serviced by water and sewer	Towns/villages serviced by water only
Barrington	Krambach
Bulahdelah	Stroud Road
Coopernook	
Crowdy Head	
Cundletown	
Forster	
Gloucester	
Green Point	
Hallidays Point	
Harrington	
Hawks Nest	
Lansdowne	
Manning Point	
Nabiac	
North Karuah	
Old Bar	
Pacific Palms	
Seven Mile Beach	
Smiths Lake	
Stroud	
Taree and Taree South	
Tea Gardens	
Tinonee	
Tuncurry	
Wallabi Point	
Wingham	

Population and demographic projections

Council has nominated the following growth rates for the six water supply schemes:

Table E.2 Equivalent Tenement (ET) projections (water supply)

Water supply scheme	2020	2026	2031	2036	2041	2046	2051
Bulahdelah	724	774	839	919	1,015	1,125	1,251
Gloucester	2,291	2,536	2,650	2,923	3,046	3,166	3,279
Manning	43,260	46,942	51,284	56,001	61,151	66,675	72,392
North Karuah	34	34	34	34	34	34	34
Stroud	646	674	745	829	949	1,093	1,265
Tea Gardens	3,481	3,943	4,264	4,548	4,771	4,940	5,055
TOTAL	**50,436**	**54,902**	**59,817**	**65,255**	**70,966**	**77,034**	**83,276**

Council has nominated the following growth rates for the 14 sewer service schemes:

Table E.3 Connected equivalent tenements (sewer service)

Sewer Service Schemes	2021	2026	2031	2036	2041	2046	2051
Bulahdelah	725	762	802	850	891	934	980
Coopernook	241	242	251	270	277	285	294
Forster	10,666	11,719	12,289	12,822	13,366	13,935	14,531
Gloucester	2,133	2,262	2,355	2,470	2,588	2,712	2,842
Hallidays Point (including Nabiac)	7,345	7,886	8,421	8,924	9,596	10,357	11,169
Harrington	1,941	2,101	2,151	2,228	2,393	2,571	2,761
Hawks Nest	3,810	4,152	4,464	4,687	5,032	5,403	5,801
Lansdowne	295	297	307	330	340	350	360
Manning Point	277	281	283	293	298	304	309
North Karuah	38	38	38	38	38	38	38
Old Bar	2,597	2,923	3,373	3,860	4,366	4,938	5,586
Stroud	547	548	573	605	619	633	647
Taree (Dawson)	9,686	10,031	10,580	11,200	11,680	12,185	12,710
Wingham	2,239	2,355	2,407	2,479	2,553	2,628	2,706
TOTAL Council	**42,539**	**45,597**	**48,294**	**51,057**	**54,039**	**57,272**	**60,733**

Water demand analysis and projection

A water demand analysis was undertaken to calculate the unit demands, estimate the non-revenue water and forecast the following demands:

- Average Day Demands (ML/d) – Based on customer metered consumption + Non-revenue Water + standard ADD/ET for future ET. Used for revenue planning.
- Peak Day WTP Production (ML/d) – Based on operational WTP production data + standard PDD/ET for future ET. Used to assess WTP requirements.
- Peak Day System Demands (ML/d) – Based on peak day customer metered consumption + Non-revenue Water + standard PDD/ET for future ET. Used to assess system reliability, including reservoir & distribution system sizing.
- Dry Year Demands (ML/year) – Based on Average Day Demand forecasts, extrapolated from recent dry year period. Used to assess drought security.

The 30-year forecasts based on Council's nominated growth, are provided in Table E.3. North Karuah is supplied by Hunter Water. Water demand forecasts for North Karuah are not available.

Table E.4 Water demand forecast

Scheme	Water Demand	2020	2026	2031	2036	2041	2046	2051
Manning	Average Day Demands (ML/day)	18.6	22.9	25.4	28.1	31.0	34.2	37.5
	Peak Day WTP Production (ML/day)	33.3	47.4	52.5	58.1	64.2	70.7	77.4
	Peak Day System Demands (ML/day)	48.9	55.7	63.7	72.4	82.0	92.2	102.9
	Dry Year Demands (ML/year)	6,805	8,366	9,272	10,256	11,330	12,482	13,674
Tea Gardens	Average Day Demands (ML/day)	1.46	2.06	2.25	2.41	2.54	2.63	2.70
	Peak Day WTP Production (ML/day)	3.4	6.1	6.6	7.1	7.5	7.8	8.0
	Peak Day System Demands (ML/day)	5.38	6.24	6.85	7.39	7.81	8.13	8.35
	Dry Year Demands (ML/year)	533	753	820	880	926	961	985
Bulahdelah	Average Day Demands (ML/day)	0.32	0.37	0.41	0.46	0.51	0.57	0.65
	Peak Day WTP Production (ML/day)	0.6	0.9	0.9	1.1	1.2	1.3	1.5
	Peak Day System Demands (ML/day)	0.83	0.92	1.05	1.20	1.38	1.59	1.83
	Dry Year Demands (ML/year)	116	136	150	166	186	209	236
Stroud	Average Day Demands (ML/day)	0.26	0.32	0.36	0.41	0.48	0.56	0.66
	Peak Day WTP Production (ML/day)	0.5	0.9	1.0	1.2	1.4	1.6	1.9
	Peak Day System Demands (ML/day)	0.92	0.97	1.10	1.26	1.48	1.74	2.06
	Dry Year Demands (ML/year)	96	118	133	151	176	206	242

Scheme	Water Demand	2020	2026	2031	2036	2041	2046	2051
Gloucester	Average Day Demands (ML/day)	0.79	1.06	1.13	1.28	1.35	1.42	1.49
	Peak Day WTP Production (ML/day)	1.5	2.3	2.5	2.8	3.0	3.1	3.3
	Peak Day System Demands (ML/day)	2.17	2.60	2.82	3.30	3.53	3.76	3.97
	Dry Year Demands (ML/year)	288	388	412	469	495	520	543

Sewer load analysis and projection

The forecast sewer loads based on Council's nominated growth strategy are shown in Table E.5.

Table E.5 Projected average dry weather flow, peaking factor, peak dry weather flow and peak wet weather flow

Scheme		2021	2031	2041	2051
Bulahdelah	ADWF (L/s)	3.6	3.9	4.4	4.8
	PDWF/ADWF Factor	2.0	2.0	2.0	2.0
	PDWF (L/s)	7.3	8.1	9.0	9.9
	PWWF (L/s) ARI=2	30.4	34.1	38.0	41.7
	PWWF/ADWF factor ARI=2	8.5	8.7	8.7	8.7
	PWWF (L/s) ARI=5	37.4	42.0	46.8	51.4
	PWWF/ADWF factor ARI=5	10.5	10.7	10.7	10.7
Coopernook	ADWF (L/s)	0.8	0.8	0.9	0.9
	PDWF/ADWF Factor	2.5	2.5	2.5	2.5
	PDWF (L/s)	1.9	2.0	2.1	2.3
	PWWF (L/s) ARI=2	9.4	10.8	12.2	13.7
	PWWF/ADWF factor ARI=2	12.4	13.6	14.4	14.8
	PWWF (L/s) ARI=5	11.5	13.2	15.0	16.9
	PWWF/ADWF factor ARI=5	15.1	16.7	17.6	18.2
Forster	ADWF (L/s)	45.2	51.5	56.0	60.9
	PDWF/ADWF Factor	1.8	1.8	1.8	1.8
	PDWF (L/s)	81.3	92.6	100.7	109.5
	PWWF (L/s) ARI=2	336.2	368.9	397.9	427.9
	PWWF/ADWF factor ARI=2	7.4	7.2	7.1	7.0
	PWWF (L/s) ARI=5	409.6	448.3	483.2	519.3
	PWWF/ADWF factor ARI=5	9.1	8.7	8.6	8.5
Gloucester	ADWF (L/s)	5.9	6.5	7.1	7.8
	PDWF/ADWF Factor	2.0	2.0	2.0	2.0
	PDWF (L/s)	11.6	12.8	14.1	15.4
	PWWF (L/s) ARI=2	87.6	96.4	105.4	114.3
	PWWF/ADWF factor ARI=2	14.9	14.9	14.8	14.6
	PWWF (L/s) ARI=5	107.9	118.8	129.8	140.7
	PWWF/ADWF factor ARI=5	18.4	18.3	18.2	18.0

Scheme		2021	2031	2041	2051
Hallidays Point	ADWF (L/s)	34.8	39.9	45.5	53.1
	PDWF/ADWF Factor	1.9	1.9	1.9	1.9
	PDWF (L/s)	65.3	74.9	85.4	99.5
	PWWF (L/s) ARI=2	276.6	323.3	372.0	423.6
	PWWF/ADWF factor ARI=2	7.9	8.1	8.2	8.0
	PWWF (L/s) ARI=5	337.6	394.9	454.6	517.0
	PWWF/ADWF factor ARI=5	9.7	9.9	10.0	9.7
Harrington	ADWF (L/s)	13.5	15.0	16.6	19.2
	PDWF/ADWF Factor	2.1	2.1	2.1	2.1
	PDWF (L/s)	28.6	31.7	35.3	40.8
	PWWF (L/s) ARI=2	67.0	82.6	88.6	97.4
	PWWF/ADWF factor ARI=2	5.0	5.5	5.3	5.1
	PWWF (L/s) ARI=5	77.4	96.8	103.5	113.4
	PWWF/ADWF factor ARI=5	5.7	6.5	6.2	5.9
Hawks Nest	ADWF (L/s)	13.6	15.3	17.2	19.8
	PDWF/ADWF Factor	2.0	2.0	2.0	2.0
	PDWF (L/s)	27.8	31.3	35.3	40.7
	PWWF (L/s) ARI=2	88.0	96.6	105.9	117.6
	PWWF/ADWF factor ARI=2	6.5	6.3	6.2	5.9
	PWWF (L/s) ARI=5	108.8	119.2	130.4	144.4
	PWWF/ADWF factor ARI=5	8.0	7.8	7.6	7.3
Lansdowne	ADWF (L/s)	0.7	0.7	0.8	0.8
	PDWF/ADWF Factor	1.4	1.4	1.4	1.4
	PDWF (L/s)	0.9	1.0	1.1	1.1
	PWWF (L/s) ARI=2	9.0	10.0	11.2	12.1
	PWWF/ADWF factor ARI=2	13.3	14.0	14.2	14.6
	PWWF (L/s) ARI=5	11.3	12.4	13.9	15.1
	PWWF/ADWF factor ARI=5	16.6	17.4	17.7	18.1
Manning Point	ADWF (L/s)	0.6	0.7	0.7	0.7
	PDWF/ADWF Factor	2.9	2.9	2.9	2.9
	PDWF (L/s)	1.9	1.9	2.0	2.1
	PWWF (L/s) ARI=2	6.8	10.9	14.1	16.8
	PWWF/ADWF factor ARI=2	10.6	16.6	20.4	23.5
	PWWF (L/s) ARI=5	8.3	13.3	17.1	20.3
	PWWF/ADWF factor ARI=5	13.0	20.3	24.8	28.4

Scheme		2021	2031	2041	2051
Old Bar	ADWF (L/s)	9.9	12.8	16.6	21.2
	PDWF/ADWF Factor	1.4	1.4	1.4	1.4
	PDWF (L/s)	13.8	17.9	23.1	29.6
	PWWF (L/s) ARI=2	85.4	106.1	129.5	155.6
	PWWF/ADWF factor ARI=2	8.7	8.3	7.8	7.3
	PWWF (L/s) ARI=5	105.9	131.3	159.9	191.5
	PWWF/ADWF factor ARI=5	10.7	10.3	9.6	9.0
Stroud	ADWF (L/s)	1.6	1.7	1.8	1.9
	PDWF/ADWF Factor	2.0	2.0	2.0	2.0
	PDWF (L/s)	3.2	3.4	3.6	3.8
	PWWF (L/s) ARI=2	15.8	17.4	19.5	21.2
	PWWF/ADWF factor ARI=2	9.9	10.5	10.9	11.3
	PWWF (L/s) ARI=5	19.3	21.4	24.0	26.0
	PWWF/ADWF factor ARI=5	12.2	12.9	13.4	13.9
Taree (Dawson)	ADWF (L/s)	41.4	45.2	49.9	54.3
	PDWF/ADWF Factor	2.0	2.0	2.0	2.0
	PDWF (L/s)	81.9	89.5	98.8	107.5
	PWWF (L/s) ARI=2	594.4	641.5	699.0	769.6
	PWWF/ADWF factor ARI=2	14.4	14.2	14.0	14.2
	PWWF (L/s) ARI=5	725.5	782.0	851.2	936.0
	PWWF/ADWF factor ARI=5	17.5	17.3	17.1	17.2
Wingham	ADWF (L/s)	7.5	8.1	8.6	9.1
	PDWF/ADWF Factor	1.6	1.6	1.6	1.6
	PDWF (L/s)	11.7	12.5	13.3	14.1
	PWWF (L/s) ARI=2	97.6	104.5	111.8	118.8
	PWWF/ADWF factor ARI=2	13.0	13.0	13.1	13.1
	PWWF (L/s) ARI=5	121.9	130.6	139.6	148.4
	PWWF/ADWF factor ARI=5	16.2	16.2	16.3	16.4

IWCM issues

The issues phase identified 80 operational and 6 strategic issues.

For the strategy, 82 of 86 issues will be grouped into the base scenario; and 4 of the strategic issues will be investigated in the options phase.

The base scenario includes all the work that Council are planning to do in water and sewer over the next 30 years, including works to address operational issues and strategic issues that do not require community consultation at this stage.

Operational issues are risks to the services that Council currently deliver every day to the community, which are actioned as part of business as usual work. Council manages and fix these issues as part of everyday operations. Examples of operational issues include:

– Water and sewer renewals
– Treatment plants, reservoirs, pump stations and other assets reaching end of life within planning horizon
– Inflow and infiltration of stormwater into the sewerage network
– Level of service targets not being monitored / data not being recorded for some water and sewer service objectives and targets

Strategic issues are the primary risks to current and future water services. These issues have potential for significant impacts upon water supply and sewerage services and their interfaces with people, the economy and ecosystems. There are some strategic issues that Council won't be consulting with the community on at this stage. An example of this is an upgrade of a sewage treatment plant in 10 years' time to cater for growth. Two of the six strategic issues identified in the issues phase to be included in the base scenario are:

– Resourcing challenges with attracting and retaining qualified and skills staff
– Aging water and sewerage assets, level of asset renewals and upgrades not being met (infrastructure cliff)

Four key strategic issues were identified in the issues phase. These will be investigated in the options phase and will not be a part of the base scenario.

1. Water security- the issues phase has identified insufficient secure yield for water supplies (based on the 5-10-10 rule) at the Manning, Bulahdelah, Stroud and Gloucester water supply schemes.
2. Sustainable effluent management - Council currently has 10 recycled water schemes. Council recycles approximately 25% of effluent in periods where rainfall is average or below average. There is the opportunity to investigate increasing the percentage of effluent recycled. This issue also considers biosolids, including the potential change to biosolids guidelines which may result in Council not being able to beneficially reuse biosolids.
3. Unserviced villages for sewerage.
4. Climate change. Council declared a climate emergency in October 2019, recognising that a state of climate emergency exists. Emission reduction and renewable energy targets have been set for Council's operations. This includes achieving net zero greenhouse gas emissions and 100% renewable energy for operations by 2040. Climate change is a key consideration for the strategic issues 1, 2 and 3 above. Climate change is also a stand-alone strategic issue, to meet Council's net zero target and to ensure that the issue of assets at risk from sea level rise are considered and addressed. This includes Wingham STP and Old Bar exfiltration beds being below the 1 in 100-year flood level.

Refer to Section 15 for the full details of IWCM issues and data gaps identified through the analysis process.

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1. The IWCM strategy

1.1 Purpose of the IWCM strategy

An Integrated Water Cycle Management (IWCM) Strategy is a local water utility's (LWU) resourcing strategy for the provision of appropriate, affordable, cost-effective and sustainable urban water services to meet community needs and protect public health and the environment.

An IWCM Strategy:

- Sets the objectives, performance standards and associated performance indicators for the water and sewer business.
- Identifies the needs and issues based on evidence and sound analysis.
- Ensures infrastructure matches needs.
- Determines the investment priority in consultation with the community and stakeholders.
- Identifies the 'best-value 30-year' IWCM scenario on an economic, environmental, social and cultural governance (quadruple bottom line including involvement of first nation people in water and wastewater planning) basis.

The key outcomes from an IWCM Strategy are:

- 30-year Total Asset Management Plan (TAMP)
- 30-year Financial Plan
- Drought and Emergency Response Contingency Plan (DERCP)

1.2 Process

An IWCM Strategy addresses three elements of the NSW Best-Practice Management (BPM) of Water Supply and Sewerage Framework (integrated water cycle management, water conservation, demand management and drought management) and six of the 19 requirements of the *NSW Government's Best-Practice Management of Water Supply and Sewerage Guidelines*, 2007.

The process of preparing an IWCM Strategy follows the NSW Department of Planning and Environment (DPE) IWCM Strategy checklist (DPIE, 2019).

The checklist is a road map to help an LWU:

- Identify the urban water service issues including water supply, sewerage and urban stormwater issues.
- Assess the options.
- Develop and evaluate IWCM scenarios.
- Adopt a sound IWCM scenario, strategy and financial plan in a transparent manner to address the identified issues.

1.3 IWCM issues paper

The IWCM Issues Paper presents the analysis that have been undertaken and summarises the issues that have been identified through the analysis. The following are inputs to the IWCM Issues Paper:

– Water and sewerage service objectives and targets
– Growth strategy
– Capability of existing systems
– Water cycle analysis
– Existing system performance assessment
– Assessment of unserviced areas

This report presents the outcomes of the analysis.

1.4 Scope and limitations

This report: has been prepared by GHD for MidCoast Council and may only be used and relied on by MidCoast Council for the purpose agreed between GHD and MidCoast Council as set out in this report.

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2. Introduction

2.1 MidCoast local government area

The MidCoast is a Local Government Area (LGA) in the New England, Hunter and Mid-North Coast regions of New South Wales. MidCoast Council (Council) was formed in 2016 from the merger of Gloucester Shire, Great Lakes and Greater Taree LGAs.

The LGA covers 10,060 square kilometres with a 2020 estimated regional population of 94,395 people. Figure 2-1 presents a map of the LGA.

Figure 2-1 MidCoast Council local government area

2.2 Serviced communities

Council provides water supply and sewerage servicing to the major towns and villages located in the LGA. Table 2.1 lists the towns and villages serviced by the six water supply schemes and the 14 sewer service schemes. Further detail of these services is provided in Sections 4.4 and 6.

Table 2.1 Serviced communities

Towns/villages serviced by water and sewer	Towns/villages serviced by water only
Barrington	Krambach
Bulahdelah	Stroud Road
Coopernook	
Crowdy Head	
Cundletown	
Forster	
Gloucester	
Green Point	
Hallidays Point	
Harrington	
Hawks Nest	
Lansdowne	
Manning Point	
Nabiac	
North Karuah	
Old Bar	
Pacific Palms	
Taree and Taree South	
Tea Gardens	
Tinonee	
Tuncurry	
Seven Mile Beach	
Smiths Lake	
Stroud	
Wallabi Point	
Wingham	

2.3 Unserviced villages

The LGA contains many unserviced small villages. Unserviced villages are discussed in Section 4.4.7 and Section 6.1.15 for water and sewer respectively.

2.4 Current IWCM strategy measures and status of outcomes

Council published its first IWCM in 2008. At that time, the term ‘Sustainable Water Cycle Management’ was adopted with the final document titled *The Manning, Karuah, Great Lakes Sustainable Water Cycle Management Strategy*. The accompanying summary document was titled *Our Water Our Future 2008.*

The second iteration of Our Water Our Future was completed in 2015. For consistency, it was titled Our Water Our Future 2045.

In 2015 Council took an adaptive planning approach to the Manning Water Supply Scheme (Manning Scheme) and decided to postpone a decision on the long-term water security options until 2020 as a result of additional water supply into the Manning Scheme from the Nabiac Inland Dune Aquifer and associated new Nabiac Water Treatment Plant, which was due in 2018. This was taking an adaptive planning approach.

The long-term options supported by the community at the time were a new dam on Peg Leg Creek or indirect potable reuse by recharging the Nabiac aquifer with purified recycled water. Desalination was not supported by the community in 2015.

Apart from the Tea Gardens water scheme which sources water from the Tea Gardens aquifer, all of Council’s smaller water supply schemes at the time had long–term water security issues, i.e. they did not meet the NSW Water Department of Planning and Environment (DPE) 5/10/10 water security rule for headwork infrastructure which states:

- Duration of drought restrictions should not exceed 5% of the time.
- Frequency of restrictions should not exceed 10% of years.
- Severity of restrictions should not exceed 10% that is, the system should be able to meet 90% of unrestricted water demand during the worst recorded drought at the level where restrictions are imposed.

In 2015, Council also estimated that continual investment in water savings initiatives and inflow and infiltration reduction in the sewer networks can defer major upgrades to infrastructure and reduce associated operating and maintenance costs.

2.4.1 Community feedback in 2015

In 2015 the community highlighted the most prominent issue at the time was the risk to water supply security. The list of issues identified at the time included:

- Water security and secure yield
- Effluent management
- Climate variability
- Compliance
- Unserviced communities
- Water quality and catchment management
- Leakage and infiltration
- Condition of major assets

The way forward was planned to involve:

- Reducing water use
- Ensuring water quality
- Securing water supplies
- Recycling and effluent management
- Servicing small villages

2.4.2 Reducing water usage

Council is committed to reducing demand and water usage as far as practicable. Programs implemented by Council in the past to reduce demand and water usage include:

- Smart Water Rebate Program including rebates for rainwater tanks.
- Community education on the efficient use of water and ways to reduce household and business demand.
- Consideration of changes to pricing including tariff pricing.
- Behavioural change programs.
- Smart meters to help reduce leaks and reduce demand slightly.
- Targeting of large water users to help them reduce demand.
- Reducing the number of leaks within the water supply system.
- Reducing pressure in water supply systems, where appropriate.
- Stormwater harvesting. e.g. irrigation of public open spaces with stormwater.

2.4.2.1 Smart water rebate program

The annual Smart Water Rebate Program commenced in 2008 and was discontinued on 1 July 2016. During the implementation of the program, Council aimed to provide at least 800 residential smart water rebates per year to help those households reduce their water use by at least 10% and also aimed to provide at least 25 rainwater tank rebates per year to help those households reduce their water use by approximately 30%.

2.4.2.2 Community education

Council created two new positions in early 2021. A Water Education and Communications Officer, with focus on water education, and a Water Resilience Officer, with a focus on water resilience, including assisting large water users with water conservation measures.

2.4.2.3 Changes to pricing including tariff pricing

In 2021, Council made changes to the water access charge and the second-tier usage charge. This has resulted in Council's pricing structure moving away from the best practice guidelines of 75% of revenue from usage charges. The percentage of revenue from usage charges for Council is 66%.

2.4.2.4 Behavioural change programs

With the addition of the Water Education and Communications Officer and the Water Resilience Officer roles in 2021, Council has commenced working with schools and large water users to raise awareness of the value of water and options for the future.

2.4.2.5 Smart water meters

Council initiated in 2021 the installation of residential smart meters in one selected trial area in Stroud Road. Currently, about 80 residential properties in Stroud Road have smart meters. The trial aims to reduce demand for that sub-scheme by 5%.

Council will be comparing usage to residential consumption prior to installation as an ongoing program. Council has also identified leaks since the rollout.

2.4.2.6 Targeting high water users

During the 2019-2020 drought, Council engaged Smart Water Mark to undertake an audit of the top 30 largest water users. Since commencement in February 2021, the Water Resilience Officer has established relationships with many of these users with an initial focus on Caravan Parks and Dairy Farms.

2.4.2.7 Leakage and pressure management

Council's aim is to reduce non-revenue water (NRW) leakage of total water supplied for the water supply schemes. Council currently estimates leakage to range between 10 % and 24 % across the six water supply schemes. However, in this estimate of NRW (completed in Appendix B), all avoidable real losses are being calculated as negative. This is either due to (or likely a combination of) calibration errors in some flow meters and/or the inputs/assumptions in the empirical formulas and values used in the calculation for real and apparent losses. Noting this, Council acknowledges that leakage in the network is an issue and will target this as part of business as usual, including meter calibration, installation of bulk flow meters at strategic locations and leak detection programs.

2.4.2.8 Stormwater harvesting options

Stormwater harvesting options were investigated at a high level in 2015 however, at the time the options identified were found to be not feasible. In recent years, a number of new stormwater harvesting opportunities for irrigation and potable uses have been identified and will be investigated as part of the IWCM strategy.

2.4.3 Ensuring water quality

2.4.3.1 Catchment management

Council's aim is to establish a long-term catchment management water quality monitoring program to look at reducing average turbidity in the rivers. Catchment Management activities are overseen by Council's Natural Systems Team. A Catchment Management Plan for the Manning River Estuary and CMP was adopted by Council in July 2021. Council has worked together with stakeholders to develop the Manning River Estuary and Catchment Management Program. This sets out a ten-year action program for Council, the community and partner organisations to improve the health and resilience of the Manning River.

2.4.3.2 Restoring riparian vegetation

Council's aim is to restore the riparian zone in the catchments upstream of the drinking water off-takes and as a result reduce the average raw water turbidity.

2.4.4 Securing water supplies

2.4.4.1 Manning Scheme

The Manning Scheme long-term plan to supplement supply with groundwater sourced from the Nabiac Inland Dune Aquifer (Nabiac Water Supply) was completed in December 2018. The Nabiac Water Supply consists of the extraction, treatment and distribution of up to 10 ML/day.

This project was a critical component of the strategy for the Manning Scheme. The Nabiac Water Supply provides the community with the following primary benefits:

- An alternative source of potable water supply, sharing the risk between the Manning River and the Nabiac Aquifer.
- Improving drought security.

2.4.4.2 Future direction for the Manning Scheme

A significant milestone has recently been achieved with modelling of the Nabiac Inland Dune Aquifer indicating that extraction rates can be increased up to 18 ML/day for a maximum period of 6 months without adversely impacting the sustainability of the groundwater supply. The Nabiac Water Treatment Plant (WTP) is currently in design phase for the Stage 2 upgrade. This will allow the WTP to produce up to 18 ML/day in the short to medium term during a drought, until the long-term water security option for the Manning Scheme is finalised and the preferred water security solution implemented. Council will consider 'all options on the table' for all of Council's water supply schemes with insufficient secure yield as part of the strategy review. One option to improving water security for Council's smaller water supply schemes involve construction of off river storage dams.

2.4.5 Recycling and effluent management

The Gloucester Sewage Treatment Plant (STP) project is in the planning phase. The concept design has been completed and the tender for detailed design was released in early 2022.

2.4.5.1 Recycled water

Council has several existing recycled water schemes where the recycled water from treated effluent is used for farm irrigation. A number of recycled water opportunities have been identified for investigation as part of the IWCM strategy.

2.4.5.2 Inflow and infiltration reduction

Council's aim is to reduce stormwater inflow and infiltration (I&I) by 35%. Council has recruited two field teams dedicated to I&I reduction in 2021. The networks with high I&I /defects have been identified and prioritised for investigations as described in Appendix C.

After I&I reduction work is completed, Council plans to use pump run times in conjunction with known pump duties to calculate pumped volumes. A rainfall event after works completed (comparable to a rainfall event prior) will be used to complete the same analysis. Difference in pumped volumes will be determined to measure I&I reduction success. This can be further supported by STP inflows.

2.4.6 Servicing small villages

A revised risk assessment of unsewered small villages was completed in August 2021. The assessment initially screened all villages, to identify the high-risk villages to include in the study. For the villages identified, the assessment ranked the small villages based on a risk criteria, including proximity to sensitive waterways. This study will support funding opportunities sought by Council to address high-risk unsewered villages.

3. Operating environment

The delivery of urban water services including water supply, sewerage and stormwater services is subject to many requirements, guidelines, contractual obligations for the delivery of services and other external and internal factors, collectively referred to as the ‘Operating Environment’. An IWCM issue will arise if there is a failure to meet the legal obligations or agreed Level of Service (LOS) in water supply and sewerage servicing including the following:

– Legislative and regulatory requirements (health requirements, Work Health and Safety (WHS), Environmental Protection Authority (EPA) Licence
– LOS targets (as agreed with customers)
– Contractual and agreed arrangements (e.g. Memorandum of Understanding (MoU))
– BPM criteria

The operating environment compliance situation is analysed in this section to identify the IWCM issues.

3.1 Regulatory and contractual compliance requirements

Council operates six water supply schemes and 14 sewerage schemes under the authority of the Local Government Act 1993. Residents outside designated service areas are required to manage their own water supply and on-site sewerage management systems (OSMS).The Local Government Act and other legislation regulates the way Council provides urban water and wastewater services. These requirements have specific implications for operation of the schemes. The relevant legislative framework, with respect to the supply of water and sewerage services, are defined and addressed within Table 3.1.

Table 3.1 Legislative requirements

Key legislative framework	Council’s current performance and future targets
Local Government Act (1993)	
This Act aims to provide the legal framework for an effective, efficient, environmentally responsible, and open system of Local Government including the provision, management and operation of water supply and sewerage works and facilities. It covers:	
Section 60 (S60) – A council must not, except in accordance with the approval of the Minister for Water, Property and Housing, do any of the following: a. (Repealed) b. as to water treatment works—construct or extend any such works, c. as to sewage—provide for sewage from its area to be discharged, treated or supplied to any person, d. (Repealed)	For water and sewage treatment plants constructed prior to 1993, S60 does not apply. Council does have S60 approval for the recycled water schemes at Hawks Nest, Bulahdelah, Harrington and Gloucester STP’s and Tuncurry Recycled Treatment Plant (RTP). Council does not have S60 approval for the recycled water schemes at Dawson and Stroud STP’s.
Section 61 – The Minister for Primary Industries or a person authorised by the Minister may direct a Council to take such measures as are specified in the direction to ensure the proper safety, maintenance and working of any of the following works: a. dams for the impounding or diversion of water for public use or any associated works b. water treatment works c. sewage treatment works	No such direction has been made to Council

Key legislative framework	Council's current performance and future targets
Section 64 - Construction of works for developers This Section gives Council powers under Division 5 of Part 2 of Chapter 6 of the Water Management Act to require developers to pay contributions and/or construct works as a condition of development. Further information is provided in the Developer Charges Guidelines.	
Section 68 – provide an approval to applications to discharge trade waste to Council's sewerage system.	Council's Liquid Trade Waste (LTW) Policy adopted in May 2019.
Section 90 – Concurrence (2) The person or authority may give the council notice that the concurrence may be assumed with such qualifications or conditions as are specified in the notice. Businesses or government agencies proposing to discharge liquid trade waste to a council's sewerage system must have prior approval from the council responsible for providing sewerage services. Such approvals need DPE concurrence. DPE has provided assumed concurrence to all councils for low-risk discharges. DPE also provides its concurrence to the council's approval of high risk and medium risk discharges, as well as authorising suitably qualified councils to 'assume concurrence' for medium risk discharges.	
Section 382 – Insurance against liability: – A Council must make arrangements for its adequate insurance against public liability and professional liability	1. Council has public liability, professional indemnity and workers compensation insurance policies. 2. Council has a Third Party Risk Management and Insurance Requirements Policy adopted in May 2017. 3. Council has a Risk Management Policy adopted in November 2019 and a Risk management Framework adopted in December 2019. 4. Council is working to prepare a Business Continuity Management Policy and Plan (Part 1 and 2) adopted in November 2020. **5.** Council has a Work Health and Safety Policy adopted in December 2017.
Section 428 – Within 5 months after the end of each year, a council must prepare a report (its "annual report") for that year reporting as to its achievements in implementing its delivery program.	No non-compliance.
Environmental Planning and Assessment Act (1979) (incl. the EPA Regulation 2000) and & Environmental Planning and Assessment Amendment Act 2008	
This Act aims to encourage proper management of resources, the orderly use of land, the provision of services, and the protection of the environment. It covers: – Local Environmental Plans (LEP) – Environmental Impact Statement (EIS) – Reviews of Environmental Factors (REF)	Council has three LEP's for: – Manning Region – Great Lakes Region – Gloucester Region Council generally complies with EPA act, monitoring data is made public.

Key legislative framework	Council's current performance and future targets
Public Health Act (2010)	
This Act aims to promote, protect and improve public health; by providing safe drinking water to the community. Section 25 – a supplier of drinking water must have a Drinking Water Management Plan (DWMP) in place and must comply with its requirements. The requirements of the DWMP are as follows: – Produce an annual report to be made available to consumers, regulatory authorities and stakeholders – The drinking water management system will be internally reviewed. The review will assess Council's performance in relation to: • Critical Control Points (CCPs) and their exceedances • Improvement Plan • Record keeping • NSW Health Database performance	Council has implemented a Drinking Water Quality Management Plan (DWQMP) July 2014. Council has fulfilled the requirements that drinking water suppliers develop and adhere to a quality assurance program from 1st September 2014. The Manning water supply system achieved 99.9% of water quality results in the reticulation system meeting DWQMP for the 2019-2020 reporting period. The system achieved 100% compliance during 2018 - 2019.
Water Management Act (2000) and Water Amendment Act 2008	
This Act promotes the sharing of responsibility for the sustainable and efficient use of water between the NSW Government and water users and provides a legal basis to manage NSW water planning, allocation of water resources and water access entitlements. The Act recognises the need to allocate and provide water for the environmental health of rivers and groundwater systems, while also providing licence holders with more secure access to water.	Council has water licenses to extract water from various water sources. Refer to Section 4.2. Water sharing plans are in place for all Council's surface water sources. Lower North Coast Unregulated and Alluvial Water Sharing Plan consisting of: – Myall River Water Source – Lower Barrington/Gloucester Rivers Water Source – Lower Manning River Water Source – Karuah River Water Sharing Plan
Protection of the Environment Operations Act 1997 (POEO Act) & Protection of the Environment Operations (General) Regulation 2009	
Section 43 Environment protection licences may be issued to authorise the carrying out of scheduled activities at any premises, as required under section 48. This clause applies to sewage treatment, meaning the operation of sewage treatment systems that involve the discharge or likely discharge of wastes or by-products to land or waters. The POEO Act provides a single licensing to reduce air, water, noise and waste management pollution.	Council has an EPA license for the sewage treatment plants. Refer to Section 6. Council has Pollution Incident Response Management Plans for all sewage treatment plants. No licence is required under Schedule 1 for water supply systems. However, should any chemical leakage, spill, disposal of wastes or similar impact on the environment, prosecution may be possible.
Work Health and Safety Act 2011 and WHS Regulation 2011	
To provide for a balanced and nationally consistent framework to secure the health and safety of workers and workplaces. Under the Act, for Workplace Management, Council has a duty to: – Identify hazards – Manage risks to health and safety – Implement, maintain and review risk control measures	Council has a Work Health and Safety Policy which "sets out the responsibilities for all staff" under the Work Health and Safety Act 2011 & the WHS Regulations. Compliance with WHS Act is required for storage and handling of chemicals on-site at Council's water supply and sewerage treatment facilities. Council undertakes regular WHS audits at the plants to ensure WHS management systems are up to date. Council's safe work method statement covers a range of water and sewer activities.
Fluoridation of Public Water Supplies Act (1957)	
This Act covers the addition of fluoride to public water supply under the NSW Fluoridation Code of Practice.	There are no issues with the fluoridation systems. Council has been assessed to meet the requirements of the Fluoridation Act and Regulations for each of the fluoridated water supply schemes. All operators are certified to operate fluoridation plants.

Key legislative framework	Council's current performance and future targets
Dams Safety Act 2015 (NSW) No 26	
Under this Act, the owner of any dam listed as a prescribed dam must meet the requirements of the NSW Dams Safety Committee (DSC). The DSC assigns dams a consequence category relative to their dam failure consequence, and this determines the level of reporting and type of actions required by the dam owner as part of their Safety Management System (SMS).	Bootawa Dam is declared a prescribed dam under the Dams Safety Act. Bootawa Dam Surveillance Report 2019 – actioning of recommendations made in the report ongoing. Council has a Dam Safety Emergency Plan (2014) for Bootawa Dam 2,275 ML.
Water Act 2007	
This Act has an objective to enable the Commonwealth, in conjunction with the Basin States, to manage the Basin water resources in the national interest.	Council reports water data for Bootawa, Bulahdelah, Stroud, Gloucester and Tea Gardens to the Bureau of Meteorology via an arrangement with WaterNSW.
Protection of the Environment Administration Act 1991	
This directive requires all Councils to prepare stormwater management plans on a local government basis. It aims to provide more effective management of urban stormwater thereby contributing to environment protection.	Council has Stormwater Management Plans (SMP) for the Taree and Bulahdelah. Taree SMP has not been updated since 2000 and will be the focus of prioritised renewals and augmentation works for the forward period.
Sec 210 (b) of the Local Land Services Act 2013 No 51	
The Catchment Management Authorities Act 2003 No 104 was repealed by sec 210 (b) of the Local Land Services Act 2013 No 51 with effect from 1.1.2014. Requirement for ongoing management plan. Promotes the coordination of activities within catchment areas. Under the provision of this Act, Local Catchment Management Authorities oversee this process in the region.	Council recently adopted the Manning River Estuary and Catchment Management Program 2021 - 2031.
Local Land Services Act 2013 and the Biodiversity Conservation Act 2016	
The Native Vegetation Act 2003 was repealed on 25 August 2017 and current legislation governing the clearing of native vegetation is the Local Land Services Act 2013 and the Biodiversity Conservation Act 2016. Regulates the clearing of native vegetation on all land in NSW, except for exclusions.	Council has a greening strategy.
Disability Discrimination Act 1992	
The Federal Disability Discrimination Act 1992 (D.D.A.) provides protection for everyone in Australia against discrimination based on disability.	Council has an Equal Employment Opportunity (EEO) Management Plan 2018 -2021.

3.2 Water and sewer services objectives and targets

DPE's objectives for LOS are defined as the following:

1. Target LOS are clearly defined and have taken account of the LWU's existing Strategic Business Plan (SBP).
2. Includes all issues from the LOS situation analysis.
3. Any warranted changes to the Target LOS are identified and explained.
4. Community consultation is essential on the proposed LOS in order to negotiate an appropriate balance between LOS and the required Typical Residential Bill.

Table 3.2 details Council's service objectives and targets for water supply and sewer services.

Table 3.2 Service objectives and targets

Key performance indicator	Service level characteristic	Performance measurement process	Target performance	Current performance	Meeting target (Yes/No)	Actions to meet performance target	Reason why LOS not met
Water supply							
Quantity	Average annual residential water demand	Expressed as kl/property, based on average across related communities	Less than 205kL per property/yr	148.5 kL per property/yr (2020/21 Performance Monitoring Report NSW	Yes	-	-
Quantity	Peak daily water demand (PDD)	Expressed as ML/property, based on highest recorded usage day in the year	Less than 1.5 ML per property	1.4 ML/property	Yes	-	-
Quantity	Non-Revenue Water (Leakage and unaccounted usage)	Expressed as a percentage of total treated water delivered from the various WTP's.	Less than 10%	Above 10%	No	Leakage reduction and pressure management	High network pressures and aging infrastructure
Quality	Good quality drinking water	Water quality to meet 2011 Australian Drinking Water Guidelines (ADWG)	E.coli 100% Chemical 100%	E.coli 100% Chemical 100% (2020/21 Performance Monitoring Report NSW	Yes	-	-
Supply of service	Plenty of notice before a customer has an interruption to service	24-hour notice prior to any planned service interruption	24 Hours	>24 Hours	Yes	-	-
Supply of service	Limit the number of properties affected by long unplanned shutdowns	No of properties that will experience an unplanned interruption of more than 5 hours in a financial year	No more than 1,000 properties a year	Unknown	-	Fill data gap, collect data	Council doesn't collect data currently on the number/type of properties affected in unplanned interruptions
Supply of service	Limit the number of mains breaks per section of pipe	Number of mains breaks	8/100km (Industry NSW, 2020)	15/100km (2020/21 Performance Monitoring Report NSW)	No	Pressure management and renewals programs	High pressure, aging network and ground conditions
Responsive-ness	Any interruption is restored in a timely manner	Any interruption to service be restored within nominated time frame	4 hours	Certain interruptions are impossible to rectify within 4 hrs	No	Fill data gap, collect data	Large service area, Council doesn't currently collect data on response times
Responsive-ness	Any new meter requests are installed in a timely manner	Install new water meters in the agreed timeframe	<10 working days after receipt of payments	10 working days	Yes	-	-

Key performance indicator	Service level characteristic	Performance measurement process	Target performance	Current performance	Meeting target (Yes/No)	Actions to meet performance target	Reason why LOS not met
System Reliability	Pump reliability	Main pump standby facility	100% standby over 22-hour pumping per day	All have standby	Yes	-	-
Asset Reliability	Assets are maintained at an acceptable level in order to provide quality and uninterrupted services	Service score of assets as recorded through MyPredictor assessment process	Service score 3 or less (scale 1-5)	On average, with current budgets, a service score of 3.2 will be maintained	No	Increase funding allocation for renewal where possible	Historical underinvestment in renewals
Safety	Continuity of required flow from fire hoses	Fire flows measured in L/s for all hydrants	Fire flows of 10 L/s can be supplied to all hydrants (20 L/s to commercial and industrial outlets)	Unknown	Unknown	Hydraulic modelling of fire flows for existing and new developments	Data gap
Customer satisfaction	Water supply service complaints/1000 customers	Community is satisfied with current water services	Result of customer satisfaction survey measured as a percentage of overall satisfaction with services	90%	Yes	-	-
Customer satisfaction	Water supply service complaints/ 1000 customers	Understand the level of satisfaction through the number of complaints made by customers as detailed in the SoE	4/1000 customers State median	1/1000 customers	Yes	-	-
Customer satisfaction	Water quality complaints/ 1000 customers	Log customer complaints in CMS and report annually.	State median 4/1000 customers	2/1000 customers	Yes	-	-
Customer satisfaction	Capital and operating costs	Average residential water service bill ($/yr)	$1,414/yr Weighted Average (Industry NSW, 2020)	$1,842/yr. Higher then weighted average.	No	Increased efficiencies	Low density of customers per kilometre of network
Sewer service							
Compliance	Compliance to License Concentration Limits	% of effluent samples compliant with licence concentration limits	100%	78% (2020/21 Performance Monitoring Report NSW)	No	STP upgrades identified	Certain treatment processes in STPs unable to accommodate peak tourist loads.
Environment	Treated Effluent Reused	% of treated effluent that is recycled	20% (2011/12)	7.85% (2020/21 Performance Monitoring Report NSW)	No	On average, Council recycled 25% of treated effluent	Above average rainfall year

Key performance indicator	Service level characteristic	Performance measurement process	Target performance	Current performance	Meeting target (Yes/No)	Actions to meet performance target	Reason why LOS not met
Service standards	Sewage Collection	All sewage deposited in the system is to be directed to treatment facilities. All unintentional discharges to be monitored and cause determined.	100% Compliance (LOS Agreement)	Unknown	No	Council keeps records of all dry weather overflows; all are reported to the EPA Improve record keeping	Wet weather overflows
Environment	Dry weather sewer discharges	Number of dry weather sewer overflow expressed in event per 100km of pipe installed.	100% State median 15/100 km	2.26/100km (2020/21 Performance Monitoring Report NSW)	Yes	-	-
Environment	Wet weather sewer discharges	Number and extent of wet weather sewer overflow.	100% measure and report.	26	-	-	-
System capacity	The system is to be able to cope with flow equivalent to 800% of the Average Dry Weather Flow (ADWF) based on 210L/EP/Day connected.	A ratio that details theoretical number of properties able to be serviced at nominated flows compared with actual number of property connections.	Greater than 8 (LOS Agreement)	Unknown	No	Council has a dedicated Inflow and Infiltration team	Illegal connections and infiltration of stormwater
Sewer reliability	The collection system is to have 100% standby capacity for pumping transfer of effluent in the various catchments, so that in the event of a single pump failure alternate pumping capability is available	Percentage of pump stations with more than 100% standby capacity.	100% (LOS Agreement)	100%	Yes	-	-

Key performance indicator	Service level characteristic	Performance measurement process	Target performance	Current performance	Meeting target (Yes/No)	Actions to meet performance target	Reason why LOS not met
Sewer system robustness	The system is to have storage for a minimum of four hours of average dry weather flow in the event of failure of the pump network or loss of power. (Including upstream pumped inputs from other catchments)	Percentage of pump stations with wet weather storage capacity greater than 4 hours of anticipated average dry weather flow.	100% (LOS Agreement)	86%	No	Risk and criticality assessment of response times with vacuum truck	Catchment development
Customer satisfaction	Odour Complaints	Number of odour complaints per 1000 properties	State Median 1/1000 properties	1/1000 Properties (2020/21 Performance Monitoring Report NSW)	Yes	-	-
Customer satisfaction	Sewerage Service Complaints	Number of service complaints per 1000 properties	State Median 4.74/1000 properties	1.23/1000 Properties (2020/21 Performance Monitoring Report NSW)	Yes	-	-
Performance	Sewer Main Breaks and Chokes	Number of sewer main breaks and chokes per 100km	State Median 29.92/100km	21/100km (2020/21 Performance Monitoring Report NSW)	Yes	-	-
Customer satisfaction	Customer Satisfaction for Sewerage Services	Percentage of satisfied customers	90% (2016)	92% (2009/10)	Yes	-	-
Affordable cost	Cost of sewerage services	Average residential sewerage service bill ($/yr)	State Median $795.62 / yr / connection	$1,019 / yr / connection (2020/21 Performance Monitoring Report	No	Increased efficiencies	Low density of customers per kilometre of network

4. Water supply

4.1 Water catchments

The three water catchments within in the Council LGA are the Manning, Karuah River and Great Lakes. Remote sections of the upper Manning catchment extend beyond Council ‘s boundary and are within the LGAs of Walcha, Tamworth, Upper Hunter Shire and Port Macquarie Hastings Councils. A small section of the Karuah catchment also falls within Dungog Council.

A map of the water catchments is shown in Figure 4-1.

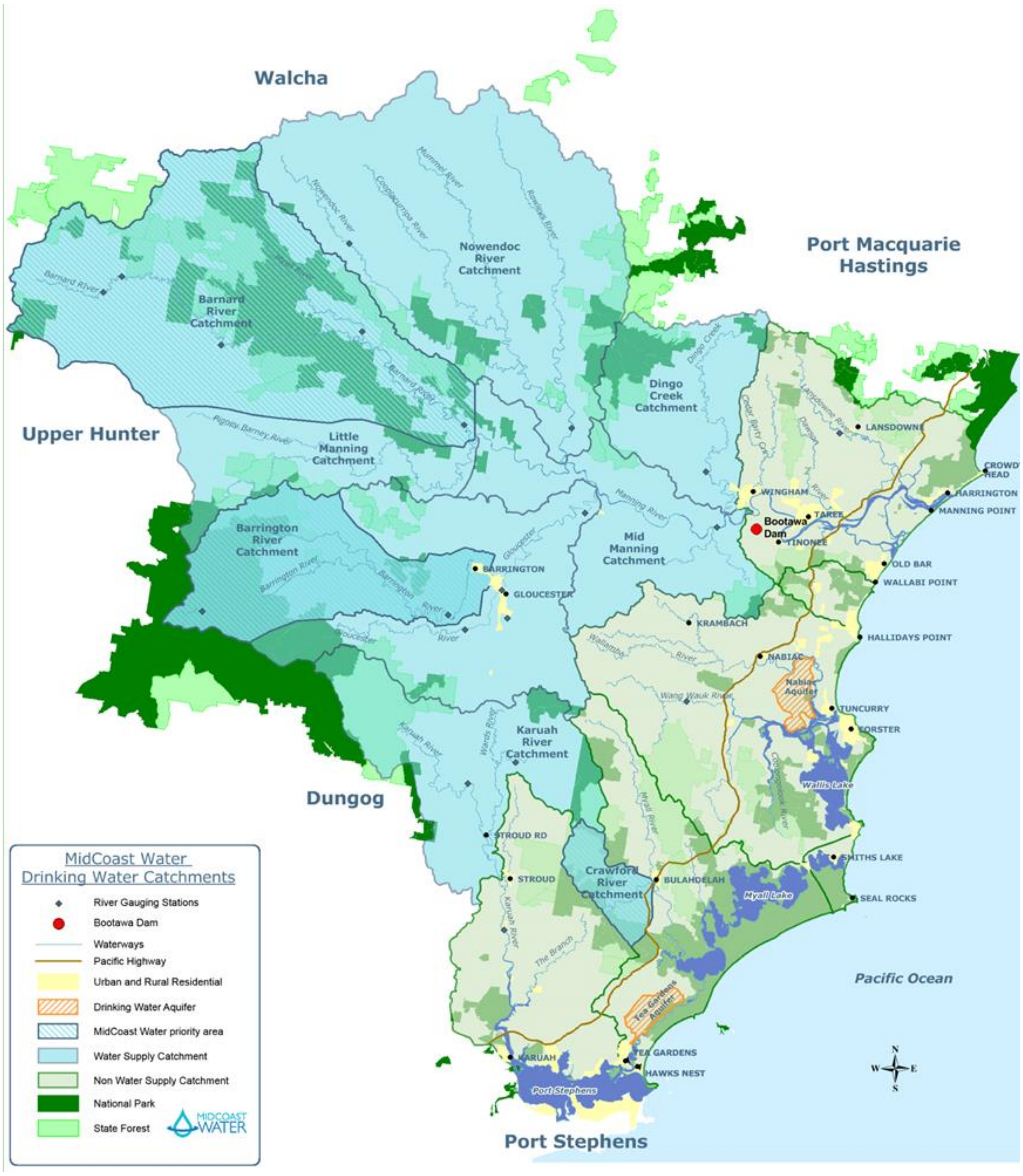


Figure 4-1 Water catchments

4.2 Water licensing

Council holds a number of water extraction licences for its water supply, as detailed in Table 4.1.

Table 4.1 Council water access licences

Licence No.	Water supply system	Water source	Entitlement (ML/annum)
20AL21249 20AL212488 20PT912027	Manning	Manning River Estuary Nabiac Bore 1 to 14	3,000 570 3650
20AL212467 20AL212465 20BL126346 20BL168799 20AL211158	Gloucester	Barrington River	567 34 50 30 150
20AL205133	Bulahdelah	Crawford River	221
20AL200003	Stroud	Karuah River Water Source / Karuah River and all tributaries that enter downstream of the Booral flow monitoring site	320
20AL218665	Tea Gardens	Viney Creek Aquifer	1300

Notes:

1. North Karuah bulk water is supplied by Hunter Water.

4.3 Water requirements and operating rules

4.3.1 Releases

The Council Water System release conditions are provided in Table 4.2.

Table 4.2 System release conditions

System	Release condition
Bulahdelah	No releases required
Stroud	No pumping allowed when flow <3.5 ML/d on a falling river level No pumping allowed when flow < 5 ML/d on a rising river level 1.5 ML/d pumping allowed when flow 5-18 ML/d on a rising river level 1.5 ML/d pumping when flow 3.5 – 18 ML/d on a falling river level 2.2 ML/d pumping allowed when flow > 18 ML/d Flow based on gauge station 209003 Karuah River at Booral
Gloucester	No releases required
Manning	No pumping allowed when flow < 30 ML/d at offtake (increases to 98 ML/d for proposed raised Bootawa Dam) at offtake (after allowing for irrigation)

4.3.2 Irrigation

Irrigation release requirements are explicit to the Gloucester and Manning. These are provided in Table 4.3.The daily flows at the Gloucester offtake available for pumping were reduced by the irrigation release requirements. The daily flows at the Manning River intake available for water supply extraction were reduced by the irrigation releases requirements to account and allow for upstream and downstream irrigation requirements.

Table 4.3 Irrigation release requirements

System	Irrigation release requirement ML/d											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gloucester	23.39	20.04	21.42	12.97	8.00	7.56	10.10	9.45	16.65	18.91	22.78	32.75
Manning	53.5	49.6	42.3	29.6	10.0	7.4	7.9	12.7	27.5	44.1	52.1	57.2

4.3.3 Operating rules

The Council Water System Operating Rules are summaries in Table 4.4.

Table 4.4 Operating rules

<table>
<tr><th>System</th><th>Release condition</th></tr>
<tr><td>Bulahdelah</td><td>Water pumped from river to storage to supply.</td></tr>
<tr><td>Stroud</td><td>Water pumped from river storage (after meeting release requirements) to off-stream storage (to keep full as possible) to supply. If flow greater than 375 ML/d at g/s then no pumping from river due to turbidity (20 NTU limit).</td></tr>
<tr><td>Gloucester</td><td>Water pumped from river (after meeting irrigation release requirements) to nominal storage to supply.
For the proposed off stream storages pumping from river not allowed when flow > 3000 ML/d (at g/s 208006 Barrington River at Forbesdale) due to turbidity.</td></tr>
<tr><td>Manning</td><td>Water is extracted from Manning River (after meeting release requirements) to meet demand from the river or Bootawa Dam and to keep storage as full as possible.
Raw water can either be pumped straight to the Bootawa WTP for direct treatment or stored in the Bootawa Dam off stream storage.
No pumping from the river occurs when the flow is > than 10,000ML/d at the intake due to turbidity (50 NTU limit).
When flow > 1000 ML/d no water is transferred to the Bootawa storage due to expected phosphorous levels however water is still transferred direct to the WTP to meet demand.
Pumping occurs from the Nabiac Inland Dune Aquifer to meet demand subject to the following:
<table>
<tr><th>Condition</th><th>Rainfall over past 6 months</th><th>Daily Extraction ML/d</th></tr>
<tr><td>Wet period</td><td>> 600 mm</td><td>10</td></tr>
<tr><td>Average period</td><td>400 – 600 mm</td><td>8</td></tr>
<tr><td>Dry period</td><td>< 400 mm</td><td>6</td></tr>
</table>
Rainfall measured at BOM station 60013 Forster –Tuncurry Marine Rescue
Note: Conditions are currently under discussion / investigation to be updated.</td></tr>
</table>

Source: Various Council water supply strategies 2016

4.4 Water supply schemes

Within the three water catchments, are six water supply schemes:

- Manning supply scheme
- Tea Gardens supply scheme
- Bulahdelah supply scheme
- Stroud supply scheme
- Gloucester supply scheme
- North Karuah supply scheme

A summary of the schemes is shown in Table 4.5.

Table 4.5 Description of water supply systems

Water supply system	Source water/catchment	Treatment process	Towns supplied	2020 Population served
Manning	Manning River	Selective pumping, retention and sedimentation in Bootawa Dam, screening, water stabilisation, coagulation, microfiltration, ozonation, biologically activated carbon (BAC) filtration, chlorination, fluoridation	Taree, Forster, Tuncurry, Hallidays Point, Wingham, Pacific Palms, Smiths Lake, Old Bar, Harrington, Coopernook, Crowdy Head, Cundletown, Krambach, Nabiac, Failford, Lansdowne, Manning Point, Tinonee and Green Point.	73,388
	Nabiac Inland Dune Aquifer	Water stabilisation, aeration, coagulation, microfiltration, chlorination, fluoridation		
Tea Gardens	Viney Creek Aquifer	Water stabilisation, aeration, coagulation, microfiltration, pH correction, chlorination, fluoridation	Tea Gardens and Hawks Nest	5,536
Gloucester	Barrington River	pH correction, coagulation, sedimentation, sand filtration, chlorination, fluoridation.	Gloucester and Barrington	3,740
Bulahdelah	Crawford River	pH correction coagulation, sedimentation, sand filtration, chlorination, fluoridation.	Bulahdelah	1,343
Stroud	Karuah River	Selective pumping, coagulation, sedimentation, off river storage, secondary coagulation, sand filtration, chlorination, fluoridation	Stroud and Stroud Road	1,200
North Karuah	Bulk water supplied by Hunter Water – Tomogo Borefields	Aeration, coagulation, filtration, pH correction, fluoridation, chlorination. Treated by Hunter Water at Lemon Tree Passage WTP.	North Karuah	76

These schemes are further detailed in Sections 4.4.1 to 4.4.6.

4.4.1 Manning water supply scheme

A schematic diagram of the Manning water supply scheme is shown in Figure 4-2.

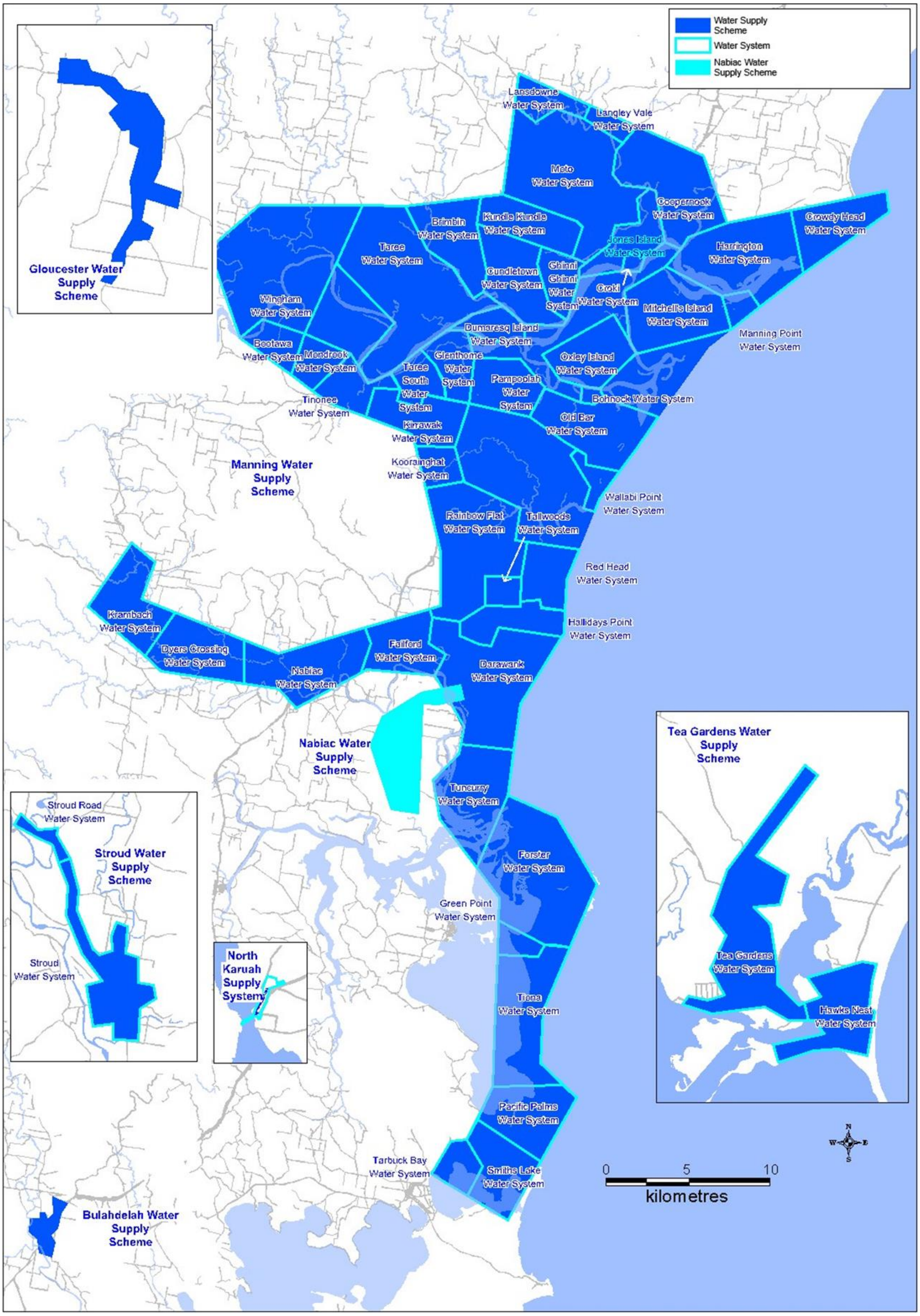


Figure 4-2 Manning water supply scheme overview

The Manning River catchment spans from Crowdy Head to Smiths Lake. The Manning Scheme contains WTP's:

– Bootawa WTP, built in 2010
– Nabiac WTP, commissioned in 2018

The major components of the Manning scheme include:

– Manning River intake and pumping station (PS1A) at Bootawa
– Old intake and pump station at Abbotts Falls (decommissioned)
– Bootawa Dam, 2250 ML capacity
– Bootawa WTP 60 ML/day capacity
– Bootawa treated water pump station (PS2B)
– 14 production bores at Nabiac Inland Dune Aquifer (commissioned 2018)
– Nabiac WTP 12 ML/day capacity
– Nabiac treated water pump station (commissioned 2018)
– Darawank balance tank and pump station (commissioned 2018)

Manning Water Supply Scheme currently serves a population of approximately 73 388, which increases to approximately 80 000 during the holiday months.

4.4.1.1 Raw water source

4.4.1.1.1 Bootawa WTP water source

Raw water is pumped from the Manning River and stored in Bootawa Dam. It is treated at Bootawa WTP and distributed as part of the Manning water scheme The Manning River catchment forms part of the traditional land of the Biripi and Geawegai people.

Bootawa WTP has three modes of raw water operation:

– Mode 1 (Manning River water turbidity <5 NTU). Water from Manning River is pumped by raw water pumps into Bootawa Dam. Water is gravity fed to the WTP.
– Mode 2 (Manning River water turbidity >5 NTU and <50 NTU). Raw water pumps transfer river water to a raw water balance tank, where it gravitates back to the inlet of the WTP.
– Mode 3 (Manning River water turbidity >50 NTU. Also dependent on phosphorus levels). Water is pumped from Bootawa Dam directly to the WTP with no water being pumped into the dam.

4.4.1.1.2 Nabiac WTP water source

The Nabiac Inland Dune Aquifer Scheme has been designed for the sustainable extraction of up to 10 ML/d from the Nabiac Inland Dune Aquifer and then treated at Nabiac WTP. The Nabiac Inland Dune Aquifer forms part of the traditional land of the Worimi and Biripi people.

Water is extracted from 14 groundwater bores in the Nabiac Inland Dune Aquifer. The bores tap the aquifer between 10 and 25 m below the surface and can yield up to 23 L/s. Pump stations transfer water to the header main and then on to the WTP. All pumps can supply a modelled maximum of 164 L/s with the target WTP flow of 138 L/s. The overall WTP production or daily raw water supply of 6, 8 or 10 ML is based on historical rainfall, groundwater levels and potential saline intrusion. The bore field pumps will operate based on a demand signal from the WTP to maintain a level in the raw water pre-treatment tank.

Refer to Section 4.4.1.1.2 for current development in the Nabiac water supply scheme.

4.4.1.2 Treatment

4.4.1.2.1 Bootwa WTP treatment

Bootawa WTP is a membrane filtration plant which currently has the capacity to treat 60 ML/day. The WTP has provision to be upgraded to a capacity of 75 ML/day in the future.

The treatment process is outlined as followed:

Stabilisation

Prior to screening, raw water is conditioned using lime and carbon dioxide for pH and alkalinity adjustment ensuring stable treated water that is not potentially corrosive to the distribution system. Lime slurry is dosed just after the plant inlet to maximise the contact time ensuring complete reaction prior to carbon dioxide dosing. Carbon dioxide (dissolved into a side stream of raw water) is injected after lime, prior to coagulation.

Screening

Pre-dosed water is screened before entering the flash mixing tank to remove large particles which could damage the filtration membranes. A rotating drum screen with 2 mm screen apertures captures solids into a small waste bin.

Coagulation (flash mixing)

Screened water is dosed with coagulant Aluminium Chlorohydrate (ACH) which is vigorously mixed by a vertical mixer in the flash mixing tank. ACH assists in the removal of colloidal and suspended particulates from the raw water by destabilising the particles allowing them to aggregate for removal in the membrane filtration stage.

Flocculation

The dosed water then flows into the inlet channel which provides gentle mixing and required contact time for the coagulated suspended particles to agglomerate and form flocs. These flocs are then easily removed in the membrane filtration phase.

Membrane filtration

The flocculated water flows along the membrane inlet channel where it enters under gravity the four micro-filtration cells (with provision for five in the future). Each cell operates identically and in parallel. Feedwater enters the bottom of each cell and passes over and around the micro-porous hollow fibre membranes. Clean water is drawn through the membrane wall by suction pressure into the center of each membrane fibre. Filtered water (filtrate) flows from the top of each module rack to the filtrate manifold into a common treated water outlet and passes to storage. The membranes provide a physical barrier for organisms such as Cyanobacteria (Blue Green Algae) and protozoa (e.g. Cryptosporidium parvum and Giardia intestinalis).

Cleaning and maintenance of the membranes is carried out routinely in various ways. Frequency of the different cleaning methods depends on raw water quality and the type of fouling. Backwash removes retained solids from membrane surfaces with the use of pumps and air scour blowers. Clean in Place (CIP) is required to maintain long term membrane performance and uses cleaning chemicals, including hypochlorite and acid cleaners, and soaking the membranes. Chemically Enhanced Backwash (CEBW) is similar to CIP but with reduced step times and no extended soaking. Compressed air is used for integrity testing and valve operation. Membrane integrity is also monitored via. the automatic pressure decay test and leak test and is trended on the Supervisory Control and Data Acquisition (SCADA) system. Filtrate from the membrane filters flows into the clear water tank which has two compartments. The main compartment is utilised for provision of backwash water for membrane filters, BAC filters, CIP make up water and ozone generation cooling water. Water from the second compartment of the clear water tank gravitates to the ozone contact tank. The ozone and BAC processes can be bypassed if not required.

Ozonation

Filtered water is treated with ozone which breaks down taste and odour-causing compounds (e.g. MIB and geosmin, associated with algae). It is also effective against bacteria (e.g. Escherichia. coli (E. coli)) and viruses). Ozone gas is generated on site and dosed via. diffusers configured in a 'baffle' arrangement in the two-stage ozone contact tank. This provides sufficient contact time to treat taste and odour compounds. Gas flow is adjusted with valves to meet water quality requirements. Water then gravitates over a weir at the outlet of the contact tank to ensure no residual ozone remains in solution at the end of the process stage.

Biologically activated carbon filters

The ozonised water then flows via gravity to BAC filters. In conjunction with ozonation, the BAC filters remove total organic carbon (TOC) and other organics which can contribute to taste and odour problems. The BAC filtration process uses naturally occurring micro-organisms to remove organics via bio-assimilation. The organic matter is readily assimilated due to ozone having broken the chemicals into readily consumable forms.

Filtered water flows out of the bottom of the tank. Media is cleared periodically to remove organics and excess biogrowth with backwashing and air scouring. Backwash water is discharged into the wastewater balance tank.

Chlorine contact tank

The BAC filtered water flows under gravity to the chlorine contact tank (CCT). Water is dosed at the inlet with chlorine gas for disinfection of pathogens (disease causing organisms such as E. coli bacteria) and fluoride (sodium silicofluoride) is added for dental hygiene. The tank consists of two long chicanes which promote plug flow ensuring a minimum of 30 minutes contact time. Chlorine is dosed at a level high enough to maintain a residual throughout the distribution system.

Treated Water Reservoir

Water passes over the outlet weir and through an underground pipe to the 8.5 ML treated water reservoir.

Soda ash (sodium carbonate) can be dosed into the water at the weir exiting the chlorine contact tank (if required) to correct the final water pH to ensure the water meets the treated water quality and corrosivity requirements.

The treated water is then pumped via. the treated water pumping station (PS2B) to the distribution system.

The WTP is automatically controlled using Programmable Logic Controllers (PLC) and SCADA systems. These systems allow operators to control the plant remotely as well as record data for all treatment processes.

A schematic diagram of the Manning water treatment process is shown in Figure 4-3

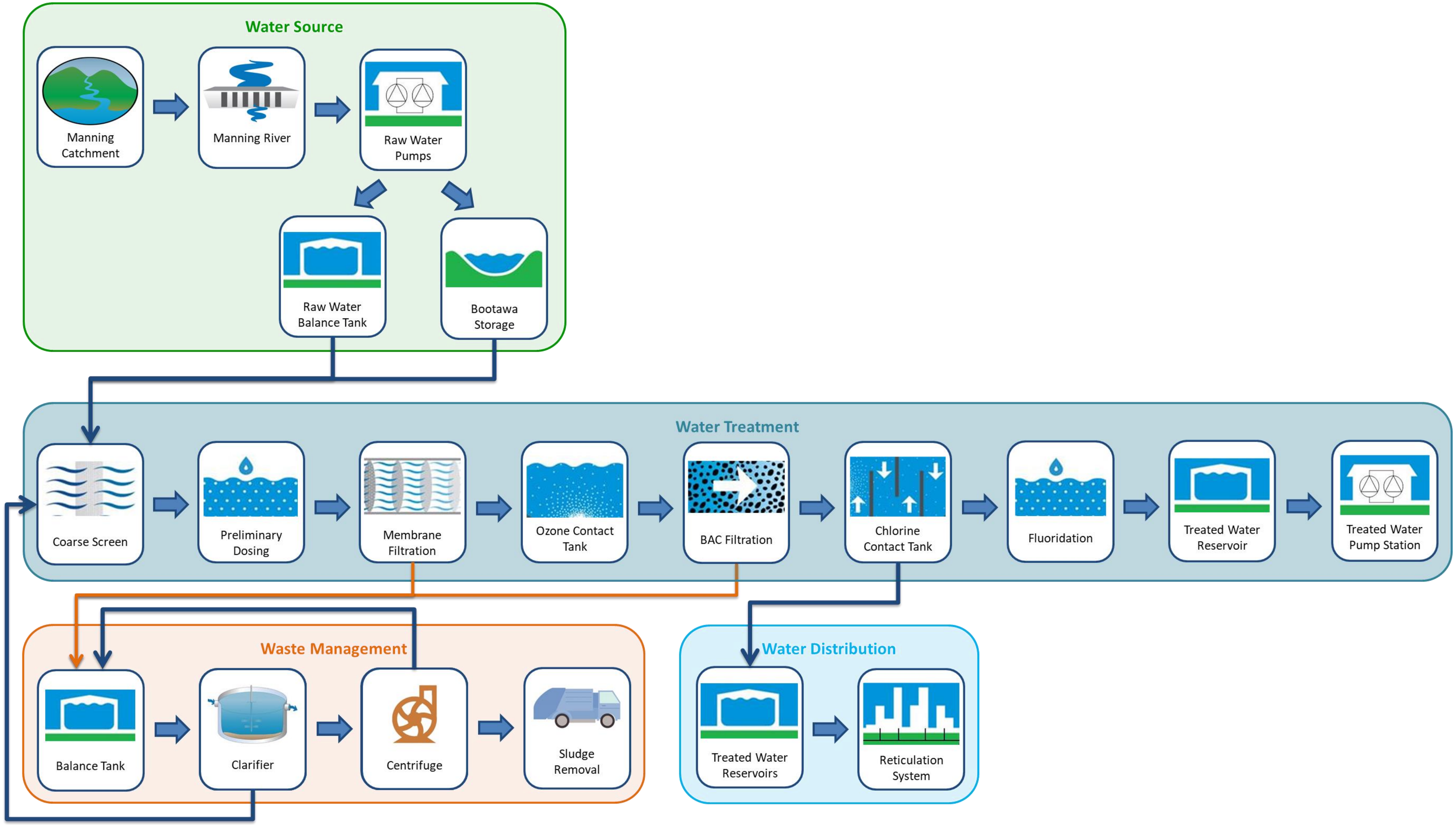


Figure 4-3 Bootawa WTP process schematic

4.4.1.2.2 Nabiac WTP treatment

The current production capacity of the Nabiac WTP is 10 ML/d over 22 hours with a hydraulic capacity of 12 ML/d. The design makes provision for future expansion of the production capacity to 24 ML/d.

Stage 2 upgrade for the Nabiac WTP is currently being undertaken. This will increase the Nabiac WTP capacity to 18 ML/d.

The Nabiac WTP consists of the following treatment processes:

Pre-treatment chemicals

Pre-treatment chemicals are dosed prior to water entering the aeration towers. Lime slurry is dosed to the raw water via two dosing pumps to increase the naturally low pH and low calcium hardness of groundwater. This increases effectiveness of coagulation. The WTP has been designed to cater for future dosing of carbon dioxide (CO_2).

Aeration tower

Pre-dosed water flows through a single aeration tower. Water is sprayed continuously on the top surface of packing media in the tower through a series of trays and weirs arranged to provide even flow over the area of packing media. A fan is installed adjacent to the tower to deliver a forced air flow into the bottom of the tower and upwards through the packing material to form a counter-current to water flow. Water reaches dissolved oxygen saturation, assisting oxidation of dissolved aluminium and iron. The aeration process also removes excess CO_2 and hydrogen sulphide. The water from the packed aeration tower will be collected in a sump and transferred into the pre-treatment tank. Coagulant (ACH) is added in line between the aeration tower sump and the pre-treatment tank with rapid mixing through an in-line static mixer. As a precautionary measure, chlorine gas dosing is also available to dose prior to the pre-treatment tank for improved oxidation of soluble metals. However, this is not considered best practice as it may increase the likelihood of undesirable chlorine by-products (trihalomethanes) in the treated water.

The WTP design has allowed for future dosing of potassium permanganate between the aeration tower and pre-treatment tank for improved oxidation if required. The aeration tower has been designed to enable chemical cleaning of the packed media. Citric acid dosed treated water is batched and distributed over the media to remove any iron or lime deposits to ensure efficient oxidation process and protect media.

Pre-treatment tank

Pre-treated water is stored in a single 400 kL tank (Stage 1) before being pumped to the membrane filtration system. The tank provides contact time for coagulant (ACH) allowing optimal coagulation as well as retention time for oxidation. It also provides a location to buffer the return of secondary membrane filtrate. Chlorine gas dosing is available to assist with oxidation of soluble metals, in particular iron, if considered necessary. Water in the tanks is mixed to maintain oxidised constituents in suspension and prevent sedimentation. The mixer is low energy to promote flocculation. The pre-treatment tank has been sized for Stage 1 of the WTP operation (12 ML/day). An additional tank will be required for construction for ultimate plant capacity of 24 ML/day (Stage 2).

Primary filtration

From the pre-treatment tank, water passes through two primary filters (disk filtration system and Arkal pod filters), prior to entering the membrane microfiltration system. These filters remove larger particles, such as sand, which could damage membranes.

Membrane filtration

The microfiltration system includes two filter racks with 48 modules per rack. Each eight-inch module has a pore size of 0.1-micron hollow fibres. As feed water travels through the filter, contaminants are separated from the water and accumulate on the outer wall of the fibre. Feedwater enters the bottom of each cell and passes over and around the microporous hollow fibre membranes. Clean water is drawn through the membrane wall by pressure from feed pumps into the centre of each membrane fibre. Filtered water (filtrate) flows from the top of each module rack to the filtrate manifold into a common treated water outlet and passes to the next stage of treatment.

Membranes provide a physical barrier for organisms such as protozoa (e.g. *Cryptosporidium parvum*, *Giardia intestinalis*). Compressed air is used for daily integrity testing and valve operation. Membrane integrity is also monitored via automatic pressure decay test and leak test and is trended on SCADA system.

The microfiltration system can be bypassed. This would only occur under emergency situations and would require extra barriers and monitoring to ensure water quality is suitable.

Post treatment chemicals

Filtrate (treated water) from the microfiltration system is dosed with gas chlorination for disinfection. Chlorine is injected into the filtered water after membrane filtration prior to the treated water reservoir. The filtered water may have a chlorine residual from pre-treatment chlorination. Chlorine dosing will be designed to add up to 5 mg/L. This is controlled using a flow meter on the filtered water line and feedback control using an on-line chlorine analyser.

Fluoride (sodium fluoride) is added to treated water for dental hygiene. Fluoride dosing is controlled using a flow meter on the filtered water line and feedback control using an on-line fluoride analyser. Output targets a finished water fluoride level of 1 mg/L.

Treated water reservoir

Treated water is stored in the treated water reservoir (TWR) at the WTP with a useable capacity of 7 ML. The overall size of the reservoir is 9.5 ML with additional storage used for firefighting and site water services. This provides chlorine contact time and acts as balance tank prior to transfer pumps which pump water to Darawank Pump Station and into the Manning reticulation system.

The transfer rate of treated water to Darawank Balance Tank is to match the transfer of water from Darawank Pump Station to the Manning reticulation system. This is between 152 L/S and 505 L/S. The plant is also designed for efficiencies where some transfer can be initially undertaken by gravity at low flows.

For Stage 2 of the Nabiac WTP, an additional treated water reservoir will be required.

Wastewater management

There are three primary waste streams at the WTP:

– Secondary membrane filter backwash
– Raw water strainers (Arkal filters) backwash
– Neutralised waste (primary membrane cleaning/backwashing and aeration tower cleaning waste)
– A fourth stream could potentially be generated from CIP of aeration tower

The first waste stream is generated when the membranes are backwashed with final treated water. The waste stream and water recovered from backwashing is collected and filtered through a secondary membrane filtration system (known as AP3). The AP3 system is the same as larger scale membrane filters used in the water treatment process and increases overall recovery rate from the water treatment process. The AP3 system consists of five modules with hollow fibre pore size of 0.1 micron, with additional space for a further five modules for Stage 2. The AP3 system requires the same cleaning process as the primary membrane with backwashing, CIP and EFM.

Backwashing or reverse filtration removes retained solids from membrane surfaces with the use of pumps and air scour blowers. CIP is required to maintain long term membrane performance and uses cleaning chemicals including sodium hypochlorite, sodium hydroxide and citric acid cleaners, as well as soaking the membranes. EFM is also used. Compressed air is used for daily integrity testing and valve operation. Membrane integrity is also monitored via. automatic pressure decay tests and leak tests and is trended on SCADA system.

The AP3 filtrate is pumped back to the pre-treatment tank which reduces overall wastewater of the plant. The waste stream produced by the AP3 is sent to the waste tanks, trade waste pit and wastewater pump station to be pumped to the sewer system at Nabiac. The waste tanks act as a detention system for the wastewater pump station to pump low flows into Nabiac sewer system.

The second waste stream is produced from backwash water of the raw water strainers (Arkal filters) which is drained directly to the trade waste pit and wastewater pump station with no chemical cleaning or neutralisation required.

The third waste stream is generated by cleaning processes which use chemicals (CIP and EFM) from cleaning the membrane and AP3 systems as well as the aeration tower cleaning process. All the water is collected in the neutralisation tank. Further chemical treatment to correct pH takes place in this tank (using either sodium hydroxide or sodium metabisulphite) before waste is discharged to the waste tanks, trade waste pit and wastewater pump station to be pumped to the sewer system at Nabiac.

Waste is monitored from the trade waste pit to comply with trade waste licence conditions.

The typical daily waste is expected to be around 100 kL, however this can be variable due to the types of cleaning process. The wastewater pump station can also operate in emergency mode if the AP3 is offline with no wastewater recovery available.

A schematic diagram of the Nabiac WTP process is shown in Figure 4-4.

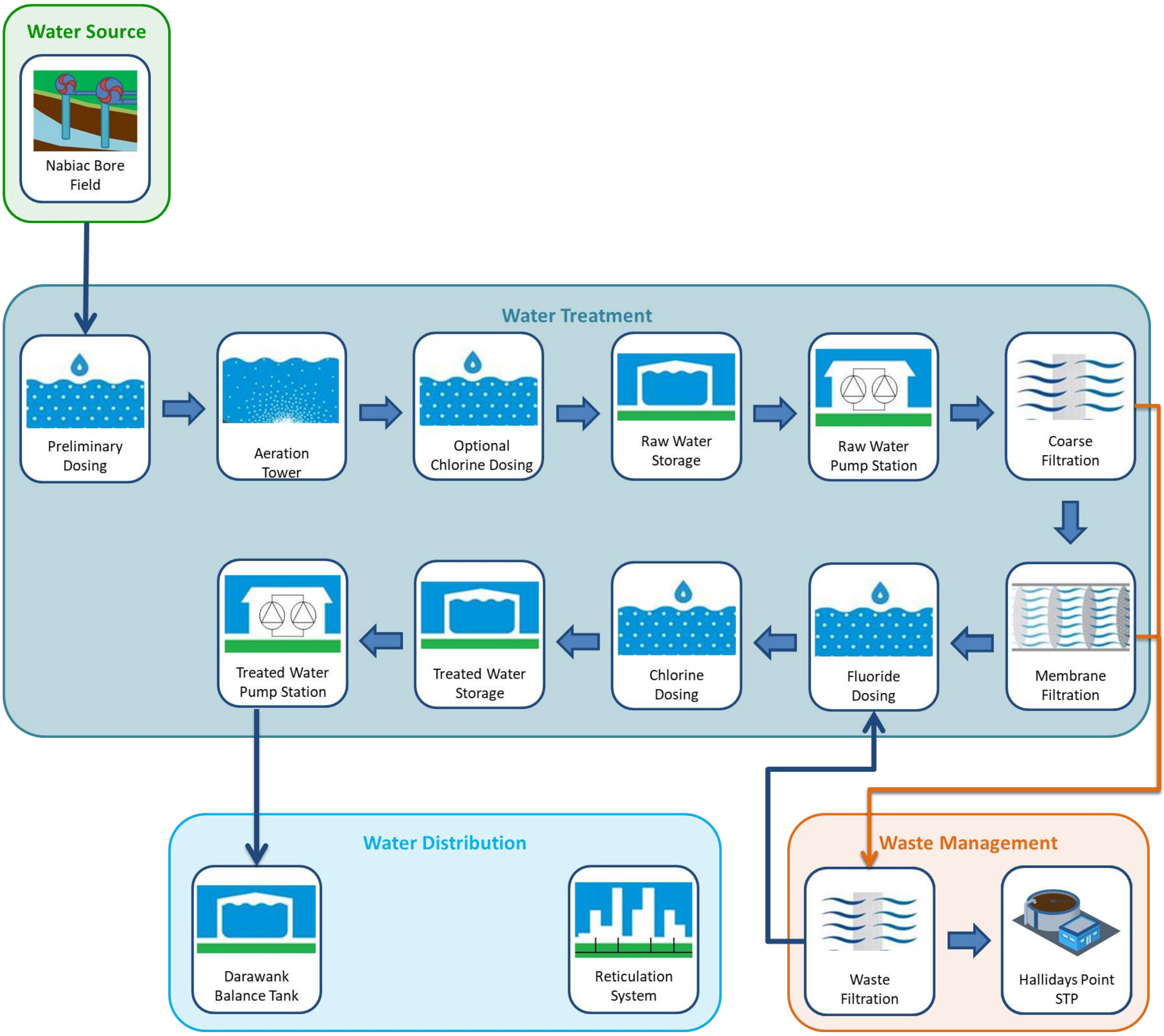


Figure 4-4 Nabiac WTP process schematic

4.4.1.3 Distribution

The Manning water Supply scheme serves the areas of Taree, Forster, Tuncurry, Hallidays Point, Wingham, Pacific Palms, Smiths Lake, Old Bar, Harrington, Coopernook, Crowdy Head, Cundletown, Krambach, Nabiac, Failford, Lansdowne, Manning Point, Tinonee and Green Point. Figure 4-5 displays the Manning Water Supply Scheme distribution schematic.

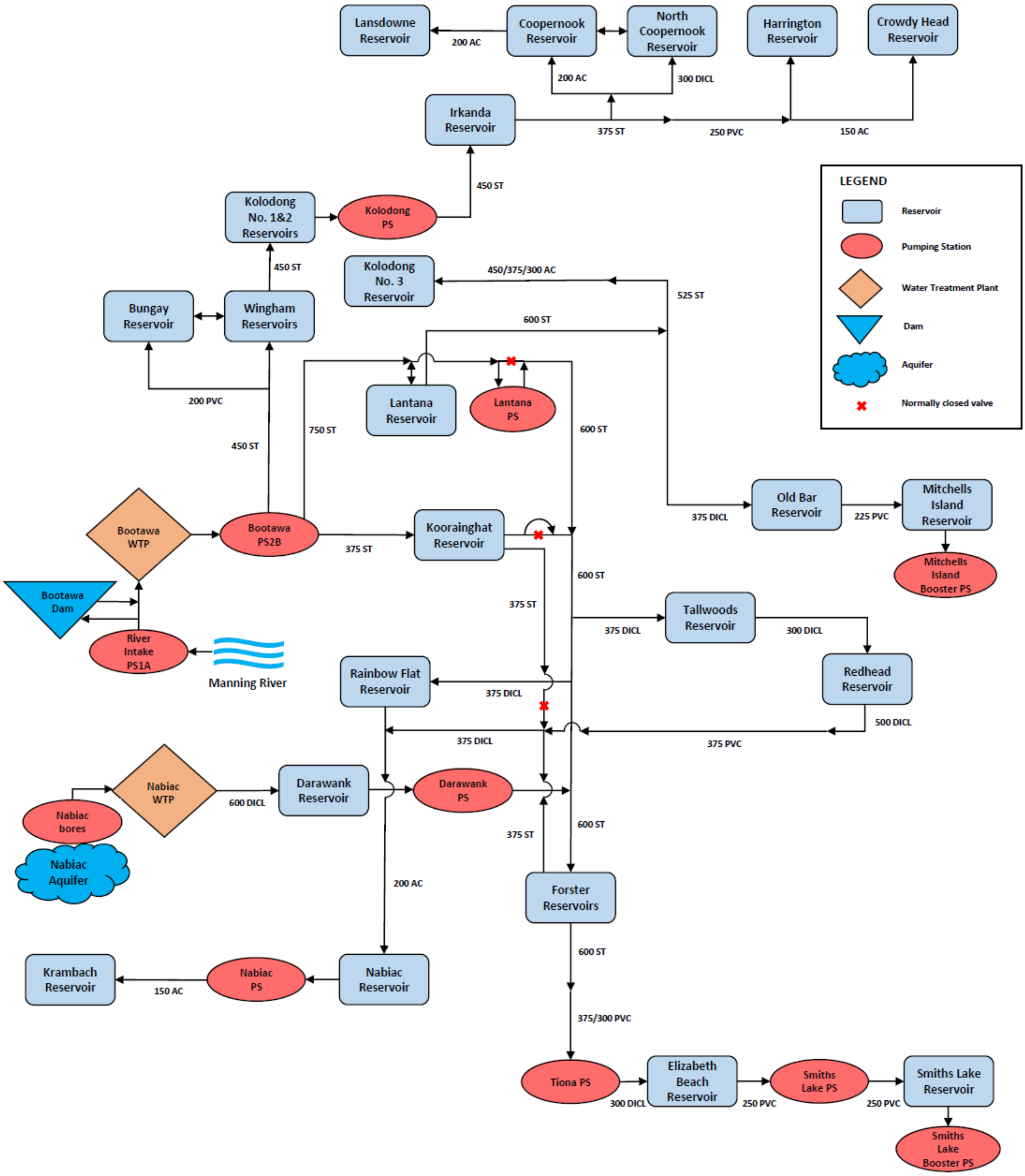


Figure 4-5 Manning water supply system schematic plan

4.4.2 Tea Gardens water supply scheme

A schematic diagram of the Tea Gardens water supply scheme is shown in ***Figure 4-6***.

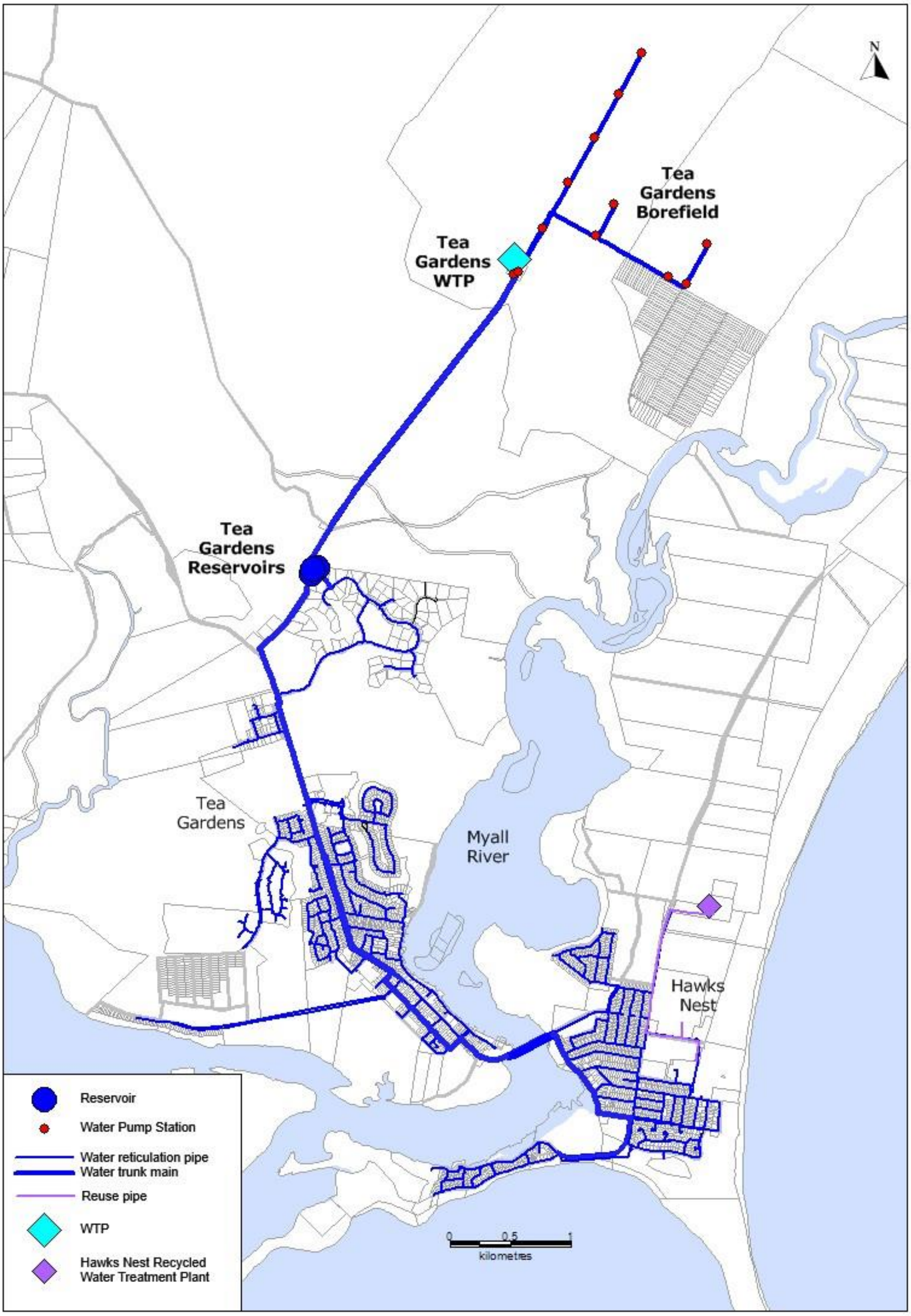


Figure 4-6 Tea Garden water supply scheme overview

4.4.2.1 Raw water source

The Tea Gardens WTP raw water is sourced from 10 bores within the Viney Creek Aquifer located 6 km northwest of Tea Gardens. The Viney Creek Aquifer forms part of the traditional land of the Worimi people.

The Viney Creek Aquifer extends over an area of 32 km^2, bounded by hills and the Myall River. The aquifer comprises of sand beds from which water is extracted as the source for the Tea Gardens water supply scheme. It is a two-sand aquifer system consisting of an unconfined upper shallow aquifer and a semi confined lower deep aquifer. A coffee rock aquitard exists between the two aquifers. Water is extracted from the deep semi-confined aquifer.

The bores are capable of producing between 12 to 15 L/s and have a combined capacity of 10 ML/day. For design purposes, the calculation of the borefield capacity is based on 9 bores with each bore pumping at a capacity of 12 L/s for 22 hours per day. This gives a capacity of 8.6 ML/day, with the remaining bore retained to be bought online in case of failure or in the advent of an emergency.

Figure 4-7 displays the layout of the bore field.

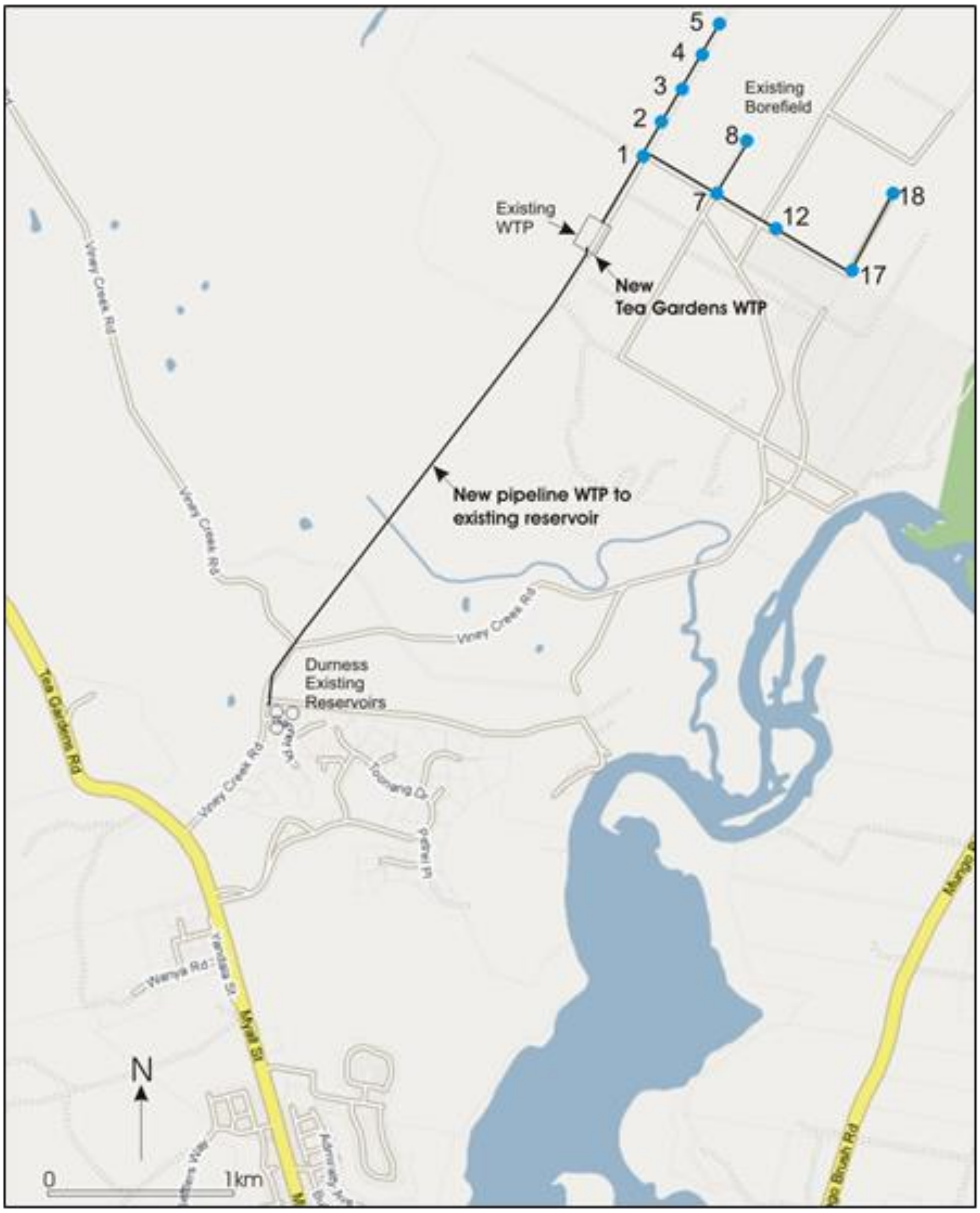


Figure 4-7 Layout of borefield at Viney Creek aquifer

4.4.2.2 Treatment

The Tea Gardens WTP was constructed in 2013. The treatment process is depicted in Figure 4-8.

Stage 1 of the WTP is designed to produce up to 8 ML of water per day with a recovery of over 99.5% of treated potable water from extracted raw water. Following minor upgrades to process mechanical items the plant will be capable of producing 12 ML/d in the future as a ‘Stage 2’.

Due to current process constraints, the WTP has a reduced average day operational capacity of 5.5 ML/d, based on 70 L/s over 22 hours. This reduced capacity is based on preferred operation to minimise wear on process components. However, the WTP can produce higher volumes up to the design capacity during peak day demand periods.

The treatment process involves:

Preliminary Dosing and Aeration

Lime dosing is undertaken to increase the pH and add calcium hardness and alkalinity. There is also the addition of ACH coagulation to precipitate inorganics and help to agglomerate colloidal particles. Forced aeration to remove hydrogen sulphide (taste and odour), remove carbon dioxide (removal increases the pH) and add oxygen (to facilitate the oxidation of soluble iron). There is also the option to chlorinate the raw water.

Raw Water Storage

Raw water is stored in two (2) 300 kL storage tanks.

Membrane Filtration

The flocculated water is then pumped through a course filter prior to the micro filtration membranes. The membranes provide a physical barrier for organisms such as Cyanobacteria (Blue Green Algae) and protozoa (e.g. *Cryptosporidium parvum*, *Giardia intestinalis*).

Post Filtration Dosing

Prior to entering the treated water storage tank, soda ash (if required) is added to increase the treated water pH. Chlorination is added to disinfect the water and to provide free chlorine residual in the reticulated water. also occurs at this point in the process, as does fluoridation of the treated water. Fluoride is added to treated water for dental hygiene.

Treated Water Storage

Filtrate from the membrane filters flows into the treated water storage tank.

A schematic diagram of the Tea Gardens WTP and water supply scheme is shown in Figure 4-8.

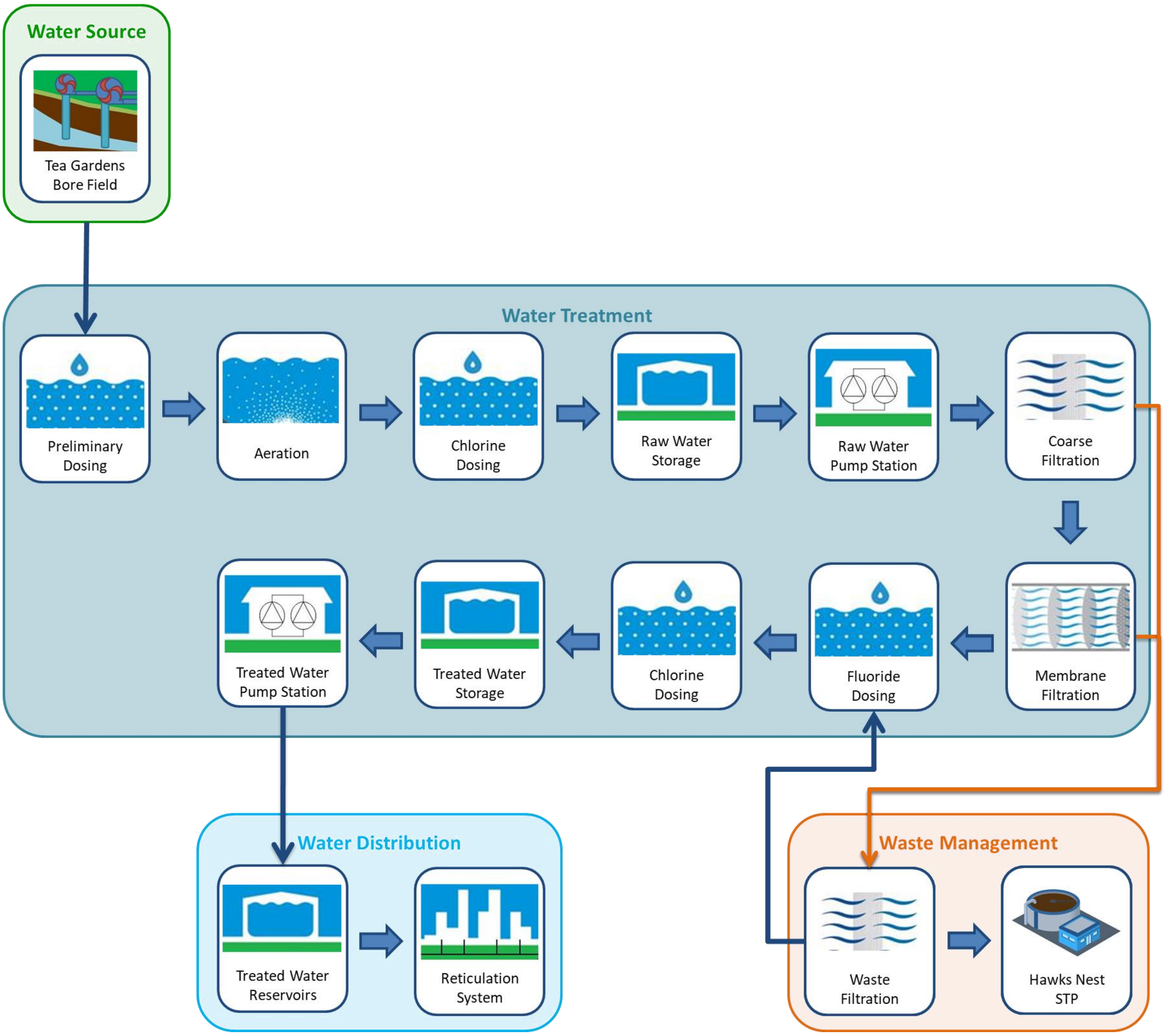


Figure 4-8 Tea Gardens WTP process schematic

4.4.2.3 Distribution

The Tea Gardens water supply scheme serves the towns of Tea Garden and Hawks Nest. Figure 4-9 displays the Tea Gardens water supply scheme schematic.

From the treated water storage tank, treated water is pumped to the Tea Gardens reservoir facility before being distributed to customers through the reticulation system. There are three service reservoirs in the Tea Gardens water supply scheme with a total capacity of 15.1 ML. The reservoirs are located adjacent to each other on Viney Creek Road (Durness Storage).

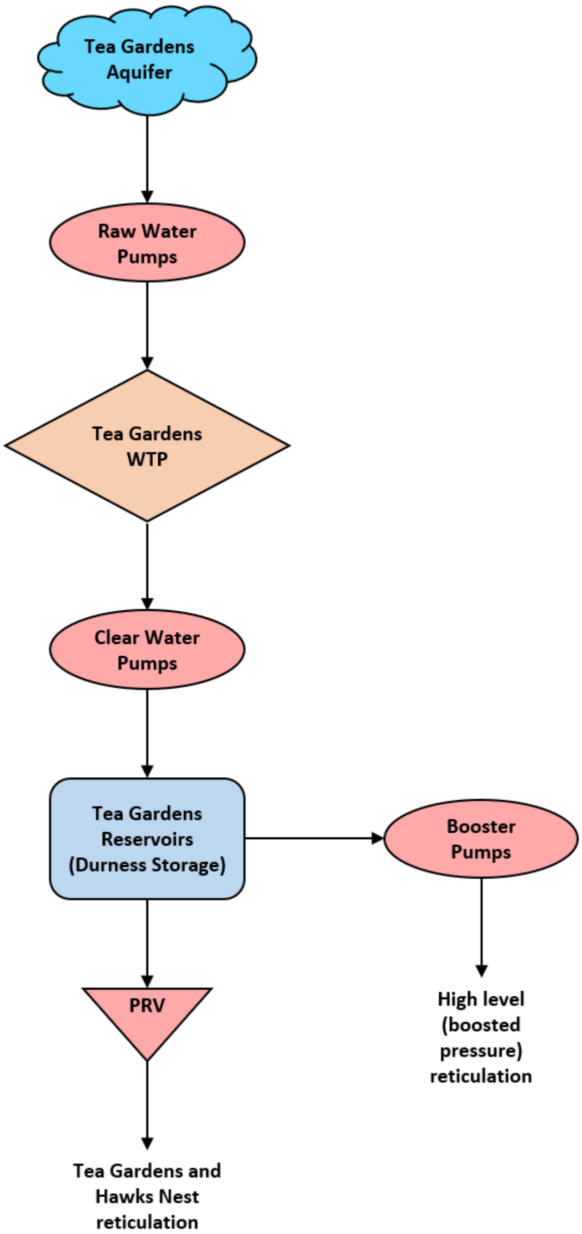


Figure 4-9 Schematic of existing Tea Gardens water supply scheme.

4.4.3 Bulahdelah water supply scheme

A schematic diagram of the Bulahdelah water supply scheme is shown in

Figure 4-10.

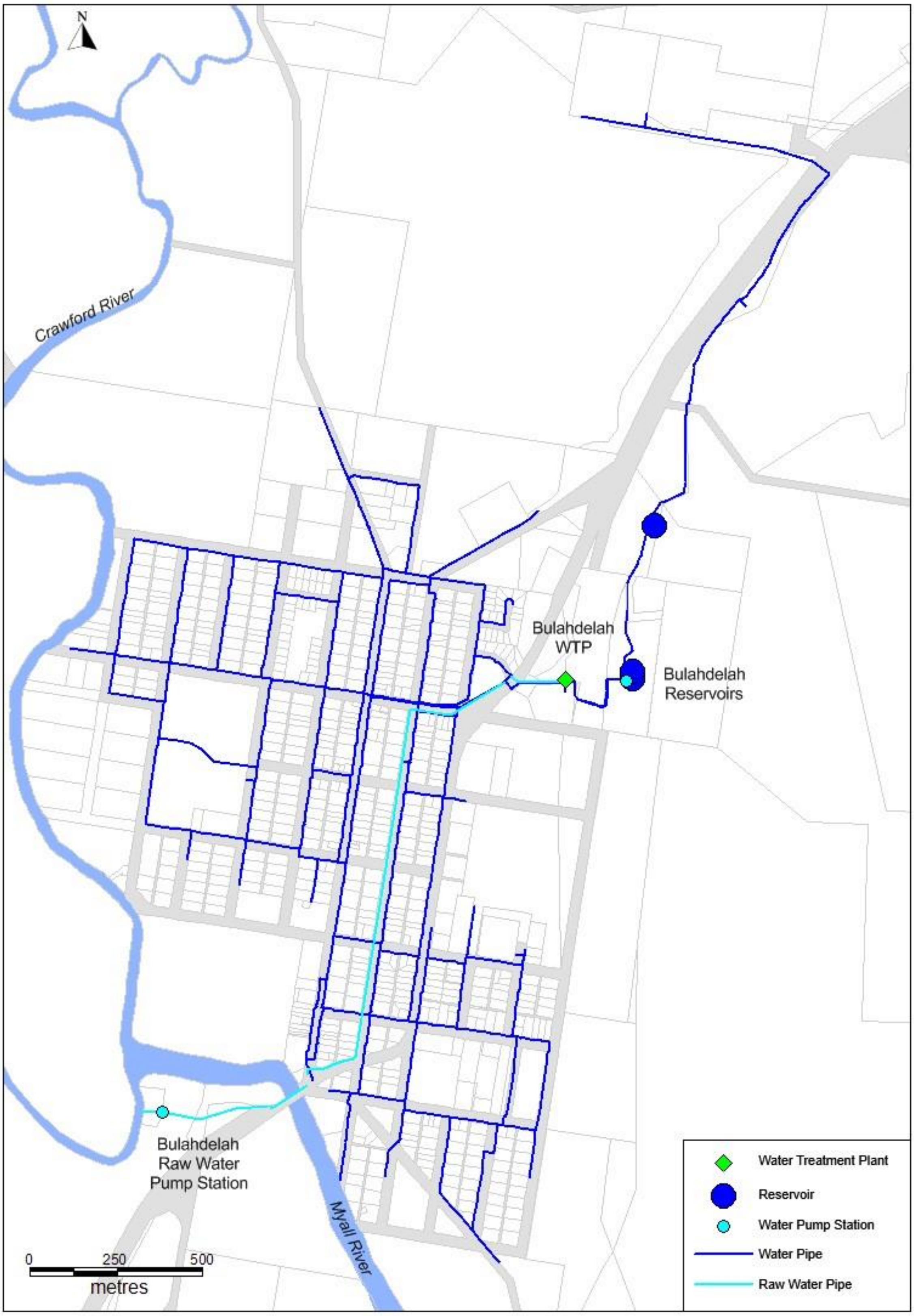


Figure 4-10 Bulahdelah water supply scheme overview

4.4.3.1 Raw water source

Crawford River catchment

The Crawford River catchment covers an area of approximately 122 km^2. The main water course of the catchment is the Crawford River which is fed by several mostly ephemeral water courses. The majority of the upper catchment is forested land managed by National Parks & Wildlife Service and State Forests. Agriculture dominates land use in the lower catchment. The Crawford catchment forms part of the traditional land of the Worimi people.

On-stream weir pool

In the Crawford River Yield Analysis Report (SKM 2005), SKM used rainfall records and catchment data of both the Myall and Crawford to estimate flows and stored volumes of the Crawford. SKM determined that, when full, the storage volume in the Crawford is estimated to be about 228 ML (163 ML available).

Raw water pump station

The intake structure is positioned within the riverbank with one side open to the river. This 'open' end features galvanised steel bars to provide protection against large debris during flood conditions. Behind the bars is a 'wall' consisting of a removable screen and stop-boards, to provide a coarse filtration system that allows water to be taken from the river at the optimum level.

Between the bars and the screen is a level sensor and turbidity sensing element. These are placed on the upstream side wall of the intake structure to minimise potential flood debris damage. Both instruments relay indicative height and turbidity levels of the overall river. This allows operators to avoid pumping 'dirty' water.

At the opposite end to the screens, a single 300 mm diameter pipe carries water from the intake structure to a wet well. The well is nominally 2400 mm in diameter and about 6 meters in depth (deep enough to allow gravitated flow from the lowest inlet on the river). The well has been sized to allow maximum flexibility of future pump installations and will accommodate a standard submersible pump, one size larger than what is needed to meet current demands.

Electrical equipment and a switchboard is located on a steel platform, above the 1% AEP flood level. Instrumentation consists of two-level sensing instruments, a turbidity meter and a flow meter. All these instruments are monitored by the Bulahdelah WTP SCADA.

Raw water is pumped from a rock filled weir pool in the Crawford River near the Pacific Highway Bridge at Bulahdelah. The pump is an ABS submersible pump with a duty of 25 l/sec at 38.65 m head.

4.4.3.2 Treatment

The treatment process consists of the following:

Preliminary Dosing and Clarification

Chemicals are dosed into the raw water line prior to water entering the clarifier. The coagulant ACH is added to assist particles to coagulate and settle. The ACH dose rate is based on raw water quality and determined through jar testing. Polymer Magnafloc LT20 is used to assist flocculation. Chlorine (sodium hypochlorite) is dosed to assist the oxidation of metals, such as aluminum and manganese, to come out of solution. These metals will be removed in the filters further down the process. Soda ash (sodium carbonate) can be added to correct pH and assist water stabilisation. By dosing chlorine and soda ash prior to the clarifier, sufficient time exists to allow oxidation reactions to take place (at appropriate pH levels). There is provision for Powdered Activated Carbon (PAC) to be dosed if required to remove taste and odour issues associated with algae, however this is rarely needed.

Sand filters

Clear water is drawn from the top of the clarifier and flows through sand filters to remove smaller particles. There are two sand filters in parallel. Zeolite media is used in the filters to assist in removal of metals such as iron and manganese. Media is changed approximately every ten years. Sand filters are backwashed as needed (usually twice a week in summer and once a week in winter). Backwash water flows to sludge lagoons.

Chlorine Contact

After filtration, water enters the clear water tank where it is dosed with sodium hypochlorite to provide disinfection with a residual adequate to ensure there is no recontamination through the distribution system. Chlorine pumps start as water is gravity fed from the filters to the clear water tank. There is provision for post dosing of soda ash at this point to correct pH.

Fluoridation

As final water leaves the clear water tank to pump to the reservoirs, fluoride in the form of sodium fluoride (NaF) is added for dental hygiene as required by NSW Health. The target concentration is 1.0 mg/L with the ADWG of 0.9 – 1.5 mg/L.

Wastewater Management

Wastewater and sludge from the clarifier, filter backwash water and chemical drainage waste flows to two sludge lagoons to allow for settling before de-watering by drying in the sludge lagoons. One sludge lagoon is operational while the other is used for sludge drying. During cleaning or wet weather, overflow of water from the sludge lagoons is discharged to sewer. Under normal operating conditions, supernatant from the sludge lagoons is returned to the head of the plant, where it mixes with raw water and re-enters the treatment system.

A schematic diagram of the Bulahdelah water supply scheme is shown in Figure 4-11.

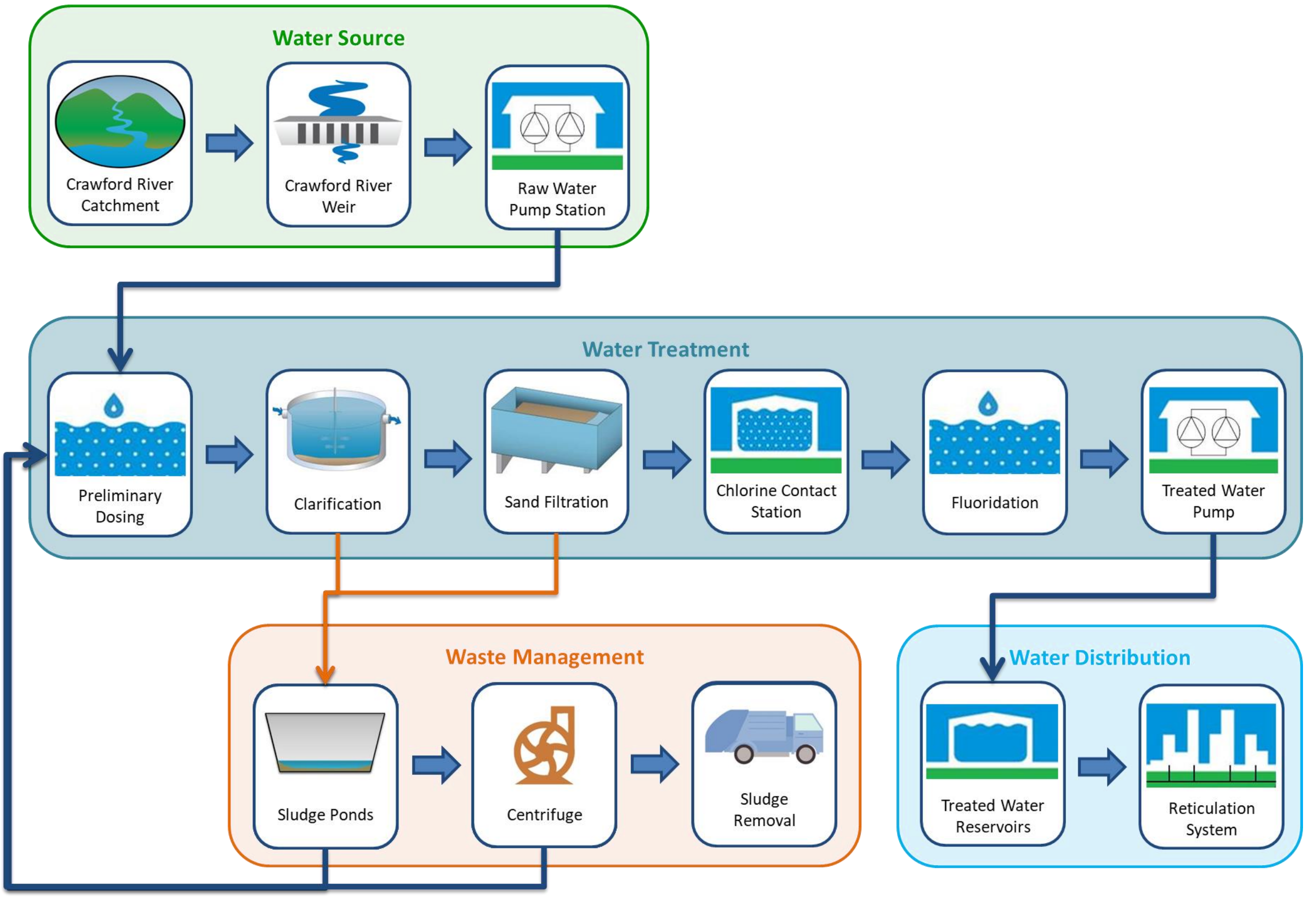


Figure 4-11 Bulahdelah WTP process layout

4.4.3.3 Distribution

Treated water leaves the WTP and travels to two reservoirs for distribution to customers through the reticulation system. This scheme serves approximately 500 houses (a population of approximately 1200). The Bulahdelah water supply scheme originated in the 1960s. The WTP was built in 1988 and upgraded in 1995 and 2006. The current WTP has a capacity to treat 2 ML/day with a reservoir storage capacity of 4 ML. This is considered adequate to meet the future growth.

There is no off-stream storage at Bulahdelah, hence the secure yield is reliant on the weir pool. Due to this, Council must pump water from the Crawford River at all times. There has been no history of Council running the weir pool dry. High turbidity after rain events leads to difficulties running the WTP and an increased frequency of filter backwashing.

4.4.4 Stroud water supply scheme

A schematic diagram of the Stroud water supply scheme is shown in Figure 4-12.

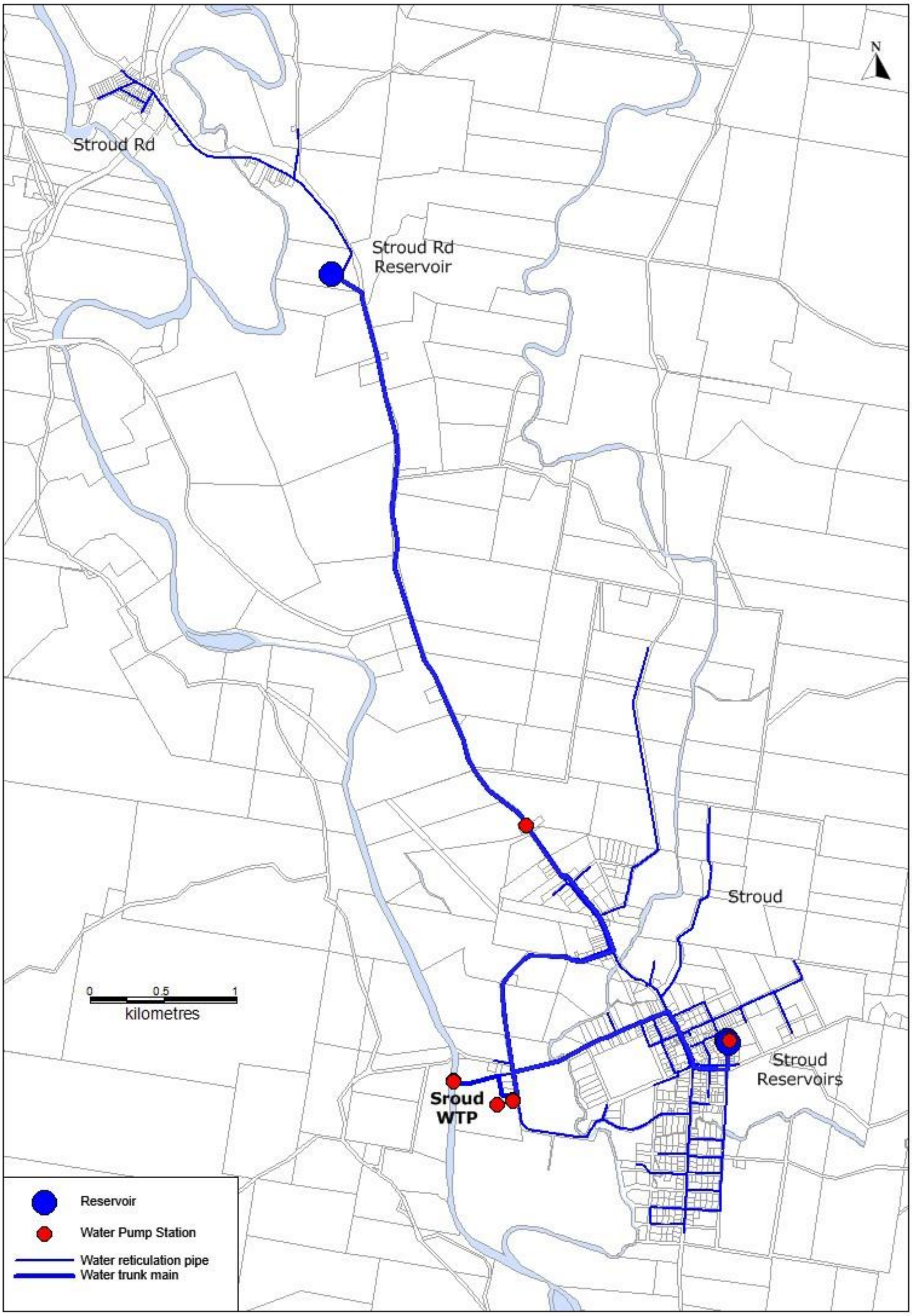


Figure 4-12 Stroud water supply scheme overview

4.4.4.1 Raw water source

Karuah River Catchment

The Karuah River catchment is located on the NSW lower north coast and is approximately 1,490 km^2 in area. The river rises at an elevation of over 1,000 metres in the Barrington Tops and discharges into the wider Port Stephens Estuary adjoining the township of Karuah.

Karuah River catchment forms part of the traditional land of the Worimi and Geawegai people.

Major tributaries of the Karuah River include: Wards River, Mammy Johnsons River and Mill Creek in the north eastern reaches; Telegherry River and upper Karuah River in the north-west headwaters; The Branch River in the eastern estuary zone; and Limeburners Creek and Deep Creek in the western tidal zone of the lower reaches.

On-stream weir pool

The Karuah River is the source of the water supplied directly to the WTP through a 17 ML on river storage/weir or indirectly during periods of high flow or poor quality from an off-stream storage. The capacity of the in-ground water storage is 50 ML, located at the WTP adjacent to the Karuah River.

Raw water pump station

Raw water is extracted from the Karuah River adjacent to the WTP site. A raw water pump station consisting of two pumps transfer water to the WTP.

Typically, the operation of the plant has been limited to a River flow of 375 ML/d and turbidity of below 20 NTU.

Nutrient levels in the raw water have recently resulted in problems with algae in the off-stream storage. A future phosphorous pumping constraint may be necessary to mitigate the risk of an algal bloom.

4.4.4.2 Treatment

The treatment process consists of the following:

Preliminary dosing and mixing

The first step in the treatment process is to pump raw water from the Karuah River when the water quality in the Karuah River is desirable (i.e. low turbidity and low nutrient levels). The raw water is dosed with chlorine and ACH and is mixed in a flocculation tank. This assists particulate matter to coagulate prior to the sedimentation lagoons.

Sedimentation lagoons

A floc is formed and the heavier particles fall out of the solution in the sedimentation lagoons. Clean water is drawn from the top and transferred to the off-stream storage.

Off-stream storage

The off-stream storage is a 50 ML dam located on the WTP site.

Sand filtration

Water is filtered through the sand filter prior to final dosing. The sand filters are backwashed as needed. The backwashed water is recycled into the flocculation tank.

Chlorine contact

After filtration, water enters the clear water tank where it is dosed with sodium hypochlorite to provide a chlorine disinfection residual adequate to ensure there is no recontamination through the distribution system. Chlorine pumps start as water is fed from the filters to the clear water tank.

Fluoridation

As final water leaves the clear water tank to pump to the reservoirs, NaF is added for dental hygiene as required by NSW Health. The target concentration is 1.0mg/L with the ADWG of 0.9 – 1.5 mg/L.

Wastewater management

Two sedimentation lagoons are used to manage waste by de-watering and drying. One sedimentation lagoon is operational and the other used for sludge drying.

A schematic diagram of the Stroud water supply scheme is shown in Figure 4-13.

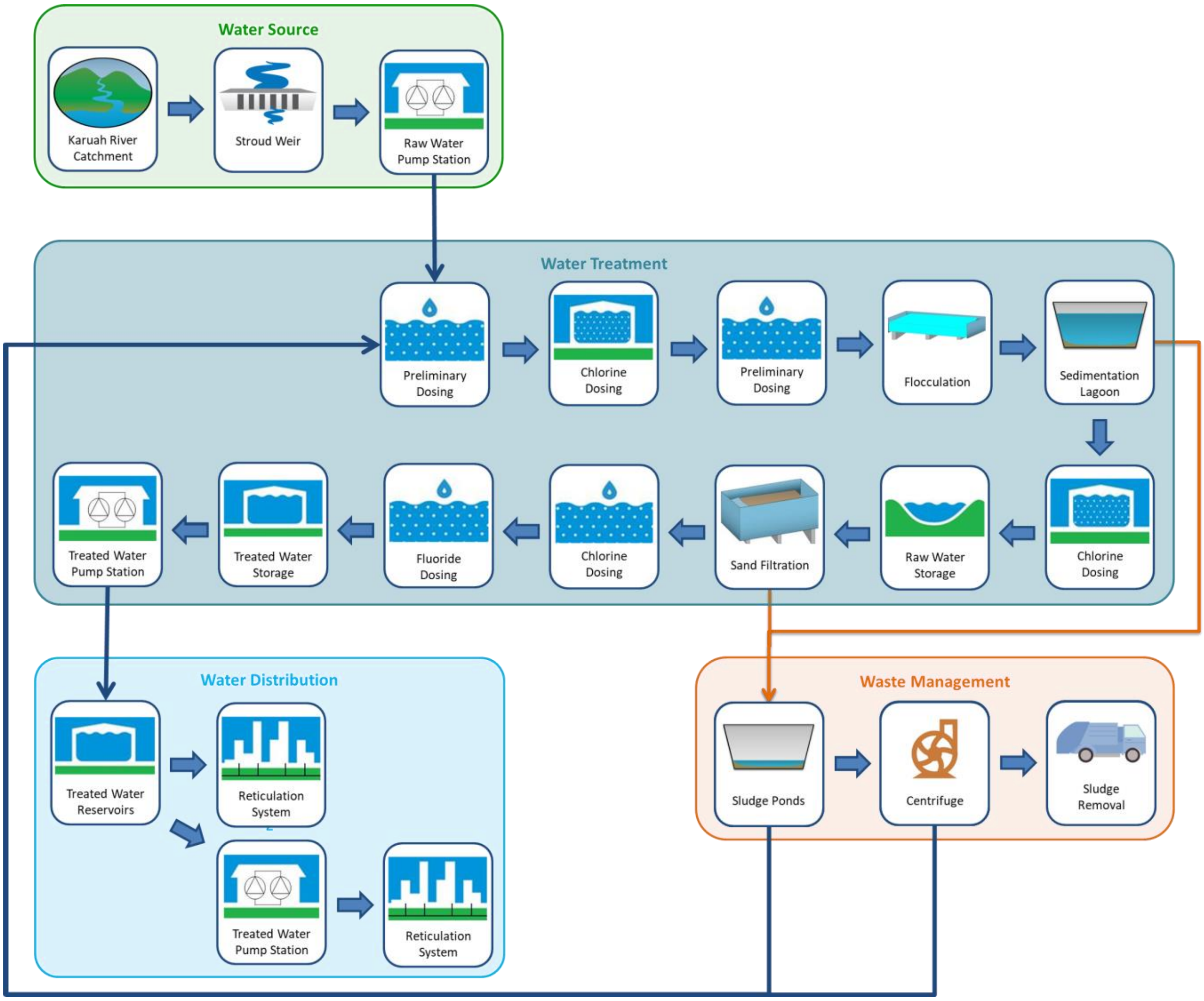


Figure 4-13 Stroud WTP process layout

4.4.4.3 Distribution

Treated water leaves the WTP and is transferred to three reservoirs (two service Stroud and the other services Stroud Road), before being distributed to customers through the reticulation system. This scheme serves approximately 470 houses (a population of approximately 1000). The WTP is currently capable of treating 2.0 ML/day and is upgradable to an ultimate capacity of 2.7 ML/day.

4.4.5 Gloucester water supply scheme

A schematic diagram of the Gloucester water supply scheme is shown in Figure 4-14.

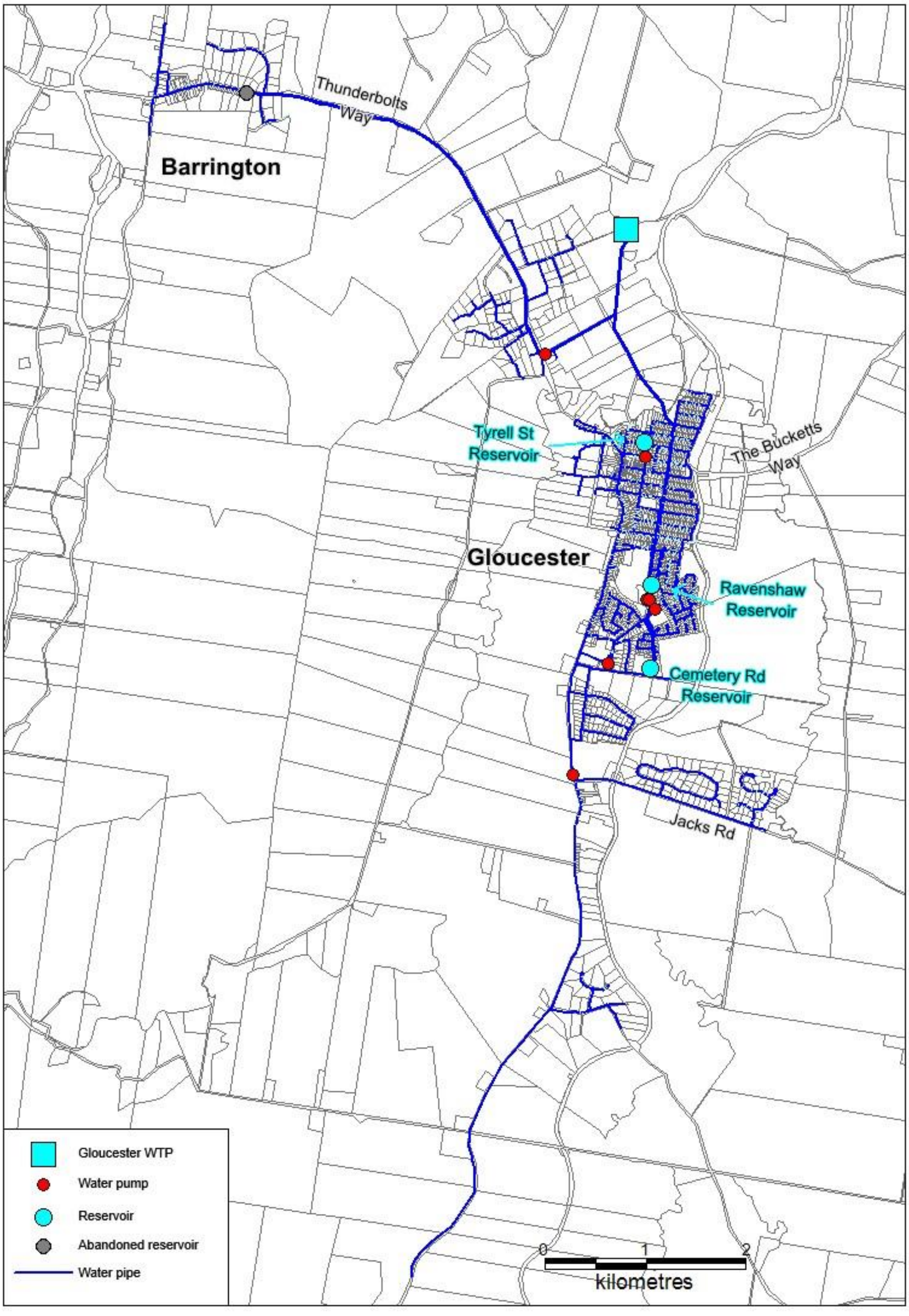


Figure 4-14 Gloucester water supply scheme overview

4.4.5.1 Raw water source

Barrington river catchment

Water is drawn from Barrington River, upstream of Gloucester for the town water supply. There is currently no raw water storage. There are three main rivers in the Gloucester catchment: Gloucester, Barrington and Avon and many smaller tributaries which all form part of the larger Manning River catchment area. Gloucester and Avon Rivers meet the Barrington River downstream of the intake to the WTP.

The Barrington River catchment forms part of the traditional land of the Geawegai people.

Major land uses in the catchment area include beef and cattle agriculture and tourism. Barrington Tops and Gloucester Tops National Parks are popular tourist destinations within the region. There is the potential for future mining explorations and activities in the catchment (with existing mining activities in the Avon River catchment). Due to this potential, extra parameters were added to the drinking water quality monitoring program for raw water in Barrington River in January 2014 (strontium, cadmium, cyanide and silver).

Raw water pump station

Raw water is extracted from Barrington River upstream from its confluence with Gloucester River. The raw water pump station has two pumps to transfer water to the WTP.

Council aims to abide by the Water Sharing Plan. There is a water sharing plan with irrigators on the Barrington River to protect the town water supply, which allows extraction until there is no visible flow in the river at the reference point, i.e., Barrington River at Forbesdale gauge.

There is no off-steam storage at Gloucester. There has been one historic zero flow recorded at the Forbesdale Gauge This occurred during December 2019. Council had to water cart to Gloucester from Tea Gardens approximately 30 days.

4.4.5.2 Treatment

The WTP is designed to treat a maximum of 4.5 ML/d or 57 L/s for 22 hrs/d.

Due to current process constraints, the WTP has a reduced operational capacity of 2.8 ML/d, based on 35 L/s over 22 hours. According to flow records, the maximum recorded flow through the plant is 2 ML/d. This reduced capacity is based on preferred operation to minimise wear on process components. However, the WTP can produce higher volumes up to the design capacity during peak day demand periods.

The plant is capable of treating water for 6250 equivalent population (EP). This is based on a peak demand of 720 L/EP/d (3 x 240 L/EP/d). Current population forecasts estimate that this capacity will not be reached until well after 2050.

Preliminary dosing and mixing

Three mixing chambers exist at the head of the plant, where pre-dose chemicals are added and flash mixing occurs. In the first chamber, the chemicals dosed include ACH to promote coagulation and a flocculation aid (Multifloc SE287) which helps to increase filter efficiency. In the second chamber, soda ash (sodium carbonate) is dosed to assist water stabilisation and pH correction, and polymer (Magnafloc LT20) is dosed to assist flocculation. The three mixing chambers allow sufficient contact time for the chemicals to achieve optimal coagulation and flocculation in the next stage.

Clarifier

From the floc chambers water flows over a baffle wall into the clarifier for settling. A traveling bridge moves along the length of the tank scraping the sludge that has settled on the bottom towards four sumps, which then drain the sludge to a pit and into the sludge lagoons. The traveling bridge runs manually (approximately hourly) when the plant is running. The tank is drained and cleaned four times a year.

Sand filters

From the clarifier, clear water flows over a weir, through a chamber to sand filters. There are two sand filters which run in parallel to remove small particles. Filters are backwashed as needed (usually every three days in summer and every four to five days in winter). A gauge in the operational lab shows filter performance and backwashes are scheduled accordingly.

The filters have plenum floors containing 480 nozzles in each, to allow water to pass through and air and water to be used in the backwash process. Backwash water is sent to the sludge lagoons.

Clear water tank (chlorination and fluoridation)

From the filters, water enters the clear water tank (under the treatment building) which has a capacity of 500 kL. Liquid chlorine (sodium hypochlorite) is dosed into the clear water tank for disinfection. Fluoride (sodium fluoride) for dental hygiene is dosed as the water leaves the plant to the distribution system.

Wastewater management

Wastewater from the filter backwashing and sludge from the clarifier is pumped to a pit and into one of four sludge lagoons. One lagoon is operational at any time and the others are used for drying. A centrifuge is used to dewater the sludge. Supernatant water from the sludge lagoons is sent back to the head of the plant at a rate of 10% of the raw water volume. Supernatant enters the treatment process in the first mixing chamber.

A schematic diagram of the Gloucester water supply scheme is shown in Figure 4-15.

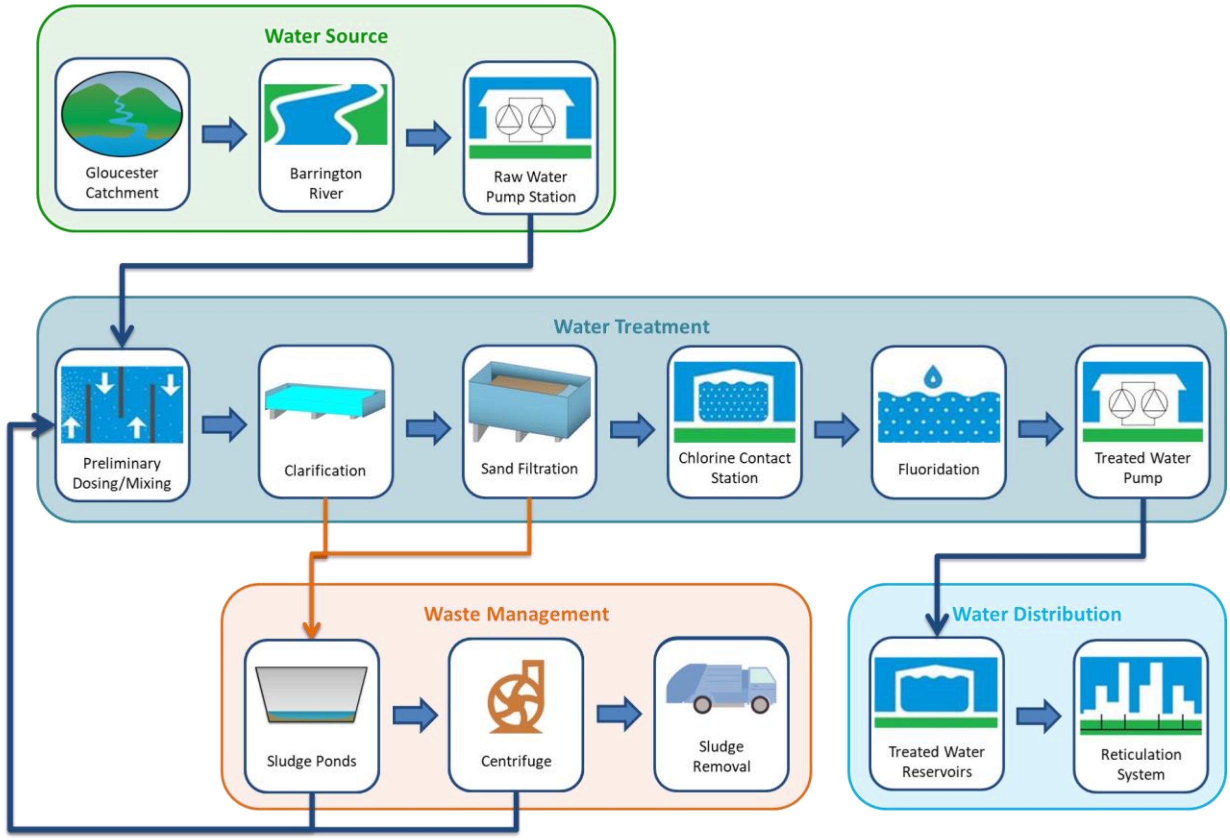


Figure 4-15 Gloucester WTP process layout

4.4.5.3 Distribution

As final treated water leaves the WTP it is pumped through a water main towards Gloucester. The water main then branches, with one arm transferring water to the township of Barrington. There are three existing reservoirs in the Gloucester water supply system: Tyrell Street (0.55 ML), Ravenshaw Street (2.3 ML) and Cemetery Rd (1.5 ML).

Council is currently in the process of constructing the Gloucester Reservoirs Project, which when complete will augment the network significantly. Construction consists of two new reservoirs at Century Road, a 0.5 ML standpipe reservoir and a 7.0 ML ground reservoir. Works included decommission the Ravenshaw reservoir and deactivation of the Tyrell Street reservoir. The Tyrell Street reservoir will be retained and kept on site due to it being heritage. These upgrades will remove the need for two existing booster pumps due to the increased elevation of the standpipe reservoir.

4.4.6 North Karuah water supply scheme

A schematic diagram of the North Karuah supply scheme is shown in Figure 4-16.

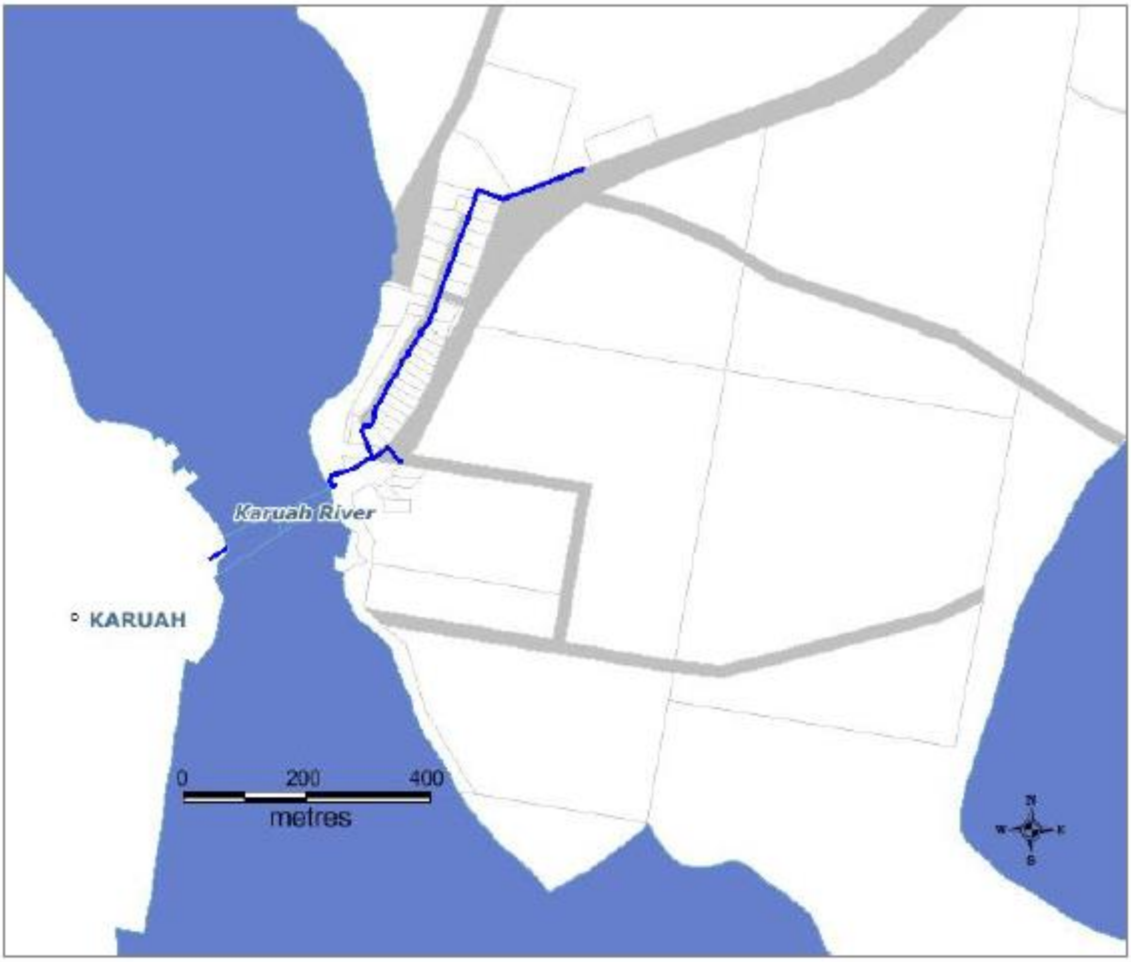


Figure 4-16 North Karuah water supply scheme overview

4.4.6.1 Raw water source, treatment and distribution

The village of North Karuah is located on the Eastern banks of the Karuah River north of the township of Karuah. Council is responsible for the provision of water and sewer services to the area, however the major infrastructure for water and sewer in North Karuah (the Karuah Sewer Treatment Plant (STP) and the Lemon Tree Passage – Karuah Water Scheme) is located in the Port Stephens LGA.

Council purchases water from Hunter Water and distributes via Council's assets located in North Karuah. Historically, residence have complaints regarding water quality. Council monitors the chlorine residual levels. Water has been noted as an issue.

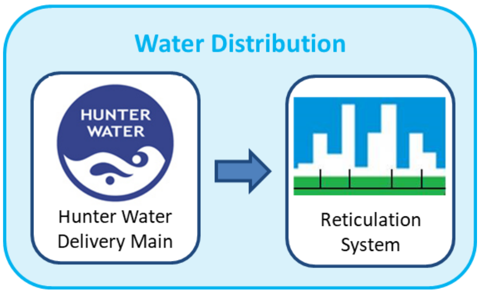


Figure 4-17 North Karuah water distribution schematic

4.4.7 Unserviced water supply villages

Table 4.6 lists the unserviced villages for water supply in the LGA.

Table 4.6 Unserviced water supply villages

Unserviced water supply villages			
Allworth	Coomba Park	Knorrit Flat	Stewarts River
Back Creek	Cooplacurripa	Knorrit Forest	Stratford
Bakers Creek	Copeland	Koorainghat	Strathcedar
Barrington Tops	Coralville	Kundibakh	Tahlee
Baxters Ridge	Craven	Kundle	Terreel
Belbora	Craven Plateau	Lansdowne Forest	The Bight
Berrico	Crawford River	Limeburners Creek	The Branch
Bindera	Crowdy Bay National Park	Mares Run	Tibbuc
Bobin	Cundle Flat	Markwell	Tipperary
Bombah Point	Curricabark	Marlee	Tiri
Boolambayte	Dewitt	Mayers Flat	Titaatee Creek
Booral	Dingo Forest	Melinga	Topi
Bootawa	Dollys Flat	Mernot	Tugrabakh
Bowman	Elands	Minimbah	Upper Karuah River
Bowman Farm	Faulkland	Mograni	Upper Lansdowne
Bretti	Firefly	Mondrook	Upper Myall
Brimbin	Forbesdale	Monkerai	Violet Hill
Bucca Wauka	Gangat	Mooral Creek	Waitui
Bulga Forest	Ghinni	Moorland	Wallanbah
Bulliac	Giro	Moppy	Wallingat
Bundabah	Girvan	Moto	Wallis Lake
Bundook	Glen Ward	Mount George	Wang Wauk
Bungwahl	Glenthorne	Mungo Brush	Wards River
Bunyah	Gloucester Tops	Myall Lake	Warranulla
Burrell Creek	Hannam Vale	Nerong	Washpool
Cabbage Tree Island	Hillville	Nooroo	Waukivory
Caffreys Flat	Invergordon	North Arm Cove	Weismantels
Callaghans Creek	Johns River	Number One	Wherrol Flat
Caparra	Karaak Flat	Pindimar	Whoota

Unserviced water supply villages			
Carrington	Khatambuhl	Possum Brush	Willina
Cedar Party	Kia Ora	Rawdon Vale	Woko
Cells River	Killabakh	Rookhurst	Wootton
Cobark	Killawarra	Saltwater	Yargon
Coneac	Kimbriki	Sandbar	Yarratt Forest
Coolongolook	Kippaxs	Seal Rocks	
Coomba Bay	Kiwarrak	Shallow Bay	

Decentralised Water Consulting (DWC) were engaged in 2019 to assess the unserviced villages in the Council area. The outcomes of the assessment are discussed in Section 12.

5. Urban stormwater

Within the Council LGA, the townships and several of the villages have stormwater drainage network infrastructure. The stormwater drainage network infrastructure enables water runoff to be directed into a pipe network and wetlands. The stormwater is conveyed to creeks, rivers or the ocean, depending on the area. Storm events which produce higher rates of runoff are directed to natural watercourses using aboveground channels, either in roadways or constructed open channels which often double as recreational land in dry weather.

Council's stormwater network consists of the following infrastructure:

- Stormwater pipes ranging from 300mm to 2100 mm in diameter. Council's stormwater pipe network includes box lines that vary in size
- Associated stormwater pits
- Surface drains including dish drains and open drains
- Wetland basins including constructed wetlands and bio-retention basins
- Engineered gross pollutant traps (GPT)
- Litter capture baskets

Table 5.1 summaries Council's stormwater drainage network infrastructure.

Table 5.1 Stormwater drainage network infrastructure summary

Region / infrastructure	Stormwater pipes (km)	Stormwater pits (No.)	Wetland basins (No.)	Gross pollutant traps (No.)	Litter baskets (No.)
Bulahdelah	4.418	251	-	-	-
Gloucester	16.757	631	-	2	-
Forster	61.722	2316	34	6	110
Stroud	4.866	151	-	-	16
Taree	80.249	3421	5	8	25
Tea Gardens	14.103	633	5	5	162
Tuncurry	24.510	709	17	2	20
Other Location	137.599	6634	46	18	303

Council's stormwater network has over 200 catchments, directly stormwater to rivers and ocean. The stormwater catchments contain many stormwater outlets, that directs flow into major waterways. These include:

- One Mile Beach, Forster
  - 1 large open drain outlet next to the Golf Course
  - 1 x 1050 pipe outlet at South One Mile
- Pebbly Beach, Forster
  - 1 x 1800 RCP pipe outlet across the road from 100 Head Street
- Forster Main Beach, Forster
  - Unknown pipe size outlet next to the "Bull Ring"
  - Wallis Lake (along Little Street)
  - 1 x 750 pipe outlet across the road from 118 Little Street
  - 1 x 1350 pipe outlet across the road from 86-88 Little Street
  - Multiple small diameter pipe outlets along Little Street and Memorial Drive
  - 1 large open drain outlet with a bridge near the Visitor Centre

- The Lakes Way, Forster
  - Large open channel and bridge just north of The Lakes Way and Cape Hawke Drive roundabout
  - Large culvert (currently still under construction) on The Lakes Way, opposite to the Palm Lakes
- Elizabeth Beach, Pacific Palms
  - Large outlet on the eastern side of Elizabeth Beach
- Blueys Beach, Pacific Palms
  - 1 x 600 pipe outlet on north end of Blueys Beach
  - 2 x 525 pipe outlet on south end of Blueys Beach
  - 2 x 900 pipe outlet on south end of Blueys Beach
- Bulahdelah
  - Large open channels that drain most of the town run through the caravan park on Lot 14 DP532271
- Tea Gardens
  - Multiple pipe outlets along Marine Drive
  - Largest pipe outlet on Marine Drive is a 900 RCP that runs between 17 & 19 Marine Drive
- Hawks Nest
  - 1 x 750 pipe outlet on the corner of Tuloa Avenue and The Anchorage
  - 1 x 900 pipe outlet on Mirreen Street
  - 1 x 750 pipe outlet across the road from 46 Moira Parade
  - Multiple pipe outlets along Moira Parade
- Tuncurry
  - Natural open channel behind Regency Circuit, also known as “Muddy Creek”
  - Multiple pipe outlets along the foreshore that drains into Wallis Lake
  - 2 x1800 x 600 box line outlet draining out to Wallis Lake on Rockpool Road
  - 2 x 750 pipe outlet draining out to Wallis Lake on Rockpool Road
- Black Head
  - Large natural open channel draining out to Black Head Beach
- Diamond Beach
  - Large open channel located on Golden Drive fed by multiple pipes drains out to Diamond Beach
- Old Bar
  - Large natural open channel known as “Racecourse Creek” draining out to Old Bar Beach
  - Large natural open channels located on Lot 100 DP1275298 fed by multiple drainage pipe outlets
- Harrington
  - Multiple pipe outlets along the foreshore that drain into Manning River
  - Multiple pipe outlets within Harrington Water Golf Course that drains to the Manning River
  - Large natural open channel located on Lot 4144 DP1065326 fed by multiple drainage pipe outlets
- Cundletown
  - 1 x 1200 pipe outlet located across the road from 85 River Street
  - 1 x 750 pipe outlet located across the road from 31A River Street
- Taree
  - Multiple pipe outlets along the foreshore that drain into Manning River
  - A large box culvert line outlet located across the road from the Pulteney Street university campus building drains into the river
  - 1 x 900 pipe outlet located Manning Street draining to the river
  - 1 x 1350 pipe outlet located Pioneer Street drains into an open creek which drains into the river

- 1 x 900 pipe outlet located on 29 Stevenson Street that drains into Browns Creek
  - 1 x 750 pipe outlet located next to 13 Bent Street that drains into Browns Creek
  - Large box culvert line outlet located on 41 Whitbread Street draining into Browns Creek
  - Multiple medium to large pipe outlets north of Muldoon Street that drains into Browns Creek
  - Large pipe outlet behind Taree Recreation Grounds that drains into the Dawson River
- Wingham
  - A large box culvert line outlet that feeds a wetland in Combined Street and drains into Cedar Party Creek
  - Multiple pipe outlets Cedar Party Creek that drain into the Manning River
- Gloucester
  - 1 x 900 pipe outlet located on 8 Cook Street draining into the Gloucester River
  - Multiple pipe outlets located west of Church Street that drains into natural open waterways which drains into the Gloucester River
  - Multiple small to medium pipe outlets along the railway line that drains into the Avon River

Council has 37 detention basins:

- 20 are dry detention basins; 17 are located on Council land.
- 10 are wet detention basins; 2 are located on Council land.
- 7 detentions are unknown as wet or dry; 5 are located on Council land.

Majority of the detention basins are dry basins. If stormwater harvesting was pursued, Council would either modify or intentionally construct detention basins to support the scheme.

Council is aware of stormwater inflow and infiltration into the sewer network. Council is actively targeting this, with a dedicated inflow and infiltration team.

Currently, the stormwater network, including detention basins, are not set up to support stormwater harvesting without significant capital investment. There is more opportunity for Council to pursue piecemeal or decentralised stormwater harvesting opportunities, such as in new housing developments.

Over the last 10 years, Council has teamed up with experts from the NSW Department of Planning Industry and Environment to investigate the local waterways. Over 1900 individual water quality samples have been taken across six major catchments to monitor waterway health, identify trends and cycles in estuaries and investigate the progress of the work being undertaken to protect them. Waterway and catchment report cards are prepared to report on the water quality results and rank against a grade (A to F, from excellent to very poor).

Under the NSW Coastal Management Framework, Council is currently preparing a series of Coastal Management Programs (CMPs) that will establish integrated, long-term programs for the coordinated management of the coast to maintain and enhance their environmental, social, and economic values. The suite of CMPs will cover the estuaries of Wallis Lake, Smith Lake, Myall Lakes, and the northern foreshores of the Port Stephens. These CMPs will target risks from the following threats:

- Catchment runoff, urban stormwater discharge and sewage effluent impacting water quality, particularly in urban areas
- Agricultural runoff poses a threat to water quality due to the inputs of nutrients and sediment from erosion
- Inundation of foreshore areas caused by coastal, catchment and tidal inundation

The CMPs are expecting to take 12 – 18 months to develop.

6. Sewerage schemes

Council is responsible for the management of 14 sewerage schemes. Council operates STP's for all schemes except for North Karuah. Sewage from North Karuah is pumped to the Karuah STP which is managed and owned by Hunter Water.

The townships and villages currently provided with sewerage services located within Council's LGA are listed in Table 6.1.

Table 6.1 Sewer schemes and service areas

Sewer schemes	Serviced towns and villages
Bulahdelah sewerage scheme	Bulahdelah
Coopernook sewerage scheme	Coopernook
Forster sewerage scheme	Forster Green Point Pacific Palms Seven Mile Beach Smiths Lakes Tarbuck Bay
Gloucester sewerage scheme	Gloucester and Barrington
Hallidays Point sewerage scheme	Hallidays Point Wallamba Nabiac Tuncurry
Harrington sewerage scheme	Harrington Crowdy Head
Hawks Nest sewerage scheme	Hawks Nest Tea Gardens
Lansdowne sewerage scheme	Lansdowne
Manning Point sewerage scheme	Manning Point Pelican Bay
North Karuah sewerage scheme	North Karuah
Old Bar sewerage scheme	Old Bar Wallabi Point
Stroud sewerage scheme	Stroud
Taree sewerage scheme	Taree Taree South Cundletown Tinonee
Wingham sewerage scheme	Wingham

The 14 sewage servicing schemes are shown in Figure 6-1.

Figure 6-1 Sewerage schemes and systems

6.1.1 Bulahdelah sewerage scheme

A schematic diagram of the Bulahdelah sewerage scheme is shown in Figure 6-2.

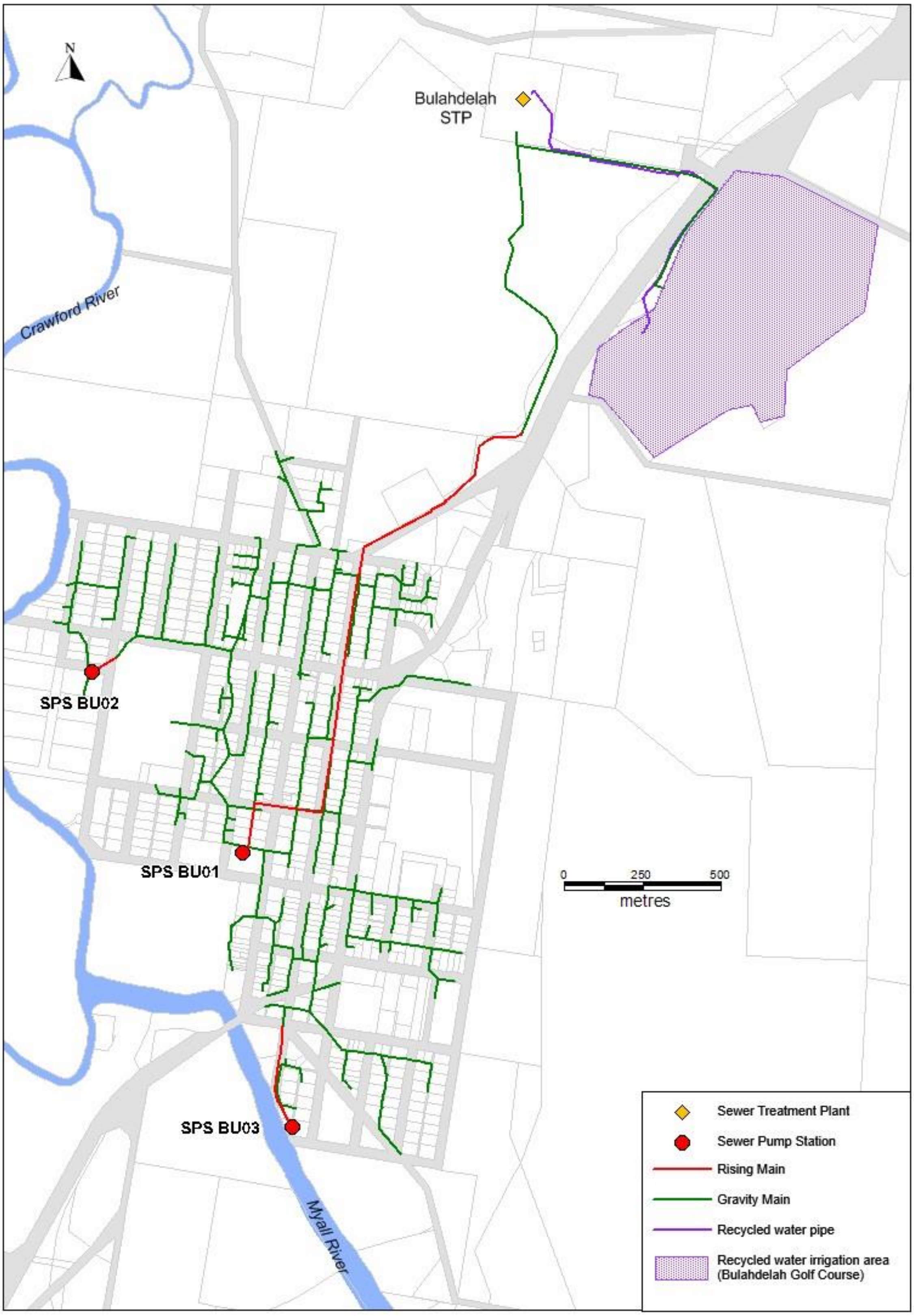


Figure 6-2 Bulahdelah sewerage scheme overview

6.1.1.1 STP description

The STP for Bulahdelah was initially constructed in 1980. The original STP was replaced by the current STP in 1996. The new STP was constructed approximately 2 km to the north of town and approximately 600 m to the west of the Pacific Highway. The new location was selected due to the convenience of being adjacent an existing landfill on the outskirts of the town. The plant is a conventional activated sludge STP in the intermittent mode. The plant has a nominal capacity of 3000 equivalent persons (EP), however is closer to 3400 EP based on current estimates. The plant has an average annual outflow of 174 ML and discharges treated effluent into Fry's Creek. Fry's Creek is a tributary of the Myall River and is located approximately 200 m north of the plant.

The current demand on the plant is less than half of the design capacity. This has resulted in functional difficulties In the past. Chlorine dosing was previously used for the disinfection of treated effluent, however, this was replaced by an ultraviolet (UV) disinfection system which was commissioned in September 2004. The STP received several upgrades in November 2007 and additional adjustments to the treatment process were undertaken in 2009.

The STP consists of the following features:

– The inlet screens consist of a step screen and a high flow splitter to remove coarse material.
– The grit collector is designed to remove particulate material from the sewage. Once the grit is removed, it is placed into a storage area before being removed by a respective specialist waste company.
– The overflow splitter diverts excess sewage flowing into the system. High flows from wet weather inflow and infiltration into the reticulation system is bypassed to the wet weather pond.
– Sewage flows into one IDEA tank.
– The two catchment ponds under normal flow take clear water from the bioreactor. The catchment ponds act as secondary clarifiers to allow sludge to settle and for the sewage liquid to be decanted for further treatment.
– Sand Filtration is a tertiary treatment process. The sand filter has a capacity of 25 L/s and consists of a concrete tank design that gravitates pumped flow from the clarifiers back into the UV disinfection tank.
– The UV treatment receives gravitated flow from the sand filter. The unit is designed to treat up to 50 L/s.
– The sludge lagoons are used to store and then further treat the sludge that is pumped from the bottom of the catchment ponds.

Figure 6-3 displays the Bulahdelah sewage treatment process layout.

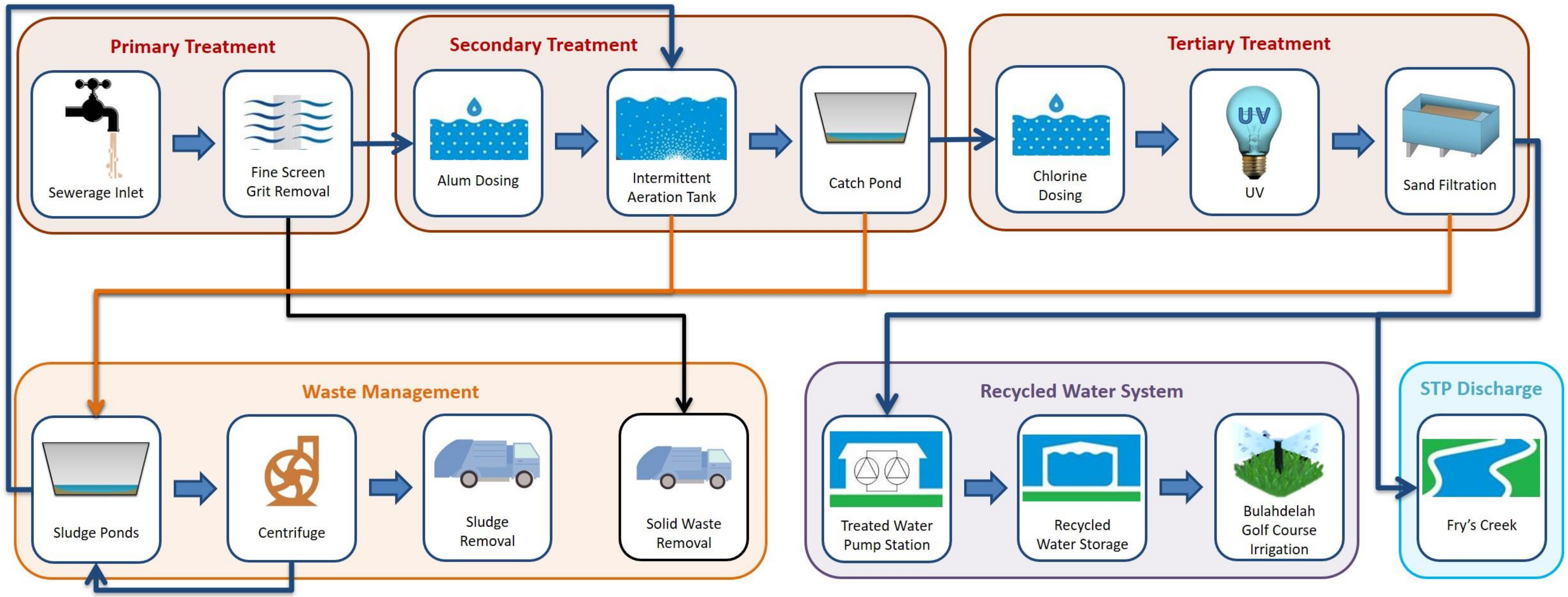


Figure 6-3 Bulahdelah STP process layout

6.1.1.2 Effluent management

6.1.1.2.1 EPA licence conditions

The EPA licence for Bulahdelah STP is Environmental Protection Licence (EPL) 5305. The last licence variation occurred on 17 January 2019. The activity at the site is for > 100 – 219 ML annual maximum discharge volume.

This licence requires adherence to section 55 of the Protection of the Environment Operations (POEO) Act 1997. The treated effluent discharges to Point 1 Fry's Creek and must not exceed the concentration limits specified for the pollutants listed in Table 6.2.

Table 6.2 Bulahdelah STP licence limits for Fry's Creek discharge

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
Oil and grease	Milligrams per litre	-	-	-	10
pH	pH	-	-	-	6.5-8.5
Phosphorus (total)	Milligrams per litre	0.3	0.5	-	1.0
Faecal Coliforms	Colony forming units per 100 millimetres	-	-	-	200
Nitrate + nitrite (nitrogen)	Milligrams per litre			-	10
Nitrogen (ammonia)	Milligrams per litre	-	-	-	1.0
Total Suspended Solids	Milligrams per litre	10	15	-	30
Biochemical Oxygen Demand	Milligrams per litre	8	10	-	20
Chlorine (free residual)	Milligrams per litre	-	-	-	0.5

6.1.1.2.2 Volume and mass limits

The Bulahdelah STP volume/mass limit is specified in Table 6.3. This volume/mass limit cannot be exceeded by thevolume/mass of liquids discharged to water or the solids or liquids applied to the area Table 6.3. Discharge monitoring at Point 2 (a V-Notch weir at the discharge end of the disinfection channel) is conducted to determine compliance with the limits specified for discharge to Point 1.

Table 6.3 Bulahdelah licence volume and mass limits

Point	Units of measure	Volume/mass limit
1 (discharge to Frys Creek 200 m downstream of the STP)	Kilolitres per day	2000

6.1.1.3 Recycled water scheme

In 2012, Bulahdelah STP was modified to enable treated effluent to be transferred to the nearby golf course for irrigation use. The Bulahdelah recycled water scheme was one of four that Council constructed with the aid of federal and state government funding. Due to the quality of the treated effluent that was discharged into Frys Creek at the time, no additional treatment measures were required to meet the needs for irrigation with restricted public access. However, some modifications were made to ensure compliance. These included connection of the existing UV system to the plant, SCADA configuration to enable automated shut down of recycled water transfer should the UV system fail, addition of a chlorine analyser and automated isolation valve (that can prevent discharge to the creek) and a transfer pump and main to the golf course.

An automated Irrigation system, pump shed and 120kL recycled water tank was constructed by Council at the Bulahdelah golf course. These assets were transferred to the Bulahdelah Golf Club to operate and maintain.

6.1.2 Coopernook sewerage scheme

A schematic diagram of the Coopernook Sewerage Scheme is shown in Figure 6-4.

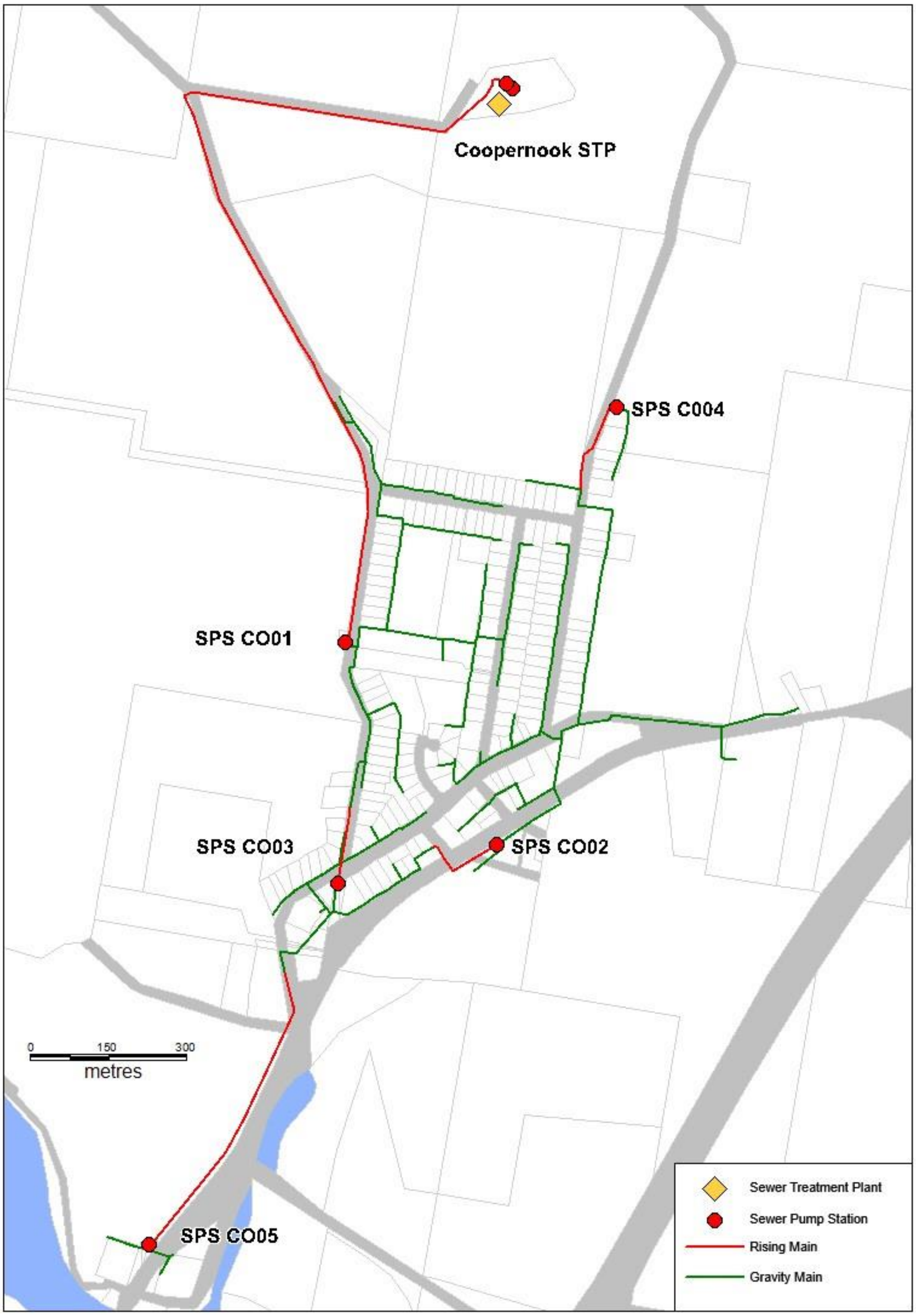


Figure 6-4 ***Coopernook sewerage scheme overview***

6.1.2.1 STP description

The Coopernook STP is located within Coopernook State Forest on Emmo Lane off Lansdowne Road, approximately 1.5 km north of town shown in Figure 6-4. The STP receives sewage flows from the village of Coopernook. The sewage source is mainly domestic with non-residential development consisting of:

– Several shops, service station, motel and hotel
– Public school
– Public amenities, church, and hall

Originally constructed in 2002, the Coopernook STP consists of an activated sludge plant of nominal design capacity of 600 EP (design values of 120 kL/day ADWF and 7 x ADWF or 840 kL/d wet weather allowance). The plant process includes:

– Secondary treatment within an intermittently decanted extended aeration tank (IDEAT)
– Effluent balance tank
– UV disinfection (2 units, capacity 9.7 L/s 7.2 x ultimate ADWF)
– 13 ML treated effluent storage pond
– Sludge thickening tank

Provision has been made for chemical dosing for nutrient reduction, filtration and duplication of the secondary treatment facilities if required in future.

The original design for the plant included provision for an additional IDEAT that would increase nominal design capacity to 1200 EP.

Figure 6-5 displays Coopernook's sewage treatment process layout.

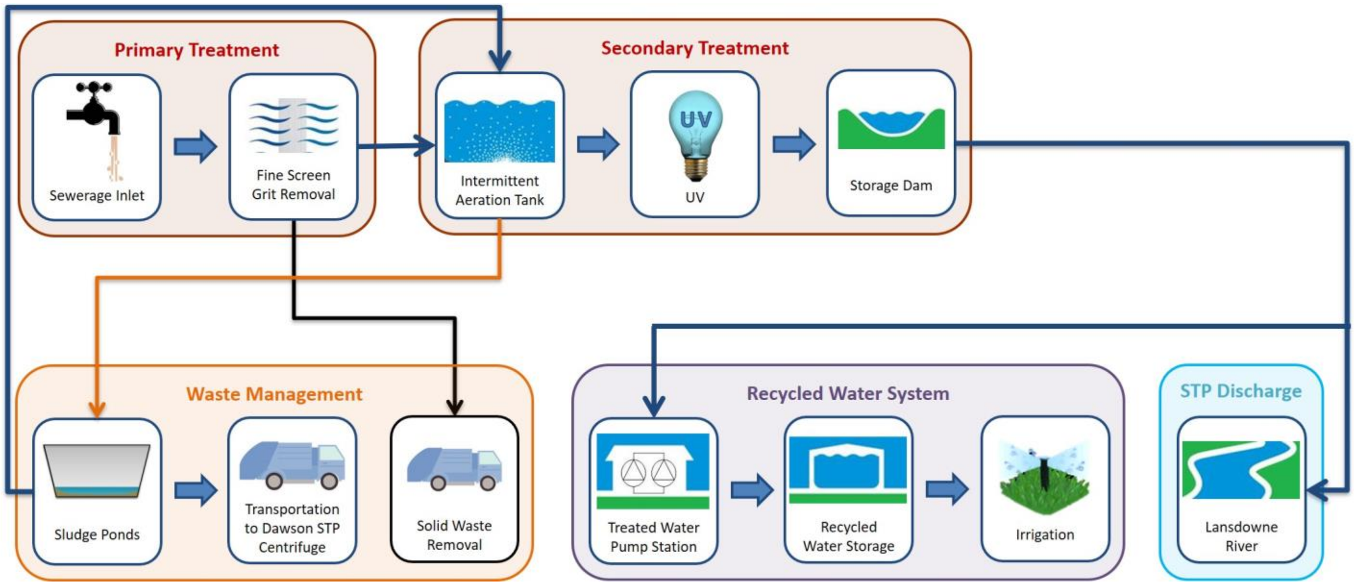


Figure 6-5 Coopernook STP process layout

6.1.2.2 Effluent management

6.1.2.2.1 EPA licence conditions

The EPA licence for Coopernook STP is EPL12583. The scale of activity at the site is 0 – 3 ML maximum volume of discharge.

The Coopernook STP is designed to meet the effluent discharge criteria stipulated in EPL 12583. The Coopernook STP is licenced to discharge to the Lansdowne River during wet weather. The treated effluent discharges to Point 1 Lansdowne River and must not exceed the concentration limits specified for the pollutants shown in Table 6.4.

Table 6.4 Coopernook STP discharge licence limits

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
Oil and grease	Milligrams per litre	-	-	-	10
pH	pH	-	-	-	6.5-8.5
Faecal Coliforms	Colony forming units per 100 millimetres	-	-	-	200
Total Suspended Solids	Milligrams per litre	-	-	-	30
Biochemical Oxygen Demand	Milligrams per litre	-	-	--	30

6.1.2.2.2 Effluent management

Management of effluent for the Coopernook scheme is via storage, beneficial re-use and release to the Lansdowne River. Secondary treated effluent is pumped to the effluent storage pond (13 ML) after disinfection and then reused on 15 Ha of privately owned irrigated pasture.

In wet weather, surplus effluent is discharged to the Lansdowne River south of Coopernook via a 160 mm PE x 3.2 km effluent transfer main. The transfer main has a capacity of 1.5 to 2 ML/d.

The effluent irrigation scheme has been designed so that sufficient land and wet weather storage is available to avoid the need for frequent discharges of effluent to the Lansdowne River. This also minimises the risk of effluent contaminating groundwater resources.

Effluent is released to the Lansdowne River on a precautionary discharge basis during high flows. River release is governed by flow conditions. Unscheduled discharges occur when effluent storages are full and irrigation cannot take place. The basis for a precautionary discharge is that river flow is sufficient to dilute effluent, and thus avoid adverse impacts on river water quality. Prior to any precautionary discharge, the effluent is sampled.

Table 6.5 summaries some of the Coopernook's STP effluent discharge management details.

Table 6.5 Coopernook's STP effluent discharge management details.

STP capacity	Current average flow	Treatment process	Reuse	Effluent discharge management
600 EP	65 kL/d 29.9 ML/y	Extended aeration, UV disinfection	1 property irrigates with recycled water	Discharged via the Lansdowne River with precautionary release: – 55 ML/d minimum flow threshold – 200:1 river flow to effluent flow – Storage dam volume is > 5 ML (40% full) and irrigation is not possible – 13 ML storage

6.1.3 Forster sewerage scheme

The Forster sewerage scheme services the townships of Forster, Green Point, Pacific Palms and Smiths Lake. This area extends approximately 25 km from Forster (north) to Smiths Lake (south).

A schematic diagram of the Forster Sewerage Scheme is shown in Figure 6-6.

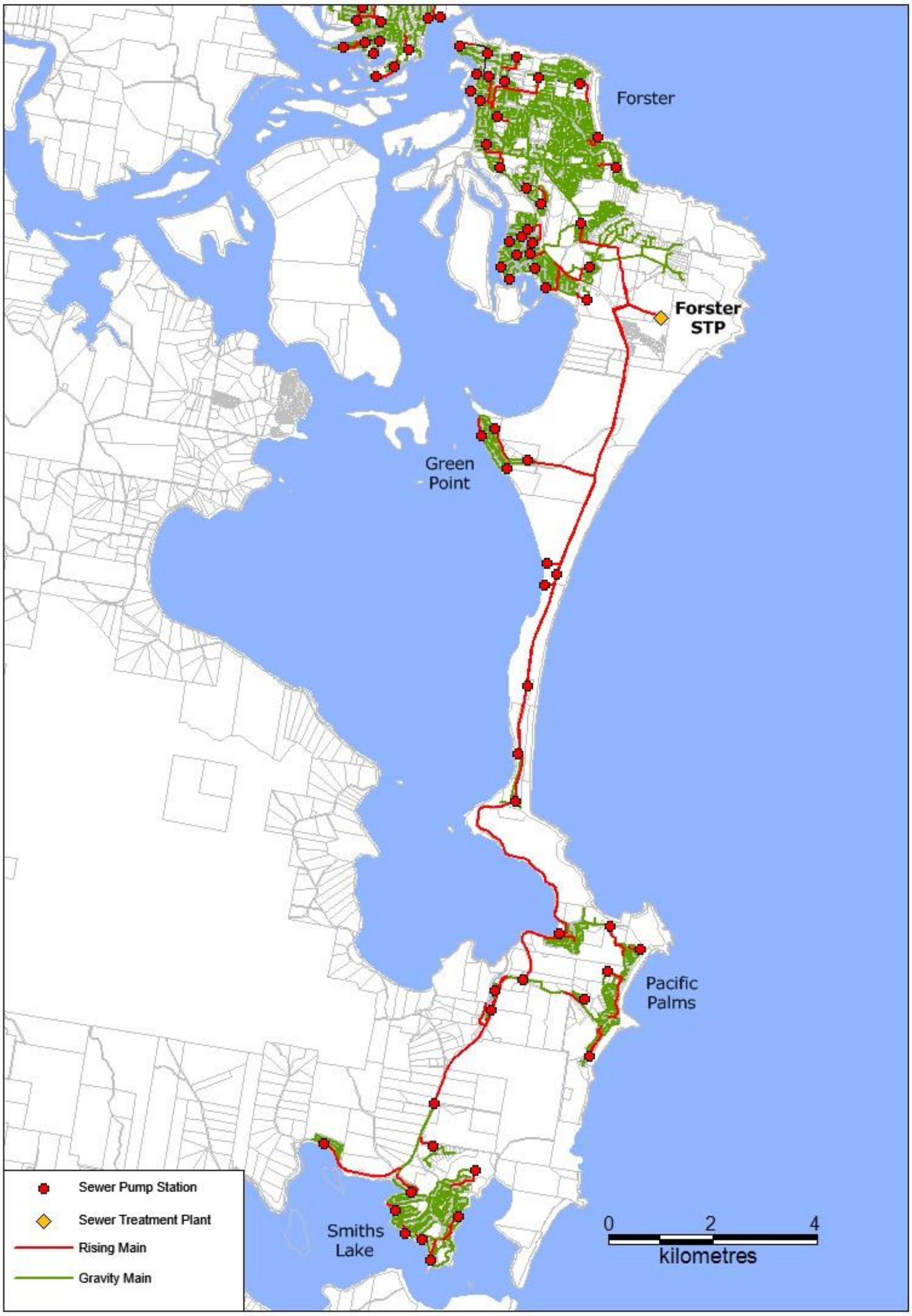


Figure 6-6 Forster sewerage scheme overview

6.1.3.1 STP description

Forster STP is located on a 6.1 Ha site on Sweet Pea Road, adjacent the northern extremity of Booti National Park, approximately 5 km south of the Forster town centre. It was originally designed with four small IDEATs in the late 1970's. It was upgraded as Stage 1 in 1996 with the addition of two larger IDEATs. A further Stage 2 upgrade in 2005 increased it's the STP capacity to 42,500 EP. Treated effluent is pumped to the Pacific Ocean via. an ocean release at Janies Corner.

The STP consists of:

– Preliminary treatment facilities comprising a balance tank, measuring flume, septic effluent receival, mechanical screening with manual screened by-pass and grit removal chamber.
– Secondary treatment: 4 x 5,150 EP and 2 x 10, 940 EP IDEAT units, 3 catch ponds (total 9800 kL) and chemical (alum) dosing for phosphorous reduction.
– Tertiary treatment: 4 x filters rated at total 150 L/s and UV disinfection for flow up to 400 L/s.
– Four effluent storage ponds with total capacity of 24 ML.
– Biosolids treatment in 4 lagoons (15,600 kL) and centrifuge for dewatering.
– The effluent management system comprises an effluent pump station (capacity 400 L/s) and a 1.86 km x 450 mm diameter rising main to Janies Corner with near-shore ocean discharge.

Figure 6-7 displays Forster's sewage treatment process layout.

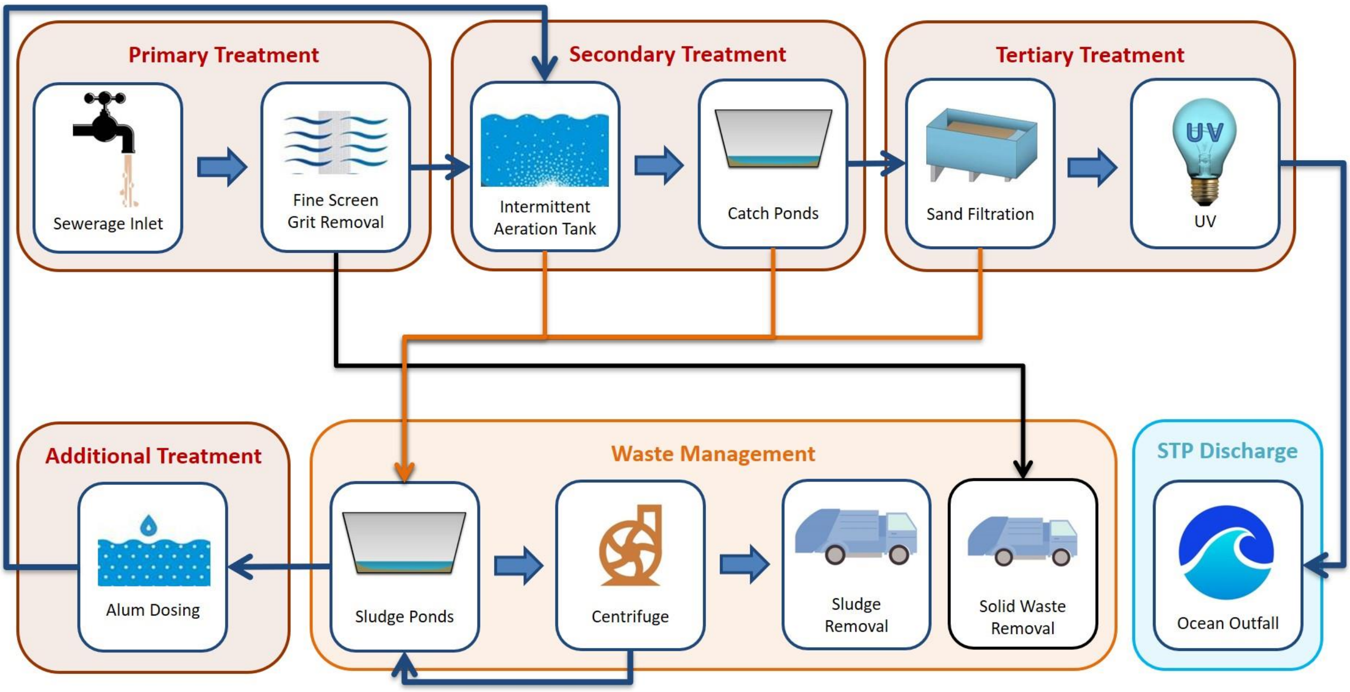


Figure 6-7 Forster STP process layout

6.1.3.2 Effluent management

6.1.3.2.1 EPA licence conditions

The EPA licence for Forster STP is EPL 2562. The scale of activity at the site is for > 1000 – 5000 ML annual maximum volume of discharge. The Forster STP was designed to meet the effluent discharge criteria stipulated in EPL 2562. The treated effluent discharges to the Point 1 Ocean outfall located at Janies Corner. The effluent must not exceed the concentration limits specified for the pollutants shown in Table 6.6. Discharge monitoring at Point 5 (using a flow meter on the outflow of the final effluent storage pump) is conducted to determine compliance with the limits for discharge to Point 1.

Table 6.6 Forster STP discharge licence concentration limit

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
Oil and grease	Milligrams per litre	-	-	-	10
Total Suspended Solids	Milligrams per litre	-	-	-	35
Biochemical Oxygen Demand	Milligrams per litre	-	-	-	20

6.1.3.2.2 Load limits

The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the Table 6.13.

Table 6.7 Forster STP point load limits

Assessable pollutant	Load limit (kg)
BOD (Enclosed Water)	
Nitrogen (total) (Enclosed Water)	13424
Oil and Grease (Enclosed Water)	5361
Phosphorus (total) (Enclosed Water)	
Total Suspended Solid (Enclosed Water)	3666

6.1.3.2.3 Volume and mass limits

The Forster STP discharge point volume/mass of liquids discharged to water; or solids or liquids applied to the area; must not exceed the volume/mass limit specified in Table 6.8. Discharge monitoring at Point 5 (flow meter on the outflow of the final effluent storage pump) is conducted to determine compliance with the limits specified by condition for discharge to Point 1.

Table 6.8 Foster licence volume and mass limits

Point	Units of measure	Volume/mass limit
5 (outlet of final effluent storage pond)	kilolitres per day	23000

6.1.3.2.4 Effluent management system

The current management comprises an ocean discharge at a near-shore outfall at Janies Corner.

The transfer system comprises an effluent PS (EPS) rated at 400 L/s capacity (34 ML/d) and 1.86 km x 450 mm diameter effluent rising main (ERM) terminating at the outfall. A 5 yearly aquatic ecology and bioaccumulation study will continue to monitor any environmental impacts on the receiving waters.

Effluent from the future Pacific Palms STP is proposed to be transferred (after flow balancing) to Forster STP for discharge with the Forster effluent. The construction of the Pacific Palms STP will be staged so that, at peak times, the flows could be initially diverted to the Pacific Palms STP site for balancing prior to being transferred to the Forster STP for treatment and disposal. Pacific Palms STP Stage 1 has been completed, which involved the construction of two sludge lagoons that provide wet weather emergency storage. Pacific Palms Stage 2 is to construct the balance of the STP. The trigger point for the construction of Stage 2 will be the servicing of Coomba Park or the development of the Charlotte Bay area beyond the capacity of SPS PP07.

The Department of Public Works & Services (DPWS) report (2002) indicates that under the most adverse conditions for mixing and exchange (dry weather in June) the outfall will operate satisfactorily provided the effluent detention in the embayment does not exceed 12 hours. A continuous dry weather discharge over 8.5 hours was found to result in a 12-hour detention in the embayment. There is no such limitation under wet weather conditions.

At the maximum 400 L/s transfer capacity, the release over 8.5 hours would be 12.2 ML, which is well above the estimated future peak period ADWF.

Under future wet weather conditions, the maximum flow entering Forster STP is estimated at 549 L/s. In addition, effluent transfer from the Pacific Palms STP will be up to 50 L/s.

Consequently, the Forster STP effluent needs to be stored and balanced to achieve a discharge rate of no more than 350 L/s (400 L/s less 50 L/s from Pacific Palms) if upgrading of the transfer system and outfall is to be avoided. Such a flow rate is equivalent to 6.3 x ADWF (4.0 x peak period ADWF). The 24 ML balancing storage available at the STP represents 6.8 days storage at permanent ADWF (5.0 days at peak ADWF). This should be sufficient to balance peak wet weather inflows (549 L/s) and limit effluent discharges to the maximum 350 L/s effluent transfer capacity available for flows treated.

In summary, the existing effluent storage, transfer system and ocean outfall at Forster are considered capable of meeting the projected increased loads over the next 30 years and beyond.

6.1.3.3 Recycled water scheme

Minor reuse occurs within the Forster STP site. The proposal of providing recycled water in the Forster area for beneficial reuse has been investigated as a means to dispose of treated effluent. It was identified that the costs involved and the current spare effluent disposal capacity makes this option not financially viable. Due to this, expanding recycled water use has not been considered further.

6.1.4 Gloucester sewerage scheme

The Gloucester sewerage scheme services the towns of Gloucester and Barrington. Council (as former MidCoast Water) inherited in July 2011 (from the former Gloucester Shire Council) the operation of Gloucester and Barrington’s water and sewer networks.

A schematic diagram of the Gloucester sewerage scheme is shown in Figure 6-8.

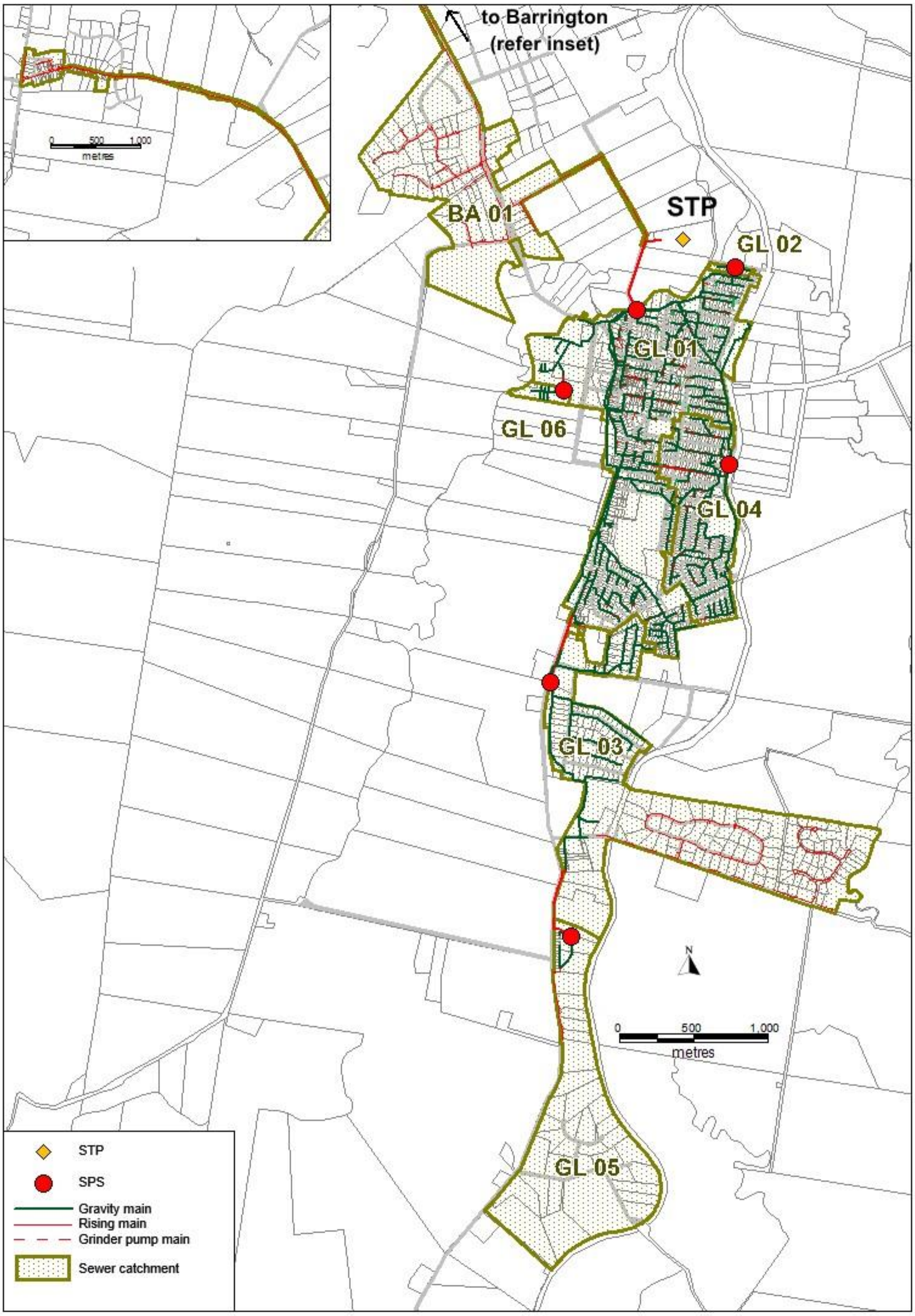


Figure 6-8 ***Gloucester sewerage scheme overview***

6.1.4.1 STP description

Flow is pumped to the Gloucester STP from sewer pump station (SPS) GL01 and from the Barrington pressure sewer network. The Gloucester STP uses a trickling filter process to treat the sewage. It is followed by detention in the maturation ponds and polishing in the artificial wetlands.

The STP has a design capacity of 4,600 EP.

The Gloucester STP has the following treatment:

- Initial screening, de-gritting and sedimentation
- Primary sedimentation tank
- Biological nutrient reduction based on Trickling Filters (2 rock media Filters)
- Effluent is clarified in 1 humus tank
- Effluent maturation ponds
- Tertiary treatment: Artificial Wetlands
- Treated effluent is discharged into the Gloucester River, a tributary of the Manning River

Figure 6-9 displays Gloucester's STP process layout.

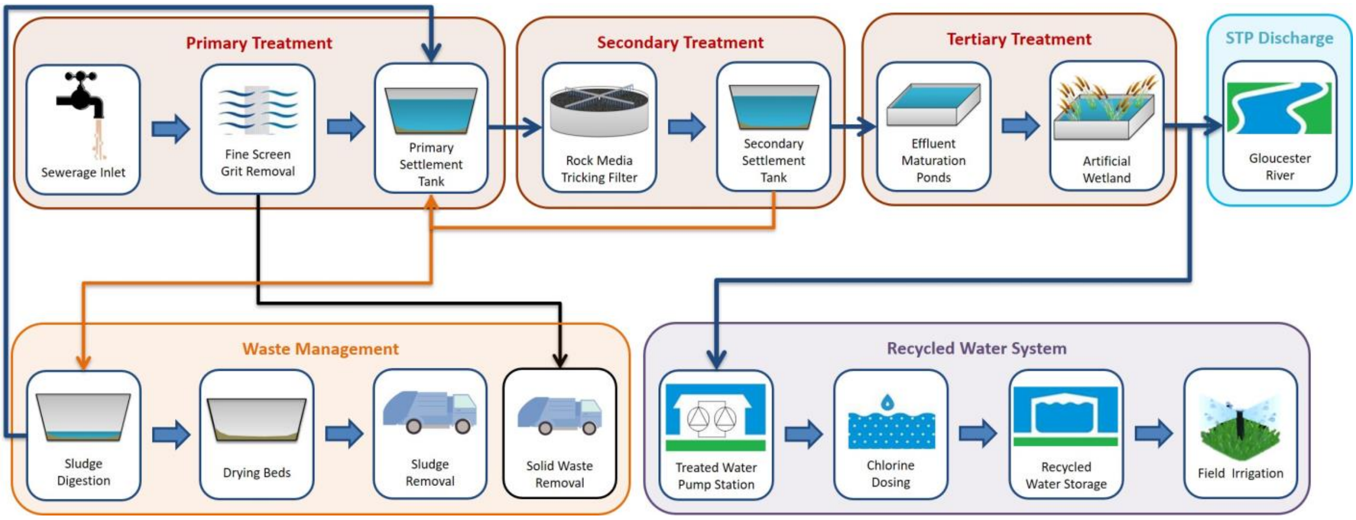


Figure 6-9 Gloucester sewage treatment process layout

Note: The Gloucester STP currently progressing into detailed design phase. The upgrade will see the construction of a new STP using continuous treatment technology and provision for running as either Modified Ludzack-Ettinger (MLE) process or 4 Stage Bardenpho (4SB).

6.1.4.2 Effluent management

6.1.4.2.1 EPA licence conditions

The EPA licence for Gloucester STP is EPL 721. The scale of activity at the site is > 219 – 1000 ML annual maximum volume of discharge. The Gloucester STP is designed to meet the effluent discharge criteria stipulated in EPL 721. The treated effluent discharges to Point 3 outlet from an artificial wetland to Gloucester River and must not exceed the concentration limits specified for the pollutants shown in Table 6.9.

Table 6.9 Gloucester STP discharge licence concentration limit

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
pH	pH	-	-	-	6.5-8.5
Total Nitrogen	Milligrams per litre	-	-	-	-35
Nitrogen (ammonia)	Milligrams per litre	-	-	-	10
Total Suspended Solids	Milligrams per litre	-	-	-	30
Biochemical Oxygen Demand	Milligrams per litre	-	-	-	20

6.1.4.2.2 Load limits

The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the Table 6.13.

Table 6.10 Gloucester load limits

Assessable pollutant	Load limit (kg)
BOD (Enclosed Water)	1525
Nitrogen (total) (Enclosed Water)	7289
Oil and Grease (Enclosed Water)	3578
Phosphorus (total) (Enclosed Water)	3578
Total Suspended Solid (Enclosed Water)	6557

6.1.4.2.3 Volume and mass limits

The Gloucester STP volume/mass limit is specified in Table 6.11. This volume/mass limit cannot be exceeded by the volume/mass of liquids discharged to water or the solids or liquids applied to the area Table 6.11. Discharge monitoring at Point 5 (a flow meter on the outflow of the final effluent storage pump) is conducted to determine compliance with the limits specified by condition for discharge to Point 1.

Table 6.11 Gloucester licence volume and mass limits

Point	Units of measure	Volume/mass limit
3 (outlet of wetland to Gloucester River)	kilolitres per day	6500

6.1.4.2.4 Effluent management system

Treated effluent from the Gloucester STP is discharged into Gloucester River from the STP's artificial wetland.

6.1.4.3 Recycled water scheme

The recycled water scheme was commissioned in 2016. It utilises 25 – 40% of the treated effluent from the Gloucester STP for irrigation for pasture on a nearby property.

The process involves the following:

- Chlorination facilities at the STP
- Transfer pumps at the STP
- Transfer main from the STP to the property to be irrigated
- An irrigation system on the property

Figure 6-10 displays Gloucester's recycled water flow diagram.

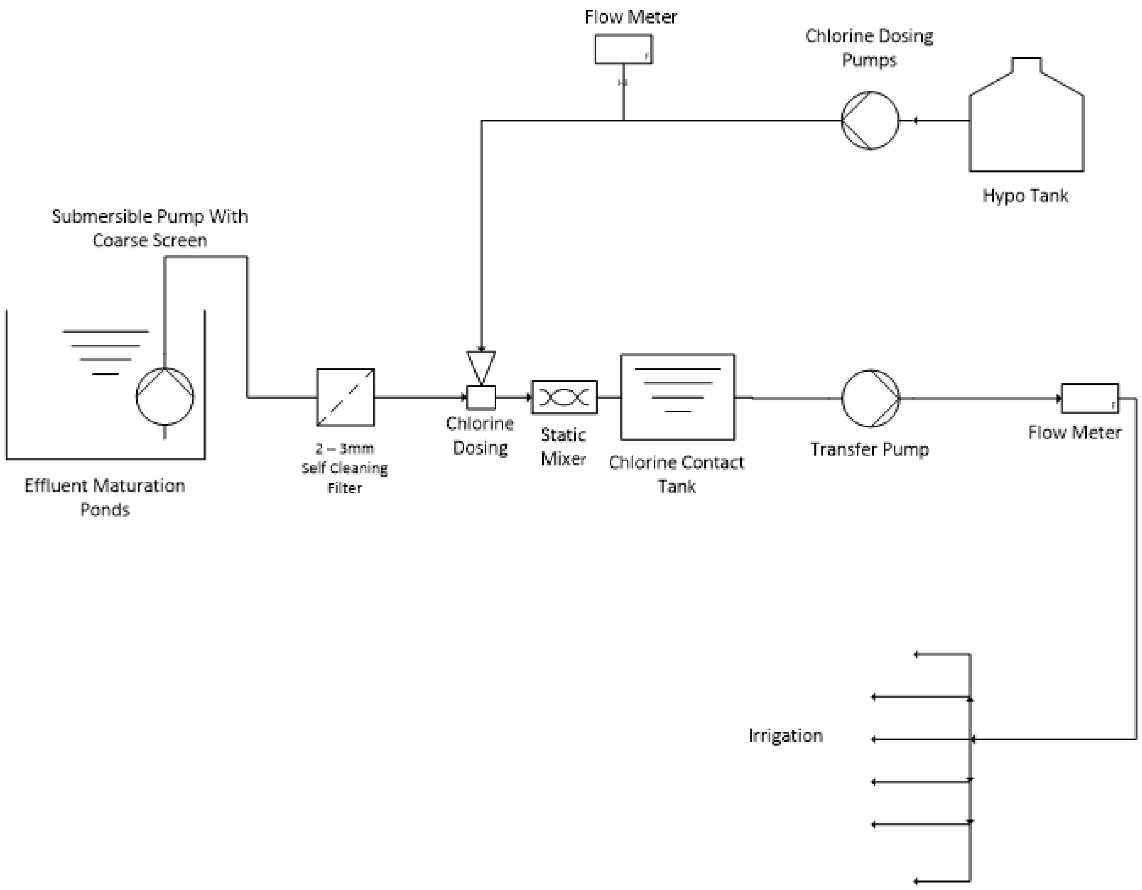


Figure 6-10 Gloucester's recycled water flow diagram

6.1.5 Hallidays Point sewerage scheme

The Hallidays Point sewerage scheme is made up of the Hallidays Point, Tuncurry and Nabiac sewerage systems. A schematic diagram of the Hallidays Point sewerage scheme is shown in Figure 6-11.

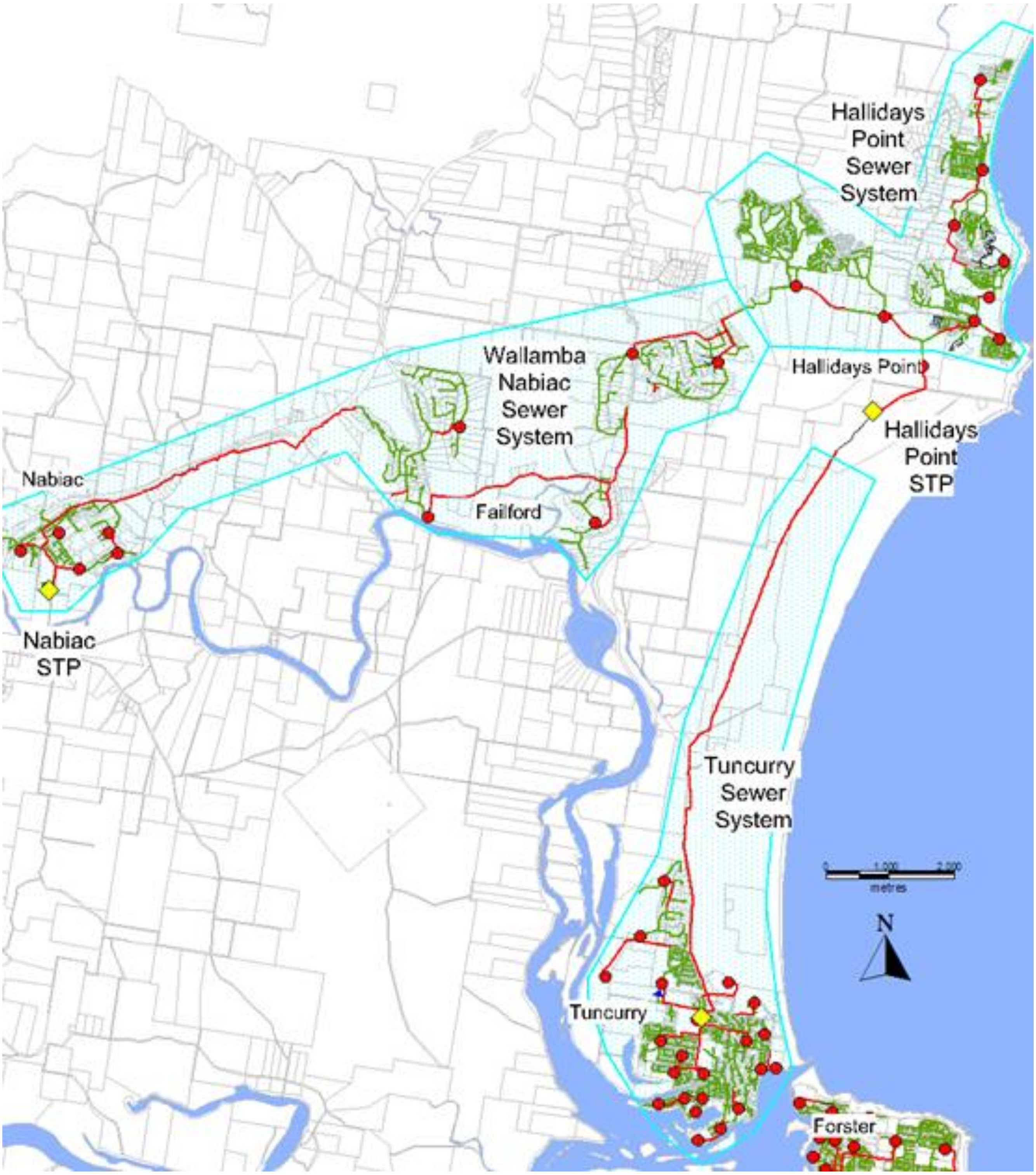


Figure 6-11 Hallidays Point sewerage service scheme overview

6.1.5.1 STP descriptions

6.1.5.1.1 Nabiac STP

The Nabiac STP receives flow from catchments NA01 to NA05, via NA02 and NA13. The plant consists of primary and secondary treatment. The STP provides some flow balancing before effluent is pumped via. the Nabiac EPS to the Hallidays Point STP, via the Wallamba and Hallidays transfer systems. The plant treats the effluent for odour issues along the 20 km to the Hallidays Point STP.

Figure 6-12 displays Hallidays' sewage treatment process layout.

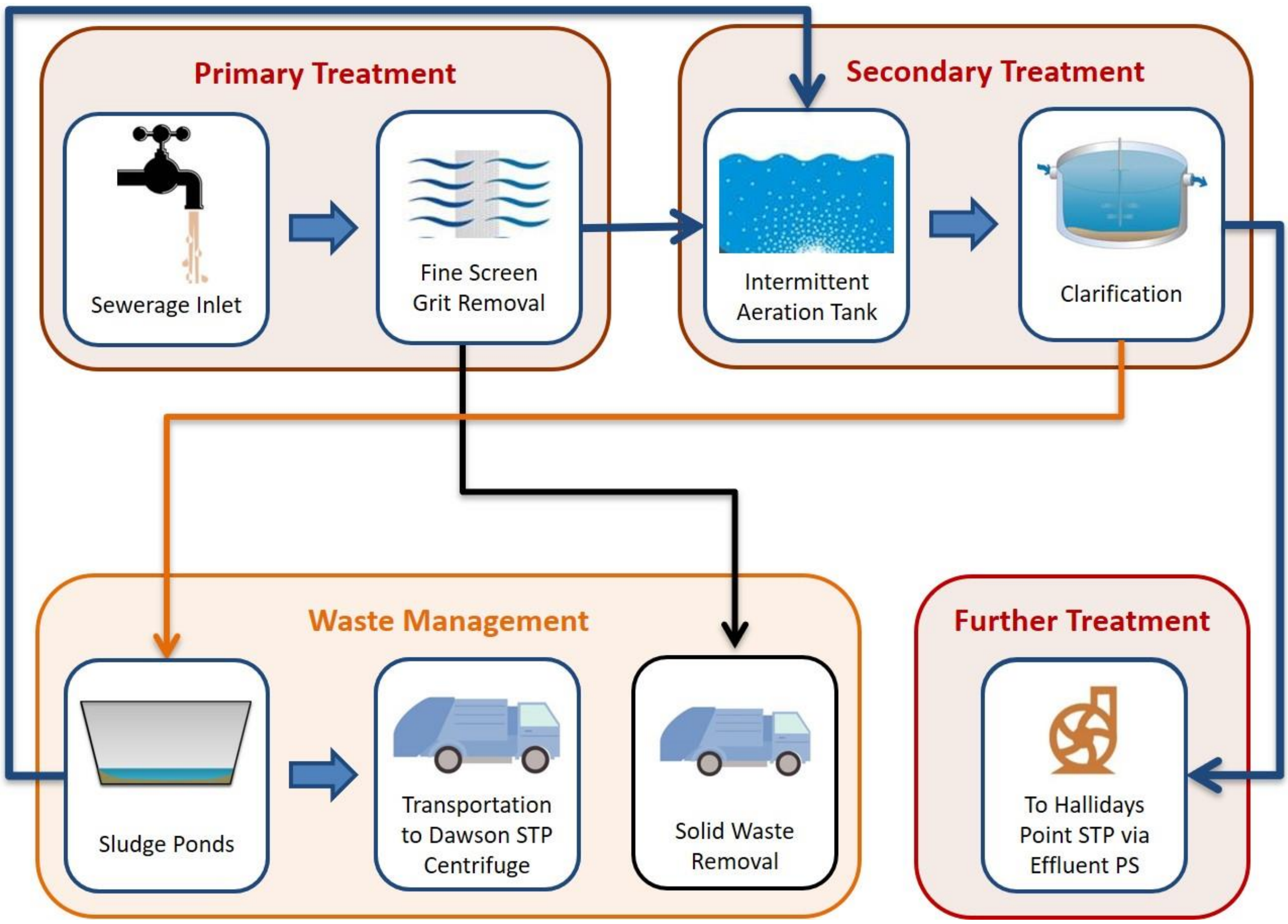


Figure 6-12 Nabiac sewage treatment process layout

The Nabiac STP was commissioned in 1999 and was originally designed to treat 940 EP. The plant is capable of treating 2400 EP, including wet weather bypass and storage The ADWF is 130 kL/d and the peak wet weather flow (PWWF) is 2.4 ML/d, according to STP flow records.

The plant is capable of handling current loads and also loading into the near future.

6.1.5.1.2 Hallidays Point STP

The Stage 1 Hallidays Point STP was commissioned in 1985 for a capacity of 5000 EP. The plant was upgraded in 2007 to Stage 2 with a capacity of 26,783 EP. Future Stage 3 upgrades are scheduled for 2025 to achieve a plant capacity of 37,700 EP. Prior to the 2007 Stage 2 upgrade, the Tuncurry STP was treating all flow from Tuncurry. The Tuncurry STP was decommissioned in 2007 and Tuncurry sewage is pumped to the Hallidays Point STP via. pump station TU23. The ADWF at Hallidays Point STP is 3 ML/d and PWWF is 13 ML/d.

Figure 6-13 displays Hallidays Point sewage treatment process layout.

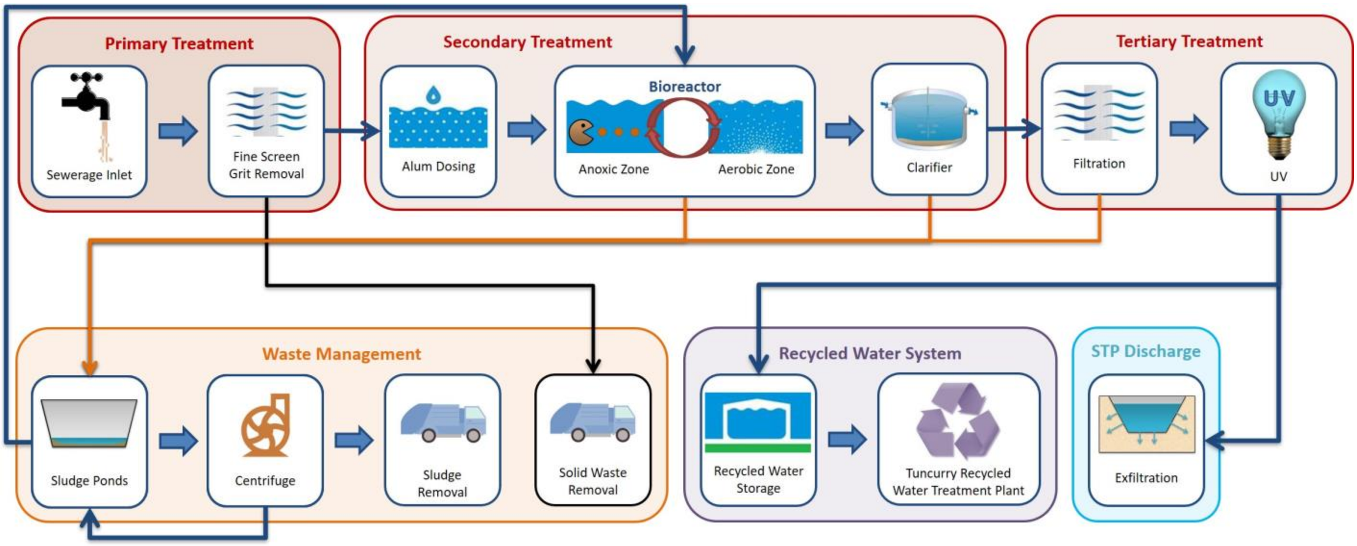


Figure 6-13 Hallidays Point sewage treatment process layout

6.1.5.2 Effluent management

6.1.5.2.1 EPA licence conditions

The EPA licence for the Hallidays Point STP is EPL 3175. The scale of activity at the site is for > 1000 – 5000 ML annual maximum volume of discharge. The Hallidays Point STP is designed to meet the effluent discharge criteria stipulated in EPL 3175. The treated effluent discharges to Point 1 outlet of the UV treatment system and must not exceed the concentration limits specified for the pollutants shown in Table 6.12.

Table 6.12 Hallidays Point STP discharge licence concentration limit

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
Oil and grease	Milligrams per litre	-	-	-	10
Nitrogen (total)	Milligrams per litre	-	-	-	10
Nitrogen (ammonia)	Milligrams per litre	-	-	-	2
Total Suspended Solids	Milligrams per litre	-	-	-	20
Biochemical Oxygen Demand	Milligrams per litre	-	-	-	20

6.1.5.2.2 Load limits

The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the Table 6.13.

Table 6.13 Hallidays Point STP load limits

Assessable pollutant	Load limit (kg)
BOD (Enclosed Water)	15195
Nitrogen (total) (Enclosed Water)	14355
Oil and Grease (Enclosed Water)	5429
Phosphorus (total) (Enclosed Water)	6580
Total Suspended Solid (Enclosed Water)	28694

6.1.5.2.3 Volume and mass limits

The Hallidays Point STP volume/mass limit is specified in Table 6.14. This volume/mass limit cannot be exceeded by the volume/mass of liquids discharged to water or the solids or liquids applied to the area.

Table 6.14 Hallidays Point STP licence volume and mass limits

Point	Units of measure	Volume/mass limit
1 (out of UV treatment)	kilolitres per day	33600
28 (Tuncurry exfiltration ponds)	kilolitres per day	3000

6.1.5.2.4 Effluent management system

Treated effluent from the Hallidays Point STP is either sent to the exfiltration beds or to the Tuncurry RTP for further treatment. The Tuncurry RTP site also has an exfiltration bed, which is not often used.

6.1.5.2.5 Hallidays Point STP exfiltration *system*

The Hallidays Point STP exfiltration system has seven beds with a total area of 5.26 ha. The seven existing exfiltration beds at the Hallidays Point STP are shown in Figure 6-14. This figure also shows the proposed C2 exfiltration beds, which is the proposed location of future exfiltration beds.

The maximum recharge capacities for the Hallidays Point STP exfiltration beds and the Tuncurry RTP bed are 4.5 ML/d and 1.5 ML/d respectively. The estimated capacity of the C2 land is 12 ML/d. The current and projected recharge volumes can be accommodated by utilising all three sites or a combination thereof, even during 1:100 year wet years and after climate change impacts of +0.9m sea level rise.

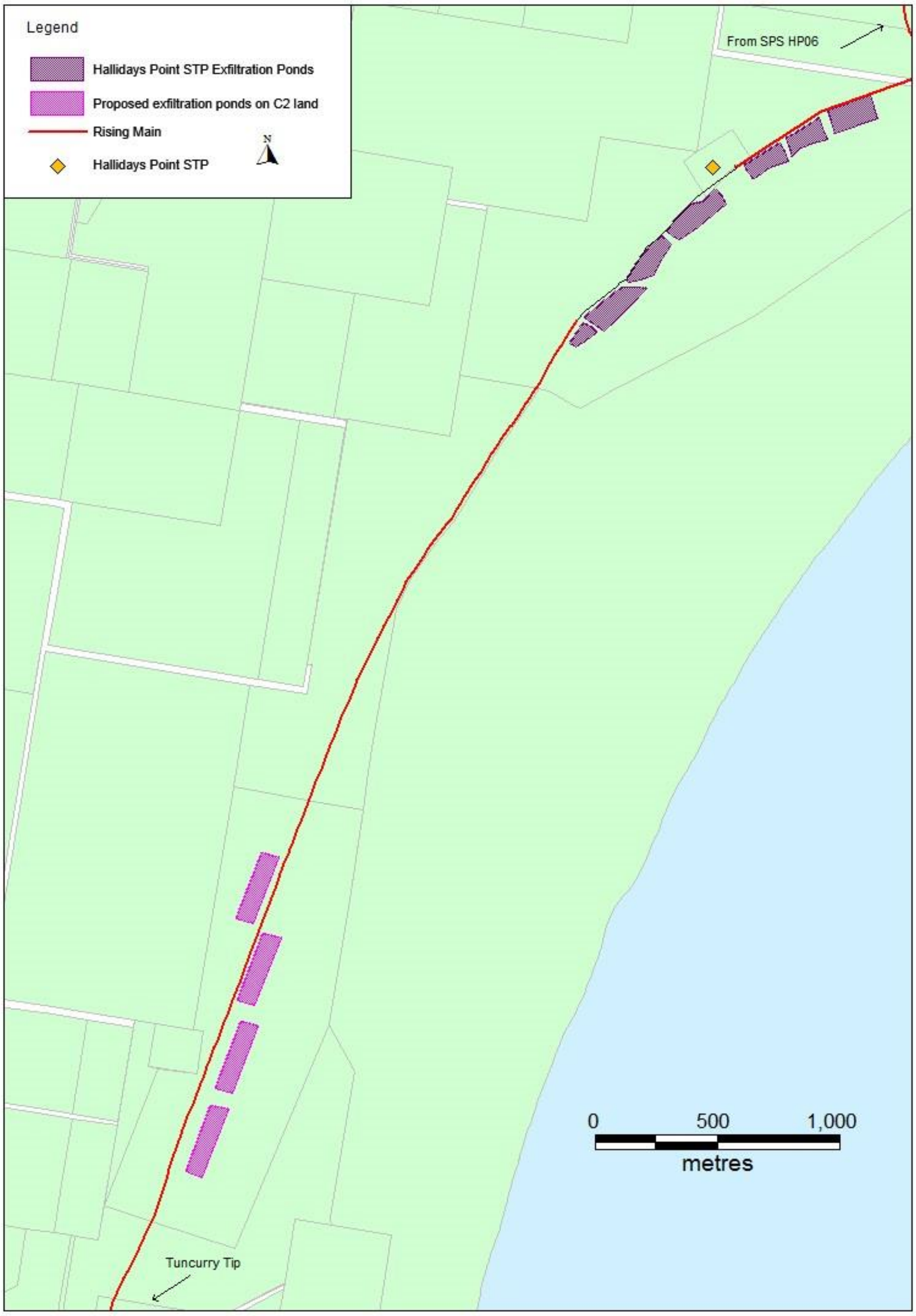


Figure 6-14 Hallidays Point STP exfiltration ponds and proposed C2 ponds

6.1.5.3 Recycled water scheme

6.1.5.3.1 Tuncurry RTP

The Tuncurry RTP treats tertiary treated effluent from the Hallidays Point STP. The recycled water is pumped to onsite storage tanks at several open spaces in Tuncurry for irrigation. The initial daily design production capacity of the Tuncurry RTP is 3.5 ML/d. The plant is upgradable to 7 ML/d.

The plant is designed to treat a nominal flow rate of 40 L/s. The design flow rates for the two major process components are shown in Table 6.15. Figure 6-15.

Table 6.15 Tuncurry RTP process design instantaneous flow rates.

Termination point	Design minimum flow (L/s)	Current design flow (L/s)	Ultimate design flow (L/s)
Raw Water Pump Station Feed	21	70	142
Filtrate	14	45	93

Figure 6-15 shows the Tuncurry recycled treatment process layout.

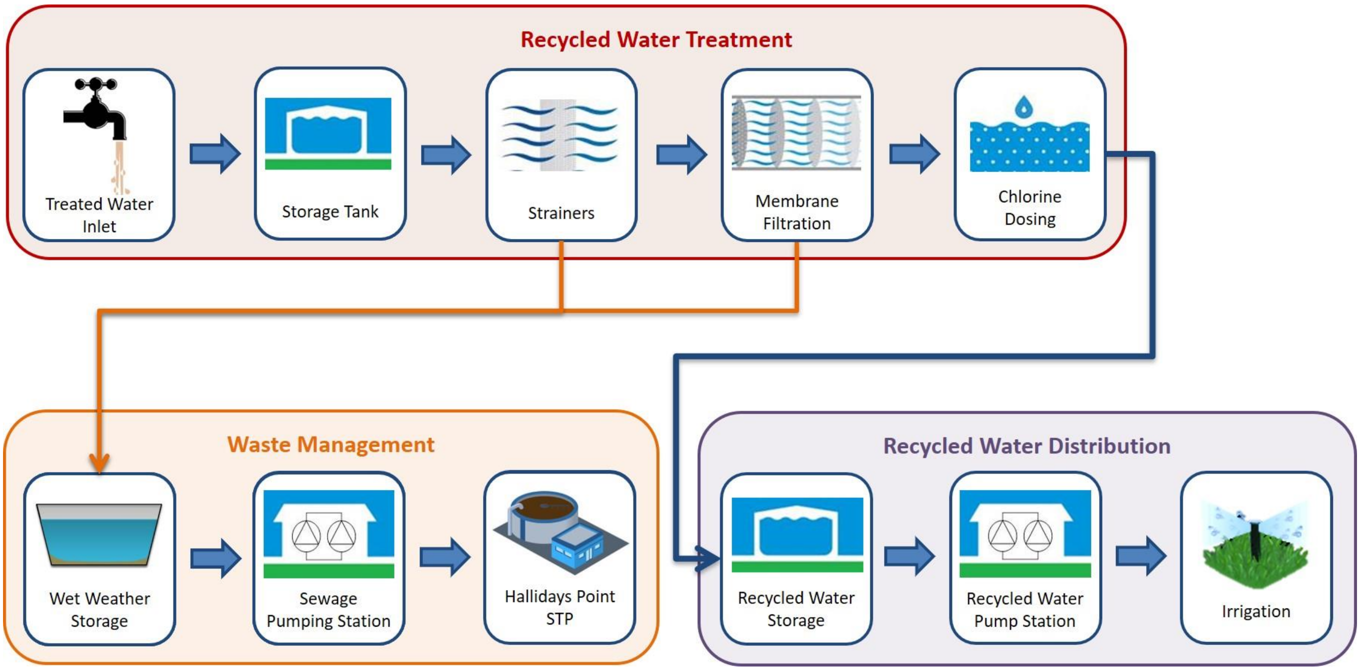


Figure 6-15 Tuncurry recycled treatment process layout

6.1.6 Harrington sewerage scheme

The Harrington sewerage scheme dates from 1976 and services the existing development within the villages of Harrington and Crowdy Head. A schematic diagram of the Harrington sewerage scheme is shown in Figure 6-16.

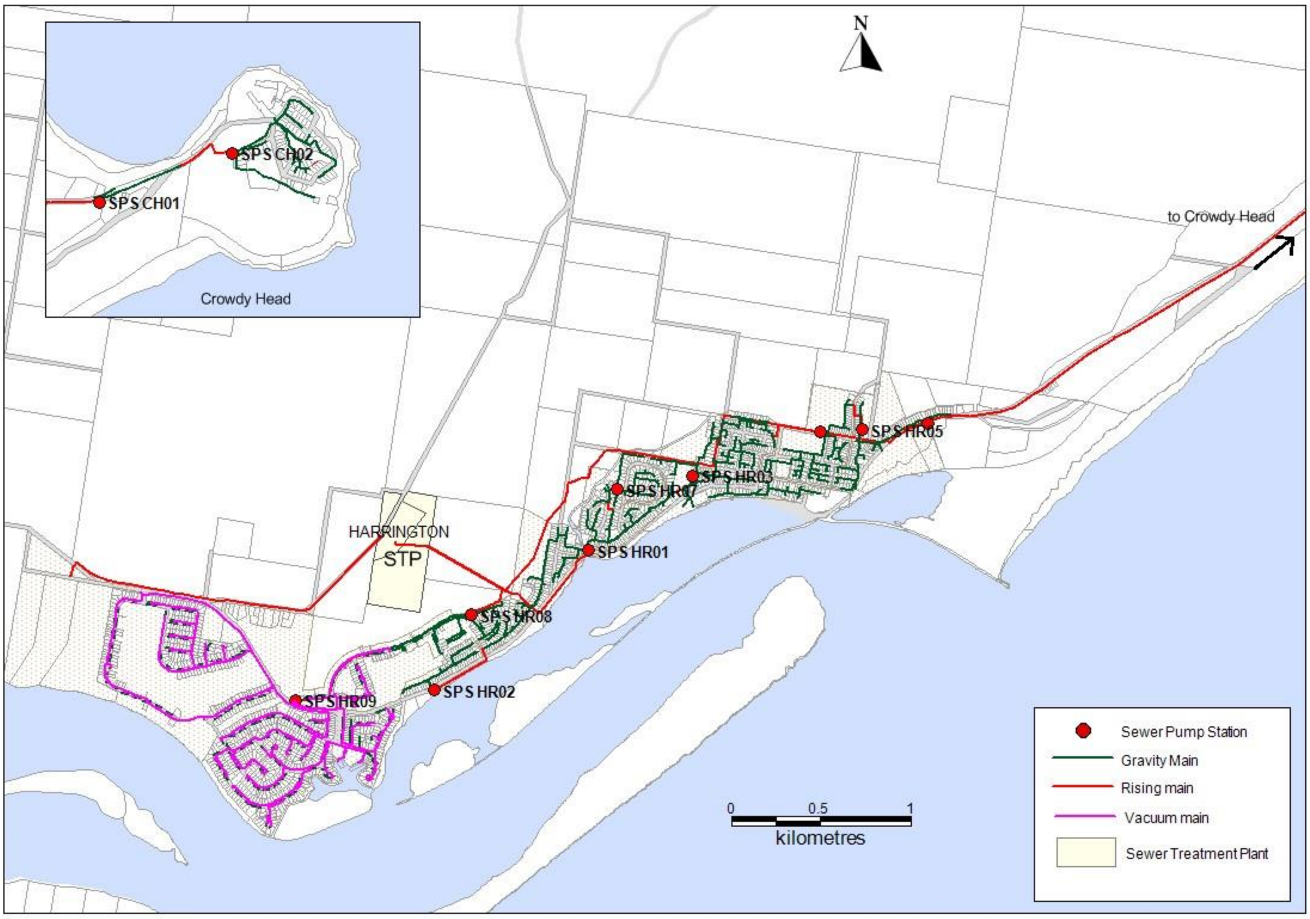


Figure 6-16 Harrington sewerage service scheme overview

6.1.6.1 STP description

The Harrington STP is located on Industrial Drive and receives sewage flows from Harrington and Crowdy Head. The sewage source is mainly domestic with limited light service industry and commercial development.

Originally constructed in 1976, the Harrington STP produces secondary treated effluent and comprises 2 x 2000 EP Pasveer Channels (P2000) that were converted to continuous aeration with the addition of two clarifiers and a catch pond in 1995. Sludge lagoons and drying beds are used for biosolids management.

In 2012 the plant was upgraded with effluent filtration, UV disinfection and a 120 kL recycled water storage tank to enable effluent to be beneficially reused on the adjacent Harrington Waters Golf Course.

Figure 6-17 displays Harrington’s sewage treatment process layout.

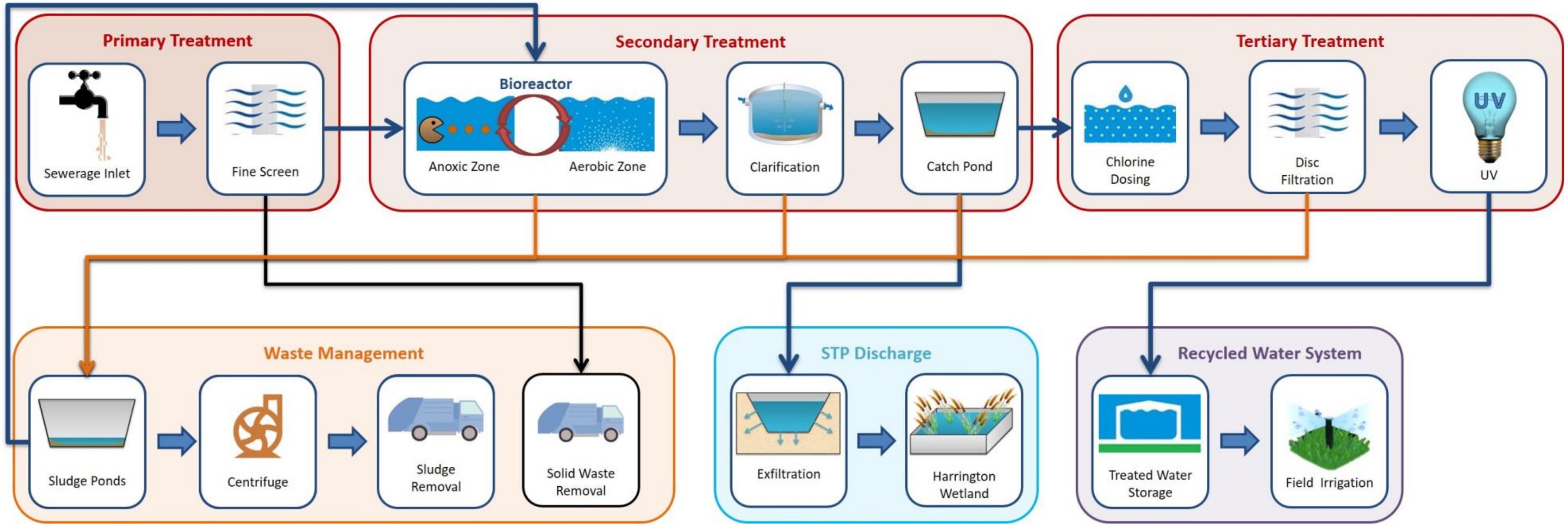


Figure 6-17 Harrington sewage treatment process layout

6.1.6.2 Effluent management

6.1.6.2.1 EPA licence conditions

The EPA licence for the Harrington STP is EPL 2505. The scale of activity at the site is > 219 – 1000 ML annual maximum volume of discharge. The Harrington STP is designed to meet the effluent discharge criteria stipulated in EPL 2505. The treated effluent discharges to Point 1 at the catch pond following the clarifiers, immediately upstream of the exfiltration ponds. This discharge must not exceed the concentration limits specified for the pollutants shown in Table 6.16.

Table 6.16 Harrington STP discharge licence concentration limit

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
pH	pH	-	-	-	6.5-8.5
Total Suspended Solids	Milligrams per litre	-	-	-	30
Biochemical Oxygen Demand	Milligrams per litre	-	-	-	20

6.1.6.2.2 Load limits

The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the Table 6.17.

Table 6.17 Harrington Point load limits

Assessable pollutant	Load limit (kg)
BOD (Enclosed Water)	1480
Nitrogen (total) (Enclosed Water)	2060
Oil and Grease (Enclosed Water)	500
Phosphorus (total) (Enclosed Water)	1940
Total Suspended Solid (Enclosed Water)	1790

6.1.6.2.3 Volume and mass limits

The Harrington STP volume/mass limit is specified in Table 6.18. This volume/mass limit cannot be exceeded by the volume/mass of liquids discharged to water or the solids or liquids applied to the area.

Table 6.18 Harrington's licence volume and mass limits

Point	Units of measure	Volume/mass limit
3 (STP inlet works)	kilolitres per day	3600

6.1.6.2.4 Effluent management system

The existing effluent management system comprises beneficial reuse on the Harrington Waters Golf Course and exfiltration to groundwater via. two effluent ponds (8 ML each) at the STP site. The effluent ponds are designed to overflow to natural wetlands (Harrington Swamp).

Harrington Swamp lies between the village of Harrington and the Harrington STP. It forms part of the extensive Great Swamp, which is mostly included within Crowdy Bay National Park. Harrington Swamp, a topographical depression hydrologically distinct from the remainder of the Great Swamp, drains into the Manning River via. Wards Gully.

6.1.6.3 Recycled water scheme

Stage 1 of the addition of effluent filtration and UV disinfection to provide beneficial reuse on the nearby Harrington Waters Golf Course is complete. Stage 2 of the beneficial reuse involves investigation into supply of recycled water to the Cattai Wetlands.

6.1.7 Hawks Nest sewerage scheme

The Hawks Nest STP is located off Mungo Brush Road, adjacent to the Hawks Nest Golf Course and to the north of existing Hawks Nest urban development.

An overview of the Hawks Nest sewerage scheme is shown in Figure 6-18.

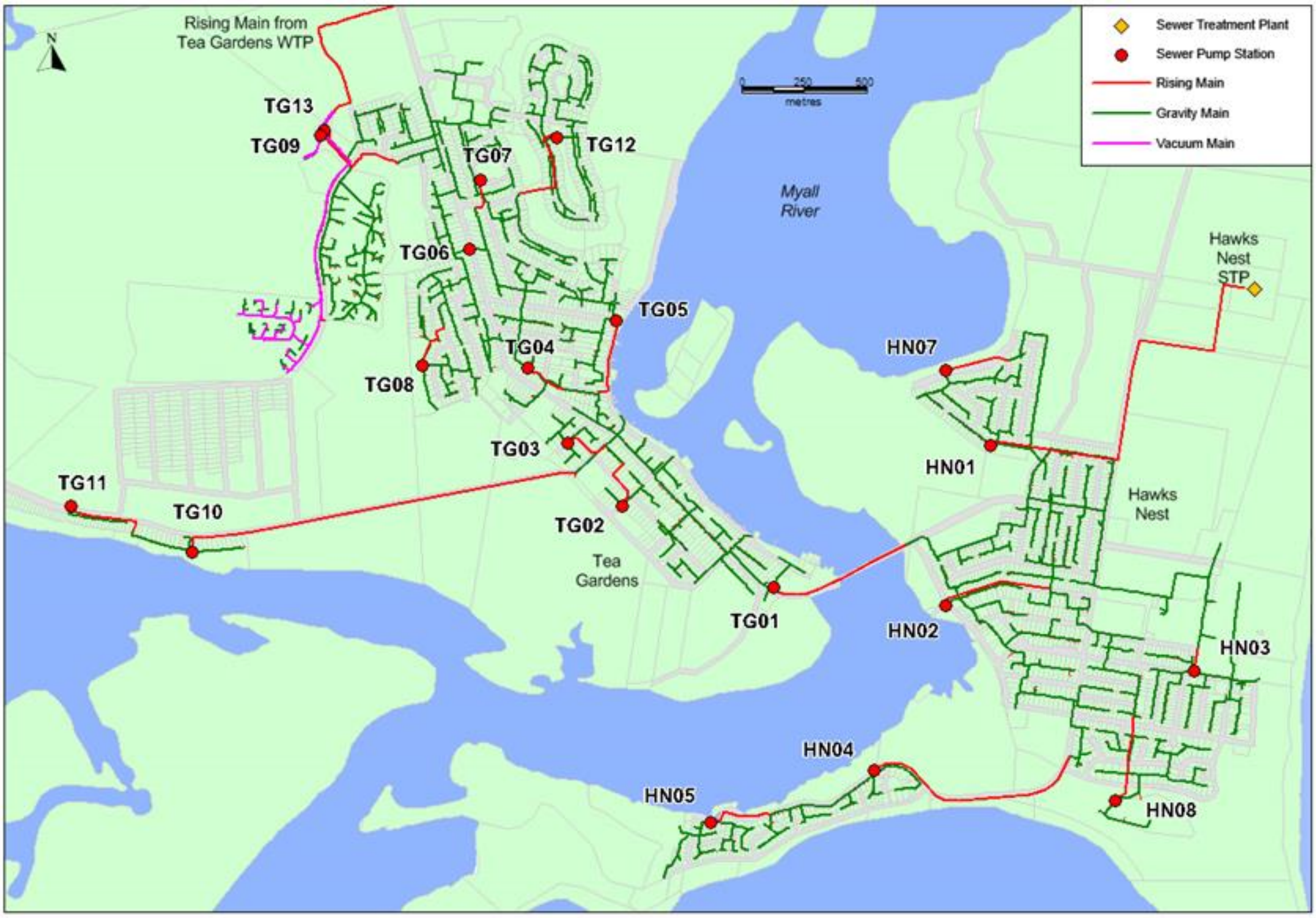


Figure 6-18 Hawks Nest sewerage service scheme overview

6.1.7.1 STP Description

The Hawks Nest STP was constructed during the 1970's and has since been upgraded to its current configuration with major renewals and upgrades undertaken in 1996.

The Hawks Nest STP consists of:

- Inlet works incorporating flow balancing, inflow measurement, screening and grit removal
- Septage receival and supernatant return pump station
- 2 x 3500 EP IDEAT units
- 2 x 1500 EP Pasveer Channels (decommissioned)
- Two stage chemical dosing for phosphorous removal
- 2 catch ponds
- UV disinfection
- 4 sludge lagoons, sludge handling and stockpile area
- 3 effluent exfiltration ponds

In 2013, the RTP was completed and has an initial daily design production capacity of 2 ML/d of recycled water. The membrane system is upgradeable through the addition of membranes to an ultimate capacity of 6 ML/d.

The current ADWF to the plant is approximately 1.1 ML/day or 210 L/EP/day. This is below the standard design flow of 240 L/EP/day utilised within the previous servicing strategy but higher than the Office of Water guide of 200 L/EP/day.

The Hawks Nest STP also experiences a significant seasonal variation in dry weather flows. During the two weeks immediately following Christmas, the plant experiences dry weather flows of up to 2 x ADWF. These flows then dissipate over the school holidays and return to normal in early February. The seasonal variations during the Easter and October school holiday periods are apparent though less significant than over Christmas-New Year period.

Wet weather inflows of up to 6 to 7 times ADWF have been recorded. The highest daily inflow of 7397 kL/day was recorded in March 2021.

Figure 6-19 shows the Hawks Nest sewage treatment process layout.

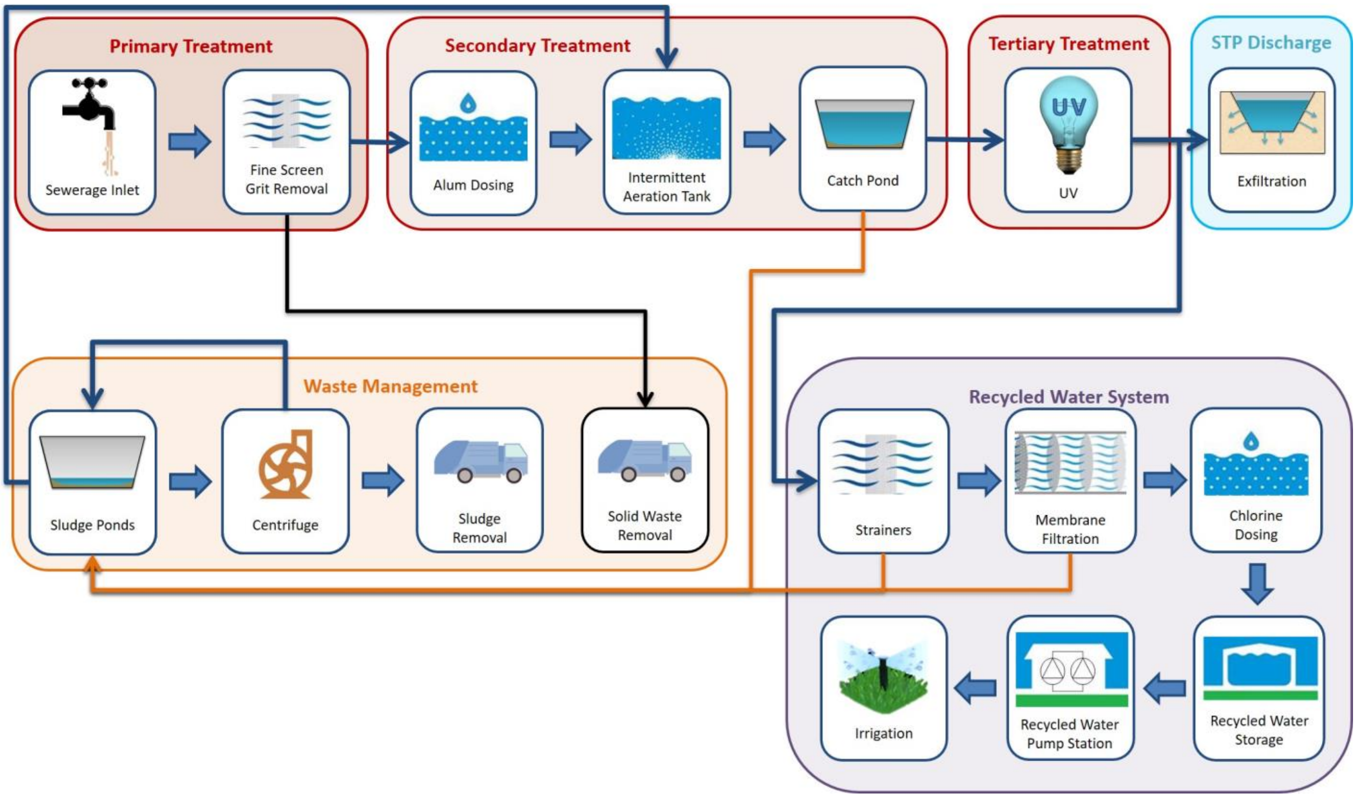


Figure 6-19 Hawks Nest sewage treatment process layout

Note: The Hawks Nest STP is currently in concept design and progressing into detailed design phase. The STP is being converted/upgraded from intermittent to continuous treatment with capabilities to run the plant as either a Modified Ludzack-Ettinger (MLE) process or 4 x Sequencing batch reactors (SBR). The STP upgrade is expected to be completed by October 2024.

6.1.7.2 Effluent management

6.1.7.2.1 EPA licence conditions

The EPA licence for Hawks Nest STP is EPL 5909. The scale of activity at the site is > 219 – 1000 ML annual maximum volume of discharge. The Hawks Nest STP is designed to meet the effluent discharge criteria stipulated in EPL 5909. The treated effluent discharges to Point 1 weir outlet from the UV sterilization unit and must not exceed the concentration limits specified for the pollutants shown in Table 6.25.

Table 6.19 Hawks Nest STP discharge licence concentration limit

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
Oil and grease	Milligrams per litre	-	5	-	-
pH	pH	-	6.5-8.5	-	-
Phosphorus (total)	Milligrams per litre	-	1.0	-	-
Faecal Coliforms	Colony forming units per 100 millimetres	-	10	-	-
Nitrate	Milligrams per litre		10		
Nitrogen (total)	Milligrams per litre	-	10	-	-
Nitrogen (ammonia)	Milligrams per litre	-	2	-	-
Total Suspended Solids	Milligrams per litre	-	15	-	30
Biochemical Oxygen Demand	Milligrams per litre	-	10	-	20

1. *Note: The EPA license for Hawks Nest STP is currently being reviewed by EPA. The Faecal Coliforms limit of 10 colony forming units per 100 millimetres is very low and the main concentration limit under review. The EPL has been amended with an interim Faecal Coliforms limit of 150 colony forming units per 100 millimetres, pending EPA review of Council's Groundwater Study for the upgrade project.*

6.1.7.2.2 Load limits

The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the Table 6.20

Table 6.20 Hawks Nest point load limits

Assessable pollutant	Load limit (kg)
BOD (Enclosed Water)	1074
Nitrogen (total) (Enclosed Water)	3356
Oil and Grease (Enclosed Water)	459
Phosphorus (total) (Enclosed Water)	961
Total Suspended Solid (Enclosed Water)	2383

6.1.7.2.3 Volume and mass limits

The Hawks Nest STP volume/mass limit is specified in Table 6.21. This volume/mass limit cannot be exceeded by the volume/mass of liquids discharged to water or the solids or liquids applied to the area.

Table 6.21 Harrington's licence volume and mass limits

Point	Units of measure	Volume/mass limit
1 (weir outlet from UV sterilization unit)	kilolitres per day	10000

6.1.7.2.4 Effluent management system

The original effluent management system consists of three exfiltration basins on the eastern boundary of the STP site. Two basins are currently used for exfiltration. The third basin is constructed and will be brought on-line when additional exfiltration capacity required. The three beds have capacity for wet weather effluent discharge volumes beyond the 2050 design horizon. These basins dispose of all treated inflows via. exfiltration into an unconfined sand aquifer, with the exception of a modest amount of internal reuse for operational purposes.

In 2013 a significant upgrade and expansion of the effluent management and reuse / disposal systems was undertaken. The works included the creation of a 2 ML/day RTP on the Hawks Nest STP site. The RTP services beneficial reuse irrigations schemes at the Hawks Nest golf course and the Myall/Providence Park playing fields.

The addition of the RTP has now permitted the utilisation of significant volumes of treated effluent for beneficial reuse, with the balance disposed via. the exfiltration ponds.

Current permanent population (non-peak) load is estimated at approximately 4300 EP increasing to 9650 EP during peak tourist holiday periods. During these peak times the plant experiences high ammonia levels in its effluent which has negative effect on the quality of the water produced by the recycled water plant and its suitability for irrigation.

Note: The current Stage 2 and 3 upgrade for the Hawks Nest STP is for 16785 EP design (baseload plus peak) projected to 2050. The issue of high ammonia and impact on irrigation is being addressed with the upgrade.

6.1.8 Lansdowne sewerage scheme

The Lansdowne sewerage scheme consists of three SPSs and the STP. A schematic diagram of the Lansdowne sewerage scheme is shown in Figure 6-20.

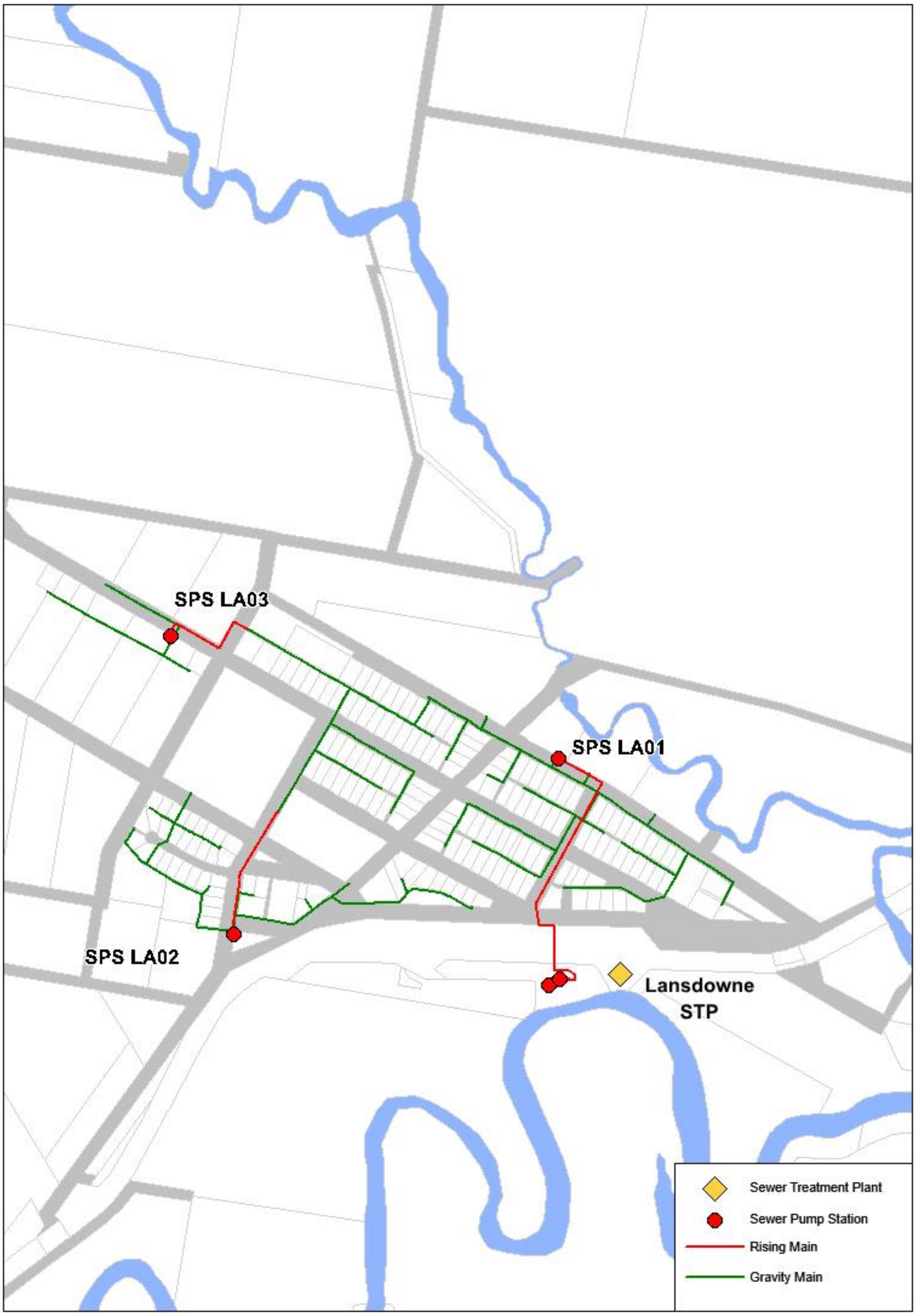


Figure 6-20 Lansdowne sewerage service scheme overview

6.1.8.1 STP descriptions

The Lansdowne STP consists of:

- Extended aeration
- UV disinfection
- Effluent lagoon

Figure 6-21 displays Lansdowne sewage treatment process layout.

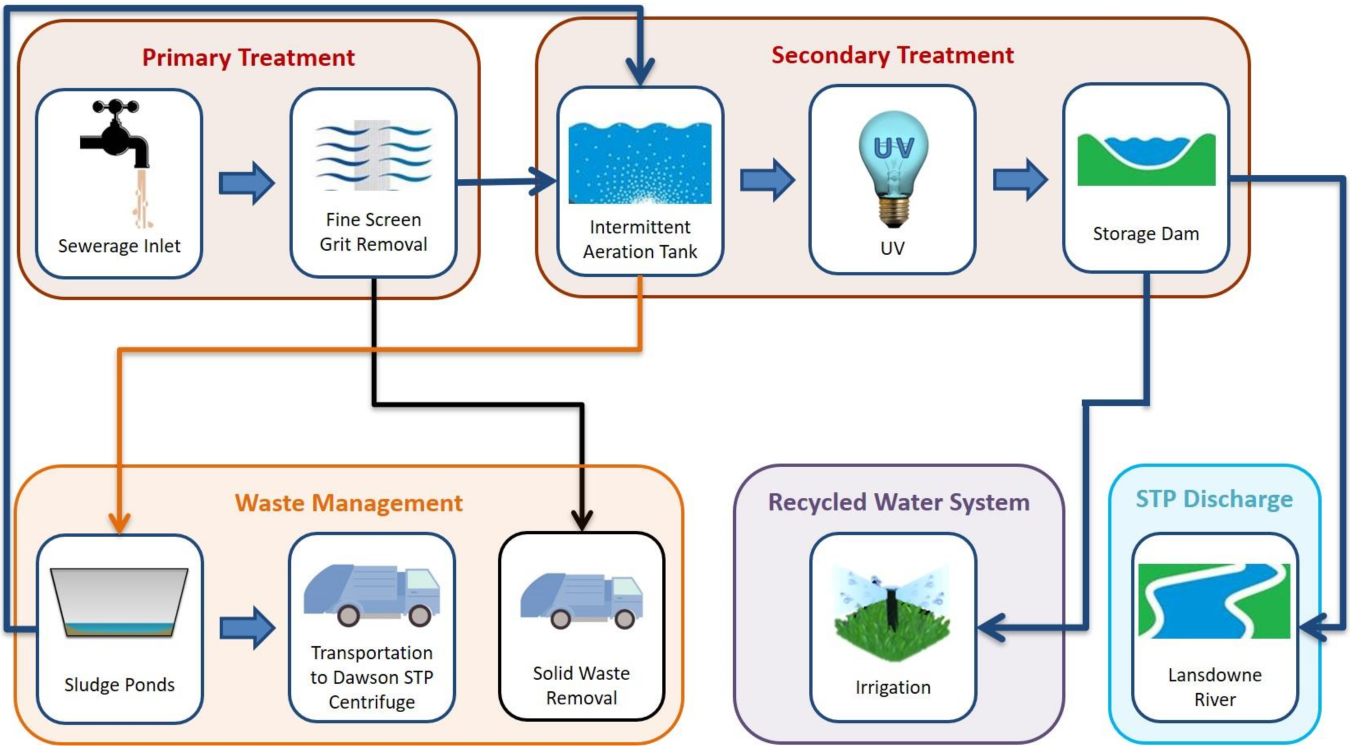


Figure 6-21 Lansdowne sewage treatment process layout

6.1.8.2 Effluent management

6.1.8.2.1 EPA licence conditions

The EPA licence for Lansdowne STP is EPL 12586. The scale of activity at the site is 0 – 3ML maximum volume of discharge. The Lansdowne STP is designed to meet the effluent discharge criteria stipulated in EPL 12586. The treated effluent discharges from the UV disinfection system to the Lansdowne River and must not exceed the concentration limits specified for the pollutants shown in Table 6.22.

Table 6.22 Lansdowne STP discharge licence concentration limit

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
Oil and grease	Milligrams per litre	-	-	-	10
pH	pH	-	-	-	6.5-8.5
Faecal Coliforms	Colony forming units per 100 millimetres	-	-	-	200
Total Suspended Solids	Milligrams per litre	-	-	-	30
Biochemical Oxygen Demand	Milligrams per litre	-	-	-	30

6.1.8.2.2 Effluent management system

The effluent management system consists of an effluent storage and irrigation scheme. Effluent is transferred to the storage and discharged to irrigation as required. When the effluent storage is full, Effluent is discharged to the Lansdowne River.

6.1.9 Manning Point sewerage scheme

The Manning Point sewerage scheme was commissioned in 2003 and comprises a vacuum sewerage collection system, the STP and the effluent reuse / groundwater recharge scheme. A schematic diagram of the Manning Point sewerage scheme is shown in Figure 6-22.

Figure 6-22 Manning Point sewerage service scheme overview

6.1.9.1 STP description

The original STP was commissioned in 2003 as a 600 EP nominal plant with a design ADWF of 120 kL/day and design PWWF of 840 kL/day. Almost immediately it was identified that the plant was undersized for peak summer loads. The Stage 2 augmentation of the plant was commissioned in December 2007. Stage 2 included a new inlet works with screening and grit removal and the addition of a new Intermittent Aeration Tank (IAT2), increasing the overall plant capacity to 2000 EP.

In 2009, further works were undertaken in parallel with the Pelican Bay sewerage connection to upgrade the effluent reuse and filtration systems at the plant. These works provided for site wash down, site irrigation and tea-tree plantation irrigation as well as improving levels of treatment. The existing treatment system of chlorine and sand filtration was upgraded with disk filtration and UV disinfection. The new system prioritises reuse of all treated effluent via. irrigation within the STP site, with wet weather flows stored for later use. The original IAT is decommissioned resulting in a plant capacity estimated at 1600 EP. The plant currently treats approximately 22 ML per year.

Figure 6-23 displays the Manning Point sewage treatment process layout.

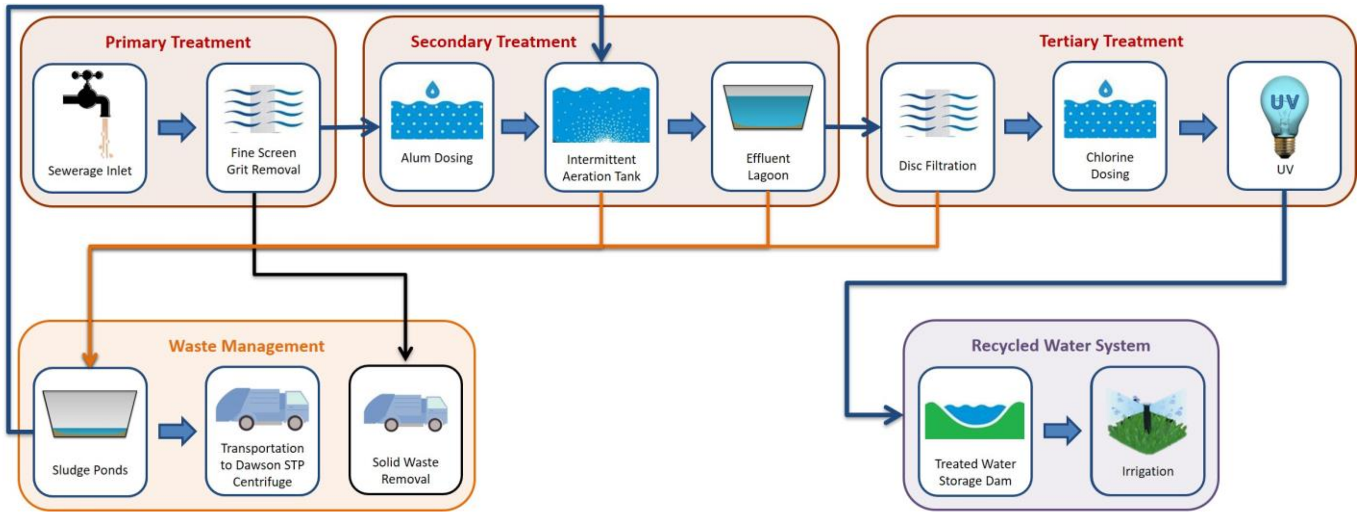


Figure 6-23 Manning Point sewage treatment process layout

6.1.9.2 Effluent management

6.1.9.2.1 Licence requirements and effluent quality

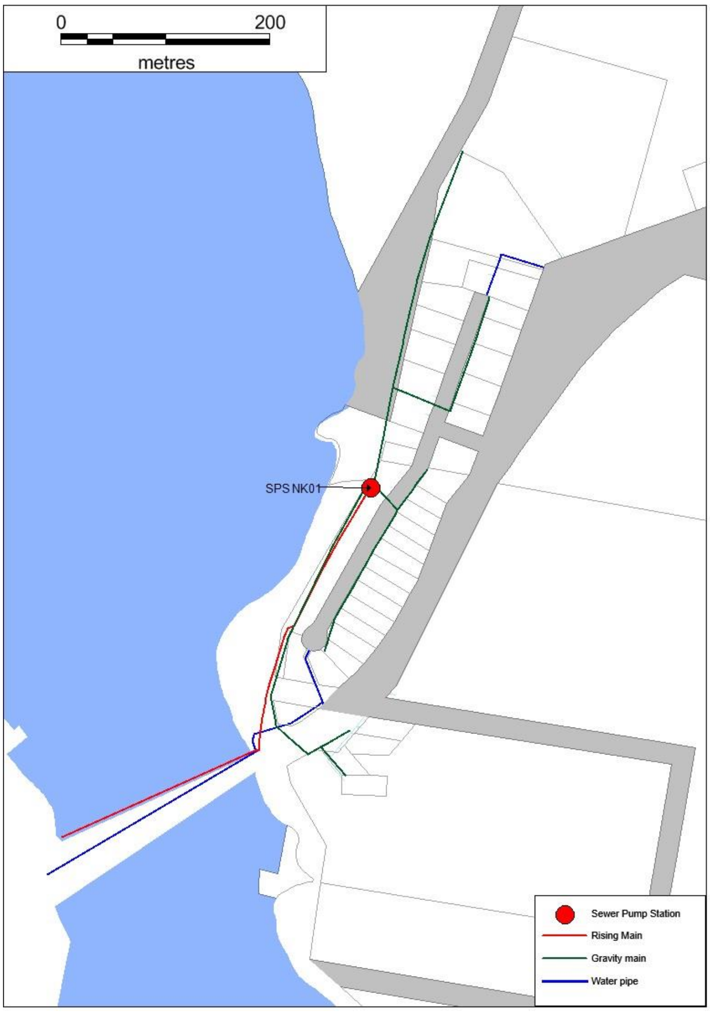
The Manning Point STP does not require an EPL as it treats effluent from less than 2000 EP. Regardless, Council conducts monthly tests of effluent quality and bi-annual tests of groundwater quality.

6.1.10 North Karuah sewerage scheme

Council provides the sewer infrastructure to service approximately 32 eTs in the North Karuah village. Hunter Water is responsible for the Karuah Sewage Scheme (south of the bridge). The Karuah scheme consists of a conventional gravity collection and transportation system, a sewage treatment plant (2500 EP) and effluent reuse.

Council transfers sewage from North Karuah to the Hunter Water operated sewage management systems at Karuah. A schematic diagram of the North Karuah sewerage scheme and North Karuah's sewage treatment process layout is shown in Figure 6-24 and Figure 6-25, respectively.

Figure 6-24 North Karuah sewerage service scheme overview



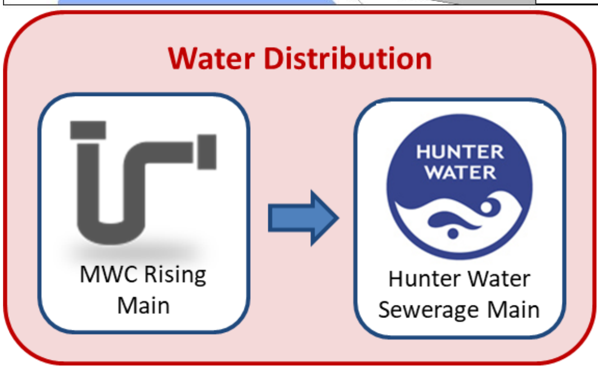


Figure 6-25 North Karuah sewage treatment process layout

6.1.11 Old Bar sewerage scheme

The Old Bar sewerage scheme provides the sewage collection and management for the coastal villages of Old Bar and Wallabi Point. A schematic diagram of the Old Bar sewerage scheme is shown in Figure 6-26.

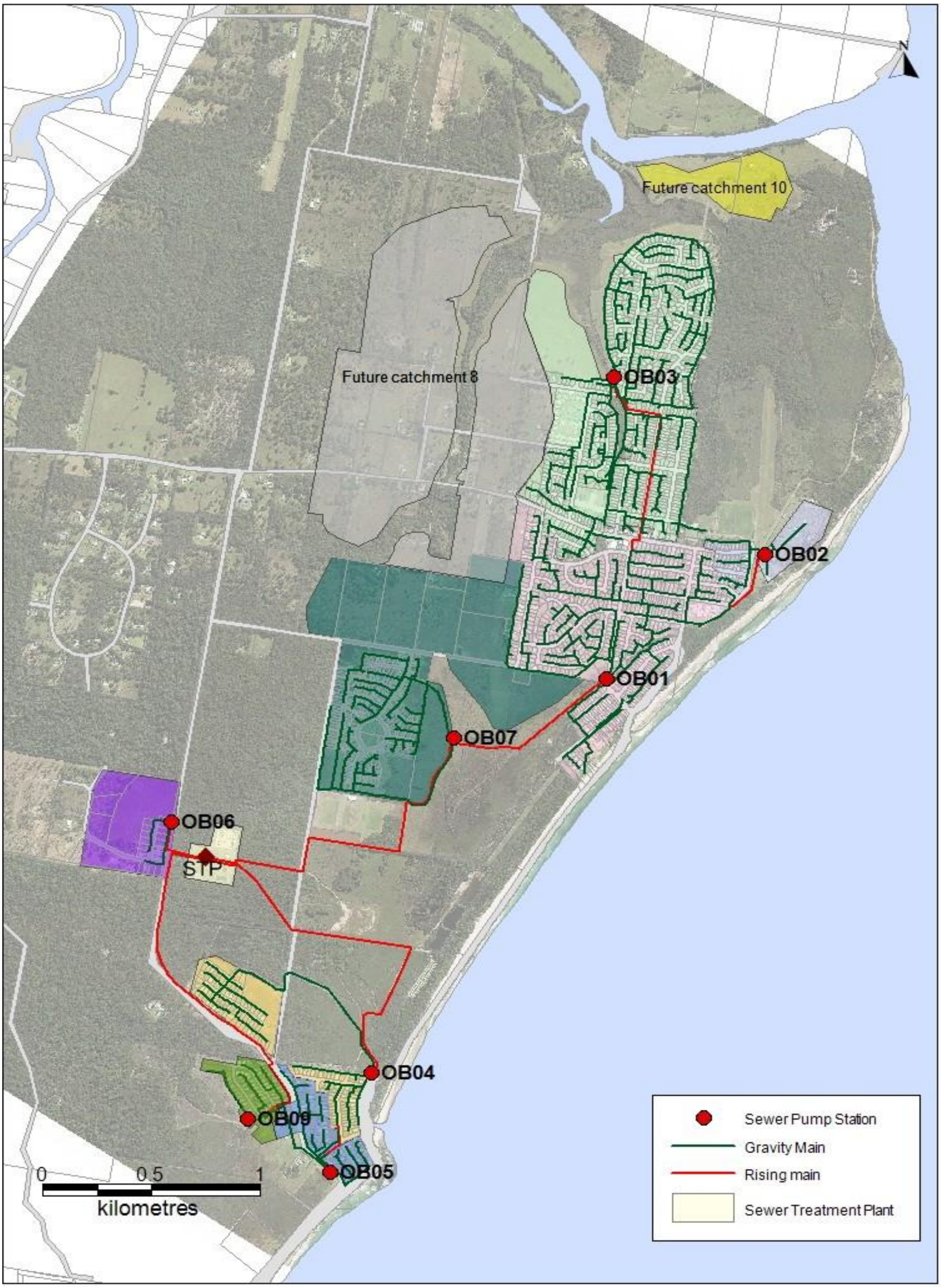


Figure 6-26 Old Bar sewerage service scheme overview

6.1.11.1 STP description

The Old Bar STP is located off Saltwater Road in the Kiwarrak Forest, approximately 3.2 km south of the existing Old Bar urban development.

The Old Bar scheme is a staged scheme with existing and planned future assets. Stage 1 was commissioned in 1985 for a capacity of 4,000 EP (with a per-capita flow allowance of 240 L/EP/d) and originally consisted of two Pasveer channels, an effluent balance tank, sludge lagoons and a bio-solids storage area.

The Stage 2 upgrade was completed in 2004. This increased the capacity to 6,857 EP (with a per-capita flow allowance of 210 L/EP/d). This involved converting the Pasveer channels into continuous bioreactors capable of handling a flow of 150 L/s pumped to the STP. It also included a large secondary clarifier capable of handling very high flows of mixed liquor from the bioreactors during wet weather. The Stage 2 upgrade enhanced the nutrient removal capabilities, particularly for phosphorus. The amount of phosphorus in the effluent was previously not removed. One of the main objectives of the Stage 2 upgrade was to eliminate the occurrence of bypasses around the bioreactor during storm-flow conditions.

A Stage 3/4 upgrade is proposed for the future. The upgrade would increase the design capacity to 300 L/s (13,773 EP with a per-capita flow allowance of 210 L/EP/d) with the addition of an extra bioreactor, an additional clarifier and a third sludge lagoon.

Figure 6-17 shows Old Bar’s sewage treatment process layout.

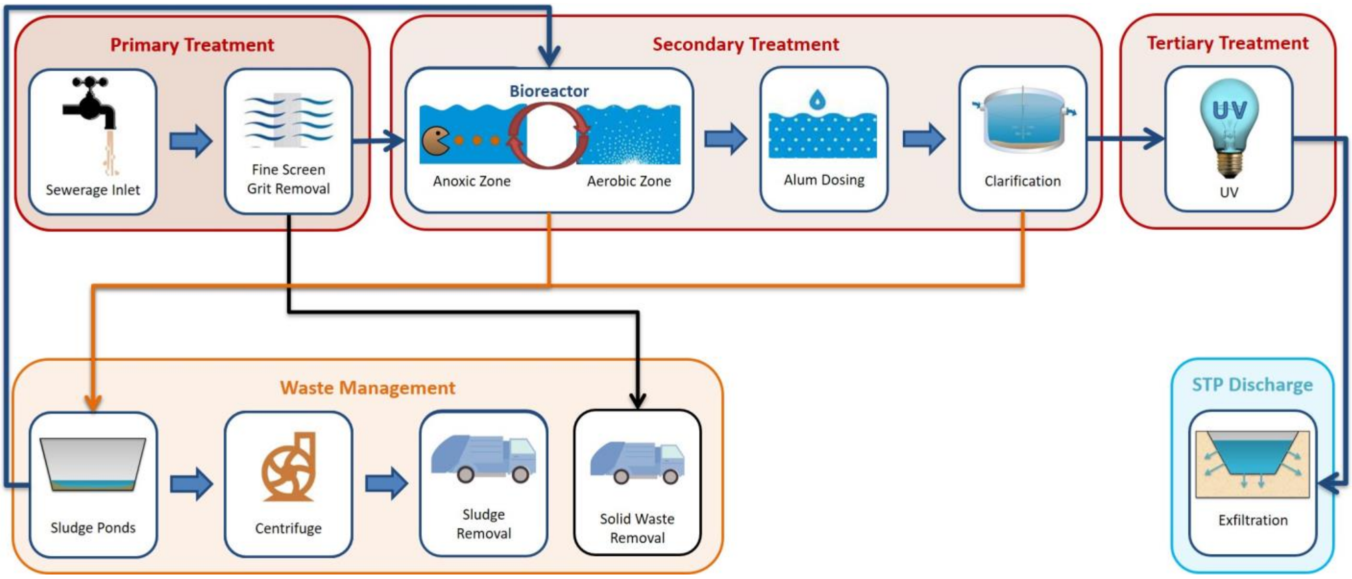


Figure 6-27 Old Bar sewage treatment process layout

6.1.11.2 Effluent management

6.1.11.2.1 EPA license conditions

The EPA license for the Old Bar STP is EPL 2505. The Old Bar STP is designed to meet the effluent discharge criteria stipulated on EPL 2505. The treated effluent discharged must meet the concentration limits specified for the pollutants shown in Table 6.23.

Table 6.23 Old Bar STP discharge licence concentration limit

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
Oil and grease	Milligrams per litre	-	-	-	10
Phosphorus (total)	Milligrams per litre	-	2	-	4
Nitrogen (total)	Milligrams per litre	-	10	-	15
Nitrogen (ammonia)	Milligrams per litre	-	4	-	5
Total Suspended Solids	Milligrams per litre	-	-	-	30
Biochemical Oxygen Demand	Milligrams per litre	-	-	-	20

6.1.11.2.2 Load limits

The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the Table 6.24.

Table 6.24 Old Bar load limits

Assessable pollutant	Load limit (kg)
BOD (Enclosed Water)	1606
Nitrogen (total) (Enclosed Water)	2000
Oil and Grease (Enclosed Water)	1621
Phosphorus (total) (Enclosed Water)	3650
Total Suspended Solid (Enclosed Water)	6589

6.1.11.2.3 Volume and mass limits

The Old Bar STP volume/mass limits are specified in Table 6.25. This volume/mass limit cannot be exceeded for the volume/mass of liquids discharged to water or the solids or liquids applied to the area Table 6.25.

Table 6.25 Old Bar's licence volume and mass limits

Point	Units of measure	Volume/mass limit
1	kilolitres per day	4025
4	kilolitres per day	4025

6.1.11.2.4 Effluent management system

The effluent management system consists of exfiltration of effluent into the surrounding groundwater.

The exfiltration ponds are located 1.2 km south-east of the Old Bar STP adjacent the Old Bar sand.

dunes. The exfiltration site is an unconfined sand aquifer.

The exfiltration process involves effluent transferred via. gravity from the STP to the exfiltration ponds. The effluent percolates from the base of the exfiltration ponds into the groundwater aquifer and is ultimately released to the ocean. Groundwater flow is towards the ocean because of the small frontal dune. The sand also provides an additional treatment to the effluent before release to the ocean.

The sustainability of the effluent exfiltration system includes minimising the impact upon the water level and the groundwater quality. Currently, the water in the aquifer is monitored through a series of bores. The effluent quality has improved, with the Stage 2 upgrade reducing the amount of nutrients in the effluent.

6.1.12 Stroud sewerage scheme

The Stroud Sewerage Scheme dates from 1980, however a new Sewerage Treatment Plant (STP) was commissioned in 2009. The sewage collection system is conventional gravity type comprising three catchments operating in series.

A schematic diagram of the Stroud sewerage scheme is shown in Figure 6-28.

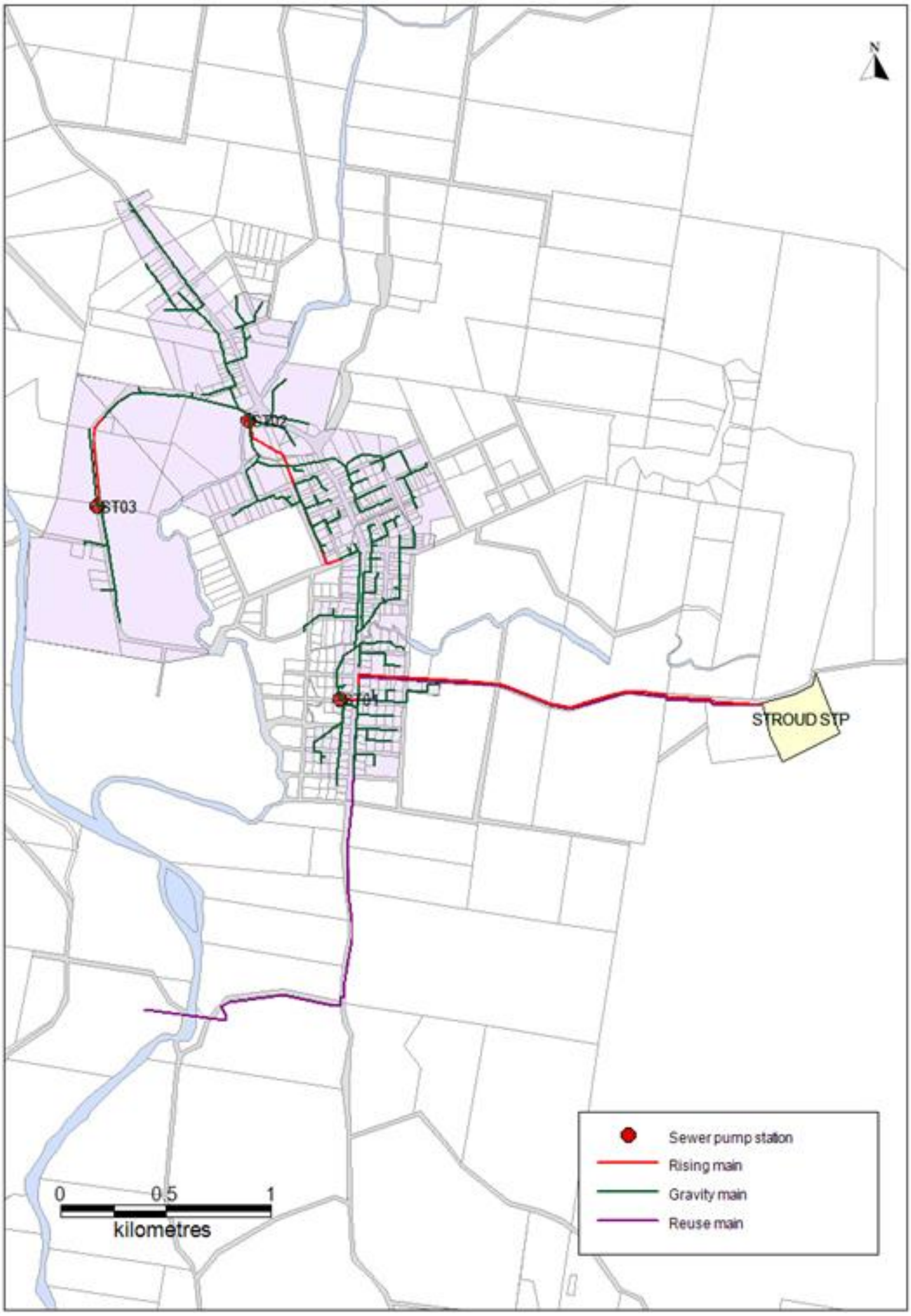


Figure 6-28 Stroud sewerage service scheme overview

6.1.12.1 STP descriptions

The Stroud STP is located on Simmsville Road approximately 2.8 kilometres east of the town. The STP was designed on a predicted population in 2031 of 1,500 and 210 L/EP/day. This is equivalent to an ADWF of 315 kL/d.

– The DPWS factor for PDWF/ADWF of 2.4 was used giving a design PDWF of 756 kL/d
– The DPWS storm allowance of 0.058 L/s/ET was used resulting in a PWWF capacity of 43 L/s

The Stroud STP is a continuous activated sludge process in the MLE configuration. Raw sewage passes through the inlet works consisting of screens and grit removal, anoxic and aerobic reaction tanks including mixed liquor return pumps, return activated sludge pumps and chemical addition (alum) for phosphorous removal.

The treatment plant is designed for 1,500 EP. Allowance has been made in the design for the future duplication of the plant process units.

Figure 6-29 displays Stroud's sewage treatment process layout.

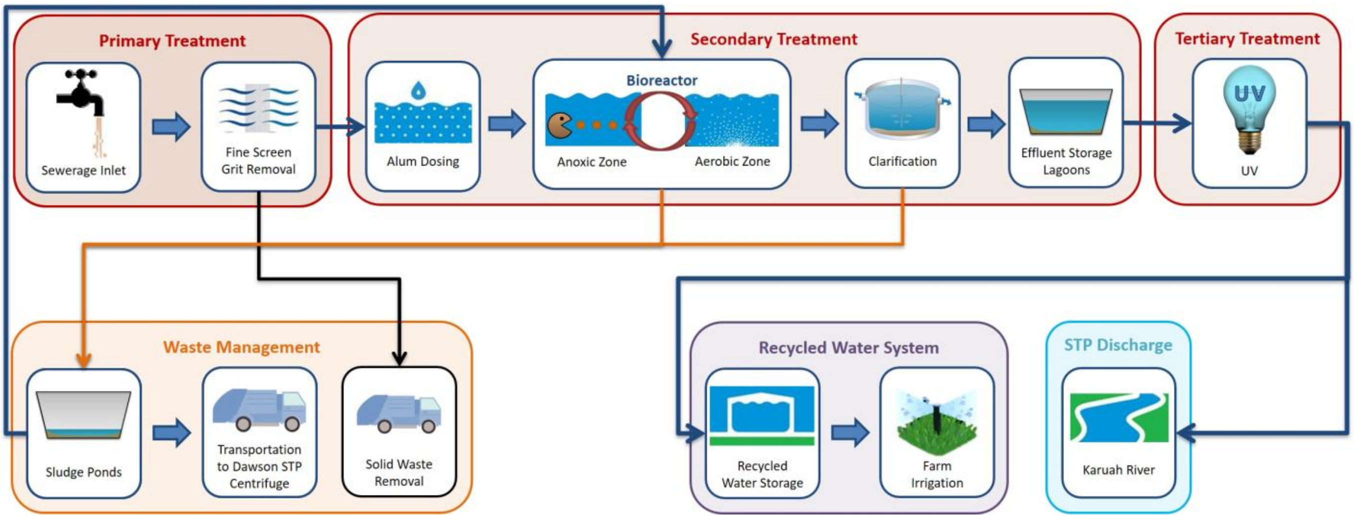


Figure 6-29 Stroud sewage treatment process layout

6.1.12.2 Effluent management

6.1.12.2.1 EPA licence conditions

The EPA licence for Stroud STP is EPL 13042. The Stroud STP is designed to meet the effluent discharge criteria stipulated in EPL 13042. The concentration limits specified for pollutants in the effluent discharge is shown in Table 6.26.

Table 6.26 Stroud STP discharge licence concentration limit

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
Oil and grease	Milligrams per litre	-	7	-	10
pH	pH	-	-	-	6.5-8.5
Phosphorus (total)	Milligrams per litre	-	-	-	4.4
Faecal Coliforms	Colony forming units per 100 millimetres	-	200	-	600
Nitrogen (total)	Milligrams per litre	-	-	-	10
Nitrogen (ammonia)	Milligrams per litre	-	-	-	2
Total Suspended Solids	Milligrams per litre	-	15	-	20
Biochemical Oxygen Demand	Milligrams per litre	-	10	-	15

6.1.12.2.2 Load limits

The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the Table 6.27.

Table 6.27 Stroud Point STP load limits

Assessable pollutant	Load limit (kg)
Phosphorus (total) (Enclosed Water)	24

6.1.12.2.3 Volume and mass limits

The Stroud STP volume/mass limit is specified in Table 6.28. This volume/mass limit cannot be exceeded by the volume/mass of liquids discharged to water or the solids or liquids applied to the area.

Table 6.28 Stroud licence volume and mass limits

Point	Units of measure	Volume/mass limit
1	kilolitres per day	2000

6.1.12.2.4 Effluent management system

The preferred method of discharge is via. irrigation of 25 Ha of land used for dairy cattle grazing on the "Girrahween" property. Under wet weather flows, the plant may also discharge into the Karuah River. Effluent from the clarifiers is stored in two 15 ML effluent storage lagoons. The storage lagoons were designed to limit discharge to the Karuah River to 5% of the average annual inflow to the plant.

6.1.12.2.5 Discharge to Karuah River

Discharge of effluent to the Karuah River is limited by the constituent concentrations of the effluent and the total annual constituent loads. Earlier work by Council and PPK indicates that phosphorous in the treated effluent is the controlling constituent for any discharge to the river.

Previous studies have indicated that that the phosphorous concentration in Karuah River downstream of Stroud should not exceed 0.02 mg/L in short-term and 0.01 mg/L in the long-term. A sustainable target load for discharge of total phosphorous to the river is at 24 kg/y.

The 2031 design ADWF has been taken as 315 kL/d. Allowing for the disposal of 300 kL/d through irrigation to Girrahween, an amount equivalent to 15 kL/d (5.5 ML/y) may have to be discharged to the river. In order to limit the total annual phosphorous load to 24 kg/y, the concentration of phosphorous in the treated effluent should not exceed 4.4 mg/L.

Precautionary discharges to the river may be made when there is sufficient flow in the river to ensure adequate dilution of the effluent. The Stroud WWTP EIS (Ehmsen 2005) indicates the river threshold flow for effluent discharge is 2,000 ML/d.

6.1.12.2.6 Recycled water scheme

Effluent is filtered, undergoes UV disinfection and is stored in two 22 kL balance tanks for supply to “Girrahween” as required. The current irrigation system that is used by “Girrahween” has a capacity of 300 kL/d.“Girrahween” is a dairy and poultry farm of 325 ha, located approximately 4 km south of Stroud on the Karuah River.

6.1.13 Taree (Dawson) sewerage scheme

The Taree (Dawson) sewerage scheme provides the wastewater services for the central Manning Valley township of Taree and Taree South, and the surrounding small villages of Tinonee and Cundletown. A schematic diagram of the Taree sewerage scheme is shown in Figure 6-30.

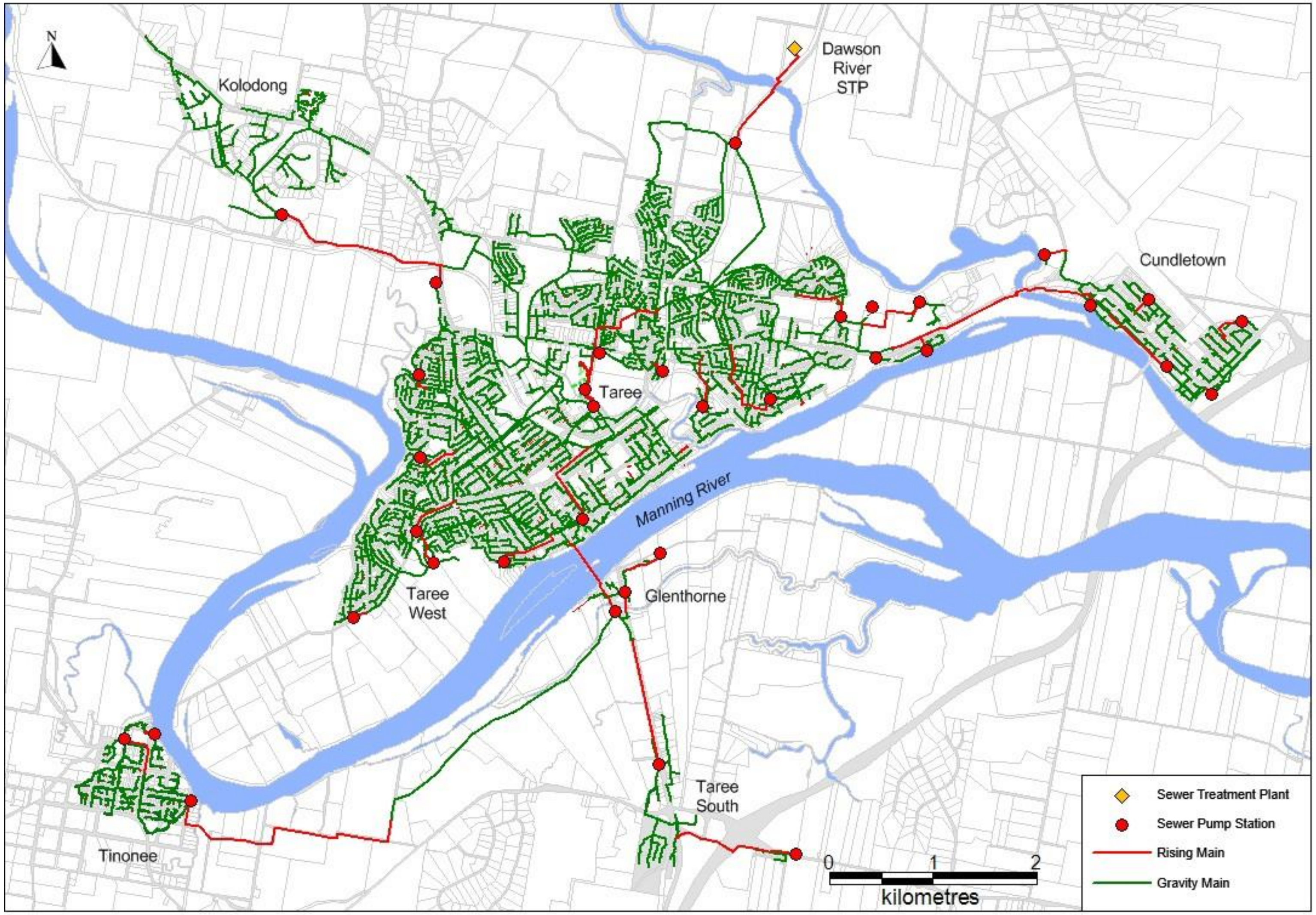


Figure 6-30 Taree sewerage service scheme overview

6.1.13.1 STP descriptions

The Taree sewerage scheme includes two treatment plants, the Dawson STP and the Taree STP. The Taree STP functions solely as a preliminary treatment plant and wet weather storage facility. All secondary and tertiary treatment undertaken at the Dawson STP.

The Dawson STP was originally designed in 1986 for 15,000 EP. The plant was constructed to split the flow with the trickling filter plant at Taree which had a capacity of 14,000 EP. A significant Stage 2 augmentation of the Dawson STP occurred in 1999. Stage 2 has a design EP of 30,000. This upgrade included:

– Disinfection of treated effluent to achieve a 95-percentile faecal coliform level of less than 200 CFU/100 mL in all water discharged to the Dawson and Manning River.
– Construction of a storm detention basin, the basin allows for the sedimentation of stormwater flows in excess of 3 x ADWF. This will reduce the pollutants discharged into the maturation ponds and therefore into the Dawson River in wet weather overflows.
– Modification to the inlet works and biological treatment facility including a step-type screen and grit removal equipment. Additional aeration equipment and construction of a new selector tank was completed to minimise the formation of filamentous bacteria. Filamentous bacteria can lead to sludge bulking and carryover of solids from the clarifiers.
– Construction of an additional sludge lagoon and pipework, as well as the installation of a sludge dewatering centrifuge and conversion of sludge drying beds to biosolids storage.
– The design and construction of electrical works and the SCADA system for the plant.

Figure 6-31 displays Dawson sewage treatment process layout.

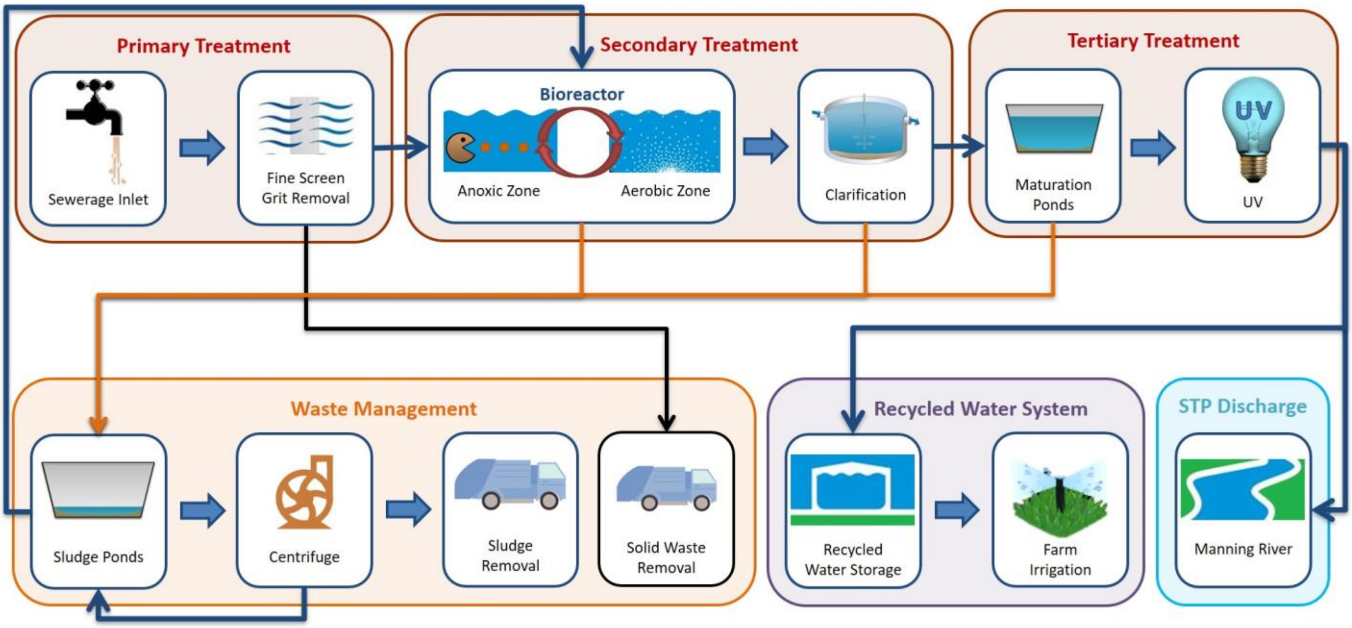


Figure 6-31 Dawson sewage treatment process layout

6.1.13.2 Effluent management

6.1.13.2.1 EPA licence conditions

The EPA license for the Dawson STP is EPL 2531. The scale of activity at the site is > 1000 – 5000 ML annual maximum volume of discharge. The Dawson STP is designed to meet the effluent discharge criteria stipulated in EPL 2431. The treated effluent must not exceed the concentration limits specified for the pollutants shown in Table 6.29.

Table 6.29 Dawson STP discharge licence concentration limit

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
pH	pH	-	-	-	6.5-8.5
Nitrogen (ammonia)	Milligrams per litre	-	5	-	10
Total Suspended Solids	Milligrams per litre	20	30	-	35
Biochemical Oxygen Demand	Milligrams per litre	20	30	-	35

6.1.13.2.2 Load limits

The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the Table 6.30 .

Table 6.30 Dawson point load limits

Assessable pollutant	Load limit (kg)
BOD (Enclosed Water)	10131
Nitrogen (total) (Enclosed Water)	18188
Oil and Grease (Enclosed Water)	11595
Phosphorus (total) (Enclosed Water)	16074
Total Suspended Solid (Enclosed Water)	15582

6.1.13.2.3 Volume and mass limits

The Dawson STP volume/mass limit is specified in Table 6.31. This volume/mass limit cannot be exceeded by the volume/mass of liquids discharged to water or the solids or liquids applied to the area.

Table 6.31 Dawson STP licence volume and mass limits

Point	Units of measure	Volume/mass limit
4	kilolitres per day	12500

6.1.13.2.4 Effluent management system

The current effluent management system that is used by the Dawson STP is to return the treated water to the natural water cycle and to ensure that any treated water leaving the plant has no impacts upon the environment. The system used for both Taree (Dawson) and Wingham schemes is the Taree Wingham Effluent Management Scheme (TWEMS). TWEMS facilitates the beneficial reuse of effluent for irrigation on farmland. This is a cost-effective way to provide water to local farms. In addition to this, no excess water is drawn from the environment to supply the farms with water.

6.1.13.2.5 Recycled water scheme

The recycled water from the Dawson STP is classified as low strength recycled water in accordance with the Office of Environment and Heritage (Use of Effluent by Irrigation DECC, 2004). Metal and pesticide levels are well below the long-term (100 years) criteria.

The recycled water is suitable, in accordance with the state (DECC, 2004) and Australian Guideline for Recycled Water (2006), for use for beef cattle grazing and dairy production. The stock withholding period for all sites is 5 days. The Dawson recycled water meets moderately sensitive crops criteria for pH, Electrical Conductivity (EC), Sodium (Na) and Sodium Adsorption Ratio (SAR). Therefore, is suitable for pastures and fodder crop production.

There are thirteen farms that receive effluent from the TWEMS. Table 6.32 summarises the amount of effluent that each of the farms receive. The amount varies based on the amount of usable land present.

Table 6.32 TWMES recycled water use

Property	Land size (ha)	Volume of effluent (ML/Yr)	ML/ha/yr
Blore	36.2	14.3	0.4
Milligan	25.4	7.1	0.28
Matthews	33.2	0.02	0.001
Hammond	29.2	111.2	3.81
Balrin South	34.9	12.7	2.85
Barlin North		86.6	
Crossman South	48.4	15	0.31
Crossman North		80.9	
Eakin	12.8	39.3	1.67
R_Mills	23.5	0.2	3.07
C_Mills		19.8	0.85
Knox	10.7	25.3	2.36
Tate	19.7	28.7	1.46
Total	**274**	**441.3**	**1.6 ML/ha/Yr (Average)**

6.1.14 Wingham sewerage scheme

The Wingham sewerage scheme provides the wastewater management for the rural village of Wingham. The historic town of Wingham, settled in 1853, is located on the northern banks of the Manning River, approximately 18 km upstream of Taree.

A schematic diagram of the Wingham sewerage scheme is shown in Figure 6-32.

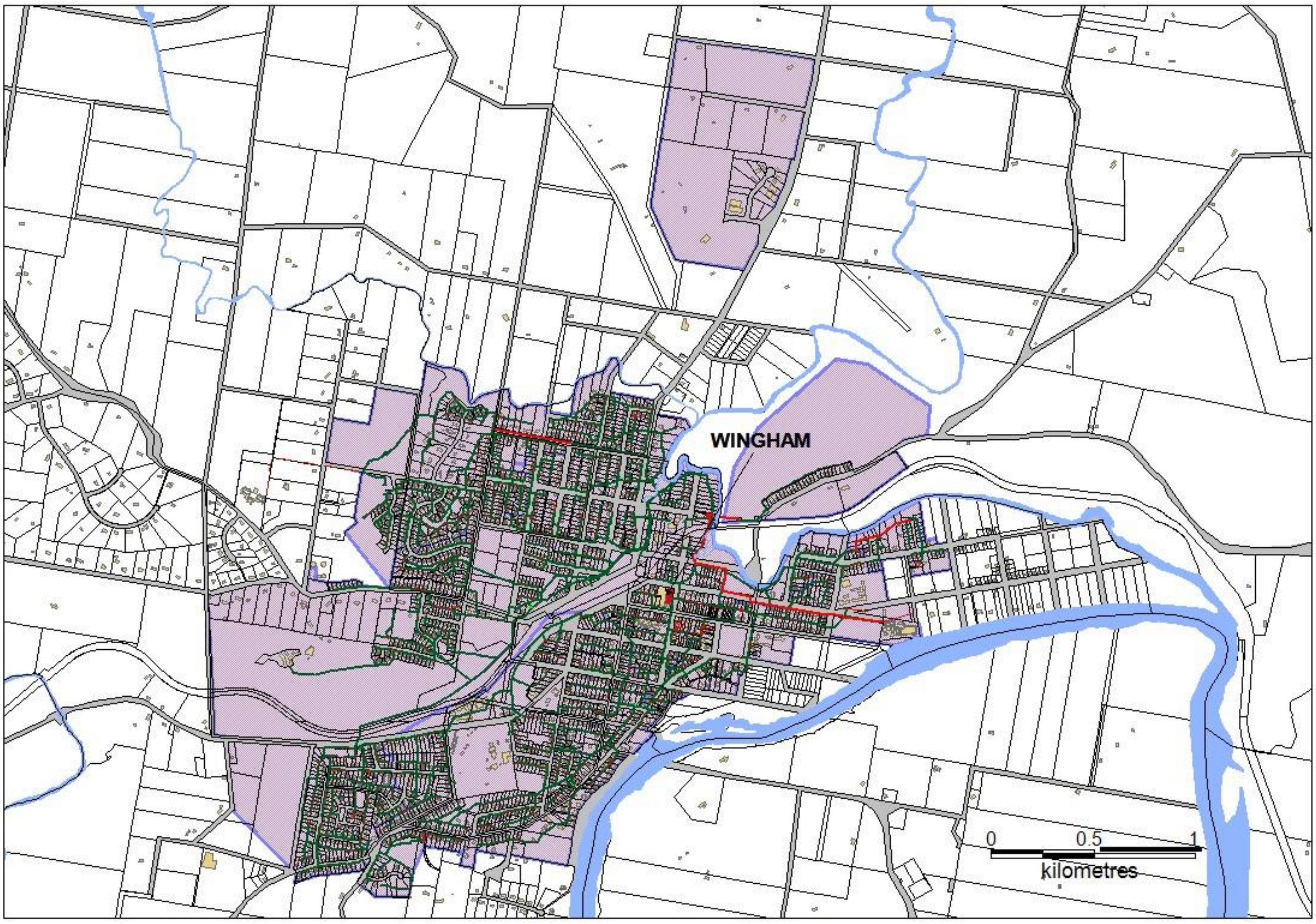


Figure 6-32 Wingham sewerage service scheme overview

6.1.14.1 STP descriptions

The Wingham STP is located at the eastern end of Combined Street, adjacent to Wingham Brush Nature Reserve. This is approximately 600 metres from the Wingham town centre.

The original sewerage system at Wingham was constructed in 1961 to service approximately 3,600 EP. The treatment process was based on trickling filters with primary and secondary treatment. The plant was augmented in 1991 to a capacity of 7,100 EP by the addition of a parallel treatment train using the IDEAT process.

In 2007, a second plant upgrade was undertaken. This was based on:

– A predicted population in 2036 of 7,500 and 200 L/EP/day equivalent to ADWF of 1.5 ML/d.
– A ratio of PDWF to ADWF of 2.0.
– A PWWF calculated as the capacity of the pumping systems giving a PWWF of 195 L/s, which is 11.2 times the ADWF.

The 2007 augmentation involved upgrade of the inlet works, the conversion of the IDEAT tank to a continuous secondary treatment process, the construction of a new secondary clarifier and sludge handling facilities. Sewage enters the treatment plant site by:

– A pumped rising main from pump station WG SPS 01, located in Wingham.
– A gravity main which discharges in a lift pump station, WG SPS 02. This is located on the treatment plant site immediately to the west of the intake works.

Figure 6-33 shows the Wingham's sewage treatment process layout.

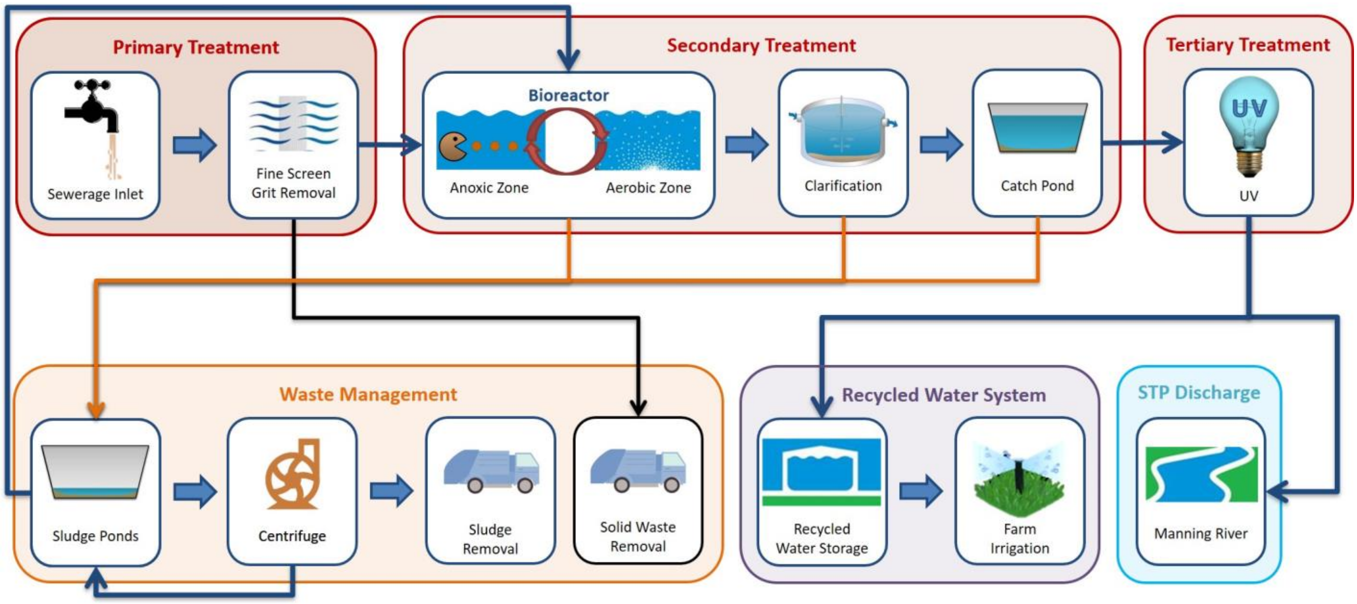


Figure 6-33 Wingham sewage treatment process layout

6.1.14.2 Effluent management

6.1.14.2.1 EPA licence conditions

The EPA licence for Wingham STP is EPL 1581. The STP is has been designed with the aim of meeting to meet the following effluent discharge criteria stipulated in EPL 1581. as per environmental protection licence limits. The criteria provided in the Environmental Protection Licence must be met as a priority. The effluent discharged must not exceed the concentration limits shown in an extract from the Wingham STP Discharge Licence (Licence number 1581) is shown in Table 6.33.

Table 6.33 Wingham STP discharge licence concentration limit

Pollutant	Units of measure	50%ile concentration limit	90%ile concentration limit	3DGM concentration limit	100%ile concentration limit
pH	pH	-	-	-	6.5-8.5
Nitrogen (ammonia)	Milligrams per litre	-	-	-	10
Total Suspended Solids	Milligrams per litre	20	30	-	35
Biochemical Oxygen Demand	Milligrams per litre	20	30	-	35

6.1.14.2.2 Load limits

The actual load of an assessable pollutant discharged from the premises during the reporting period must not exceed the load limit specified for the assessable pollutant in the Table 6.34.

Table 6.34 Wingham point load limits

Assessable pollutant	Load limit (kg)
BOD (Enclosed Water)	1353
Nitrogen (total) (Enclosed Water)	4870
Oil and Grease (Enclosed Water)	2132
Phosphorus (total) (Enclosed Water)	3466
Total Suspended Solid (Enclosed Water)	3648

6.1.14.2.3 Volume and mass limits

The Wingham STP volume/mass limit is specified in Table 6.35. This volume/mass cannot be exceeded by the volume/mass of liquids discharged to water or the solids or liquids applied to the area.

Table 6.35 Wingham licence volume and mass limits

Point	Units of measure	Volume/mass limit
1,2	kilolitres per day	3400

6.1.14.2.4 Effluent management system

The existing effluent management system comprises the TWEMS and a licence to release 1,420 kL/day to the Manning River. Council is not determined to have exceeded an effluent volume limit if wet weather conditions are the sole cause of the exceedance as per the 2010 Department of Energy and Climate Change (DECC 2010).

6.1.14.2.5 Recycled water scheme

The scheme pumps treated effluent from the STP into a central storage dam located on Wingham Bight, where effluent is supplied to approximately 60 ha of local farmland. This scheme was designed to achieve approximately 70% effluent reuse on an average annual basis.

Beneficial reuse is the preferred management method. Release to the Manning River is only used when necessary. This is usually during periods of rain when irrigation is not required and the central storage dam is full.

There are four farms that receives effluent. Table 6.36 summarises the reuse properties. The amount of effluent that each of the farms receive varies due to the amount of usable land present.

Table 6.36 TWMES recycled water use

Property	Land size	Volume of effluent	% of total reuse	ML/ha/yr
V. Brown	17.5 ha	66 ML/yr	30%	3.8 ML/ha/yr
P. Brown	8.8 ha	33 ML/yr	15%	3.8 ML/ha/yr
L. Mitchell	7.6 ha	29 ML/yr	13%	3.8 ML/ha/yr
R. Perrin	25 ha	93 ML/yr	42%	3.7 ML/ha/yr
Total	59.9 ha	221 ML/yr	100%	3.8 ML/ha/yr (AVE)

6.1.15 Unserviced sewer villages

There are many villages that utilise on-site septic treatment and are not serviced by the fourteen sewer schemes. Table 6.37 summaries the registered and monitored onsite septic properties within each township. The total number of unserviced properties within Council's LGA is 8,133.

Table 6.37 Unserviced sewer villages and number of unserviced properties

Unserviced villages	No. of unserviced properties in villages
Allworth	96
Back Creek	1
Bakers Creek	3
Barrington	9
Belbora	27
Berrico	1
Bindera	2
Bobin	15
Bohnock	28
Bombah Point	10
Boolambayte	66
Boomerang Beach	2
Booral	192
Bootawa	38
Bowman	15
Bowman Farm	3
Brimbin	16
Buccawauka	17
Bulahdelah	179
Bulliac	1
Bundabah	88
Bundook	6
Bungwahl	167
Bunyah	63
Burrell Creek	83
Cabbage Tree Island	7
Caffreys Flat	9
Callaghans Creek	2
Caparra	16
Carrington	22
Cedar Party	63
Cellsriver	1
Charlotte Bay	56
Cobark	1
Comboyne	4
Coolongolook	210
Coomba Bay	74
Coomba Park	486

Unserviced villages	No. of unserviced properties in villages
Coopernook	19
Copeland	4
Coralville	10
Craven	5
Crawford River	28
Croki	21
Cundleflat	4
Cundletown	164
Darawank	46
Dewitt	1
Diamond Beach	106
Dollys Flat	9
Dumaresq Island	14
Dyers Crossing	88
Elands	35
Elizabeth Beach	1
Failford	46
Faulkland	8
Firefly	52
Forbesdale	6
Forster	18
Ghinnighinni	18
Girvan	91
Glenthorne	51
Gloucester	19
Green Point	1
Hallidays Point	13
Hannam Vale	48
Harrington	14
Hawks Nest	6
Hillville	44
Johns River	100
Jones Island	34
Karaak Flat	7
Karuah	21
Kia-Ora	2
Killabakh	49
Killawarra	18
Kimbriki	61
Kippaxs	3
Knorrit Flat	3
Koorainghat	19
Krambach	103

Unserviced villages	No. of unserviced properties in villages
Kundibakh	13
Kundle Kundle	41
Langley Vale	9
Lansdowne	28
Limeburners Creek	119
Markwell	58
Marlee	38
Mayers Flat	33
Melinga	18
Minimbah	118
Miscellaneous Areas	5
Mitchells Island	172
Mograni	2
Mondrook	51
Monkerai	49
Mooral Creek	11
Moorland	110
Moto	36
Mount George	57
Mungobrush	10
Nabiac	168
Nerong	109
Nooroo	27
North Arm Cove	338
Number One	1
Old Bar	162
Oxley Island	116
Pampoolah	137
Pindimar	223
Possum Brush	24
Rainbow Flat	183
Redhead	7
Rookhurst	5
Saltwater	1
Seal Rocks	67
Shallow Bay	30
Smiths Lake	12
Stewarts River	20
Stratford	24
Strathcedar	8
Stroud	116
Stroud Road	124
Tallwoods Village	1

Unserviced villages	No. of unserviced properties in villages
Tarbuck Bay	19
Taree	303
Taree South	103
Tea Gardens	162
Terreel	7
The Bight	16
The Branch	54
Tibbuc	5
Tinonee	68
Tipperary	5
Tiri	3
Titaatee Creek	2
Topitopi	42
Tugrabakh	4
Tuncurry	10
Upper Karuah River	10
Upper Lansdowne	152
Upper Myall	16
Violet Hill	2
Waitui	28
Wallabi Point	6
Wallanbah	4
Wallingat	4
Wallis Lake	16
Wangwauk	27
Wards River	98
Warranulla	21
Washpool	17
Waukivory	6
Weismantels	13
Wherrol Flat	47
Whoota	45
Willina	24
Wingham	282
Wootton	140
Yagon	2
Total	**8,133**

Source: Council's on-site septic sewerage system database

7. Asset, business performance and issues

7.1 Corporate asset management system

Council has established an Asset Management Working Group (AMWG) to deliver a coordinated and consistent approach to asset management across the organisation. Membership of the AMWG comprises of the executive management team, asset managers and asset staff representing each asset class from across Council, as well as staff from Finance, Risk Management and IT Systems. The role of the AMWG is to provide strategic direction and governance for asset management by contributing to the development and implementation of Council's Asset Management Policy, Asset Management Strategy and Asset Management Plans.

Council is in the process of preparing a 2022 – 2023 Asset Management Strategy (AMS), developed in accordance with the Integrated Planning and Reporting Framework Guidelines and which will provide the basis for consistent and effective asset management across all asset classes.

The AMS will be supported by specific Asset Management Plans (AMPs) where assets are grouped by Water and Sewer. These AMPs describe the various asset types and provide details of such things as condition, replacement value, expected remaining useful life, maintenance strategies, and condition monitoring methodology.

Developing asset management maturity will allow Council to improve strategic asset management capabilities and decision making. This will involve:

– Collaborating with our operational and technical teams to improve asset information to ensure that decisions are based on current asset information.
– Changing Council's asset management culture to ensure that staff understand why we need to improve and are motivated to make the shift.
– Improving Council's capital works planning and finalisation processes, including policy development, along with education to enhance the use of systems to support project managers, asset managers and accountants.
– Developing, monitoring and improving Council's medium to long term planned capital new, renewal and upgrade programs to address increased population and service demand, ageing infrastructure and respond to severe weather events and other climate change related impacts.
– Moving towards being a digital utility by introducing mobile technology that allows operational staff to record, review and update asset information out in the field.

Council's asset register contains the detailed data for the recognised assets, including those that are financial in nature and those that are necessary for operational processes. The asset register is a single database that is linked to maintenance and work orders so operational transactions can be related directly to the assets. Data stored against each asset is used in asset management decision making. Council's water & sewer asset register is grouped into water, sewer & reuse assets and comprise of:

– Treatment Plants
– Pump Stations
  Dams & Reservoirs
– Bores & Aquifers
– Network Mains

7.2 Asset condition assessment

As part of Councils Asset Class Management Plans (AMPs) annual revision, Council develops an Asset Management Strategy (AMS) which summaries the key asset groups and reports on each asset class condition profile. Condition is measured using a 1 – 5 grading system as detailed in Table 7.1.

Council's 10-year AMS summaries the key asset classes and reports on a number of profiles including:

– Renewal
– Maintenance
– Condition

Table 7.1 Simple condition grading model

Grade	Condition	Description
0	Not rated	Asset decommissioned, no longer exists or has not been rated.
1	Very good	Very good condition (Brand new asset)
2	Good	Minor defects only (Minor maintenance required (up to 10% of asset))
3	Fair	Maintenance required (Significant maintenance required (10-20% of asset))
4	Poor	Requires renewal (Significant renewal/upgrade required (20-50% of asset))
5	Very poor	Unserviceable – (Out of service, over 50% of asset requires replacement)

Figure 7-1 and Figure 7-2 displays the condition profiles of Councils water and sewer assets over the past 4 years and show progressive improvement in asset condition to 2020/21.

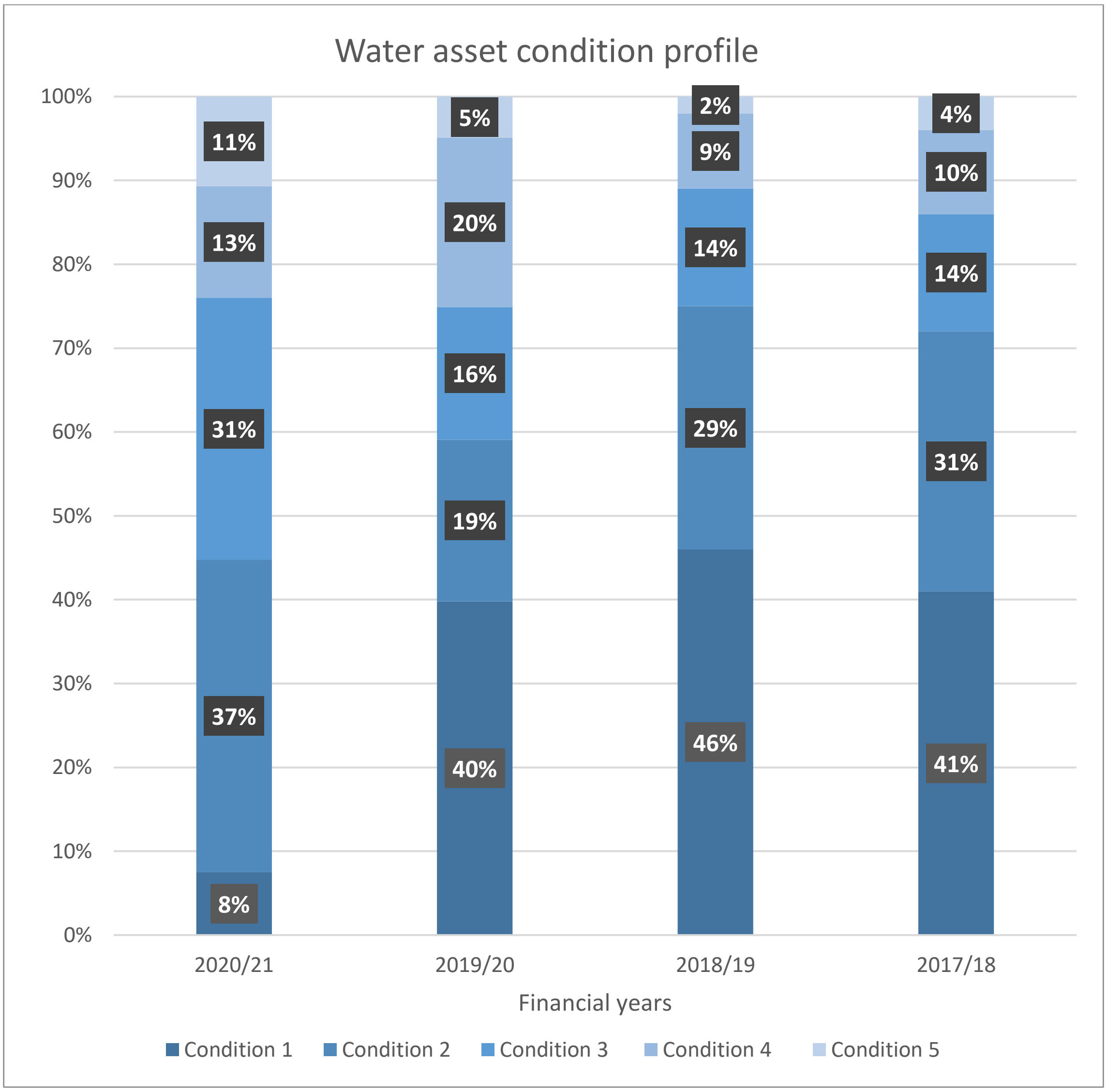


Figure 7-1 Water assets condition profiles

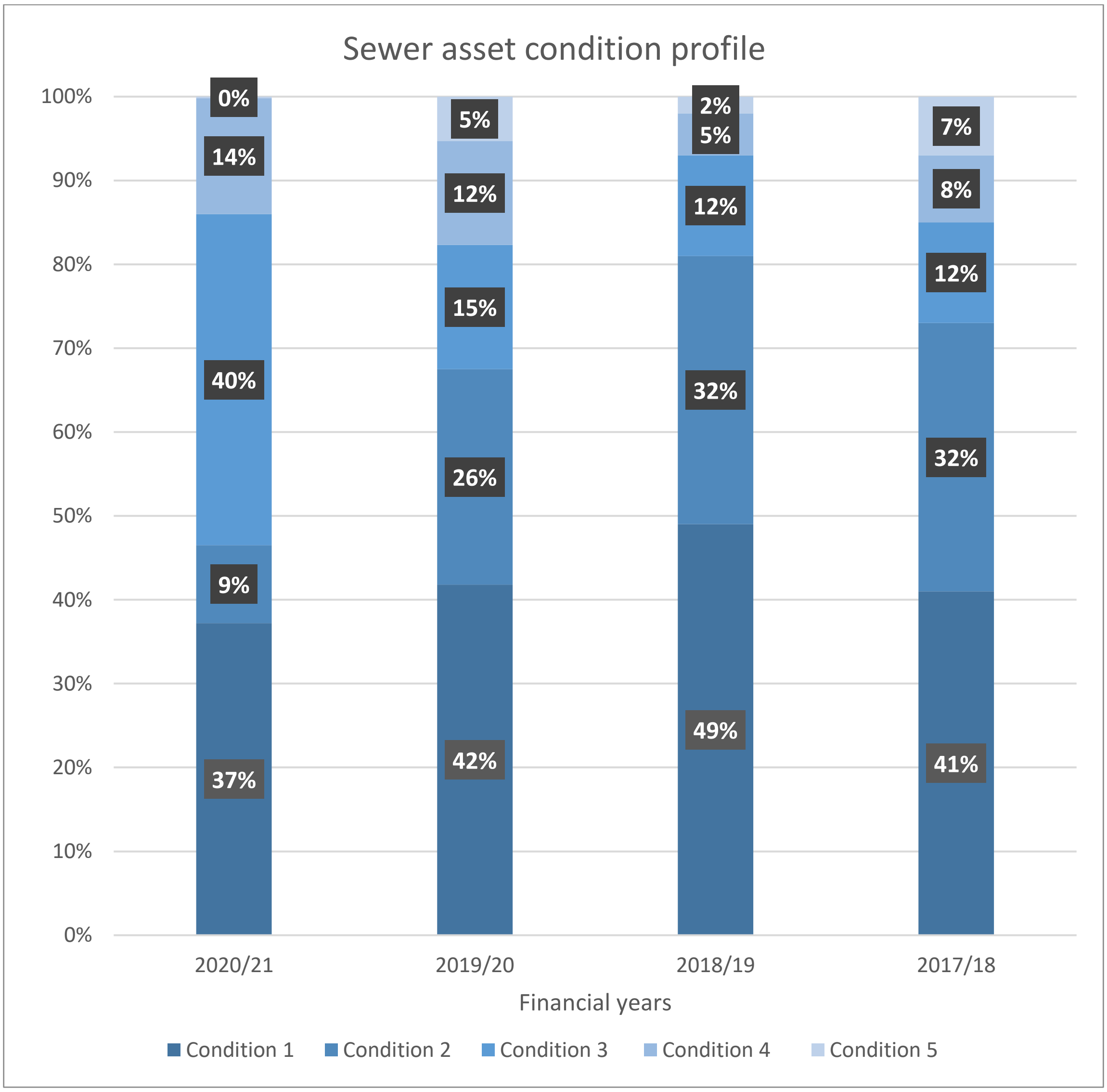


Figure 7-2 ***Sewer assets condition profiles***

7.3 Critical asset assessment

A critical assessment of Council water and sewerage assets was undertaken by Hatch in 2016. Asset criticality was rank from 1-4 and analysed by area and asset class. Asset classes included the following:

– Dams and source water, aquifers and intakes
– Information Communication Technology (ICT) hardware and software
– SPS
– STP
– Water reservoirs
– Water reticulation
– WPS
– WTP

The risk of asset failure was assessed in relation to the following criteria:

– Compliance and legal
– Environment
– Financial
– Public Health,
– Reputation, and
– Supply Service.

The development of Council's Criticality Assessment represented the first step in the continuous improvement cycle for moving towards a risk-based asset management system. This multi factor rating system prioritises asset responses and renewals for water and sewer infrastructure. The rating system is designed to provide a qualitative assessment of the relative criticality of Council's major network assets. As functional criticality is a measure of the contribution an asset provides organisation's business objectives, the rating system seeks to test the relative importance of an asset in achieving this objective.

To do this, ratings were gathered by asking key staff to rate the impact to Council's objectives should the asset be unavailable under a consistent operating context. The validation process highlighted the following key learnings which can be built into future criticality assessment revisions:

– The 4-hour timeframe selected by Council to align the criticality operating context to Council's Risk Consequence Table – whilst adequate for identifying short term critical assets, is not an appropriate time measure for assets such as treatment facilities which operate on the tactical to strategic time horizon.
– The current asset naming and equipment hierarchies proved problematic in identifying assets, particularly for linear assets.
– For water reticulation assets – Use of redefined equipment hierarchies, grouping and aggregating network elements into a manageable set for rating will enable more effective knowledge of the assets.

While these recommendations were adopted by Council, there is a further body of work to be completed that overlays criticality and risk into the long-term planning for capital and operational infrastructure programs.

7.4 Asset management assessment

An asset management audit undertaken by Morrison and Low in 2021 determined Council is at a BASIC level of competence in asset management. The radar chart presented in Figure 7-3 provides a graphical representation of Council's current asset management strengths and weaknesses.

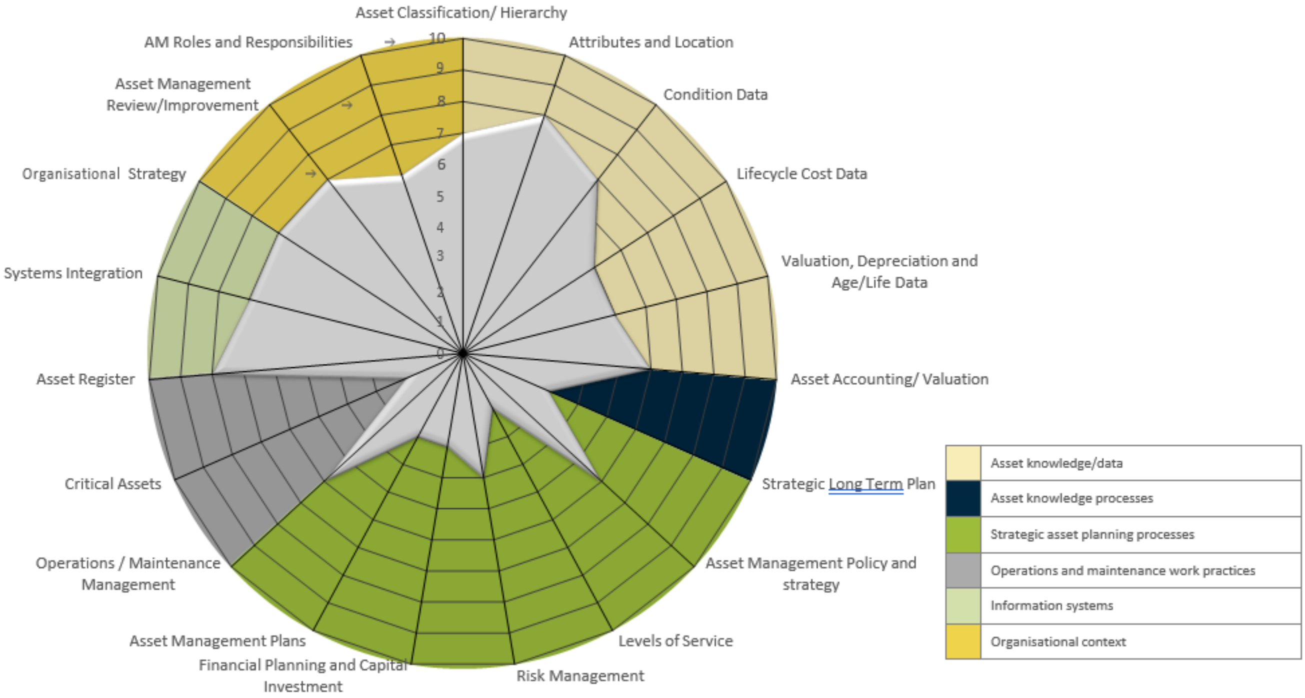


Figure 7-3 Sewer assets condition profiles

Specific water and sewer asset management issues identified for improvement from the review of information and discussions with Council's Asset Management Team include:

- Asset register asset classification/hierarchy data - parent/child relationship has not been identified. This is a result of data transferred from the previous water and sewer asset system.
- Data collection policies, procedures and training.
- Collection of operational data to inform capital renewal program.
- Collection of capital new and renewal data.
- Accurate recording of capital planned and unplanned maintenance data against assets.
- Limited security controls for staff on accessing and editing the asset register data.
- Asset condition data – further work is required in the development of more comprehensive guidelines to ensure consistency in asset condition rating.
- Verifying the condition of asbestos cement (AC) water mains.
- Staff resourcing to implement Strategic Asset Planning (SAP) and defects modules.

7.5 Asset performance indicators

The Office of Local Government (OLG) requires several prescribed performance indicators in relation to infrastructure asset management. These measures are designed to assess whether a Council is maximising its return on resources and minimising unnecessary burden on the community and business. This includes consideration of whether Council is meeting the agreed level and scope of infrastructure for communities as identified through the Integrated Planning and Reporting process.

The infrastructure asset performance indicators that will use include:

– Building and infrastructure **renewal** ratio - this ratio assesses the rate at which these assets are being renewed against the rate at which they are depreciating. It is an indicator of whether Council's infrastructure backlog is likely to increase. The benchmark is greater than 100%.

– Infrastructure **backlog** ratio - this ratio indicates what proportion the infrastructure backlog is against the total value of the Council's infrastructure. Increasing backlogs may affect the Council's ability to provide services and remain sustainable. The benchmark is less than 2%.

– Asset **maintenance** ratio- This ratio compares actual versus required annual asset maintenance. It measures whether Council is spending enough on maintaining its assets to avoid increasing its infrastructure backlog. The benchmark is greater than 100%.

The following information has been taken from Council's Annual Financial Statements. However, since merger (1/7/2017 from MidCoast Water), the impact of corporate knowledge loss, introduction of new systems, and staff changes, have resulted in inconsistent reporting. As such, the data gathered between 2017 – 2020 is not a reliable indicator, and it is only in more recent years that improvement to data and processes has become more robust.

Table 7.2 Previous ratios

Year	Building & Infrastructure Renewal Ratio Benchmark >100%	Infrastructure Backlog Ratio Benchmark <2%	Asset Maintenance Ratio Benchmark >100%
2017/–018 - Water	12.15%	14.06%	65.36%
2017/–018 - Sewer	0.18%	15.12%	82.37%
2018/–019 - Water	33.64%	10.75%	79.45%
2018/–019 - Sewer	22.75%	8.51%	109.14%
2019/–020 - Water	35.75%	2.77%	252.71%
2019/–020 - Sewer	23.02%	2.82%	126.66%
2020/–021 - Water	43.38%	3.61%	82.54%
2020/–021 - Sewer	65.09%	3.56%	85.65%
2021/–022 - Water	In preparation	In preparation	In preparation
2021/–022 - Sewer	In preparation	In preparation	In preparation

7.6 Financial performance and issues

7.6.1 Current price signals

The pricing of water is a two-tiered system, with the first tiered price $3.60/kL and second $4.40/kL. The volume of water that triggers the second tier depends on the size of the water meter.

The Typical Residential Bill (TRB) for water and sewerage combined has increased gradually over the past four years and is well above the state average of similar sized LWUs. This is due to Council having lower than state average connections per kilometre, for both water mains and sewer mains.

Table 7.3 Typical Residential Bill (TRB) over past years

Financial Year	TRB Water and Sewer
2016/17	$1,653
2017/18	$1,759
2018/19	$1,880
2019/20	$1,842
2019/20 State average for LUWs over 10,000 assessments	$1,370

7.7 Liquid trade waste policy

The policy adopted in May 2019 aims to control the quality of effluent from non-residential customers entering the sewer system. Discharge is categorized into 3 categories and annual fees vary. The 21/22 usage charge is $3.00/kL (category 1) which is higher than the NSW average of $1.85.

Data gaps identified include the number of trade waste licenses and any records of non-compliance.

8. 30 Year water cycle analysis and projection

8.1 Historical population

According to the Australia Bureau of Statistics (ABS) 2016 Census there were 90,303 people living in 47,538 dwellings with an average household size of 2.24. The total LGA growth has been 0.7% on average each year from 2016 to 2021.

The 2020 population was estimated by Profile id to be 94,395.

Table 8.1 shows the connected water supply population for each service area in 2020, which was estimated using dwelling occupancy rates and residential water connections from Council's water billing data. There are approximately 10,000 dwellings in the Council area that are not connected to a water supply system but are counted in the Census. Council's unserviced villages are discussed in Section 12.

Table 8.1 Connected population and occupancy rates per water supply service area

Water supply service area	2020 residential connections	Occupancy rate	2020 connected population
Bulahdelah	495	2.30	1,139
Gloucester	1,520	2.10	3,192
Manning	29,211	2.30	67,185
North Karuah	33	2.10	69
Stroud	399	2.50	998
Tea Gardens	2,604	2.00	5,208
TOTAL	**34,262**	**-**	**77,791**

8.1.1 Historical demand trends, all water supply systems

Despite the increasing population, residential demand per unit has been declining for the past 15 years. This reduction in demand is due to extensive demand management programs, water pricing and the implementation of BASIX. This is shown in Table 8.2 and Figure 8-1.

Table 8.2 Residential demand per property

	Manning Scheme	Tea Gardens Scheme	Bulahdelah Scheme	Stroud Scheme	Gloucester Scheme	North Karuah Scheme
2004	237	213	198	199	-	184
2005	228	197	191	193	-	175
2006	216	208	196	220	-	174
2007	199	179	184	228	-	176
2008	173	173	163	179	-	130
2009	184	191	176	201	-	153
2010	177	183	168	185	-	163
2011	165	176	156	171	213	150
2012	161	142	146	160	146	135
2013	168	158	152	177	162	152
2014	168	151	147	162	152	146
2015	153	150	143	148	132	138

	Manning Scheme	Tea Gardens Scheme	Bulahdelah Scheme	Stroud Scheme	Gloucester Scheme	North Karuah Scheme
2016	159	148	135	140	124	144
2017	163	163	145	139	128	133
2018	163	160	145	147	141	145
2019	157	154	144	142	136	115
2020	143	134	140	125	119	123

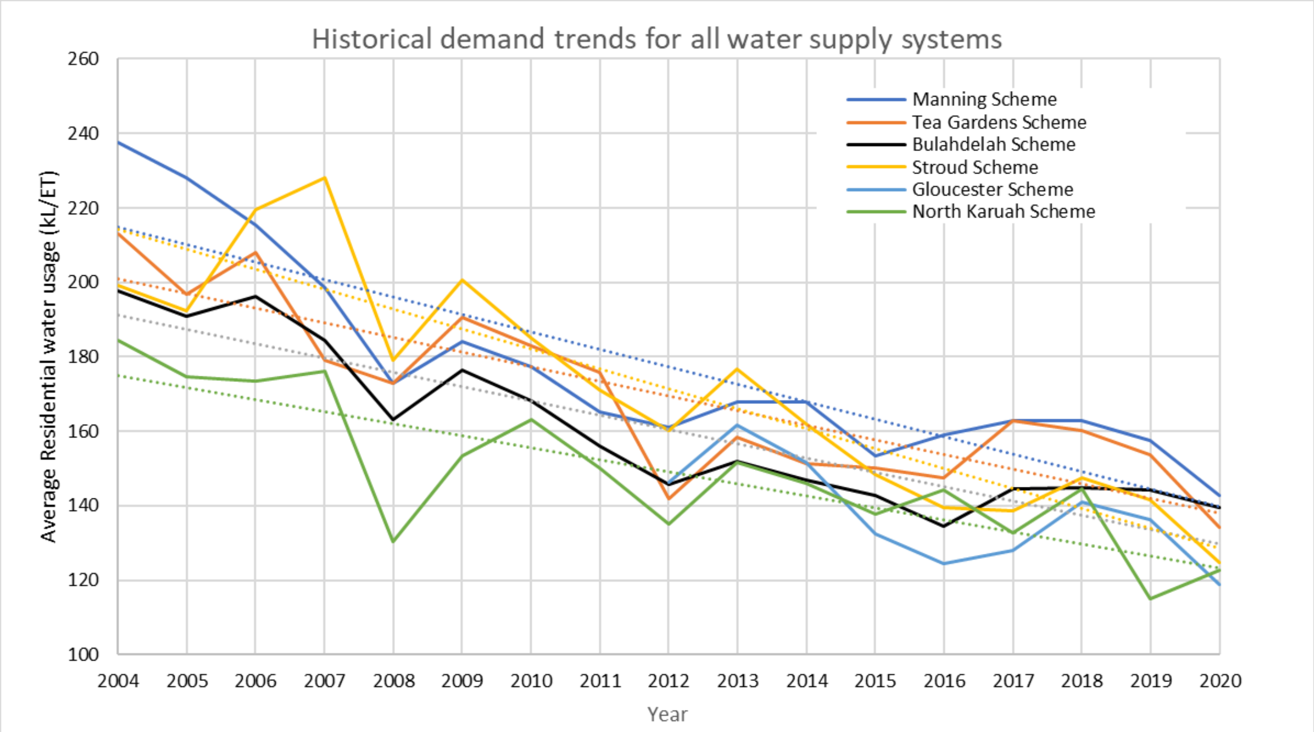


Figure 8-1 Average kL/ET residential demand history

8.1.2 Serviced dwellings

Connected properties are defined as single detached homes, semi-detached homes and flats/units for residential purposes. All other lots are classified as non-residential. Table 8.3, Table 8.4 and Table 8.5 show the connected water supply residential and non-residential properties by service area. The water property connection data was obtained from Council's water billing database for the period of 2015 to 2020. Refer to Appendix A for details.

Table 8.3 Connected residential properties (water supply)

Water supply service area	Connected properties – - Residential					
	2015	2016	2017	2018	2019	2020
Bulahdelah	487	493	494	495	495	495
Gloucester	1,449	1,478	1,489	1,506	1,514	1,520
Manning	27,524	27,980	28,295	28,634	28,941	29,211
North Karuah	33	33	33	33	33	33
Stroud	378	386	391	393	396	399
Tea Gardens	2486	2531	2569	2591	2597	2,604
TOTAL	**32,357**	**32,901**	**33,271**	**33,652**	**33,976**	**34,262**

Table 8.4 Connected non-residential properties (water supply)

Water supply service area	Connected properties – - Non-residential					
	2015	2016	2017	2018	2019	2020
Bulahdelah	87	89	90	90	90	89
Gloucester	248	257	257	259	260	261
Manning	2,517	2,630	2,648	2,664	2,681	2,697
North Karuah	3	3	3	3	3	3
Stroud	77	80	80	80	81	81
Tea Gardens	140	151	159	162	163	164
TOTAL	**3,072**	**3,210**	**3,237**	**3,258**	**3,278**	**3,295**

Table 8.5 Connected residential and non-residential properties (water supply)

Water supply service area	Connected properties – Residential and non-residential					
	2015	2016	2017	2018	2019	2020
Bulahdelah	574	582	584	585	585	584
Gloucester	1,697	1,735	1,746	1,765	1,774	1,781
Manning	30,041	30,610	30,943	31,298	31,622	31,908
North Karuah	36	36	36	36	36	36
Stroud	455	466	471	473	477	480
Tea Gardens	2626	2682	2728	2753	2760	2,768
TOTAL	**35,429**	**36,111**	**36,508**	**36,910**	**37,254**	**37,557**

8.1.3 Vacant lots

Council's water billing database contains a category for vacant lots. For planning purposes, uninhabited (vacant) lots were counted as lots using less than 5 L/d of water. The ABS reported in 2016 that 82% of residential dwellings in the Council LGA were occupied. This is lower than the Regional NSW average of 87%.

Table 8.6 indicates that there has been an increase in serviced vacant lots since 2015. Refer to Appendix A for details. This is likely due to increased sub-division and land releases.

Table 8.6 Vacant lot changes over past six years

Year	2015	2016	2017	2018	2019	2020
Vacant Lots	639	697	729	780	844	970
Connected properties using less than 5 L/day						200

Vacant lots per water supply service area are shown in Table 8.7 . Refer to Appendix A for details.

Table 8.7 Vacant lots per water supply service area

Water supply service area	Vacant lots
Bulahdelah	15
Gloucester	56
Manning	775
North Karuah	1
Stroud	24
Tea Gardens	99
TOTAL	970

8.2 Nominated growth strategy

8.2.1 Equivalent Tenement projections

Council has nominated the growth rates presented in Table 8.8 for the six water supply schemes. Equivalent Tenements for 2020 were calculated using residential water billing data and Non-revenue Water factors (Table 9.1) for each scheme to determine average annual demand per Equivalent Tenement. Standard Equivalent Tenement demands for the 2020 financial year are shown in Table 8.9.

Projected Equivalent Tenement values are based on Council's forecasted water demands (for residential and non-residential connections) and Council's design Equivalent Tenement demand factor of 205 kL/year/ET. Refer to Section 8.2.2 for Council's methodology for forecasting water demands.

Table 8.8 Equivalent Tenement (ET) projections (water supply)

Water supply scheme	2020	2026	2031	2036	2041	2046	2051
Bulahdelah	724	774	839	919	1,015	1,125	1,251
Gloucester	2,291	2,536	2,650	2,923	3,046	3,166	3,279
Manning	43,260	46,942	51,284	56,001	61,151	66,675	72,392
North Karuah	34	34	34	34	34	34	34
Stroud	646	674	745	829	949	1,093	1,265
Tea Gardens	3,481	3,943	4,264	4,548	4,771	4,940	5,055
TOTAL	50,436	54,902	59,817	65,255	70,966	77,034	83,276

Table 8.9 Equivalent Tenement (ET) standard demands for 2020 financial year

Water supply scheme	2020 standard ET demand (kL/year)
Bulahdelah	161
Gloucester	131
Manning	158
North Karuah	152
Stroud	151
Tea Gardens	153

8.2.2 Demand forecasts

The water demand forecasts used Council's 2019-20 financial year (2020) billing data for the baseline year. Council's WaterGEMS hydraulic models were used to define water supply zones within each scheme. Consumption records from the 2020 billing data were assigned to specific water supply zones using the hydraulic models.

The 2020 annual consumption records were used to calculate 2020 Average Day Demands (ADD) for each water supply zone. Average Day production requirements were then calculated by adding a Non-revenue Water (NRW) factor, calculated in the Water Balance Dashboard Summary (Table 9.1), to each zone's ADD. The 2020 Peak Day Demand (PDD) was calculated by assigning a Peak Day Factor (PDF) for each water supply zone and multiplying this PDF by each zone's Average Day production requirement. These PDFs were assigned based on observed SCADA flowmeter data, the zone size and annual population variability (i.e. tourism rates).

Forecasted demands were calculated for each water supply zone at 5-year Census increments, from 2026 up to the year 2051. All forecasted demands were calculated in L/day, based on Council's standard design PDD factors outlined below:

– Residential demands – 2,000 L/day per ET
– Non-residential demands – 1,600 L/day per ET

These design factors are based on Council's standard Equivalent Tenement demand factor of 205 kL/year/ET. Council's standard design PDD factors are rounded figures based on Peak Day Factors of 2.8 and 3.5 for non-residential and residential demands, respectively.

Council uses standard Equivalent Tenement Peak Day Demands for all growth projections and new developments. This approach has been adopted for several reasons including:

– Uniform and consistent peak day projections and deign demands are defendable to developers and their consultants.
– Council's customer base is changing, and past water usage is not a prediction of the future water usage.

8.2.2.1 Residential growth forecasts

Residential growth was estimated using .id population forecasts for new dwellings in MidCoast Council growth areas. These forecasts provide the estimated number of additional dwellings (assumed to equal one ET) within 5-year periods that align with Census years, from 2021 to 2036. Each .id growth area was assigned to a water supply zone using a percentage to reflect the allocation of future demands within each water supply zone. Some residential growth fell outside of water supply zones and was deemed as "unserviced growth". Similarly, some existing water supply zones were anticipated to experience no growth.

For each water supply zone, the cumulative number of dwellings from 2020 to 2036 was used to extrapolate a line of best fit and forecast the additional growth in each water supply zone for the years 2036 to 2051. All additional residential dwellings (ETs) were assigned a future PDD of 2,000 L/day.

8.2.2.2 Non-residential growth forecasts

Non-residential growth was assumed to occur by a combination the following methods:

– "Natural growth", whereby the non-residential growth increases at the same annual growth rate as residential. This was calculated for each 5-year Census period by adding additional Peak Day Demands to each water supply zone, at a rate equivalent to the percentage growth in residential Peak Day Demands in the same zone.
– "Major development growth", for large future non-residential developments that were identified in Council's strategic planning documents: *MidCoast Council Urban Release Areas Report* (July 2021) and *MidCoast Council Employment Zones Review – Part A* (August 2021). Where these developments were not accounted for by "natural growth" demand forecasts, each large future non-residential development was assigned an ET value and an estimated development year. All new non-residential ET was assigned a future PDD of 1,600 L/day per ET.

9. Water demand analysis and issues

9.1 Methodology for water analysis

9.1.1 System demands

For each water supply zone, the 2020 annual consumption was divided into the following two categories using the water billing data:

- Residential demands.
- Non-residential demands (including Commercial, Industrial, Institutional and Public Use).

Future water network demands were estimated using growth rates assigned to each water supply zone (refer to Section 8.2). Projected water demands were calculated separately for residential and non-residential connections, before being added together to form the overall forecasted demands for each water supply zone.

For each scheme, the following forecasted demand trends were calculated:

- Average Day Demands (ML/d) – Based on customer metered consumption + Non-revenue Water + standard ADD/ET for future ET. Used for revenue planning.
- Peak Day WTP Production (ML/d) – Based on operational WTP production data + standard PDD/ET for future ET. Used to assess WTP requirements.
- Peak Day System Demands (ML/d) – Based on peak day customer metered consumption + Non-revenue Water + standard PDD/ET for future ET. Used to assess system reliability, including reservoir & distribution system sizing.
- Dry Year Demands (ML/year) – Based on Average Day Demand forecasts, extrapolated from recent dry year period. Used to assess drought security.

9.1.2 Peak week production assessment

Two methods were compared for this assessment:

1. Peak week analysis completed by finding the peak production day across the year and taking the peak week as the three days before and three days after this peak day
2. Peak week analysis by identifying the highest seven-day period of production in the year

Both methods were compared, and it was identified that method 2:

- Resulted in a higher total peak week production in all schemes for all financial year periods
- Did not capture any operational peaks (i.e. there were no cases of zero daily production within the peak week due to an operational reason) in any schemes for all financial year periods
- All peak weeks for all schemes for all financial years coincided with warmer weather and/or school holidays

Council has adopted method 2 for the analysis. With this approach, the peak day can fall anywhere within the seven-day period (i.e. this method does not require the highest daily production to occur in the middle of the peak week).

From this assessment, for each scheme's peak week over the 5-year analysis period, the highest peak day production value (excluding any obvious outliers) was used to estimate projections for future WTP peak day production requirements ("Peak Day WTP Production" as discussed in Section 9.1.1).

9.1.3 Security of supply

Variable climatic patterns will affect rainfall in NSW and impact water availability. The affects the security of town water supplies dependent on surface water and for groundwater sources that are reliant on surface water recharge.

Council has adopted the methodology detailed in ‘Assuring future urban water security: Assessment and adaption guidelines for NSW local water utilities’, NSW Office of Water 2013. These guidelines adopt a ‘5/10/10’ design rule which requires water security planning based on:

– Total time spent in drought restrictions should be no more than 5% of the time
– Restrictions should not need to be applied in more than 10% of years
– An average reduction of 10% in water usage during restrictions

This methodology approximates the severity of a ‘1 in 1,000-year drought’ with secure yield defined as the highest annual water demand that can be supplied from a water supply headworks system whilst meeting the 5/10/10 design rule. Water security achieved in the secure yield of a water supply is at least equal to the unrestricted dry year annual demand.

The secure yield was assessed by NSW Urban Water Services in 2021 for the Manning, Bulahdelah, Stroud and Gloucester water supply headworks systems. A summary of secure yield estimates for these four systems is outlined in Sections 9.4.4.1, 9.6.4.1, 9.7.4.1 and 9.8.4.1 respectively. A copy of the full Secure Yield Study is presented in Appendix B and outlines the limitations and how to best use the secure yield figures for planning.

The secure yield for the Tea Gardens scheme has been estimated using Council’s 2007 MODFLOW hydrologic model. This is outlined in Section 9.5.4.1

For each scheme, the estimated secure yield has been assessed against the Dry Year Demand forecasts.

9.1.4 Distribution system capacity

9.1.4.1 Trunk mains and water pump station capacity assessment

All major trunk mains and water transfer pumping stations were assessed based on the asset’s ability to transfer at least 1 peak day of supply to downstream supply reservoirs. The current maximum flowrates for all trunk mains were defined using observed operational data from ClearSCADA and other metering sources where available. Trunk mains were defined as either:

– Gravity transfer mains – available to transfer the maximum flow rate for up to 24 hours on a peak day if required.
– Pumped transfer mains – available to transfer the maximum flow rate for up to 17 hours on a peak day to avoid peak tariff charges.

9.1.4.2 Supply reservoirs capacity assessment

Surface reservoirs were assessed based on the asset’s ability to provide one full peak day of supply to all downstream demands (either customers or supply reservoirs). Elevated reservoirs were assessed based on the asset’s ability to provide 4 hours of peak day supply plus 4 hours of fire flows at 20 L/s to all downstream demands (either customers or supply reservoirs).

9.1.4.3 Reticulation capacity assessment

Council’s WaterGEMS hydraulic models are used to assess the water reticulation capacity of each scheme. The models are set up to display when water mains exceed maximum allowable headloss gradients and velocities, and when customers fall outside of Council’s desired levels of service for pressure. Council’s hydraulic modelling updates and assessments are ongoing. Issues with network distribution capacity are assessed and resolved as part of Council’s business as usual operations.

9.2 Non-revenue water and losses all supply systems

For each water supply service area, a water balance dashboard, as shown in Table 9.1, was prepared using WTP production data, water billing data and system data to identify non-revenue water (water that is not paid for) and real water losses. Refer to Appendix B for details. Prior to the Council amalgamations inn 2016, all end uses supplied with water were metered.

From the analysis, the estimate of Unavoidable Annual Real Losses calculated resulted in negative values when subtracted from the real losses between production and billing. This may be attributed to the high average pressures and/or long length of the systems.

Table 9.1 Water balance dashboard summary

System information	Bulahdelah	Gloucester	Stroud	Tea Gardens	North Karuah	Manning
Length of Water Mains, Lm (km)	27.62	78.88	42.74	93.52	1.03	1181.89
Number of Service Connections, Ns	584	1781	480	2768	36	31908
Average Operating Pressure, Pav (m)	46	50	43	52	45	55
Connection Density (conn/km)	21.15	22.58	11.23	29.60	34.87	27.00
Results summary						
Annual Real Losses (ML)	15	24	18	64	1	546
Current Annual Real Losses, CARL (L/day)	42,062	64,558	50,464	176,111	3,199	1,496,605
Unavoidable Annual Real Losses, UARL (L/day)	44,357	142,235	49,589	202,679	2,132	2,574,019
Unavoidable Annual Real Losses, UARL (ML)	16	52	18	74	1	940
Real Losses (L/conn/day)	72	36	105	64	89	47
Real Losses (L/km/day)	1,523	818	1,181	1,883	3,099	1,266
Real Losses (%)	13%	8%	18%	12%	14%	8%
Non-revenue Water (%)	15%	10%	21%	14%	24%	10%
Infrastructure Leakage Index (ILI)	0.95	0.45	1.02	0.87	1.50	0.58

Council notes that all avoidable real losses are being calculated as negative. This is either due to (or likely a combination of) calibration errors in some flow meters and/or the inputs/assumptions in the empirical formulas and values used in the calculation for real and apparent losses.

Council has identified leakage in the networks as an issue and will target this as a part as business as usual, including meter calibration, installation of bulk flow meters at strategic locations and leak detection programs.

9.3 High water users all supply systems

Figure 9-1 presents the Top 30 water users by consumption and Figure 9-2 shows the top water users by category. This information was obtained from 2019 - 2020 billing data.

The information shows the highest water user is Wingham Beef (the abattoir on Gloucester Road in Wingham) which is supplied by the Manning Scheme. Many of the high-water users are caravan parks as the area is a popular holiday destination. Council completed water audits of these high users in 2019 to help them reduce leakage and overall consumption. Following on from the outcomes of this audit, Council's water resilience officer position is working with large users, as part of Council's business as usual. This work will be ongoing, where Council will work with and support Council's large water users to look for opportunities and initiates to reduce water usage. This includes the rollout of smart meters to identify leaks and target behaviour change.

All the top 30 water users are supplied by the Manning Scheme, except for:

- RSL Lifecare (a retirement village) and Viney Creek Reservoir (a council asset) in the Tea Gardens scheme
- W'ter 'N Tipper Hire Pty, supplied by the Gloucester scheme

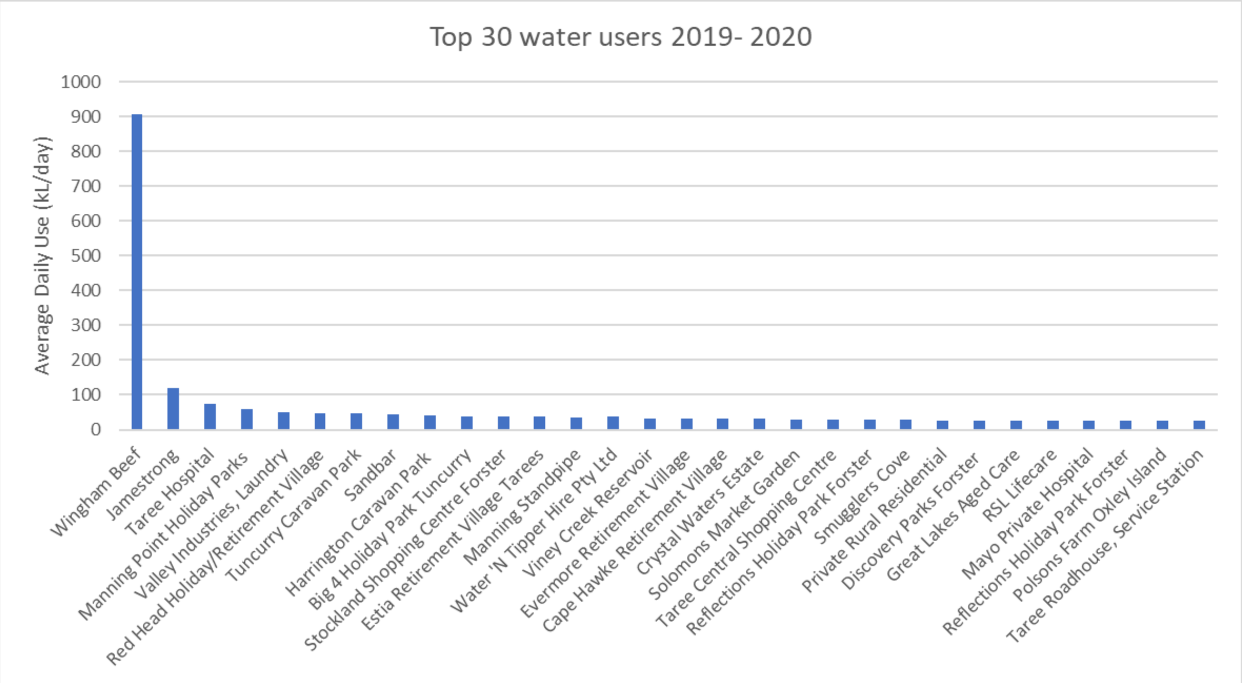


Figure 9-1 Top 30 water users by consumption

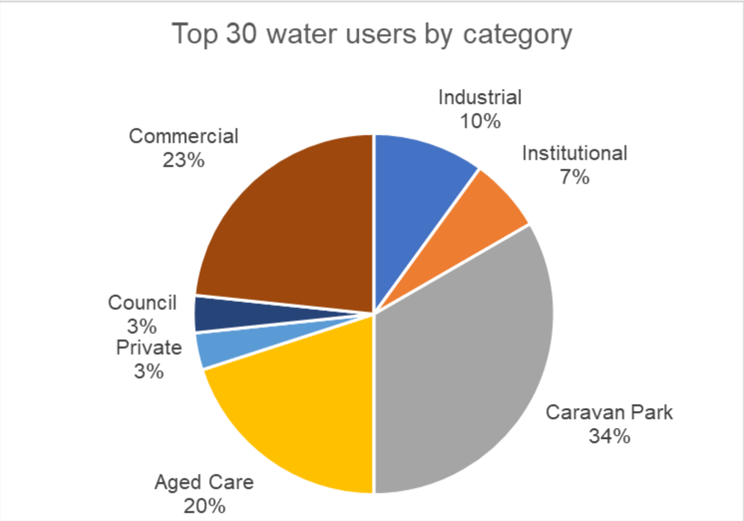


Figure 9-2 Top 30 water uses by category

9.4 Manning supply scheme

9.4.1 Production data

Table 9.2 presents the date range of records obtained for daily water production data for Bootawa and Nabiac WTPs.

Table 9.2 Water treatment plant production data recorded

Water treatment plant	Start of recorded data	End of recorded data
Bootawa	13/03/2016	16/12/2020
Nabiac	20/11/2018	16/12/2020

The historical production data and monthly average for the Bootawa WTP and Nabiac WTP are shown in Figure 9-3 and Figure 9-4.

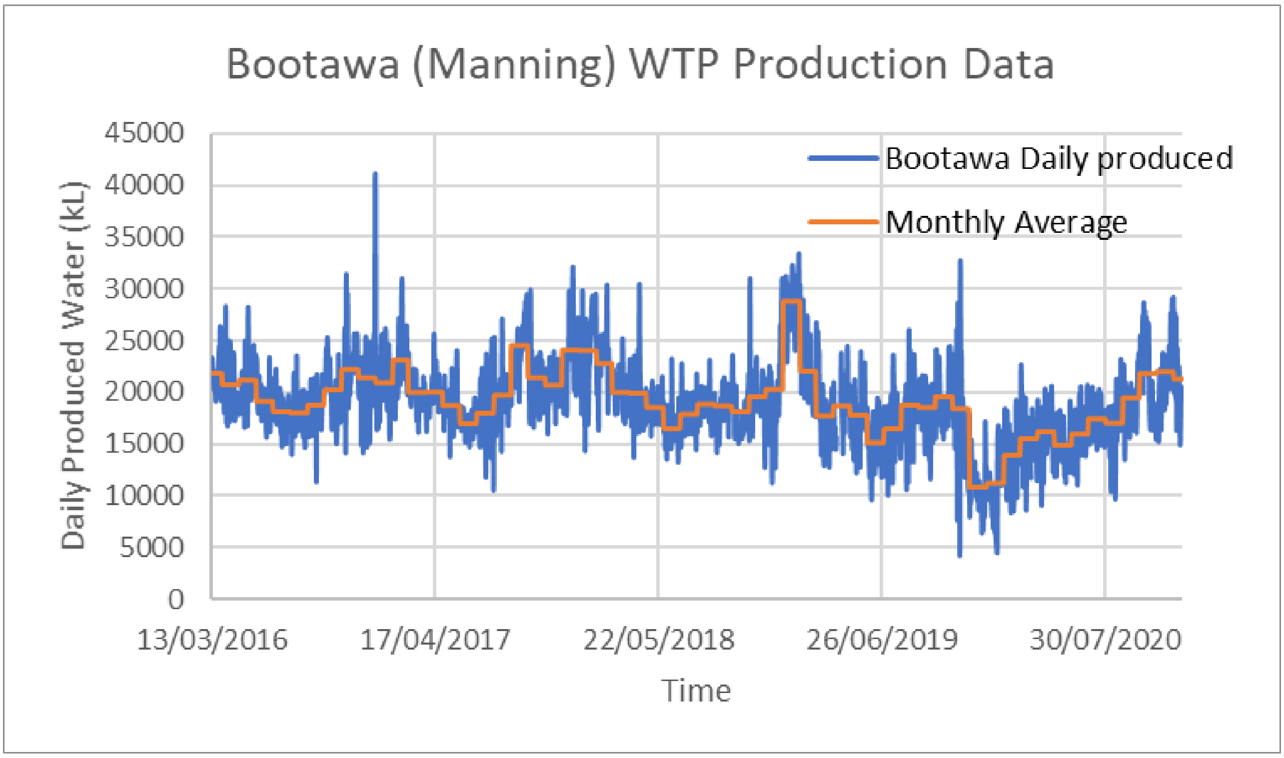


Figure 9-3 Bootawa (Manning) WTP daily production data and monthly average production

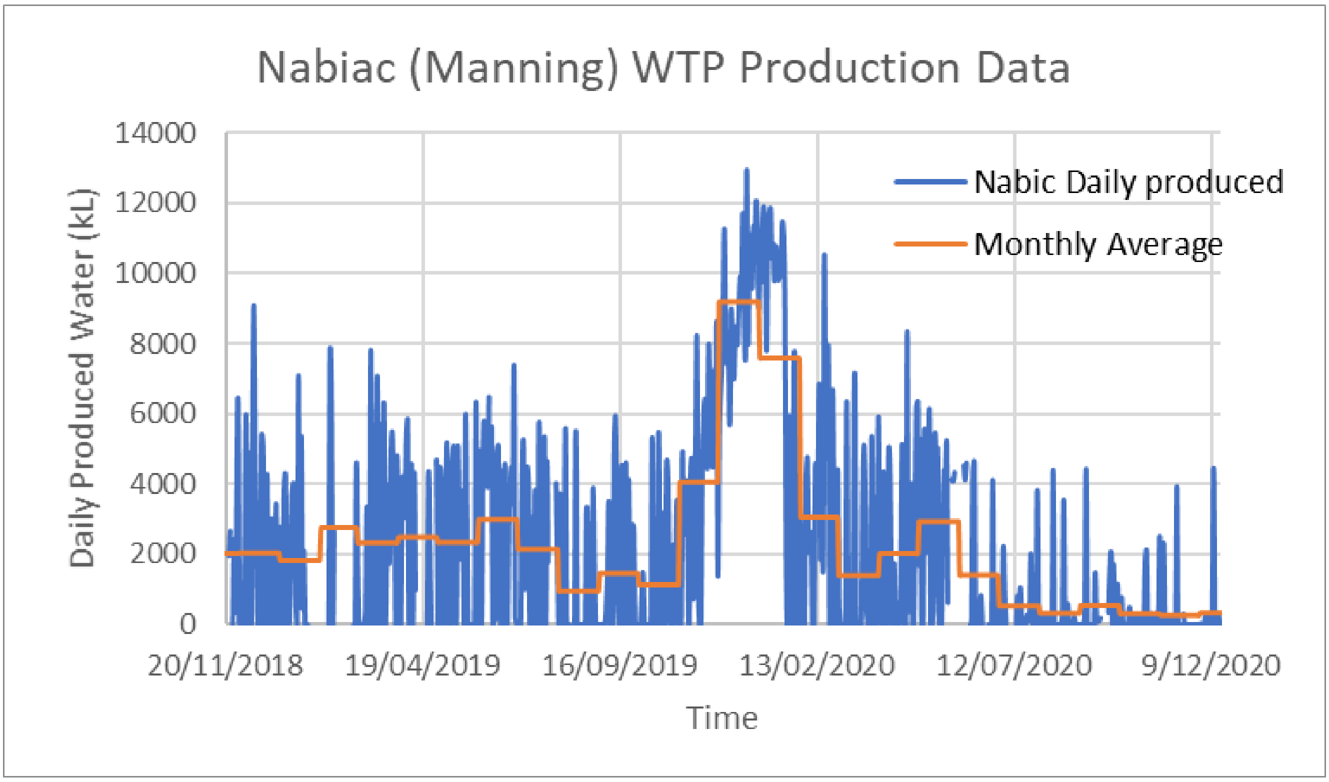


Figure 9-4 Nabiac (Manning) WTP daily production data and monthly average production

9.4.2 Metered consumption

Water meter billing data was provided for the 2014/15 financial year to the 2019/20 financial year. Water meters are read quarterly. The Manning connection and water usage data is shown in Figure 9-5.

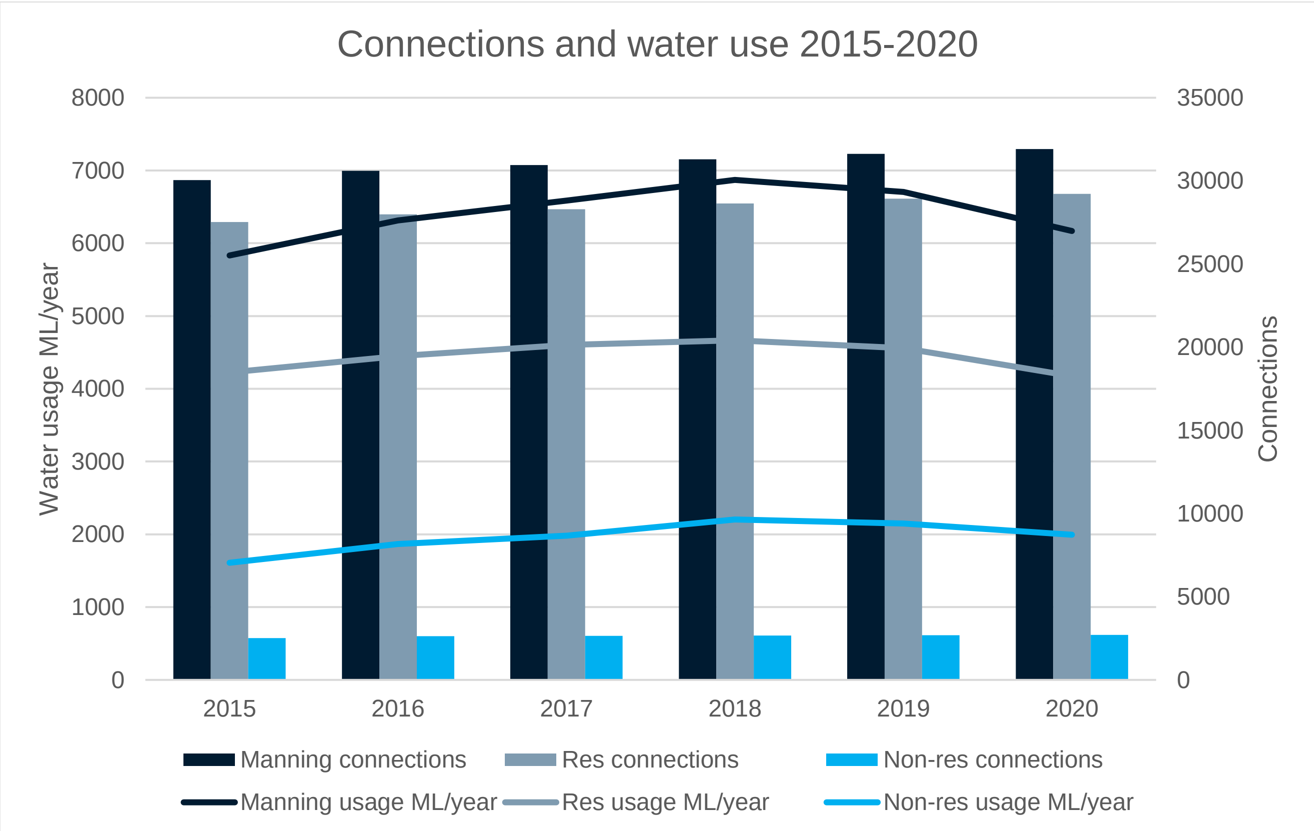


Figure 9-5 Manning connections and water usage data

The key findings for the total Manning water scheme are:

– The current daily average water demand for the past six years is approximately 16.86 ML/day.
– The five-year average is 17.56 ML/day.
– The residential to non-residential demand split is approximately 68% residential demand to 32% non-residential demand.
– The number of connections has increased each year, from 30,401 in 2014/15 to 31,908 in 2019-2020.
– The average day consumption for an active connected residential property is 391 L/conn/day in 2019-2020.
– Wingham Beef is the highest non-residential user, accounting for 5% of the system's daily water consumption. Refer to Section 9.3 for the Top 30 water users in the LGA.

The Manning system can be dissected into the separate supply sub-zones, shown in Table 9.3.

Table 9.3 Manning water supply sub-zones, connection and consumption

Manning water supply sub-zone	2020 total connections	Annual consumption (ML/year)	Average Daily Demand (ML/d)
Bootawa Raw	3	0.35	0.001
Coopernook	230	59.86	0.16
Crowdy Head	80	8.47	0.02
Denva Road Reduced	61	13.17	0.04
Dyers Crossing Reduced	26	5.49	0.02
Elizabeth Beach	1,042	154.62	0.42
Forster	6,603	1,201.09	3.29
Harrington	636	97.28	0.27
Irkanda	685	149.52	0.41
Irkanda Rising Main	535	118.77	0.33
Kolodong 3	6,482	1,316.89	3.61
Koorainghat	224	46.12	0.13
Krambach	120	17.16	0.05
Krambach Rising Main	67	28.67	0.08
Lansdowne	139	16.48	0.05
Lantana	1,006	236.81	0.65
Mitchells Island	173	52.14	0.14
Mitchells Island Boosted	43	7.19	0.02
Moto	186	67.18	0.18
North Coopernook	1,163	153.65	0.42
Old Bar	2,737	458.07	1.25
Pilot Hill Reduced	43	3.78	0.01
Rainbow Flat	3,579	737.08	2.02
Red Head	1,790	261.13	0.72
Smiths Lake	830	87.41	0.24
Smiths Lake Boosted	154	18.53	0.05
Tallwoods	479	56.33	0.15
Tinonee	399	64.71	0.18
Wingham	2,319	715.75	1.96
TOTAL	**31,834**	**6,153.68**	**16.86**

9.4.2.1 Manning System demands

Peak period analysis was undertaken on daily Bootawa and Nabiac WTP production data. The peak week persistence patterns (total of both plants production) from financial years 2015/16 to 2019/20 is shown in Figure 9-6. Refer to Appendix B for details.

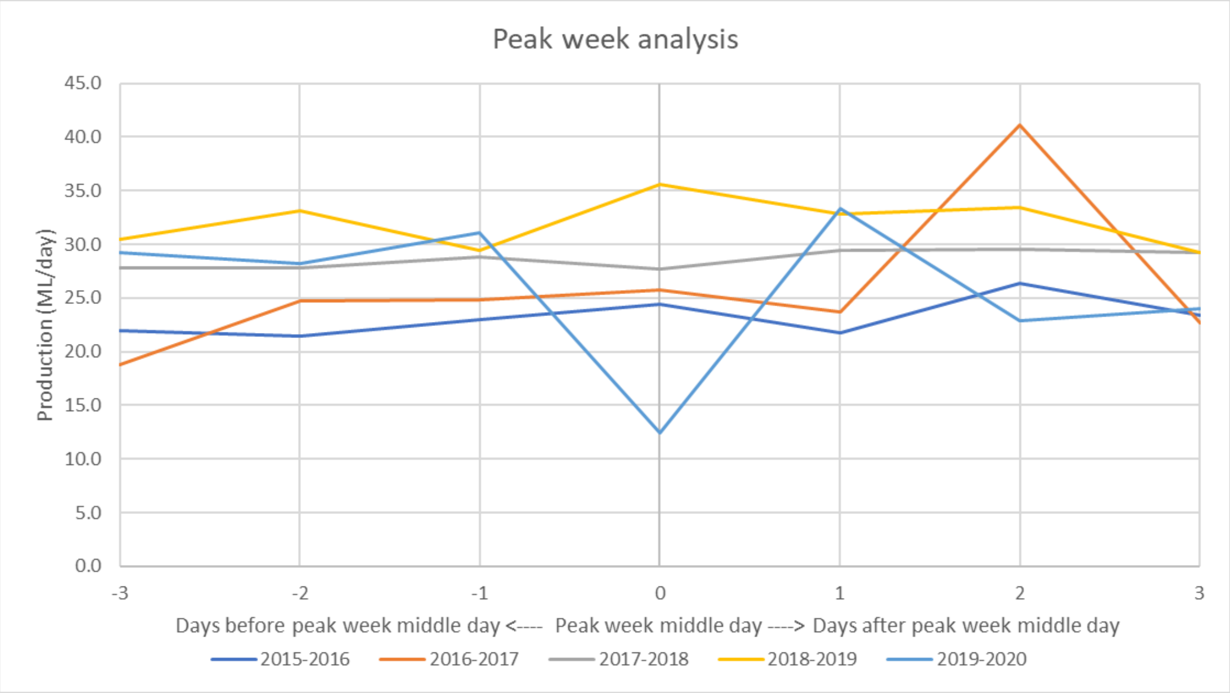


Figure 9-6 Manning peak week persistence patterns

In the last five years, all peak weeks occurred in either school holidays or in a period of warmer weather (i.e., no peak weeks are experienced in winter). All weeks have no days where zero daily production occurs. All peak weeks demonstrate relatively consistent water production across all seven days of the peak week (i.e., the peaks do not show steady growth leading up to the peak day, rather a consistently higher daily water demand).

In the last five years, the maximum peak day production was 41.15 ML/day. This occurred on 31 December 2016. This large peak only occurred once in the peak week period across the five-year period. This peak was approximately 1.6 times the average daily production of that peak week. The next highest maximum peak day production was 35.63 ML/day which occurred on 16 January 2019. This was approximately 1.1 times the average day production of that peak week. This trend was similar for all other peak week periods, where production on the peak day was generally close to average peak week production (between 1.0 and 1.3 times higher).The peak period production data is presented in Table 9.4 and key statistics around the peaks is presented in Table 9.5.

Table 9.4 Peak period information

Peak week date of middle day (day 0)		26/03/2016	29/12/2016	27/09/2017	16/01/2019	13/11/2019
Daily demand for each day in peak week (ML)	-3	21.95	18.82	27.78	30.45	29.23
	-2	21.49	24.77	27.79	33.15	28.22
	-1	22.95	24.82	28.86	29.39	31.04
	0	24.44	25.70	27.70	**35.63**	12.43
	1	21.73	23.66	29.47	32.84	**33.35**
	2	**26.40**	**41.15**	**29.51**	33.40	22.91
	3	23.43	22.65	29.23	29.23	24.01
Sum of peak week production (ML)		162.39	181.57	200.34	224.08	181.19

Table 9.5 Peak period statistics

Peak week by year	Average day peak week (ADPW) (ML/day)	Peak day (ML/day)	Peak day / ADPW
2015-2016 (28/03/2016)	23.20	26.40	1.14
2016-2017 ((31/12/2016)	25.94	41.15	1.59
2017-2018 (29/09/2017)	28.62	29.47	1.03
2018-2019 (16/01/2019)	32.01	35.63	1.11
2019-2020 (14/11/2019)	25.88	33.35	1.29

9.4.3 Manning demand forecast

From the modelled demands and Council's nominated growth strategy, the water demand forecasts for the Manning system are presented in Table 9.6.

Table 9.6 Manning water forecast

	2020	2026	2031	2036	2041	2046	2051
Average Day Demands (ML/day)	18.6	22.9	25.4	28.1	31.0	34.2	37.5
Peak Day WTP Production (ML/day)	33.3	47.4	52.5	58.1	64.2	70.7	77.4
Peak Day System Demands (ML/day)	48.9	55.7	63.7	72.4	82.0	92.2	102.9
Dry Year Demands (ML/year)	6,805	8,366	9,272	10,256	11,330	12,482	13,674

The peak day supply requirements at a water supply zone level are provided in Table 9.7.

Table 9.7 Manning peak day system demands at water supply zone level

Total (ML/day)	2020	2026	2031	2036	2041	2046	2051	2020-2051 growth (%)
Bootawa Raw	0.002	0.002	0.002	0.002	0.002	0.002	0.002	**0%**
Coopernook	0.56	0.61	0.69	0.84	1.03	1.28	1.59	**181%**
Crowdy Head	0.10	0.12	0.13	0.14	0.15	0.15	0.15	**49%**
Denva Road Reduced	0.16	0.17	0.20	0.23	0.26	0.30	0.35	**124%**
Dyers Crossing Reduced	0.06	0.07	0.08	0.08	0.09	0.09	0.09	**34%**
Elizabeth Beach	1.82	1.94	2.08	2.25	2.44	2.66	2.90	**59%**
Forster	8.49	9.53	10.70	11.59	12.52	13.35	14.11	**66%**
Harrington	1.15	1.17	1.18	1.19	1.20	1.20	1.20	**5%**

Total (ML/day)	2020	2026	2031	2036	2041	2046	2051	2020-2051 growth (%)
Irkanda	1.06	1.16	1.26	1.39	1.53	1.69	1.87	**77%**
Irkanda Rising Main	0.84	1.18	1.69	2.25	2.96	3.77	4.70	**460%**
Kolodong 3	9.31	10.06	11.21	12.61	14.17	15.95	17.58	**89%**
Koorainghat	0.33	0.35	0.37	0.40	0.44	0.49	0.54	**67%**
Krambach	0.16	0.18	0.19	0.21	0.22	0.24	0.25	**52%**
Krambach Rising Main	0.34	0.40	0.45	0.51	0.56	0.60	0.62	**84%**
Lansdowne	0.16	0.17	0.19	0.24	0.30	0.37	0.47	**199%**
Lantana	1.67	1.90	2.16	2.57	3.03	3.53	4.08	**144%**
Mitchells Island	0.49	0.51	0.53	0.56	0.60	0.64	0.69	**40%**
Mitchells Island Boosted	0.08	0.09	0.09	0.10	0.11	0.11	0.12	**45%**
Moto	0.79	0.81	0.86	0.94	1.06	1.21	1.37	**73%**
North Coopernook	1.45	1.70	1.81	1.96	2.02	2.04	2.04	**41%**
Old Bar	4.32	5.11	6.21	7.41	8.88	10.56	12.44	**188%**
Pilot Hill Reduced	0.04	0.04	0.04	0.04	0.04	0.04	0.04	**0%**
Rainbow Flat	5.21	5.63	6.18	6.93	7.69	8.56	9.54	**83%**
Red Head	2.46	3.40	4.13	4.74	5.24	5.62	5.89	**139%**
Smiths Lake	1.03	1.06	1.09	1.13	1.18	1.22	1.28	**24%**
Smiths Lake Boosted	0.22	0.23	0.25	0.27	0.30	0.32	0.35	**61%**
Tallwoods	0.53	0.73	0.90	1.05	1.17	1.26	1.32	**149%**
Tinonee	0.61	0.65	0.72	0.79	0.87	0.97	1.08	**78%**
Wingham	5.06	5.51	5.86	6.24	6.54	6.81	7.05	**39%**
Brimbin (NEW)	0.33	1.17	2.49	3.76	5.37	7.17	9.19	**2,697%**
TOTAL	**48.9**	**55.7**	**63.7**	**72.4**	**82.0**	**92.2**	**102.9**	**111%**

9.4.4 Infrastructure capacity assessment

9.4.4.1 Security of supply

The Manning Scheme secure yield was modelled for the existing Bootawa Dam (supplied by pumping from the Manning River) and Nabiac borefield. Two cases of useable storage were considered - secure yield using historical data and future secure yield with 1-degree warming. While these are the best estimates, the full report presented in Appendix B outlines the limitations and how to best use these figures for planning.

Table 9.8 summarises the secure yield estimates for the Manning scheme. The security of supply assessment is based on the results from Run number 114, which assumes:

– Flow Series 2, as this results in the most conservative streamflow estimates
– Bootawa Dam useable storage with Deep Water Recovery, as this extraction method has can be performed during emergency scenarios

Table 9.8 Manning water supply headworks secure yield estimates

Run number	Bootawa Dam useable storage	Flows	Secure yield ML/year	
			Historical climate	1ºC climate warming
Gravity Flow to WTP				
112	1638 ML	Flow Series 2	5696	5571
113	1638 ML	Flow Series 6	5928	5928
Using Deep Water Recovery				
114	**2124 ML**	**Flow Series 2**	**6606**	**6309**
115	2124 ML	Flow Series 6	6825	6700

Figure 9-7 shows the Manning Scheme's historical and forecasted annual demands. These demands have been plotted against the secure yield for both the historical climate and 1° climate warming scenarios. The figure also shows the maximum annual extraction specified in the Water Access Licences for both Bootawa Dam and the Nabiac borefield.

This assessment shows that demands have already exceeded the secure yield of the Manning Scheme's supply. However, the combined Water Access Licence is expected to be sufficient beyond 2051.

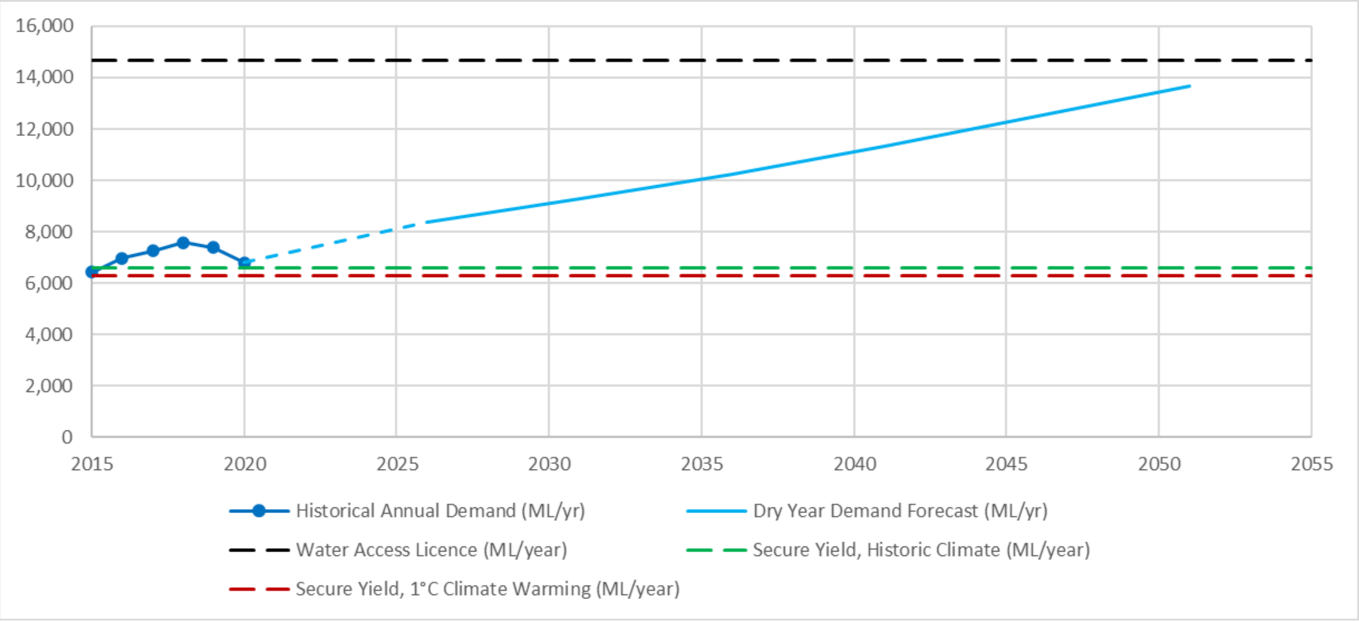


Figure 9-7 Manning Scheme annual demands

9.4.4.2 Headworks capacity

Figure 9-8 shows the Manning Scheme's daily demand forecasts plotted against the combined WTP capacity for both Bootawa WTP (60 ML/d current, 75 ML/d upgrade capacity) and Nabiac WTP (12 ML/d current, 18 ML/d upgrade capacity).

The forecasted Peak Day WTP Production curve represents the WTP capacity required to meet future peak day demands. These values were calculated using observed operational peaks from WTP production data to estimate peak day demands at the headworks level.

This assessment shows that forecasted peak day production requirements may exceed the combined WTP capacity by the year 2046. However, the combined upgrade capacity is expected to be sufficient beyond 2051.

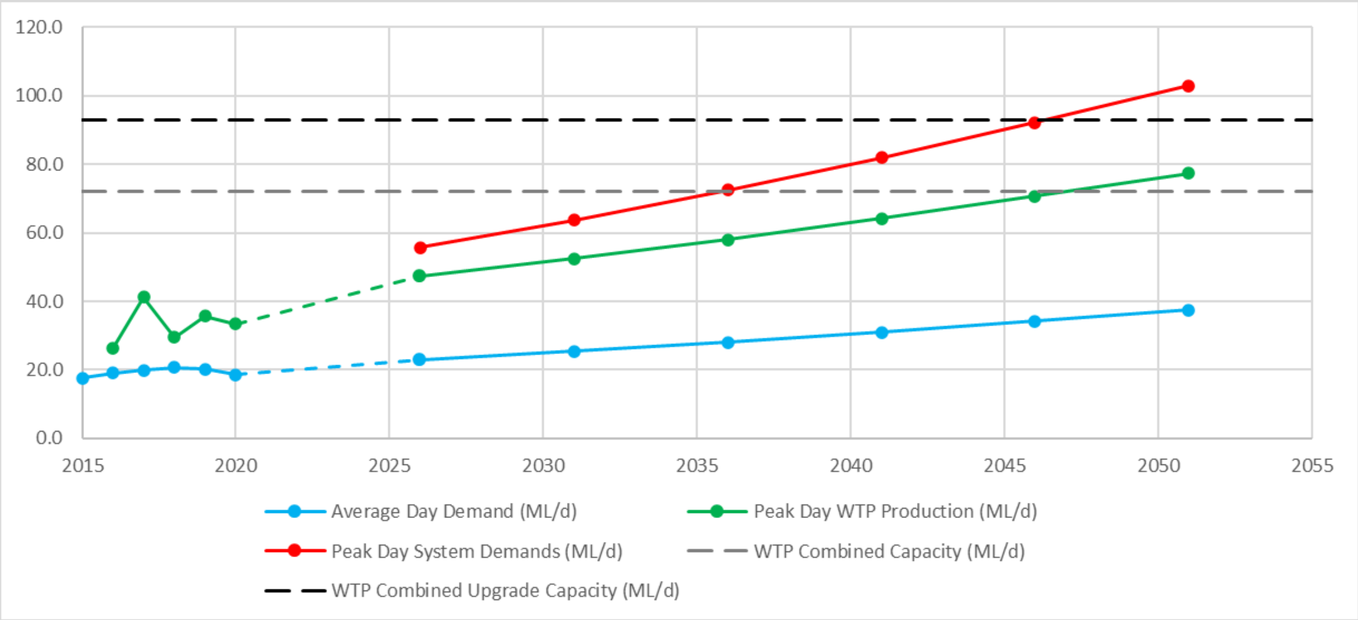


Figure 9-8 Manning Scheme daily demands and WTP capacity

9.4.4.3 Distribution system capacity

In Figure 9-8, the forecasted Peak Day System Demands curve represents the distribution system requirements and is assessed at zone level for both reservoirs and distribution trunk mains. These values were calculated using calibrated network peak day factors based on observed SCADA flowmeter data, zone size and annual population variability (i.e. tourism).

Table 9.9 shows the list of all supply reservoirs in the Manning scheme and the year they are expected to reach peak capacity. The peak capacity assessment is based on the reservoir's ability to provide one full peak day of supply to all downstream demands, which includes customers and downstream supply reservoirs.

In the Manning scheme, the following storages are considered to be "headworks reservoirs", as they are supplied directly from the Bootawa WTP treated water reservoir pumping station (PS2B):

- Wingham reservoirs, which supply to customers and other reservoirs in the Northern Manning system
- Lantana reservoir, which supplies to customers and other reservoirs in the Central Manning system, as well as the Southern Manning system via the Lantana WPS
- Koorainghat reservoir, which only supplies to customers directly

For the purpose of this assessment, reservoirs and supply zones are grouped into the following systems:

- Northern Manning – zones supplied by gravity feed from Wingham reservoirs
- Central Manning – zones supplied by gravity feed from Lantana reservoir
- Southern Manning – zones supplied from either Lantana WPS (via Lantana reservoir) or Darawank WPS (from Nabiac WTP)

Table 9.9 Manning reservoir capacity assessment

Reservoir storage	Total capacity (ML)	2020 PDD (ML/d)	Year peak capacity reached
Northern Manning			
Wingham Combined (incl. Bungay) #	13.26	11.54	2026
Kolodong 1&2	6.13	6.48	2020
Irkanda	7.00	6.48	2026
Harrington	2.27	1.15	Beyond 2051
Crowdy Head	0.45	0.10	Beyond 2051
Nth Coopernook	5.00	1.45	Beyond 2051
Coopernook	0.45	1.51	2020
Lansdowne	0.59	0.16	Beyond 2051
Central Manning			
Lantana #	15.00	16.04	2020
Kolodong 3	9.09	9.31	2020
Koorainghat #	2.27	0.94	Beyond 2051
Old Bar	7.00	4.90	2036
Mitchells Island	2.50	0.58	Beyond 2051
Southern Manning			
Forster *	44.30	11.56	Beyond 2051
Elizabeth Beach	3.50	3.07	2036
Smiths Lake	3.50	1.25	Beyond 2051
Tallwoods	6.20	2.99	2041
Redhead *	7.50	2.46	Beyond 2051
Rainbow Flat *	5.60	5.78	2020
Nabiac	0.45	0.56	2020
Krambach	0.45	0.56	2020

Headworks reservoirs filled directly from Bootawa WTP treated water reservoir pumping station (PS2B).

* Rainbow Flat, Forster and Redhead work as one system and work on total capacity.

All major trunk mains and water transfer pumping stations were assessed based on the asset's ability to transfer at least 1 peak day of supply to downstream supply reservoirs, using the methodology specified in Section 9.1.4.1. This assessment was completed for all reservoir storages listed in Table 9.9. Where applicable, this was assessed for multiple distribution scenarios (for example, when a single trunk main supplies multiple downstream reservoirs).

The assessment showed that for most trunk mains in the Manning Scheme, there was sufficient capacity to deliver peak day supply beyond the year 2051. Table 9.10 lists the distribution locations where peak day demands exceeded transfer capacity before 2051.

Table 9.10 Manning trunk main capacity assessment issues

Downstream reservoir storage	Upstream trunk main diameter (mm)	Trunk main distribution scenario	Trunk main current capacity (ML/d)	2020 PDD (ML/d)	Year peak capacity reached
Northern Manning					
Wingham Combined (incl. Bungay)	450	Bootawa PS2B filling Wingham Res	17.1	11.54	2036
Kolodong 1&2	450	Wingham Res filling Kolodong Res 1&2	15.1	6.48	2041
Irkanda	450	Kolodong WPS filling Irkanda Res	11.6	6.48	2036
Coopernook	375/200	Irkanda Res filling only Coopernook	2.9	1.51	2051
Coopernook	375/200	Irkanda Res filling Coopernook Res while Harrington Res is filling	1.9	1.51	2036
Central Manning					
Lantana	750	Bootawa PS2B filling Lantana Res	29.4	16.04	2046
Kolodong 3	600 / 525 / 300 / 450	Lantana Res filling Kolodong 3 Res	13.0	9.31	2041
Kolodong 3	600 / 525 / 300 / 450	Lantana Res filling Kolodong Res while Old Bar Res is filling	11.2	9.31	2036
Southern Manning					
Forster	600	Lantana WPS filling Forster Res while Rainbow Flat Res is filling	15.3	11.56	2041
Elizabeth Beach	300	Tiona WPS filling Elizabeth Beach Res	4.3	3.07	2051
Rainbow Flat	375	Lantana WPS filling Rainbow Flat Res while Forster Res Filling	9.2	5.78	2046
Krambach	150	Nabiac WPS filling Krambach Res	0.7	0.56	2036

9.5 Tea Gardens supply scheme

9.5.1 Production data

Production data from 1 November 2013 to 17 December 2020 was analysed. The historical production data is shown in Figure 9-9.

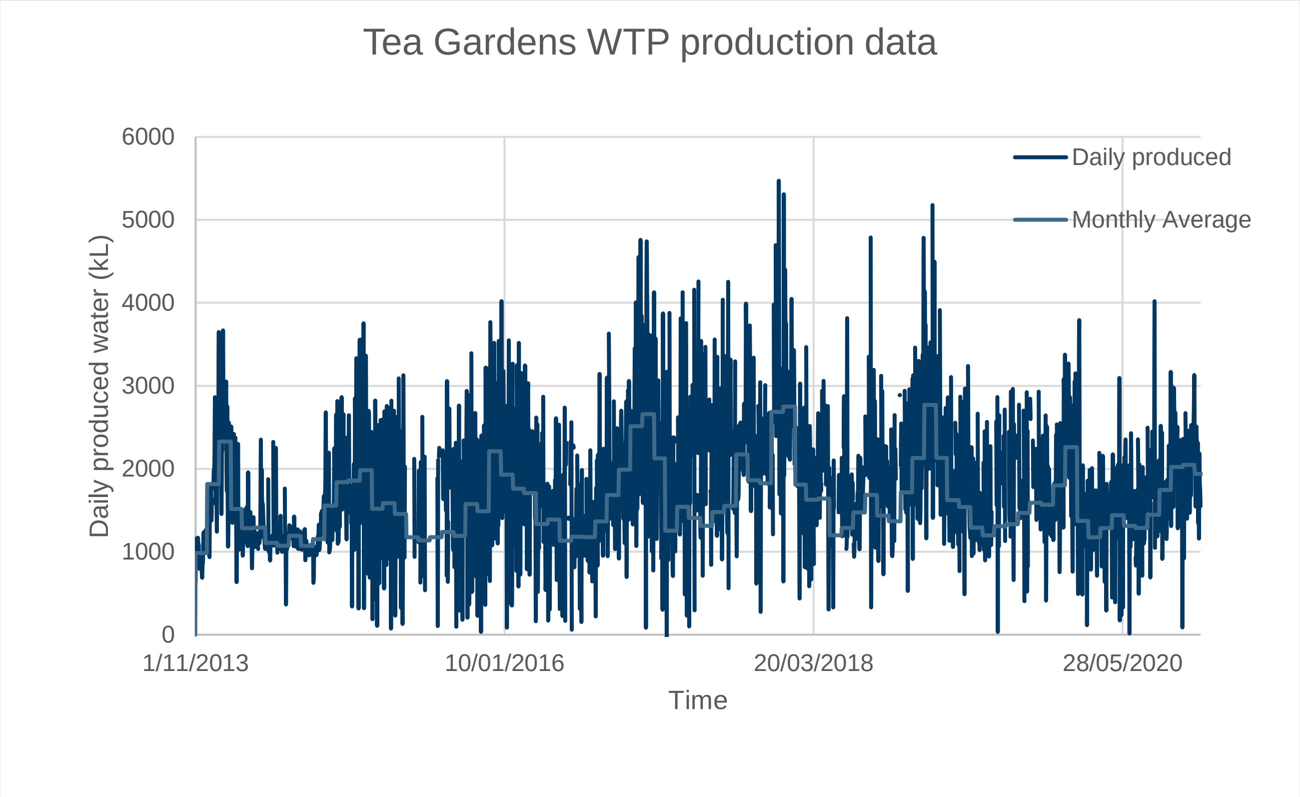


Figure 9-9 Tea Gardens WTP daily production data and monthly average production

9.5.2 Metered consumption

Water meter billing data was provided by Council for the 2014/15 financial year to the 2019/20 financial year. The Tea Gardens connection and water usage data is shown in Figure 9-10.

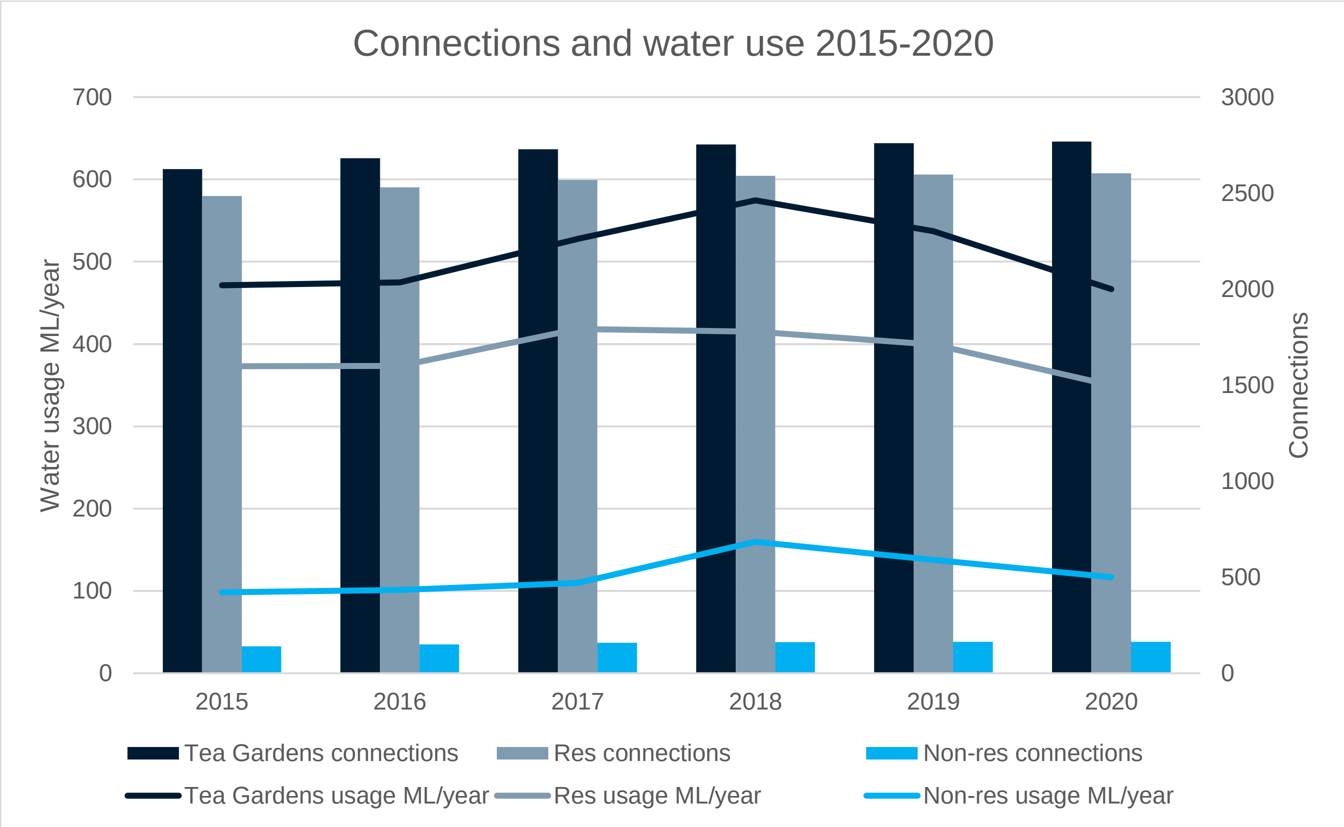


Figure 9-10 Tea Gardens connection and water usage data

The key findings are for the Tea Gardens supply are:

– Last year's average water demand was 1,280kL/day.
– The five-year average is 1,391kL/day.
– The residential to non-residential demand split is about 75% residential to 25% non-residential.
– The number of connections has increased slightly each year, from 2,626 in 2014/15 to 2,768 in 2019/2020.
– The average day consumption for an active connected residential property is 391L/conn/day.

The connection and consumption details per water supply sub-zone are shown in Table 9.11.

Table 9.11 Water supply sub-zone

Water supply zone	2020 total connections	Annual consumption (ML)	ADD (ML/d)
Durness Boosted	74	15.97	0.04
Durness Gravity	5	0.40	0.00
Durness Reduced	2691	437.22	1.20
Tea Gardens Raw	3	14.08	0.04

9.5.2.1 Tea Gardens system demands

Peak period analysis was undertaken on daily Tea Gardens WTP production data. The peak week persistence patterns from financial years 2013/14 to 2020/21 is shown in Figure 9-6. Refer to Appendix B for details.

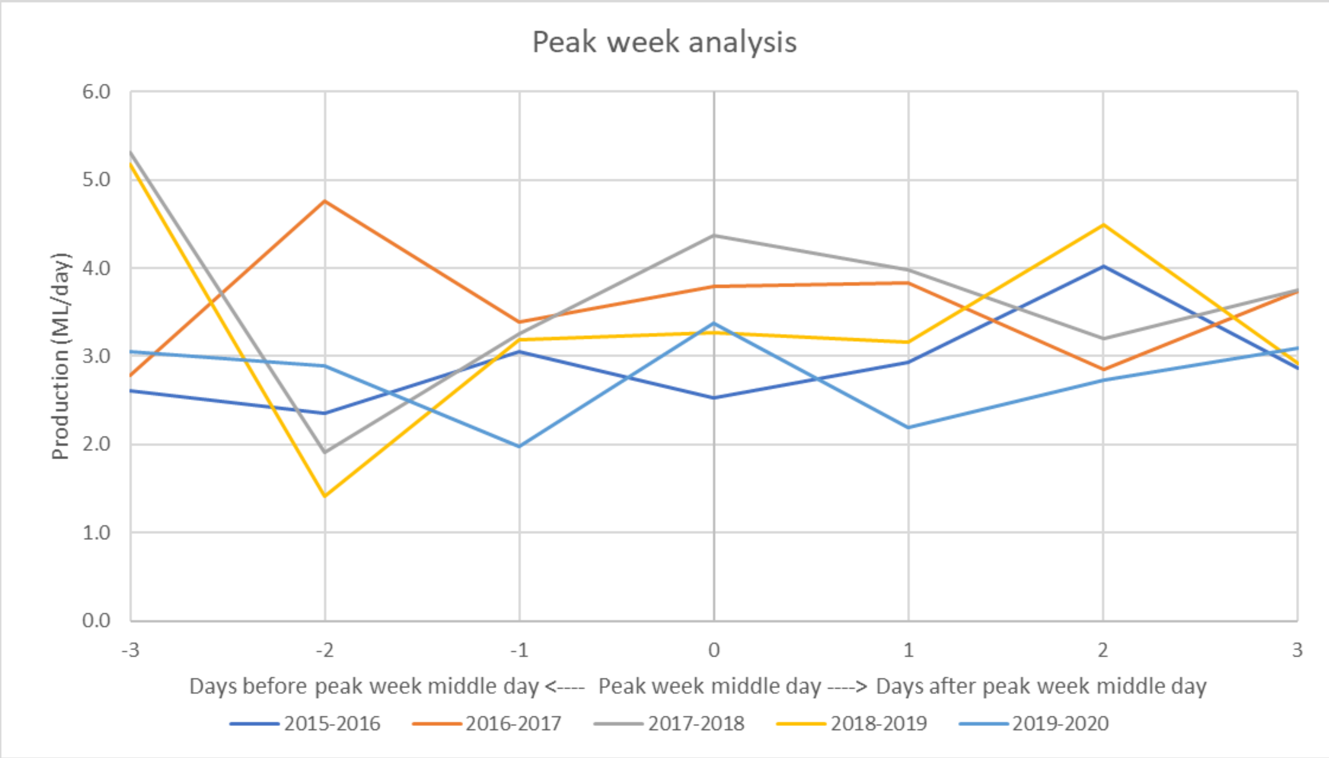


Figure 9-11 ***Tea Gardens peak week persistence patterns***

In the last five years, all peak weeks occurred in either school holidays or in a period of warmer weather (i.e., no peak weeks are experienced in winter). All peak weeks have no days where zero daily production occurs. All peak weeks demonstrate relatively consistent water production across all seven days of the peak week (i.e., the peaks do not show steady growth leading up to the peak day, rather a consistently higher daily water demand).

In the last five years, the maximum peak day production was 5.31 ML/day. This occurred on 2 January 2018. This peak was approximately 1.5 times the average daily production of the peak week. This peak is slightly higher than the second highest maximum peak day production of 5.18 ML/day. This occurred on 22 January 2019. This peak was also approximately 1.5 times the average daily production of the peak week. This trend was similar for all other peak week periods, where production on the peak day was generally close to average peak week production (between 1.2 and 1.4 times higher). The peak period production data is presented in Table 9.12 and key statistics around the peaks is presented in Table 9.13.

Table 9.12 ***Peak period information***

Year		2015 – 2016	2016 – 2017	2017 – 2018	2018 – 2019	2019 - 2020
Peak week date of middle day (day 0)		31/12/2015	29/12/2016	5/01/2018	25/01/2019	31/12/2019
Daily demand for each day in peak week (ML)	-3	2.61	2.78	**5.31**	**5.18**	3.06
	-2	2.36	**4.76**	1.92	1.41	2.89
	-1	3.05	3.38	3.25	3.19	1.97
	0	2.53	3.79	4.37	3.26	**3.38**
	1	2.93	3.84	3.98	3.17	2.19
	2	**4.02**	2.86	3.20	4.50	2.73
	3	2.87	3.74	3.75	2.92	3.09
Sum of peak week production (ML)		20.37	25.15	25.78	23.62	19.31

Table 9.13 Peak period statistics

Peak week by year	Average day peak week (ADPW) (ML/day)	Peak day (ML/day)	Peak day / ADPW
2015-2016 (02/01/2016)	2.91	4.02	1.38
2016-2017 (27/12/2016)	3.59	4.76	1.32
2017-2018 (02/01/2018)	3.68	5.31	1.44
2018-2019 (22/01/2019)	3.37	5.18	1.53
2019-2020 (31/12/2019)	2.76	3.38	1.22

9.5.3 Tea Gardens demand forecast

From the modelled demands and Council's nominated growth strategy, the water demand forecast for Tea Gardens are presented in Table 9.14.

Table 9.14 Tea Gardens water forecast

	2020	2026	2031	2036	2041	2046	2051
Average Day Demands (ML/day)	1.46	2.06	2.25	2.41	2.54	2.63	2.70
Peak Day WTP Production (ML/day)	3.4	6.1	6.6	7.1	7.5	7.8	8.0
Peak Day System Demands (ML/day)	5.38	6.24	6.85	7.39	7.81	8.13	8.35
Dry Year Demands (ML/year)	533	753	820	880	926	961	985

The peak day supply requirements at a water supply zone level are provided in Table 9.15.

Table 9.15 Tea Gardens peak day system demands at water supply zone level

Total (ML/day)	2020	2026	2031	2036	2041	2046	2051
Durness Boosted	0.22	0.28	0.32	0.37	0.40	0.43	0.45
Durness Gravity	0.004	0.17	0.31	0.44	0.53	0.61	0.66
Durness Reduced	5.05	5.68	6.10	6.47	6.76	6.98	7.13
Tea Gardens Raw	0.11	0.11	0.11	0.11	0.11	0.11	0.11
TOTAL	**5.38**	**6.24**	**6.85**	**7.39**	**7.81**	**8.13**	**8.35**

9.5.4 Tea Gardens infrastructure capacity assessment

9.5.4.1 Security of supply

Council has a groundwater access licence with an entitlement of 1,300 ML/year. In 2007, Council produced a MODFLOW model using a range of physical properties collected for the Tea Gardens Aquifer including boundary properties, groundwater level data and cross-sectional data collected over a range of years to establish a reasonable estimate for the sustainable yield. The model conceptually represented the three layers of the aquifer, with a top (layer 1) and bottom aquifer (layer 3) separated by an aquitard (layer 2, indurated layer of sand). Extraction is from layer 3. Calibration was undertaken for the period 2005/06, with verification of the model by independent 'peer review' (PB 2007).

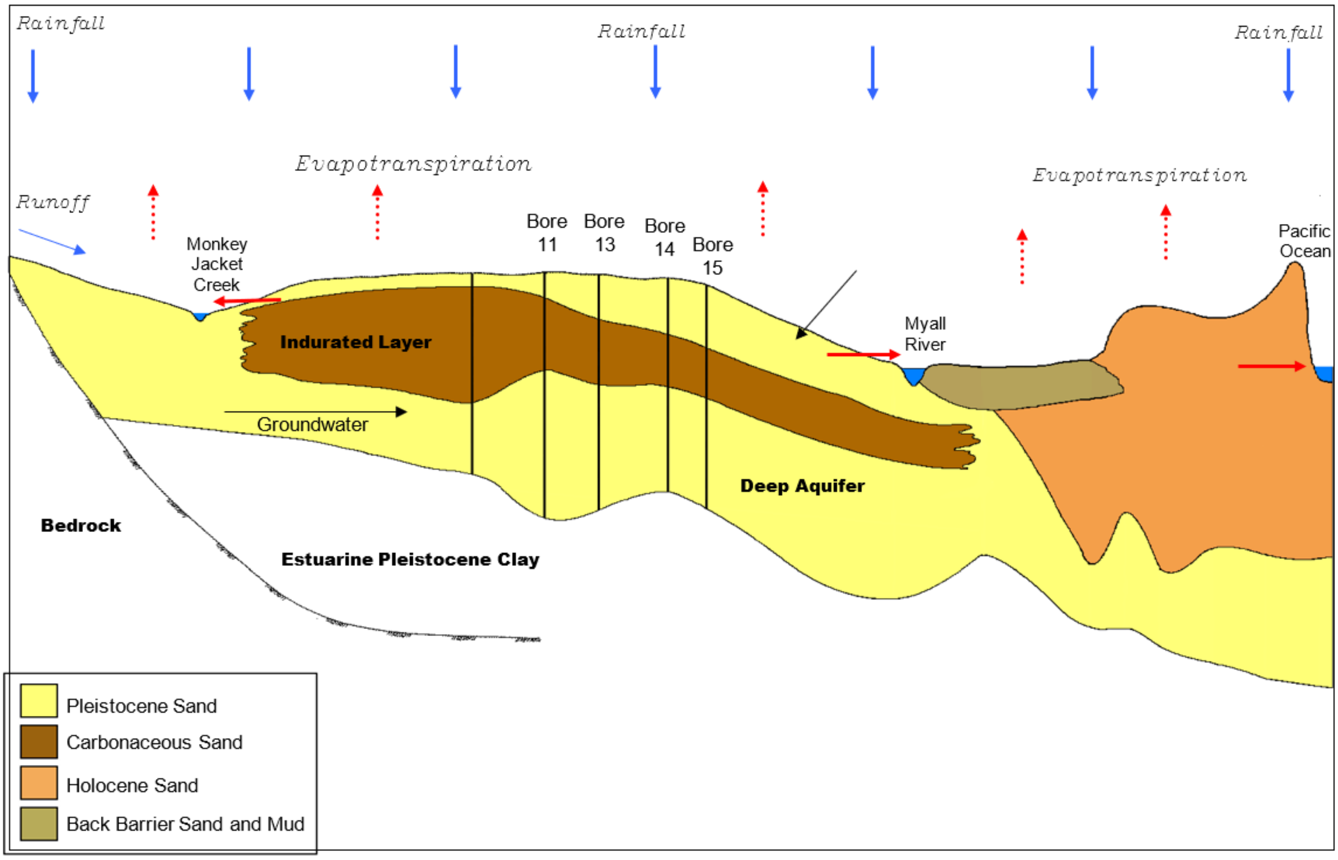


Figure 9-12 Groundwater conceptual model

The model indicated the long-term sustainable yield from the Tea Gardens aquifer for the 1 in 10-year dry event was about 2,200 ML/annum to 2,600 ML/annum with peak extractions of 14 to 16 ML/d continuous over a three-month peak period. In very dry times (1 in 20-year dry event) the extraction would reduce to 1,600 ML/annum.

Figure 9-13 shows the Tea Gardens Scheme's historical and forecasted annual demands. These demands have been plotted against the secure yield for both the 1 in 10-year and 1 in 20-year dry event scenarios. The figure also shows the maximum annual extraction specified in the Water Access Licence for the Tea Gardens borefield.

This assessment shows that the Water Access Licence and the Tea Gardens borefield secure yield is expected to be sufficient beyond 2051.

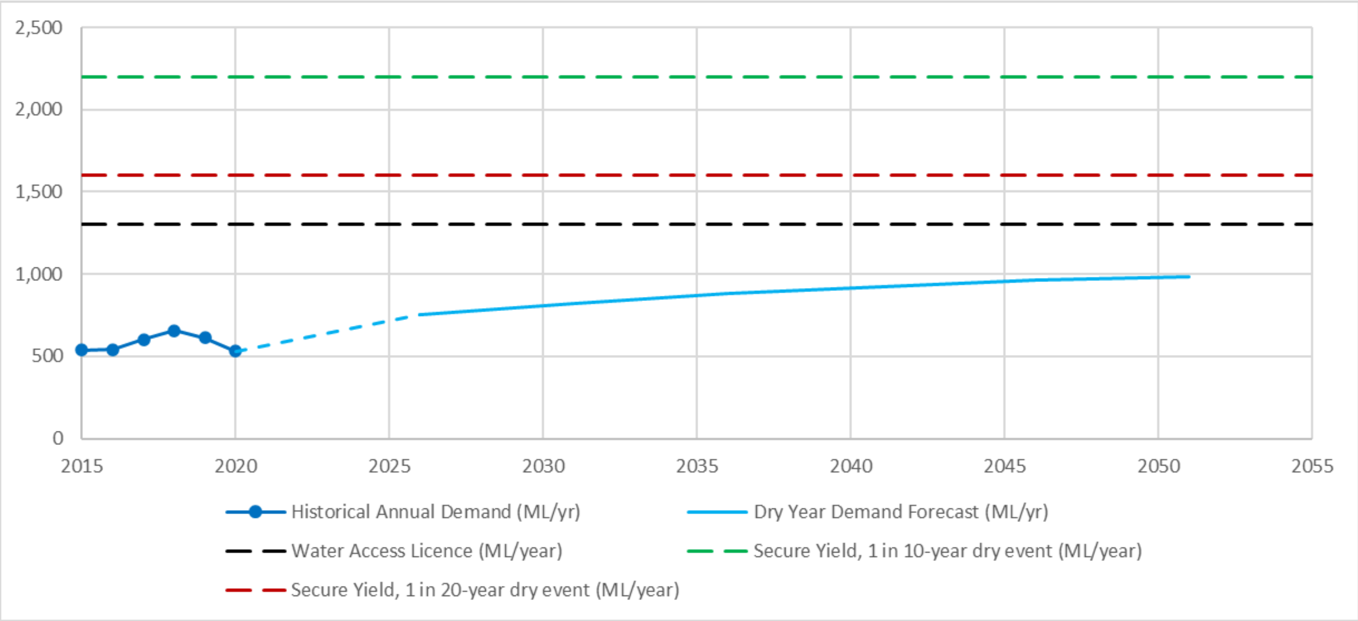


Figure 9-13 Tea Gardens Scheme Annual Demands

The borefield location relative to the WTP is shown in Figure 9-14 and a monitoring of shallow and deep bores is carried out. A management philosophy is in place to ensure the shallow aquifer is not impacted by dry conditions and high extraction and the spread of the bores ensures the aquifers sustainability.

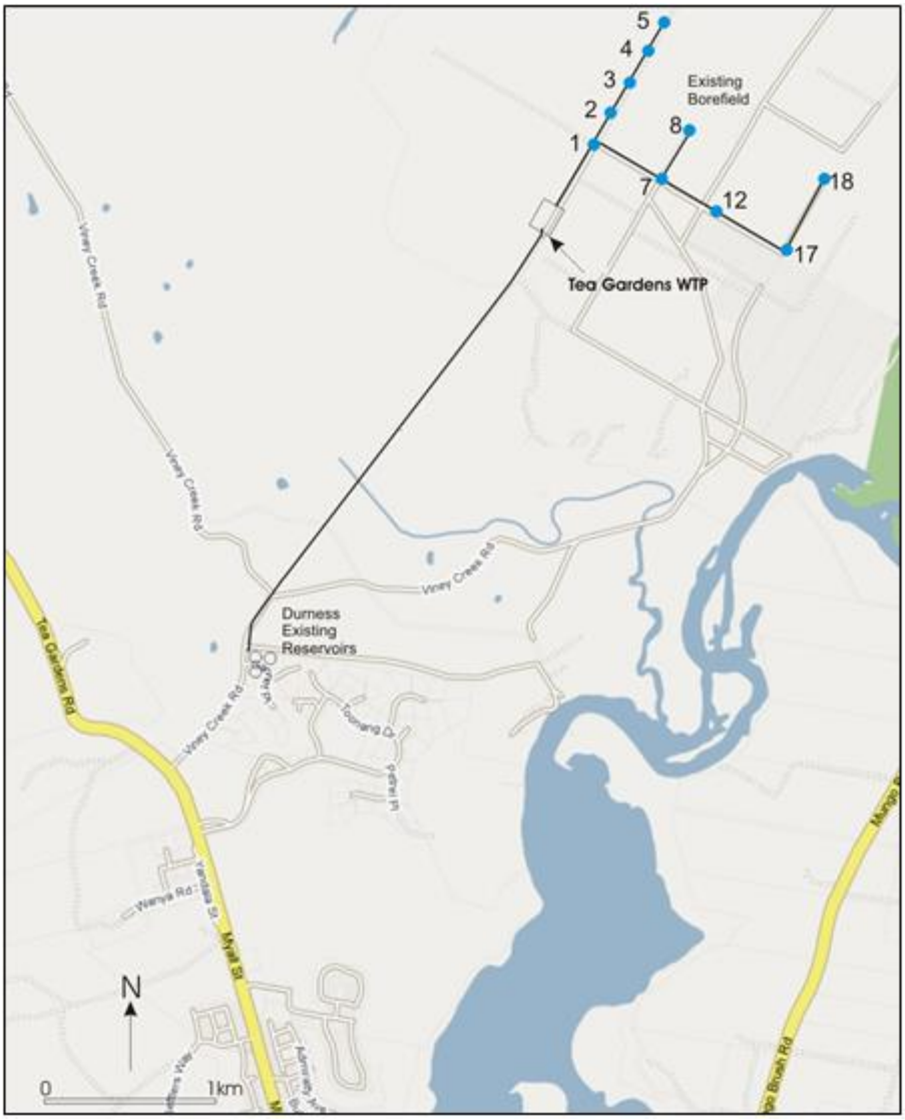


Figure 9-14 Tea Gardens Production Bore Location

9.5.4.2 Headworks capacity

Figure 9-15 shows the Tea Gardens Scheme's daily demand forecasts plotted against the WTP capacity. The current (Stage 1) design capacity of the WTP is 8 ML/d, which can be produced on peak days if required. However, due to current process constraints, the WTP has a reduced average day operational capacity of 5.5 ML/d. This reduced capacity is based on preferred operation to minimise wear on process components.

The forecasted Peak Day WTP Production curve represents the WTP capacity required to meet future peak day demands. These values were calculated using observed operational peaks from WTP production data to estimate peak day demands at the headworks level.

For the purpose of this assessment, the WTP design capacity is sufficient to meet production requirements to the year 2051.

The WTP has a future (Stage 2) design capacity of 12 ML/d.

The provision of an alternative water supply to Hawks Nest is an issue. Hawks Nest water supply is fed from the Tea Gardens reticulation network. There is no bulk trunk water supply to Hawks Nest. Isolating the water supply in Tea Gardens would mean that Hawks Nest has no supply.

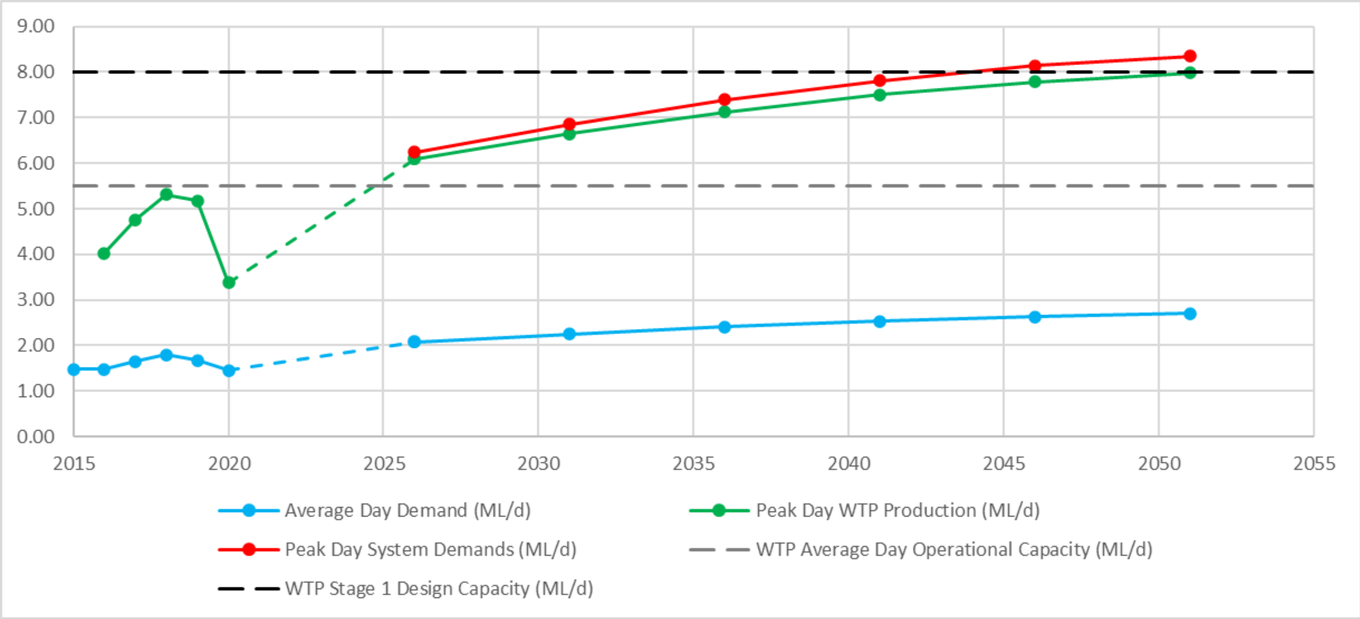


Figure 9-15 Tea Gardens Scheme daily demands and WTP capacity

9.5.4.3 Distribution system capacity

In Figure 9-15, the forecasted Peak Day System Demands curve represents the distribution system requirements and is assessed at zone level for both reservoirs and distribution trunk mains. These values were calculated using calibrated network peak day factors based on observed SCADA flowmeter data, zone size and annual population variability (i.e. tourism).

Table 9.15 lists the water supply zones within the Tea Gardens Scheme. The “Tea Gardens Raw” comprises existing supplies of raw water from the Tea Gardens borefield, upstream of the WTP. This zone is not expected to experience any growth. All other zones are supplied from the Durness Reservoirs, either by gravity supply, via a pressure reducing valve (PRV) or via booster pumps.

The reservoir capacity assessment is based on the reservoir’s ability to provide one full peak day of supply to all downstream customers. The Durness Reservoirs have a total capacity of 15.1 ML and are expected to have sufficient storage capacity beyond the year 2051.

Trunk mains and water transfer pumping stations were assessed based on the asset’s ability to transfer at least 1 peak day of supply to downstream supply reservoirs, using the methodology specified in Section 9.1.4.1.

The Durness Reservoirs are filled by pumping from the WTP via three parallel trunk mains, with diameters 200mm, 250mm and 375mm. The current combined capacity of these trunk mains is 6.1 ML/d. Peak day demands from Durness Reservoirs are expected to exceed this capacity in the year 2026.

9.6 Bulahdelah supply scheme

9.6.1 Production data

Bulahdelah WTP production data from 01 June 2013 to 15 December 2020 was analysed. The historical production data is shown in Figure 9-16.

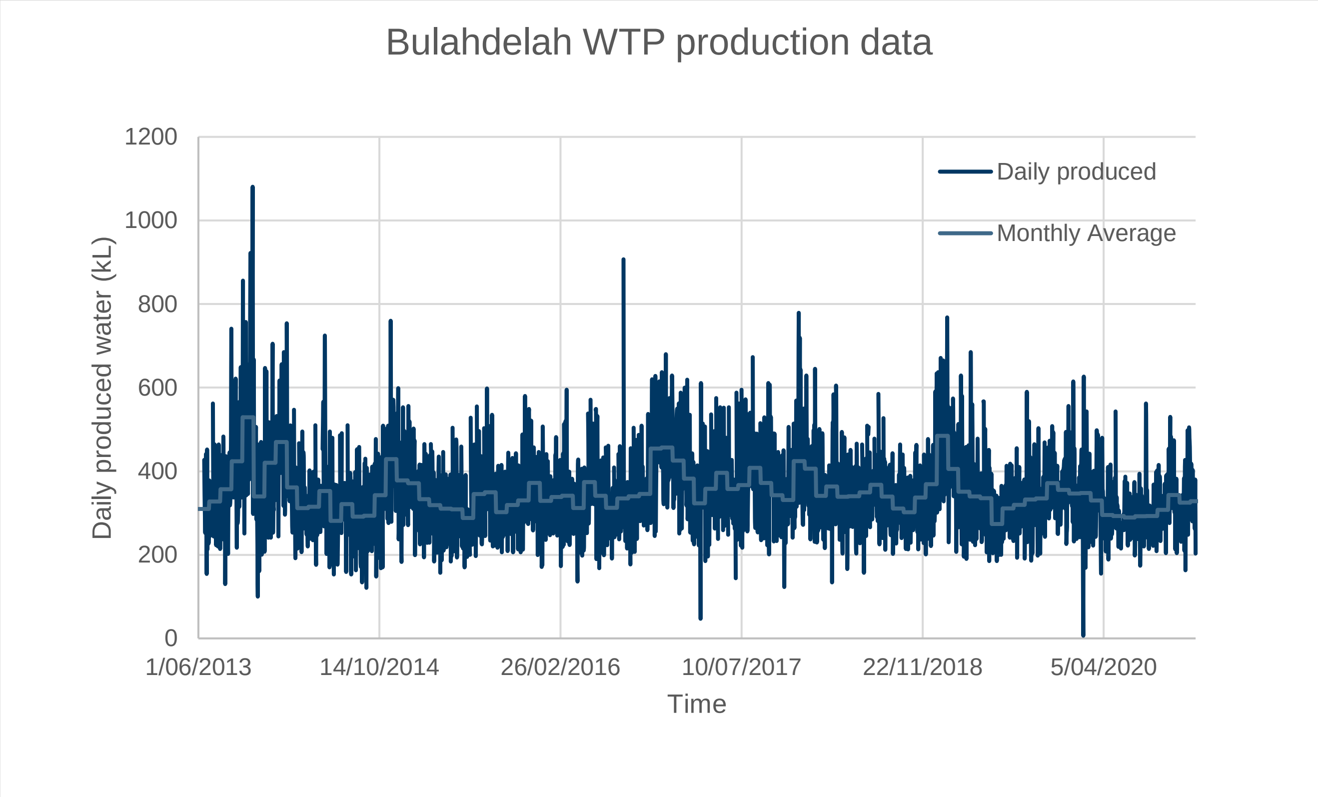


Figure 9-16 Bulahdelah WTP daily production data and monthly average production

9.6.2 Metered consumption

Water meter billing data was provided by Council for the duration of the 2014/15 financial year to the 2019/20 financial year. The Bulahdelah connection and water usage data is shown in Figure 9-17.

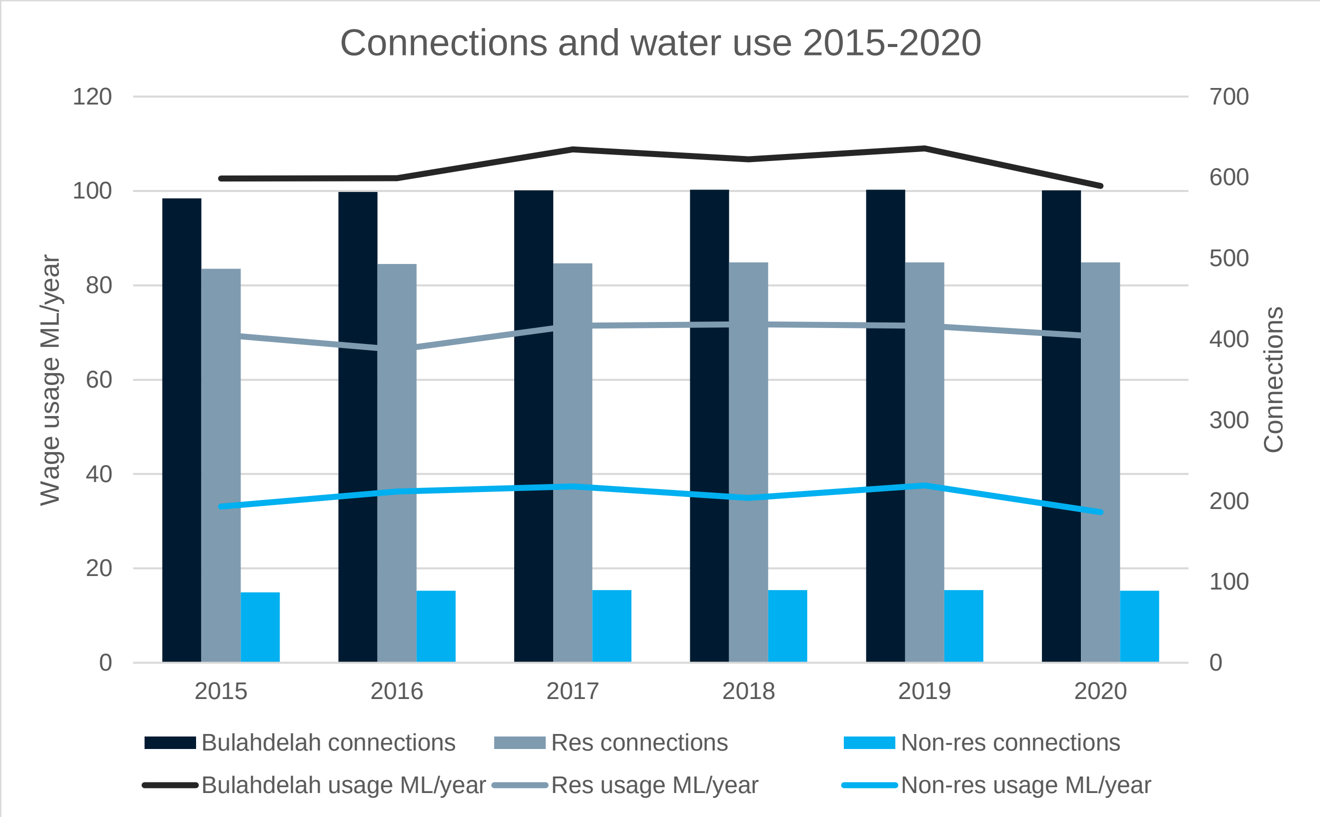


Figure 9-17 ***Bulahdelah connection and water usage data***

Details of the meter data analysis is provided in Section 9.2. The key findings for the Bulahdelah are:

- Last years' average water demand was 280 kL/day
- The five-year average is 287 kL/day
- The residential to non-residential demand split is about 67% residential to 33% non-residential
- The number of connections show a minor increase each year, from 574 in 2014/15 to 584 in 2019/20
- The average day consumption for an active connected residential property is 383 L/conn/day
- River Myall Investments is the highest non-residential user, accounting for 4% of the daily water consumption. This non-residential user's daily consumption did not make the Top 30 water users in the LGA, listed in Section 9.3

9.6.2.1 System demands

Peak period analysis was undertaken on daily Bulahdelah WTP production data. The peak week persistence patterns for financial years 2012/13 to 2020/21 is shown in Figure 9-6. Refer to Appendix B for details.

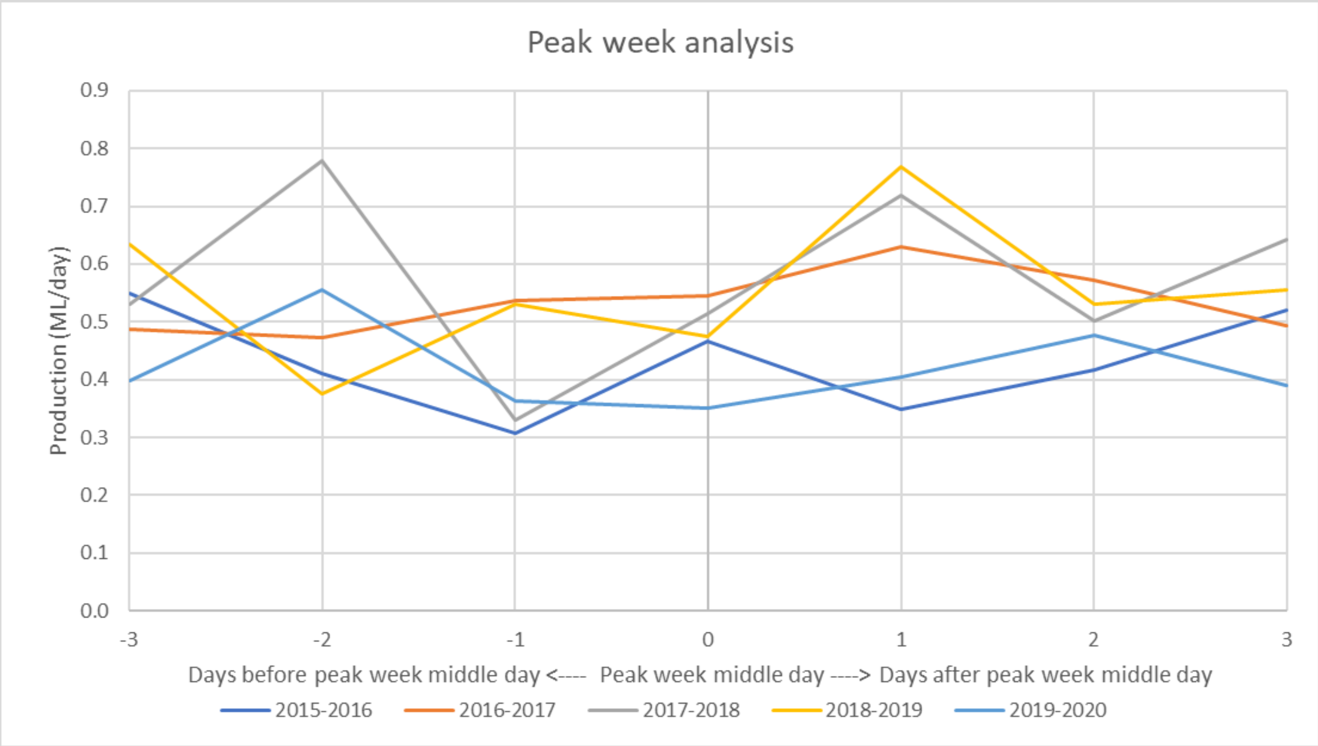


Figure 9-18 ***Bulahdelah peak week persistence patterns***

In the last five years, all peak weeks occurred in either school holidays or in a period of warmer weather (i.e., no peak weeks are experienced in winter). All peak weeks have no days where zero daily production occurs. All peak weeks demonstrate relatively consistent water production across all seven days of the peak week (i.e., the peaks do not show steady growth leading up to the peak day, rather a consistently higher daily water demand).

In the last five years, the maximum peak day production was 0.78 ML/day on 15 December 2017 and 0.77 ML/day on 29 January 2019. Both these peaks were approximately 1.4 times the average daily production of the respective peak week. The next highest maximum peak day production of 0.63 ML/day occurred on 30 December 2016. For all other peak week periods, production on the peak day was generally close to average peak week production (between 1.1 and 1.3 times higher). The peak period production data is presented in Table 9.16 and key statistics around the peaks is presented in Table 9.17.

Table 9.16 ***Peak period information***

Year		2015 – 2016	2016 – 2017	2017 – 2018	2018 – 2019	2019 - 2020
Peak week date of middle day (day 0)		4/12/2015	29/12/2016	17/12/2017	28/01/2019	1/01/2020
Daily demand for each day in peak week (ML)	-3	**0.55**	0.49	0.53	0.63	0.40
	-2	0.41	0.47	**0.78**	0.38	**0.56**
	-1	0.31	0.54	0.33	0.53	0.36
	0	0.47	0.55	0.51	0.47	0.35
	1	0.35	**0.63**	0.72	**0.77**	0.40
	2	0.42	0.57	0.50	0.53	0.48
	3	0.52	0.49	0.64	0.56	0.39
Sum of peak week production (ML)		3.02	3.74	4.02	3.87	2.94

Table 9.17 Peak period statistics

Peak week by year	Average day peak week (ADPW) (ML/day)	Peak day (ML/day)	Peak day / ADPW
2015-2016 (01/12/2015)	0.43	0.47	1.08
2016-2017 (30/12/2016)	0.53	0.57	1.07
2017-2018 (15/12/2017)	0.57	0.78	1.36
2018-2019 (29/01/2019)	0.55	0.77	1.39
2019-2020 (30/12/2019)	0.42	0.56	1.33

9.6.3 Bulahdelah forecast

From the modelled demands and Council's nominated growth strategy, the water demand forecast for Bulahdelah are presented in Table 9.18.

Table 9.18 Bulahdelah water forecast

	2020	2026	2031	2036	2041	2046	2051
Average Day Demands (ML/day)	0.32	0.37	0.41	0.46	0.51	0.57	0.65
Peak Day WTP Production (ML/day)	0.6	0.9	0.9	1.1	1.2	1.3	1.5
Peak Day System Demands (ML/day)	0.83	0.92	1.05	1.20	1.38	1.59	1.83
Dry Year Demands (ML/year)	116	136	150	166	186	209	236

The peak day supply requirements at a water supply zone level are provided in Table 9.19.

Table 9.19 Bulahdelah peak day production requirements at water supply zone level

Total (ML/day)	2020	2026	2031	2036	2041	2046	2051
Bulahdelah 1 & 2	0.81	0.91	1.03	1.19	1.37	1.58	1.82
Bulahdelah 3 (Elevated)	0.02	0.02	0.02	0.02	0.02	0.02	0.02
TOTAL	**0.83**	**0.92**	**1.05**	**1.20**	**1.38**	**1.59**	**1.83**

9.6.4 Infrastructure capacity assessment

9.6.4.1 Security of supply

The secure yield was modelled for the Bulahdelah water supply headworks consisting of Bulahdelah weir on the Crawford River, from which water is directly pumped to the WTP.

Table 9.20 summarises the secure yield estimates for the Bulahdelah scheme, using both the historical climate and 1° climate warming scenarios.

Table 9.20 Bulahdelah water supply headworks secure yield estimates

Run number	Storage system	Secure yield ML/year	
		Historical climate	1ºC climate warming
Bula401	Bulahdelah Weir storage 228 ML on Crawford River	155	116

Figure 9-19 shows the Bulahdelah Scheme's historical and forecasted annual demands. These demands have been plotted against the secure yield for both the historical climate and 1° climate warming scenarios. The figure also shows the maximum annual extraction specified in the Water Access Licences for the Crawford River.

This assessment shows that the Water Access licence may need to be extended by 2051. The secure yield modelling using historical climate data shows the water source is nearing its limit to supply water to the system. Secure yield based on the 1°C climate warming data has already been exceeded.

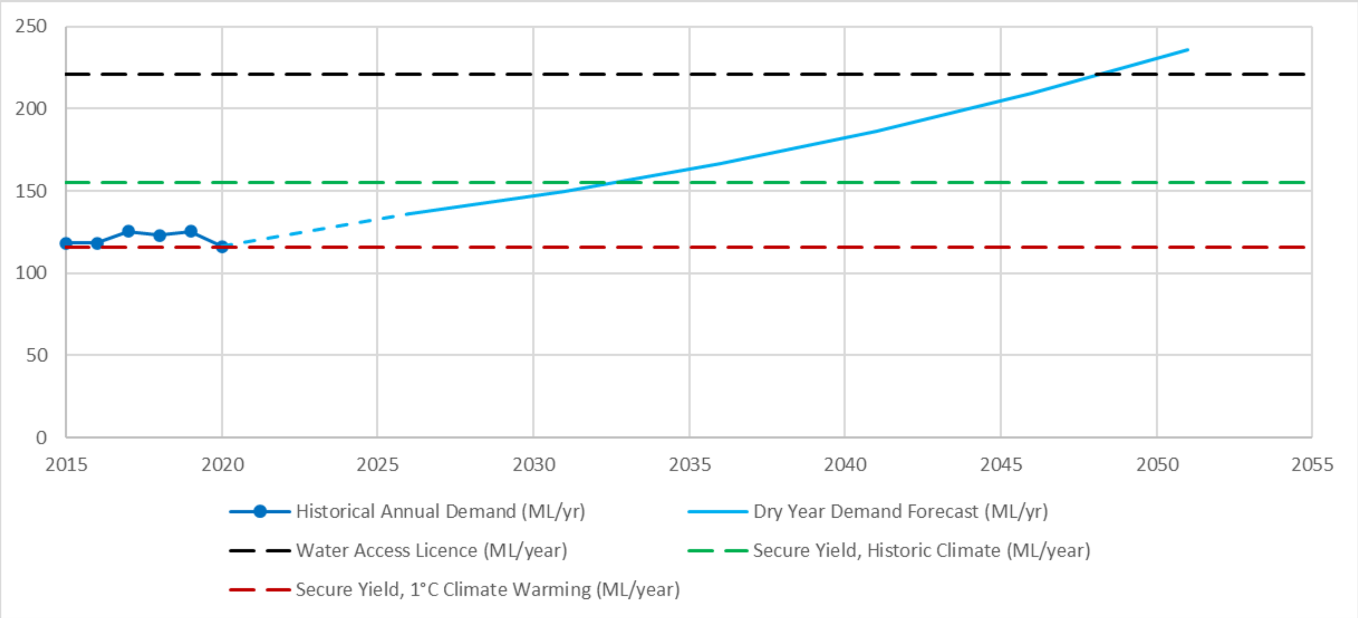


Figure 9-19 Bulahdelah Scheme annual demands

9.6.4.2 Headworks capacity

Figure 9-20 shows the Bulahdelah Scheme's daily demand forecasts plotted against the WTP capacity (2 ML/d).

The forecasted Peak Day WTP Production curve represents the WTP capacity required to meet future peak day demands. These values were calculated using observed operational peaks from WTP production data to estimate peak day demands at the headworks level.

This assessment shows that the WTP design capacity is sufficient to meet production requirements beyond the year 2051.

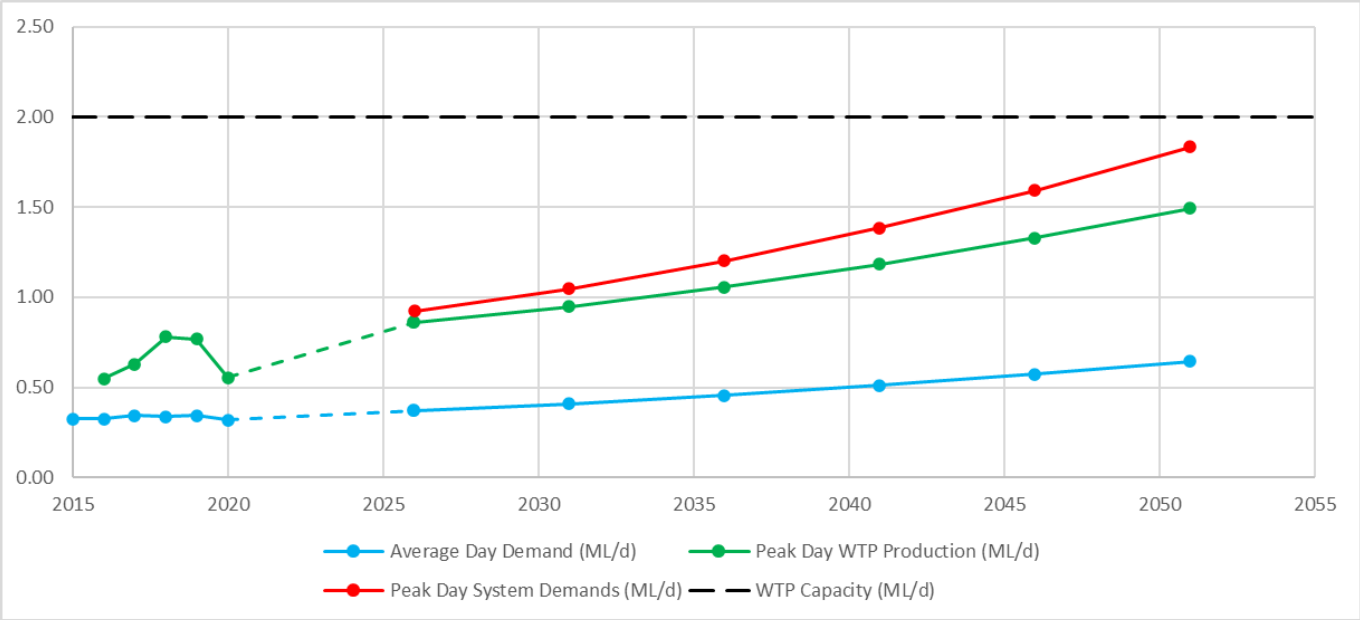


Figure 9-20 Bulahdelah Scheme daily demands and WTP capacity

9.6.4.3 Distribution system capacity

In Figure 9-20, the forecasted Peak Day System Demands curve represents the distribution system requirements and is assessed at zone level for both reservoirs and distribution trunk mains. These values were calculated using calibrated network peak day factors based on observed SCADA flowmeter data, zone size and annual population variability (i.e. tourism).

The reservoir capacity assessment is based on the reservoir's ability to provide one full peak day of supply to all downstream customers. The Bulahdelah Scheme consists of the following two supply zones:

– Bulahdelah 1 & 2 Reservoirs – total storage of 4 ML
– Bulahdelah 3 Reservoir (supplied by Bulahdelah 1 & 2 Reservoirs) – total storage of 0.12 ML

The reservoir storages in both of the above zones are expected to have sufficient capacity beyond the year 2051.

Trunk mains and water transfer pumping stations were assessed based on the asset's ability to transfer at least 1 peak day of supply to downstream supply reservoirs, using the methodology specified in Section 9.1.4.1.

The Bulahdelah 1 & 2 Reservoirs are filled by pumping from the WTP via a 200mm main. The current capacity of this trunk main is 1.5 ML/d. Peak day demands from the Bulahdelah reservoirs are expected to exceed this capacity in the year 2046.

9.7 Stroud supply scheme

9.7.1 Production data

Stroud WTP production data from 1 June 2013 to 16 December 2020 was analysed. The historical production data is shown in Figure 9-21.

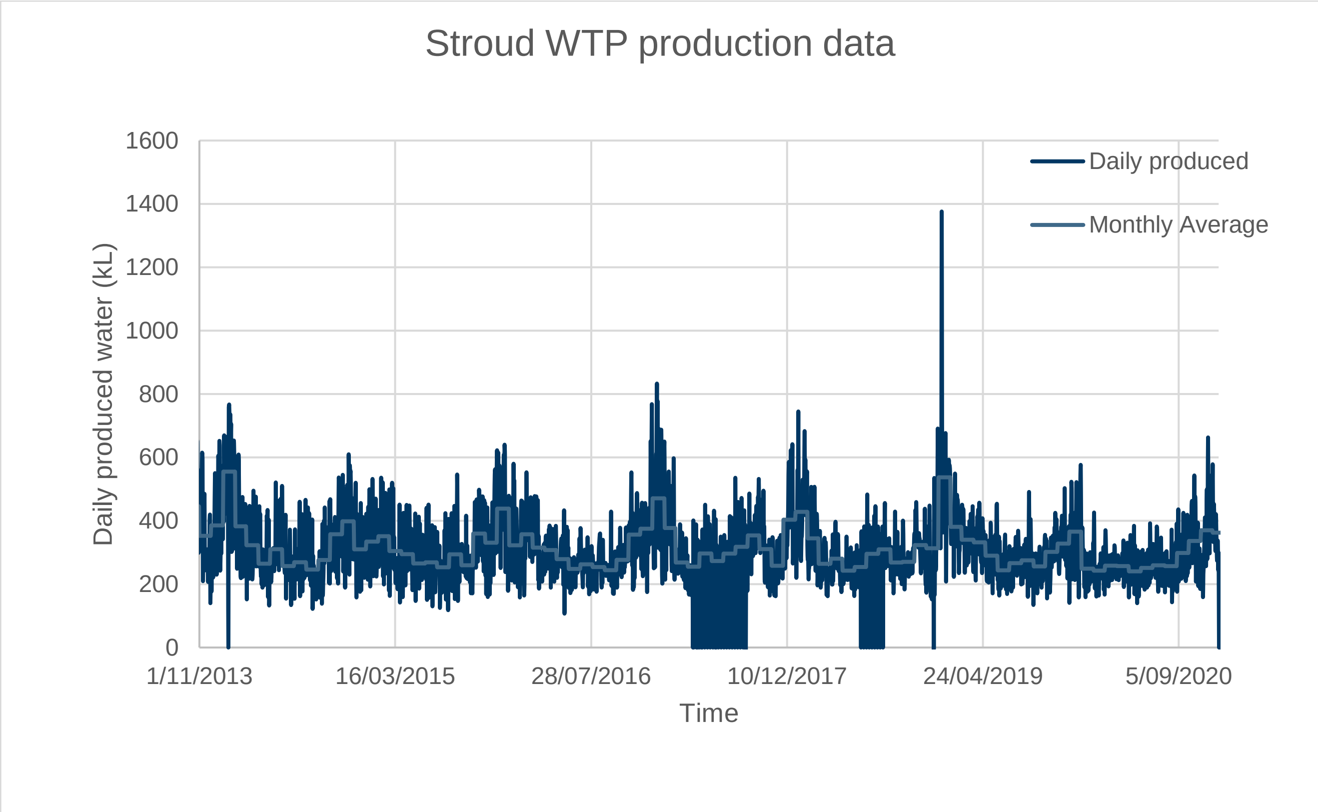


Figure 9-21 Stroud WTP daily production data and monthly average production

9.7.2 Metered consumption

Water meter billing data was provided by Council for the duration of the 2014/15 financial year to the 2019/20 financial year. The Stroud connection and water usage data is shown in Figure 9-22.

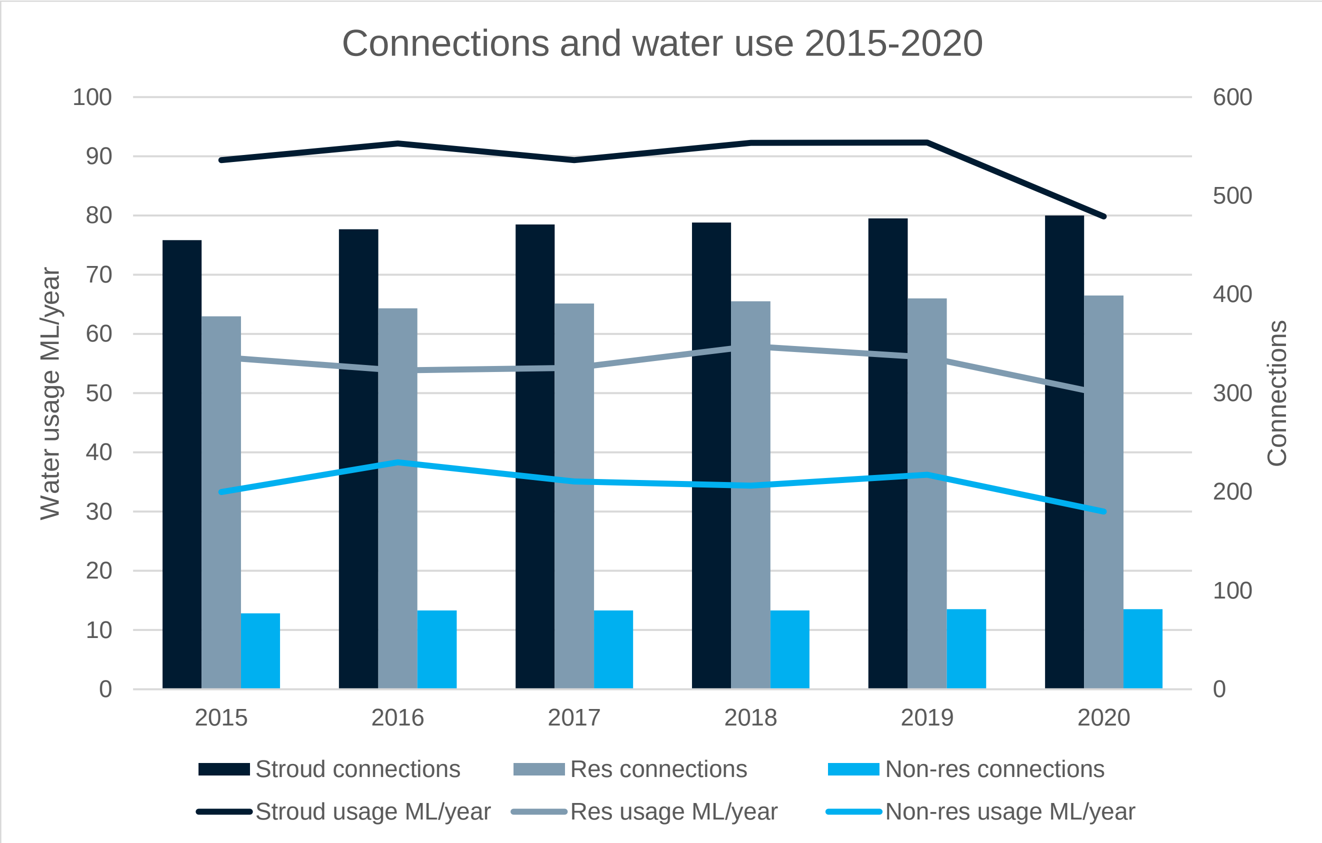


Figure 9-22 Stroud connection and water usage data

Details of the meter data analysis is provided in Section 9.2. The key findings are for the Stroud are:

- The 2020 daily average demand was 218 kL/day
- The historical daily average water demand for the past five years is approximately 244 kL/day
- The residential to non-residential demand split is about 62% residential to 38% non-residential
- The number of connections shown slight increase each year, from 455 in 2014/15 to 480 in 2019/2020
- The average day consumption for an active connected residential property is 342 L/conn/day
- A rural non-residential property is the highest non-residential user, accounting for 4% of the daily water consumption. This non-residential user's daily consumption did not make the Top 30 water users in the LGA, listed in Section 9.3.

9.7.2.1 System demands

Peak period analysis was undertaken on daily Stroud WTP production data. The peak week persistence patterns from financial years 2012-2013 to 2020-2021 is shown in Figure 9-6. Refer to Appendix B for details.

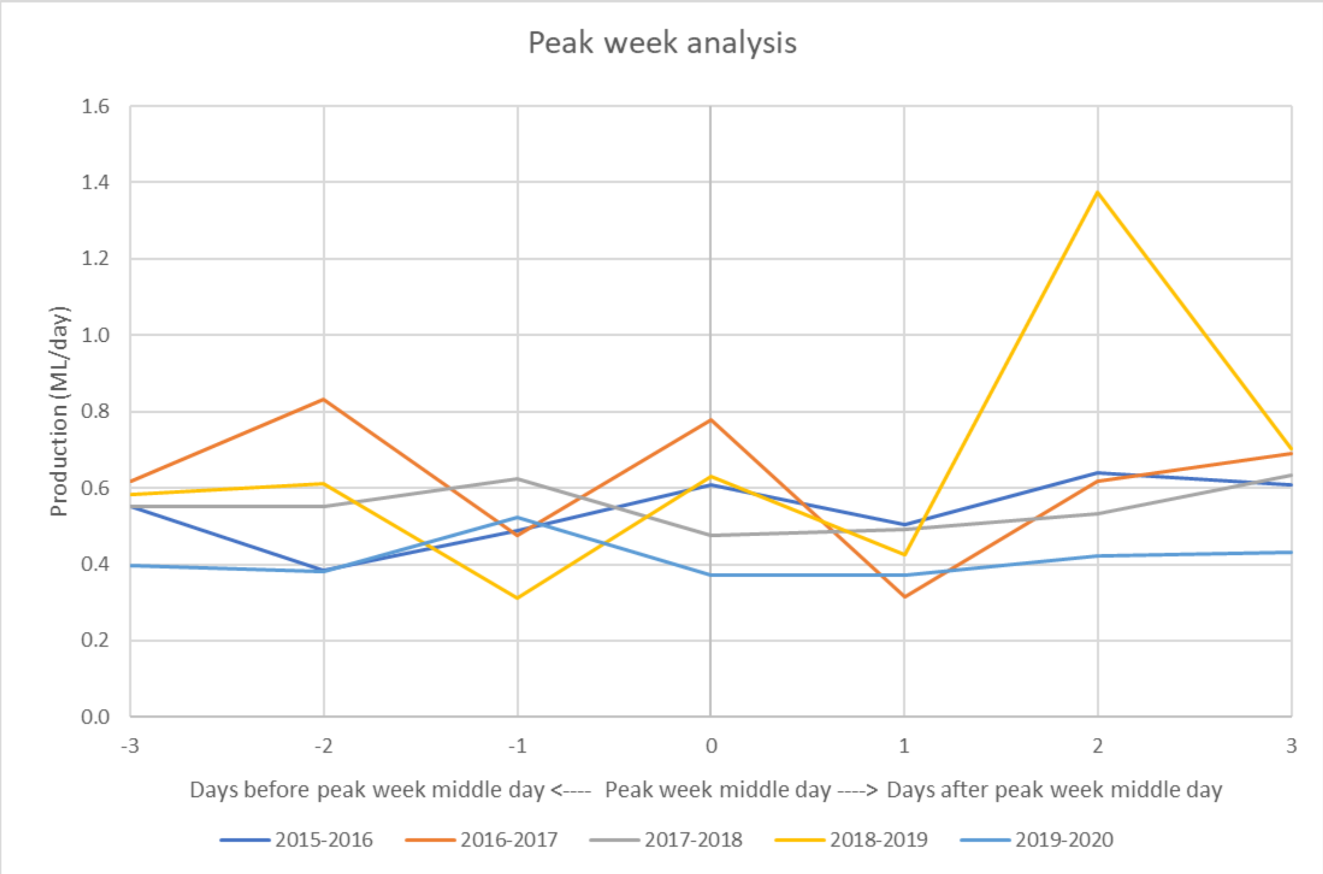


Figure 9-23 Stroud peak week persistence patterns

In the last five years, all peak weeks occurred in either school holidays or in a period of warmer weather (i.e., no peak weeks are experienced in winter). All peak weeks have no days where zero daily production occurs. All peak weeks demonstrate relatively consistent water production across all seven days of the peak week (i.e., the peaks do not show steady growth leading up to the peak day, rather a consistently higher daily water demand).

In the last five years, the maximum peak day production was 1.38 ML/day. This occurred on 9 January 2019. This large peak occurred once in the peak week period across the five-year period. This peak was approximately 2 times the average daily production of the peak week. The next highest maximum peak day production was 0.83 ML/day. This occurred on 12 January 2017. This was approximately 1.4 times the average day production for that peak week. This trend was similar for all other peak week periods, where production on the peak day was generally close to average peak week production (between 1.2 and 1.3 times higher). The peak period production data is presented in Table 9.21 and key statistics around the peaks is presented in Table 9.22.

Table 9.21 Peak period information

Peak week date of middle day (day 0)		18/12/2015	14/01/2017	21/12/2017	7/01/2019	20/12/2019
Daily demand for each day in peak week (ML)	-3	0.55	0.62	0.55	0.58	0.40
	-2	0.39	**0.83**	0.55	0.61	0.38
	-1	0.49	0.48	0.62	0.31	**0.52**
	0	0.61	0.78	0.48	0.63	0.37
	1	0.50	0.32	0.49	0.43	0.37
	2	**0.64**	0.62	0.53	**1.38**	0.42
	3	0.61	0.69	**0.63**	0.70	0.43
Sum of peak week production (ML)		3.79	4.33	3.85	4.64	2.90

Table 9.22 Peak period statistics

Peak week by year	Average day peak week (ADPW) (ML/day)	Peak day (ML/day)	Peak day / ADPW
2015-2016 (20/12/2015)	0.54	0.64	1.18
2016-2017 (12/01/2017)	0.62	0.83	1.35
2017-2018 (24/12/2017)	0.55	0.63	1.15
2018-2019 (09/01/2019)	0.66	1.38	2.07
2019-2020 (19/12/2019)	0.41	0.52	1.26

9.7.3 Stroud forecast

From the modelled demands and Council's nominated growth strategy, the water demand forecast for Stroud are presented in Table 9.23. The Stroud WTP has a capacity of 2 ML/day.

Table 9.23 Stroud water forecast

	2020	2026	2031	2036	2041	2046	2051
Average Day Demands (ML/day)	0.26	0.32	0.36	0.41	0.48	0.56	0.66
Peak Day WTP Production (ML/day)	0.5	0.9	1.0	1.2	1.4	1.6	1.9
Peak Day System Demands (ML/day)	0.92	0.97	1.10	1.26	1.48	1.74	2.06
Dry Year Demands (ML/year)	96	118	133	151	176	206	242

The peak day supply requirements at a water supply zone level are provided in Table 9.24.

Table 9.24 Stroud peak day production requirements at water supply zone level

Total (ML/day)	2020	2026	2031	2036	2041	2046	2051
Stroud 1 & 2	0.63	0.66	0.74	0.83	0.96	1.12	1.30
Stroud Road	0.29	0.31	0.36	0.43	0.52	0.63	0.76
TOTAL	**0.92**	**0.97**	**1.10**	**1.26**	**1.48**	**1.74**	**2.06**

9.7.4 Stroud infrastructure capacity assessment

9.7.4.1 Security of supply

The secure yield was modelled for the Stroud water supply headworks consisting of Stroud Weir on the Karuah River, from which water is pumped to an off-stream storage at the Stroud WTP.

There is also a River offtake from the Karuah River at the WTP which can source additional raw water supply.

Table 9.25 summarises the secure yield estimates for the Stroud scheme, using both the historical climate and 1° climate warming scenarios.

Table 9.25 Stroud water supply headworks secure yield estimates

Run number	Storage system	Secure yield ML/year	
		Historical climate	1oC climate warming
Stro302	Stroud Weir storage 17 ML on Karuah River pumped to 50 ML off-stream storage	97	79

Figure 9-24 shows the Stroud Scheme's historical and forecasted annual demands. These demands have been plotted against the secure yield for both the historical climate and 1° climate warming scenarios. The figure also shows the maximum annual extraction specified in the Water Access Licences for the Karuah River.

This assessment shows that demands have already exceeded the secure yield of the Stroud Scheme's supply. However, the Water Access Licence is expected to be sufficient beyond 2051.

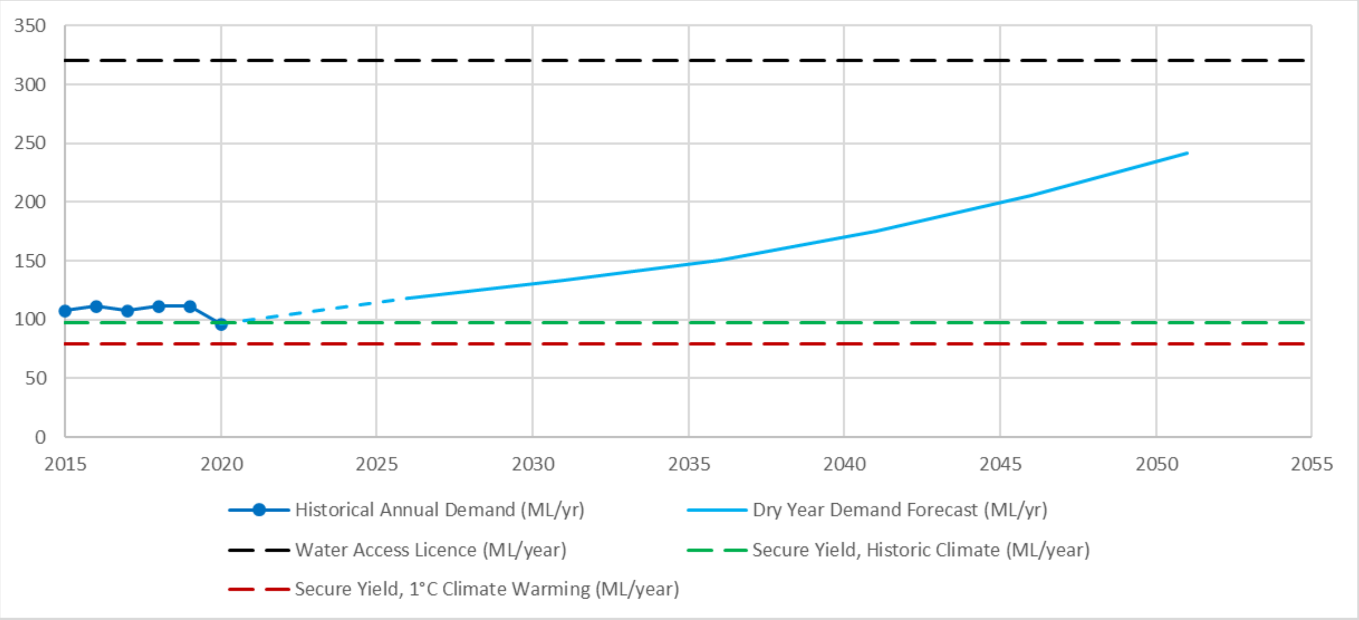


Figure 9-24 Stroud Scheme annual demands

9.7.4.2 Headworks capacity

Figure 9-25 shows the Stroud Scheme's daily demand forecasts plotted against the WTP capacity (2 ML/d).

The forecasted Peak Day WTP Production curve represents the WTP capacity required to meet future peak day demands. These values were calculated using observed operational peaks from WTP production data to estimate peak day demands at the headworks level.

This assessment shows that the WTP design capacity is sufficient to meet production requirements up to the year 2051.

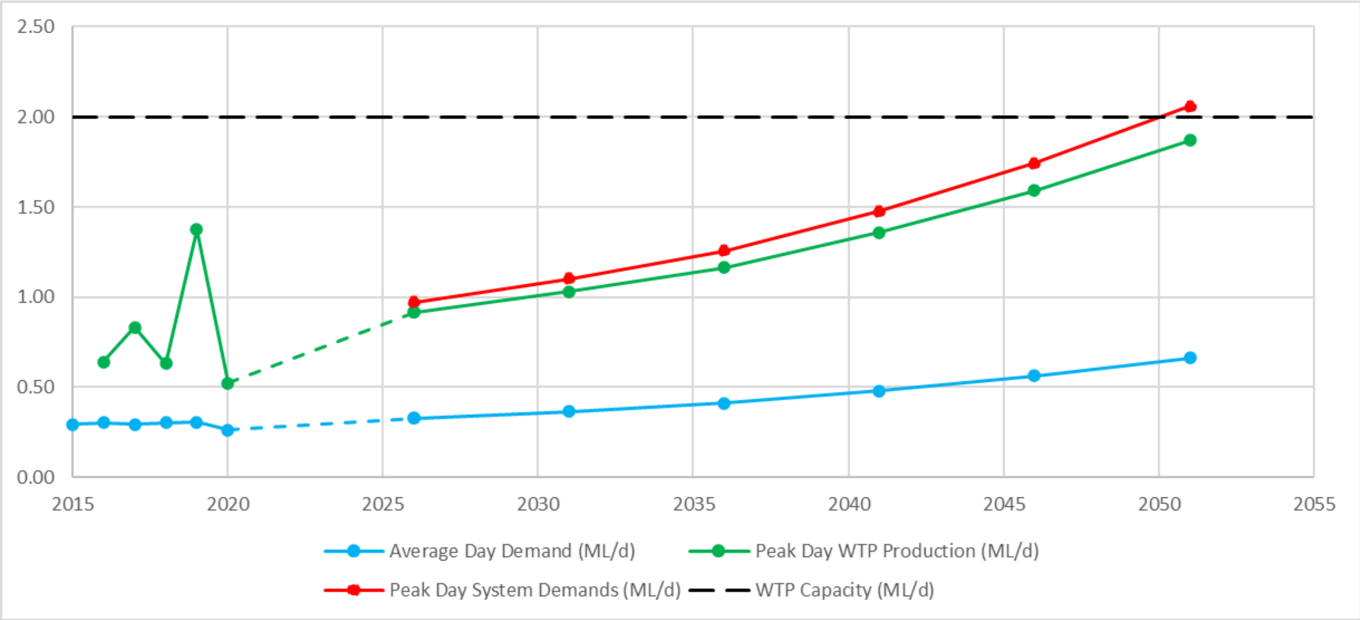


Figure 9-25 Stroud Scheme daily demands and WTP capacity

9.7.4.3 Distribution system capacity

In Figure 9-25, the forecasted Peak Day System Demands curve represents the distribution system requirements and is assessed at zone level for both reservoirs and distribution trunk mains. These values were calculated using calibrated network peak day factors based on observed SCADA flowmeter data, zone size and annual population variability (i.e. tourism).

The reservoir capacity assessment is based on the reservoir's ability to provide one full peak day of supply to all downstream customers. The Stroud Scheme consists of the following two supply zones:

– Stroud 1 & 2 Reservoirs – total storage of 1.36 ML
– Stroud Road Reservoir – total storage of 0.45 ML

The Stroud 1 & 2 Reservoirs are expected to have sufficient capacity beyond the year 2051. Peak day demands from the Stroud Road Reservoir are expected to exceed reservoir capacity in the year 2041.

Trunk mains and water transfer pumping stations were assessed based on the asset's ability to transfer at least 1 peak day of supply to downstream supply reservoirs, using the methodology specified in Section 9.1.4.1.

Table 9.26 shows the results of the trunk main capacity assessment for Stroud.

Table 9.26 Stroud trunk main capacity assessment

Downstream reservoir storage	Upstream trunk main diameter (mm)	Trunk main distribution scenario	Trunk main current capacity (ML/d)	2020 PDD (ML/d)	Year peak capacity reached
Stroud 1&2	150	Stroud WTP to Stroud Res 1&2	1.5	0.63	Beyond 2051
Stroud Road	100	Stroud WTP to Stroud Road Res	0.3	0.29	2026

9.8 Gloucester supply scheme

9.8.1 Production data

Gloucester WTP production data from 30 June 2011 to 17 December 2020 was analysed. The historical production data is shown in Figure 9-26.

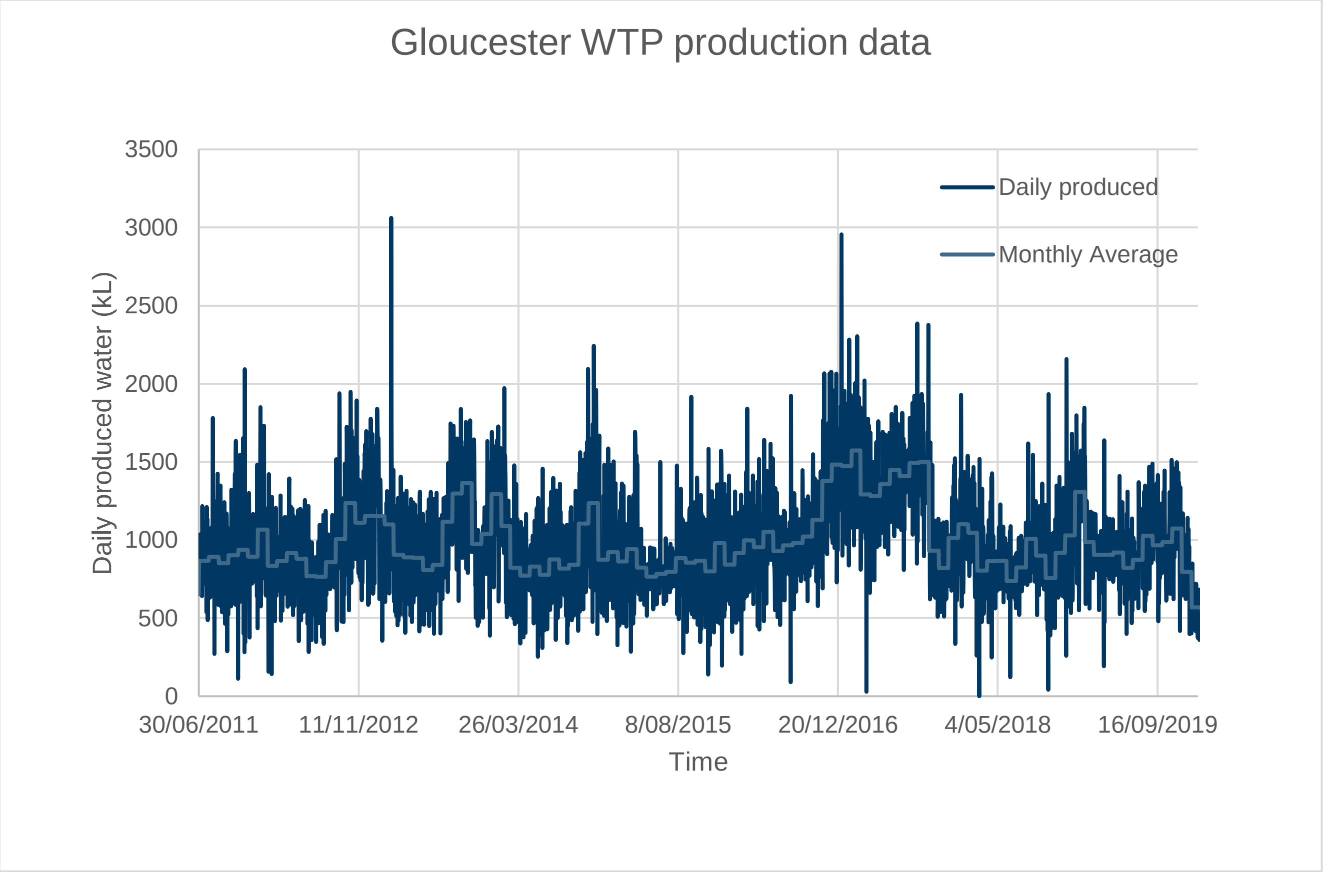


Figure 9-26 Gloucester WTP daily production data and monthly average production

9.8.2 Metered consumption

Water meter billing data was provided by Council for the duration of the 2014/15 financial year to the 2019/20 financial year. The Gloucester connection and water usage data is shown in Figure 9-27.

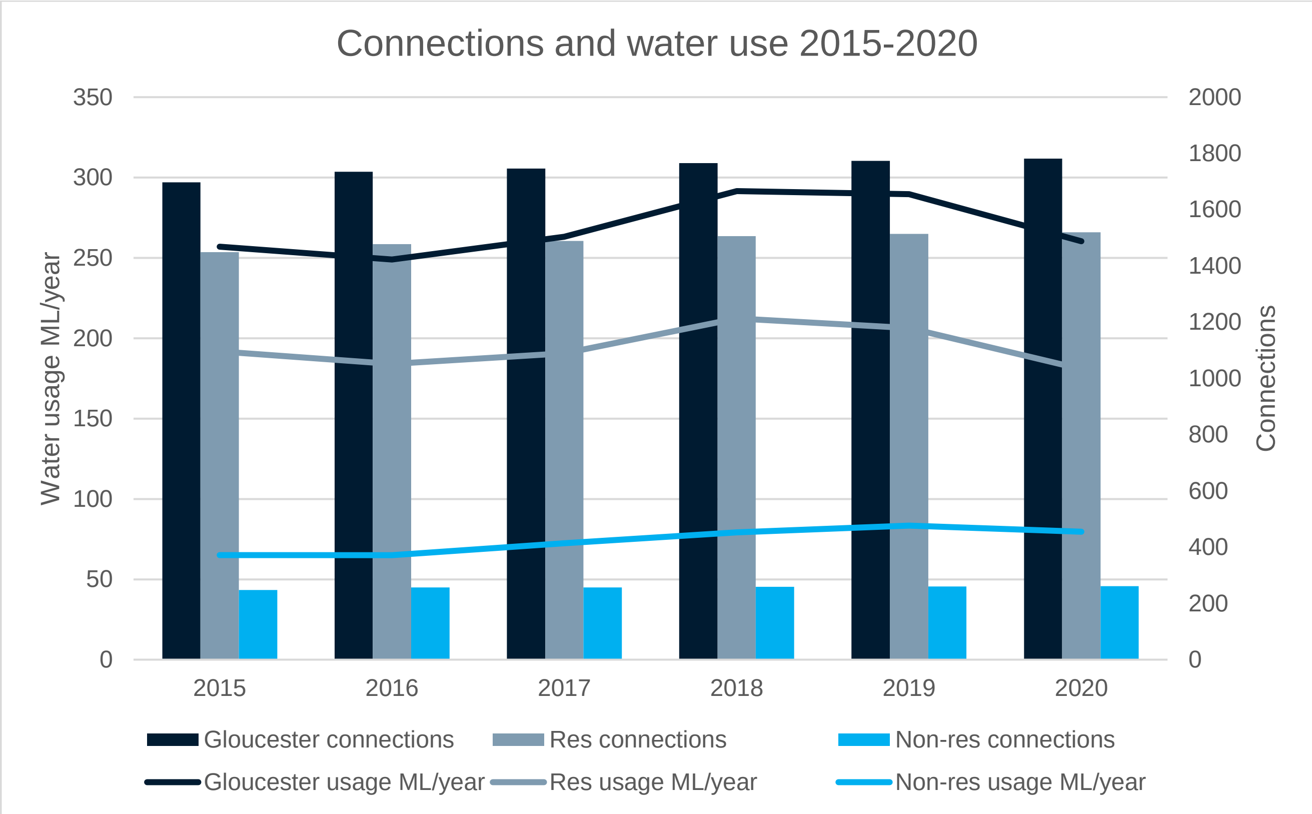


Figure 9-27 ***Gloucester connection and water usage data***

Details of the meter data analysis is provided in Section 9.2 above. The key findings are for the Gloucester are summarised as follows:

- The historical daily average water demand for the past six years is approximately 827 kL/day
- Last year's consumption was 750kL/day
- The residential to non-residential demand split is about 70% residential to 30% non-residential
- The number of connections shown slight increase each year since 2014/15, from 1,697 to 1,781 in 2019/2020
- The average day consumption for an active connected residential property is 326 L/conn/day
- W'ter 'N Tipper Hire Pty Ltd is the highest non-residential user, accounting for 5% of the daily water consumption. Refer to Section 9.3 for the Top 30 water users in the LGA.

9.8.2.1 System demands

Peak period analysis was undertaken on daily Stroud WTP production data. The peak week persistence patterns from financial years 2012-2013 to 2020-2021 is shown in Figure 9-6. Refer to Appendix B for details.

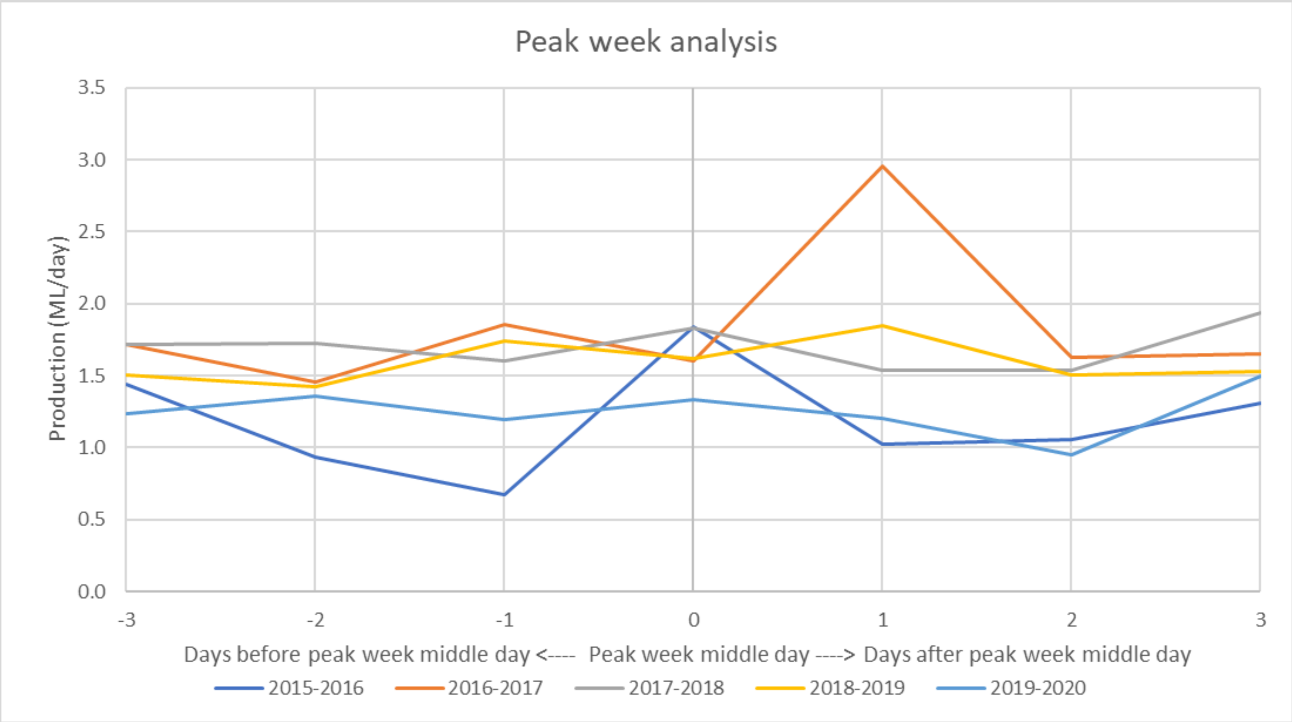


Figure 9-28 Gloucester peak week persistence patterns

In the last five years, all peak weeks occurred in either school holidays or in a period of warmer weather (i.e., no peak weeks are experienced in winter). All peak weeks have no days where zero daily production occurs. All peak weeks demonstrate relatively consistent water production across all seven days of the peak week (i.e., the peaks do not show steady growth leading up to the peak day, rather a consistently higher daily water demand).

In the last five years, the maximum peak day production was 2.96 ML/day on 31 December 2016. This large peak occurred once in the peak week period across the five-year period. This peak was approximately 1.6 times the average daily production of that peak week. The next highest maximum peak day production was 1.94 ML/day which occurred on 8 October 2017. This date coincides with the October school holidays. This peak was approximately 1.1 times the average daily production of the peak week. Across the five-year period, production on the peak day was generally close to average peak week production (between 1.1 and 1.6 times higher).The peak period production data is presented in Table 9.27 and key statistics around the peaks is presented in Table 9.28.

Table 9.27 Peak period information

Year		2015 – 2016	2016 – 2017	2017 – 2018	2018 – 2019	2019 - 2020
Peak week date of middle day (day 0)		11/03/2016	30/12/2016	5/09/2017	29/01/2019	12/11/2019
Daily demand for each day in peak week (ML)	-3	1.44	1.72	1.72	1.51	1.24
	-2	0.93	1.45	1.72	1.42	1.36
	-1	0.68	1.86	1.60	1.75	1.19
	0	**1.84**	1.60	1.83	1.62	1.33
	1	1.03	**2.96**	1.54	**1.85**	1.20
	2	1.06	1.63	1.54	1.51	0.95
	3	1.31	1.65	**1.94**	1.53	**1.50**
Sum of peak week production (ML)		8.28	12.87	11.87	11.18	8.78

Table 9.28 Peak period statistics

Peak week by year	Average day peak week (ADPW) (ML/day)	Peak day (ML/day)	Peak day / ADPW
2015-2016 (11/03/2016)	1.18	1.84	1.56
2016-2017 (31/12/2016)	1.84	2.96	1.61
2017-2018 (08/09/2017)	1.70	1.94	1.14
2018-2019 (30/01/2019)	1.60	1.85	1.16
2019-2020 (15/11/2019)	1.25	1.50	1.19

9.8.3 Gloucester forecast

From the modelled demands and Council's nominated growth strategy, the water demand forecast for Gloucester are presented in Table 9.29.

Table 9.29 Gloucester water forecast

	2020	2026	2031	2036	2041	2046	2051
Average Day Demands (ML/day)	0.79	1.06	1.13	1.28	1.35	1.42	1.49
Peak Day WTP Production (ML/day)	1.5	2.3	2.5	2.8	3.0	3.1	3.3
Peak Day System Demands (ML/day)	2.17	2.60	2.82	3.30	3.53	3.76	3.97
Dry Year Demands (ML/year)	288	388	412	469	495	520	543

The peak day supply requirements at a water supply zone level are provided in Table 9.30.

Table 9.30 Gloucester peak day production requirements at water supply zone level

Total (ML/day)	2020	2026	2031	2036	2041	2046	2051
Barrington Boosted	0.29	0.31	0.33	0.35	0.37	0.40	0.41
Cemetery Road	1.25	1.35	1.43	1.75	1.84	1.92	2.00
Cemetery Road Elevated	0.39	0.50	0.59	0.69	0.78	0.86	0.95
Jacks Road Boosted	0.24	0.44	0.47	0.51	0.54	0.58	0.61
TOTAL	**2.17**	**2.60**	**2.82**	**3.30**	**3.53**	**3.76**	**3.97**

9.8.4 Infrastructure capacity assessment

9.8.4.1 Security of supply

The secure yield was modelled for Gloucester water supply headworks consisting of drawing water from the Barrington River, upstream of Gloucester and transferring it the Gloucester WTP. Two cases of assumed allowances for upstream irrigation were considered. Modelling was also undertaken to estimate the off-stream storage size required to meet a future target demand of 366 ML/a.

Table 9.31 summarises the secure yield estimates for the Gloucester scheme. The security of supply assessment is based on the results from Run numbers Glou301 and Glou302, which assume no headworks storage, as this reflects the current system.

Table 9.31 Gloucester water supply headworks secure yield estimates

Run number	Storage system	Irrigation	Off-stream storage size ML	Secure yield ML/year	
				Historical climate	1oC climate warming
Glou301	**Pumping from Barrington River. No headworks storage.** ***For secure yield modelling assumed 1 ML storage.***	**Without**	**0**	**67**	**43**
Glou302		**With**	**0**	**0**	**0**
Glou305	Pumping from Barrington River to off stream storage sized to meet future demand of 366 ML/a.	With	105	366	Not required
Glou310		Without	25	366	366
Glou311		With	137	490	379

Figure 9-29 shows the Gloucester Scheme's historical and forecasted annual demands. These demands have been plotted against the secure yield for both the historical climate and 1° climate warming scenarios, assuming no headworks storage and no upstream irrigation. The figure also shows the maximum annual extraction specified in the Water Access Licence for the Barrington River.

This assessment shows that demands have already exceeded the secure yield of the Gloucester Scheme's supply. However, the Water Access Licence is expected to be sufficient beyond 2051.

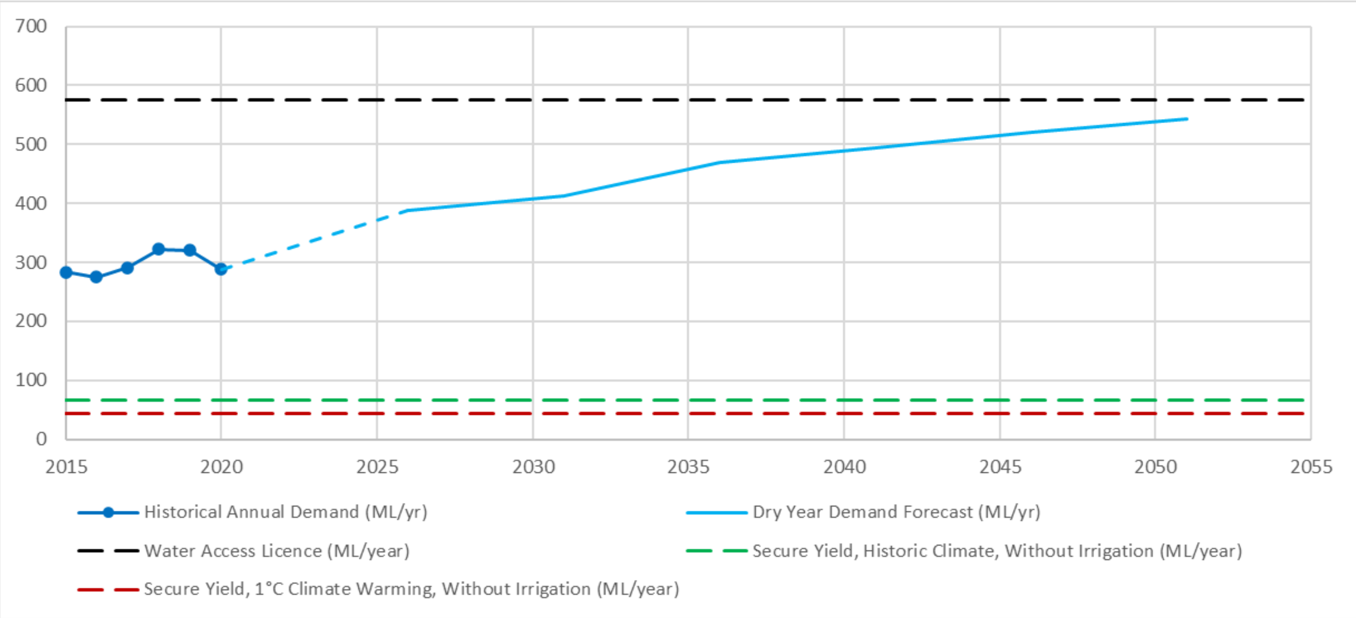


Figure 9-29 Gloucester Scheme annual demands

9.8.4.2 Headworks capacity

Figure 9-30 shows the Gloucester Scheme's daily demand forecasts plotted against the WTP capacity. The current design capacity of the WTP is 4.5 ML/d, which can be produced on peak days if required. However, due to current process constraints, the WTP has a reduced average day operational capacity of 52.8 ML/d. This reduced capacity is based on preferred operation to minimise wear on process components.

The forecasted Peak Day WTP Production curve represents the WTP capacity required to meet future peak day demands. These values were calculated using observed operational peaks from WTP production data to estimate peak day demands at the headworks level.

For the purpose of this assessment, the WTP design capacity is sufficient to meet production requirements beyond the year 2051.

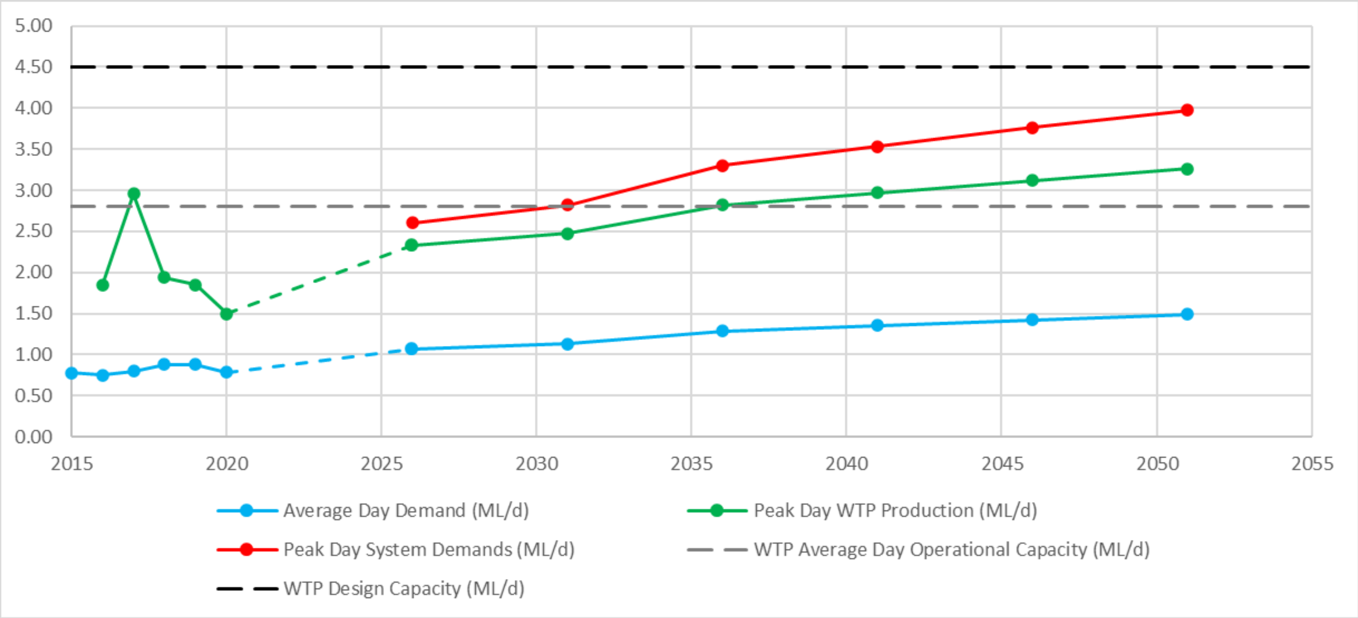


Figure 9-30 Gloucester Scheme daily demands and WTP capacity

9.8.4.3 Distribution system capacity

In Figure 9-30, the forecasted Peak Day System Demands curve represents the distribution system requirements and is assessed at zone level for both reservoirs and distribution trunk mains. These values were calculated using calibrated network peak day factors based on observed SCADA flowmeter data, zone size and annual population variability (i.e. tourism).

The capacity assessment was based on the future Gloucester water network, which is currently under construction. The future Gloucester Scheme consists of the following two reservoir supply zones:

– Cemetery Road FUTURE Reservoir– total storage of 7 ML
– Cemetery Road Elevated Reservoir (supplied by Cemetery Road Reservoir) – total storage of 0.5 ML

The capacity assessment for surface reservoirs is based on the reservoir's ability to provide one full peak day of supply to all downstream customers. Elevated reservoirs were assessed based on the asset's ability to provide 4 hours of peak day supply plus 4 hours of fire flows at 20 L/s to all downstream customers.

The reservoir storages in both of the above supply zones are expected to have sufficient capacity beyond the year 2051.

Trunk mains and water transfer pumping stations were assessed based on the asset's ability to transfer at least 1 peak day of supply to downstream supply reservoirs, using the methodology specified in Section 9.1.4.1.

The Cemetery Road FUTURE Reservoir is filled by pumping from the WTP via a new 300mm main, which is currently under construction. The current capacity of this trunk main is 3.1 ML/d. Peak day demands from the Gloucester reservoirs are expected to exceed this capacity in the year 2036.

9.9 North Karuah supply scheme

9.9.1 Production data

North Karuah supplied by Hunter Water. No production data is available as the WTP supplies other Hunter Water catchments. Consumption data for North Karuah is shown in Table 9.32.

9.9.2 Metered consumption

There is an online flow meter for North Karuah. Hunter Water bills Council for consumption using this meter. Council then bills individual customers. The arrangement for purchasing water for North Karuah from Hunter Water is currently being discussed between Hunter Water and Council.

Water meter billing data was provided by Council for the duration of the 2014/15 financial year to the 2019/20 financial year. Water meters are read quarterly. The read date for each meter recorded by Council.

Details of the meter data analysis is provided in Section 9.2. The key findings are for the North Karuah are:

- The historical daily average water demand for the past five years is around 12 kL/day.
- Residential to non-residential demand split is about 99% residential to 1% non-residential.
- The number of connected properties has remained at 36 each year since 2014/15.
- Average day consumption for an active residential assessment is 342 L with an estimated peak day consumption of 984 L (peak day to average day ratio of 2.9).
- A rural non-residential property is the highest non-residential user, accounting for 2% of the North Karuah schemes daily water consumption. This non-residential user's daily consumption did not make the Top 30 water users in the LGA, listed in Section 9.3.

9.9.2.1 System demands

9.9.2.1.1 Peak day system demand

North Karuah supplied by Hunter Water. Since billing is provided 3 times as a year, peak daily consumption is not available for North Karuah.

9.9.2.1.2 Annual system demand

Since North Karuah is supplied water from Hunter Water no water production model has been developed by Council. The North Karuah water demands are shown in Table 9.32 from the water consumption bills Hunter Water have provided Council.

Table 9.32 North Karuah annual water demand

Financial year	Annual water demand (ML/year)
2012	4.2
2013	4.9
2014	5.9
2015	4.6
2016	4.8
2017	4.7
2018	5.3
2019	4.7
2020	5.5
2021	4.4

Average year production of 4.9 ML/year or daily production 13.4 kL/day has been adopted for North Karuah.

9.9.3 Forecast

North Karuah supplied by Hunter Water. Water demand forecasts in 5 yearly increments from 2020 to 2050 for North Karuah are not available. The peak day supply requirements at a reservoir zone level in 5 yearly increments from 2020 to 2051 is not available for North Karuah.

9.9.4 Infrastructure capacity assessment

As the North Karuah scheme is supplied by Hunter Water, the infrastructure capacity assessment is not applicable.

10. Sewer load analysis and issues

10.1 Methodology for sewer load analysis

10.1.1 Risk ranking

A high-level risk assessment was conducted for each of the issues identified using Council's Risk Management Framework. A summary of the issue, risk value (based on the most significant risk consequence) and proposed action for each issue has been provided in a table underneath the relevant sub-heading. The full list of the risks identified is detailed in Council's Risk Register – IWCM Issues included in Appendix E.

Further scrutinization of the risk value assigned to each issue will take place in the optioneering phase on a case-by-case basis, where required. This will be completed if it is determined that the high-level risk rating provided in this issues paper is not representative of the risk of a specific issue (i.e. SPS capacity issue in an environmentally sensitive area vs. non environmentally sensitive area).

10.1.2 Historical sewage flows

Council has analysed 6 years of available operation data records for each STP (2015-2021). These records include daily inflow volumes, rainfall, and biological parameters for influent and effluent. The operational data was used to determine sewage loading and peaking factors unique to each scheme.

Forster, Hawks Nest, and Taree (Dawson) STPs include septage receival. These loads have been broadly captured in the composite influent sampling with general influent loads. Council will complete discrete sampling for investigation of septage loads in the design of future plant upgrades. Sewer system flow analysis

10.1.2.1 Average Dry Weather Flow (ADWF)

Council has adopted a unique design loading based on operational data for each STP/sewerage scheme. This is considered an acceptable approach considering the varying demographics and water usage habits across the LGA. Each scheme's unique design loading has been assigned to all existing and future ET's within that scheme.

For STP inflow data to be considered in the ADWF loading calculation, the following criteria must have been met:

– Daily rainfall in any one of the previous 7 days not to exceed 5mm
– Inflow date outside of "peak" seasonal periods (i.e. not within school holidays or long weekends)

Applicable inflow data was then averaged for each calendar year within the range of available data (2015-2021).

The adopted scheme ADWF was taken as an average of the previous 2 years of applicable inflow data. For comparative purposes, calculations also included an ADWF loading rate using the previous 6 years of applicable inflow data. Refer to Appendix C for details.

The ADWF loading rate was taken as the adopted scheme ADWF divided by the existing ET for that scheme.

Schemes with an ADWF loading rate greater than Council's upper limit of 630 L/ET/d have been highlighted as an issue, possibly as a result of groundwater infiltration. Operational ADWF loading rate remains adopted.

Schemes with an ADWF loading rate less than Council's lower limit of 200 L/ET/d have been highlighted as an issue. A lower limit ADWF loading rate (200 L/ET/d) has been adopted.

10.1.2.2 Peak Dry Weather Flow (PDWF)

Council has adopted a unique PDWF factor based on operational data for each STP/sewerage scheme. This is considered an acceptable approach considering the varying demographics and water usage habits across the LGA. Each scheme's unique PDWF factor has been assigned to all existing and future ET's within that scheme.

For STP inflow data to be considered in the PDWF factor calculation, the following criteria must have been met;

- Daily rainfall in any one of the previous 7 days not to exceed 5mm
- Inflow date within “peak” seasonal periods (i.e. during school holidays and long weekends)

STP inflow data was considered throughout each calendar year due to some schemes (often rural schemes) experiencing higher dry weather inflows outside of the typical “peak” seasonal periods (i.e., these schemes don’t experience a holiday tourist peak).

The 95th and 99th percentile daily inflow (volume) was retrieved from the applicable inflow data for each calendar year within the range of available data (2015-2021).

The adopted scheme PDWF was taken as the maximum of the previous 2 years of 99th percentile applicable inflow data. For comparative purposes, calculations also included PDWF using the previous 6 years of applicable inflow data. In some instances, the 99th percentile captured the tail end of a significant rainfall event, or data input errors. Where it is clear and evident that this has occurred for any scheme, the maximum of the previous 2 years of 95th percentile applicable inflow data was adopted.

The PDWF/ADWF ratio was taken as the adopted PDWF (kL/d) divided by the adopted ADWF (kL/d) for that scheme. Refer to Appendix C for details.

10.1.2.3 Peak Wet Weather Flow (PWWF)

The PWWF in each catchment was calculated in general accordance to the Water Services Association of Australia- Gravity Sewerage Code of Australia (WSAA) (WSA 02-2014 – V3.1 Appendix C) methodology, where PWWF is equal to the sum of PDWF, groundwater infiltration (GWI) and rainfall dependent inflow & infiltration (RDI).This was completed for each distinct catchment in every scheme. There are some instances where Council has deviated from this methodology (outlined below).

PDWF

WSA 02 estimates PDWF with a “d” factor (derived from dwelling/population density) multiplied by ADWF. Council found that this method often resulted in an unrealistically large PDWF, particularly for catchments with low population density.

Instead, PDWF was calculated for each catchment area by multiplying the scheme ADWF loading rate, catchment ET and scheme PDWF/ADWF ratio, derived from operational data using the methodology outlined in 10.1.2.1 and 10.1.2.2.

GWI

WSA 02 estimates GWI using the gross catchment area multiplied by the percentage of pipe network below groundwater multiplied by a constant. Council has adopted this methodology in full.

Council currently has sewerage catchment areas defined by polygons within GIS for every scheme. These areas encompass lots currently serviced by sewer and sometimes include un-serviced lots with potential to be serviced by sewer in the future. This was considered by Council as the maximum catchment area and it was deemed necessary to estimate the gross catchment area for the existing (2021) system.

Gross catchment area (2021) was taken as a 50m radius buffer around the existing gravity sewer mains within that catchment. Gross catchment area for each subsequent decade (2031, 2041 etc.) increased linearly until the maximum catchment area is reached at 2051 (i.e. 2021 buffer = 10m^2, 2031 = 15 m^2, 2041 = 20 m^2, 2051 max = 25 m^2).

The portion of pipe network where the groundwater table exceed pipe inverts was completed at catchment level for all schemes. This was achieved by overlaying the gravity sewer network on top of the March 2021 Flood Event layers in Council’s GIS. The portion (%) wet was estimated based on a visual judgment.

RDI

WSA 02 estimates RDI by factoring population/development density, pipe leakage severity, and rainfall intensity with a constant. There are some instances where Council has deviated from this methodology. Refer to Appendix C for details.

Population density (A_{Eff}) was calculated using Council's adopted catchment ET, scheme occupancy rate, and gross catchment area (see GWI).

The leakage severity coefficient (C) is the sum of the soil aspect and network defects and inflow aspect. WSA 02 defines the range of each of these two components as between 0.2 (low impact) and 0.8 (high impact).

Council adopted a soil aspect of 0.2 for each catchment area due to the presence of typically sandy soils. This also gave Council the ability to "calibrate" the RDI calculation by manipulating the network defects factor.

Council manipulated the network defects and inflow aspect for each catchment to achieve a PWWF that closely matched operational data. Refer to Appendix C for details. This was achieved as follows;

- Operational pump run-times were retrieved for each SPS during dry weather and a significant wet weather event. Operational PWWF/ADWF calculated
- PWWF flow estimation (using Council's adopted methodology) completed. Theoretical PWWF/ADWF ratio calculated
- Alignment of the theoretical PWWF/ADWF ratio to the operational PWWF/ADWF ratio by manipulating the network defects and inflow aspect

There were some cases where a networks defect and inflow aspect greater than 0.8 was required to meet the operational PWWF/ADWF ratio. This exceedance was allowed by Council's methodology and highlights potential inflow issues.

There were some cases where a networks defect and inflow aspect less than 0.2 was required to meet the operational PWWF/ADWF ratio. This exceedance was not allowed by Council's methodology and 0.2 was adopted. This highlights potential ongoing groundwater infiltration (groundwater extending dry weather pump operation).

The rainfall component (I) is a function of rainfall intensity, catchment area and required containment standard. Council has calculated two different RDI results, an ARI=2 1-hour rainfall event and an ARI=5 1-hour rainfall event. The rainfall intensity for each event was retrieved from BOM Intensity-Frequency-Duration (IFD 2016) design rainfalls, based on the geographic location of that catchment.

The WSAA methodology utilises average recurrence interval (ARI) terminology regarding design rainfalls. As the industry moves towards annual exceedance probability (AEP) as the preferred terminology, it is important to consider design rainfalls in terms of AEP. Two design rainfalls have been considered, as presented in Table 10.1.

Table 10.1 Design rainfall events considered for peak wet weather flow containment

Duration	ARI	AEP (%)	AEP (1 in X)
1-hour	2	39.35	2.54
1-hour	5	18.13	5.52

A sensitivity analysis was completed to compare differences between the WSAA methodology and the fixed storm allowance methodology as per the Public Works Design Manual. This is presented in Table 10.2.

Table 10.2 Comparison of WSAA methodology and Public Works design manual fixed storm allowance methodology

	Ratio PWWF/ADWF		
	Network defects (0.2)	Network defects (0.4)	Network defects (0.8)
2-year ARI	-	-	10
5-year ARI	-	10	16.5
Public works design	8		

Council has adopted a design PWWF flow based on a network defect factor of 0.4 and an ARI=5 containment factor, which is equivalent to a PWWF/ADWF ratio of 10. It was observed that the PWWF/ADWF ratio for smaller catchments (ETs) were often very high and very sensitive to changes in ETs. Because of this, many of these small catchments were flagged for network defect issues. Further investigation is required in these smaller catchments to better determine ETs and occupancy rates, baseline ADWF, and performance under defined rainfall events.

PWWF was calculated for each catchment in response to the two design rainfall events, ARI=2 1-hour duration and ARI=5 1-hour duration. Council calibrated the calculation against operational data in response to a "best guess" ARI=5 rainfall event. Council does not have the ability to accurately identify these design rainfall events in historic rainfall data. This makes it difficult to compare and calibrate operational performance against the design rainfall event.

A summary of the rainfall intensity data issue identified across all STPs is presented in Table 10.3.

Table 10.3 Rainfall intensity issue summary

Issue	Risk[1]	Action
Council does not currently have the means to measure rainfall intensity. Measuring rainfall intensity via. Tipping rain gauges would enable Council to measure its performance against a 5-year ARI containment factor. Estimated PWWF across all sewerage schemes using the WSAA methodology was calibrated against a single undefined rainfall event from June 2021 (best guess ARI=2 given the available data).	Compliance Medium (6)	Install tipping rain gauges. This action is currently underway. A project has been initiated for the rollout of tipping gauges at all of Council's STPs. Recalibrate PWWF estimations using a defined historic rainfall event once tipping gauges have been installed and a sufficient rainfall event has been recorded.

1: Risk level based on Council's Risk Management Framework

10.1.3 Tourist population effects

The Council LGA has a diverse range of locations, some of which experience large increases in population due to tourism (particularly coastal areas such as Forster/Tuncurry, Hawks Nest and Pacific Palms). Each specific sewage scheme has been assessed considering the historical peaks in flow to the STP that occur. This is typically during the Christmas and Easter holidays.

10.1.4 Climate variability

CSIRO published the State of the Climate in 2020 which states "Heavy Rainfall events in Australia are becoming more intense". With the increase in variability of extreme rainfall, these periods may cause higher loadings on the STP's. This climate variability is relevant for all fourteen STPs.

10.1.5 Biological and nutrient loading

The sewage parameters assessed at each STP include several or all of the following parameters:

– Biochemical Oxygen Demand (BOD)
– Ammonia (NH_3)
– Total Nitrogen (TN)
– Total Phosphorus (TP)

Investigation of biological and nutrient loading is usually done to inform future infrastructure upgrades or to assess specific concerns at STP's.

Analysis includes both operational BOD load projections for each STP, as well as design BOD projections.

10.1.6 Sewer system flow projections

Population forecasts were produced using sewer scheme connection and billing information to determine the number of sewer connections for the year 2020.

Catchment specific ProfileID forecast growth figures (2021 – 2036) were adopted for this period. Between 2036 and 2051, Council adopted the average growth rate from 2021 – 2036 to 2050. This was used to forecast growth at a catchment level. Forecast growth rates were applied against peak period ET figures. Refer to Appendix C for details.

Growth areas within which land is designated as an "Urban Release Area to be rezoned for future development" (sourced from Council's Urban Release Areas Report, July 2021) have been included in the ultimate catchment capacity.

Growth is distributed across catchments evenly. When a catchment reaches its ultimate capacity, future growth is distributed to other catchments in the network with spare capacity.

10.1.7 Infrastructure capacity assessment

10.1.7.1 Sewer reticulation network

No gravity main hydraulic modelling has been undertaken as part of this assessment. This issue requires a concerted effort by Council in future years to build and calibrate sewer models for each of its sewer schemes.

10.1.7.2 Sewage pumping station capacity

Sewage pump stations are designed with pumps sized to manage PWWF at ultimate development based on a 5-year ARI containment factor and 0.4 network defect factor and/or minimum slime control velocity in the rising main. In some instances, pump flows will be increased as development progresses. All pumps selected are required to meet the PWWF requirements for the life of the pump (20 years).

Council's level of service for sewage spill frequency is a 5-year ARI containment factor based on a network defect factor of 0.4. This is equivalent to a sewage spill frequency for a 2-year ARI containment factor based on the highest allowable networks defect factor of 0.8.

Each SPS has been assessed based on the PWWF containment factors above, the recorded pump flow capacity and changing inflows due to catchment growth/decline in decadal increments between 2021 and 2051. For reporting purposes, only 2021 and 2051 pump capacities have been presented. Full calculations for incremental periods between 2021 and 2051 are available in Appendix C.

In cases where pump capacity does not meet the 5-year ARI containment standard, the 2-year ARI containment standard has also been estimated. This has been completed as the regional environmental regulations permit a 2-year ARI containment standard.

Sewer pump stations with pumps that do not meet the 5-year ARI containment standard have been flagged for monitoring to mitigate reputational risk. Sewer pump stations with pumps that do not meet the 2-year ARI containment standard have been flagged as an issue to eliminate compliance risk.

Issues identified in completing this analysis are summarized in Table 10.4.

Table 10.4 Sewage pumping station issue summary

Issue	Risk[1]	Action
Data gaps for pressurized/vacuum sewage reticulation systems (i.e. discreet flow monitoring, pump capacity)	Service Delivery & Infrastructure Medium (9)	Identify and fill all data gaps relevant to pressure / vacuum sewage reticulation design for existing infrastructure.
SPS pumps are under capacity for PWWF in response to ARI=2 and/or ARI=5 design rainfall event(s)	Environment Medium (9)	Perform risk-based assessments of SPSs depending on potential overflow impacts on the receiving environment (i.e. environment/visual/public health).

1: Risk level based on Council's Risk Management Framework

10.1.7.3 Inflow and infiltration/network defects

The PWWF/ADWF ratio derived from the WSAA methodology was calibrated to closely align with the operational PWWF/ADWF ratio observed using pump run-times for each catchment for the selected single rain event. This was achieved by adjusting the network defect (ND) factor. Refer to Appendix C and Section 10.1.2.3 for details.

Catchments where the ND factor exceed the upper limit of the prescribed range (>0.8) have been flagged as these exceed the WSAA design network defect range. This indicates high network defects contributing to inflow and infiltration (I&I), or “top-down” inflow. These catchments will be targeted as a priority by the I&I team as part of Council’s business as usual.

Catchments where the ND factor are below the lower limit of the prescribed range (<0.2) have been flagged as these do not meet the WSAA design network defect range. This indicates high baseline groundwater infiltration, or “bottom up” inflow. Catchments with a ND factor <0.2 often display low PWWF/ADWF pump run-time ratio. This is due to the dampening of ADWF with ongoing baseline groundwater infiltration. This is a risk for areas with a high groundwater table (i.e. Tuncurry, Forster Keys, Tea Gardens, Harrington).

A limitation of calibrating the WSAA method with PWWF/ADWF pump run times occurs when overflows are experienced in the network and total flow is not captured by a pump station or treatment plant. Currently, this impact may be dampened by the methodology to assess at scheme level, not catchment level.

10.1.7.4 Pump run-time assessment

Potential issues with a sewerage system can be identified by comparing observed historical ADWF pump run times with theoretical ADWF pump run-times. Theoretical pump run-times were calculated using the current ADWF sewage load and population projections. This was compared with actual ADWF pump runtime figures retrieved from SCADA. Refer to Appendix C for details. It is assumed there is no additional flow from non-residential premises in the future.

Occurrences where historical (actual) run-times are more than 50% above theoretical run-times have been highlighted. This can be resulting from one or many factors such as inflow and infiltration, degradation of pump performance, pump chokes or incorrect asset data. Any significant differences between theoretical and actual ADWF pump run-times will be investigated to find the root cause of the deviation. This can be achieved by completing drop tests or inspections of the SPS and is undertaken as part of Council’s scheduled maintenance program.

A summary of the pump run time issues for identified sewer catchments is highlighted in Table 10.5.

Table 10.5 Pump run-time issue summary

Issue	Risk[1]	Action
Historical (actual) pump run times are significantly greater than theoretical run times for average dry weather flow	Service Delivery and Infrastructure Medium (9)	Develop a program for all identified pump stations. Complete drop tests and inspections as part of Council’s scheduled maintenance program to confirm duty flow and condition of pumps and wet well. Based on outcome of drop test and inspection, actions may include pump renewal or overhaul, SPS well maintenance or I&I reduction

1: Risk level based on Council’s Risk Management Framework

10.1.7.5 Emergency storage capacity

In Council’s current Levels of Service, the response time to have staff on-site for sewerage system failures is four (4) hours. Council has adopted a minimum of four hours ADWF storage capacity from the immediate catchment for all existing sewer pump stations. For new and future assets, Council has adopted an increased minimum emergency storage capacity of six (6) hours.

As a first pass, Council has calculated the available storage volume in the wet well. Catchments with less than 4 hours of ADWF storage volume in the wet well will be flagged and investigated further as part of business as usual. This process will include confirming the level of the overflow point followed by calculation of the volume available in the reticulation network and manholes prior to overflow. Refer to Appendix C for details.

A summary of the emergency storage issues for identified sewer pump stations is presented in Table 10.6.

Table 10.6 Emergency storage issue summary

Issue	Risk[1]	Action
Emergency storage volume for SPS wet well is below the design 4 hours catchment ADWF for 20210 and/or 2051.	Environment Medium (9)	Undertake assessment for volume attenuated in reticulation for catchments that do not have adequate emergency storage in wet well. Perform risk-based assessments of SPSs, depending on potential overflow impacts on the receiving environment (i.e. environment/visual/public health). Improve asset data to allow overflow points and levels in catchments to be identified. Integrate in SCADA “time to overflow” information for each catchment, based off inflow into SPS. Actions will be completed as part of optioneering phase.
Data gaps for vacuum sewer systems (i.e. collection chamber volumes and connections). Insufficient in-house design expertise with vacuum sewer systems.	Service Delivery & Infrastructure High (12)	Identify and fill all data gaps relevant to vacuum sewer design for existing infrastructure. Initiate training program for relevant Council staff to improve design knowledge and understanding of vacuum sewer systems. Training should include staff from: Planning, Development Assessment, SCADA, Asset Management, Water Management & Treatment and Water Operations.

1: Risk level based on Council’s Risk Management Framework

10.1.7.6 Odour/septicity potential

Septicity potential is generally assessed by reviewing sewage detention times in sewage pump rising mains. According to WSA 07-2007 (3.15.1), sewage with a detention time between 4 and 8 hours has a medium risk of septicity, and above 8 hours has a high risk of septicity. This section assessed rising main detention time for each catchment using the formula shown in WSA 04-2005 Appendix D (3.2).

Rising mains with detention times between 4 and 8 hours have been flagged for monitoring. Rising mains with detention times greater than 8 hours have been flagged as an issue for further action. Possible actions are dependent on the system and may include inspection of assets including receiving manholes, SPSs and STP inlet works for concrete corrosion, chemical dosing and vent stacks with carbon filter.

10.1.7.7 Rising main velocity

To maintain an unobstructed pressure sewer to minimise septicity, velocities should be sufficient to achieve self-cleansing and slime control action and minimize the likelihood of grease depositing on the soffit of the pipe. For sewer rising mains, the maximum flow velocity is typically less than 2.5 m/s but should not be greater than 3.5 m/s. This section assessed calculated flow velocity against the minimum flow velocity required for slime stripping. Minimum flow velocity was determined for any given diameter using the minimum pumping rate formula shown in WSA 04-2005 Appendix D (3.5). Minimum flow velocity to control sedimentation buildup in pressure sewer is 0.9 m/s as stipulated in WSA 04-2005 (10.3.5).

Catchments where rising mains have velocities above 3.5 m/s or below minimum flow velocity will be flagged as an issue for further action.

10.1.7.8 EPA license non-compliance and overflows

Reported (major) overflows for the last 5 years (2016 – 2017 to 2020 – 2021) have been investigated by reviewing STP compliance to EPA licensing through Council’s annual returns. All non-compliances were identified and the status of rectification actions noted, to identify if any outstanding issues are present.

Non-reported (minor) overflows for the last 5 years (2016 – 2017 to 2020 – 2021) were investigated for all catchments. This information was obtained from Council’s TechnologyOne database, where all overflows reported by members of the community are stored. This information is received through Council’s customer service team at Council’s customer service offices, through phone calls, Council’s website, emails or from council staff.

Overflow reports for each sewer scheme were collated and split into wet weather discharges and dry weather discharges, where this information was available. A summary of the limitations of Council’s system for filing customer requests is presented in Table 10.7.

Table 10.7 Council's Business Enterprise Management System issue summary

Issue	Risk[1]	Action
Council's TechnologyOne database doesn't allocate asset numbers to work orders. This eliminated the opportunity to identify overflow points at assets and trend over the 5-year period. The risk for this issue is being unable to measure continuous improvement initiatives due to lack of asset data related to the location of overflow.	Compliance Medium (8)	Customer service / Council staff member who receives overflow report to allocate manhole number on overflow reports.
Council's TechnologyOne database doesn't allocate dry weather or wet weather discharge to all overflow reports. The risk for this issue is being unable to measure continuous improvement initiatives due to missing information relating to weather conditions when overflow experienced.	Compliance Medium (8)	Council's TechnologyOne system to have the option for the 'Request Type' to be selected as either 'Overflow- Dry Weather' or 'Overflow-Wet Weather'.

1: Risk level based on Council's Risk Management Framework

10.1.7.9 STP capacity

The biological treatment capacity of Council's STPs were assessed by comparing dry weather influent loads against the design influent load of the treatment plant. This was completed by comparing the forecast plant load in Biochemical Oxygen Demand (BOD) (including Nitrogenous Biochemical Oxygen Demand (NBOD)) against the original treatment plant design values. The holiday loads have been assessed over the Christmas period where applicable, i.e. for schemes with high tourism.

The hydraulic treatment capacity of Council's STPs was assessed by comparing dry and wet weather influent flows against the design full treatment flow (DFTF) and design storm treatment flow (DSTF). DFTF was taken as the maximum flow that will receive full treatment without significantly compromising effluent quality. Flows exceeding DFTF are captured by the DSTF capacity (if available), which bypasses some treatment processes. Flows exceeding DSTF exceed overall plant capacity, bypassing all treatment processes and is often stored in ponds located at the STP.

A summary of the frequently encountered limitations of Council's records for STP hydraulic capacities is presented in Table 10.8.

Table 10.8 STP common issues summary

Issue	Risk	Action
[Data Gap] DFTF and DSTF could not be found or distinguished for numerous STPs.	NA	Data retrieval for DFTF and DSTF for STPs where information not available

10.1.8 Sewer load analysis and issues

The sewer load analysis and issues identified during the analysis is summarised in tables for the following STP catchments. Full details of the sewer load analysis and issues identified for each STP catchment is available in Appendix C.

10.2 Bulahdelah STP

A summary of the SPS septicity issues is presented in Table 10.9.

Table 10.9 SPS septicity issue summary

SPS	Issue/comment	Risk[1]	Action
BU01	SPS rising main detention time presents a medium risk of septicity. SPS pumps directly to BU STP inlet works and presents risk of gas attack to receiving infrastructure.	Compliance Medium (6)	Undertake condition assessment of receiving infrastructure. Identify preventative or treatment measures as part of optioneering phase.

1: Risk level based on Council's Risk Management Framework

10.3 Coopernook STP

A summary of the SPS performance issues is presented in Table 10.10.

Table 10.10 SPS performance issue summary

SPS	Issue/comment	Risk[1]	Action
CO02	SPS duty flow is under capacity for 2051 ARI=5 PWWF events.	Environment Low (4)	Continue with business as usual activities, including planned I&I reduction, planning and design considerations when renewing pumps.
CO03	SPS duty flow is under capacity for 2021 ARI=5 PWWF events. SPS duty flow is under capacity for 2051 ARI=2 and ARI=5 PWWF events.	Environment Low (4)	Continue with business-as-usual activities, including planned I&I reduction, planning and design considerations when renewing pumps. Consider pump upgrade as part of SPS Pump Renewals Program.

1: Risk level based on Council's Risk Management Framework

A summary of the catchment network defects issues is presented in Table 10.11.

Table 10.11 Catchment network defects issue summary

Sewer catchment	Issue/comment	Risk[1]	Action
CO02 CO03	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) suggesting high baseline groundwater infiltration flows. This may be resultant of higher baseline flow due to ground water infiltration, however ET loading based on STP dry weather inflows does not confirm this. CO02 and CO03 pump runtimes in wet weather event selected for calibrating WSAA PWWFs are high (~20 hours). There is the potential that pumps are undersized or the network defects factor is low (contributing to infiltration).	Service delivery & infrastructure High (12)	Undertake an investigation of SPS (catchment-specific) inflow in ADWF to confirm loading per catchment. Interrogate pump performance in wet weather. This will be completed in optioneering phase. Pending outcome of this investigation, if baseline groundwater infiltration suspected to be present, target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).

A summary of the SPS septicity issues is presented in Table 10.12.

Table 10.12 SPS septicity issue summary

SPS	Issue	Risk[1]	Action
CO01	SPS rising main detention time presents a high risk of septicity. SPS pumps directly to CO STP inlet works and presents risk of gas attack to receiving infrastructure.	Compliance High (12)	Undertake condition assessment of receiving infrastructure. Identify preventative or treatment measures as part of optioneering phase.

SPS	Issue	Risk[1]	Action
CO04 CO05	SPS rising main detention time presents a medium risk of septicity. Receiving manhole is <50m from numerous sensitive receivers.	Compliance Medium (6)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS velocity issues is presented in Table 10.13.

Table 10.13 SPS velocity issue summary

SPS	Issue/comment	Risk[1]	Action
CO01 CO03	Rising main velocity is less than minimum flow velocity for slime stripping.	Service delivery & infrastructure High (12)	Investigate increasing the duty of pumps in SPS as part of pump renewals program to achieve minimum velocity.

1: Risk level based on Council's Risk Management Framework

10.4 Forster STP

A summary of the peaking factor discrepancy between the WSAA methodology and peak inflow into the STP is presented in Table 10.14.

Table 10.14 WSAA methodology and STP peak inflow peaking factor discrepancy issue summary

Scheme	Issue/comment	Risk[1]	Action
Forster Sewer	The actual peak wet weather flow of 29,871 kL/day as detailed in the relevant section of Appendix C equates to a peaking factor of 7.7. This specific rain event was greater than a 5-year ARI. The lower peaking factor than calculated for a 5-year ARI event (9.1) is attributed to overflows in the network.	Reputation Medium (8)	Continue with business-as-usual activities, including identifying overflow points in the network as part of business as usual, planned I&I reduction in sewer catchments, planning and design considerations when renewing pumps.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS performance issues is presented in Table 10.15.

Table 10.15 SPS performance issue summary

SPS	Issue/comment	Risk[1]	Action
PP07	SPS duty flow is under capacity for 2021 and 2051 ARI=2 and ARI=5 PWWF events. SPS collects all Pacific Palms catchments. All Pacific Palms catchments have low ADWF:PWWF ratios. SPS has ~ 20 minutes emergency storage in wet well.	NA[2]	Pacific Palms Emergency Storage project is currently in the construction phase and will provide capacity to accommodate PWWF loading.

SPS	Issue/comment	Risk[1]	Action
FO05	SPS duty flows are under capacity for 2051 ARI=2 and ARI=5 PWWF events. FO05 receives no upstream pumped flows. FO05 has a high ADWF:PWWF ratio.	Environment Low (4)	Target FO05 as a high priority catchment for I&I reduction in the short term (1-year). Re-assess pump station capacity following targeted I&I.
FO11	SPS duty flows are under capacity for 2021 ARI=5 PWWF events. SPS duty flows are under capacity for 2051 ARI=2 and ARI=5 PWWF events. FO11 receives no upstream pumped flows. FO11 has an acceptable ADWF:PWWF ratio.	Environment Low (4)	Continue with business-as-usual activities, including planning and design considerations when renewing pumps.

1: Risk level based on Council's Risk Management Framework

2: Issue has been eliminated as the actions required to address the risk is planned or underway.

A summary of the catchment network defects issues is presented in Table 10.16.

Table 10.16 Catchment network defects issue summary

Sewer catchment	Issue/comment	Risk[1]	Action
SM01 PP14 FO05 FO12 FO25 FO30	Catchments actual run times demonstrate network defects higher than WSAA range (>0.8) indicating high network defects contributing to inflow and infiltration.	Service delivery & infrastructure Medium (9)	Target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).
PP04 PP06 PP07 PP08 PP09 PP11 PP12 PP13 PP16 PP17 PP18 PP19	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) indicating high baseline groundwater infiltration flows. Council is of the understanding that Pacific Palms catchments do not have baseline groundwater infiltration due to shallow rock. Pacific Palms area has one of the lowest occupancy rates in the LGA (55%) (ProfileiD). Council has calibrated WSAA PWWFs using a rain event in July 2021 when COVID19 lockdown in place (i.e. restricted travel to holiday towns).	NA	Further investigation is required in optioneering phase to identify realistic PWWFs, occupancy rates and calibration factors for Pacific Palms catchments.

Sewer catchment	Issue/comment	Risk[1]	Action
FO32	FO32 pump station was not commissioned at the time of the rain event used to calibrate the WSAA methodology. FO29 pump details are no longer available on SCADA as SPS has been decommissioned. A network defects factor calibration was unable to be completed for FO32. In 2021, only 8 ETs (out of a catchment ultimate of 829 ETs) were connected to the network. Majority of the catchment is under development, commencing 2020. This development is expected to be relatively watertight.	NA	NA
Remaining Catchments	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) indicating high baseline groundwater infiltration flows. Forster STP ET loading based on STP dry weather inflows is within expected range (366L/ET/day). Multiple catchments in Forster area suggest high baseline infiltration. Many catchments indicate acceptable peaking factors in wet weather (within design range). It is expected that the impact of catchments with high baseline infiltration (such as Forster Keys area) on STP inflows is dampened due to over half of the 62 catchments not having high peak wet weather flows.		Undertake an investigation of SPS (catchment-specific) inflow in ADWF to confirm loading per catchment, for areas with known high groundwater table. This includes Tea Gardens, Forster Keys, Harrington and Tuncurry. This will be completed in optioneering phase. Pending outcome of this investigation, if baseline groundwater infiltration suspected to be present, target catchments as a high priority catchment for I&I reduction in the short term (1-3 years). If baseline groundwater infiltration not believed to be an issue, progress servicing strategy initiatives to improve the network.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS septicity issues is presented in Table 10.17.

Table 10.17 SPS septicity issue summary

SPS	Issue/comment	Risk[1]	Action
GP01 SM04 PP07	SPS rising main detention time presents a high risk of septicity. SPS pumps directly to FO STP inlet works and presents risk of gas attack to receiving infrastructure.	Compliance High (12)	Undertake condition assessment of receiving infrastructure. Identify preventative or treatment measures as part of optioneering phase.
SM02	SPS rising main detention time presents a high risk of septicity. Risk of septicity downgraded by 2051 with increased ADWF due to growth factors. Receiving manhole is away from sensitive receivers.	Compliance High (12)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.

SPS	Issue/comment	Risk[1]	Action
SM03 SM06	SPS rising main detention time presents a high risk of septicity. Receiving manhole is away from sensitive receivers.	Compliance High (12)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.
PP19 FO08 FO30	SPS rising main detention time presents a high risk of septicity. PP19 receiving manhole is 200m from the nearest sensitive receiver. FO08, FO30 receiving manholes are <50m from numerous sensitive receivers.	Compliance High (12)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.
FO32	SPS rising main detention time presents a high risk of septicity. Risk of septicity downgraded by 2026 with increased ADWF due to progress of planned development.	Compliance High (12)	Confirm presence and proper function of sewer vent stack. Monitor for corrosion at receiving manhole as part of ongoing maintenance program as development progresses until septicity risk is downgraded to low.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS velocity issues is presented in Table 10.18.

Table 10.18 SPS velocity issue summary

SPS	Issue/comment	Risk[1]	Action
FO02	Rising main velocity through shared DN225 is less than minimum flow velocity for slime stripping. SPS FO03 meets minimum flow velocity for slime stripping.	NA	Nil.
SM03 PP03 PP07 FO08 FO11 FO20 FO22 FO24 FO25	Rising main velocity is less than minimum flow velocity for slime stripping.	Service delivery and infrastructure High (12)	Investigate increasing the duty of pumps in SPS as part of pump renewals program to achieve minimum velocity.
FO12	Rising main velocity exceeds maximum flow velocity of 3.5m/s. Two new pumps have been recently procured (awaiting installation). Expected velocity for new pumps is 1.57m/s.	NA[2]	Nil.
FO32	Rising main velocity is less than minimum flow velocity for slime stripping. Planned pump upgrade to increase from 23 l/s (current) to 32 l/s as development in the catchment continues. When duty increased, rising main velocity matches minimum velocity to control slimes.	Service delivery and infrastructure High (12)	Continue with planned pump upgrade at development trigger point.

1: Risk level based on Council's Risk Management Framework

2: Issue has been eliminated as the actions required to address the risk is planned or underway.

10.5 Gloucester STP

A summary of the SPS performance issues is presented in Table 10.19.

Table 10.19 SPS performance issue summary

SPS	Issue/comment	Risk[1]	Action
GL01	SPS duty flow is under capacity for 2021 and 2051 ARI=5 PWWF events. SPS duty flow is under capacity for 2051 ARI=2 PWWF events. Several upstream catchments have network defect factors outside of WSAA range, indicating high network defects (GL01, GL04, GL06) and high baseline groundwater infiltration (GL05).	Environment Low (4)	Continue with business-as-usual activities, including planned I&I reduction in Gloucester catchments, planning and design considerations when renewing pumps.
GL03	SPS duty flow is under capacity for 2021 and 2051 ARI=5 PWWF events. SPS duty flow is under capacity for 2021 and 2051 ARI=2 PWWF events. GL03 receives pumped flows from GL05. GL03 has a low network defect factor below WSAA range, indicating high baseline groundwater infiltration.	Environment Medium (9)	Target GL05 for I&I reduction in the short term (1-3 years). Reassess pump station capacity for ARI=2 and ARI=5 following I&I rectification. Consider pump upgrade as part of SPS Pump Renewals Program.
GL05 GL06	SPS is under capacity for 2051 ARI=5 PWWF events.	Environment Low (2)	Continue with business-as-usual activities, including planned I&I reduction in catchments, planning and design considerations when renewing pumps.

1: Risk level based on Council's Risk Management Framework

A summary of the catchment network defects issues is presented in Table 10.20.

Table 10.20 Catchment network defects issue summary

Sewer Catchment	Issue/comment	Risk[1]	Action
GL05	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) indicating high baseline groundwater infiltration flows.	Service delivery & infrastructure High (12)	Target catchment as a high priority catchment for I&I reduction in the short term (1-3 years).
GL01 GL04 GL06	Catchments actual run times demonstrate network defects higher than WSAA range (>0.8) indicating high network defects contributing to inflow and infiltration.	Service delivery & infrastructure Medium (9)	Target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).

1: Risk level based on Council's Risk Management Framework

A summary of the SPS septicity issues is presented in Table 10.21.

Table 10.21 SPS septicity issue summary

SPS	Issue	Risk[1]	Action
GL05	Rising main detention times presents a high risk of septicity in 2021 and 2051.	GL05	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.

1: Risk level based on Council's Risk Management Framework

10.6

10.6 Hallidays Point STP

A summary of the peaking factor discrepancy between the WSAA methodology and peak inflow into the Hallidays Point STP is presented in Table 10.22.

Table 10.22 WSAA methodology and STP peak inflow peaking factor discrepancy issue summary

Scheme	Issue/comment	Risk[1]	Action
Hallidays Point Sewer	The actual peak wet weather flow of 19,378 kL/day as detailed in the relevant section of Appendix C equates to a peaking factor of 6.4. This specific rain event was greater than a 5-year ARI. The lower peaking factor than calculated for a 5-year ARI event (9.8) may be attributed to overflows in the network.	Hallidays Point Sewer	Continue with business as usual activities, including identifying overflow points in the network as part of business as usual, planned I&I reduction in sewer catchments, planning and design considerations when renewing pumps. Undertake capital works projects, including HP SPS 13 construction.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS performance issues is presented in Table 10.23.

Table 10.23 SPS performance issue summary

SPS	Issue/comment	Risk[1]	Action
HP01	SPS under capacity for 2021 and 2051 ARI=5 wet weather events. HP01 collects from HP02, HP03, HP05, HP07, HP08 and HP09. Several catchments have network defect factors outside of WSAA range, suggesting high network defects (HP02) and high baseline groundwater infiltration (HP08).	Environment Medium (9)	Determine root cause of pump capacity exceedance (i.e. pump deterioration, I&I, undersized) and action accordingly. Continue with business-as-usual activities, including planned I&I reduction.
HP03	SPS under capacity for 2051 ARI=2 and ARI=5 wet weather events. HP03 collects from HP09, HP07, HP05, HP08. All catchments have an acceptable WSAA network defect factor except for HP08.	Environment Low (4)	Determine root cause of pump capacity exceedance (i.e. pump deterioration, I&I, undersized) and action accordingly. Target HP08 as a high priority catchment for I&I reduction in the short term (1-3 years).
HP05	SPS under capacity for 2051 ARI=2 wet weather events. SPS under capacity for 2021 and 2051, ARI=5 wet weather events. HP05 collects from HP08. HP08 has a lower network defect factor than the acceptable WSAA range.	Environment Medium (9)	Determine root cause of pump capacity exceedance (i.e. pump deterioration, I&I, undersized) and action accordingly. Target HP08 as a high priority catchment for I&I reduction in the short term (1-3 years).
HP06	SPS under capacity for 2021 ARI=2 wet weather events. SPS under capacity for 2021 and 2051, ARI=5 wet weather events. Construction of HP13 will take load off HP06 (all NA catchments, HP11 and HP12). New capacity exceeded in ~ 2040 for ARI=5 wet weather events.	Environment Medium (9)	Complete construction of HP SPS 13. Continue with business-as-usual activities, including planned I&I reduction. Consider upgrading pumps as part of SPS Pump Renewals program as new capacity exceedance approaches.
HP10	SPS under capacity for 2021 ARI=2 and ARI=5 wet weather events. Construction of HP13 will take load from HP10. HP10 capacity satisfactory for 2051 ARI=2 and ARI=5 wet weather events.	NA[2]	Complete construction of HP SPS 13.

SPS	Issue/comment	Risk[1]	Action
HP11	SPS under capacity for 2021 and 2051 ARI=2 and ARI=5 wet weather events. Construction of HP13 will take load from HP11 and has capacity after HP143 commissioning. HP11 will only receive flows from HP12 (very low flows). New capacity reached in ~ 2030 for ARI=5 and ~2040 for ARI=2 wet weather events. HP11 has low network defect factor, outside WSAA range.	Environment Medium (9)	Complete construction of HP SPS 13. Target HP11 as a high priority catchment for I&I reduction in the short term (1-3 years). Consider upgrading pumps as part of SPS Pump Renewals program as new capacity exceedance approaches.
NA08 NA11 NA12 HP13	NA08 and NA11 under capacity for 2021 ARI=5 wet weather events. SPS's under capacity for 2051 ARI=2 and ARI=5 wet weather events. NA12 and HP13 under capacity for 2051 ARI=2 and ARI=5 wet weather events. NA08 has peer to peer comms to hold back flows from the STP and WTP in wet weather, when the high well level alarm is triggered. Holding this flow back in wet weather provides capacity in an ARI=2 and ARI=5 wet weather event for all SPSs. NA01, NA02, NA03, NA04, NA05, NA08, NA09, NA11, NA12 all have very low network defect factors, outside WSAA range, indicating high groundwater infiltration.	NA[2]	Target NA01, NA02, NA03, NA04, NA05, NA08, NA09, NA11, NA12 as high priority catchments for I&I reduction in the short term (1-3 years). Continue with peer-to-peer comms operational philosophy for NA08.
NA13	SPS under capacity for 2021 and 2051, ARI=2 wet weather events. SPS under capacity for 2021 and 2051, ARI=5 wet weather events. NA13 is the pump station at the NA STP. The high-capacity ratios are not a concern as the STP has storage for attenuate flows in wet weather events.	NA[2]	Nil.
HP02 HP07 HP08 HP09 NA09 TU06	Multiple SPS are under capacity for 2051 PWWF flows.	Environment Low (3)	Continue with business-as-usual activities, including planned I&I reduction in catchments, planning and design considerations when renewing pumps.

1: Risk level based on Council's Risk Management Framework

2: Issue has been eliminated as the actions required to address the risk is planned or underway.

A summary of the catchment network defects issues is presented in Table 10.24.

Table 10.24 Catchment network defects issue summary

Sewer Catchment	Issue/comment	Risk[1]	Action
Multiple Catchments	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) indicating high baseline groundwater infiltration flows. Tuncurry area is known to have high baseline groundwater infiltration. Majority of catchments with lower network defects factors are the Tuncurry area. Eight of twelve Nabiac catchments suggest high baseline groundwater infiltration.	Service delivery & infrastructure High (12)	Undertake an investigation of SPS (catchment-specific) inflow in ADWF to confirm loading per catchment. Nabiac catchments with low network defects factors are located close to the Wallamba River. Interrogate Tuncurry flows into Hallidays Point STP using TU23 rising main flow meter. This will be completed in optioneering phase. Pending outcome of this investigation, if baseline groundwater infiltration suspected to be present, target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).
HP11	Catchments actual run times demonstrate network defects higher than WSAA range (>0.8) indicating high network defects contributing to inflow and infiltration	Service delivery & infrastructure Medium (9)	Target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).

1: Risk level based on Council's Risk Management Framework

A summary of the SPS septicity issues is presented in Table 10.25.

Table 10.25 SPS septicity issue summary

SPS	Issue/comment	Risk[1]	Action
HP07	Council has received numerous odour complaints in the vicinity of receiving manhole and downstream gravity reticulation.	Reputation Medium (6)	Investigate potential septicity issue at HP07 and/or upstream catchments. Identify preventative or treatment measures as part of optioneering phase.
HP13	SPS rising main detention time presents a medium risk of septicity. SPS pumps directly to HP STP inlet works and presents risk of gas attack to receiving infrastructure.	Compliance Medium (6)	Undertake condition assessment of receiving infrastructure. Identify preventative or treatment measures as part of optioneering phase.
TU23	SPS rising main detention time presents a high risk of septicity. SPS pumps directly to HP STP inlet works and presents risk of gas attack to receiving infrastructure.	Compliance High (12)	Undertake condition assessment of receiving infrastructure. Identify preventative or treatment measures as part of optioneering phase.
TU17 TU22	SPS rising main detention time presents a high risk of septicity. TU17 receiving manhole <50m from nearest sensitive receiver. TU22 receiving manhole <50m from numerous sensitive receivers.	Compliance High (12)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.

SPS	Issue/comment	Risk[1]	Action
TU18	SPS rising main detention time presents a medium risk of septicity. TU18 receiving manhole <50m from numerous sensitive receivers.	Compliance Medium (6)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS velocity issues is presented in Table 10.26.

Table 10.26 SPS velocity issue summary

SPS	Issue/comment	Risk[1]	Action
NA13	Pump station NA13 is part of the Nabiac STP and pumps effluent to the inlet works. NA13 pumps a short distance and is not an issue.	NA[2]	Nil.
HP05 TU05 TU18 TU22	Rising main velocity is less than minimum sedimentation cleansing velocity of 0.9 m/s and minimum velocity to control slimes.	Service delivery & infrastructure High (12)	Investigate increasing the duty of pumps in SPS as part of pump renewals program to achieve minimum velocity

1: Risk level based on Council's Risk Management Framework

2: Issue has been eliminated as the actions required to address the risk is planned or underway

10.7 Harrington STP

For projections, new ET in non-vacuum schemes is given a hydraulic loading of 1,193 L/ET/day, while ET in vacuum schemes are given 355 L/ET/day. Council plans to address the issue of infiltration in Harrington as part of business as usual with a dedicated I&I reduction team. As the level of inflow reduction achievable is unknown, the worst-case scenario flow figures shall be utilized in this assessment.

A summary of the ADWF issue is presented in Table 10.27.

Table 10.27 ADWF and hydraulic loading issue summary

Catchment	Issue/comment	Risk[1]	Action
Multiple Catchments	Hydraulic loading for non-vacuum catchments is significantly higher than Council's adopted design figure. High hydraulic loading is attributed to groundwater infiltration intensified by high water table and network defects. High hydraulic loading is triggering substantial infrastructure upgrades earlier than expected resulting in increased servicing cost per ET/EP.	Finance High (12) Reputation Medium (6)	Continue with business-as-usual activities, including targeted I&I reduction in Harrington catchments. In the short term (1-year). Camera investigation or after hours (during the night) manhole inspections are more applicable than smoke testing for investigating baseline groundwater infiltration.

Catchment	Issue/comment	Risk[1]	Action
HR09 (Vacuum Catchment)	The hydraulic loading for vacuum catchment HR09 is 308 L/ET/day. HR09 is Harrington Waters estate. There is the potential that this catchment has lower occupancy rates than obtained from ProfileiD. There is also the potential that this loading is a reasonable representative of sewer loading for this catchment. Harrington Waters is a recent development, with the vacuum catchment expected to be relatively watertight. This sewer loading is not unrealistic for water consumption rates of 180 L/EP/day, which is observed by customers across Council's water supply areas.	TBD	Interrogate ET occupancy for HR09 with 2021 Census data. This data is planned to be released from June 2022.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS performance issues is presented in Table 10.28.

Table 10.28 SPS performance issue summary

SPS	Issue/comment	Risk[1]	Action
HR03	Multiple SPS are under capacity for 2051 PWWF flows.	Environment Low (2)	Continue with business-as-usual activities, including planned I&I reduction in catchments, planning and design considerations when renewing pumps.
CH02	SPS under capacity for 2021 and 2051 ARI=2 wet weather events. SPS under capacity for 2021 and 2051 ARI=5 wet weather events. CH02 receives pumped flows from a low-pressure network.	Environment Medium (9)	Determine root cause of pump capacity exceedance (i.e. pump deterioration, I&I, undersized) and action accordingly.
HR01	SPS under capacity for 2051 ARI=5 wet weather events. HR01 receives pumped flows from HR02, HR03, HR04, HR05, HR06 and HR07. Several catchments have network defect factors outside of WSAA range, indicating high network defects (HR06) and high baseline groundwater infiltration (HR02, HR03, HR04, HR05, HR07).	Environment Low (3)	Target HR02, HR03, HR04, HR05, HR06, HR07 as high priority catchments for I&I reduction in the short term (1-3 years). Reassess pump station capacity following targeted I&I.

1: Risk level based on Council's Risk Management Framework

A summary of the catchment network defects issues is presented in Table 10.29.

Table 10.29 Catchment network defects issue summary

Sewer catchment	Issue/comment	Risk[1]	Action
Multiple Catchments	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) indicating high baseline groundwater infiltration flows. Hydraulic loading for non-vacuum catchments is significantly higher than Council's adopted design figure. High hydraulic loading is attributed to groundwater infiltration intensified by high water table and network defects.	Service delivery & infrastructure High (12)	Target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).
HR06	Catchment actual run times demonstrate network defects higher than WSAA range (>0.8) indicating high network defects contributing to inflow and infiltration	Service delivery & infrastructure Medium (9)	Target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).

1: Risk level based on Council's Risk Management Framework

A summary of the SPS septicity issues is presented in Table 10.30.

Table 10.30 SPS septicity issue summary

SPS	Issue	Risk[1]	Action
CH01	SPS rising main detention time presents a high risk of septicity. SPS pumps directly to HR STP inlet works and presents risk of gas attack to receiving infrastructure.	Compliance High (12)	Undertake condition assessment of receiving infrastructure. Identify preventative or treatment measures as part of optioneering phase.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS velocity issues is presented in Table 10.31.

Table 10.31 SPS velocity issue summary

SPS	Issue/comment	Risk[1]	Action
CH02 HR07	Rising main velocity is less than minimum sedimentation cleansing velocity of 0.9 m/s and minimum velocity to control slimes.	Service delivery & infrastructure High (12)	Investigate increasing the duty of pumps in SPS as part of pump renewals program to achieve minimum velocity.

1: Risk level based on Council's Risk Management Framework

Design ARI=2 and ARI=5 PWWF to Harrington STP could not be compared against the hydraulic capacities of the plant as design documentation could not be found via a search of Council records. This has been flagged as an issue in Section 10.1.7.9.

A risk assessment on the Harrington STP issues is presented in Table 10.32.

Table 10.32 STP capacity issue

STP	Issue/comment	Risk[1]	Action
Harrington	Forecast hydraulic load on the plant will exceed the design capacity between 2032 and 2036 Forecast biological load on the plant will exceed the design capacity between 2036 and 2044	Financial Extreme (20)	This issue requires further consideration in the strategic options section of the IWCM.
Harrington	The STP does not have grit removal at the inlet works. Grit is accumulating at the base of the oxidation tank and is reducing the aeration depth, impacting effluent quality.	Financial Extreme (20)	This issue requires further consideration in the strategic options section of the IWCM.

1: Risk level based on Council's Risk Management Framework

10.8 Hawks Nest STP

A summary of the peaking factor discrepancy between the WSAA methodology and peak inflow into the STP is presented in Table 10.33.

Table 10.33 WSAA methodology and STP peak inflow peaking factor discrepancy issue summary

Scheme	Issue/comment	Risk[1]	Action
Tea Gardens Hawks Nest Sewer	The actual peak wet weather flow of 7,393 kL/day as detailed in the relevant section of Appendix C equates to a peaking factor of 6.3. This specific rain event was greater than a 5-year ARI. The lower peaking factor than calculated for a 5-year ARI event (8.0) is attributed to overflows in the network. There are known overflows in wet weather events less than the minimum design containment factor.	Reputation Medium (8)	Continue with business-as-usual activities, including identifying overflow points in the network as part of business as usual, planned I&I reduction in sewer catchments, planning and design considerations when renewing pumps. Undertake capital works projects, including Tea Gardens Rising Main project.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS performance issues is presented in Table 10.34.

Table 10.34 SPS performance issue summary

SPS	Issue/comment	Risk[1]	Action
TG04 TG09	SPS under capacity for 2021 and 2051 ARI=2 wet weather events. SPS under capacity for 2021 and 2051 ARI=5 wet weather events.	Environment Medium (9)	Tea Gardens rising main project (currently in concept phase) will reduce load on TG04. Continue with business as usual activities, including planned I&I reduction in catchments, planning and design considerations when renewing pumps.

1: Risk level based on Council's Risk Management Framework

A summary of the catchment network defects issues is presented in Table 10.35.

Table 10.35 Catchment network defects issue summary

Sewer catchment	Issue/comment	Risk[1]	Action
Multiple Catchments	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) resulting in a dampened PWWF/ADWF ratio. This may be resultant of higher baseline flow due to ground water infiltration, however ET loading based on STP dry weather inflows does not confirm this. Tea Gardens catchments are known to respond poorly to wet weather events with several recurring overflows in the network.	Service delivery & infrastructure High (12)	Undertake an investigation of SPS (catchment-specific) inflow in ADWF to confirm loading per catchment, for areas with known high groundwater table. This includes Tea Gardens, Forster Keys, Harrington and Tuncurry. This will be completed in optioneering phase. Pending outcome of this investigation, if baseline groundwater infiltration suspected to be present, target catchments as a high priority catchment for I&I reduction in the short term (1-3 years). If baseline groundwater infiltration not believed to be an issue, progress servicing strategy initiatives to improve the network. For Hawks Nest Tea Gardens, this is the Tea Gardens Rising Main project.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS odour/septicity issues is presented in Table 10.36.

Table 10.36 SPS septicity issue summary

SPS	Issue	Risk[1]	Action
TG10 TG11	SPS rising main detention time presents a high risk of septicity. Receiving manholes <50m from numerous sensitive receivers. Compounding TG10 and TG11 high septicity risk may result in further downstream knock on effects.	Compliance High (12)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS velocity issues is presented in Table 10.37.

Table 10.37 SPS velocity issue summary

SPS	Issue/comment	Risk[1]	Action
HN04 HN05 TG05	Rising main velocity is less than minimum sedimentation cleansing velocity of 0.9 m/s and minimum velocity to control slimes.	Service delivery and infrastructure High (12)	Investigate increasing the duty of pumps in SPS as part of pump renewals program to achieve minimum velocity
TG13	Velocity exceeds 3.5m/s. TG SPS 13 currently pumps to TG SPS 09. Both these pump stations are located adjacent each other, at the same site.	NA[2]	The operation of the TG SPS 13 rising main will change upon the completion of the new TG SPS rising main. This project is currently in the concept phase. TG SPS 13 will be redirected to the new transfer pump station, which will be located adjacent TG SPS 13 (in the same building). The rising main from TG SPS 13 to the new TPS will be designed to satisfy velocity requirements.

1: Risk level based on Council's Risk Management Framework

2: Issue has been eliminated as the actions required to address the risk is planned or underway.

A risk assessment on the HN STP issues is presented in Table 10.38.

Table 10.38 STP capacity issue

STP	Issue/comment	Risk[1]	Action
Hawks Nest	Forecast biological treatment load on the plant was exceeded from 2016 for PDWF (holiday periods). Forecast hydraulic load on the plant has exceeded the design capacity for ADWF since 2016 and PDWF since earlier than 2015. Forecast hydraulic load on the plant is presumed to have exceeded the design capacity for PWWF since earlier than 2015.	Financial Extreme (20)	The Hawks Nest STP upgrade (Stage 2 and 3) is currently in the detailed design phase. This will provide adequate biological and hydraulic treatment up to the 2050 design horizon.

1: Risk level based on Council's Risk Management Framework

10.9 Lansdowne STP

Table 10.39 WSAA methodology and STP peak inflow peaking factor discrepancy issue summary

Scheme	Issue/comment	Risk[1]	Action
Lansdowne Sewer	The actual peak wet weather flow of 691 kL/day as detailed in section 0 equates to a peaking factor of 14.9. This specific rain event was greater than a 5-year ARI. The lower peaking factor than calculated for a 5-year ARI event (21.1) is attributed to overflows in the network.	Reputation Medium (8)	Continue with business-as-usual activities, including identifying overflow points in the network as part of business as usual, planned I&I reduction in sewer catchments, planning and design considerations when renewing pumps.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS performance issues is presented in Table 10.40.

Table 10.40 SPS performance issue summary

SPS	Issue/comment	Risk[1]	Action
LA01	SPS under capacity for 2021 ARI=5 peak wet weather flow events. SPS under capacity for 2051 ARI=2 and ARI=5 peak wet weather flow events. LA01 receives flows from LA02 and LA03. All three catchments have network defect factors lower than WSAA design range, suggesting high baseline groundwater infiltration.	Environment Low (4)	Target LA01, LA02 and LA03 as high priority catchments for I&I reduction in the short term (1-3 years).

1: Risk level based on Council's Risk Management Framework

A summary of the catchment network defects issues is presented in Table 10.41.

Table 10.41 Catchment network defects issue summary

Sewer Catchment	Issue/comment	Risk[1]	Action
LA02 LA03	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) indicating high baseline groundwater infiltration flows. This may be resultant of higher baseline flow due to ground water infiltration, however ET loading based on STP dry weather inflows does not confirm this.	Service delivery & infrastructure High (12)	Undertake an investigation of SPS (catchment-specific) inflow in ADWF to confirm loading per catchment. This will be completed in optioneering phase. Pending outcome of this investigation, if baseline groundwater infiltration suspected to be present, target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).

1: Risk level based on Council's Risk Management Framework

A summary of the SPS septicity issues is presented in Table 10.42.

Table 10.42 SPS septicity issue summary

SPS	Issue/comment	Risk[1]	Action
LA03	SPS rising main detention time presents a medium risk of septicity. Receiving manholes <50m from nearest sensitive receiver.	Compliance Medium (6)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.

1: Risk level based on Council's Risk Management Framework

10.10 Manning Point STP

A summary of the peaking factor discrepancy between the WSAA methodology and peak inflow into the STP is presented in Table 10.43.

Table 10.43 WSAA methodology and STP peak inflow peaking factor discrepancy issue summary

Scheme	Issue/comment	Risk[1]	Action
Manning Point	Unable to calibrate PWWF estimation method due to insufficient operational data i.e. pump run-times. Estimated PWWF for design rainfall events may be under or over-estimated.	Compliance Low (4)	Implement discreet monitoring systems and data logging for each unique sewage transport system (i.e. flow, pump run-time).

1: Risk level based on Council's Risk Management Framework

A summary of the SPS performance issues is presented in Table 10.44.

Table 10.44 SPS performance issue summary

SPS	Issue/Comment	Risk[1]	Action
MP Vacuum MP Pressure	Data gaps for pressurized/vacuum sewage reticulation systems (i.e. discreet flow monitoring, pump capacity)	Service Delivery and Infrastructure Medium (6)	Identify and fill all data gaps relevant to pressure /vacuum sewage reticulation design for existing infrastructure.

1: Risk level based on Council's Risk Management Framework

10.11 Old Bar STP

A summary of the peaking factor discrepancy between the WSAA methodology and peak inflow into the STP is presented in Table 10.45.

Table 10.45 WSAA methodology and STP peak inflow peaking factor discrepancy issue summary

Scheme	Issue/comment	Risk[1]	Action
Old Bar Sewer	The actual peak wet weather flow of 10,606 kL/day as detailed in the relevant section of Appendix C equates to a peaking factor of 12.5. This specific rain event was greater than a 5-year ARI. This peaking factor approximates estimated PWWF from an ARI=5 wet weather event (10.7). This is attributed to overflows in the network.	Reputation Medium (8)	Continue with business-as-usual activities, including identifying overflow points in the network as part of business as usual, planned I&I reduction in sewer catchments, planning and design considerations when renewing pumps. Undertake capital works projects, including OB SPS 08.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS performance issues is presented in Table 10.46.

Table 10.46 SPS performance issue summary

SPS	Issue/comment	Risk[1]	Action
OB03 OB04 OB05 OB06	Multiple SPS are under capacity for 2051, ARI=5 peak wet weather flow events.	Environment Low (2)	Continue with business-as-usual activities, including planned I&I reduction in catchments, planning and design considerations when renewing pumps.
OB07	SPS under capacity for 2051, ARI=2 peak wet weather flow events.	Environment Low (3)	Continue with business-as-usual activities, including planned I&I reduction in catchments, planning and design considerations when renewing pumps. Consider upgrading the duty capacity of OB07 to cater for ARI=2 wet weather events once SPS OB08 is commissioned.

1: Risk level based on Council's Risk Management Framework

2: Issue has been eliminated as the actions required to address the risk is planned or underway.

A summary of the catchment network defects issues is presented in Table 10.47.

Table 10.47 Catchment network defects issue summary

Sewer catchment	Issue/comment	Risk[1]	Action
OB04 OB07 OB09	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) indicating high baseline groundwater infiltration flows	Service delivery & infrastructure High (12)	Undertake an investigation of SPS (catchment-specific) inflow in ADWF to confirm loading per catchment. This will be completed in optioneering phase. Pending outcome of this investigation, if baseline groundwater infiltration suspected to be present, target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).
OB02	Catchment actual run times demonstrate network defects higher than WSAA range (>0.8) indicating high network defects contributing to inflow and infiltration	Service delivery & infrastructure Medium (9)	Target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).

1: Risk level based on Council's Risk Management Framework

A summary of the SPS septicity issues is presented in Table 10.48.

Table 10.48 SPS septicity issue summary

SPS	Issue/comment	Risk[1]	Action
OB04	SPS rising main detention time presents a medium risk of septicity.	Compliance Medium (6)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.
OB07	SPS rising main detention time presents a high risk of septicity. SPS pumps directly to OB STP inlet works and presents risk of gas attack to receiving infrastructure. Risk of septicity downgraded upon the completion of SPS OB08 and connection to OB07.	Compliance High (12)	Confirm presence and proper function of sewer vent stack. Monitor for corrosion at receiving manhole as part of ongoing maintenance program as development progresses until septicity risk is downgraded to low.
OB09	SPS rising main detention time presents a high risk of septicity. SPS pumps directly to OB STP inlet works and presents risk of gas attack to receiving infrastructure.	Compliance High (12)	Undertake condition assessment of receiving infrastructure. Identify preventative or treatment measures as part of optioneering phase.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS velocity issues is presented in Table 10.49.

Table 10.49 SPS velocity issue summary

SPS	Issue/comment	Risk[1]	Action
OB05 OB07 OB09	SPS OB07 rising main velocity presents a high risk of solids accumulation, due to the duty flow of the pump station and the diameter of the rising main. Future SPS OB08 will pump into OB07. OB08 will also collect flow from OB03, which currently pumps to OB01 (being redirected). The additional flow from OB08 to OB07 shall require a pump upgrade in OB07.	Service delivery & infrastructure High (12)	Continue with the planned construction of SPS OB08 and redirection of SPS OB03. This will trigger an upgrade of SPS OB07 pumps.

1: Risk level based on Council's Risk Management Framework

A risk assessment on the OB STP issues is presented in Table 10.50.

Table 10.50 STP Capacity Issue

STP	Issue/Comment	Risk[1]	Action
Old Bar	Forecast hydraulic load on the plant will exceed the design capacity between 2028 and 2033 Forecast biological load on the plant will exceed the design capacity between 2032 and 2039	Financial Extreme (20)	This issue requires further consideration in the strategic options section of the IWCM.

1: Risk level based on Council's Risk Management Framework

10.12 Stroud STP

A summary of the peaking factor discrepancy between the WSAA methodology and peak inflow into the STP is presented in Table 10.51.

Table 10.51 WSAA methodology and STP peak inflow peaking factor discrepancy issue summary

Scheme	Issue/comment	Risk[1]	Action
Stroud Sewer	The actual peak wet weather flow of 1,917 kL/day as detailed in the relevant section of Appendix C equates to a peaking factor of 14.0. This specific rain event was greater than a 5-year ARI. This peaking factor approximates estimated PWWF from an ARI=5 wet weather event (12.2). This is attributed to overflows in the network.	Reputation Medium (8)	Continue with business-as-usual activities, including identifying overflow points in the network as part of business as usual, planned I&I reduction in sewer catchments, planning and design considerations when renewing pumps.

1: Risk level based on Council's Risk Management Framework

A summary of the catchment network defects issues is presented in Table 10.52.

Table 10.52 Catchment network defects issue summary

Sewer catchment	Issue/comment	Risk[1]	Action
ST01 ST02 ST03	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) indicating high baseline groundwater infiltration flows. This may be resultant of higher baseline flow due to ground water infiltration, however ET loading based on STP dry weather inflows does not confirm this.	Service delivery & infrastructure High (12)	Undertake an investigation of SPS (catchment-specific) inflow in ADWF to confirm loading per catchment. This will be completed in optioneering phase. Pending outcome of this investigation, if baseline groundwater infiltration suspected to be present, target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).

1: Risk level based on Council's Risk Management Framework

A summary of the pump run time issues for ST01 and ST02 are presented in Section 1.1.7.4. The summary of pump run time issues for ST03 is presented in Table 10.53, as this case is unique to the general pump run-time discrepancies observed across sewer catchments.

Table 10.53 Pump run-time issue summary

Sewer catchment	Issue/comment	Risk[1]	Action
ST03	ST03 pump runtimes vary considerably in ADWF. ST03 is a small catchment with low ETs (12). It is understandable that run times are peaky, however a run time of 5.5 hours requires investigation.	Compliance Low (4)	Complete drop tests and inspections of the SPS as part of Council's scheduled maintenance program to confirm duty flow and condition of pumps and wet well. Based on outcome of drop test and inspection, actions may include pump renewal or overhaul or SPS well maintenance or I&I reduction

1: Risk level based on Council's Risk Management Framework

A summary of the SPS detention time issues is presented in Table 10.54.

Table 10.54 SPS detention time issue summary

SPS	Issue/comment	Risk[1]	Action
ST01	SPS rising main detention time presents a high risk of septicity. SPS pumps directly to STP inlet works and presents risk of gas attack to receiving infrastructure.	Compliance High (12)	Undertake condition assessment of receiving infrastructure. Identify preventative or treatment measures as part of optioneering phase.
ST03	SPS rising main detention time presents a high risk of septicity. Receiving manhole <50m from nearest sensitive receiver.	Compliance High (12)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.

1: Risk level based on Council's Risk Management Framework

10.13 Taree (Dawson) STP

A summary of the peaking factor discrepancy between the WSAA methodology and peak inflow into the STP is presented in Table 10.55.

Table 10.55 WSAA methodology and STP peak inflow peaking factor discrepancy issue summary

Scheme	Issue/comment	Risk[1]	Action
Dawson Sewer	The actual peak wet weather flow of 31,953 kL/day as detailed in the relevant section of Appendix C equates to a peaking factor of 8.9. This specific rain event was greater than a 5-year ARI. The lower peaking factor than calculated for a 5-year ARI event (17.5) is attributed to overflows in the network.	Reputation Medium (8)	Continue with business-as-usual activities, including identifying overflow points in the network as part of business as usual, planned I&I reduction in sewer catchments, planning and design considerations when renewing pumps. Undertake capital works projects, including Dawson inlet works balance tank and Cundletown Rising Main projects.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS performance issues is presented in Table 10.56.

Table 10.56 SPS performance issue summary

SPS	Issue/comment	Risk[1]	Action
TA01	Based on existing SPS operating philosophy, SPS is under capacity when inflow exceeds duty flow of WW2# + WW#1 + OW. WW#2 pump duty flow is restricted due to downstream SPS TA06 capacity. SPS relies on wet weather storage at TA STP for 2021 ARI=2 PWWF events. SPS is under capacity for 2051 ARI=5 PWWF events. TA01 and upstream catchments experience high wet weather peaking factors. SPS has recently experienced overflows in response to rainfall events that may be less intense than the design ARI=2 rainfall event.	Environment Low (2)	SPS theoretically has enough capacity to handle wet weather flows until 2050. Further investigation of recent overflows required. Increase WW#2 pump duty flow to SPS TA06 upon completion of Cundletown Rising Main Project. Continue with business-as-usual activities, including planned I&I reduction in Dawson catchments, planning and design considerations when renewing pumps. Further assessment required to be completed during optioneering phase.
TA06	SPS is under capacity for 2051 ARI=2 and ARI=5 wet weather flow events. Cundletown Rising Main project will take load off SPS. Flows from SPS TA01 will increase to take up capacity. Ultimate SPS TA01 strategy may significantly impact SPS. A review of SPS pump configuration and operating philosophy is underway with the intent to increase duty flow.	Environment Low (4)	Further assessment required to be completed during optioneering phase with considerations to SPS TA01 actions. Continue with business-as-usual activities, including planned I&I reduction in Dawson catchments, planning and design considerations when renewing pumps.
TA11 TA12 TA19 TI04	SPS under capacity for 2021 ARI=2 PWWF events. Cundletown Rising Main project will take load off TA11	Environment Medium (9)	Target SPS as a high priority catchment for I&I reduction in the short term (1 year). Consider upgrading TA12 capacity as part of the Cundletown Rising Main project. This capacity issue requires further consideration in the strategic options section of the IWCM.

SPS	Issue/comment	Risk[1]	Action
TA02 TA20 TI01 TS03 TS04	SPS under capacity for 2051 ARI=2 peak wet weather flow events.	Environment Low (3)	Continue with business-as-usual activities, including planned I&I reduction in Dawson catchments, planning and design considerations when renewing pumps.
TA03 TA18 TA21 TS01	SPS under capacity for 2051 ARI=5 peak wet weather flow events.	Environment Low (2)	Continue with business-as-usual activities, including planned I&I reduction in Dawson catchments, planning and design considerations when renewing pumps.

1: Risk level based on Council's Risk Management Framework

A summary of the catchment network defects issues is presented in Table 10.57.

Table 10.57 Catchment network defects issue summary

Sewer catchment	Issue/comment	Risk[1]	Action
Multiple Catchments	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) indicating high baseline groundwater infiltration flows. Dawson STP ET loading based on STP dry weather inflows is within expected range (369L/ET/day). Nine catchments in Taree (out of a total 34) indicate high baseline infiltration. Many catchments indicate acceptable peaking factors in wet weather (within design range). There is potential that the impact of catchments with high baseline infiltration on STP inflows is dampened, as about 25% of the Dawson catchments not indicating baseline groundwater infiltration.	Service delivery & infrastructure High (12)	Undertake an investigation of SPS (catchment-specific) inflow in ADWF to confirm loading per catchment. This will be completed in optioneering phase. Pending outcome of this investigation, if baseline groundwater infiltration suspected to be present, target catchments as a high priority catchment for I&I reduction in the short term (1-3 years). If baseline groundwater infiltration not believed to be an issue, progress servicing strategy initiatives to improve the network.
Multiple Catchments	Catchments actual run times demonstrate network defects higher than WSAA range (>0.8) indicating high network defects contributing to inflow and infiltration.	Service delivery & infrastructure Medium (9)	Target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).

1: Risk level based on Council's Risk Management Framework

A summary of the SPS septicity issues is presented in Table 10.58.

Table 10.58 SPS septicity issue summary

Catchment	Issue/comment	Risk[1]	Action
TA12	Rising main detention time presents a high risk of septicity. Receiving manhole is <150m from numerous sensitive receivers. Risk of septicity downgraded upon the completion of the Cundletown Rising Main project.	Compliance High (12)	Confirm presence and proper function of sewer vent stack. Monitor for corrosion at receiving manhole as part of ongoing maintenance program as development progresses until septicity risk is downgraded to low.
TA05 TA22 TA21	Rising main detention time presents a medium risk of septicity. Receiving manhole is <150m from numerous sensitive receivers. Risk downgraded by 2051 with increased ADWF due to expected growth.	Compliance Medium (6)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.

Catchment	Issue/comment	Risk[1]	Action
TA32 TI01 TS02	Rising main detention time presents a high risk of septicity. TA32, TI01, receiving manhole is >150m from nearest sensitive receiver. TS02 receiving manhole is <150m from numerous sensitive receivers.	Compliance High (12)	Confirm presence and proper function of sewer vent stack. Undertake a condition assessment of concrete at receiving manhole. Include rising main and receiving manhole in a Council-wide network septicity options study for all identified issues, to be completed in optioneering phase.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS velocity issues is presented in Table 10.59.

Table 10.59 SPS velocity issue summary

SPS	Issue/comment	Risk[1]	Action
TA08 TA18 TA32 TI01	Rising main velocity is less than minimum flow velocity for slime stripping.	Service delivery & infrastructure High (12)	Investigate increasing the duty of pumps in SPS as part of pump renewals program to achieve minimum velocity

1: Risk level based on Council's Risk Management Framework

10.14 Wingham STP

A summary of the peaking factor discrepancy between the WSAA methodology and peak inflow into the STP is presented in Table 10.60.

Table 10.60 WSAA methodology and STP peak inflow peaking factor discrepancy issue summary

Scheme	Issue/comment	Risk[1]	Action
Wingham Sewer	The actual peak wet weather flow of 14,440 kL/day as detailed in the relevant section of Appendix C equates to a peaking factor of 22.3 This specific rain event was greater than a 5-year ARI. The lower peaking factor than calculated for a 5-year ARI event (16.2) is attributed to overflows in the network.	Reputation Medium (8)	Continue with business-as-usual activities, including identifying overflow points in the network as part of business as usual, planned I&I reduction in sewer catchments, planning and design considerations when renewing pumps.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS performance issues is presented in Table 10.61.

Table 10.61 SPS performance issue summary

Catchment	Issue/comment	Risk[1]	Action
WG02	SPS under capacity for 201 ARI=5 wet weather events.	Environment Low (2)	Continue with business-as-usual activities, including planned I&I reduction in Wingham catchments, planning and design considerations when renewing pumps.

1: Risk level based on Council's Risk Management Framework

A summary of the catchment network defects issues is presented in Table 10.62.

Table 10.62 Catchment network defects issue summary

Sewer catchment	Issue/comment	Risk[1]	Action
WG02	Catchment actual run times demonstrate network defects higher than WSAA range (>0.8) indicating high network defects contributing to inflow and infiltration	Service delivery & infrastructure Medium (9)	Target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).

Sewer catchment	Issue/comment	Risk[1]	Action
WG03 WG06	Catchments actual run times demonstrate network defects lower than WSAA range (<0.2) indicating high baseline groundwater infiltration flows.	Service delivery & infrastructure High (12)	Undertake an investigation of SPS (catchment-specific) inflow in ADWF to confirm loading per catchment. This will be completed in optioneering phase. Pending outcome of this investigation, if baseline groundwater infiltration suspected to be present, target catchments as a high priority catchment for I&I reduction in the short term (1-3 years).

1: Risk level based on Council's Risk Management Framework

A summary of the SPS WG02 emergency storage volume issue is presented in Table 10.63.

Table 10.63 SPS emergency storage volume issue summary

SPS	Issue/comment	Risk[1]	Action
WG02	Emergency storage volume in wet wells for WG02 is below the design 4 hours. WG02 is a lift station located within Wingham STP. A large diameter upstream gravity main provides some emergency storage.	NA	Nil.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS septicity issues is presented in Table 10.64.

Table 10.64 SPS septicity issue summary

SPS	Issue	Risk[1]	Action
WG01	SPS rising main detention time presents a medium risk of septicity. SPS pumps directly to the WG STP inlet works and presents risk of gas attack to receiving infrastructure.	Compliance Medium (6)	Undertake condition assessment of receiving infrastructure. Identify preventative or treatment measures as part of optioneering phase.
WG03 WG04	SPS rising main detention time presents a medium risk of septicity. Receiving manhole are <50m from nearest sensitive receivers. WG03 septicity risk downgraded by 2051 with increased ADWF due to growth factors.	Compliance Medium (6)	Confirm presence and proper function of sewer vent stack. Monitor for corrosion at receiving manhole as part of ongoing maintenance program as development progresses until septicity risk is downgraded to low.

1: Risk level based on Council's Risk Management Framework

A summary of the SPS velocity issues is presented in Table 10.65.

Table 10.65 Rising main velocity issue summary

SPS	Issue/comment	Risk[1]	Action
WG02	WG02 is inside the STP and the discharge pipe is short, less than 10 m and is sized to reduce grit and solids settling.	NA[2]	A project to relocate the gravity main leading to WG SPS 02 is in the concept phase. WG SPS 02 will be decommissioned.

1: Risk level based on Council's Risk Management Framework

2: Issue has been eliminated as the actions required to address the risk is planned or underway

PWWF to Wingham STP has been estimated in response to both the design ARI=2 and ARI=5 rainfall events and compared against the plant's design full treatment flow (DFTF) and design storm treatment flow (DSTF) capacities in Table 10.64. Wingham STP currently has insufficient hydraulic DSTF capacity for design PWWF. PWWF storage is utilized for flows exceeding the hydraulic capacity for DSTF. Further investigation into the hydraulic capacity of the plant through inlet works to storage pond infrastructure is required as flagged in Appendix C.

Table 10.66 STP capacity issue summary

STP	Issue/comment	Risk[1]	Action
Wingham	Forecast PWWF for ARI=2 and ARI=5 rainfall events currently exceed the hydraulic capacity (DSTF) of the plant, continuing throughout the 30-year planning horizon.	Financial Extreme (20)	Investigate further as part of optioneering phase.

1: Risk level based on Council's Risk Management Framework

11. Infrastructure performance assessment and issues

11.1 Level of Service

Recording and analysing the number and nature of customer notifications and complaints can provide useful information of potential water quality issues, which can assist timely response and rectification. Any rapid or noticeable change in conditions including water quality, water pressure etc. may be detected by customers. All notifications and complaints are registered and investigated. This monitoring forms part of verification of water supply performance.

Australian Standards define a complaint as an 'expression of dissatisfaction made to an organisation, related to its products, or the complaints handling process itself, where a response or resolution is explicitly or inexplicitly expected' (AS ISO 10002-2006).

Water quality complaints are reported in the following categories: taste, dirty, odour, chlorine and other. The category 'other' covers complaints such as scaling or illness. These categories and definitions are consistent with NSW DPE requirements for NSW Water Utilities Performance Monitoring. Details of complaints for each water supply are provided in Table 11.1.

Table 11.1 Summary of water quality complaints 2019 – 2020

Water Supply	Taste	Dirty	Odour	Chlorine	Other	TOTAL
Manning	4	9	1	1	1	16
Bulahdelah	0	2	0	0	0	2
Stroud	0	0	0	0	0	0
Tea Gardens	0	1	0	0	0	1
Gloucester	0	0	0	2	0	2
North Karuah	0	0	0	0	0	0
TOTAL	**4**	**12**	**1**	**3**	**1**	**20**

11.2 Manning water supply

The Manning supply achieved 99.9% of water quality results in the reticulation system meeting Australian Drinking Water Guidelines (ADWG) for the 2019-2020 reporting period. The system achieved 100% compliance during 2018 – 2019. There were 2582 analytes tested for verification monitoring in the Manning scheme.

The following exceedance occurrences were reported in Council's Drinking Water Quality Management Plan (DWQMP) Annual Report 2019-2020:

– One occurrence of iron outside of ADWG. This is potentially due to leaching of metals from water pipes and tap fittings caused by stagnant water during periods of low water usage.
– One occurrence of lead outside of ADWG. This is potentially due to leaching of metals from water pipes and tap fittings caused by stagnant water during periods of low water usage.
– There were twelve occurrences of chlorine levels <0.2 mg/L, which is recommended by NSW Health and DPE. Eight of these results were for samples collected during late January to March 2020. These sampling dates were either during or soon after the first and second heavy rain events following the 2019/2020 catastrophic summer bush fires. Increased chlorine demand was due to high DOC and turbidity in the river. This persisted for some time and was the cause for low chlorine readings. Chlorine dosing was increased at the Bootawa WTP. Flushing was undertaken which helped to restore chlorine levels.

– Four occurrences of chlorine levels <0.2 mg/L were recorded at a reticulation site in Tuncurry in December 2019 and March 2020. Investigations indicated that this sample site was not representative of the typical chlorine residual levels in the reticulation system and it was replaced by another site in April 2020. The other two occasions of chlorine levels <0.2 mg/L were recorded in January at a sample site in Smiths Lake and in May at a sample site in Lansdowne. These were related to the CCP breaches at Smiths Lake Reservoir on 6 January 2020 and Lansdowne Reservoir on 25 May 2020. Chlorine levels were increased at the Smiths Lake Reservoir by hand dosing. Extra monitoring at reservoir and reticulation system was also carried out. To rectify chlorine readings in Lansdowne, the reservoir was isolated and the reticulation system was supplied from the North Coopernook Reservoir. Flushing was also undertaken to pull water from North Coopernook Reservoir.

11.3 Manning water treatment plant

Manning WTP site inspections for the 10 Year Renewal Program have not yet been undertaken. This has been identified as a data gap for future actioning.

11.3.1 Critical control points

A CCP is defined as a point, step or procedure at which control can be applied and a hazard can be prevented, eliminated or reduced to acceptable levels. All significant hazards identified through the risk assessment process need to be managed to ensure the risk is reduced to an acceptable level.

Councils DWQMP defines the CCPs for the Manning water supply scheme. These are summarised in Table 11.2.

Table 11.2 Manning water supply scheme critical control point summary

CCP No. and description	Monitoring parameter	Target criterion	Adjustment limit	Critical limit
1: Filtration (Bootawa)	Turbidity NTU	< 0.1	> 0.3	> 0.5
2: Disinfection (Bootawa)	Free chlorine mg/L	1.4 – 2.6	< 1.4 or > 2.6	< 1.0 or > 5.0
3: Fluoridation (Bootawa)	Fluoride mg/L	1.0	< 0.9 or > 1.1	> 1.5
4: Filtration (Nabiac)	Turbidity NTU	< 0.1	> 0.3	> 0.5
5: Disinfection (Nabiac)	Free chlorine mg/L	3.0	< 1.5 or > 4.0	< 1.0 or > 5.0
6: Fluoridation (Nabiac)	Fluoride mg/L	1.0	< 0.9 or > 1.1	> 1.5
7: Manning Reservoirs	Free chlorine mg/L and reservoir integrity	> 0.5 Secure and vermin proof	< 0.3 Evidence of breach	< 0.2 Breach not rectified or serious breach
8: Lantana Chlorine Booster Station	Free chlorine mg/L	2.0	< 1.5 or > 2.5	< 0.5 or > 4.0
9: Kolodong and Forster Chlorine Booster Stations	Free chlorine mg/L	1.5	< 1.0 or > 2.0	< 0.5 or > 4.0

There were five occasions of CCP exceedance in the Manning water scheme. Table 11.3 displays the critical limit exceedances for the Manning scheme between 2019-2020.

Table 11.3 Critical limit exceedances – Manning water supply scheme

Date	CCP exceedance	Details	Corrective action	Preventive action
16/09/2019	Disinfection in service reservoir (Bungay Road)	Free chlorine =0.16 mg/l	Chlorine levels increased at reservoir. Extra monitoring at the reservoir and reticulation system.	Improved monitoring program for this reservoir and investigated options to improve turn over
6/01/2020	Disinfection in service (Smiths Lake) reservoir	Free chlorine = 0.08 mg/L	Chlorine levels increased at reservoir. Extra monitoring at reservoir and reticulation system.	Increased vigilance during very hot weather
17/02/2020	Disinfection in service reservoir (North Coopernook)	Free chlorine = 0.04 mg/L	Chlorine levels increased at reservoir. Extra monitoring at reservoir and reticulation system.	Increase hand dosing of chlorine tablets throughout retic system due to high DOC increasing
17/02/2020	Disinfection in service reservoir (North Tuncurry)	Free chlorine = 0.19 mg/L	Chlorine levels increased at reservoir. Extra monitoring at reservoir and reticulation system.	Increase hand dosing of chlorine tablets throughout retic system due to high DOC increasing chlorine demand (rain after fires and drought)
25/05/2020	Disinfection in service reservoir (Lansdowne)	Free chlorine = 0.12 mg/L	Reservoir was isolated due to issue with valve. Town supplied from North Coopernook reservoir. Flushing in retic system.	Better communication of maintenance works between teams has been developed including CCP training. Project initiated to check the representativeness of sampling points and analysers.

11.3.2 Application of health-based treatment targets

The ADWG is planning to introduce Health Based Targets (HBTs) as a measure of microbial risk assessment (QMRA). Council have undertaken a preliminary Cryptosporidium risk assessment to assess the vulnerability of supply systems. Table 11.4 displays the preliminary results of Cryptosporidium risk assessment.

Table 11.4 Preliminary results of Cryptosporidium risk assessment

Water supply	Preliminary Cryptosporidium risk rating	Considerations
Manning Water Supply	Low	This rating is based on the ability of the membranes and ozone to control Cryptosporidium oocysts that may be present from the stock, STP and onsite systems in the catchment.

11.4 Manning water distribution system

The LWU Circular 18 was prepared in 2014 to address LWU of a new protocol to ensure safety of drinking water supply across regional NSW. LWUs were required to review and update their standard operating procedures to ensure three key barriers were achieved. Reporting on the three key barriers within the DWQMP are as follows:.

Barrier: Effective disinfection – achieve minimum chlorine contact time (Ct)

Council's DWQMP states that chlorine contact has been calculated as:

- 41.5 mg.min/L for Bootawa
- 106.7 mg.min/L for Nabiac

Barrier: Distribution system integrity

Council maintains a database of reservoir inspections derived from the Aqualift reservoir inspections. The reservoir deficiencies from the Aqualift ASAM database are listed as follows:

Coopernook Reservoir:

- Bird Proofing – There is an area next to the top fill inlet where small birds can enter the tank

Crowdy Head Reservoir:

- Entry Hatch – The upstream frame of the entry hatch is not sealed and the roof water drains directly into the tank

Cundletown Reservoir:

- Bird Proofing – Pigeons are living inside the tank

Elizabeth Beach Reservoir:

- Ventilation – One of the turbine vents is seized and needs to be replaced before it breaks away, leaving the tank open to bird entry

Hallidays Point Reservoir:

- Ventilation – Some sections of the wall fascia mesh are in poor condition and will no longer be bird proof
- Bird Proofing – The mesh needs refixing at 12 o'clock

Smiths Lake Reservoir:

- Ventilation – One turbine roof vent has seized and needs to be replaced before it blows off and leaves the tank open to bird entry

Chatham NIU Reservoir:

- Bird Proofing – Pigeons are living inside the tank

Barrier: Maintain a free chlorine residual in the water in the distribution system

The verification monitoring program is divided into the following two parts:

1. Manning north supply system- Mostly serviced by Bootawa WTP (MC01)
2. Manning south supply system- Mostly serviced by Nabiac WTP (MC09)

Council's monitors water supply sampling in 36 locations within the Manning scheme. Detail of the sample results are given in Appendix D.

11.5 Tea Gardens water supply

The Tea Gardens water supply system achieved 97.2% of water quality results in the reticulation system within ADWG for the 2018 – 2019 reporting period. This was compared to 96.6% during 2018 – 2019. A total of 353 analytes were tested for verification monitoring in Tea Gardens reticulation system.

The following exceedance occurrences were reported in Council DWQMS Annual Report 2019-2020:

- Nine occurrences of total trihalomethanes (THMs) and one occurrence of dichloroacetic acid outside of ADWG. Disinfection by-products are formed when organic matter reacts with chlorine. Elevated THMs in the reticulation system are a result of high DOC in the groundwater and the treated water produced by Tea Gardens WTP, extended detention time in reservoirs and the reticulation system due to low water usage outside holiday periods. Council has since made the necessary changes to resolve the high DOC at Tea Gardens.
- In response to this, water levels are reduced in reservoirs when appropriate, also considering fluctuating water demand (due to high numbers of tourists during holiday periods) and monitoring frequency has been increased. To improve system knowledge, two sample sites are routinely monitored for disinfection by-products.

11.5.1 Tea Gardens water treatment plant

The Tea Gardens WTP site inspections for the 10 Year Renewal Program have not yet been undertaken. This has been identified as a data gap for future actioning.

11.5.2 Critical control points

The DWQMP defines the CCPs for the Tea Garden water supply scheme is summarised in Table 11.5.

Table 11.5 Tea Garden water supply system critical control point summary

CCP No. and description	Monitoring parameter	Target criterion	Adjustment limit	Critical limit
1: Filtration	Turbidity NTU	< 0.1	> 0.3	> 0.5
2: Disinfection	Free chlorine mg/L	3.0	< 1.4 or > 4.0	< 1.0 or > 5.0
3: Fluoridation	Fluoride mg/L	0.9 – 1.1	< 0.9 or > 1.1	> 1.5
4: Reservoirs	Free chlorine mg/L and reservoir integrity	> 1.0 Secure and vermin proof	< 0.8 Evidence of breach	< 0.2 Breach not rectified or serious breach

Tea Gardens water supply scheme achieved all results within CCP requirements. There are no CCP exceedances to report.

11.5.3 Application of health-based treatment targets

Table 11.4 displays the preliminary results of Cryptosporidium risk assessment.

Table 11.6 Preliminary results of Cryptosporidium risk assessment

Water supply	Preliminary Cryptosporidium risk rating	Considerations
Tea Gardens Water Supply	Low	This rating is based on the ability of the membranes to control Cryptosporidium oocysts that may be present from the stock and onsite systems in the catchment.

11.6 Tea Gardens distribution system

Reporting on the three key barriers within the DWQMP are as follows:

Barrier: Effective disinfection – achieve minimum chlorine contact time (Ct)

Council's DWQMP states that chlorine contact has been calculated as 285.7 mg.min/L.

Barrier: Distribution system integrity

Council maintains a database of reservoir inspections derived from the Aqualift reservoir inspections. There are no reservoir deficiencies from the Aqualift ASAM database relating to distribution system integrity.

Barrier: Maintain a free chlorine residual in the water in the distribution system

Council's monitors water supply sampling in 4 locations within the Tea Gardens scheme. Detail of the sample results are given in Appendix D.

11.7 Bulahdelah water supply

The Bulahdelah water supply scheme achieved 98.1% of water quality results in the reticulation system meeting ADWG in 2018 – 2019. This is compared to 97.0% during 2018 – 2019. There were 313 analytes tested for verification monitoring within the Bulahdelah system.

The following exceedance occurrences were reported in Council DWQMS Annual Report 2019-2020:

– Five occurrences of total THMs and one occurrence of dichloroacetic acid outside of ADWG. Increased levels of naturally occurring DOC in Crawford River during the warmer months contributed to the higher levels of THMs.

11.7.1 Bulahdelah treatment plant

The Bulahdelah WTP site inspections for the 10 Year Renewal Program have not yet been undertaken. This has been identified as a data gap for future actioning.

11.7.2 Critical control points

The DWQMP defines the CCPs for the Bulahdelah water supply scheme is summarised in Table 11.7.

Table 11.7 Bulahdelah water supply system critical control point summary

CCP No. and description	Monitoring parameter	Target criterion	Adjustment limit	Critical limit
1: Filtration	Turbidity NTU	< 0.2	> 0.4	> 1.0
2: Disinfection	Free chlorine mg/L	2.5 – 4.0	< 2.5 or > 4.0	< 1.0 or > 5.0
3: Fluoridation	Fluoride mg/L	0.9 – 1.1	< 0.9 or > 1.1	> 1.5
4: Reservoirs	Free chlorine mg/L and reservoir integrity	> 1.0 Secure and vermin proof	< 0.8 Evidence of breach	< 0.2 Breach not rectified or serious breach

The Bulahdelah water supply scheme achieved all results within CCP requirements for the 2018 – 2019 period. There are no CCP exceedances to report.

11.7.3 Application of health-based treatment targets

Table 11.8 displays the preliminary results of Cryptosporidium risk assessment.

Table 11.8 Preliminary results of Cryptosporidium risk assessment

Water supply	Preliminary Cryptosporidium risk rating	Considerations
Bulahdelah Water Supply	Low	This rating is based on the ability of the coagulation process, clarification and filters to control Cryptosporidium oocysts that may be present from the stock and onsite systems in the catchment.

11.8 Bulahdelah water distribution system

Reporting on the three key barriers within the DWQMP are as follows: Barrier: Effective disinfection – achieve minimum chlorine contact time (Ct)

Council's DWQMP states that chlorine contact has been calculated as 30.4 mg.min/L.

Barrier: Distribution system integrity

Council maintains a database of reservoir inspections derived from the Aqualift reservoir inspections. There are no reservoir deficiencies from the Aqualift ASAM database relating to distribution system integrity.

Barrier: Maintain a free chlorine residual in the water in the distribution system

Council's monitors water supply sampling in 4 locations within the Bulahdelah scheme. Detail of the sample results are given in Appendix D.

11.9 Stroud water supply

The Stroud water supply system achieved 99.7% of samples within ADWG in the reticulation, compared to 99.3% during 2018 – 2019. A total of 315 analytes were tested in Stroud reticulation system for verification monitoring in the reporting period.

The following exceedance occurrence was reported in Council DWQMS Annual Report 2019-2020:

– One occurrence of aluminum chlorohydrate (ACH) outside of ADWG in January 2020. Investigations found that ACH dosing was increased at the WTP due to algae in the off-stream storage. This led to a slight increase in the aluminum concentrations in treated water and the reticulation system. Aluminum dosing at the WTP is closely monitored to prevent this in the future.

11.9.1 Stroud water treatment plant

The Stroud WTP site inspections for the 10 Year Renewal Program have not yet been undertaken. This has been identified as a data gap for future actioning.

11.9.2 Critical control points

The DWQMP defines the CCPs for the Stroud water supply scheme is summarised in Table 11.9.

Table 11.9 Stroud water supply system critical control point summary

CCP No. and description	Monitoring parameter	Target criterion	Adjustment limit	Critical limit
1: Filtration	Turbidity NTU	< 0.4	> 0.7	> 1.0
2: Disinfection	Free chlorine mg/L	2.5	< 2.0 or > 3.5	< 1.0 or > 5.0
3: Fluoridation	Fluoride mg/L	0.9 – 1.1	< 0.9 or > 1.1	> 1.5
4: Reservoirs	Free chlorine mg/L and reservoir integrity	> 0.5 Secure and vermin proof	< 0.3 Evidence of breach	< 0.2 Breach not rectified or serious breach

The Stroud water supply scheme achieved all results within CCP requirements for 2018 – 2019. There are no CCP exceedances to report.

11.9.3 Application of health-based treatment targets

Table 11.10 displays the preliminary results of Cryptosporidium risk assessment.

Table 11.10 Preliminary results of Cryptosporidium risk assessment

Water supply	Preliminary Cryptosporidium risk rating	Considerations
Stroud Water Supply	Medium	This rating is based on the ability of the sedimentation process, coagulation and filters to control Cryptosporidium oocysts that may be present from the stock and onsite systems in the catchment.

11.10 Stroud water distribution system

Reporting on the three key barriers within the DWQMP are as follows:

Barrier: Effective disinfection – achieve minimum chlorine contact time (Ct)

Council's DWQMP states that chlorine contact has been calculated as:

- 24.9 mg.min/L for Stroud
- 77.2 mg.min/L for Stroud Road

Barrier: Distribution system integrity

Council maintains a database of reservoir inspections derived from the Aqualift reservoir inspections. There are no reservoir deficiencies from the Aqualift ASAM database relating to distribution system integrity.

Barrier: Maintain a free chlorine residual in the water in the distribution system

Council's monitors water supply sampling in 4 locations within the Stroud scheme. Detail of the sample results are given in Appendix D.

11.12 Gloucester water supply

The Gloucester water supply system achieved 99.7% of samples within ADWG in the reticulation system, which is the same as the previous reporting period. There were 334 analytes tested for verification monitoring in Gloucester reticulation system.

The following exceedance occurrences were reported in Council DWQMS Annual Report 2019-2020:

– One occurrences of aluminum outside of ADWG in the reticulation system at Gloucester. Filter performance is being investigated and optimised at the WTP.
– Two occurrences of residual chlorine levels <0.2 mg/L were recorded. These results were for samples collected from Barrington during February 2020. This was during or soon after the first heavy rain event following the bush fires. The low chlorine level readings were due to increased chlorine demand from high DOC and turbidity in the river. Chlorine dosing was increased at the WTP. Flushing was undertaken which restored chlorine levels.

11.12.1 Gloucester water treatment plant

The Gloucester WTP site inspections for the 10 Year Renewal Program have not yet been undertaken. This has been identified as a data gap for future actioning.

11.12.2 Critical control points

The DWQMP defines the CCPs for the Stroud water supply scheme is summarised in Table 11.5.

Table 11.11 Gloucester water supply system critical control point summary

CCP No. and description	Monitoring parameter	Target criterion	Adjustment limit	Critical limit
1: Filtration	Turbidity NTU	< 0.4	> 0.7	> 1.0
2: Disinfection	Free chlorine mg/L	3.0	< 2.0 or > 4.0 Nov-Feb < 2.0 or > 3.5 Mar-Oct	< 1.0 or > 5.0
3: Fluoridation	Fluoride mg/L	0.9 – 1.1	< 0.9 or > 1.1	> 1.5
4: Reservoirs	Free chlorine mg/L and reservoir integrity	> 0.5 Secure and vermin proof	< 0.3 Evidence of breach	< 0.2 Breach not rectified or serious breach

There was one occurrence of a CCP exceedance in the Gloucester water scheme. This is shown in Table 11.3.

Table 11.12 Critical limit exceedances – Gloucester water supply scheme

Date	CCP exceedance	Details	Corrective action	Preventive action
3/12/2019	Disinfection in service reservoir (Cemetery Road)	Free chlorine =0.12 mg/L	Chlorine dosing increased at WTP and tablets added to reservoir. Extra monitoring at the reservoir and reticulation system	Increased vigilance during very hot weather

Gloucester water supply scheme achieved all results within CCP requirements for 2018-2019. There are no CCP exceedances to report.

11.12.3 Application of health-based treatment targets

Table 11.13 displays the preliminary results of Cryptosporidium risk assessment.

Table 11.13 Preliminary results of Cryptosporidium risk assessment

Water supply	Preliminary Cryptosporidium risk rating	Considerations
Gloucester Water Supply	Medium	This rating is based on the ability of the coagulation process and filters to control Cryptosporidium oocysts that may be present from the stock and onsite systems in the catchment.

11.13 Gloucester water distribution system

Reporting on the three key barriers within the DWQMP are as follows: Barrier: Effective disinfection – achieve minimum chlorine contact time (Ct)

Council's DWQMP states that chlorine contact has been calculated as 64.4 mg.min/L.

Barrier: Distribution system integrity

Council maintains a database of reservoir inspections derived from the Aqualift reservoir inspections. The reservoir deficiencies from the Aqualift ASAM database are listed below:

Gloucester Ravenshaw Road Reservoir:

– Entry Hatch – The front edge area of the hatch and platform area is not sealed against contamination and drainage is entering the tank.

Gloucester Tyrell Street Reservoir:

– Entry Hatch – The hatch cover is not sealed against bird, vermin or roof drainage entry into the tank.
– Bird Proofing – There is a significant gap at the base of the entry hatch front flap, where birds and vermin can enter the tank.

Barrier: Maintain a free chlorine residual in the water in the distribution system

Council's monitors water supply sampling in 6 locations within the Gloucester scheme. Detail of the sample results are given in Appendix D.

11.14 North Karuah water supply

North Karuah reticulation system achieved 100% of water quality results within ADWG during 2018 – 2019 which is consistent with the previous year. A total of 169 analytes were tested in this reticulation system during the reporting period.

Five occurrences were recorded where free chlorine was below the recommended level of 0.2 mg/L in the reticulation system. Each occasion was notified to Hunter Water and NSW Health. Corrective actions were put in place, including flushing until chlorine levels were back within target. Although chlorine levels below 0.2 mg/L are not specified as outside guideline values in ADWG, these results are outside operational control points in reticulation systems, NSW Health and DPE recommendations. There was considerable improvement in the chlorine readings since January 2020 after the new reservoir dosing regime was implemented by Hunter Water.

North Karuah water supply scheme achieved all results within CCP requirements. There are no CCP exceedances to report.

11.14.1 North Karuah water treatment plant

North Karuah's water supply is supplied by Hunter Water's Karuah Scheme. For the WTP's 10 Year Renewal, Hunter Water undertakes the annual site inspections and CCP reporting. No CCP exceedances have been reported to Council for 2018-2019.

11.14.2 Application of health-based treatment targets

North Karuah's water supply is supplied by Hunter Water's Karuah Scheme. No HBT results have been reported to Council.

11.15 North Karuah water distribution system

Reporting on the three key barriers within the DWQMP are as follows:

Barrier: Effective disinfection – achieve minimum chlorine contact time (Ct)

Council purchases bulk water supply from Hunter Water to distribute to customers at North Karuah Hunter Water is responsible for extraction, treatment, operational monitoring and verification monitoring of the Karuah zone of this water supply. No chlorine contact time has been calculated.

Barrier: Distribution system integrity

No reservoirs in North Karuah. Council purchases bulk water supply from Hunter Water.

Barrier: Maintain a free chlorine residual in the water in the distribution system

Council's monitors water supply sampling in 1 location within the North Karuah scheme. Detail of the sample results are given in Appendix D.

11.16 Sewerage treatment plants performance

Council is currently in the process of updating the10 Year Renewal Program for STPs. The 10 Year Renewal Program is developed by extracting asset data at component level from Council's Asset Register. The extraction is followed by annual site inspections conducted by Water Asset Staff.

All site inspections are accompanied by Infrastructure and Engineering Services staff from the Assets Team as well as a SCADA/Electrician, Mechanical Technician and the Site Controller. The condition assessment process is outlined below:

- All civil, mechanical and electrical assets are printed out of the MC1 database, relevant to the site being inspected.
- All members onsite proceed with inspecting each individual asset. The assets are given a condition score from 1 to 5 (1 being new and 5 is imminent failure). The scores are in line with the Council Condition Assessment Handbook.
- Comments are made against each asset as necessary. All decommissioned or new assets that don't exist in the database are also noted.
- All information is then collated and taken back to the office.
- The Assets System Officer updates and uploads all inspected condition scores in MC1.
- The Assets Engineer then creates a spread sheet relevant to each site and notes down all assets at a 4 or 5 condition (with relevant comments of the issue), which then goes on a planned renewals plan.
- The assets are prioritised based on the combined summed value of inspected condition and age score. This is a score out of 10.

The age condition of an asset is calculated using the Table 11.14.

Table 11.14 Age condition

Age condition	Life expectancy range
1	if current age is equivalent to 0 to 20% of life expectancy
2	if current age is equivalent to 20 to 40% of life expectancy
3	if current age is equivalent to 40 to 60% of life expectancy
4	if current age is equivalent to 60 to 80% of life expectancy
5	if current age is equivalent to 80 to 100% of life expectancy

Sections 11.16.1 to 11.16.15 list the current WHS issues, suggests modification / improvements to the existing system and EPL non-compliances.

11.16.1 Bulahdelah sewage treatment plant

From the 10 Year Renewal site inspections, the Bulahdelah STP identified deflects are:

- Filter backwash – surpassed theoretical useful life
- Filter aeration blower – surpassed theoretical useful life
- Filter compressor – surpassed theoretical useful life
- Grit removal air blower 1 – surpassed theoretical useful life
- Pump pit hoist crane – wear and tear
- EAT blower 1, 2 and 3 – surpassed theoretical useful life

The performance of the Bulahdelah's STP with its EPL over the last ten years is outlined in Table 11.15.

Table 11.15 Bulahdelah sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
05 Dec 2020	The volume discharge limit of 2000kL a day was exceeded on 3 consecutive days	3
05 Dec 2019	100 percentile oxidised nitrogen concentration of 10mg/L was exceeded	1
05 Dec 2018	An EPA inspection found: leaks from chemical dosing lines; bunding capacity less than required; Alum dosing pump outside of the bunded area. The EPA added a PRP to the licence to address these shortcomings.	1
30 Jun 2017	The daily volume was not recorded from EPA point 2	47
05 Dec 2014	Limits exceeded for Ammonia, oxidised nitrogen and pH. The centrifuge was operating in the plant increasing nitrogen concentrations as a result of de-watering. pH exceeded unknown cause and unexpected. PRP 3 & 4 to address issues.	3
05-Dec-2013	Limit for oxidised nitrogen exceeded on one occasion. Denitrification process compromised through load reduction from low inflows. Operational adjustment to oxidation process. PRPs 3 & 4 to address issue.	1
05-Dec-2012	Concentration limit of nitrogen ammonia exceeded on two occasions. EPA has added a Pollution Reduction Program to address this issue.	2
05-Dec-2012	Volume limit exceeded on two occasions due to flood conditions. CCTV inspections & smoke testing of the reticulation system has been undertaken to minimise infiltration. EPA has added a Pollution Reduction Program to address this issue.	2
05-Dec-2011	Nitrogen (Ammonia) 90 percentile & 100 percentile concentration limit exceeded on several occasions. High rainfall caused high dilution of incoming flow. Existing manhole covers will be replaced with more water tight plastic covers.	5
05-Dec-2011	Outflow limit of 2000 kL was exceeded twice. High rainfall causing localised flooding in the retic system. Manholes were inspected to defect any points of water impress. Existing manhole covers replaced with water tight plastic manhole covers.	2

The performance against the EPL license may indicate the following issues:

– High inflow/infiltration within the sewerage system leading to volume exceedance during rainfall events.
– Insufficient denitrification process capacity (partly due to insufficient inflow).
– Insufficient storm storage capacity to attenuate peak inflows and avoid exceeding volume discharge limit.

Other know issues with the Bulahdelah STP are:

– Lack of suitable biosolids storage area.
– Aged biosolids dewatering equipment.

11.16.2 Coopernook sewage treatment plant

From the 10 Year Renewal site inspections, the Coopernook STP identified deflects are:

– Roadway access – reseal is needed – pot holes currently visible on driveway entry.
– Inlet weirs at IAT tank – significant corrosion with holes throughout the scum boards.

The performance of the Coopernook's STP with its EPL over the last ten years is outlined in Table 11.15.

Table 11.16 Coopernook sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
15 Apr 2016	Concentration limit for faecal coliform was exceeded at MP1 on two occasions suspected to be due to exposure to ducks and wildlife. Blowers have been initiated to destratify the dam. The EPA to write to the licensee re this non-compliance.	2
15 Apr 2015	The 100 percentile range for pH was exceeded. Cause was algae growth. Timer replaced aerator now operational. Mixes also introduced to destratify. Duck weed established.	1
15 Apr 2014	Faecal coliforms 100 percentile limit was exceeded on 1 occasion. Cause by high flows reduced UV exposure. New fluoro lamps installed ahead of schedule.	1
15 Apr 2012	Exceed 100%ile limit for faecal coliforms at monitoring point 1 on 1 occasion due to automated cleaning wipers not operating correctly causing damage. UV lighting system repaired & serviced; & regular maintenance contract established with contractors	1
15 Apr 2011	Exceeded Faecal Coliforms 100 percentile concentration limit on 12/02/11, caused by wet weather. The non compliance is not related to treated effluent quality. New concrete lining of storage lagoon has been included in the budget	1

The performance against the EPL license may indicate the following issues:

– UV system is not always operating well and may not be sized to cater for the peak flow capacity or there is insufficient storm storage.

Other know issues with the Coopernook STP are:

– Nil

11.16.3 Forster sewage treatment plant

From the 10 Year Renewal site inspections, the Forster STP identified deflects are:

– Backwash valve filters 1, 2, 3 and 4 – heavily corroded but working
– Effluent drain valve filters 1, 2, 3 and 4 – heavily corroded valves. New actuators and valves are needed
– Sand media filters 1, 2, 3 and 4 – overall structure is good. Grates, handrails corroding
– Sand filter unfiltered inlet valve filters 1, 2, – and 4 - heavily corroded. Pneumatic controls, pipework and bracketing are all showing signs of wear and tear.
– Sand media filter pneumatic control panel 1 and 2 – ageing showing signs of wear and tear

- Step screen 1 septic receival – surpassed theoretical useful life
- Aeration blower 2 EAT 1 and 2 – surpassed theoretical useful life
- Sand filter air compressor 1 – surpassed theoretical useful life
- Axial lift pump 1 effluent discharge – surpassed theoretical useful life
- Grit classifier conveyor 1 – heavily corroded and keeps filling with sand from the retic sand.
- Vortex grit removal 1 – heavily corroded
- Inlet works – steel plate stairs are badly corroded and in need of replacing.
- Rotork penstock 1 – close to theoretical useful life
- Mechanism decant weir IDEAT 1 – surpassed theoretical useful life
- Sand filters air scour blower 1 – surpassed theoretical useful life
- Sand filter control air compressor 1 and 2 – surpassed theoretical useful life
- Grit removal air blower 1 and 2 – surpassed theoretical useful life
- Ultraviolet filter module 1, 2, 3, 4 and 5 – surpassed theoretical useful life
- Decant drive 1, 2, 3, 4, 5 and 6 gearbox – surpassed theoretical useful life

The performance of the Forster's STP with its EPL over the last ten years is outlined in Table 11.15.

Table 11.17 Forster sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
05 Aug 2020	The total suspended solids load limit of 3666kg was exceeded	1
05 Aug 2020	The discharge volume of 23000kL at EPA point 5 was exceeded on two occasions	2
05 Aug 2018	The discharge volume limit of 23000kL at EPA point 5 was exceeded on one occasion. 508mm of rain was recorded over 4 days up to and including the day of the non-compliance	1
05 Aug 2016	Exceed limit for TSS due to algae growth in effluent pond. Detention time has been minimised in final pond	1
05 Aug 2015	Total suspended solids load limit exceeded due to algal growth. Plant operating as per design. Review to further minimise effluent detention times.	1

The performance against the EPL license may indicate the following issues:

- High inflow/infiltration within the sewerage system leading to volume exceedance during rainfall events
- Algal growth in the ponds.
- Insufficient storm storage capacity to attenuate peak inflows and avoid exceeding volume discharge limit.

Other know issues with the Forster STP are:

- Tertiary effluent filters have lost a significant amount of filter media since commissioning in 1995. The filters are beginning to lose suspended solids removal performance, causing the plant to exceed the load based limit license on effluent discharge.
  - EPA has been engaged to increase the LBL license for SS discharge. If this fails, a ~$500,000 upgrade on the backwash system and filter media replacement shall be required.
- EAT –lowers - blower failures and increase in DO requirements requires renewal and upgrade to the majority of blower onsite.
- Major switchboard renewal required.

11.16.4 Gloucester sewage treatment plant

The Gloucester STP site inspections for the 10 Year Renewal Program have not yet been undertaken. This has been identified as a data gap for future actioning.

The performance of the Gloucester's STP with its EPL over the last ten years is outlined in Table 11.15.

Table 11.18 Gloucester sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
30 Nov 2020	The BOD concentration limit of 20mg/L was exceeded on one occasion.	1
30 Nov 2020	Ammonia concentration limit of 10mg/L was exceeded three times.	3
30 Nov 2020	The licensed discharge load of 1525kg for BOD was exceeded.	1
30 Nov 2019	The concentration limit for suspended solids of 30mg/L and 20mg/L for BOD was exceeded when taking a grab sample from the wetland. There was no discharge occurring at the time.	1
30 Nov 2018	Exceedance of concentration range pH 6.5- 8.5	1
30 Nov 2017	Suspended solids exceeded the concentration limit of 30mg/L	2
30 Jun 2017	Suspended solids exceeded the concentration limit of 30mg/L on four occasions.	4
30 Nov 2016	Suspend solids and pH limits exceeded. Significant change to the wetland hydraulic properties from reduced flows due to demand for recycled water, caused algal growth. Licensee investigating new STS, EPA will liaise with council through this process.	2
30 Nov 2015	Load limits exceeded due to poor wetland performance. Maintenance of the wetland undertaken to restore capacity. The licensee is investigating the installation of a new STS, EPA will liaise with MidCoast County Council through this process.	3
30 Nov 2015	Ammonia and Suspended Solids limits exceeded 4 times. Maintenance of the wetland undertaken to restore capacity. The licensee is investigating the installation of a new STS, EPA will liaise with MidCoast County Council through this process.	4
30 Nov 2015	Discharge volume was not recorded due to power failure to flow instrumentation equipment. Total volume monitor at inlet works used for reference data. EPA satisfied issue has been resolved.	1
30 Nov 2015	Establishment of an effluent reuse scheme was not completed by the deliverable date listed in the licence. Meeting held with licensee and EPA, new delivery date agreed upon. Licensee to provide regular progress reports.	1
30 Nov 2014	BOD and SS limits exceeded due to vegetation growth in wetland. This resulted with a small increase in velocity sufficient to disturb settled particulate matter. EPA is aware of ongoing improvements to premises to manage risk in future.	2
30 Nov 2014	Report submission after due date. Cause – Unexpected leave from an employee critical for the data projection modelling forming the basis of the report. EPA wrote to licensee to prevent a recurrence.	1
30 Nov 2013	The TSS concentration limit exceeded for reasons unknown, though isolated to function of wetland. Possible wildlife disturbance or other external factor was the cause. Additional monitoring conducted and monitoring location cleaned.	4
30 Nov 2013	On two occasions the flow volume for EPA Point 3 was not recorded, reasons unknown, possible communication fault with the logger, fault automatically reset and operational. Inflow data was obtained	2
30 Nov 2011	Exceeded limit for Ammonia & Suspended Solids. Ammonia from plant met limit. Possible sampling error for suspended solids. Review of sampling techniques undertaken. No effluent was discharged to environment at the times these recordings were made.	2
30 Jun 2011	Volume of discharge through EPA Point 3 could not be retrieved from the telemetry when requested. Licence has been transferred to Midcoast Water and data and telemetry systems were relocated to MCW office for better control into the future.	1

Year ending	Type of non-compliance	No. of times occurred
30 Nov 2010	Not all flow monitoring recorded at point 3. Flow monitor (faulty) during establishment of better treatment. Midcoast Water completed work in October 2010. STP is being handed over to Midcoast Water operation on 1 July 2011. Caution issued.	324
30 Nov 2010	Licensee failed to submit "Annual System Performance Report" with Annual Return. Performance report now been submitted. Official Caution issued	1

The performance against the EPL license may indicate the following issues:

– High inflow/infiltration within the sewerage system leading to volume exceedance during rainfall events.
– Algal growth in the maturation ponds.
– Wetlands de-sludging may require optimisation.
– Treatment plant capacity exceeded and understood a new treatment configuration is being implemented to meet discharge limits and increase capacity.

Other know issues with the Gloucester STP are:

– There is significant deterioration to the sedimentation tanks concrete walls with a failure observed at one point. Cracking is evident from the sections that are exposed and this structure is considered extremely fragile. This structure is estimated to have been standing since the original construction of the plant and hence is over 80 years old. New walkways and handrails have been installed on the tank due to the failure of the wall.
– The concrete surrounding the trickling filters has failed in numerous locations, with noticeable displacement on the northern edge. An earth buttress has been installed to assist in restricting movement of the wall, which has been observed to be relatively successful. On the southern wall, there are cracks evident, although movement of the wall was not observed.
– The digester forms part of the original plant and is hence 80 years old. Significant cracks have been observed both internally and externally as well as exposed aggregate in the areas above the water line.
– The northern wall of the pond was observed to have some wind / water erosion damage, with on-going erosion likely.
– The majority of the existing plant is submerged during more severe 100 year flood events. Key electrical equipment and infrastructure lies above the impacted area; however, many of the existing process units feature no electrical components.
– Receiving water analysis indicates that background analyte concentrations within the Gloucester River are elevated (particularly nitrogen, phosphorus and faecal coliforms).
– Analysis of historic effluent quality indicates that phosphorus concentrations are highly variable. Total Phosphorus at the plant is controlled passively to some extent through the maturation pond and tertiary wetland.
– The existing site cannot effectively reduce Total Nitrogen.
– Biosolids contamination data is not available.

11.16.5 Hallidays Point sewage treatment plant

From the 10 Year Renewal site inspections, the Hallidays Point STP identified deflects are:

– Alum dosing pump 1 – inspection condition 4
– Alum dosing pump 2 – inspection condition 4
– Motorised weir 1 bypass to clarifier flowsplitter – inspection condition 4
– Motorised weir 2 to anoxic tank – inspection condition 5
– WAS pump 1 aeration tank – inspection condition 4
– WAS pump 2 aeration tank – inspection condition 4
– Vortex grit removal 1 – inspection condition 5

- Anoxic tank mixer 2 – inspection condition 4
- Anoxic tank mixer 3 – inspection condition 4
- Anoxic tank mixer 4 – inspection condition 4
- Effluent pump 1 – inspection condition 4
- UV disinfection units – inspection condition 4
- Anoxic tank – mixer 1 – inspection condition 4
- Diffuser air blower 1 – inspection condition 4
- Diffuser air blower 2 – inspection condition 4
- Diffuser air blower 3 – inspection condition 4
- Anoxic tank mixer 1 Crane Davit Arm – inspection condition 4
- MLR pump 1 crane – inspection condition 4
- MLR pump 2 crane – inspection condition 4
- MLR pump 3 crane – inspection condition 4
- Effluent reuse pump 2 – inspection condition 4
- Effluent reuse pump 1 – inspection condition 4
- Inlet works – lightpost (needs replacing) very corroded at bottom – inspection condition 4
- Mixed Liquor Return (MLR) pump station – inspection condition 4

There has not been any non-conformances of the Hallidays Point's STP with its EPL over the last ten years. The last recorded non-conformance in 2008.

Other know issues with the Hallidays Point STP are:

- Lack of suitable biosolids storage area.
- Aged biosolids dewatering equipment.

11.16.6 Harrington sewage treatment plant

From the 10 Year Renewal site inspections, the Harrington STP identified deflects are:

- Inlet works step screen – surpassed theoretical useful life
- Step screen conveyor 1- surpassed theoretical useful life
- Inlet works – wear and tear exceeded remaining useful life
- Blower 1, 2 and 3 – surpassed theoretical useful life
- Bioreactor 1 diffuser bank 2, 3 and 4 – surpassed theoretical useful life
- Bioreactor 2 diffuser bank 2, 3 and 4 – surpassed theoretical useful life
- Pipework and valves – pipework around bioreactors 1 and 2 need replacing
- Bioreactor 1 and 2 oxidation ditch – structure failing
- Clarifier 1 and 2 – scrapers need replacing
- Sludge drying beds 1 and 2 – wear and tear, need bitumen resealing
- Oxidation ditch 1 brush aerator 1a, 1b, 2a, 2b – surpassed theoretical useful life
- Emergency electric generator – surpassed theoretical useful life
- Potable onsite water pump – surpassed theoretical useful life
- Hypo dosing pump – and 2 - needs replacing
- Offsite reuse pump 1 and 2 isolation valves – making noise

The performance of the Harrington's STP with its EPL over the last ten years is outlined in Table 11.19.

Table 11.19 Harrington sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
31 Jul 2020	The volume limit of 3600 kL per day at EPA monitoring point 3 at the inlet works was exceeded on one occasion	1
31 Jul 2018	The 100 percentile limit of BOD (20mg/L) was exceeded at Point 1 on one occasion by 2 mg/L. Other sample results from the catch ponds indicated that BOD levels were compliant.	1
31 Jul 2018	The annual BOD load limit of 1480 kg was exceeded as a result of the non-compliance with L3.4 at Point 1 which increased the flow-weighted concentration of BOD. Plant was operating as per design.	1
31 Jul 2014	BOD & Nitrogen load limits exceeded. Elevated BOD on some occasions. Following each high result a resample taken. Each instance showed good results. Increased monitoring frequency to fortnightly & analysis of COD introduced.	1
31 Jul 2014	BOD & pH limits exceeded on various dates due to unknown reasons (BOD) & algae growth (pH). A resample taken following each high result returning good results. Increased monitoring to fortnightly & duplicate samples for BOD analysis.	5
31 Jul 2013	Volume limit exceeded on 2 occasions due to localised flooding from persistent and heavy rainfall.	2
31 Jul 2013	pH limit was exceeded on 3 occasions at point 1 due to algae growth. Continue to re seed the exfiltration pond with duckweed to prevent nuisance algal growth.	3
31 Jul 2013	BOD, TN & TSS load limits exceeded. Licensee advised flows have increased by 50 % since 2009/10 & significant rainfall events caused localised flooding and increased total flows. These combined caused exceedances. Effluent reuse has now commenced	3
31 Jul 2012	pH limit exceeded. Algae growth in the effluent pond raises pH. A storm even with damaging winds and torrential downfalls destroyed much of the duckweed colony. Duckweed was reestablished in the pond.	2
31 Jul 2012	TSS and Nitrogen limit exceeded due to severe storm impacting duckweed and increased inflow volume. The commissioning of the Harrington re-use scheme is expected next year.	2
31 Jul 2011	pH 100 percentile limit exceeded on one occasion. Algae in effluent pond during warm weather caused the exceedance. This was the beginning of the season and duckweed (which is used to control the algae) was not fully established.	1
31 Jul 2011	Total Suspended Solids load limit was slightly exceeded. Significant increase of inflow to the plant due to exceptionally high rainfall throughout the year. Detailed designs for the Harrington effluent reuse scheme are underway.	1

The performance against the EPL license may indicate the following issues:

– High inflow/reduced UV exposure within the sewerage system leading to concentration exceedance during rainfall events.
– Algal growth in the exfiltration ponds.
– The STP appears to have insufficient capacity to treat incoming loads for discharge and is now relying on effluent reuse to reduce load to environment. Effluent reuse however does not offer a robust solution as reuse demand can decrease during wet weather.
– Insufficient storm storage capacity to attenuate peak inflows and avoid exceeding volume discharge limit.

Other know issues with the Harrington STP area:

- Inlet works balance tank is undersized and does not contain grit removal.
  - Stage 1 Upgrade (inlet works upgrade) is in progress. Expected completion in 22/23 FY.
- Plant is approaching nutrient treatment capacity.
  - Stage 2 Upgrade (full treatment plant upgrade) is planned to be undertaken as treatment plant capacity approaches EPA license limits.

11.16.7 Hawks Nest sewage treatment plant

The Hawks Nest STP site inspections for the 10 Year Renewal Program have not yet been undertaken. This has been identified as a data gap for future actioning.

The performance of the Hawks Nest's STP with its EPL over the last ten years is outlined in Table 11.20.

Table 11.20 Hawks Nest sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
29 Jun 2020	The 90 percentile concentration of 10cfu/100ml for Faecal Coliforms was exceeded.	1
29 Jun 2019	The 90 percentile concentration limit of 2mg/L for nitrogen ammonia was exceeded.	1
29 Jun 2018	The 90 percentile limit of 10mg/L for total nitrogen was exceeded.	2
29 Jun 2015	Concentration limit exceeded for Faecal Coliform and Total Phosphorus on three occasions each due to various reasons. Various actions taken to prevent recurrence of non-compliances	3
29 Jun 2014	Ammonia & Total Nitrogen limits were exceeded. Variable & increased loads associated with tourism during the Christmas holidays. Aeration is now automated from DO sensors allowing operation to be based on real time data.	3
29 Jun 2013	Total Phosphorus concentration readings 1.03, 1.69 & 1.41. Variable & increased load associated with tourism during school holidays. Re-commissioning of pasveer channels before holiday season to increase capacity during high load period.	3
29 Jun 2012	Total nitrogen and phosphorus limits exceeded at point 1 on one day due to high variability and increased load with influx of tourism during holiday period. Operational changes to aim to address in coming years.	2
29 Jun 2010	Exceedance of total nitrogen 90 percentile concentration limit on one occasion due to mechanical problem with decanter leaving plant running on only one extended aeration tank. Timely action taken to rectify breakdown.	1

The performance against the EPL license may indicate the following issues:

- High inflow/reduced UV exposure within the sewerage system leading to concentration exceedance during rainfall events.
- Algal growth in the storage lagoons.
- The STP appears to have insufficient capacity to treat incoming loads for discharge (exacerbated due to holiday peaks) and is now relying on effluent reuse to reduce load to environment. Effluent reuse however does not offer a robust solution as reuse demand can decrease during wet weather.
- Treatment configuration unable to achieve consistent nitrogen and phosphorus discharge concentrations. Hawks Nest STP upgrade is being investigated currently to select a new process.

Other know issues with the Hawks Nest STP area:

- Aged biosolids dewatering equipment.

11.16.8 Lansdowne sewage treatment plant

From the 10 Year Renewal site inspections, the Lansdowne STP identified deflects are:

– Roadway access – reseal is needed – pot holes currently visible on driveway entry
– Inlet weirs at IAT tank – significant corrosion with holes throughout the scum boards
– Inlet feed pipe – corroded and needs replacing

The performance of the Lansdowne's STP with its EPL over the last ten years is outlined in Table 11.21.

Table 11.21 Lansdowne sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
15 Apr 2014	Faecal coliforms 100 percentile limit of 200 cfu/100ml was exceeded due to high inflows/reduced UV exposure. Concentration of 15,000 cfu/100ml recorded. New fluoro lamps installed ahead of schedule.	1
15 Apr 2013	pH concentration limit exceeded on 1 occasion. Mixer was under mechanical repair prior to discharge resulting in slight exceedance of limit. Consequently, algae growth in irrigation dam occurred. New mixer installed.	1
15 Apr 2012	Faecal Coliforms concentration limit exceeded due to an earlier vandalism incident. A complete service to the UV lighting system was undertaken including the replacement of damaged and fatigued components.	3
15 Apr 2011	Exceeded pH and Total Suspended Solids 100 percentile concentration limit and on 05/10/10, caused by algae growth in storage lagoon during hot weather. Exceeded Faecal Coliforms 100 percentile concentration limit on 07/06/10, caused by wet weather	3

The performance against the EPL license indicates the following issues:

– High inflow/reduced UV exposure within the sewerage system leading to concentration exceedance during rainfall events
– Algal growth in the storage dam

Other know issues with the Lansdowne STP area:

– Nil

11.16.9 Manning Point sewage treatment plant

From the 10 Year Renewal site inspections, the Manning Point STP identified deflects are:

– Crane in generator room – the legs are rusting off – asset to be decommissioned
– Grit removal wash water pump – badly corroded but working
– Vortex grit removal 1 – badly corroded but working
– Inflow flow meter – visually aged
– Pelican bay inlet flow meter – visually aged
– Transfer pumps – visually aged
– Transfer pump station flow meter – visually aged
– Transfer pump station probe sensor – visually aged IAT 2 decanter – gearbox to be replaced. VSD to decanter will need major electrical fitout.
– IAT 2 mixer 1 – cables are starting to deteriorate
– WAS flow meter – visually aged
– Effluent pond return pump – issues with pumping out the sludge
– Irrigation reuse flow meter – visually aged
– Irrigation balance tank pipework – pipework is badly corroded
– Catchment pond jib crane – corroded

– Daikin AC unit – vermin cable chews
– Vacuum pump station superstructure – corroded vacuum station doors
– Vacuum pump station roof – the leaking vent pipes has caused rotting trusses

The performance of the Manning Point's STP with its EPL over the last ten years is outlined in Table 11.22.

Table 11.22 Manning Point Sewerage Non-compliances

Year ending	Type of non-compliance	No. of times occurred
15 Apr 2014	Faecal coliforms 100 percentile limit of 200 cfu/100ml was exceeded due to high inflows/reduced UV exposure. Concentration of 15,000 cfu/100ml recorded. New fluoro lamps installed ahead of schedule.	1
15 Apr 2013	pH concentration limit exceeded on 1 occasion. Mixer was under mechanical repair prior to discharge resulting in slight exceedance of limit. Consequently, algae growth in irrigation dam occurred. New mixer installed.	1
15 Apr 2012	Faecal Coliforms concentration limit exceeded due to an earlier vandalism incident. A complete service to the UV lighting system was undertaken including the replacement of damaged and fatigued components.	3
15 Apr 2011	Exceeded pH and Total Suspended Solids 100 percentile concentration limit and on 05/10/10, caused by algae growth in storage lagoon during hot weather. Exceeded Faecal Coliforms 100 percentile concentration limit on 07/06/10, caused by wet weather	3

The performance against the EPL license may indicate the following issues:

– High inflow/reduced UV exposure within the sewerage system leading to concentration exceedance during rainfall events
– Algal growth in the storage dam

Other know issues with the Manning Point STP area:

– Nil

11.16.10 Nabiac sewage treatment plant

From the 10 Year Renewal site inspections, the Nabiac STP identified deflects are:

– Aeration blower 1 and 2 – surpassed theoretical useful life
– Site pipework – rust noted at all weld joints. Maintenance is needed

Nabiac STP does not have an EPL. All flow from Nabiac STP is received by Hallidays Point STP. The performance of the Nabiac's STP process is assessment under the Hallidays Point STP EPL.

11.16.11 North Karuah sewage treatment plant

North Karuah sewage is treated at the Karuah STP which is owned, operated, and maintain by Hunter Water. Infrastructure assessment of the Karuah STP is the responsibility of Hunter Water.

11.16.12 Old Bar sewage treatment plant

From the 10 Year Renewal site inspections, the Old Bar STP identified deflects are:

– Step screen 1 conveyor – gear box and auger need replacing
– Vortex grit removal 1 – corroded/replace
– Selector tank rotork 1 and 2– corroded/replace
– Diffuser air blower 1,2 and 3 – aged with wear and tear
– Bioreactor 1 surface aerator 1 – aged with wear and tear

- WAS pump 1 – aged with wear and tear
- Diversion rotork 1 and 2 – aged with wear and tear
- Bioreactor 2 surface aerator 8 – aged with wear and tear
- Reuse water surge tank – only one system and needs replacing
- RAS pump 1, 2 and 3 – aged with wear and tear
- Reuse water pump 2 – aged with wear and tear
- Secondary clarifier motor and gear box – needs replacing
- Scum pump 2 – aged with wear and tear
- Supernatant pump 1 and 2 – aged with wear and tear
- Emergency RAS pump 1 and 2 – aged but still working

The performance of the Old Bar's STP with its EPL over the last ten years is outlined in Table 11.23.

Table 11.23 Old Bar sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
31 May 2019	The total phosphorus concentration of 4mg/L was exceeded on one occasion.	1
31 May 2019	The 90 percentile concentration limit of 2mg/L for total phosphorus was exceeded.	2
31 May 2017	The ammonia 90 and 100 percentile concentration limits were marginally exceeded.	1
31 May 2016	Total Nitrogen discharge was exceeded. Cause was loss of biological process from toxic shock due to illegal discharges. Media release to community to educate regarding placement of toxic substances in sewer.	1
31 May 2014	Time frame for intermediate reporting of pollution reduction program 3 not met. Misunderstanding of incidental reporting requirement prior to submission of the PRP findings report. Incidental report has been submitted.	1
31 May 2012	The volume limit was exceeded due to localised flooding resulting in infiltration into the sewer system. There was 109 mm of rain recorded on the day of the non-compliance. Very little licensee could do in such rainfall.	1
31 May 2011	Total nitrogen limit was exceeded. Suspected illegal trade waste dump caused a breakdown of the biological process in September 2010. The licensee is conducting a trade waste investigation within the reticulation system.	1

The performance against the EPL license may indicate the following issues:

- Potentially insufficient alum dosing capacity
- Potentially insufficient aeration capacity

Other know issues with the Old Bar STP area:

- Aged biosolids dewatering equipment

11.16.13 Stroud sewage treatment plant

The Stroud STP site inspections for the 10 Year Renewal Program have not yet been undertaken. This has been identified as a data gap for future actioning.

The performance of the Stroud's STP with its EPL over the last ten years is outlined in Table 11.24.

Table 11.24 Stroud sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
30 Jun 2017	An unscheduled discharge to the Karuah River commenced prior to notifying and seeking approval from the EPA	1
30 Jun 2017	Highest recorded total suspended solids concentration of 23mg/L in effluent discharged to the Karuah River	1
13 May 2013	Faecal Coliforms was exceeded on one occasion. FC treatment via UV exposure was limited due to very high inflows from intense rainfall event. FC sample taken a week later confirmed UV lamp treatment was operational under normal conditions.	1
13 May 2013	Discharge to the Karuah River occurred once while river flow was exceeding 2000ML/day & projected to rise with heavy rain forecast. Delay in the arrival of the rain resulted with unexpected river flow falls.	1
13 May 2012	100 percentile limit for Suspended Solids, pH & Total Nitrogen were exceeded once. Caused by algae growth in effluent storage dam. Duckweed introduced in storage dam to inhibit algae growth. Oxygen set point adjusted down for better TN reduction.	1
13 May 2011	Limit exceeded for TSS & pH due to algae in effluent storage dam. Investigating extending reuse area.	1
13 May 2011	Treated effluent discharged when river flows <2000mL/day due to remote operation valve control failure. Additional checks introduced in operational procedure.	1
13 May 2011	Method used for Volume Monitoring different to that specified due to computer malfunction. Computer replaced.	1

The performance against the EPL license may indicate the following issues:

- High inflow/reduced UV exposure within the sewerage system leading to concentration exceedance during rainfall events
- Algal growth in the effluent pond

Other know issues with the Stroud STP area:

- Aged biosolids dewatering equipment

11.16.14 Taree (Dawson) sewage treatment plant

From the 10 Year Renewal site inspections, the Taree STP identified deflects are:

- Surface aerator 1 – upgrade is required. Investigation is needed.
- Site boundary fence & gates –whole fence requires renewal.
- Bioreactor actuated weir 1 – badly corroded weir. Needs replacing
- Bioreactor diffuser bank 1, 2, 3 and 4 – upgrade is required.
- Sludge drying bed 1, 2,3 and 4 – bitumen re-seal and paving, as well as drainage is needed.
- Clarifier 1 and 2- the weir on the clarifier structure is starting to rust out and will need replacement.
- Sludge lagoon 4 – upgrade is required.
- Step screen 2 – upgrade is required.

The performance of the Taree's STP with its EPL over the last ten years is outlined in Table 11.25.

Table 11.25 Taree sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
08 Sep 2020	The discharge limit of 20000kL was exceeded at EPA monitoring point 2	1
08 Sep 2018	The pH concentration limit of pH 8.5 was marginally exceeded on one occasion, likely due to algal growth in the maturation pond.	1
08 Sep 2018	The discharge volume of 20,000kL from EPA Point 2 was exceeded on one occasion due to a significant wet weather event whereby 300 mm of rain fell between 21 and 24 March 2018.	1
30 Jun 2017	The discharge volume of 20000kL per day from EPA monitoring point 2 was exceeded on three times	3
08 Sep 2016	The discharge volume limit from EPA Monitoring Point 2 was exceeded on one occasion due to localised flooding, >200mm of rainfall recorded	1
08 Sep 2014	The pH concentration limit was exceeded on one occasion due to algae growth in maturation pond. Effluent reuse to irrigation reduced environmental discharges.	1
08 Sep 2013	The pH concentration range limit was exceeded on 2 occasions due to algal growth in maturation pond. Effluent reuse to irrigation reduced environmental discharge volumes. No discharge for at least a fortnight before or after 1st event.	2
08 Sep 2013	The licensee reported discharge limit of 20,000 kL from monitoring point 2 exceeded on 4 occasions due to persistent and heavy rainfall that resulted in localised flooding in the Taree Region.	4
08 Sep 2012	The discharge limit at point 2 was exceeded on 1 occasion. The Taree region and Manning River were under flood conditions with very heavy localised rainfall.	1
08 Sep 2012	Flow measurements were recorded on the 2 discharge events from point 1, however confidence in the accuracy of the measurements is low as sensor was found to be malfunctioning. A new sensor was installed.	2
08 Sep 2012	MCW received tankered waste from local industry due to misunderstanding about what waste could be accepted. Licence variation to allow liquid waste receival generated outside sewerage system was subsequently issued by EPA.	1
08 Sep 2011	Discharge volumes at wet weather overflow point were not measured on 4 occasions. Weir structure and level sensor were completely under water, therefore discharge volumes could not be measured during flood event in June.	4

The performance against the EPL license may indicate the following issues:

– High inflow/infiltration within the sewerage system leading to volume exceedance during rainfall events
– Algal growth in the maturation ponds.
– Insufficient storm storage capacity to attenuate peak inflows and avoid exceeding volume discharge limit.

Other know issues with the Taree STP area:

– Lack of an inlet works balance tank limits flows to plant to 240 L/s or bypassing the bioreactor occurs.
  - The proposed Cundletown rising main shall make flow balancing a necessity.
– Inlet works utilizes a step screen and a band screen. The step screen requires replacement with a band screen.
– The plant has 4 sludge lagoons. 2 concrete lined and 2 earthen lined. The 2 earthen lagoons require upgrade to concrete lined.
– Major switchboard renewal required.
– Aged biosolids dewatering equipment.

11.16.15 Wingham sewage treatment plant

The Wingham STP site inspections for the 10 Year Renewal Program have not yet been undertaken. This has been identified as a data gap for future actioning.

The performance of the Wingham's STP with its EPL over the last ten years is outlined in Table 11.26.

Table 11.26 Wingham sewerage non-compliances

Year ending	Type of non-compliance	No. of times occurred
28 Feb 2019	The pH range of 6.5-8.5 was exceeded.	1
28 Feb 2017	Concentration limit for pH range was exceeded once. High algae content in catchpond. River discharges were limited zero flow to river on monitoring date & preceding 4 days	1
29 Feb 2016	Assessable pollutant load limit for BOD was exceeded during reporting period due to substantial reduction in the use of recycled water from rainfall during peak irrigation periods	1
29 Feb 2012	pH concentration limit slightly exceeded on 1 occasion. Reading was 8.7, limit is 8.5	1
28 Feb 2011	Total inflow was not recorded on two occasions at Monitoring Point 2. Occurred because of error in PLC and due to blackout. Reconfiguration of backup system is now in place.	2
28 Feb 2011	pH 100 percentile limit exceeded on one occasion at Monitoring Point 3. Cause was algal growth in the pond caused by seasonal hot weather. Exceedance was minor and no environmental impact was likely.	1

The performance against the EPL license may indicate the following issues:

– High inflow/infiltration within the sewerage system leading to volume exceedance during rainfall events.
– Algal growth in the maturation ponds leading to pH non-compliance.

Other know issues with the Wingham STP area:

– Plant is located below flood level.

11.17 Urban stormwater network performance

The majority of current expenditure on stormwater improvements are as a result of issues identified in stormwater management plans (SMP) or from documented stormwater hotspots. Council is currently undertaking a stormwater management plan concurrently with the review of the floodplain risk management study and plan for Bulahdelah. The North Arm Cove SMP has resulted in a series of capital works projects to augment existing drainage infrastructure for reduced flooding magnitude and frequency. Current activities are underway in Forster Keys and Smiths Lake for the relining of several pipes through private property that have been determined to have failure before the useful life have been reached. The significant expenditure on road renewals in the Taree, Wingham and Cundletown areas has included assessments of drainage and in many cases stormwater assets have also been renewed and/or augmented to improve infrastructure performance and longevity

Over the immediate forward period Council is committed to a review of the Taree SMP via a catchment-by-catchment approach. The Taree SMP has not been updated for almost 20 years and will be the focus of prioritised renewals and augmentation works for the forward period.

12. Unserviced villages

Decentralised Water Consulting (DWC) were engaged in 2019 to assess unserviced villages in the Council area. Thirty villages were assessed with the objective to assist Council to understand the risks from on-site sewage management systems in unsewered villages across the LGA. The process involved a risk prioritisation assessment designed to identify high risk villages and present high-level options to improve wastewater management in these areas. The outcomes of the project have enabled Council to focus on high-risk villages where the benefits of investment in improved wastewater services are likely to be maximised.

The villages assessed, along with the number of lots, high-level servicing options, cost estimates and ranking are detailed in Table 12.1. Note: Legend is at the base of the table.

Table 12.1 Unserviced Village Assessment

Rank	Village	No. Lots	Servicing Option 1 Sewer	Servicing Option 2 Cluster system	Servicing Option 3 Partial On- site	Servicing Option 4 Full On-site	Cost $ Million
1	Coomba Park	670					20 – 40
2	North Pindimar	91					9 – 14
	South Pindimar	137					
	North Arm Cove	409					16 – 25
	Bundabah	125					6 – 10
	Nerong	168					8 – 13
	Seal Rocks	73					4 – 6
	Carrington & Tahlee	40					2 – 4
9	Bungwahl	74					4 – 6
10	Croki	25 + 38 caravan park sites					2 – 4
11	Allworth	92					4 – 7
	Copeland	116					6 – 9
13	Tea Gardens (Industrial Estate)	38					
14	Coolongolook	77					4 – 6
15	Stroud Road	91					
16	Krambach	238					9 – 14
17	Oxley Island Mitchells Island	177 47					3 – 6
	Wards River	64					3 – 5
19	Mount George	97					5 – 8
	Elands	62					3 – 5
21	Johns River	173					8 – 14
22	East Wingham	65					Sewer
23	Craven	23					1 – 2
24	Wootton	23					1 – 2

Rank	Village	No. Lots	Servicing Option 1 Sewer	Servicing Option 2 Cluster system	Servicing Option 3 Partial On- site	Servicing Option 4 Full On-site	Cost $ Million
25	Stratford	100					5 – 8
26	Limeburners Creek	58					3 – 5
27	Booral	53					3 – 4
28	Moorland	120					6 – 10
29	Barrington	91					2 – 3
30	Bundook	79					1 – 3

Selected	Alternate Option	Un-suitable

The project was undertaken by Council in response to the inherent public health and environmental risks that exist with unserviced villages serviced by on-site sewage management systems. If Council decided to provided centralized sewerage to an unserviced village, it would consider providing town water as well to take advantage of the cost savings of delivery the infrastructure for both services.

13. Recycled water opportunities

Council has several existing recycled water schemes where the recycled water from treated effluent is used for farm irrigation. These schemes are in Gloucester, Taree, Wingham, Coopernook, Lansdowne and Stroud.

Four RTPs treat wastewater to water quality standards that are suitable for public open space irrigation such as golf courses and sporting fields. The public open space irrigation schemes are located at Tuncurry, Hawks Nest, Bulahdelah and Harrington.

Council does have S60 approval for the recycled water schemes at Tuncurry, Hawks Nest, Bulahdelah, Harrington and Gloucester STP's.

Council is committed to increasing the level of recycled water use in the LGA and are continuing investigations into further opportunities for sustainable effluent management. Recycled water opportunities identified for investigations include the following:

– Irrigation of dairy farms and sporting fields
– Irrigation of public open spaces in North Tuncurry and Taree

14. Stormwater harvesting opportunities

Council does not currently have any stormwater harvesting schemes to capture stormwater for purposes such as irrigation of public open spaces. Stormwater harvesting opportunities identified for investigations include the following sites/areas:

– North Tuncurry
– Tuncurry Golf Course
– PACE Chicken Farm in Gloucester
– Taree (coincide investigation with review of the Taree Stormwater Management Plan)
– Stocklands Shopping Centre Foster

Council will investigate stormwater harvesting opportunities as part of the water security options phase for schemes with insufficient secure yield. This will include looking at stormwater harvesting opportunities with the existing stormwater network and localized opportunities in areas identified for future development.

15. Issues and data gaps

15.1 IWCM issues

The water, sewer and general IWCM issues, identified through the analyses are listed in Table 15.1, Table 15.2 and Table 15.3. Refer to the Council Risk Assessment - IWCM Issues in Appendix E for details.

Table 15.1 General IWCM issues

Issue type	Target for compliance	Issue
Asset Performance	Linking Asset Number to Work Orders	Council's TechnologyOne database doesn't allocate asset numbers to work orders.
Business performance	Sufficient resourcing for capital works planning	Council's water business has resource gaps in engineering, particularly around specific design and project engineering support. Currently the delivery team is relying heavily on planning team, consultants or the experienced design draftsman. Outsourcing is an option but will come at significant cost.
Business performance	Asset renewals	Renewal program – assets for program and management responsibility.
Business performance	Asset management – finalisation and capitalisation	Finalisation of new, renewed assets in the asset management and financial systems.

Table 15.2 Water supply system issues

Issue type	Target for compliance	Issue
Levels of Service	Notifications of customers of water quality incident in a timely manner	Unable to alert customers connected to a particular reservoir in the event of a water quality incident in a timely manner due to lack of GIS and billing system integration.
Levels of Service	Provision of alternative water supply to Hawks Nest	Hawks Nest water supply is fed from the Tea Gardens reticulation network. There is no bulk trunk water supply to Hawks Nest. Isolating the water supply in Tea Gardens would mean that Hawks Nest has no supply.
Levels of Service	Provision of alternative water supply to Bulahdelah	Bulahdelah has only a single feed into town from the reservoir – this main once failed causing a major leak and drained the supply reservoir to 30% volume in approx. 15 minutes.
Levels of Service	Water security 5 - 10 - 10 rule	In the Manning scheme, Gloucester, Stroud and Bulahdelah there is insufficient secure yield for water supply as it does not meet 5 - 10 - 10 rule. There is no raw water storage at Gloucester and no off-stream storage at Bulahdelah. In drought or flood there is no water to available to take.
Levels of Service	Water supply - minimum flow and pressure standards	Insufficient supply from Kolodong 3 Reservoir to service Cundletown and new industrial developments near Taree Airport (due to losses from customer demands in Taree). Current network relies on supply into Cundletown from DN375 transfer main from Irkanda Reservoir via PRV on Blacks Lane.
Levels of Service	Gloucester water supply demand requirements	Impact of large water users such as chicken farm developments on the provision water supply to Gloucester.
Levels of Service	Council minimum water pressure standards	HWC provide Council with water Council has no control over the water pressure. The existing water supply agreement requires review and updating.

Issue type	Target for compliance	Issue
Levels of Service	Council minimum water pressure standards	Low pressures at Lansdowne during fire flows or standpipe withdrawals due to low Reservoir height. Inadequate static head buffers between service connections and minimum reservoir levels.
Levels of Service	Council minimum water pressure standards	No defined buffer zones in Council's mapping system around existing reservoirs for Land Use Planning/Zoning based on static heads to deliver adequate supply head by gravity to new developments.
Levels of Service	Council maximum water pressure standards	High pressures for low level customers in Tuncurry and Forster (above recommended by WSA) There is a legacy issue with high rise development in Forster and Tuncurry and a need to study options for alternate servicing for these developments.
Levels of Service	Non-Revenue Water (Leakage and unaccounted usage) less than 10%	High network pressures and aging infrastructure resulting in leakage above target
Levels of Service	No more than 1,000 properties a year will experience an unplanned interruption of more than 5 hours in a financial year	Council currently doesn't collect data on the number/type of properties affected in unplanned interruptions
Levels of Service	Number of mains breaks no more than 8/100km (Industry NSW, 2020)	High network pressures and aging infrastructure resulting in mains break above target
Levels of Service	Any interruption to service be restored within 4 hours	Council currently doesn't collect data on response times to interruptions to services
Levels of Service	Assets are maintained at an acceptable level with a score 3 or less (scale 1-5)	Historical underinvestment in renewals resulted in a score above target
Levels of Service	Fire flows of 10 L/s can be supplied to all hydrants (20 L/s to commercial and industrial outlets)	No current hydraulic modelling of to assess fire flows for existing and new developments
Asset Performance	Reservoir integrity	Reservoir with deficiencies that have potential to impact on water quality if not addressed include: – Coopernook Reservoir – Crowdy Head Reservoir – Cundletown Reservoir – Elizabeth Beach Reservoir – Hallidays Point Reservoir – Smiths Lake Reservoir – Chatham NIU Reservoir – Gloucester Ravenshaw Street Reservoir – Gloucester Tyrell Street Reservoir
Asset Performance	Reservoir design standards	Dedicated headworks reservoirs are being utilised as service reservoirs due to legacy DA approvals resulting in customer complaints from pressure and chlorination fluctuations.
Asset Performance	Operation efficiency	Manning Water scheme is complex and interconnected.

Issue type	Target for compliance	Issue
Asset Performance	Meter performance	Large ELSTA H5000 water meters are having a high rate of failures.
Asset Performance	Reservoir design standards	Forster Reservoir: operational zone of the reservoir resides in the top 2-3% of the reservoir due to the need to service Bennets Head Road.
Business performance	Provide the community with specific timing of developments	State Government has control over future major land releases at Brimbin and North Tuncurry resulting in developments being progressed where infrastructure for water and sewer is not sufficient to accommodate.
Business performance	Optimising operational costs	PS2B Pumps from Bootawa WTP to Lantana Res are too big (designed for delivery to Forster. Potential issues with current and future energy costs, pump maintenance.
Business performance	Water revenue	Water revenue loss because private meters aren't picking up all flows (or broken due to meters sized incorrectly for their purpose) - large discrepancy between billing and plant data, especially at Stroud.
Business performance	Water carters fill from approved hydrant locations	Water carter filling from hydrants results in low water pressure in some instances.
Business performance	North Karuah water charges	Customers are charged at Council water rates which is more expensive than HWC rate. Water charges require review.
Capacity	Reservoir capacity sufficient for water supply demands	– Coopernook reservoir at capacity in 2020 – Krambach reservoir at capacity in 2020 – Brimbin future servicing strategy is uncertain. The ‘do-nothing’ scenario means the supply comes off Irkanda and upstream network resulting in reservoirs and the network reaching capacity earlier than planned – Lantana reservoir at capacity in 2020 – Irkanda reservoir at capacity in 2026 – Rainbow Flat reservoir at capacity in 2020 – Wingham reservoir at capacity in 2026 – Kolodong 3 reservoir at capacity in 2020 – Old Bar reservoir at capacity in 2036 – Elizabeth Beach res at capacity in 2036 – Tallwoods reservoir at capacity in 2041 – Stroud Road reservoir at capacity in 2041 – Trunkmain to Stroud Rd reservoir at capacity in 2026 – Trunkmain to Wingham reservoir at capacity in 2036 – Trunkmain and pumps to Irkanda reservoir at capacity in 2036 – Trunkmain to Kolodong 1&2 reservoir at capacity in 2041 – Trunkmain to Kolodong 3 reservoir at capacity in 2036 – Trunkmain and pumps to Lantana reservoir at capacity in 2046 – Trunkmain and pumps to Forster reservoir at capacity in 2041 – Trunkmain and pumps to Rainbow Flat reservoir at capacity in 2046 – Trunkmain and pumps to Krambach reservoir at capacity in 2036

Issue type	Target for compliance	Issue
Regulatory	Australian Drinking Water Guidelines – treated water quality	Water treatment plants at Bulahdelah, Gloucester and Stroud fail to meet NSW Health requirements
Regulatory	Australian Drinking Water Guidelines – residual chlorine levels	Council has no control over water quality North Karuah. North Karuah is supplied by Hunter Water and the water suppled generally has low residual chlorine levels.
Regulatory	Australian Drinking Water Guidelines – THM's	Tea Gardens, Bulahdelah and Hawks Nest water reticulation system has consistently high THMs exceeding the ADWG limits. The cause is the high DOC level in the groundwater source.
Regulatory	Australian Drinking Water Guidelines – Aluminium	Stroud and Gloucester have experienced some high Aluminium levels in the treated water likely due to breakthrough.

Table 15.3 Sewerage system issues

Issue type	Target for compliance	Issue
Levels of Service	100% of effluent samples compliant with licence concentration limits	Certain treatment processes in STPs unable to accommodate peak tourist loads
Levels of Service	All sewage deposited in the system is to be directed to treatment facilities (100% Compliance)	No record of wet weather overflows
Levels of Service	Ratio > 8 for the number of theoretical properties connected compared to actual number of property connected to cope with 800% ADWF based on 210L/EP/Day	No current hydraulic modelling of to assess ratio
Levels of Service	100% of pump stations with wet weather storage capacity greater than 4 hours ADWF	% wet weather storage capacity less than target
Asset Performance	Linking Asset Number to Work Orders	Inability to investigate/action reported overflows or measure increase/decrease in reported overflow points due to Asset Number not linked to Work Orders.
Asset Performance	Sewerage catchment network defects factor < 0.8	Catchment network defects factor exceeds the prescribed range (> 0.8) indicating significant network defects contributing to rainfall dependent inflow and infiltration ("top-down") resulting in surcharging at various SPS well and/or upstream infrastructure. Refer to Section 10 for details.
Asset Performance	Sewerage catchment network defects factor > 0.2	Catchment network defects factor falls below the prescribed range (< 0.2) indicating high baseline flows resultant of groundwater infiltration ("bottom-up") triggering major infrastructure upgrades before required. Refer to Section 10 for details.
Asset Performance	Works Health and Safety – confined spaces entry (eliminate where if possible	Strategic issues with TA01 and TA06. i.e. the planning involved in modifying TA01 to remove confined space, or redirect overflow pipework due to asset condition.

Issue type	Target for compliance	Issue
Asset Performance	Bulahdelah STP	Identified defects require addressing Lack of suitable biosolids storage area. Aged biosolids dewatering equipment. High inflow/infiltration within the sewerage system leading to volume exceedance during rainfall events. Insufficient denitrification process capacity (partly due to insufficient inflow). Insufficient storm storage capacity to attenuate peak inflows and avoid exceeding volume discharge limit.
Asset Performance	Coopernook STP	Identified defects require addressing
Asset Performance	Forster STP	Identified defects require addressing. Insufficient storm storage capacity to attenuate peak inflows and avoid exceeding volume discharge limit. Algal growth in the ponds. The filters are beginning to loose suspended solids removal performance, causing the plant to exceed the load based limit license on effluent discharge. Blower failures and increase in DO requirements requires renewal and upgrade. Major switchboard renewal required.
Asset Performance	Gloucester STP	High inflow/infiltration within the sewerage system leading to volume exceedance during rainfall events. Algal growth in the maturation ponds. Treatment plant capacity exceeded with new treatment configuration is being implemented. Significant deterioration to the sedimentation tanks. Concrete surrounding the trickling filters has failed in numerous locations. Significant cracks in digester. Pond has wind erosion damage. The majority of the existing plant is submerged during severe 1 in 100-year flood events. The process can't effectively reduce Total Nitrogen.
Asset Performance	Hallidays Point STP	Identified defects require addressing. Lack of suitable biosolids storage area. Aged biosolids dewatering equipment.
Asset Performance	Harrington STP	High inflow/reduced UV exposure within the sewerage system leading to concentration exceedance during rainfall events. Algal growth in the exfiltration ponds. Insufficient capacity to treat incoming loads for discharge and is now relying on effluent reuse to reduce load. Effluent reuse however does not offer a robust solution as reuse demand can decrease during wet weather. Insufficient storm storage capacity to attenuate peak inflows and avoid exceeding volume discharge limit. Inlet works balance tank is undersized and does not contain grit removal. Stage 1 Upgrade (inlet works upgrade) is in progress. Plant is approaching nutrient treatment capacity. Stage 2 Upgrade (full treatment plant upgrade) is planned to be undertaken as treatment plant capacity approaches EPA license limits.

Issue type	Target for compliance	Issue
Asset Performance	Hawks Nest STP	High inflow/reduced UV exposure within the sewerage system leading to concentration exceedance during rainfall events. Algal growth in the storage lagoons. The STP appears to have insufficient capacity to treat incoming loads for discharge (exacerbated due to holiday peaks) and is now relying on effluent reuse to reduce load to environment. Effluent reuse however does not offer a robust solution as reuse demand can decrease during wet weather. Treatment configuration unable to achieve consistent nitrogen and phosphorus discharge concentrations. Hawks Nest STP upgrade is being investigated currently to select a new process. Aged biosolids dewatering equipment.
Asset Performance	Lansdowne STP	Identified defects require addressing
Asset Performance	Manning Point STP	Identified defects require addressing
Asset Performance	Nabiac STP	Identified defects require addressing
Asset Performance	Old Bar STP	Identified defects require addressing Potentially insufficient alum dosing capacity Potentially insufficient aeration capacity Aged biosolids dewatering equipment
Asset Performance	Stroud STP	Aged biosolids dewatering equipment.
Asset Performance	Taree (Dawson) STP	Identified defects require addressing High inflow/infiltration within the sewerage system leading to volume exceedance during rainfall events Algal growth in the maturation ponds Insufficient storm storage capacity to attenuate peak inflows and avoid exceeding volume discharge limit. Lack of an inlet works balance tank limits flows to plant to 240 L/s or bypassing the bioreactor occurs The step screen requires replacement with a band screen The 2 earthen lagoons require upgrade to concrete lined Major switchboard renewal required. Aged biosolids dewatering equipment.
Asset Performance	Wingham STP and SPS's	Algal growth in the maturation ponds leading to pH non-compliance Wingham STP is located under 1 in 100-year flood level. Pump stations requiring to be turned off in significant wet weather event (STP unable to receive flows). Significant disruption to STP process
Asset Performance	EPA licence requirement for STP's – sewer rising mains	Sewer rising main on the Tea Gardens Singing bridge is a condition grade 5 and requires renewal
Asset Performance	Continued operation and service delivery	Service delivery of STP's impacted by natural disasters (bushfire, flood, storm damage and other) - long term effect on element of operation
Business performance	North Karuah sewerage charges	Customers are charged at Council sewerage rates which is more expensive than HWC rate. Sewerage charges require review.

Issue type	Target for compliance	Issue
Capacity	SPS wet weather emergency storage > 4 Hrs ADWF	Emergency storage volume for various SPS wells is below the design 4 hours ADWF for 2020 and/or 2050. Refer to Section 10 for details.
Capacity	SPS installed pump duty is sufficient for estimated PWWF for ARI =2 rainfall event in 2020	Potential overflows at various SPS wells and/or upstream infrastructure for ARI 2 rainfall event due to insufficient pump capacity. Refer to Section 10 for details.
Capacity	SPS installed pump duty is sufficient for estimated PWWF for ARI =5 rainfall event in 2020	Potential overflows at various SPS wells and/or upstream infrastructure for ARI 2 rainfall event due to insufficient pump capacity. Refer to Section 10 for details.
Capacity	SPS installed pump duty is sufficient for estimated PWWF for ARI =2 rainfall event in 2050	Potential overflows at various SPS wells and/or upstream infrastructure for ARI 2 rainfall event due to insufficient pump capacity. Refer to Section 10 for details.
Capacity	SPS installed pump duty is sufficient for estimated PWWF for ARI =5 rainfall event in 2050	Potential overflows at various SPS wells and/or upstream infrastructure for ARI 2 rainfall event due to insufficient pump capacity. Refer to Section 10 for details.
Capacity	STP capacity sufficient for hydraulic load / biological load	Forecast hydraulic load / biological load is expected to exceed various STP capacities within the next 30 years. Refer to Section 10 for details.
Regulatory	EPA licence requirement for STP's – system overflows	Sewage inflow to various SPS's exceeding emergency storage and/or pump capacities causing varying degrees of impacts depending on the receiving environment
Regulatory	EPA licence requirement for STP's – system odours	Detention time in various SPS rising main presents a high risk (>8 hours) of odour/septicity potential causing odour complaints and H2S corrosion to rising mains, manholes and STP inlet works. Refer to Section 10 for details.
Regulatory	EPA biosolids guidelines	Copper levels in biosolids potentially above the allowable limits for use on agricultural land.
Performance	Infrastructure performance against Council's adopted containment factors (ARI=2 and ARI=5 1-hour rainfall events)	Council does not currently have the means to measure rainfall intensity so can't accurately calibrate STP PWWF estimations or assess infrastructure performance against define rainfall events.
Performance	Sewage velocity in rising main < 3.5 m/s	Sewage velocity in various SPS rising main exceeds the maximum allowable flow velocity (3.5 m/s) causing harmful scouring, increased turbulence at manholes and increase H2S corrosion and odour risk. Refer to Section 10 for details.
Performance	Sewage velocity in rising main > minimum flow velocity required for sedimentation/slime control.	Sewage velocity in various rising main < minimum flow velocity causing sedimentation/slime built up and potential for large pulsed of grit to be transferred downstream. Refer to Section 10 for details.
Performance	EPA licence requirement for STP's – overflows	PWWF:ADWF ratio at various STP inlet works during a severe wet weather event (ARI>5) is significantly less than what estimated suggesting unidentified overflows within the system, high baseload I&I or a well-sealed system. Refer to Section 10 for details.

Issue type	Target for compliance	Issue
Performance	Sewerage system inflow and infiltration	There are known issues with high levels of inflow and infiltration in the following catchments OB SOS 03, TA SPS 06, TA SPS 01, TA SPS 12
Performance	Recycled water quality requirements	UF membrane renewals for Hawks Nest and Tuncurry Recycled Treatment Plants are due, however PALL no longer manufacture this type of module. Modifications may be required to ensure that new UF membrane modules can be installed

Table 15.4 Stormwater system issues

Issue Type	Target for Compliance	Issue
Levels of Service		Council is currently undertaking a stormwater management plan (SMP) for Bulahdelah and Taree. The Taree SMP has not been updated for 20 years. These SMP's along with others will be the focus of prioritised renewals and augmentation works for the forward period

15.2 Data gaps

Some data gaps have been identified during the analysis. These have been outlined in Table 15.5.

Table 15.5 Data gaps/inconsistencies

Area	Data gap/inconsistency
Outcome 5A of the IWCM Strategy Checklist D19 due to lack of systems integration	Unable to link connected properties to a reservoir zone as the unique link between Council spatial system and the new MC1 billing system has been lost. Unable to match each lot to the respective assessment and/or meter in the customer billing data or then link to reservoir /pressure zones is the GIS system. Unable to show boundaries or reservoir/pressure zones. WUSD not considered in previous IWCM studies.
Taree stormwater data	Stormwater data for Taree. Taree Stormwater Management Plan has not been updated for since 2000.
Trade waste licenses	Any records of non-compliance.
Manning WTP condition data	Physical condition data and 10 Year Renewal Plan.
Tea Gardens WTP condition data	Physical condition data and 10 Year Renewal Plan.
Bulahdelah WTP condition data	Physical condition data and 10 Year Renewal Plan.
Stroud WTP condition data	Physical condition data and 10 Year Renewal Plan.
Gloucester WTP condition data	Physical condition data and 10 Year Renewal Plan.
Gloucester trunk main analysis	The trunk main analysis was incomplete due to data gaps and future plans for the system.
Hawks Nest STP condition data	Physical condition data and 10 Year Renewal Plan.
Stroud STP condition data	Physical condition data and 10 Year Renewal Plan.
Wingham STP condition data	Physical condition data and 10 Year Renewal Plan
North Karuah water demand forecasts	North Karuah supplied by Hunter Water. Water demand forecasts in 5 yearly increments from 2020 to 2050.
North Karuah peak day supply	North Karuah supplied by Hunter Water. The peak day supply requirements at a reservoir zone level in 5 yearly increments from 2020 to 2051.

Area	Data gap/inconsistency
Water distribution system integrity - data on reservoir defects	Data on reservoir defects in relation to potential contaminate and system integrity.
Large User Water Policy	Council Large User Water Policy to limit impact on existing water supply systems e.g. Impact of a large chicken producer connecting to a small town water supply.
Pressurized/vacuum sewage reticulation system data	Incomplete/non-existent design details for pressurized/vacuum sewage reticulation systems (i.e. no discreet flow monitoring or pump capacity data).
Vacuum sewer systems data	Incomplete/non-existent design details for vacuum sewer systems (i.e. collection chamber volumes and connections). Insufficient in-house design expertise with vacuum sewer systems.
STP design full treatment flow (DFTF) and design storm treatment flow (DSTF) data	DFTF and DSTF could not be found or distinguished for numerous STPs.

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Appendices

Appendix A

30-year water cycle analysis and projection

SharePoint Link:

https://ghdnet.sharepoint.com/:f:/r/sites/12545621/Shared%20Documents/Draft%20IWCM%20Issue%20Paper/Appendix/Appendix%20A%20-%2030%20year%20water%20cycle%20analysis%20and%20projection?csf=1&web=1&e=aJCRhd

Appendix B

Water demand analysis and issues

SharePoint Link:

https://ghdnet.sharepoint.com/:f:/r/sites/12545621/Shared%20Documents/Draft%20IWCM%20Issue%20Paper/Appendix/Appendix%20B%20-%20Water%20demand%20analysis%20and%20issues?csf=1&web=1&e=KMlxb6

Appendix C

Sewer load analysis and issues

SharePoint Link:

https://ghdnet.sharepoint.com/:f:/r/sites/12545621/Shared%20Documents/Draft%20IWCM%20Issue%20Paper/Appendix/Appendix%20C%20-%20Sewer%20load%20analysis%20and%20issues?csf=1&web=1&e=lQz8rI

Appendix D

Infrastructure performance assessment and issues

SharePoint Link:

https://ghdnet.sharepoint.com/:f:/r/sites/12545621/Shared%20Documents/Draft%20IWCM%20Issue%20Paper/Appendix/Appendix%20D%20-%20Infrastructure%20performance%20assessment%20and%20issues?csf=1&web=1&e=cgKKGG

Appendix E

Issues and data gaps

SharePoint Link:

https://ghdnet.sharepoint.com/:f:/r/sites/12545621/Shared%20Documents/Draft%20IWCM%20Issue%20Paper/Appendix/Appendix%20E%20-%20Issues%20and%20Data%20Gaps?csf=1&web=1&e=y6LeoL

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